Big Creek
Watershed Plan
Balancing Growth and Watershed Stewardship

2010

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Acknowledgements

This watershed plan was developed by the Cuyahoga River Community Planning Organization (CRCPO) in cooperation with the Big Creek Watershed Planning Partnership.

ABOUT THE BIG CREEK WATERSHED PLANNING PARTNERSHIP

The members of the Big Creek Watershed Planning Partnership are appointed by the mayors of the watershed communities and are assisted in the planning process by agencies and institutions working toward watershed stewardship.

ABOUT THE CUYAHOGA RIVER COMMUNITY PLANNING ORGANIZATION (CRCPO)

The CRCPO is the nonprofit organization that manages the Cuyahoga River Remedial Action Plan (RAP) and the Cuyahoga American Heritage River Initiative, and works to support restoration efforts and long term community stewardship of the Cuyahoga River Watershed and Area of Concern.

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Big Creek
Balanced Growth Initiative
2010

The Big Creek Balanced Growth Initiative is a community-driven land suitability plan that will assist communities in balancing economic growth with conservation of critical and valuable natural resources of the Big Creek Watershed.

The goals of the Plan are to

- Preserve, restore and enhance existing watershed features
- Promote development and redevelopment that balances economic growth and watershed function
- Recommend land use practices that best avoid or minimize impacts on the watershed and stream resulting from development

Big Creek is one of the most urban watersheds in the Cuyahoga River basin. Restoration of natural infrastructure in strategic areas is an important tool to improve water flow and quality issues. Opportunities for preservation of natural systems are limited, but chances exist to replace and retrofit aging urban built structure with infill natural systems.

Building and strengthening stewardship in the river's tributaries is an important part of the Cuyahoga River Remedial Action Plan for delisting beneficial use impairments in the Cuyahoga. The Big Creek watershed is fortunate to have an active, energetic and effective stewardship group, Friends of Big Creek (FOBC), leading the charge for conservation and restoration. The Cuyahoga River Community Planning Organization has been working with FOBC and the communities whose land drains to Big Creek, as well as the Cleveland Metroparks.

This Plan presents input from community representatives, and the data and portrait of the watershed they used when identifying Priority Conservation Areas and Priority Development Areas. It also contains detailed data on Big Creek's wetlands and selected sites, as well as lists of the tools and strategies the FOBC and partners will use to implement the plan.

Contents

This plan was prepared by the Cuyahoga River Community Planning Organization under award NA07NOS4190076 from the National Oceanic and Atmospheric Administration, U. S. Department of Commerce, through the Ohio Department of Natural Resources Office of Coastal Management.

The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, U. S. Department of Commerce, through the Ohio Department of Natural Resources Office of Coastal Management.

Big Creek maps were produced by the Cuyahoga County Planning Commission.

Photographs by Friends of Big Creek.

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Big Creek
Balanced Growth Initiative
2010

PROJECT SCOPE

- Organize the Big Creek Watershed Planning Partnership representing communities, organizations, agencies and residents.
- Gather and analyze GIS data of critical natural watershed features
- Identify and evaluate community issues and desires
- Develop and agree on criteria and create a model for designating Priority Development / Redevelopment Areas (PDAs) and Priority Conservation Areas (PCAs)
- Identify undeveloped land for potential conservation / restoration sites in relation to natural features
- Designate Priority Conservation Areas & Priority Development Areas
- Identify ordinances, strategies and tools for stewardship
- Support adoption of the BGI Plan and implementation of strategies.

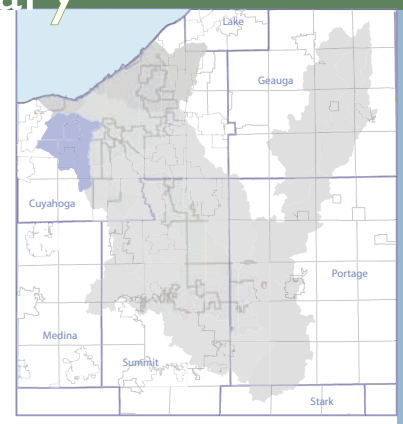
Executive Summary

Working with Friends of Big Creek, local government representatives and the Cuyahoga River Community Planning Organization created the Big Creek Watershed Planning Partnership to address shared concerns about the health of the Creek and the quality and quantity of water flowing throughout the watershed. The Partnership's tasks, outlined in the "Project Scope" at left, became focused on developing a Balanced Growth Plan to identify Priority Conservation Areas and Priority Development areas for land use planning, as well as a set of strategies for conservation and restoration of watershed functions.

The Partnership identified community issues and studied the critical features of the watershed, which led them to identify sites, strategies, policies and implementation steps. This plan presents the products of that process, and outlines specific sites for conservation, restoration and development.

With these tools, the Partnership, led and supported by the Friends of Big Creek, will take the next steps toward implementation, namely land acquisition or conservation, funding and restoration, retrofitting developed areas, and updating local ordinances. Thus, a heavily urbanized watershed can regain its health and become a more beneficial contributor to the Cuyahoga River and the Great Lakes.

Executive Summary
Big Creek



Big Creek is the northernmost, and one of the most urbanized, of the major tributaries to the Cuyahoga River. It joins the river approximately 7 miles south of the river's mouth at Lake Erie. The entire drainage area of Big Creek encompasses nearly 39 square miles, with a total stream length of 12.0 miles.

The creek travels through seven communities, including Cleveland, Brooklyn, Linndale, Parma, Parma Heights, Brook Park, and North Royalton.

Typical of many urban streams, Big Creek has been subject to the effects of extensive urbanization for more than 150 years. Its original drainage patterns, wetlands, floodplains and riparian areas have been severely altered and fragmented as a result of channelization, spillway structures, culverts, and land uses encroaching on the stream. This has substantially and permanently altered stream discharge rates and volumes, decreased diversity and livability of habitat and limited the recovery potential of the stream.

Water quality in Big Creek is degraded, limiting the usability of this stream for recreational purposes. Bacteria levels frequently exceed water quality standards. Ecological water quality conditions are typical of those within an urban area with fish habitat in the fair range, poor fish communities but improving and macroinvertebrate communities are also poor but improved from grossly polluted conditions of twenty years ago. The degraded water quality is a result of urban runoff, alteration and encroachment on the stream.

Big Creek is part of the Cuyahoga River Area of Concern, a designation reflecting its polluted nature. At the same time, this helps those who would improve the watershed to garner Federal and State commitments to cooperate with local entities to ensure that Remedial Action Plans are developed and implemented.

Approximately 1,570 acres (or 6%) of open space remains undeveloped. Many of these areas hold important watershed resources that are valuable examples of nature in the city and may offer opportunities for restoration.

The keys to improving Big Creek include properly conserving these natural resources as communities continue to develop and also restoring areas that have been impacted in the past.

MAJOR ISSUES IN THE BIG CREEK WATERSHED

- A large, urban watershed with high impervious coverage (39%) and one of the densest populations in the region.
- Watershed communities are susceptible to flooding, erosion and water quality effects.
- Need for improved stormwater management through retrofits and restoration.
- Remnant greenspaces or natural areas present opportunities for preservation / restoration; these areas have community value as examples of nature in the city.
- Integrating balanced growth recommendations into local community master plans and regulations.

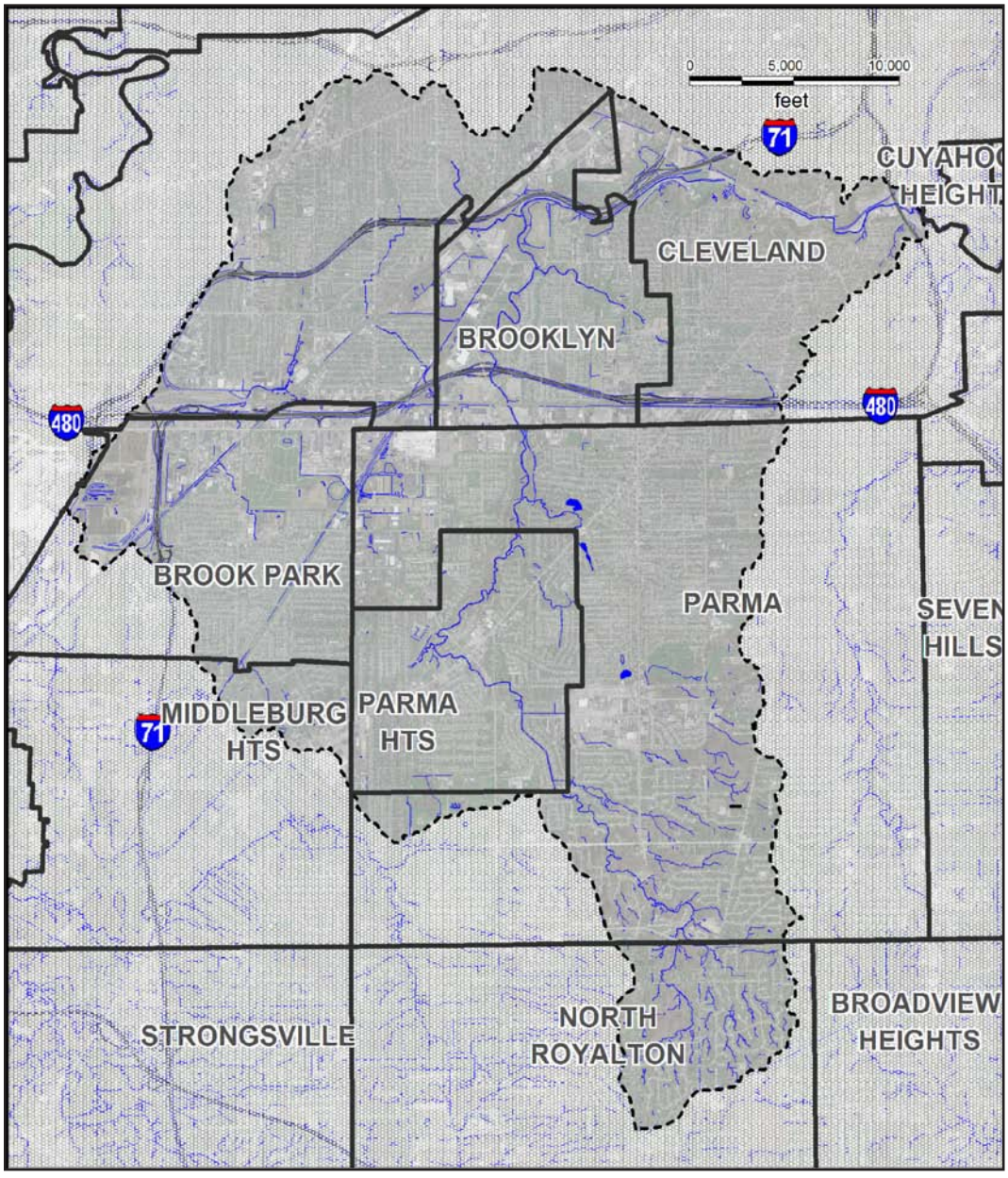
WATER QUALITY & BIOLOGICAL INTEGRITY

Big Creek is designated by Ohio EPA as a "Primary Contact" and "Warm Water Habitat" stream. These designations mean that Big Creek should have bacteria concentrations within a reasonable limit to allow safe recreational contact and be able to support a well-balanced population of fish and aquatic insects.

Water quality in Big Creek is degraded, limiting the usability of this stream for recreational purposes. Fecal bacteria levels frequently exceed water quality standards, indicating that sewage contamination is present.

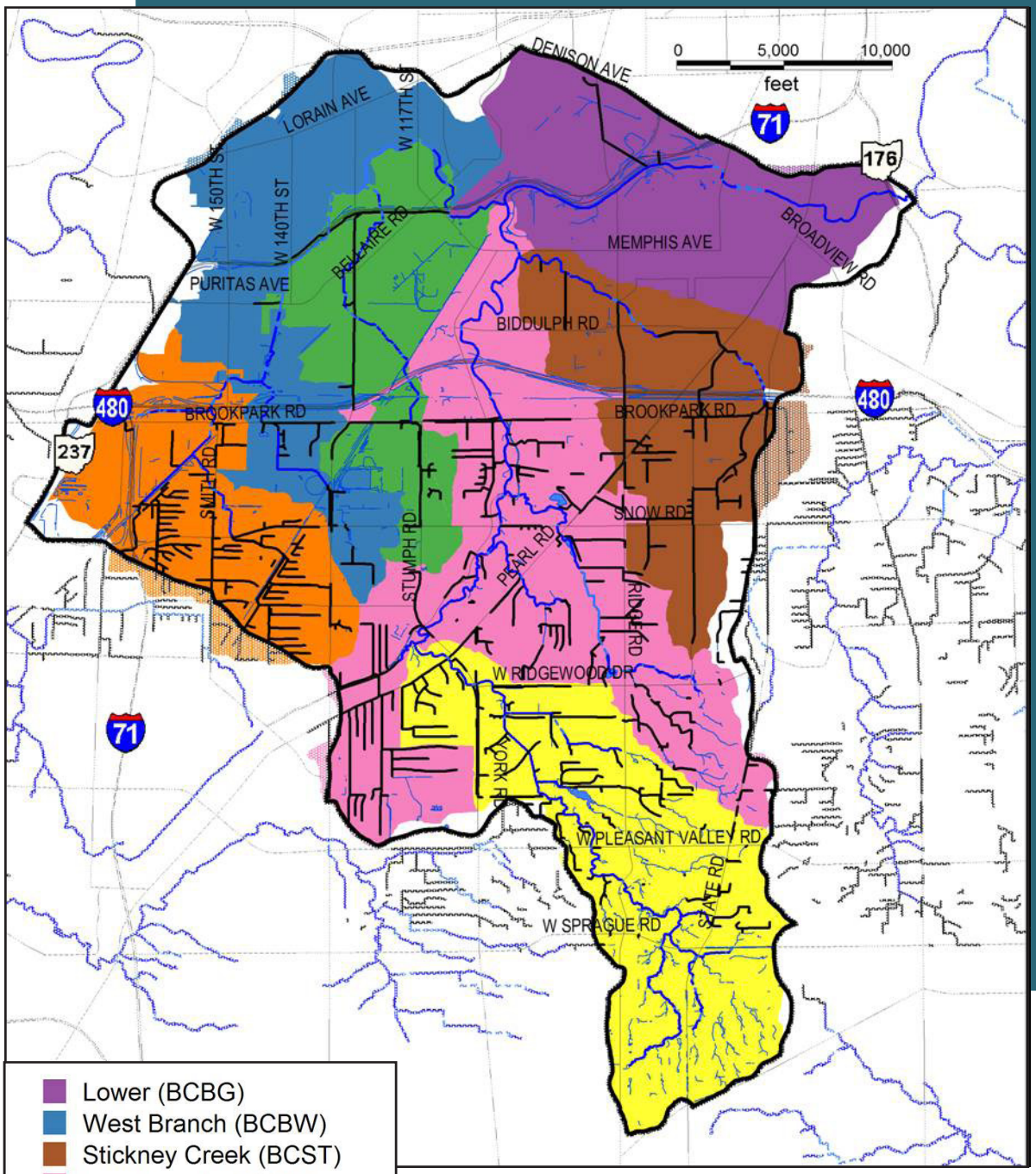
Biological conditions are typical of those within an urban area. Fish and aquatic insect communities are poor but improving from grossly polluted conditions of twenty years ago. The degraded biological community is a result of the presence of combined sewer overflows, sanitary sewer overflows, urban runoff and alteration of and encroachment on the stream.

Big Creek Municipalities



Municipal Composition of Big Creek Watershed

Brooklyn	11%	Linndale	0.2%
Brook Park	10%	North Royalton	5%
Cleveland	33%	Parma	29%
Parma Heights	11%		



Big Creek and its Subwatersheds

CRITICAL NATURAL FEATURES

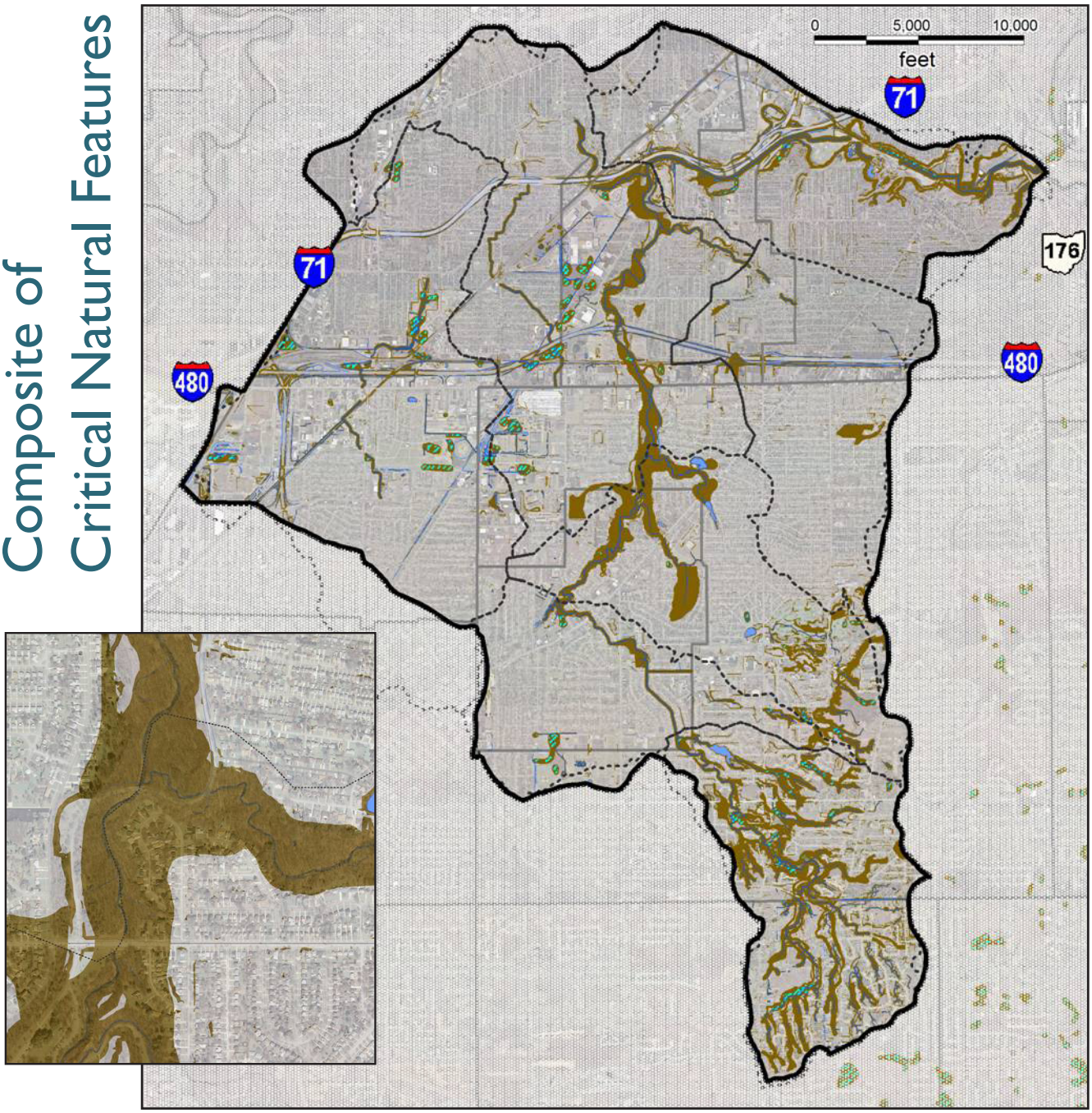
The natural features that are the focus of study when addressing how effectively the watershed functions include:

• soils • slopes • streams and riparian zones • flood plains • wetlands • forests.

Each feature was mapped individually to show where that feature appeared in the watershed, then combined to show the concentration of features in certain areas of the watershed.

This map displays the critical natural features “layered-up”. It represents the most important functional elements of the watershed which need to be preserved or restored to help restore stream functionality.

Composite of Critical Natural Features



METHODOLOGY

1. Identify and Evaluate Community Issues and Desires
2. Identify and remediate, where feasible, polllution issues.
   Early in the process of evaluating stream and watershed conditions, the Watershed Planning Partnership determined that due to the extreme urban condition of the watershed, coupled with the aged community infrastructure, the planning effort should embrace the techniques and tools of the new Balanced Growth Initiative watershed planning process as developed by the Ohio Lake Erie Commission. The plan development methodology followed OLEC BGI guidelines, including:
   A. GIS Data Analysis & Qualitative Assignment of Big Creek's Natural Features to Reflect Community Needs & Watershed Function
   B. Identify Undeveloped & Developed Land with Relation to Natural Features
3. Analyze Potential Priority Development / Redevelopment Areas
   - GIS Data Analysis of Priority Development / Redevelopment Areas
4. Identify Priority Conservation and Development / Redevelopment Areas
5. Analyze and Identify Priority Areas for Conservation Using Stormwater Retrofit Techniques
6. Review Community Ordinances and Identify Tools, Practices & Strategies for Community Stewardship

DEVELOPING EVALUATION CRITERIA
for Priority Conservation Areas and Priority Development Areas

Identifying Priority Conservation Areas (PCAs) and Priority Development Areas (PDAs) began with identifying community needs.

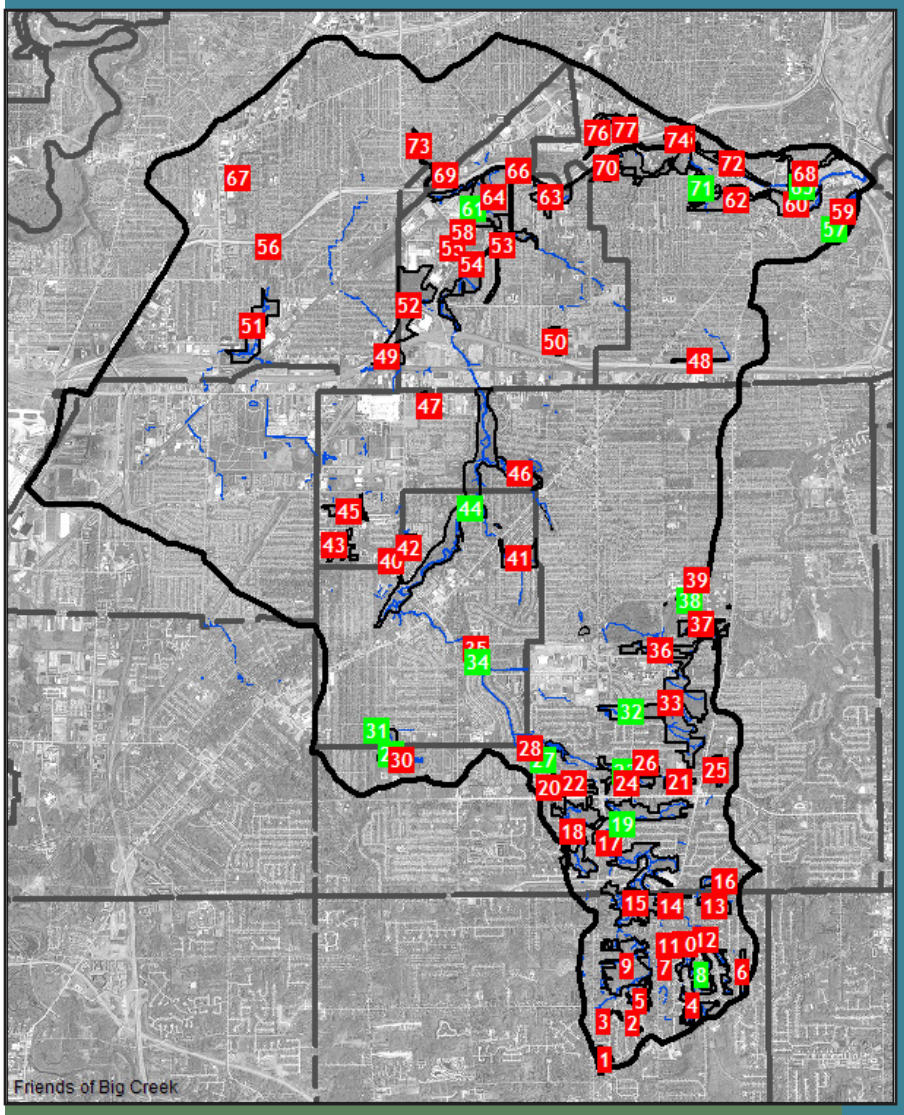
Numerous Watershed Planning Partnership meetings were held, and we solicited feedback from the partnership to help shape the evaluation criteria for identifying conservation and development areas. Each community representative received a scoring priority worksheet titled "Scoring Priorities for Conservation of Important Watershed Features". The worksheet listed watershed features and their associated function and each person was asked to rank the importance of each item.

The table below includes the list of items and shows the scoring results. The survey determined, by the frequency of responses, which factors mattered most to the communities. The top scoring watershed features and issues will be used to identify areas of the watershed that should be pursued for conservation and, conversely, areas without these characteristics should be more suitable for development.

GOALS of the Big Creek Watershed Balanced Growth Plan

COMMUNITY PRIORITIES for CONSERVATION	Results
Priorities for a Watershed Plan	%
Protect Stream features through Stream and Wetland Restoration	95%
Link Redevelopment with Natural Resource Protection	88%
Improve Water Quality in Big Creek	86%
Flood Hazard Reduction	85%
Improve Community Livability and Appeal	76%
Link Stream Valley to Neighborhoods w/ Green Trail Corridors	75%
Promote Economic cooperation for Community Development	71%

The next step in the analysis was to identify large areas of undeveloped land, helping to set the stage for identification of Priority Conservation Areas. The process also indicated future development pressures in relation to critical natural features.



The GIS land cover data and field investigations identified 1,570 acres in 63 tracts of undeveloped land, comprising 6.4% of the watershed, that are non-park-related and are therefore unprotected.

The characteristics of these 63 large undeveloped and unprotected tracts vary and include

- flat, heavily-forested upland areas that may have high development pressure;
- land adjacent to creek gorges, with steep terrain that could present difficulties for developers; and
- back lots of "bowling alley"-shaped parcels that could be consolidated

These parcels, shown in red on the map, hold considerable amounts of wetlands, streams, steep slopes and critical soils.

Parcels shown in green are park-owned lands and their proximity to critical features could mark them as valuable assets for land assembly for conservation.

Critical Features in Large Undeveloped Land Areas

	Total	Critical Soils	Steep Slopes	Flood Zones	Forest Cover	Wetlands & Streams
Total Unprotected Land in Large Tracts (acres)	1,570	814	486	not calculated*	297	914.7
Represents % of Features Remaining in Watershed	6.40%	7.70%	25%	not calculated*	71.90%	52.20%
* data unavailable, will incorporate when new data becomes available						

PCA

Priority Conservation Areas

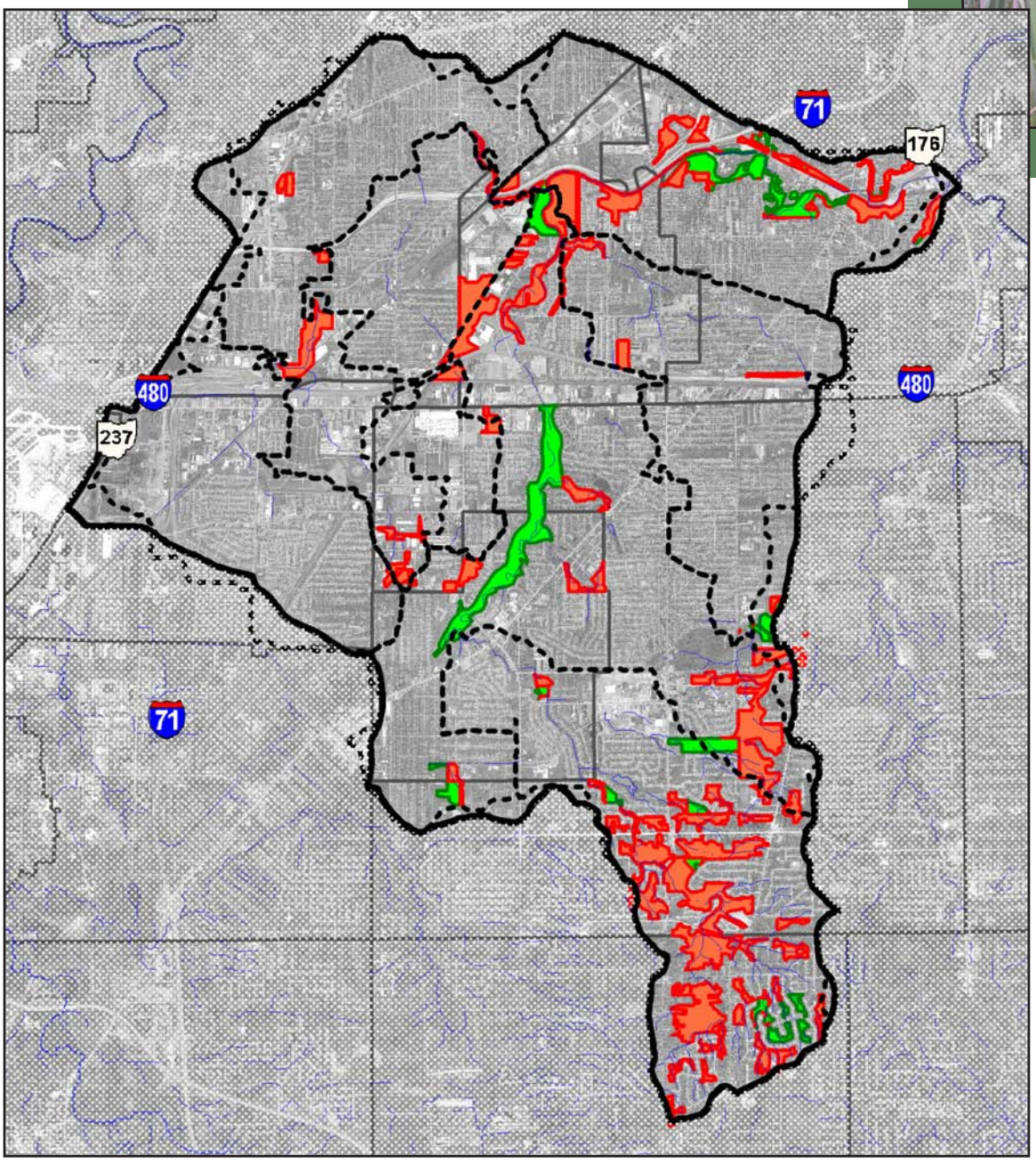
Priority conservation areas are locations where land use change is predicted to have a high impact on the watershed in terms of flooding, erosion, and water quality, based on the analysis of several data sets representing criteria that the watershed planning partners determined were important.

- CRITICAL SOILS
  Recommendation: In critical soil areas, communities should develop soil compaction limitations to help conserve this resource during construction. Conservation and low impact design standards are recommended.
- STEEP SLOPES
  Recommendation: In steep slope areas, communities should conserve these resources to the maximum extent possible for health, safety, property and environmental concerns. Setbacks should be implemented on slopes of 12% or more.
- STREAMS & NATURAL RIPARIAN AREAS
  Recommendation: Stream and riparian corridor areas should be protected from encroachment at all costs. Communities should adopt riparian setback ordinances to protect both headwater and primary headwater streams. Where impacts occur in these areas, mitigation within the immediate drainage area should be required .
- FLOODPLAINS
  Recommendation: Communities should conserve flood plains to accommodate excess flow, protect health and property. Community regulations need to maintain current flood plain maps and adequately protect floodplains from development to reduce future damages.
- WETLANDS
  Recommendation: Wetland areas should be conserved as essential storage and filtration systems. Communities should adopt ample setback ordinances for all wetlands categories.
- FORESTS
  Recommendation: Communities should conserve forested areas within riparian corridors and minimize the loss of existing forested areas throughout the entire watershed, through conservation development and tree preservation regulations.

PCA Analysis by Subwatersheds

Subwatershed	Total Large Tract Acres	Total Critical Watershed Features (Acres)	% of Watershed's Total Critical Features
East Branch (BCBE)	466.4	437.3	3.5%
Lower (BCBG)	288.9	222.1	1.8%
West Branch (BCBW)	122.2	98.0	0.8%
Colleda Branch (BCCD)	0.0	0.0	0.0%
Chevy Branch (BCCH)	28.3	34.6	0.3%
Stickney Creek (BCST)	41.3	22.6	0.2%
Upper Big Creek	623.8	614.1	4.9%
Total	**1570.9**	**1428.7**	**11.5%**

Priority Conservation Areas



Priority Conservation Areas

Protected Land

PDA

Priority Development Areas

Priority development areas are locations where land use changes are predicted to have minimal impact on the watershed and where conditions suggest that additional development would be appropriate.

The Big Creek watershed includes seven municipalities that are largely complete with zoning, water and sewer availability and other factors important for development.

- **HIGH DENSITY ZONING** lies within areas zoned for high density commercial, industrial or residential uses.

  The Plan relies on the community's underlying zoning to focus development and redevelopment in these areas. These areas typically followed business and industrial corridors and town centers. Directing development to these areas can bring businesses back to inner-ring suburbs where infrastructure currently exists.

- **HIGHWAY and MAJOR INTERCHANGES** lie within a 500-foot radius of a major intersection or half-mile radius of a highway interchange.

  Interchanges act as service centers that are important to commercial, industrial and residential development. They have high passenger volumes, multi-modal forms of transportation and are typically near town centers. Major intersections and highway interchanges were based on U.S. census classifications.

- **VACANT PARCELS** lie within undeveloped areas zoned for high density commercial, industrial and residential development.

  The location of vacant parcels can provide guidance in prioritizing future development. Directing redevelopment to these areas can bring businesses or mixed use residential growth back to cities where infrastructure currently exists, reducing urban sprawl.

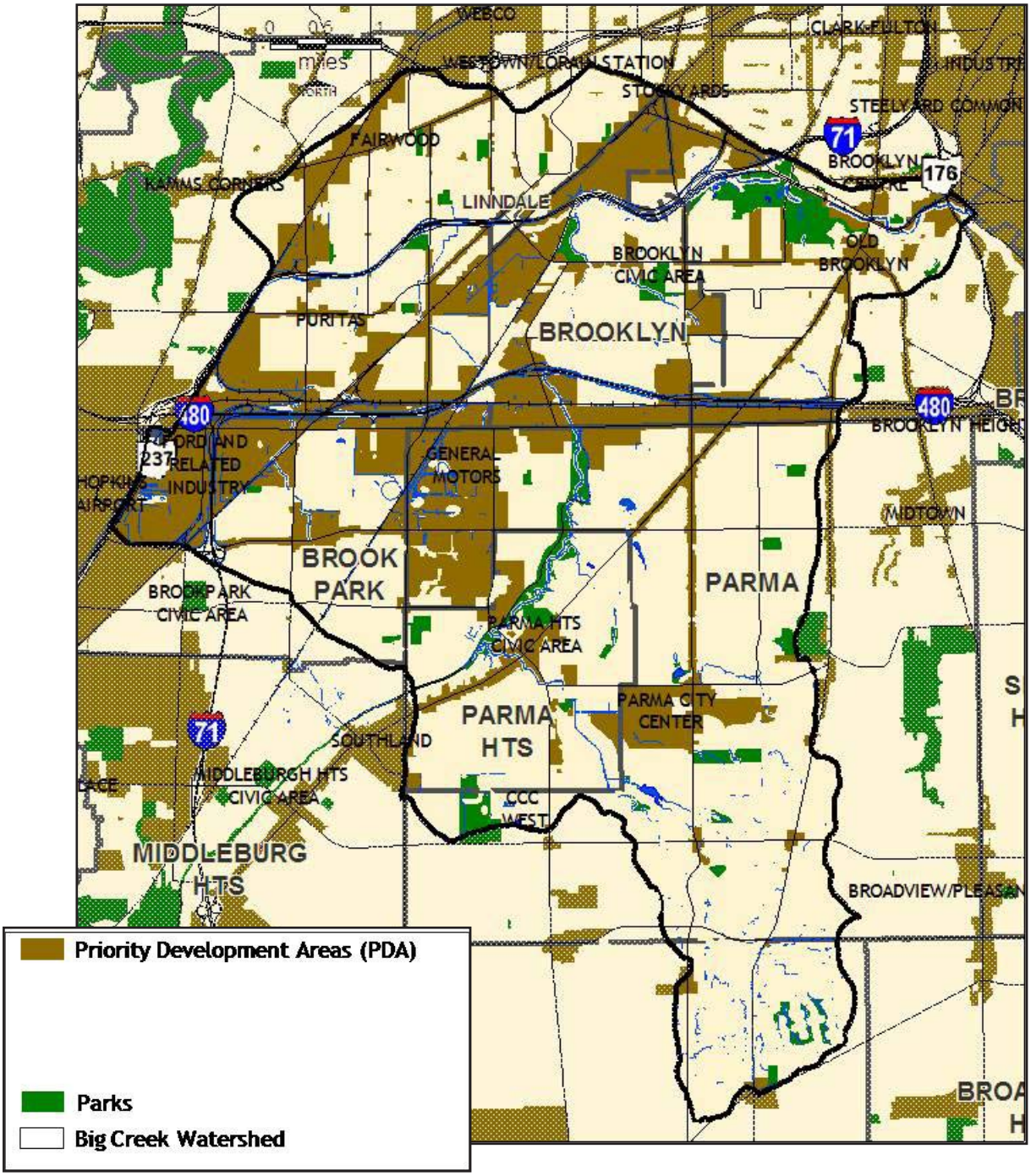
- **WITHOUT CRITICAL WATERSHED FEATURES** Priority Conservation Areas should be excluded from future development.

  Critical watershed features play an important role in managing stormwater. These features are already scarce and the remaining acreage should be protected for the benefit of the communities. Parks, restoration projects and greenway systems can be implemented in many of the areas.

The Ohio Lake Erie Commission Balanced Growth Program established a development suitability technical advisory committee to determine which factors were most important to the development community. Below are the top ten development suitability factors.

RESIDENTIAL	COMMERCIAL	INDUSTRIAL
1. Public water availability	1. Public water availability	1. Proximity to highway
2. Public sewer availability	2. Public sewer availability	2. Public sewer availability
3. Pro-development community attitude	3. Median household income in community	3. Public water availability
4. School quality	4. Community population density	4. Land availability
5. Land cost	5. Proximity to highway	5. Proximity to highway interchange
6. Median household income in community	6. Community growth characteristics	6. Pro-development attitude of community
7. Land availability	7. Land availability	7. Proximity to employees.
8. Community growth characteristics	8. Pro-development community attitude	8. Land cost
9. Proximity to highway	9. Proximity to highway interchange	9. Soil type / stability
10. Proximity to highway interchange	10. Proximity to other commercial development	10. Median household income

Priority Development / Redevelopment Areas



PDA Analysis by Subwatersheds

The Colleda and West Branch have the largest acreage of Priority Development Areas each with over 1,000 acres. East Branch and the Lower Branch followed closely behind with 856 acres and 762 acres.

Analysis of high density land uses by city shows that the City of Cleveland holds the most acreage in this type of zoning (2,351 acres,) approximately double the acreage of Brook Park and Brooklyn (1,154 acres each.) Parma holds 1,522 acres of PDA-class zoning, while Parma Heights holds 349 acres and North Royalton only 32.7 acres.

	Net Area (Total Acres minus PCAs)					
Tributary	COMMERCIAL	INDUSTRIAL	MIXED	MULTI-FAMILY	Total PDA Acres (minus PCA)	% PDA Area Remaining
East Branch	464.0	356.9	-	35.5	856.4	89.6%
Lower	191.3	541.7	-	29.7	762.7	89.9%
West Branch	288.2	628.0	97.4	5.7	1,019.2	91.1%
Colleda Branch	177.8	611.4	348.1	27.7	1,165.0	99.8%
Chevy Branch	167.3	449.4	16.4	81.1	714.3	90.1%
Stickney Creek	314.6	190.2	-	5.7	510.5	94.3%
Upper Big Creek	330.3	-	-	81.5	411.8	98.9%
No Designated Tributary	43.4	129.0	0.1	11.7	184.2	97.7%
TOTAL	**1,977.1**	**2,906.5**	**462.0**	**278.6**	**5,624.2**	**93.3%**

Implementation Strategies - PCAs to Include Stormwater Retrofit Sites

In response to the "Goals of the Big Creek Watershed Plan," the group targeted "Improving water quality" and "Flood hazard reduction" as immediate and actionable objectives. They focused on a category of strategies that identified sites outside the roster of conventionally-defined PCAs that would be appropriate for restoration using stormwater retrofits – structural practices installed within the stream corridor or upland areas to capture and treat stormwater runoff before it is delivered to the stream. Considering the heavily urban nature of Big Creek, stormwater retrofits will be the primary restoration practice, since they can treat nonpoint source pollutants, minimize channel erosion and help restore stream hydrology.

Four specific types of sites and strategies were identified:

- **Large Parking Lots of 5 Acres or Larger** could receive infiltration-type best management practices (BMPs) at their outfalls, perimeters or interior areas;
- **Modifications to Existing Dry Basins** could add water treatment and storage areas;
- **New Storage Below Outfalls** could divert and manage flows split from existing drainage systems, sending waters to treatment areas on public land in the stream corridor; and
- **Storage at Highway Interchanges** could hold large amounts of runoff in depressions within rights-of-way, clover-leafs, medians and entrance/exit circles.

In Conclusion:

Continuing leadership on the part of the Friends of Big Creek, and collaboration by the communities of Big Creek, the Watershed Planning Partnership and the Cuyahoga River RAP will be essential for ongoing improvement and stewardship within the watershed.

Recommendations

Short Term

- Support the Friends of Big Creek.

  This Plan will be implemented by the FOBC and the local communities.
  This planning process identified policies, tools and strategies, which must be carried forward by the watershed partnership. Communities and partners must, in turn, commit to continue to support the Friends in this mission.

- Adopt a resolution among the watershed communities to formally recognize the Balanced Growth Plan.

  The participating jurisdictions should agree to a Resolution which outlines the relationship and obligations of the jurisdictions within the Big Creek BGI Watershed Plan. This step is crucial in order to receive state endorsement and future financial incentives.

- Submit BGI Plan to the State for approval.

  The final BGI Plan will be submitted to the Ohio Lake Erie Commission for approval. Once the plan has endorsement from the State, financial incentives for conservation and development areas become available.

Friends of Big Creek will serve as Plan Implementation Coordinator - working closely with the local governments of the watershed on action steps, funding, and a timetable to achieve implementation of the stated plan goals and action elements.

FOBC will convene meetings as necessary and continue to be the communications hub for stewardship activities in the watershed, as it has for many years.

Long Term

- **Incorporate the PCA / PDA map into local master plans and zoning maps.** Each jurisdiction should submit and adopt the PCA/PDA Map to elected officials and approving bodies for review and approval. Each jurisdiction should follow its established public review processes for plan adoption.
- **Update local ordinances and zoning codes as recommended in the plan.** Each jurisdiction should update land use policies and documents, including comprehensive plans, zoning and subdivision regulations, to ensure consistency with the BGI Plan.
  Jurisdictions should work together on this task.
- **Create uniform storm water codes throughout the watershed** to ensure that watershed protection and site development review processes are fair, consistent and apply evenly to all areas of the watershed as development and plan implementation moves forward.
- **Implement conservation, restoration and retrofit programs** at sites that have been identified, as well as the top ten wetland project sites identified in Big Creek through the RAP's prioritization study. Use this information to capture funding and assemble willing land owners and project partners. Identifying these sites allows projects to be expedited to meet mitigation needs and attract public and private funds.
- **Explore developing a Transfer of Development Rights / Purchase of Development Rights / Density Transfer Program** as a long term goal.

  Development Rights Programs should be considered as part of the tool kit of options to achieve conservation and direct development away from sensitive areas.
- **Revise and update plan when needed.** As different projects or watershed needs become apparent, additional chapters should be added to the BGI Plan.

The Plan

INTRODUCTION

The Big Creek Watershed is one of the most highly urbanized watersheds within Cuyahoga County and the entire Lake Erie Basin. Big Creek serves as a major tributary to the Cuyahoga River, entering the river approximately 7 river miles south of the mouth. Big Creek drains nearly 39 square miles with a total stream length of 12.0 miles, flowing through seven communities including Cleveland, Brooklyn, Linndale, Parma, Parma Heights, Brook Park, and North Royalton.

The Cuyahoga River Community Planning Organization (CRCPO) received a grant from the Ohio Coastal Management Assistance Grants Program to develop a Watershed Action Plan for Big Creek. That plan would address water quality by focusing on physical, biological and chemical impacts on local water resources. In such an urbanized, built-out watershed as Big Creek, it is also important to tackle the issues of land use and economic development alongside those of conservation.

This Balanced Growth Plan provides that part of the overall Action Plan, as it focuses primarily on land cover and characteristics, and land use, and has been developed under the guidance of the Ohio Balanced Growth Initiative (BGI). The Big Creek BGI Plan is a community driven land suitability plan that will assist in balancing economic development while conserving and restoring critical natural resources that benefit the watershed communities.

The Big Creek Balanced Growth Plan is a resource for community decision makers to evaluate the potential impacts of land use changes in the watershed. The plan identifies Priority Conservation Areas (PCAs), Priority Development Areas (PDAs) and, in some cases, PCAs that are prime candidates for stormwater retrofit projects.

CRCPO is doing this work in cooperation with the Friends of Big Creek and with official support from the cities of Cleveland, Brooklyn, Brook Park, Parma and Parma Heights. For additional information on the Balanced Growth Initiative, go to the program website at http://balancedgrowth.ohio.gov .

The Ohio Lake Erie Commission (OLEC) is coordinating with State agencies to develop state incentives and funding opportunities to assist communities in implementing these watershed plans. Integrating the Big Creek Plan into a community's comprehensive plan is an important step in managing and improving floodplains, wetlands, and open spaces that are currently providing flood control, erosion control and water quality protection.

Going forward, the Friends of Big Creek will continue in its role as the lead organization to manage the implementation of the Plan and communication among the Partnership governments and assisting agencies.

This Plan provides the roadmap that the Partnership will follow, as well as the toolkit they can use to build a healthy watershed.

GOALS of the BIG CREEK BALANCED GROWTH INITIATIVE PLAN

1. Preservation, Restoration & Enhancement of existing watershed features
2. Promote Development & Redevelopment that balances economic growth and watershed function.
3. Recommend Best Land Use Practices to avoid or minimize impacts from development.

The Big Creek Balanced Growth Plan is a community driven land suitability plan that will assist in balancing economic growth while conserving critical natural resources that benefit the watershed communities.

Every portion of the earth's landscape is characterized by a different set of features that render it more suitable for certain uses than others. Since all the earth's surface is divided into drainage areas, or watersheds, the concept of land suitability applies to watersheds as well. That is, different areas of a watershed are characterized by different sets of features that render them more suitable for certain uses and less suitable for others.

The objective of a land suitability process such as this is to direct development to an area that is capable of handling this type of land use and, on the other hand, avoiding or minimizing development in areas that could prove hazardous. This concept emphasizes that land use planning and development should recognize watershed functions and other natural processes.

PROJECT SCOPE

- Organize the Big Creek Watershed Planning Partnership representing communities, organizations, agencies and residents.
- Gather and analyze GIS data of critical natural watershed features
- Identify and evaluate community issues and desires
- Develop and agree on criteria and create a model for designating Priority Development / Redevelopment Areas (PDAs) and Priority Conservation Areas (PCAs)
- Identify undeveloped land for potential conservation / restoration sites in relation to natural features
- Designate Priority Conservation Areas & Priority Development Areas
- Identify ordinances, strategies and tools for stewardship
- Support adoption of the BGI Plan and implementation of strategies.

PCA

Priority Conservation Areas

Priority conservation areas are locations where land use change is predicted to have a high impact on the watershed in terms of flooding, erosion, and water quality, based on the analysis of several data sets representing criteria that the watershed planning partners determined were of interest.

PDA

Priority Development Areas

Priority development areas are locations where land use changes are predicted to have minimal impact on the watershed and where conditions suggest that additional development may be appropriate.

BALANCED GROWTH INITIATIVE

"Linking Land Use Planning to the Health of Watersheds"

Balanced Growth is a strategy being led by the Lake Erie Commission to protect and restore Lake Erie and its watersheds in order to assure long-term economic competitiveness, ecological health and quality of life.

Lake Erie is Ohio's greatest natural resource and provides tremendous natural and economic benefits. Despite this, Lake Erie's watershed has endured and continues to face many challenges. Urban Sprawl is one of the greatest of these.

Total population in northeast Ohio has remained relatively stable. However, we continue to expand and develop. While development and community growth is encouraged, it is the manner in which the development occurs that is the most damaging. Of the 11,649 square mile area comprising the Ohio Lake Erie Watershed, over 78% has been altered from its original form, leaving only 22% relatively intact.

As a result of these ongoing problems, the Ohio Lake Erie Commission recognized the need to encourage communities to use their natural resources efficiently to benefit the economy and quality of life.

The Balanced Growth Initiative is both a response to this need and a framework around which can be built elements that will support watershed stewardship and land use management for the future:

- Communities setting priorities in a watershed context
- Whole-watershed collaborations on land use planning, and
- Consistency among ordinances and municipal operations.

KEY BGI GUIDELINES

- Use a regional focus in land use and planning.
- Create local Watershed Planning Partnerships to designate Priority Conservation Areas and Priority Development Areas.
- Adopt Watershed Plans and implement recommended model regulations to help promote best local land use practices that minimize impact on water quality and provide for well-planned development efficiently served by infrastructure.
- Align state policies, incentives, funding, and other resources to support watershed balanced growth planning and implementation.

BGI LONG-TERM INTERESTS

- Sustaining and restoring natural systems in the Lake Erie basin.
- Encouraging the reuse and redevelopment of urban lands
- Maximizing the efficient use of infrastructure
- Conserving farmland
- Providing open space and recreational opportunity
- Promoting compact development patterns
- Helping local governments plan for economic development opportunities and stream-lined decision making
- Providing consistency and predictability for private and public development decisions

Big Creek
Planning By Watershed

Ohio is a home rule state and much of the land use decisions are made at the local level. However, local officials are often faced with pressing issues, such as flooding that cannot effectively be addressed within the context of political jurisdictions.

Flooding and water quality problems transcend community boundaries. Multi-community cooperation and planning by watersheds is imperative in order to address these problems. Watershed planning also helps to leverage resources and complement regulatory programs (ex. NPDES Phase II) of local and state agencies.

WATERSHEDS

Watersheds are complex systems of soils, waterways, water storage areas and vegetation that work together to manage the precipitation falling as rain or snow within a geographic area. All the water in a single watershed that does not evaporate into the air will eventually drain to a single stream, river or lake.

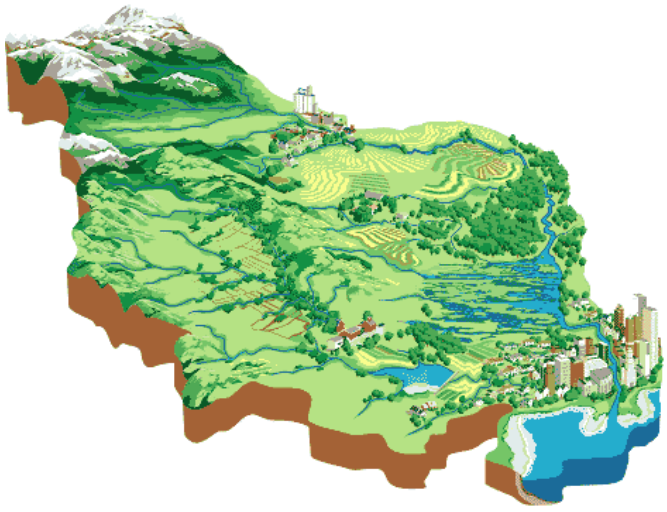
Watersheds function by:

- Pooling water to evaporate
- Soaking water into the soil
- Gathering surface water into streams

Streams and watersheds work together.

Streams are dynamic systems that adjust to compensate for changes in their watersheds and have the capacity to:

- Moderate the volume and energy of water
- Transport and deposit sediment
- Create and sustain aquatic habitat, and
- Assimilate or process a limited amount of pollutants and still achieve water quality standards.

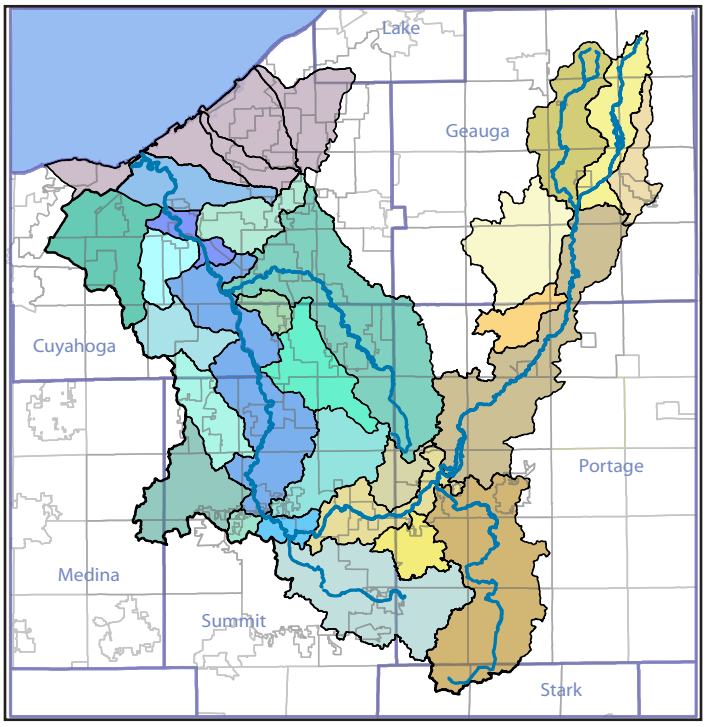


The Cuyahoga River basin drains 813 square miles and includes 1,220 stream miles spanning parts of Geauga, Medina, Portage, Summit and Cuyahoga counties, emptying into Lake Erie at Cleveland. The basin contains parts of three major physiographic provinces: the glaciated Allegheny Plateau, the till plains, and the lake plains. Most of the basin occurs in the glaciated Allegheny Plateau, and owes its topographic and hydrologic features to a complex glacial history. A small portion of the basin in southwest Cuyahoga County lies within the till plains, a relatively flat area more characteristic of north central and northwestern Ohio. The Cuyahoga River basin also cuts through the narrow border of the nearly level lake plains that surround Lake Erie and represents the ancient bottom of the predecessors to Lake Erie.

The Cuyahoga basin is situated within the Erie/Ontario Lake Plain (EOLP) ecoregion, a glacial plain that lies between the unglaciated Western Allegheny Plateau (WAP) ecoregion to the southeast and the relatively flat Eastern Corn Belt Plains (ECBP) ecoregion to the west and southwest. The EOLP ecoregion is characterized by glacial formations that can have a significant local relief of up to 300 feet and exhibits a mosaic of cropland, pasture, woodland, and urban areas.

Soils are mainly derived from glacial till and lacustrine deposits and tend to be light colored, acidic, and moderately to highly erodible. Many glacial features characteristic of the EOLP ecoregion are found in the Cuyahoga River basin. The northern and eastern boundaries of this v-shaped watershed are largely defined by the terminal moraines left by two fingers of glacial ice. Retreating glaciers then buried the ancient river valleys with glacial outwash. The headwaters originate in northeastern Geauga County and flow southwest to Akron through relatively hilly knob and kettle topography. The river generally follows the course of the buried valleys, but does traverse a ridge of erosion resistant sandstone, resulting in the falls and cascades of Cuyahoga Falls. The river turns sharply to the northwest at the confluence with the Little Cuyahoga River in north Akron, then winds through outwash terraces, till plains, and till ridges before reaching the flat lake plain of the Cleveland area.

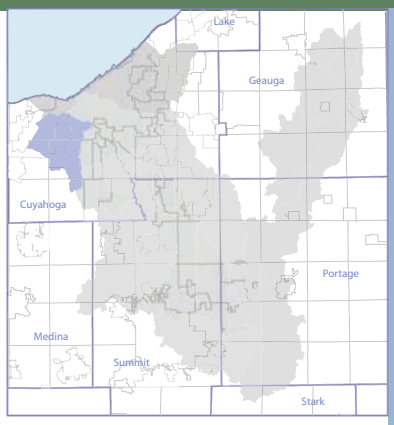
Land cover information from the 2003 Lower Cuyahoga TMDL report shows that approximately 36% of the watershed is covered by deciduous forest. 28% of the watershed is residential, 16% is pasture/hay/row crop agriculture, 11% is industrial/commercial/transportation, and 2% urban/recreational grasses. Slightly over 3% is determined to be woody or emergent herbaceous wetlands.



Land use patterns vary greatly from the upper basin that is primarily agricultural, to the lower basin which is among the most densely populated and industrialized urban areas in the state. Agriculture is the predominant land use in the upper basin, and while less prevalent in the middle basin, the soils are highly erodible and can result in significant sedimentation and nutrient loadings. Resource extraction and hydromodification are localized throughout the basin. The waters of the heavily populated areas of the middle and lower basin are influenced by urban and construction site runoff, combined/sanitary sewer overflows, and land disposal.

Part of the upper Cuyahoga River is a designated State Scenic River and several stream segments within the basin have been designated as State Resource Waters. The Cuyahoga River, from the Ohio Edison Dam to the mouth and the nearshore area two miles west to ten miles east of the mouth has been identified as an Area of Concern by the International Joint Commission. Twenty-two miles of the lower Cuyahoga River flow through the Cuyahoga Valley National Park. Additionally both the Cleveland Metro Parks and MetroParks Serving Summit County have waterways contained in their respective holdings. The Cuyahoga River was designated an American Heritage River in 1998.

Big Creek



Big Creek is the northernmost, and one of the most urbanized, of the major tributaries to the Cuyahoga River. It joins the river approximately 7 miles south of the river's mouth at Lake Erie. The entire drainage area of Big Creek encompasses nearly 39 square miles, with a total stream length of 12.0 miles.

The creek travels through seven communities, including Cleveland, Brooklyn, Linndale, Parma, Parma Heights, Brook Park, and North Royalton.

Typical of many urban streams, Big Creek has been subject to the effects of extensive urbanization for more than 150 years. Its original drainage patterns, wetlands, floodplains and riparian areas have been severely altered and fragmented as a result of channelization, spillway structures, culverts, and land uses encroaching on the stream. This has increased flow volumes, decreased diversity and livability of habitat and limited the recovery potential of the stream.

Water quality in Big Creek is degraded, limiting the usability of this stream for recreational purposes. Bacteria levels frequently exceed water quality standards. Ecological water quality conditions are typical of those within an urban area with fish habitat in the fair range, poor fish communities but improving and macroinvertebrate communities are also poor but improved from grossly polluted conditions of twenty years ago. The degraded water quality is a result of urban runoff, alteration and encroachment on the stream.

Big Creek is part of the Cuyahoga River Area of Concern, a designation reflecting its polluted nature. At the same time, this helps those who would improve the watershed to garner Federal and State commitments to cooperate with local entities to ensure that Remedial Action Plans are developed and implemented.

Approximately 1,570 acres (or 6%) of open space remains undeveloped. Many of these areas hold important watershed resources that are valuable examples of nature in the city and may offer excellent opportunities for restoration.

The keys to improving Big Creek include properly conserving these natural resources as communities continue to develop and also restoring areas that have been impacted in the past.

MAJOR ISSUES IN THE BIG CREEK WATERSHED

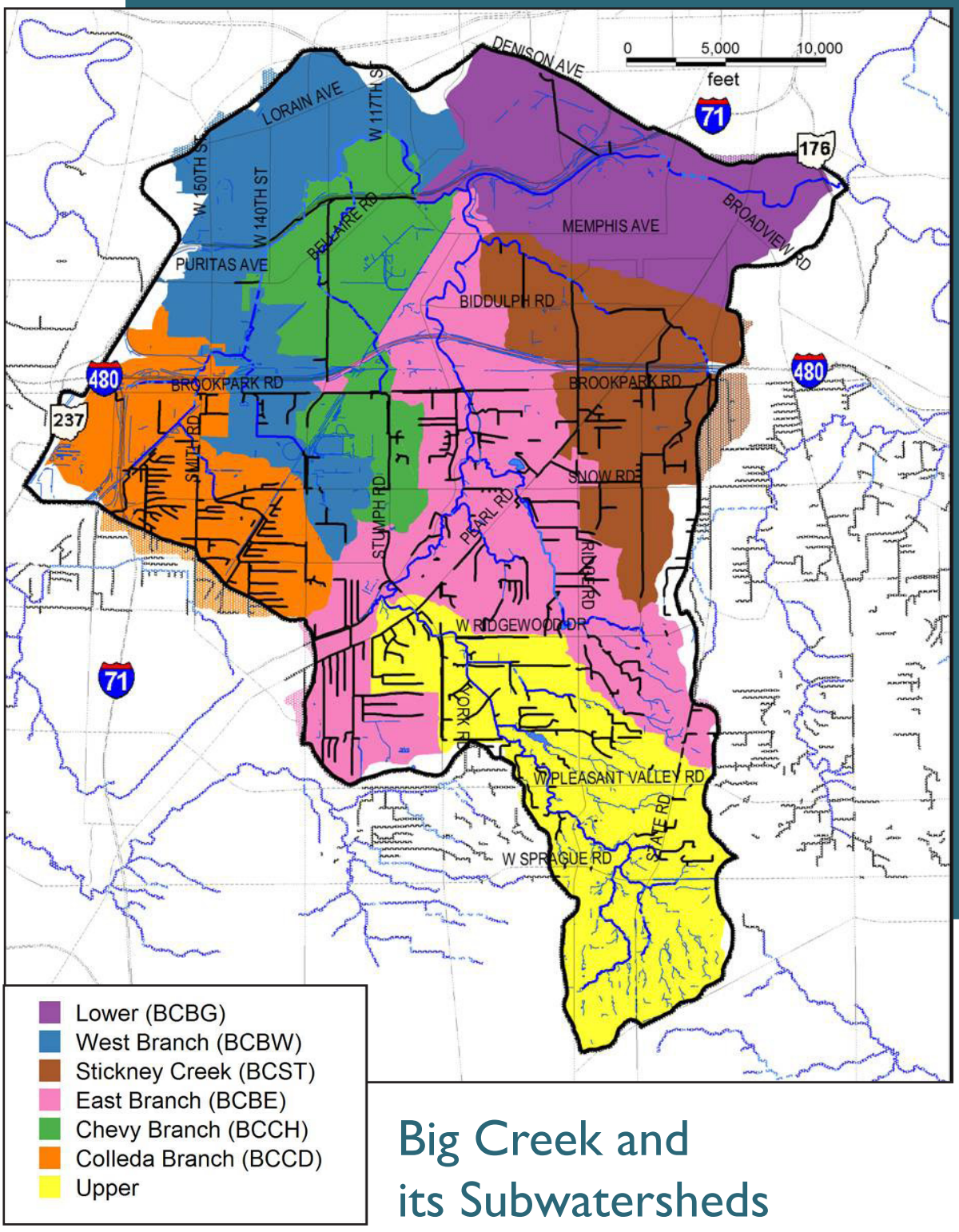
- A large, urban watershed with high impervious coverage (39%) and one of the densest populations in the region.
- Watershed communities are susceptible to flooding, erosion and water quality effects.
- Need for improved stormwater management through retrofits and restoration.
- Remnant greenspaces or natural areas present opportunities for preservation / restoration; these areas have community value as examples of nature in the city.
- Integrating balanced growth recommendations into local community master plans and regulations.

WATER QUALITY & BIOLOGICAL INTEGRITY

Big Creek is designated by Ohio EPA as a "Primary Contact" and "Warm Water Habitat" stream. These designations mean that Big Creek should have bacteria concentrations within a reasonable limit to allow safe recreational contact and be able to support a well-balanced population of fish and aquatic insects.

Water quality in Big Creek is degraded, limiting the usability of this stream for recreational purposes. Fecal bacteria levels frequently exceed water quality standards, indicating that sewage contamination is present.

Biological conditions are typical of those within an urban area. Fish and aquatic insect communities are poor but improving from grossly polluted conditions of twenty years ago. The degraded biological community is a result of the presence of combined sewer overflows, sanitary sewer overflows, urban runoff and alteration of and encroachment on the stream.



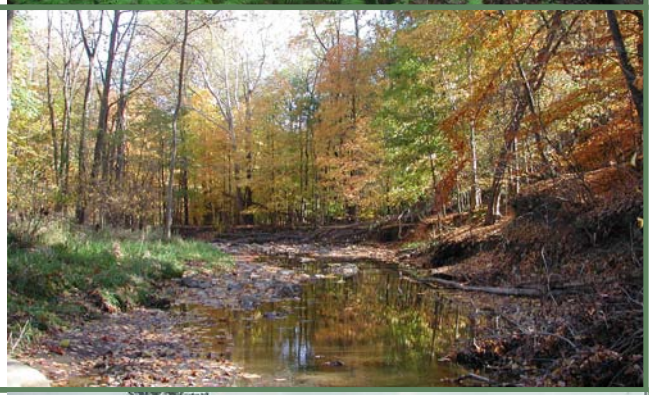
Big Creek and its Subwatersheds

WETLANDS are nature's way of trapping water, storing it, dissipating its energy, filtering out impurities, and slowly releasing it into streams and groundwater supplies. Wetlands store excess water that would otherwise contribute to flooding and stream bank erosion.

Wetlands provide critical habitat - food, shelter and nursery - for a wide variety of plants, birds, amphibians, insects and fish, all of which are necessary in order for ecosystems to thrive. Filling in and paving over wetlands eliminates these important functions and forces the water to flow headlong and unfiltered into streams.

RIPARIAN ZONES are heavily vegetated lands along streams that absorb water and dissipate energy. Leaves, soil and roots absorb water, reduce erosion and stabilize banks.

Vegetated corridors along streams provide for fish and wildlife migration: shade and cool water allowing more oxygen retention; and support habitats by providing nutrients and woody debris and cleaner runoff by filtering pollutants. Natural riparian zones are essential to stream function and need to be preserved.



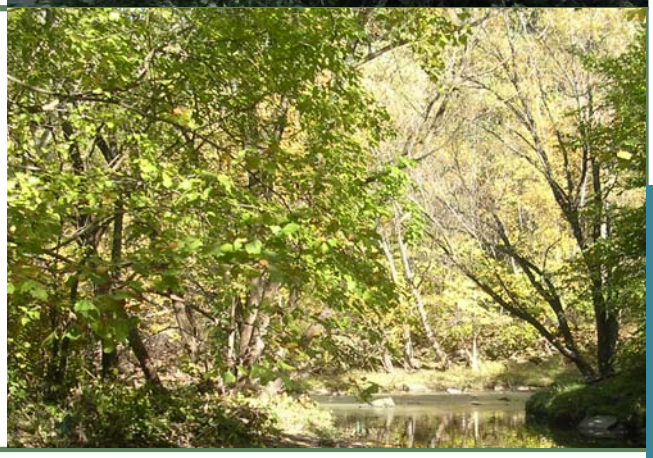
FLOODPLAINS are natural rights-of-way and temporary storage areas for flooding events.

Floodplains are relatively flat areas along stream banks that absorb floodwaters, allowing for the slow release of water back into the stream.

Floodplains enhance biological productivity by supporting a high rate of plan growth. Floodplains provide excellent habitats for fish and wildlife by serving as breeding and feeding grounds. This helps to maintain biodiversity and the integrity of ecosystems.

Floodplains need to be kept undeveloped to allow for stormwater release and space for streams to meander.

PRIMARY HEADWATER STREAMS:
Every stream begins somewhere. That somewhere is its headwaters, the network of small streams that blanket the landscape of every watershed. Primary headwater streams are like the capillary system of a blood supply network- just as the health of whole organism depends upon a functioning capillary system, the health of larger streams and rivers depend upon an intact primary headwater system. These small streams help control the flow of storm water, sediment and nutrients to larger streams. Headwaters are typically impacted the most during development and need protection.



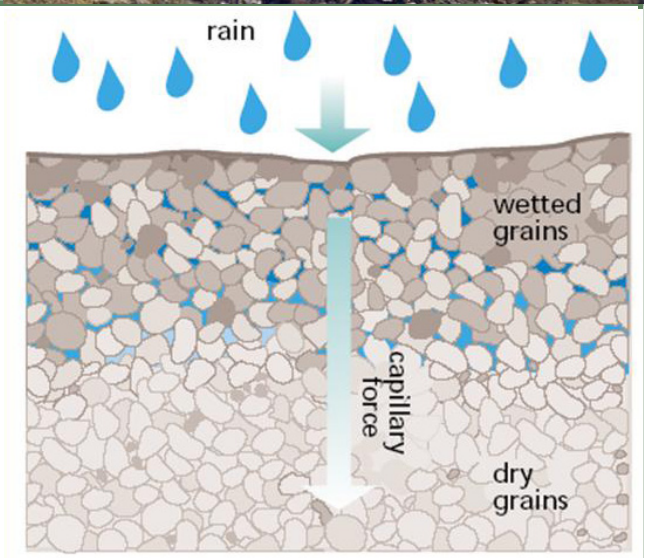
STEEP SLOPES are features of stream valleys and need to be protecterd. Any significant disturbance to the hillside's environment may result in landslides or land instability, alteration in drainage patterns; and loss of scenic value. When development takes place on or near steep slopes (15% or greater), vegetative cover is greatly reduced, significantly increaseing soil instability and erosion. Soil erosion and sedimentation into waterways poses several threats to public health and safety, including increased potential for flooding, that are difficult and expensive to correct. Property damage is commonly associated with development on steep slopes.

CRITICAL SOILS

Porous soils such as sand and gravels provide an opportunity for groundwater recharge by stormwater and should be preserved as a potential stormwater management option. *Unstable or easily erodible soils* should be managed carefully with proper erosion and sedimentation practices.

Infiltration of stormwater into the soil reduces both the volume and peak discharge of runoff from a given rainfall event, and also provides for water quality treatment and groundwater recharge. Soils with maximum permeabilities (moderate infiltration and well drained soils) allow for the most infiltration of runoff into the subsoil.

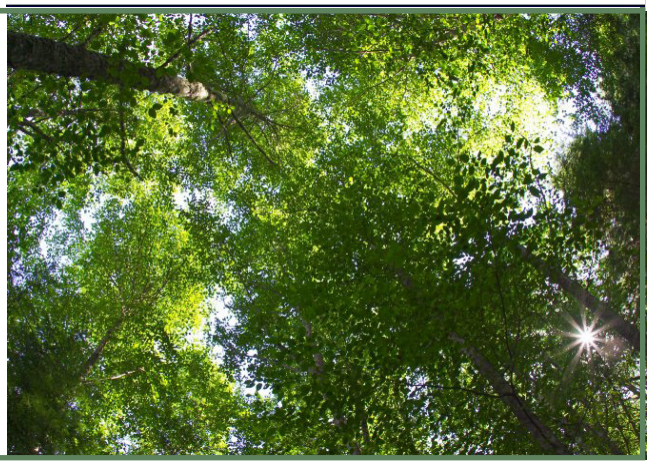
Thus, areas of a site with these soils should be conserved as much as possible and these areas should ideally be incorporated into undisturbed natural or open space areas.



FOREST COVER supports a community's quality of life by maintaining the proper functions of watersheds. Wooded areas support water quality, stream health and aquatic habitat and keep soils in place, reducing sediment.

A healthy forest system can reduce communities' storm water infrastructure costs by intercepting rain, increasing ground absorption and slowing the rate of runoff. Other community benefits include: protecting drinking water supplies, enhancing property values and reducing household energy costs.

Communities need to develop forest cover programs that help maintain and restore tree cover to beneficial levels.

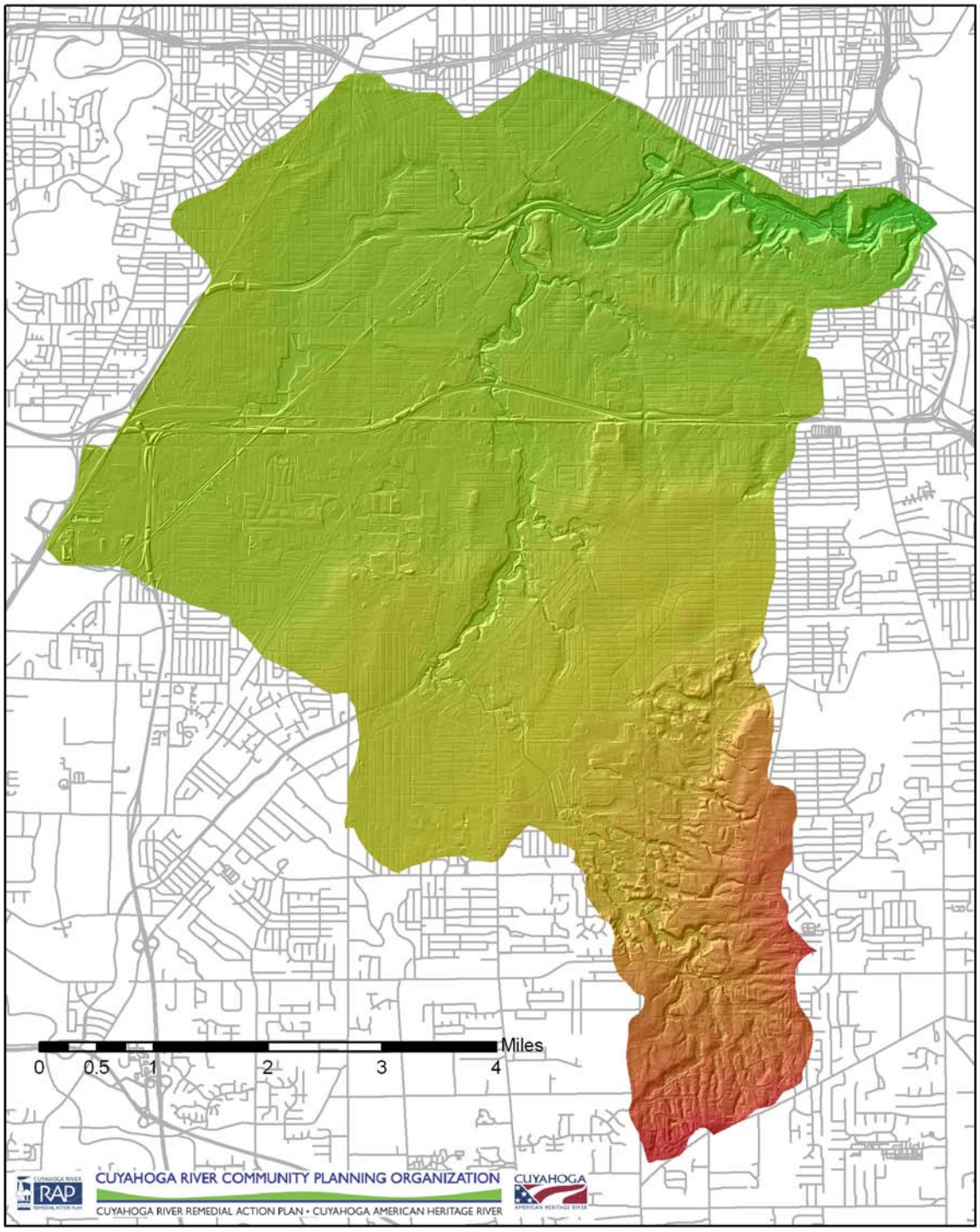


These watershed features reflect long-term geologic, climatic and vegetative patterns.

They exist in the watershed to fulfill a specific need, and any disruption to this system often results in downstream costs.

These impacts must be carefully balanced through mitigation or avoidance.

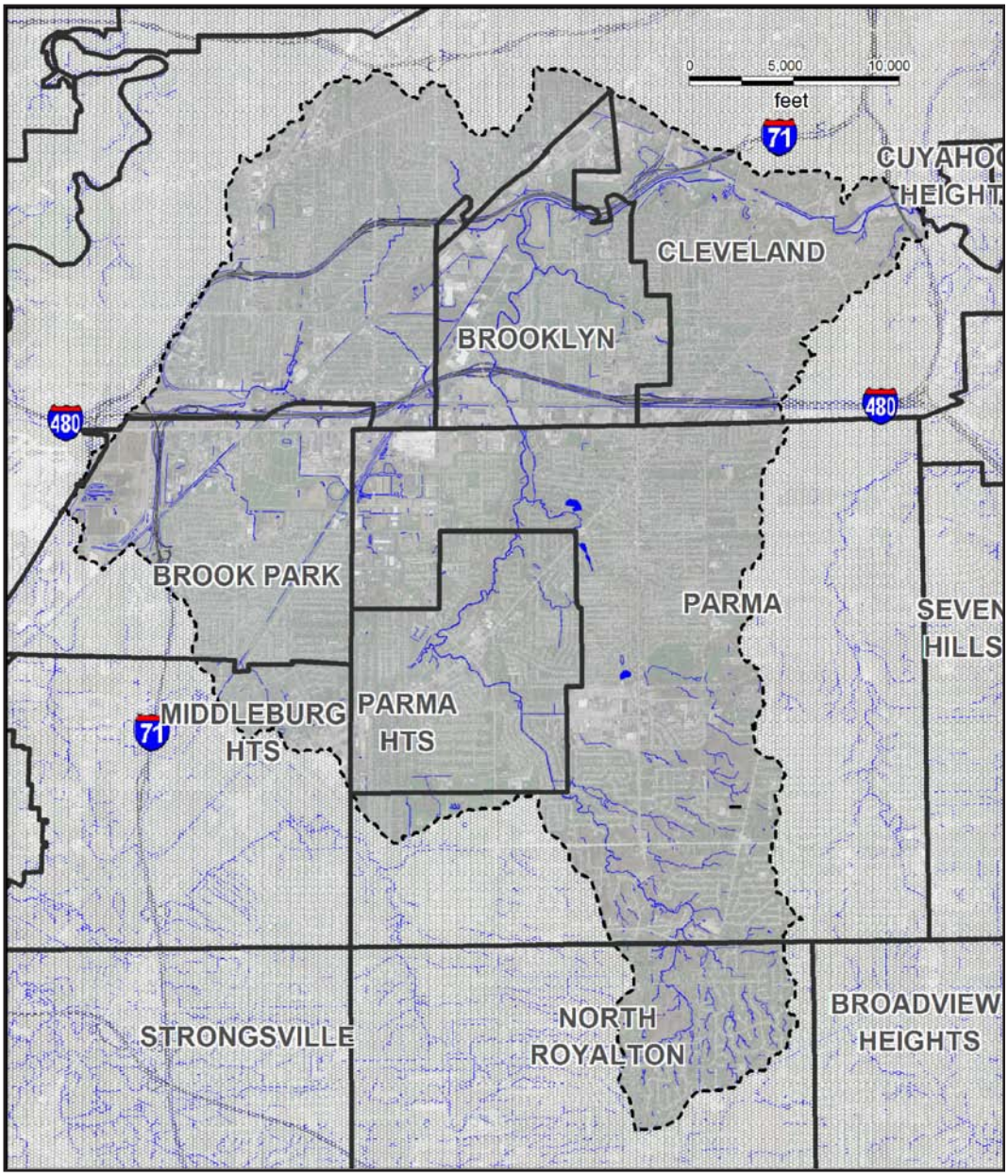
Big Creek Elevation



Most of Big Creek has a relatively flat profile, except for
- the Upper Creek at the south end where a cluster of headwater streams deeply incise the land,
- the large East Branch cutting up through the center of the watershed and
- the Lower Creek where high cliffs surround the creek as it meets the Cuyahoga River.

The drop in elevation from approximately 780 - 800 feet above sea level in the upland areas to 577 feet at the mouth of the creek happens primarily along these ridges.

Big Creek Political Boundaries



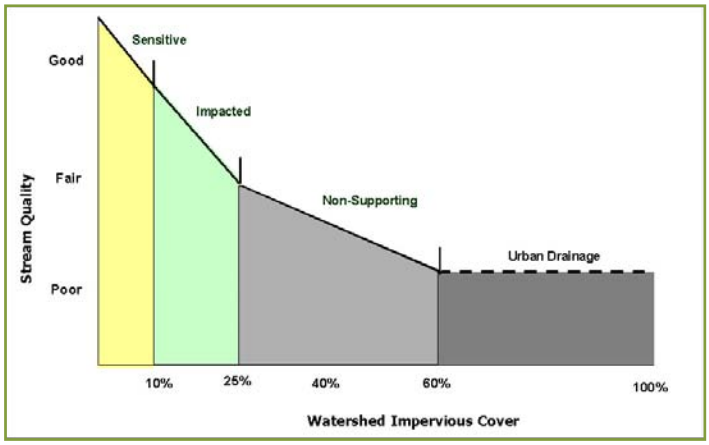
Municipal Composition of Big Creek Watershed

Brooklyn	11%	Linndale	0.2%
Brook Park	10%	North Royalton	5%
Cleveland	33%	Parma	29%
Parma Heights	11%		

Big Creek
Impervious Cover and Watershed Quality

The most important hydrologic characteristic affecting storm water runoff is impervious cover. Impervious surfaces are hard surfaces (ex. roads, rooftops) that do not allow stormwater to infiltrate into the ground, causing the runoff to flow directly into drainage systems. The amount of imperviousness in a watershed correlates directly with frequent flooding and poor water quality. Highly urbanized areas, where much of the land surface has been either paved or covered with buildings, are considered highly impervious. Rural areas tend to have low imperviousness, in which case stormwater infiltration and runoff is controlled by the surrounding soil type.

Diagram: As impervious surface increases, stream quality decreases



IMPERVIOUS COVER MODEL

The Center for Watershed Protection (CWP) has summarized research findings and created an Impervious Cover Model (ICM). The ICM predicts that most stream quality indicators show a decline as the total impervious cover within a watershed increases. (Source: Center for Watershed Protection)

Watershed Impervious Cover 0-10%- these streams usually sustain a high quality, and are often typified by stable channels and healthy biotic communities. The streams may not experience as frequent flash flooding as other urbanized streams.

Watershed Impervious Cover 11-25%- these streams are described as impacted and flooding will occur more frequently. Watershed urbanization may cause stream degradation and alter the stream geometry as a result of increased storm flow and erosion. Some sensitive species may also disappear from the stream.

Watershed Impervious Cover >25%- streams are described as damaged with more frequent flooding and poor water quality. This category of stream becomes unstable and experiences severe erosion and channel widening. Aquatic life becomes dominated by a small variety of pollution tolerant fish and insects.

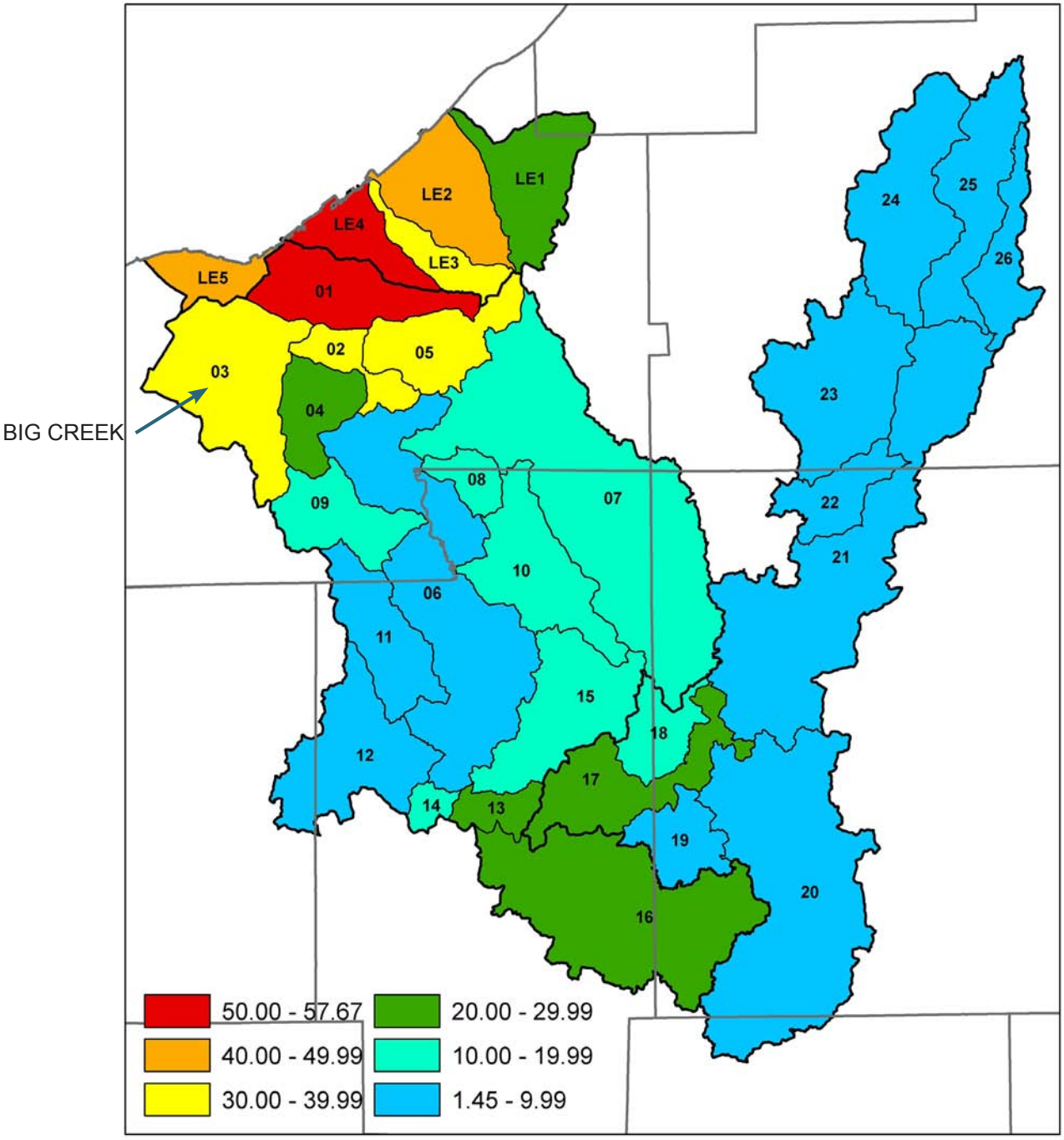
IMPERVIOUS COVER MAPPING

allows communities to gain an idea of how impacted their watersheds currently are, allows them the opportunity to evaluate potential impacts from future development and provides a means to make better-informed site-design decisions.

Understanding the link between impervious cover and watershed quality is essential for communities, organizations and agencies to appropriately deal with the issues of watershed and stream degradation now and in the future.

Impervious Cover in the Cuyahoga River Watershed

The map below shows the overall imperviousness of the Cuyahoga River tributary watersheds. From the headwaters on the right, in blue, the river travels south through areas that are still primarily rural. At the southeast edge of the "V" it encounters Akron's northern outskirts and passes through the Cuyahoga Valley National Park, still within areas with less than 20% impervious cover. As it reaches Big Creek the overall imperviousness increases to more than 25%, the tipping point above which stream quality, form and function will permanently suffer.

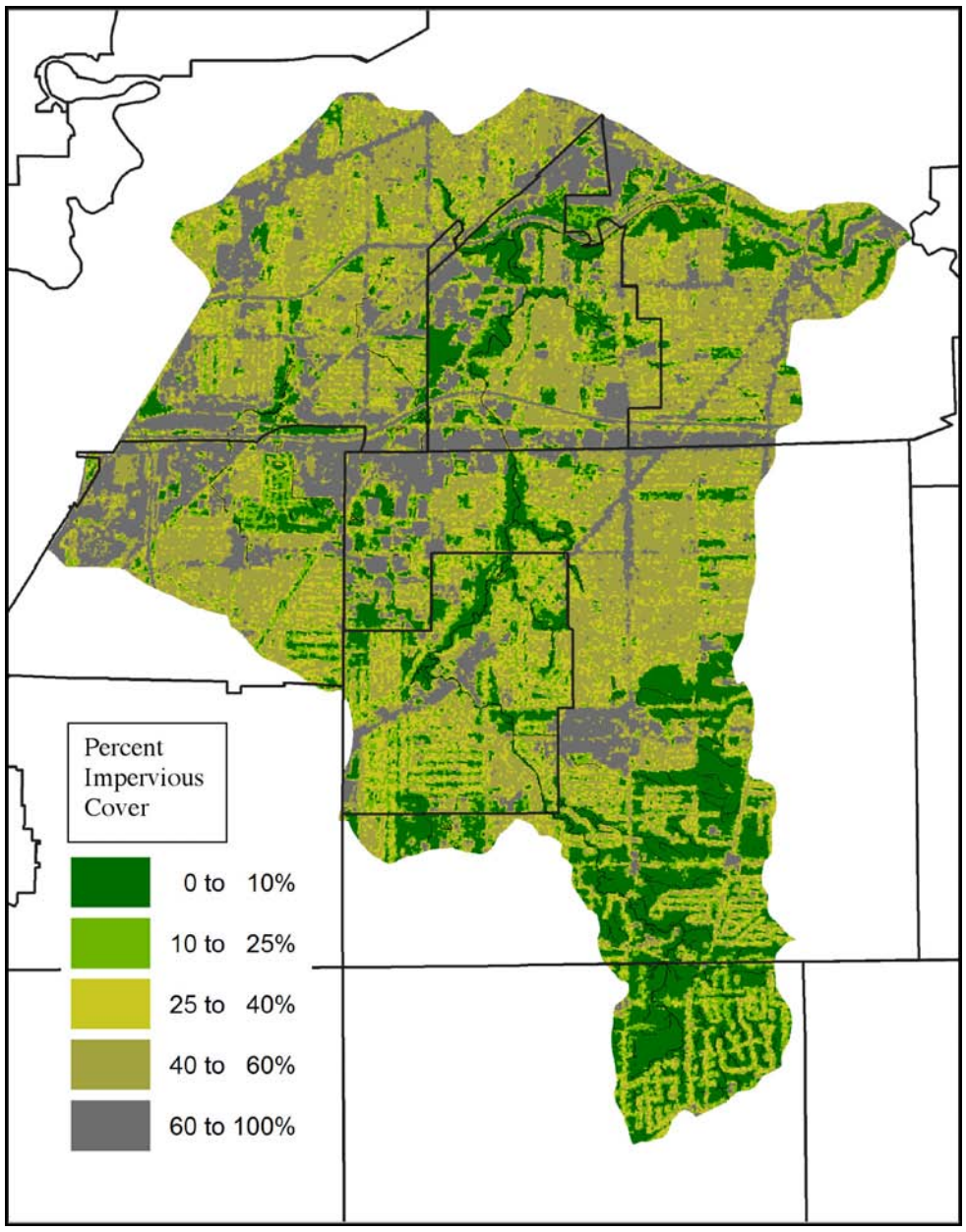


Big Creek
Overall Impervious Cover

Research indicates that 15% is the maximum percentage of impervious cover in which streams can still commonly meet aquatic life standards. However, when important watershed features exist, such as forested riparian corridors and influx of groundwater, streams may still meet attainment even at greater levels of urban land use. (Yoder et al., 2000)

Big Creek has been subjected to extensive urbanization over a period of more than 150 years. The majority of the development in the watershed occurred prior to stormwater regulations and without knowledge of storm water management.

This map shows percent impervious cover based on the analysis of satellite imagery which has a 30 meter pixel resolution (Clapham, 2001). From this overall imperviousness of the Big Creek Watershed and its subwatersheds can be determined.



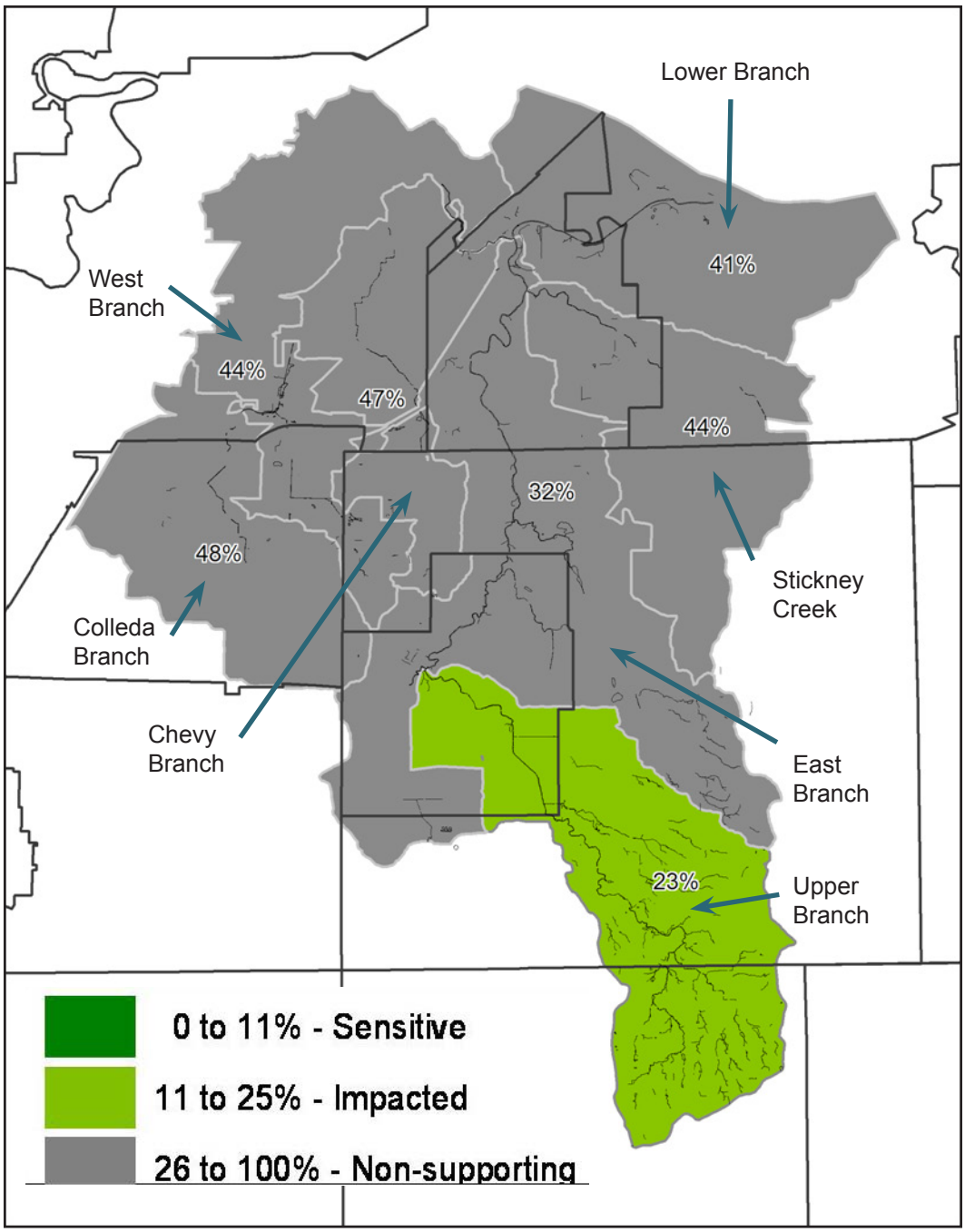
Approximately 39% of the Big Creek watershed is covered by impervious surfaces. Many of these surfaces contain no stormwater management devices and directly drain and contribute excessive runoff to receiving streams, causing downstream flooding and property erosion.

Research indicates that 26% is the maximum percentage of impervious cover in which streams can still commonly meet aquatic life standards.

The amount of impervious coverage in Big Creek, along with the long history of urban development, hinders the creek's ability to reach water quality attainment.

Redevelopment in the watershed communities can be seen as an opportunity to improve community design, stormwater management, and the overall health of Big Creek.

Impervious Cover By Subwatershed



SUBWATERSHED IMPERVIOUS COVER

Most Big Creek communities have too many stressed watershed features to restore all at once and projects must be prioritized. Big Creek was divided into smaller, more manageable subwatersheds that were analyzed for impervious coverage, which will provide insight into planning and management strategies, subwatershed priorities and feasible restoration options.

Four out of the seven subwatersheds have impervious cover levels above 40% with the Colleda Branch having the highest with 48%. The East Branch has 32% impervious cover and the Upper Branch scores the lowest with 23%.

Big Creek
Water Quality & Biological Integrity

The water quality and the health of aquatic life in Big Creek is a useful indicator of the collective land use conditions in the watershed. Problems with poor water quality or aquatic life do not simply originate from a factory effluent pipe: they originate with the way land is used throughout the watershed. The problems can often be initiated by the location of development (e.g. building in flood zones or riparian corridors) and the design of the development (e.g. development that creates large amounts of impervious cover and stormwater runoff).

USE-ATTAINMENT IN BIG CREEK

Poor water quality over the last one hundred years has limited the potential of Big Creek to become an ecological resource for the region. Urban streams nationwide struggle to retain their viability as a community resource due to impacts from urban runoff, industrial land use practices and the lack of protection of watershed resources. Water quality monitoring by the Ohio Environmental Protection Agency (Ohio EPA) and the Northeast Ohio Regional Sewer District (NEORSD) show that Big Creek is no exception to these struggles.

Big Creek is designated by Ohio EPA as a “Primary Contact” and “Warm Water Habitat” stream. These designations mean that Big Creek should have bacteria concentrations within a reasonable limit to allow safe recreational contact and be able to support a well-balanced population of fish and aquatic insects.

WATER QUALITY IN BIG CREEK WATERSHED

Water quality in Big Creek is degraded, limiting the usability of this stream for recreational purposes. Fecal bacteria levels frequently exceed water quality standards.

Fecal bacteria are microscopic organisms that are present in the intestine or feces of warm-blooded animals. They are often used as indicators of sewage contamination in streams.

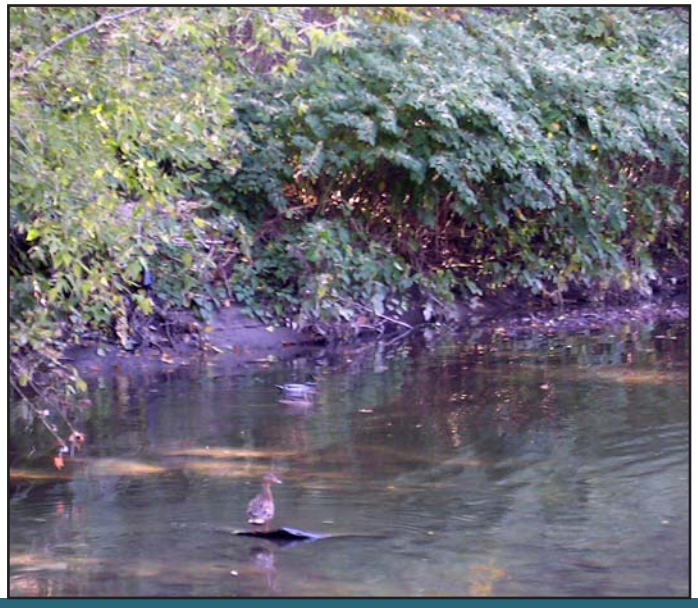
Increased counts of these bacteria are often equated with increased risk of water-borne illness if a person were to come into contact with the untreated water. The bacteria and viruses of concern in urban streams can come from humans, wildlife, and household pets.

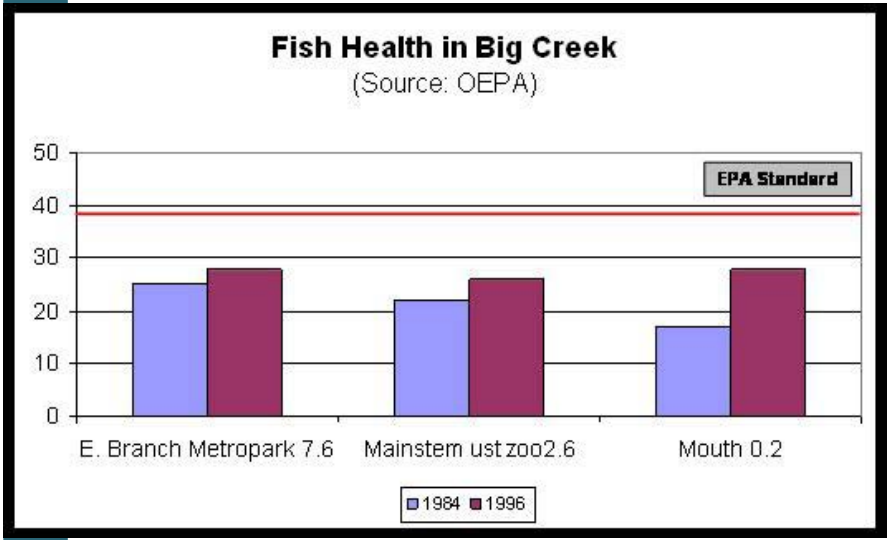
The Ohio EPA and NEORSD both report that the predominant sources of these water quality limitations include the presence of combined sewer overflows, sanitary sewer overflows and urban runoff. While the combined sewers are being remediated, the separate sanity sewers are a problem in Big Creek and other urban watersheds. Typical sanitary sewer problems are blockages or breaks in the lines. Many of these problems appear to stem from Parma and other areas in the Stickney Creek Subwatershed.

BIOLOGICAL INTEGRITY IN BIG CREEK WATERSHED

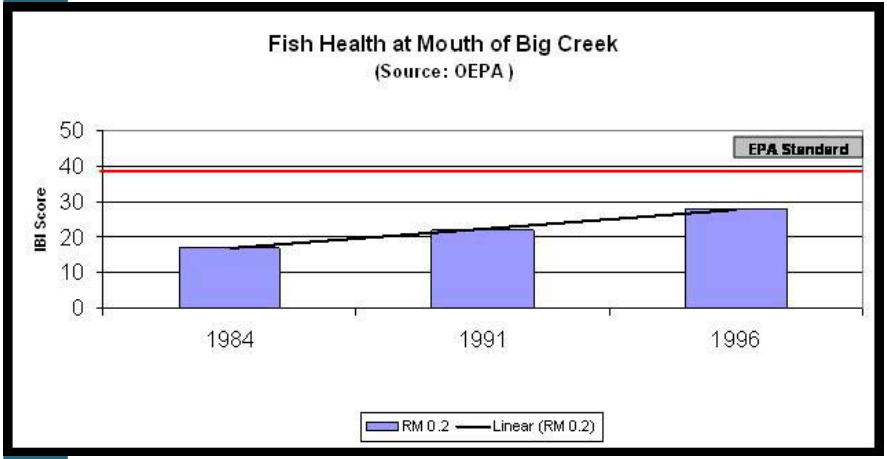
Biological conditions are typical of those within an urban area. Fish and aquatic insect communities are poor but improving from grossly polluted conditions of twenty years ago. The degraded biological community is a result of the presence of combined sewer overflows, sanitary sewer overflows, urban runoff and alteration and encroachment on the stream.

Limited biological sampling exists for Big Creek. The most recent sampling completed by Ohio EPA was 1996. NEORSD sampling is more recent but does not include a complete range of samples needed to determine stream health.

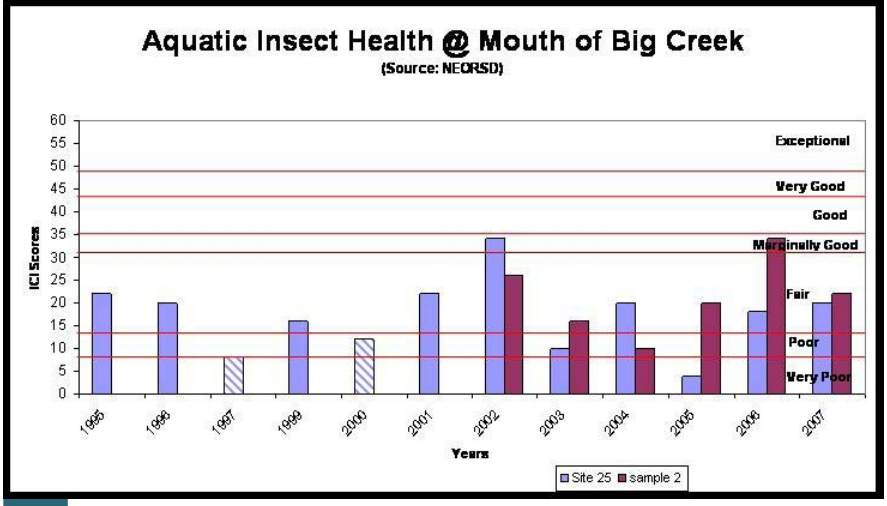




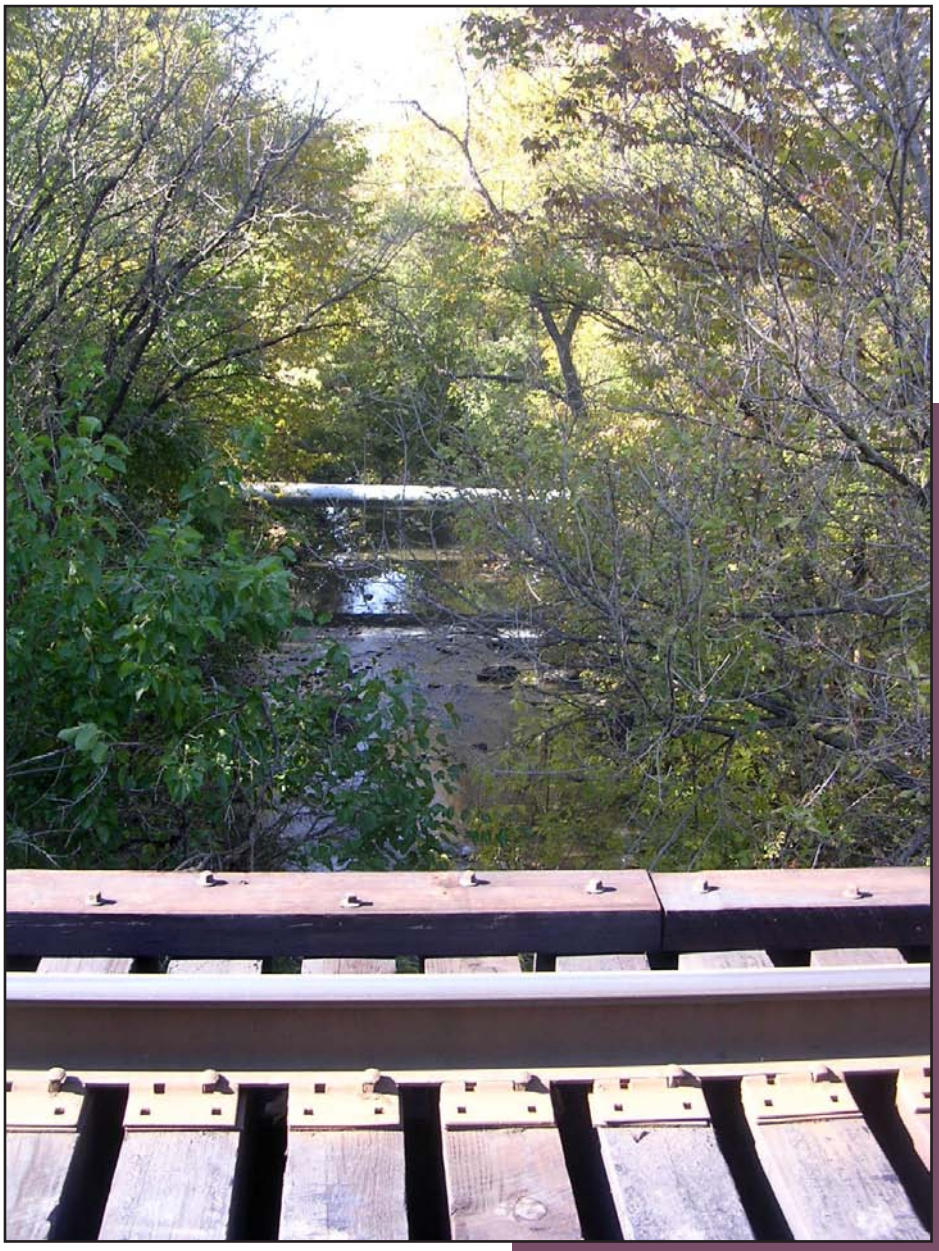
This graph indicates a slight improvement in conditions between 1984 and 1996. But all three sample sites were still below OEPA standards (red line).



This graph indicates that fish health at the Mouth of Big Creek showed improvement from 1984 to 1991 to 1996, but was still not meeting Ohio EPA standards.



This graph indicates that from 1995-2007 aquatic insect communities were below Ohio EPA standards except for 2002 and 2006. This was the first time that this section of Big Creek had indicators of attainment.



CREATING THE PLAN began with reaching out to local governments in the watershed and asking their leadership to appoint representatives – officials, leaders, residents – to the Watershed Planning Partnership.

Those partners met with experts from local agencies involved in watershed management. Following the steps outlined below, and mindful of the issues that present challenges to watershed health, listed at right, the group assembled its data and formulated this Plan.

Major Issues to Manage in the Big Creek Watershed

- A large, urban watershed with high impervious cover (39&) and one of the densest populations in the region
- Watershed communities are susceptible to flooding, erosion and water quality impacts.
- There is a need for improved stormwater management through retrofits and restoration.
- Remnant greenspaces or natural areas present opportunities for preservation/ restoration. These areas have community value as examples of nature in the city.
- Integrating balanced growth recommendations into local community master plans and regulations.

Methodology

1. Identify and Evaluate Community Issues and Desires
2. Identify and remediate, where feasible, polllution issues.
   Early in the process of evaluating stream and watershed conditions, the Watershed Planning Partnership determined that due to the extreme urban condition of the watershed, coupled with the aged community infrastructure, the planning effort should embrace the techniques and tools of the new Balanced Growth Initiative watershed planning process as developed by the Ohio Lake Erie Commission.
   The plan development methodology followed OLEC BGI guidelines, including:
   A. GIS Data Analysis & Qualitative Assignment of Big Creek's Natural Features to Reflect Community Needs & Watershed Function
   B. Identify Undeveloped & Developed Land with Relation to Natural Features
3. Analyze Potential Priority Development / Redevelopment Areas
   - GIS Data Analysis of Priority Development / Redevelopment Areas
4. Identify Priority Conservation and Development / Redevelopment Areas
5. Analyze and Identify Priority Areas for Conservation Using Stormwater Retrofit Techniques
6. Review Community Ordinances and Identify Tools, Practices & Strategies for Community Stewardship

The Big Creek Balanced Growth Plan has been developed to provide a proactive approach to managing development and ensuring the protection of natural resources and watershed function. The Plan provides guidance on which land is suitable for development and conservation as well as, how such land can be preserved and protected.

The process to identify Priority Conservation Areas (PCAs) and Priority Development Areas (PDAs) began with identifying community needs and incorporating these ideas into the planning process. Numerous Watershed Planning Partnership meetings were held. We solicited feedback from the partnership to help shape the evaluation criteria for identifying conservation and development areas. Each community representative received a scoring priority worksheet titled "Scoring Priorities for Conservation of Important Watershed Features". The worksheet listed watershed features and their associated function and each person was asked to rank the importance of each item.

The group analyzed the land and soil features critical to watershed function, and was informed by the Wetlands Analysis that the Cuyahoga River RAP produced as well as mapping done by the Cuyahoga County Planning Commission.

Once the criteria were established, data mapping identified potential sites for conservation, restoration or areas that were appropriate for development. The group chose five priority sites for conservation and twelve sites for conservation/restoration using stormwater retrofit practices.

Finally, a course of action was laid out as short- and long-term recommendations that the Partners will carry out in cooperation with Friends of Big Creek and other supporting organization.

Step 1: Identify and Evaluate Community Issues

Table #1 includes the list of items and shows the scoring results. The survey determined, by the frequency of responses, which factors mattered most to the communities. The top scoring watershed features and issues will be used to identify areas of the watershed that should be pursued for conservation and conversely, areas without these characteristics should be more suitable for development.

Table 1: Big Creek Scoring Priorities for Conservation of Important Watershed Features

PRIORITIES FOR THE BIG CREEK WATERSHED	Results %
Protect Stream features through Stream and Wetland Restoration	95%
Link Redevelopment with Natural Resource Protection	88%
Improve Water Quality in Big Creek	86%
Flood Hazard Reduction	85%
Improve Community Livability and Appeal	76%
Link Stream Valley to Neighborhoods w/ Green Trail Corridors	75%
Promote Economic cooperation for Community Development	71%
Additional Goals to Pursue	
ID other potential restoration areas	
- Oxbow Area	
- W140th / Manufacturing Wetland area as a possiblility	
- Open air some culverts also at W140th	
- Channelized areas ie. along I-71	
NEOPIPE Lawn fertilization program	
Establish riparian setbacks for future developments	
- Focus on remaining headwaters in N. Royalton	
Educate the public w/in the watershed	
- target streamside landowners / citizens overall	
Importance of native plantings	
Health of citizens	

Step 2: Analyze Critical Natural Features and Land Areas for Potential Priority Conservation Area Designation

Step 2a: Qualitative Assignment of Natural Features to Reflect Community Needs & Watershed Function

Defining the process for developing evaluation criteria to identify priority conservation and development areas in the Big Creek Watershed was a necessary first step in creating the balanced growth plan.

Based on the results of the scoring priorities, a Geographical Information Systems (GIS) approach was used to identify watershed characteristics that best reflected the community's needs.

Geographical Information Systems (GIS) are some of the most comprehensive tools available for watershed and land use planning. The implementation of GIS can not only reduce time needed for analyzing information about a watershed, but can also ensure a more efficient use of resources. GIS enables users to display large amounts of data graphically to greatly enhance interpretation and analysis.

The Big Creek planning process included numerous data layers from the most current available data sources to map existing landscape features, both natural and manmade. This provides a starting point from which to formulate future land use scenarios.

The key resource data layers were identified and run through a qualitative analysis. Resource layers were measured based on their importance to watershed function and how they matched up to the local community needs (see Table #2 Qualitative Criteria Focus). A qualitative assignment was necessary to prioritize the environmentally sensitive areas in the planning area for their value in maintaining a healthy watershed and to begin to recognize degrees of sensitivity as they relate to proposed future land uses.

QUALITATIVE CRITERIA FOCUS

1. Water Quantity Management
   - Stormwater & Flood Management
2. Soil Conservation
   - Minimize Erosion
3. Optimizing Green Infrastructure Services
   - Use the natural resources of the watershed to provide stormwater services

Key Natural Resource GIS Data Layers

A. Soils-
   - Infiltration Rate
   - Drainage Rate
   - Hydric
   - Erodibility

B. Steep Slopes
   - Slopes > or = 12%

C. Streams
   - . Headwaters Streams
   - Primary Headwater Streams

D. Floodplains
   - 100 year flood zone
   - 500 year flood zone

E. Riparian Corridors
   - 75 ft. width
   - 25 ft. width

F. Wetlands

G. Forest Cover
   - Forested Areas (dominated by trees). 2002 orthophotos by CVNP

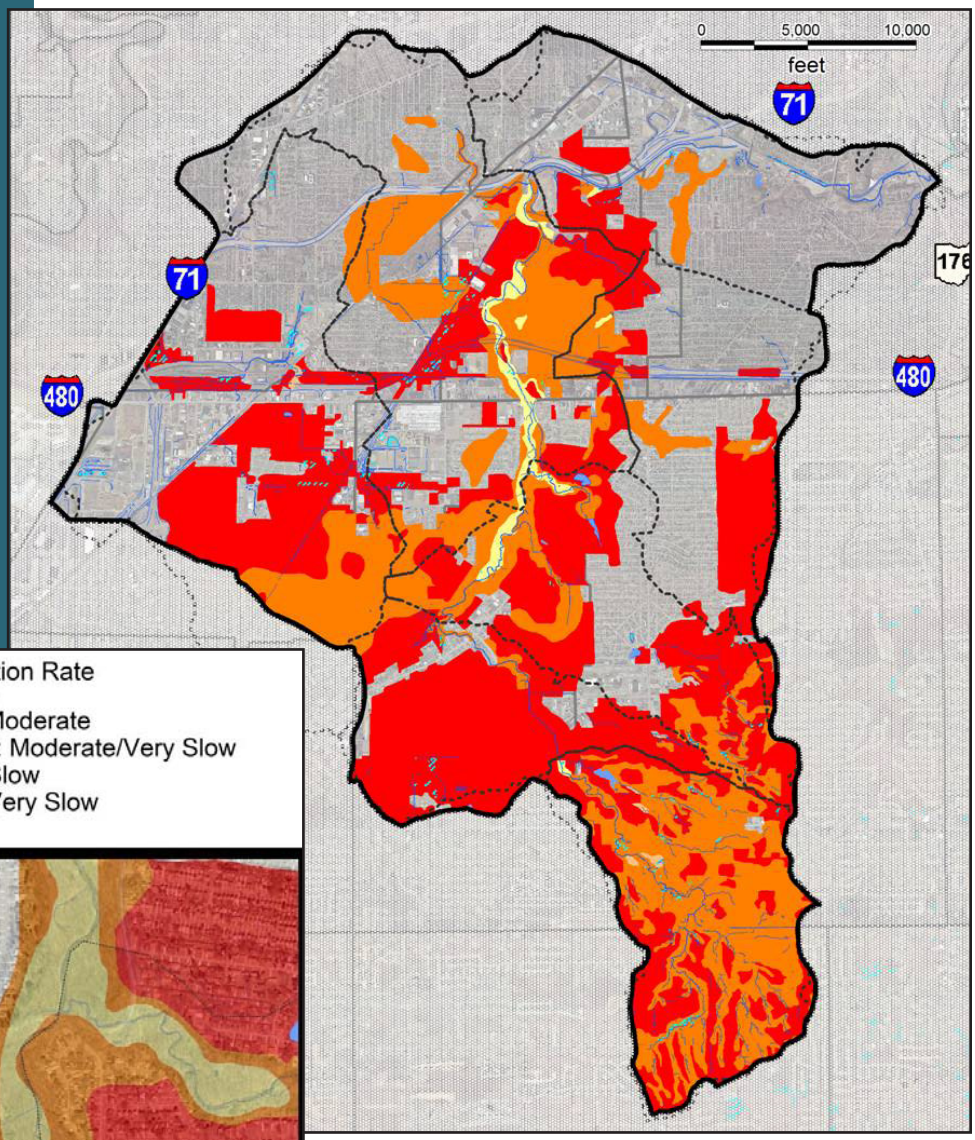
Natural Feature: Critical Soils

Infiltration

The composition and characteristics of soils are important for their impacts on water quality.

Soil properties related to this are:

- the ability to store nutrients essential to plant growth,
- erosion potential,
- permeability, which is the soil's ability to allow precipitation to percolate into the ground and become part of the groundwater system, and
- hydric value (NOTE: No hydric soils were identified in the Big Creek watershed, most likely due to the urban nature of the area.)

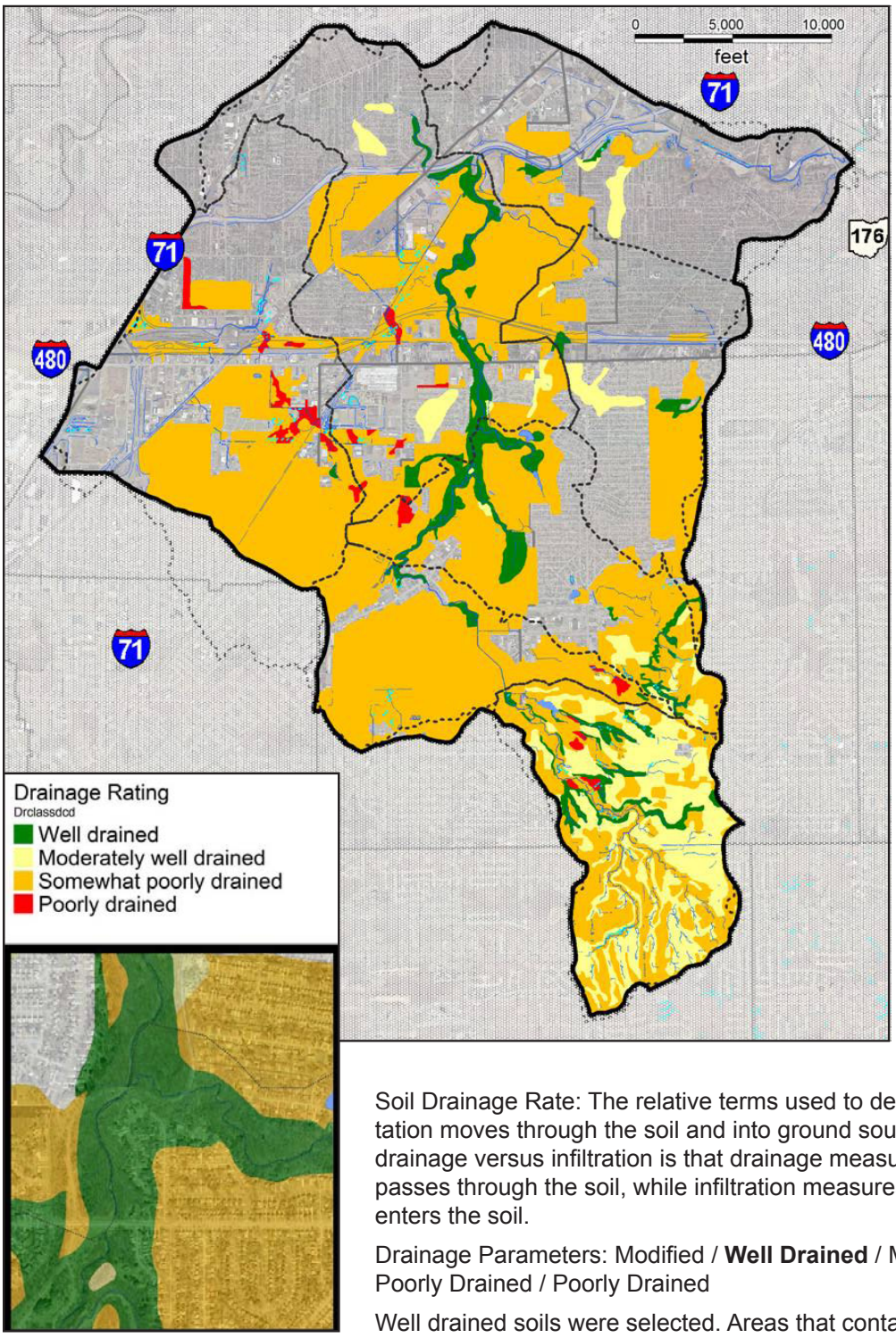


Soil Infiltration Rate: Rate at which water penetrates the surface of the soil at any given instant. The rate at which infiltration takes place, usually in inches per hour, can be limited by infiltration capacity of the soil.

Infiltration Parameters: Unrated / **Moderate** / Slow / Very Slow

Moderate soil infiltration rate was selected. Areas that contain these soil conditions help absorb stormwater more quickly and thereby minimize runoff and erosion rates downstream. These are "working soils" which are providing a valuable function to the communities.

Natural Feature: Critical Soils



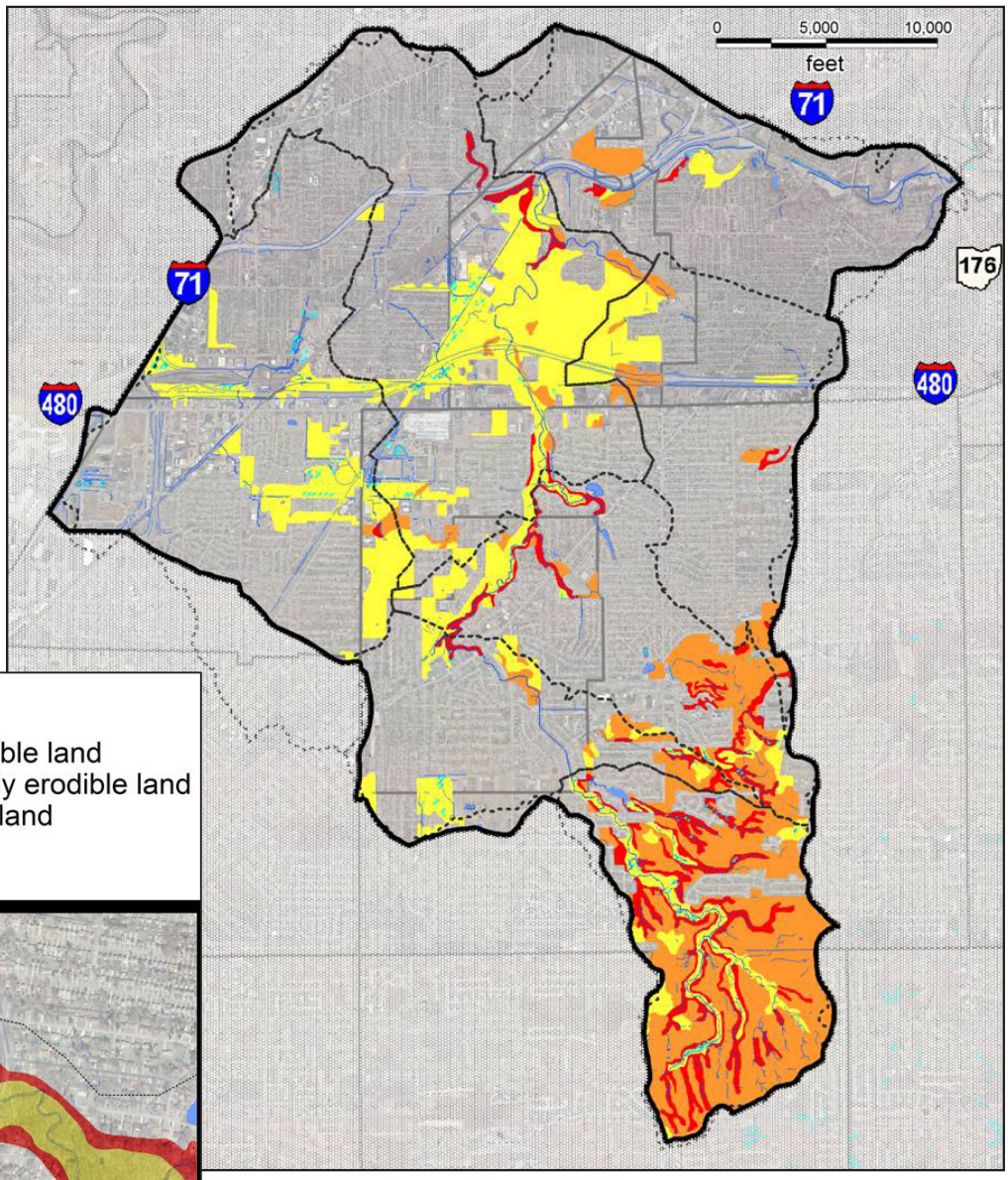
Drainage

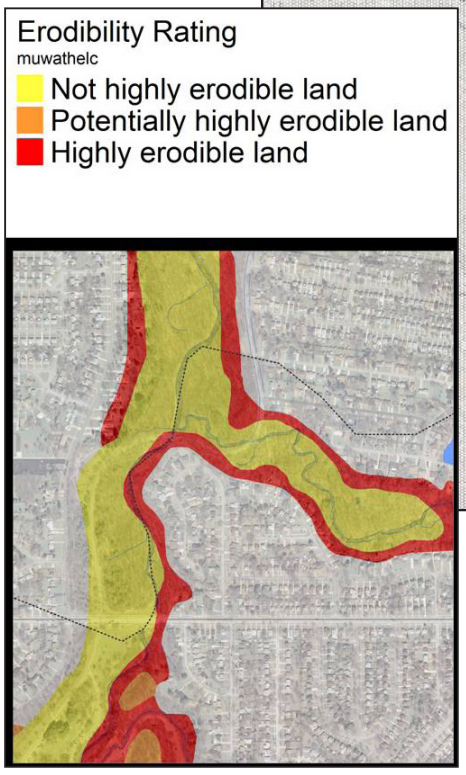
Soil Drainage Rate: The relative terms used to describe the rate at which precipitation moves through the soil and into ground sources. The difference between drainage versus infiltration is that drainage measures the rate at which water passes through the soil, while infiltration measures the rate at which water first enters the soil.

Drainage Parameters: Modified / **Well Drained** / Moderately Drained / Somewhat Poorly Drained / Poorly Drained

Well drained soils were selected. Areas that contain these soil conditions reduce runoff rates by allowing stormwater to filter into groundwater supplies. The groundwater is then slowly released into the streams. These are also “working soils” which are providing a valuable function to the communities.

Erodibility





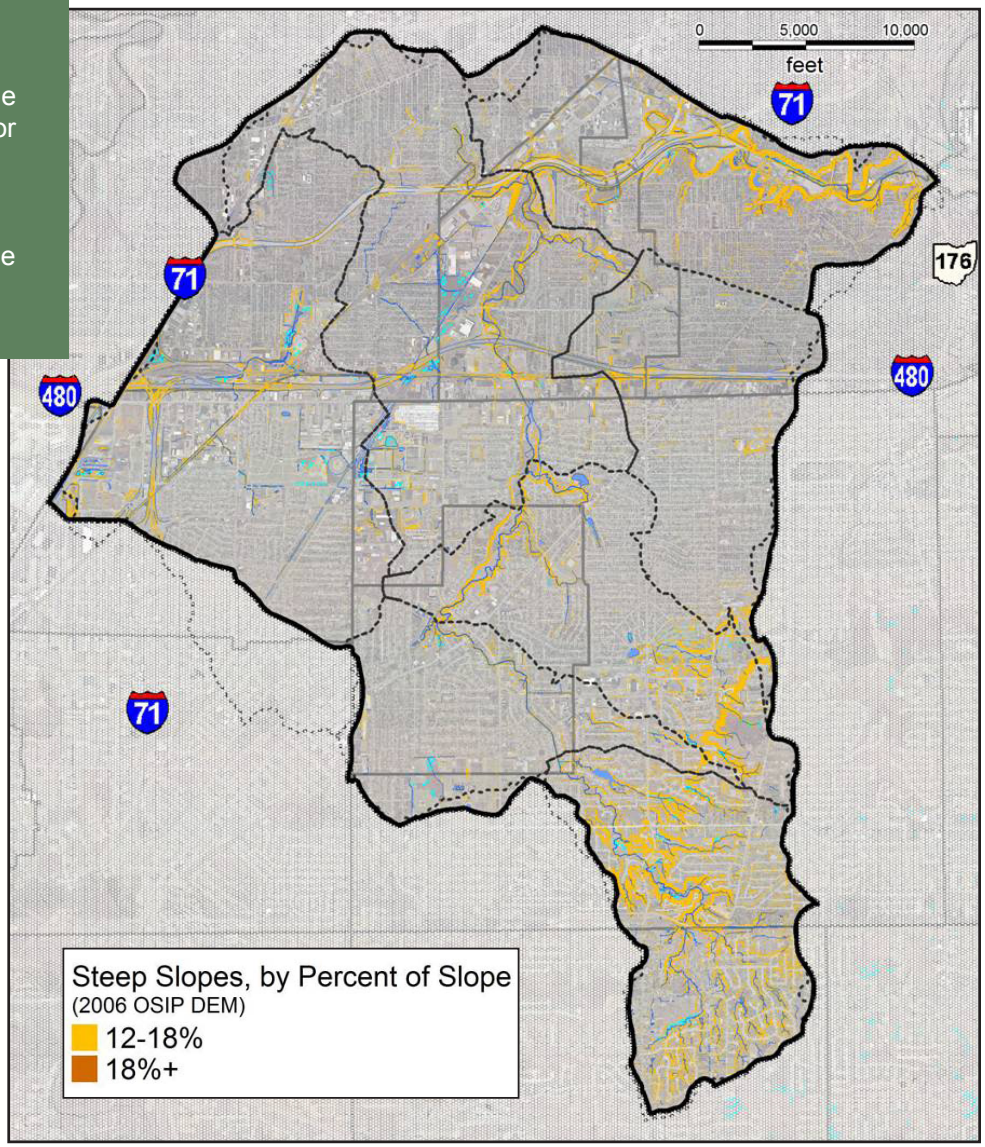
Erodibility: indicates the susceptibility of a soil to erosion by water. Soil erodibility is determined by combining the effects of soil type, % slope, and susceptibility to erosion due to loss of vegetative cover. An erodibility index has been developed characterizing soils with “low”, “medium” and “high” susceptibility to erosion.

Erodibility Parameters: Low Susceptibility/ Medium Susceptibility/ **High Susceptibility**

Big Creek
Natural Feature: Steep Slopes

Slopes vary greatly within the Big Creek Watershed. They range from steep gorge areas where the creek has cut its way down through the bedrock, to gentle slopes and flat areas.

Slopes are mapped using a scale that ranges from flat to steep. For our analysis, we identified the steeply sloped areas that could contribute to higher erosion potential and offer the most value for sensitive lands and habitat.

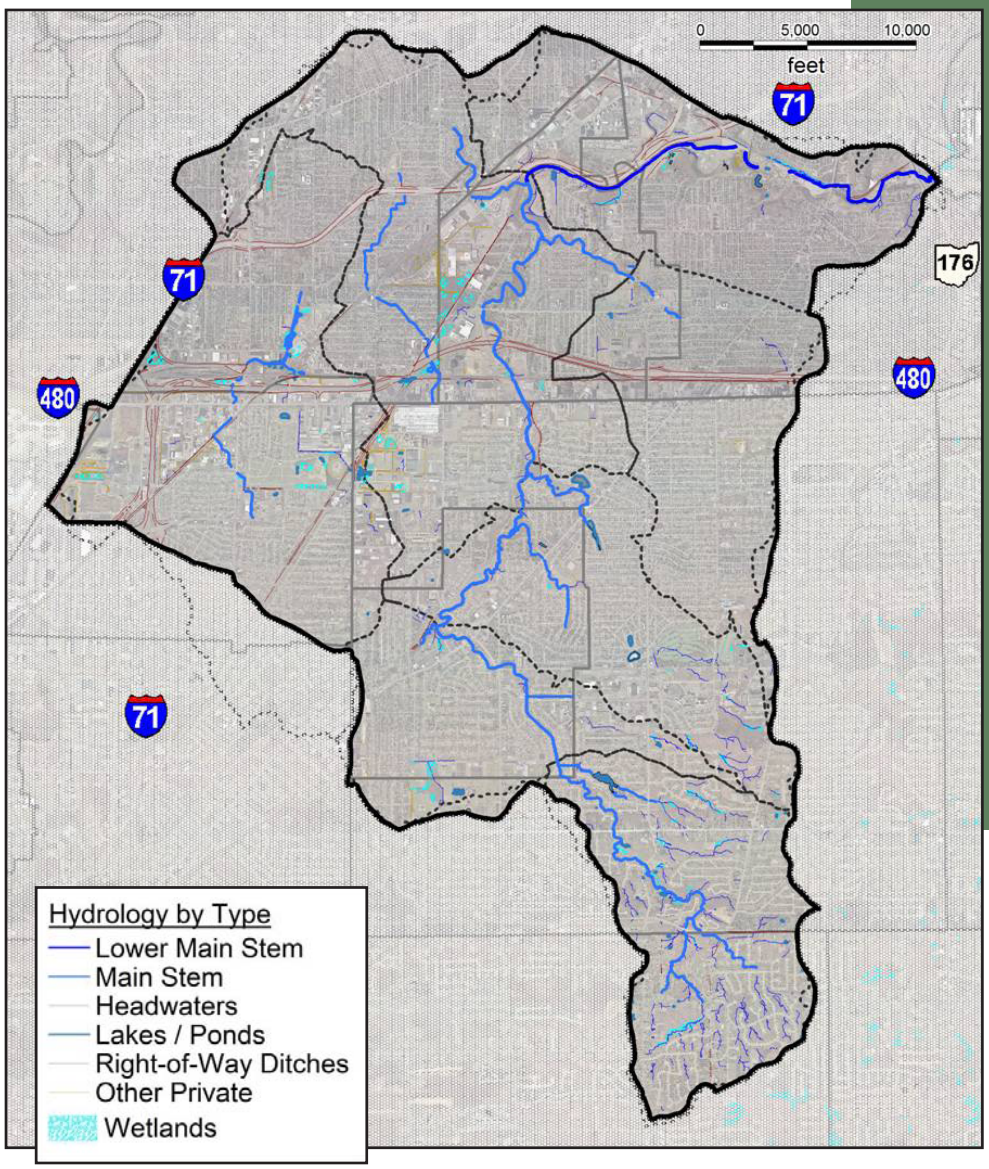


Slopes with a grade of 15% or more are considered steep slopes. Vegetated steep slopes provide an important resource to be preserved because any significant disturbance to the hillside's environment may result in: landslides or land instability, unacceptable alteration in the drainage patterns and loss of scenic value all of which pose risks to local property owners.

Slope Parameters: 0-5%, >5-10%, >10-15%, **>12-18%, >18% and up**

Steep slopes with grade of 12% or more were selected. The need to protect these slopes is based on percent and length of slope, the fact that soils in these areas are often easily erodible, and that other important natural resources (ex. streams and wetlands) can be in close proximity.

Natural Feature: Streams



Streams are the conduits that receive, manage and distribute water. The communities within a watershed drain to a network of streams that transport water through the system, from small streams to larger rivers and eventually to a lake. Water in Big Creek flows into the Cuyahoga River and finally reaches and discharges into Lake Erie.

STREAM ORDER

Headwater and primary headwater streams provide:

- Sediment control
- Nutrient control
- Flood control
- Habitat corridors

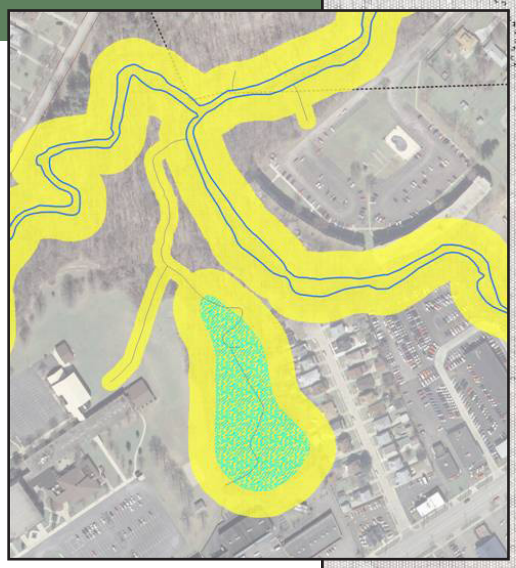
For our analysis, streams with their associated sub-watershed were identified and sorted into two primary groups: Streams that have a drainage area of approximately 0.5-20sq miles and streams that drain approximately <0.5 sq. miles. The streams were organized in this manner to help determine riparian width size.

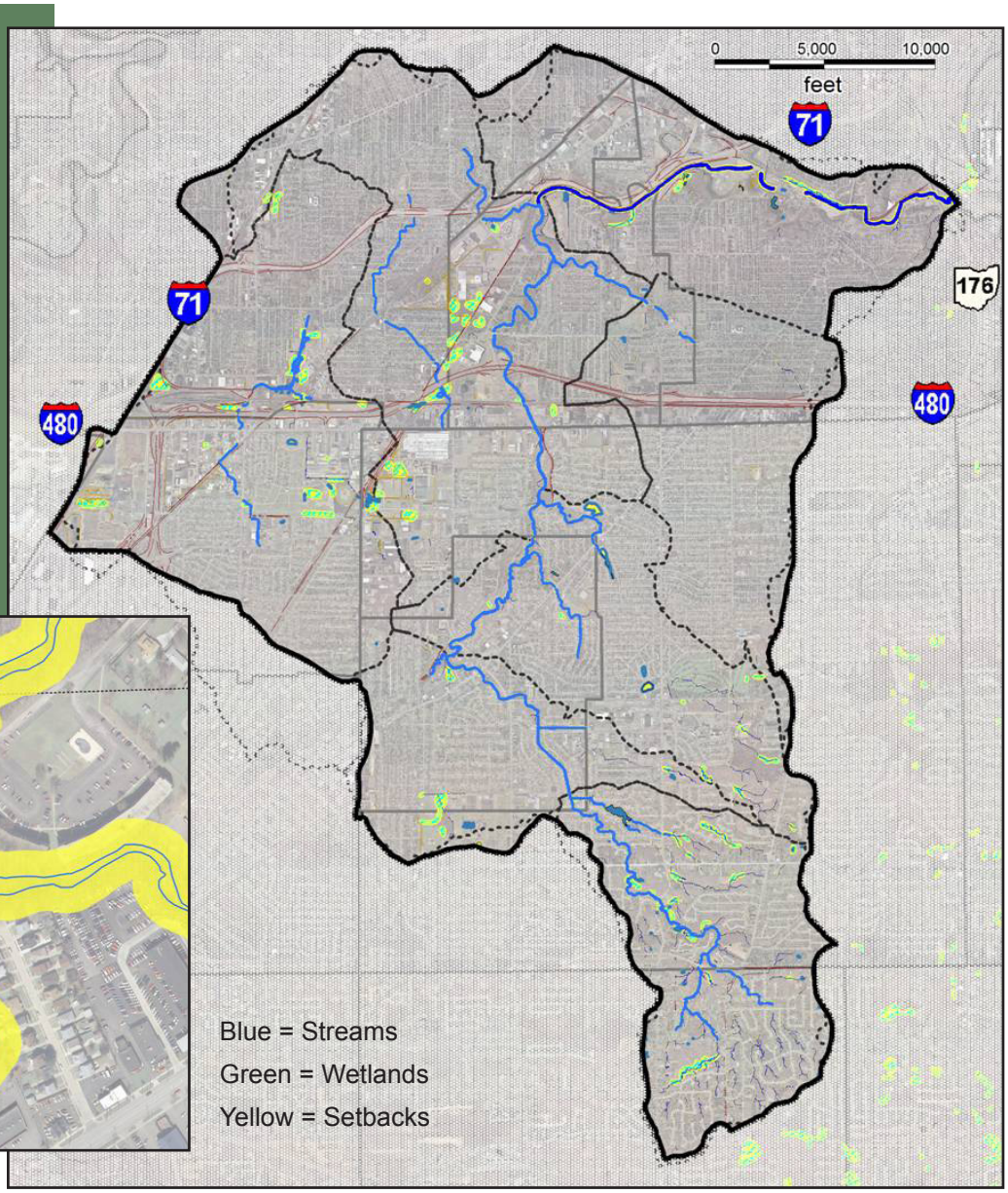
Headwater Streams- Streams that drain a watershed of 20 sq. miles or less are called headwater streams. These are the creeks and streams that feed larger rivers. These small streams join together to form larger streams and rivers or run directly into larger streams and lakes. Big Creek, by definition, is a headwater to the Cuyahoga River. When headwater streams become damaged or impaired, the larger, downstream river will suffer as well.

Primary Headwaters Streams - Streams that drain a watershed less than 1sq. mile are called primary headwater streams. Every stream begins somewhere. That somewhere is its primary headwaters. Primary headwater streams are like the capillary system of a blood supply network- just as the health of the whole organism depends upon a functioning capillary system, the health of larger streams and rivers depend upon an intact primary headwater stream network.

Natural Feature: Riparian Areas & Wetlands

Riparian corridors are the lands along the banks of rivers and creeks that separate the water from the surrounding landscape. These corridors stretch from the stream's primary headwaters to its mouth and are directly influenced by flowing water. Riparian corridors, when appropriately sized and well-vegetated, maintain healthy streams and aquatic life.



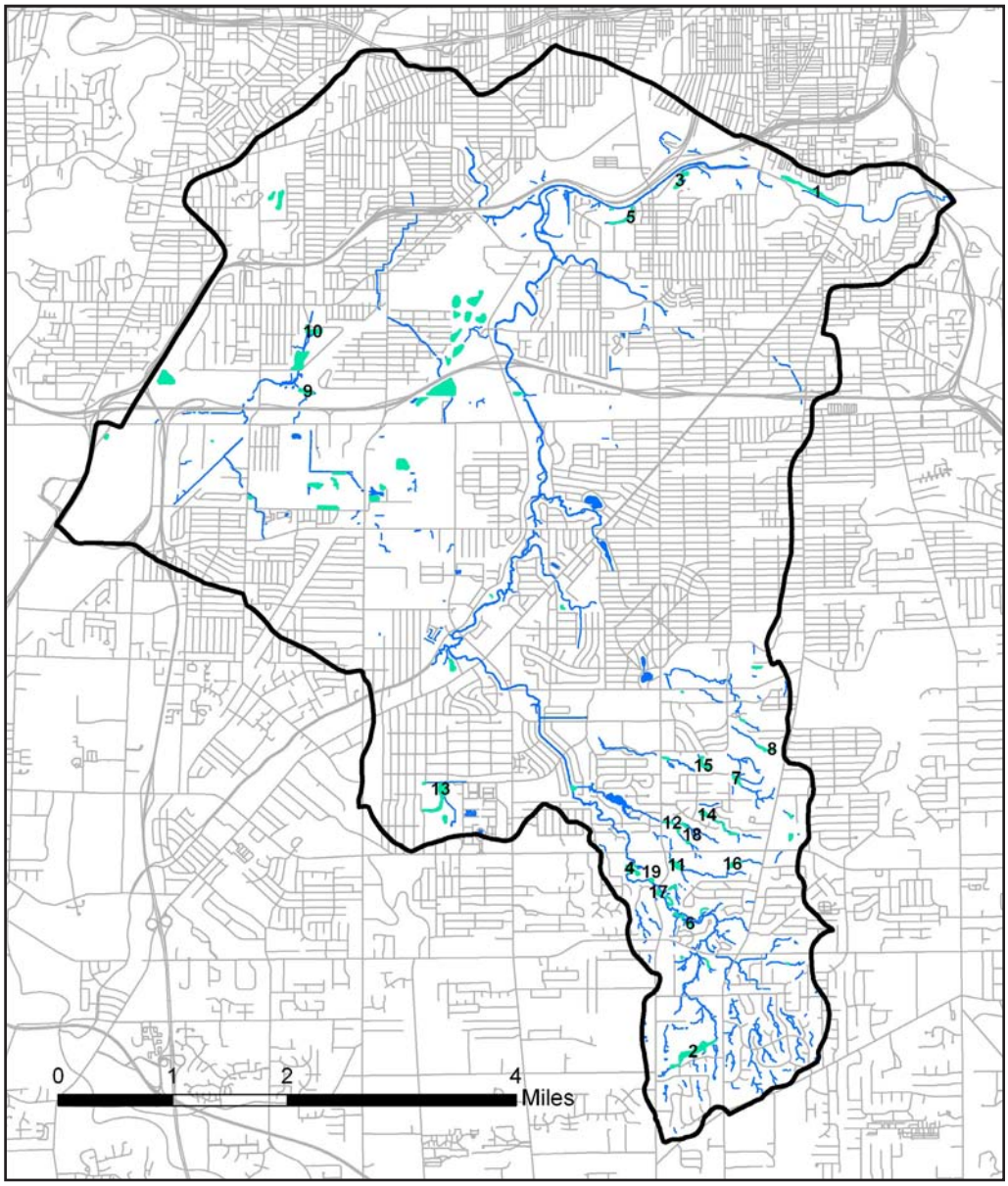


For the riparian corridor analysis, stream drainage areas of 0.5-20 sq. miles and <0.5 sq. miles were incorporated to determine riparian width. Recommended riparian corridor setback distances are based on the analysis of scientific studies that indicate the minimum setbacks required to maintain the functioning of riparian areas. These distances change as streams and their drainage areas get larger.

A 75 ft. riparian setback is recommended for streams that have a drainage area of 0.5-20 sq. miles

A 25 ft. riparian setback is recommended for streams that have a drainage area of <0.5 sq. miles

Wetlands



Wetlands within a watershed serve several purposes that are important to the overall health and function of the watershed system. Wetlands provide for storage of flood waters. Wetlands filter out contaminants and sediment in stormwater runoff, while also providing shelter and breeding habitat for many organisms.

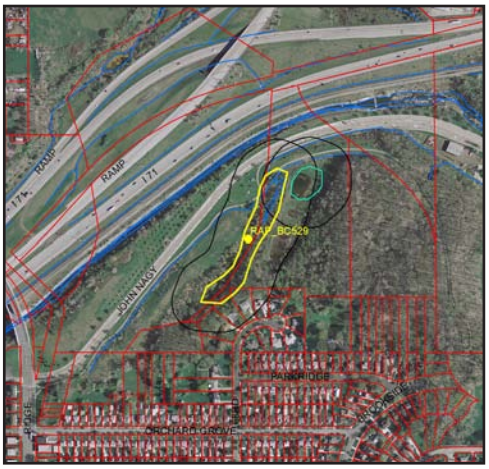
As discussed in more detail in the “Tools for Watershed Stewardship” wetlands require a setback or buffer zone (75ft or 120ft) based on the overall quality of the wetland. For the purposes of this project we placed a 75ft setback on all identified wetlands. (Please see Appendix B for additional Big Creek wetland information.)

A total of 137.5 acres of wetlands have been identified in the Big Creek watershed through the CRCPO’s wetlands prioritization project. The top ten sites were ranked through analysis of a combination of traits including size, impact on watershed function, potential for improvement or restoration, stressors and potential for acquiring the property for conservation, among other criteria. Those ten sites, featured on the following page and in Appendix B, range in size from .75 acres to 9 acres and total 28 acres, or nearly 20% of the total wetland acreage in the Big Creek watershed.

Big Creek Wetlands

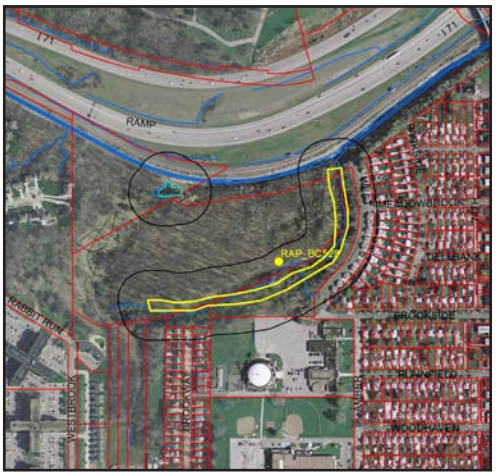
BIG CREEK WETLAND #1 is located in Cleveland, just upstream of the confluence with the Cuyahoga River.

BIG CREEK WETLAND #2 is a 9-acre forested shrub/scrub wetland in North Royalton.

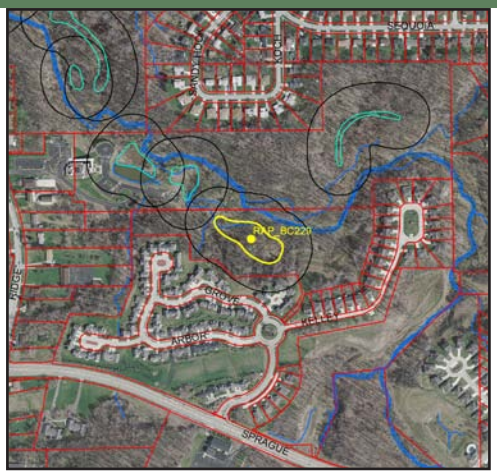


BIG CREEK WETLAND #3 is a 2-acre forested wetland in Cleveland, along a tributary of Big Creek near I-71 and Ridge Road.

BIG CREEK WETLAND #4 is almost two acres of emergent wetland in Parma, connected to riparian corridor and near other wetlands.

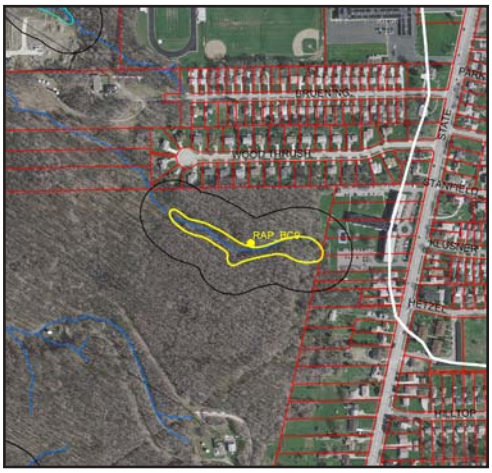


BIG CREEK WETLAND #5 is a 2-acre forested wetland in the “Oxbow” area in Brooklyn.

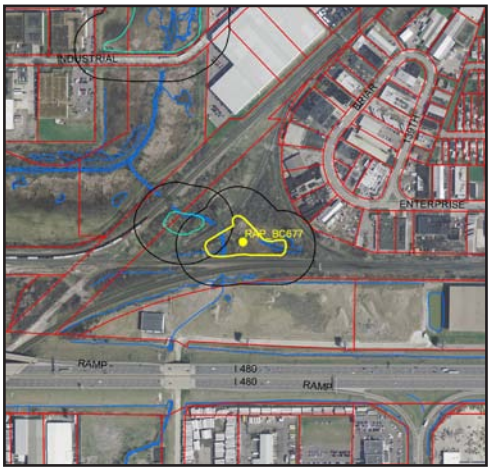


BIG CREEK WETLAND #6 is a bit over an acre in Parma, near other wetlands and streams.

BIG CREEK WETLAND #7 is approximately 1.5 acres of forested wetland on a tributary just upstream from Stearns Farm Homestead.



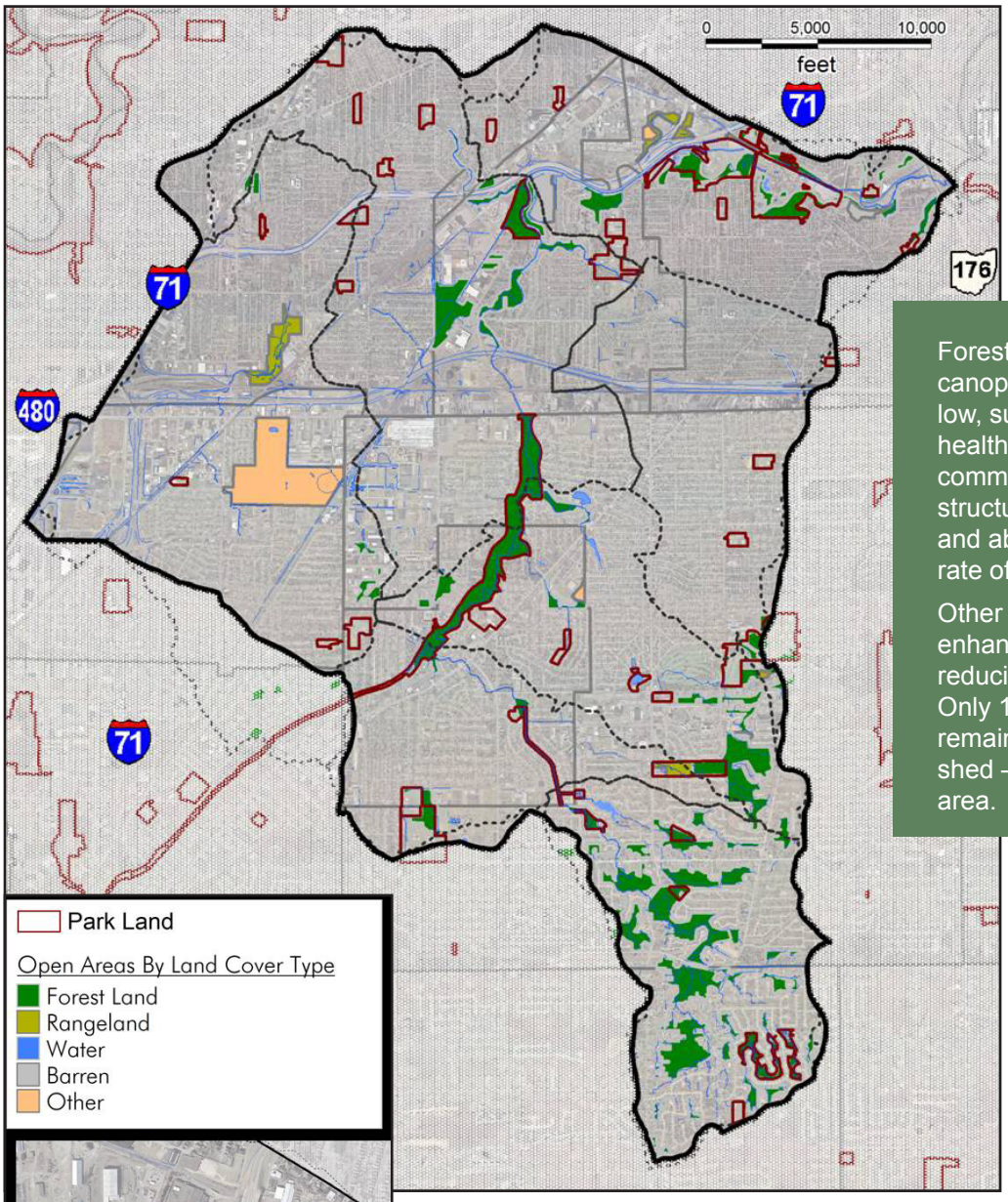
BIG CREEK WETLAND #8 is a 1.82-acre forested wetland just northeast of #7 in Parma.



BIG CREEK WETLAND #9 is a 1.29 emergent and forested wetland in Cleveland, near an industrial park and south of the Puritas stormwater basin.

BIG CREEK WETLAND #10 is a 3-acre emergent wetland within the Puritas basin of the West Branch of Big Creek.

Big Creek
Natural Feature: Forest Cover

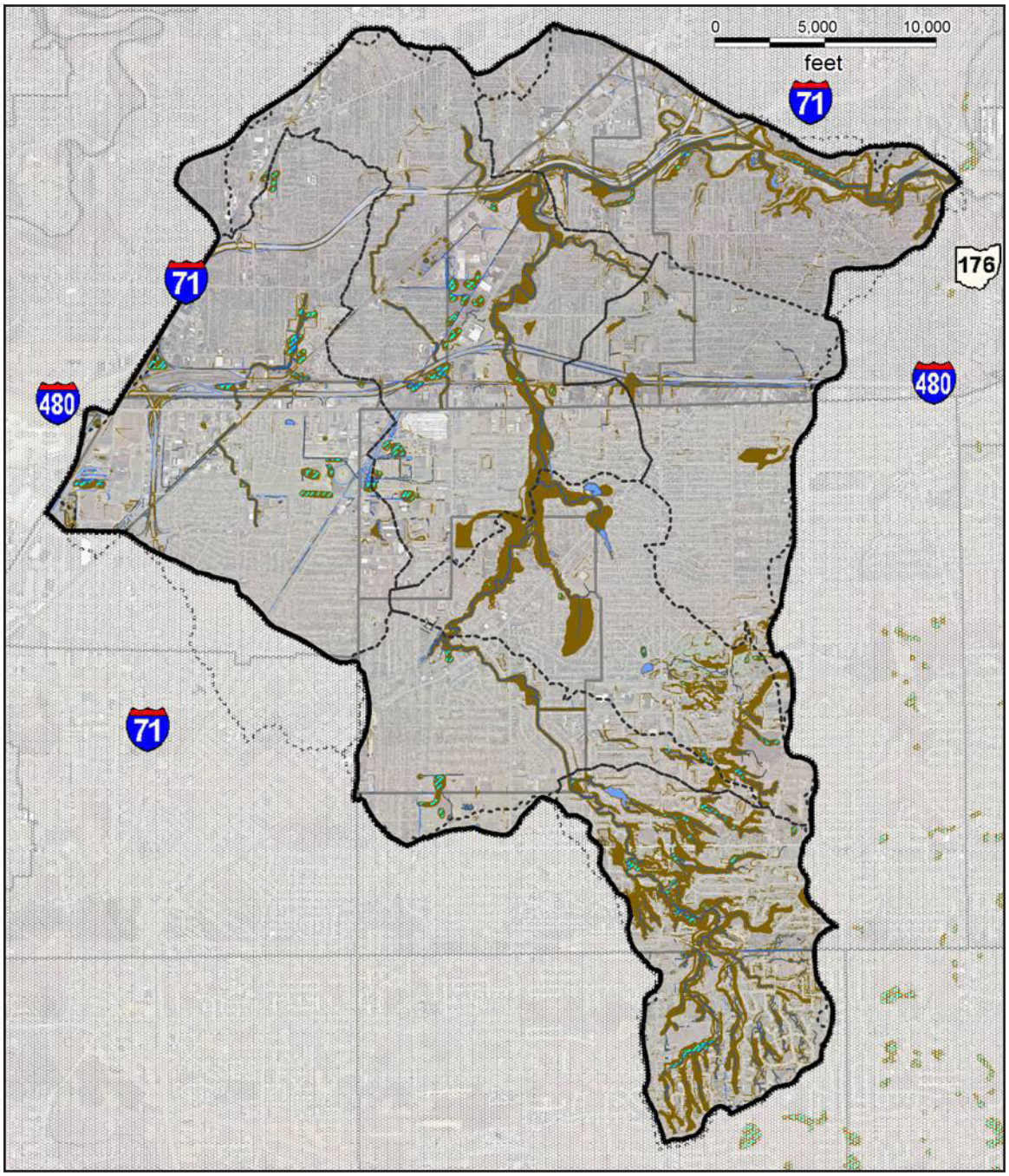


Forest cover consists of tree canopy, understory plants and low, surface vegetative cover. A healthy forest system can save communities storm water infrastructure costs by intercepting and absorbing rain, slowing the rate of runoff and stabilizing soils.

Other community benefits include enhancing property values and reducing household energy costs. Only 1,833 acres of forest cover remain in the Big Creek Watershed – that is 7.5% of the total area.

Composite of Critical Natural Features

The composite map embodies all the critical natural features “layered-up” in the Big Creek Watershed. This map represents the values the watershed partnership expressed and the necessary functional aspect of the Big Creek Watershed.



PCA

Priority Conservation Areas

Priority conservation areas are locations where land use change is predicted to have a high impact on the watershed in terms of flooding, erosion, and water quality, based on the analysis of several data sets representing criteria that the watershed planning partners determined were of interest.

The GIS land cover data and field investigations identified 1,570 acres of undeveloped land, comprising 6.4% of the watershed, that are non-park-related and are therefore unprotected. These areas have value to each community as examples of nature the city and many present excellent prospects for conservation, restoration and enhancements.

The characteristics of these large undeveloped and unprotected tracts vary and include

- flat, heavily-forested upland areas that may have high development pressure;
- land adjacent to creek gorges, with steep terrain that could present difficulties for developers; and
- back lots of “bowling alley”-shaped parcels that could be consolidated

Priority Conservation Areas have one or more of the following characteristics:

- **CRITICAL SOILS**
  In critical soil areas, communities should develop soil compaction limitations to help conserve this resource during construction. Conservation and low impact design standards are recommended.
- **STEEP SLOPES**
  In steep slope areas, communities should conserve these resources to the maximum extent possible for health, safety, property and environmental concerns. Setbacks should be implemented on slopes of 12% or more.
- **STREAMS & NATURAL RIPARIAN AREAS**
  Stream and riparian corridor areas should be protected from encroachment at all costs. Communities should adopt riparian setback ordinances to protect both headwater and primary headwater streams. Where impacts occur in these areas, mitigation within the immediate drainage area should be required .
- **FLOODPLAINS**
  Communities should conserve flood plains to accommodate excess flow, protect health and property. Community regulations need to maintain current flood plain maps and adequately protect floodplains from development to reduce future damages.
- **WETLANDS**
  Wetland areas should be conserved as essential storage and filtration systems. Communities should adopt ample setback ordinances for all wetlands categories.
- **FORESTS**
  Communities should conserve forested areas within riparian corridors and minimize the loss of existing forested areas throughout the entire watershed, through conservation development and tree preservation regulations.

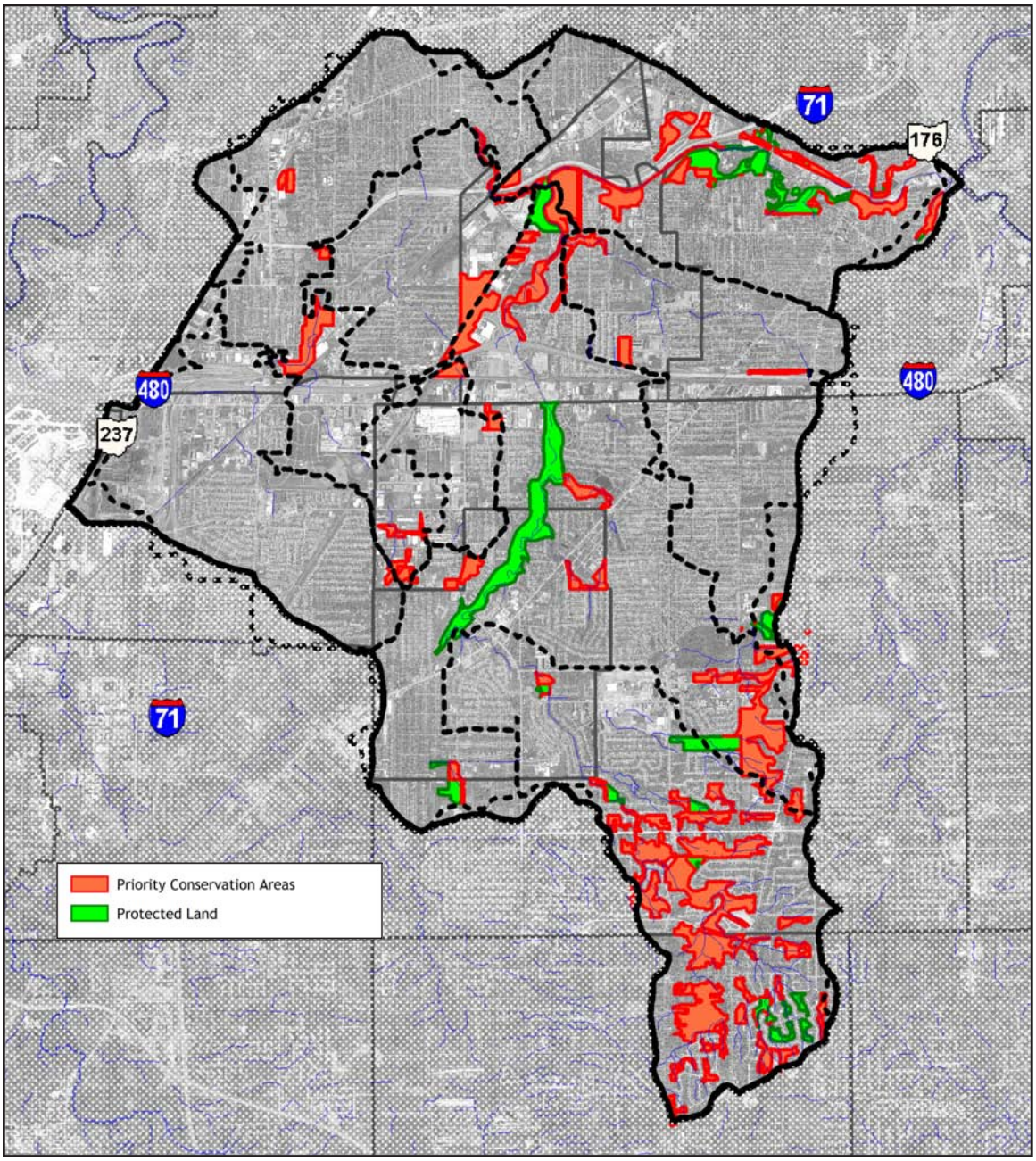
PCA Analysis by Subwatersheds

SUBWATERSHED	TOTAL UNDEVELOPED LARGE TRACT ACRES	TOTAL CRITICAL WATERSHED FEATURES (ACRES)	% OF WATERSHED'S TOTAL CRITICAL FEATURES
East Branch (BCBE)	466.4	437.3	3.5%
Lower (BCBG)	288.9	222.1	1.8%
West Branch (BCBW)	122.2	98.0	0.8%
Colleda Branch (BCCD)	0.0	0.0	0.0%
Chevy Branch (BCCH)	28.3	34.6	0.3%
Stickney Creek (BCST)	41.3	22.6	0.2%
Upper Big Creek	623.8	614.1	4.9%
Total	**1570.9**	**1428.7**	**11.5%**

PCA Analysis by Community

CITY	TOTAL LARGE TRACTS (ACRES)	TOTAL CRITICAL FEATURES (ACRES)	% OF CRITICAL FEATURES THAT ARE IN PCAs	REPRESENTS % OF WATERSHED'S TOTAL CRITICAL FEATURES
BROOKLYN	326.1	258.4	18.1%	2%
BROOK PARK	0.0	0.0	0.0%	0.0%
CLEVELAND	282.1	241.4	16.9%	1.9%
LINNDALE	0.0	0.0	0.0%	0.0%
NORTH ROYALTON	275.4	272.0	19.0%	2.2%
PARMA	641.9	617.5	43.2%	5.0%
PARMA HEIGHTS	45.1	39.5	2.8%	0.4%
TOTAL	**1570.6**	**1428.8**	**100%**	**11.5%**

Priority Conservation Areas



Taking into account the GIS data and analysis of the location, characteristics and quality of the critical natural watershed features on the Big Creek watershed, and aligning that with the community's desires as stated in the community priorities process, the areas above, marked in red, were identified as Priority Conservation Areas (PCAs.)

Step 2b: Identify Undeveloped and Developed Land in Relation to Natural Features

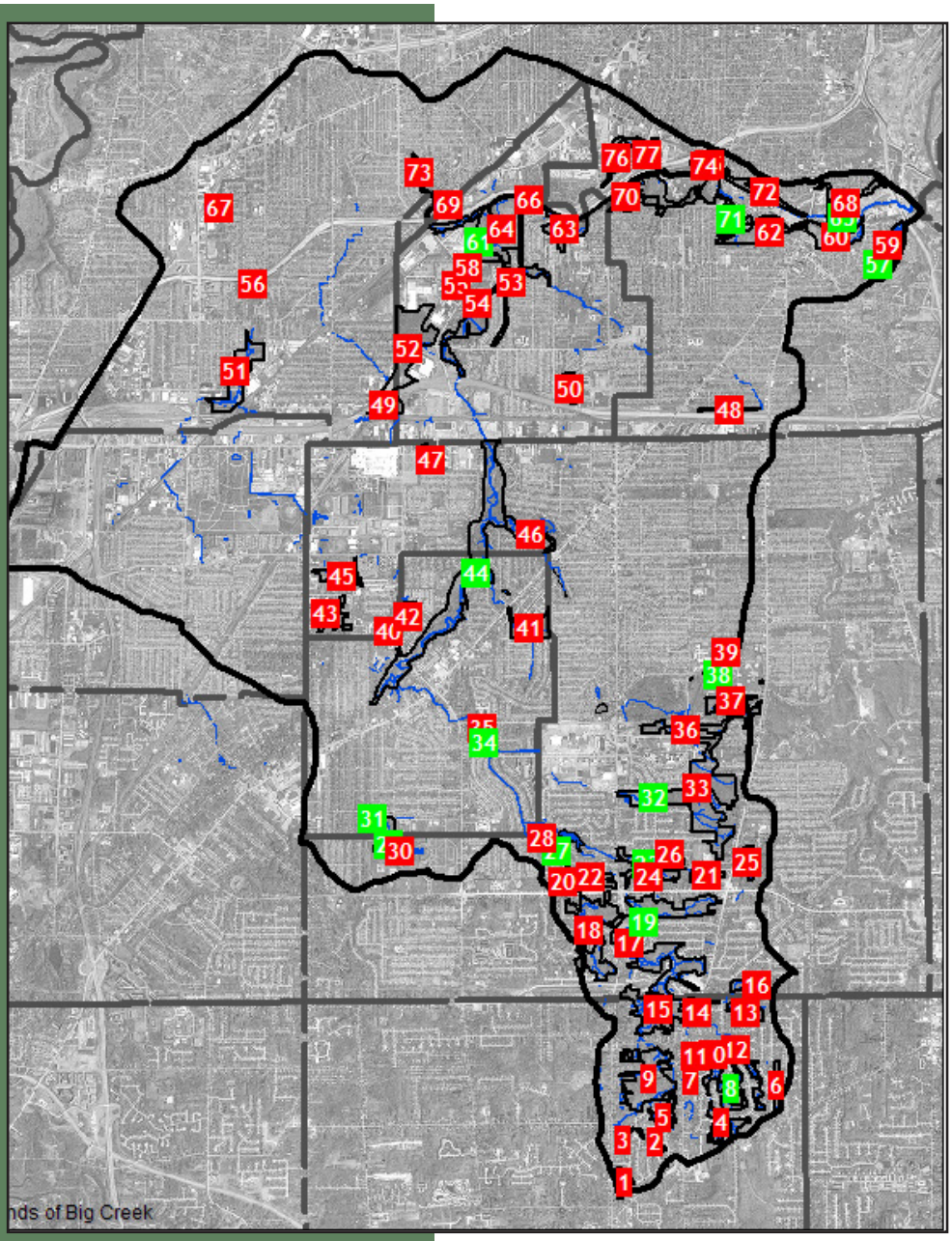
The GIS land cover data and field investigations identified 1,570 acres of undeveloped land, comprising 6.4% of the watershed, that are non-park-related and are therefore unprotected.

The characteristics of these 63 large undeveloped and unprotected tracts vary and include

- flat, heavily-forested upland areas that may have high development pressure;
- land adjacent to creek gorges, with steep terrain that could present difficulties for developers; and
- back lots of "bowling alley"-shaped parcels that could be consolidated

These parcels, shown in red on the map, hold considerable amounts of wetlands, streams, steep slopes and critical soils.

Parcels shown in green are park-owned lands and their proximity to critical features could mark them as valuable assets for land assembly for conservation.



Critical Features in Large Undeveloped Land Areas

	Total	Critical Soils	Steep Slopes	Flood Zones	Forest Cover	Wetlands & Streams
Total Unprotected Land in Large Tracts (acres)	1,570	814	486	not calculated*	297	914.7
Represents % of Features Remaining in Watershed	6.40%	7.70%	25%	not calculated*	71.90%	52.20%
* data unavailable from FEMA						

Step 3: Analyze Potential Priority Development / Redevelopment Areas

PDA

Priority Development Areas are locations where land use changes are predicted to have minimal impact on the watershed and where conditions suggest that additional development may be appropriate.

The Big Creek watershed includes seven municipalities that are largely complete with zoning, water and sewer availability and many other factors deemed important for development.

Priority Development Areas were analyzed and have the following characteristics:

- **High Density Zoning**- lie within areas zoned for high density commercial, industrial or residential.

  We relied on the community's underlying zoning to encourage development and redevelopment in these areas. These areas typically followed business and industrial corridors and town centers. Directing development to these areas can bring businesses back to inner-ring suburbs where infrastructure currently and minimizes urban sprawl.

- **Highway & Major Interchanges-** lie within 500-feet radius of a major intersection or half mile radius of a highway interchange.

  Interchanges act as service centers that are important to commercial, industrial and residential development. Interchanges have high passenger volumes, multi-modal forms of transportation and are typically near town centers planned around these areas. Major intersections and highway interchanges were based on U.S. census classifications.

- **Vacant Parcels**- lie within parcels that are undeveloped and are zoned for high density commercial, industrial and residential development

  The vacant parcel locations can provide additional guidance in prioritizing future development. Directing development to these areas can bring businesses or mixed use residential growth back to inner-ring suburbs where infrastructure currently and minimizes urban sprawl.

- **Do not lie within Critical Watershed Feature-** the priority conservation areas should be excluded from future development.

  Critical watershed features play an important role in managing stormwater. These features are already scarce and the remaining acreage should be protected for the benefit of the communities. Parks, restoration projects and greenway systems can be implemented in many of the areas.

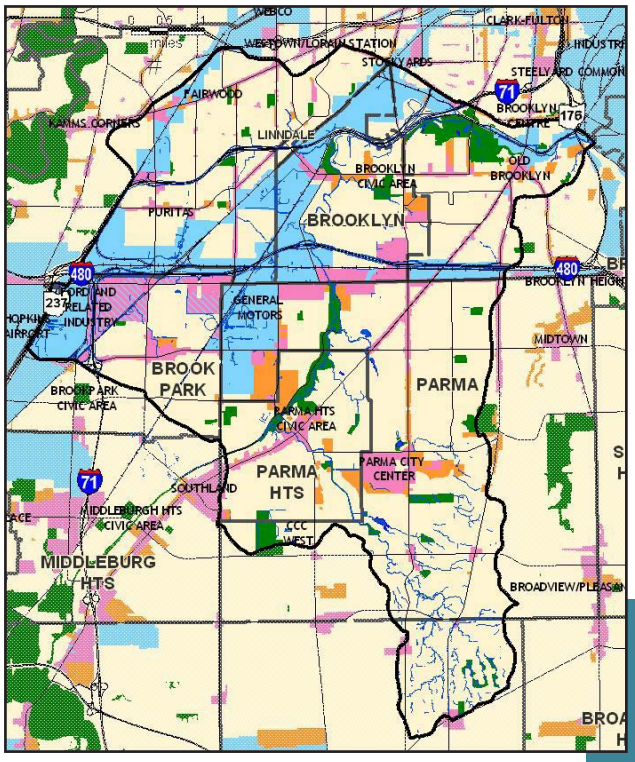
The Ohio Lake Erie Commission Balanced Growth Program established a development suitability technical advisory committee to determine which factors were most important to the development community.

TOP TEN DEVELOPMENT SUITABILITY FACTORS

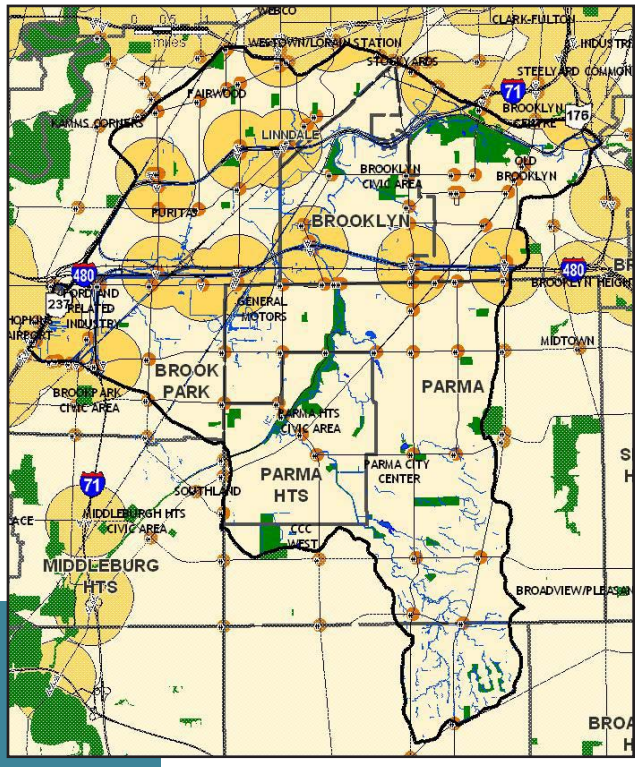
RESIDENTIAL	COMMERCIAL	INDUSTRIAL
1. Public water availability	1. Public water availability	1. Proximity to highway
2. Public sewer availability	2. Public sewer availability	2. Public sewer availability
3. Pro-development community attitude	3. Median household income in community	3. Public water availability
4. School quality	4. Community population density	4. Land availability
5. Land cost	5. Proximity to highway	5. Proximity to highway interchange
6. Median household income in community	6. Community growth characteristics	6. Pro-development attitude of community
7. Land availability	7. Land availability	7. Proximity to employees.
8. Community growth characteristics	8. Pro-development community attitude	8. Land cost
9. Proximity to highway	9. Proximity to highway interchange	9. Soil type / stability
10. Proximity to highway interchange	10. Proximity to other commercial development	10. Median household income

Priority Development / Redevelopment Areas

High Density Zoning



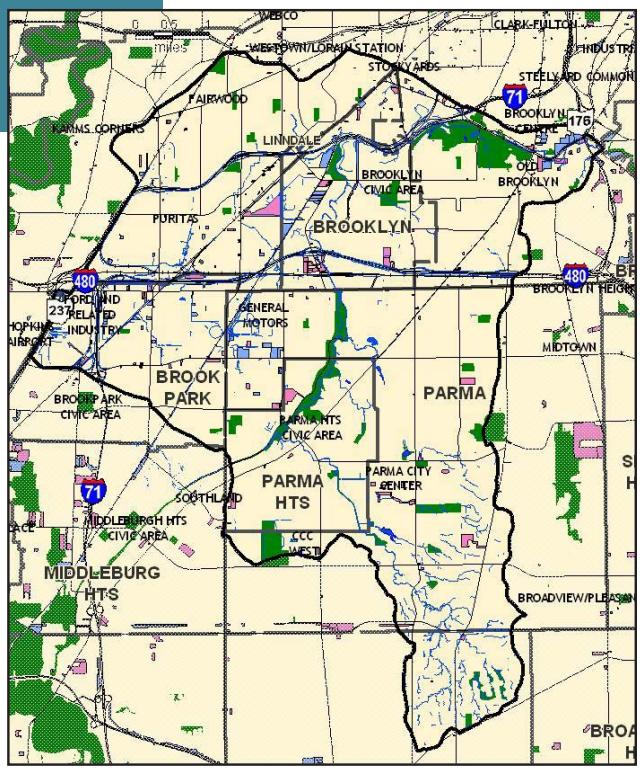
Highway Interchanges



In looking at the potential for development in this virtually fully-built-out watershed, the planning groups agreed that redevelopment of existing hard space was paramount. Infill development not only serves as a deterrent to urban sprawl, it can bring new businesses and jobs to the area, and it offers opportunities to include sustainable practices in the building design and surface treatments.

The Partnership decided that, rather than identifying any of the vacant land or undeveloped tracts for new development, it would instead treat any unused area as a potential Priority Conservation Area. This opens more spaces for siting stormwater retrofits, moving them out of the development inventory and into the stock of conservation assets.

In the end, using Highway Interchange areas and Vacant Lots, and converting hard surfaces to stormwater management facilities, expands the bank of land to be conserved and raises the value of underused built assets.



Vacant Land

PDA Analysis by Subwatershed

Tributary	Net Area (Total minus PCAs)					
	COMMERCIAL	INDUSTRY	MIXED	MULTI-FAMILY	Total PDA Acres (minus PCA)	% PDA Area Remaining
East Branch	464.0	356.9	-	355	856.4	89.6%
Lower	191.3	541.7	-	29.7	762.7	89.9%
West Branch	288.2	628.0	97.4	5.7	1,019.2	91.1%
Colleda Branch	177.8	611.4	348.1	27.7	1,165.0	99.8%
Chevy Branch	167.3	449.4	16.4	81.1	714.3	90.1%
Stickney Creek	314.6	190.2	-	5.7	510.5	94.3%
Upper Big Creek	330.3	-	-	81.5	411.8	98.9%
No Designated Tributary	43.4	129.0	0.1	11.7	184.2	97.7%
TOTAL	1,977.1	2,906.5	462.0	278.6	5,624.2	93.3%

The Colleda and West Branch subwatersheds have the largest acreage of potential Priority Development Areas, each with over 1,000 acres. East Branch and the Lower Branch followed closely behind with 856 acres and 762 acres.

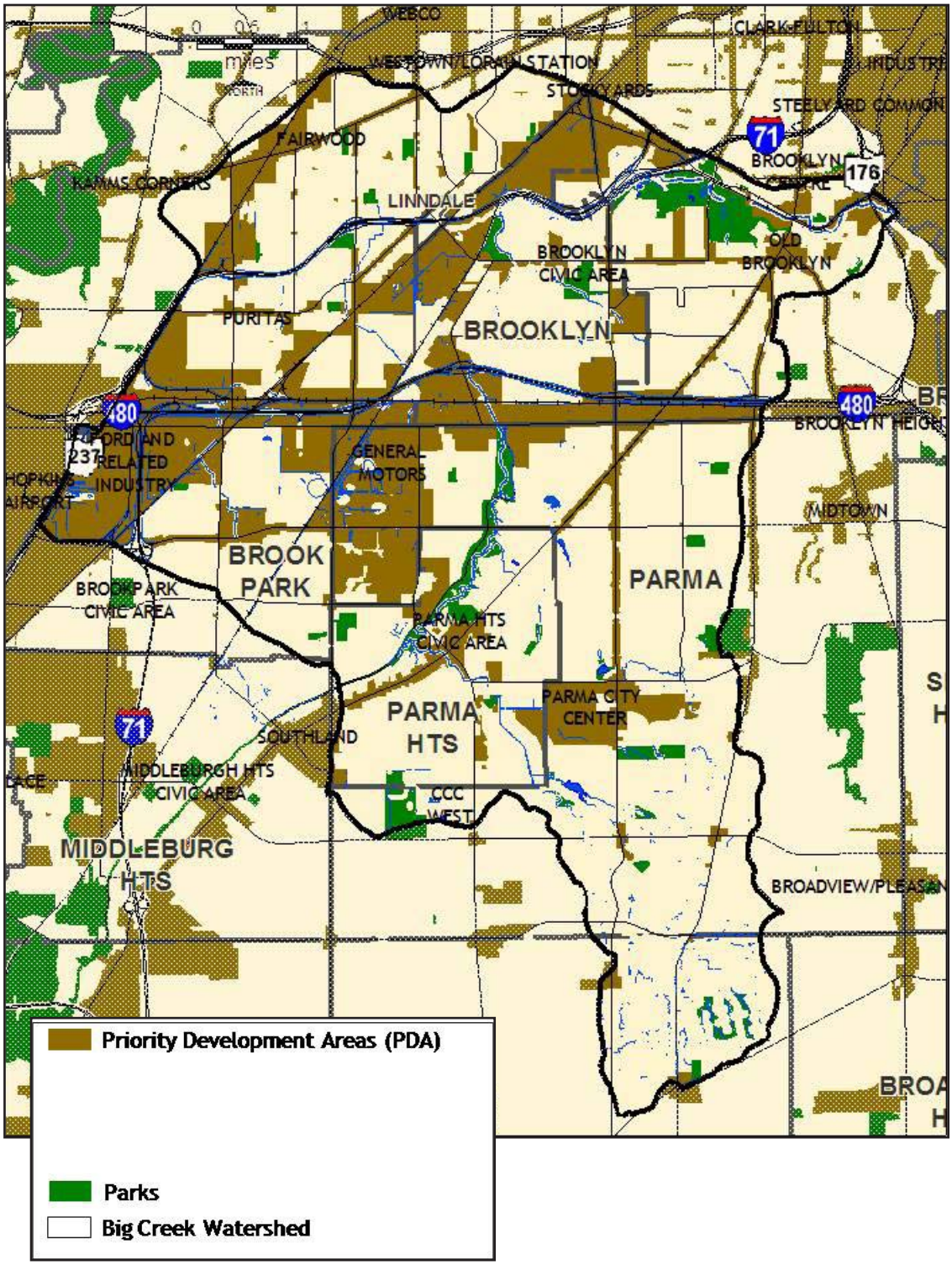
PDA Analysis by Community

		ZONING				
CITY	ACRES	COMM'L	INDUST	MIXED	MULTI-FAMILY	TOTAL
BROOK PARK	Total	259.1	455.0	462.0	27.7	1,203.7
	PCA	10.6	17.5	20.3	0.8	49.2
	Net PDA	**248.5**	**437.5**	**441.7**	**26.8**	**1,154.5**
BROOKLYN	TOTAL	346.4	946.7	0.0	121.2	1,414.3
	PCA	32.9	196.8	0.0	29.9	259.6
	NET PDA	**313.5**	**750.0**	**0.0**	**91.3**	**1,154.7**
CLEVELAND	TOTAL	570.1	1,965.0	0.0	181.6	2,716.6
	PCA	66.1	344.8	0.0	13.9	364.7
	NET PDA	**563.9**	**1,620.2**	**0.0**	**167.7**	**2,351.9**
NORTH ROYALTON	TOTAL	35.5	0.0	0.0	0.0	35.5
	PCA	2.8	0.0	0.0	0.0	2.8
	NET PDA	**32.7**	**0.0**	**0.0**	**0.0**	**32.7**
PARMA	TOTAL	646.4	630.3	0.0	348.6	1,625.3
	PCA	29.8	60.7	0.0	12.0	102.5
	NET PDA	**616.6**	**569.5**	**0.0**	**336.6**	**1,522.8**
PARMA HEIGHTS	TOTAL	165.2	0.0	0.0	217.8	383.0
	PCA	9.7	0.0	0.0	24.4	34.2
	NET PDA	**155.5**	**0.0**	**0.0**	**193.3**	**348.8**
TOTAL WATERSHED	TOTAL	2,024.6	3,997.0	462.0	896.8	7,380.4
	PCA	92.0	619.7	20.3	81.0	813.0
	NET PDA	**1,930.7**	**3,377.3**	**441.7**	**815.8**	**6,565.5**

PCA = overlapping acres of priority conservation areas

NET PDA = Total acreage meeting Priority Development Area criteria minus Priority Conservation acreage

Priority Development / Redevelopment Areas



Step 4: Identify Priority Conservation and Development / Redevelopment Areas

Each of the large tracts was analyzed for conservation and/or restoration opportunities. The large tracts were prioritized by the quantity of critical watershed features. A summary description is provided of the top large tract in each subwatershed.

Upper Big Creek Priority Conservation Area – Large Tract #17

Summary

Large tract #17 is 168 acres and the largest of the greenspaces identified in Big Creek. This openspace is entirely located in the city of Parma between W. Pleasant Valley Rd. and W. Sprague Rd. The land contains approximately 30 parcels under various ownerships. Major property owners are Busch Development Corp and the cities of Cleveland and Parma. Sandy Brook Park is an adjacent greenspace.

This large tract is a significant contiguous piece of land that encompasses the upper reaches of Big Creek. It contains large areas of forest, critical soils and steep slopes. It also contains 44 acres of stream (and buffer) and 25 acres of wetlands (and buffer).

Conservation / Restoration Options

Efforts to preserve this site should receive the utmost attention. As noted above, this large tract contains nice headwaters streams, wetlands and forested areas. Two of the major parcels are publicly owned. Parcel #45425001 is owned by the Shiva Vishnu Temple and parcel # 45415001 is owned by the city of Parma. In 2009, West Creek Preservation Committee bought 13 acres of the Busch property and, along with 42 acres already owned by the city of Parma, placed 55 acres under a conservation easement. Other parcels to conserve need to be further explored.

The Cuyahoga River RAP identified a wetland restoration opportunity in a separate study. Preservation and enhancements of a 1.16 acre forested wetland totaled over $30,000. (See Appendix B: Big Creek Watershed Wetlands Analysis, Wetland Ranked #6)

The Northeast Ohio Regional Sewer District's (NEORSD) RIDE Study indentified debris and erosion problems in this area. Opportunities for stream channel restoration exist with cooperation from the city, NEORSD and local watershed group.

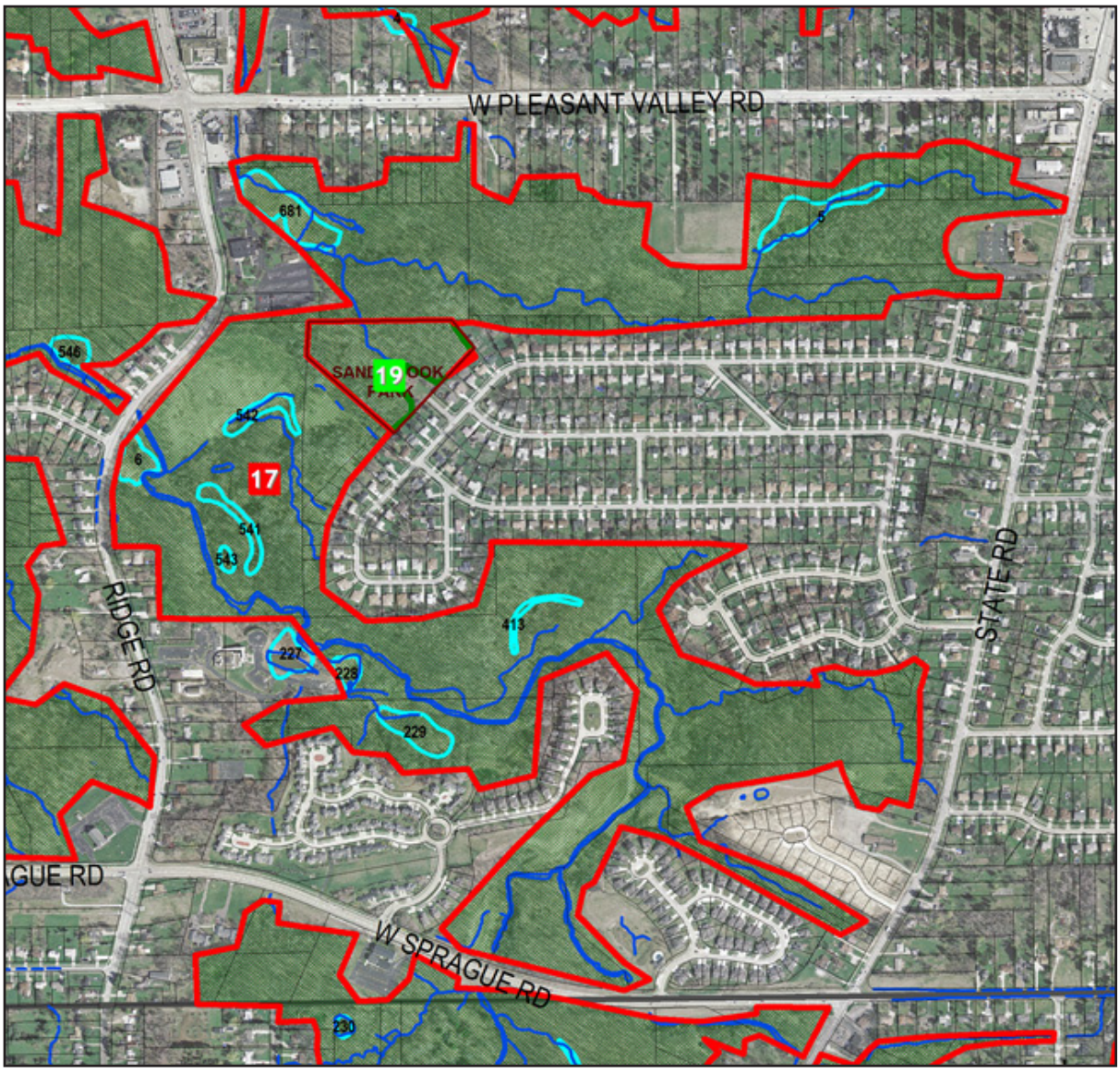
Large Tract #17 – Upper Big Creek: Remaining Open Space Analysis

Map ID#	Acres	Percent Remaining Acres	Percent Remaining Open Forest	Percent Remaining Open Critical Soils	Percent Remaining Open Riparian	Percent Remaining Open Steep Slope	Percent Remaining Critical Areas
17	168.9	8.10%	9.60%	11.00%	11.10%	11.40%	8.70%

Large Tract #17 – Upper Big Creek: Watershed-wide Analysis

Map ID#	Acres	Percent Watershed Acres	Percent Watershed Forest	Percent Watershed Critical Soils	Percent Watershed Riparian	Percent Watershed Steep Slope	Percent Watershed Critical Areas
17	168.9	0.70%	9.50%	1.20%	7.40%	4.00%	1.40%

Upper Big Creek Priority Conservation Area – Large Tract #17



East Branch Priority Conservation Area – Large Tract #33

Summary

Large tract #33 is 134 acres and the second largest greenspace identified in Big Creek. This openspace is entirely located within the city Parma between State and Ridge roads. The land contains approximately 29 parcels under various ownerships. Two of the major parcels are privately owned by Scripps Howard and Citicasters. Stearns Farm Homestead is adjacent to this large tract and West Creek Reservation is nearby to the east.

This is a large contiguous openspace contains nice forests, steep slopes, critical soils, multiple stream networks and several wetlands. Streams (and buffer) totaled nearly 12 acres and wetlands (and buffers) totaled nearly 10 acres.

Conservation / Restoration Options

This is a prime openspace in Big Creek and should be preserved. It contains a lot of important watershed resources and could be an asset to other nearby park systems. The two major parcels, #450-26-002 and #450-27-001, are both very costly and may prohibit conservation. Adjacent properties also provide an opportunity to preserve headwater tributaries and should be further explored.

The Cuyahoga River RAP identified two wetland restoration opportunities in a separate study. Preservation and enhancements of a 1.46 acre wetland and 1.82 acre wetland totaled over one million due to property costs. Other alternatives to collaborate with the property owners should be explored. (See Appendix B: Big Creek Watershed Wetlands Analysis, Wetlands Ranked #7 & #8)

There are proposed greenway trails system plans that run through this large tract. The trails would link Stearns Farm Homestead with the West Creek Reservation and ultimately down to the Cuyahoga River. Partnerships should be developed to ensure that future projects are multi-objective and integrate trails and watershed preservation.

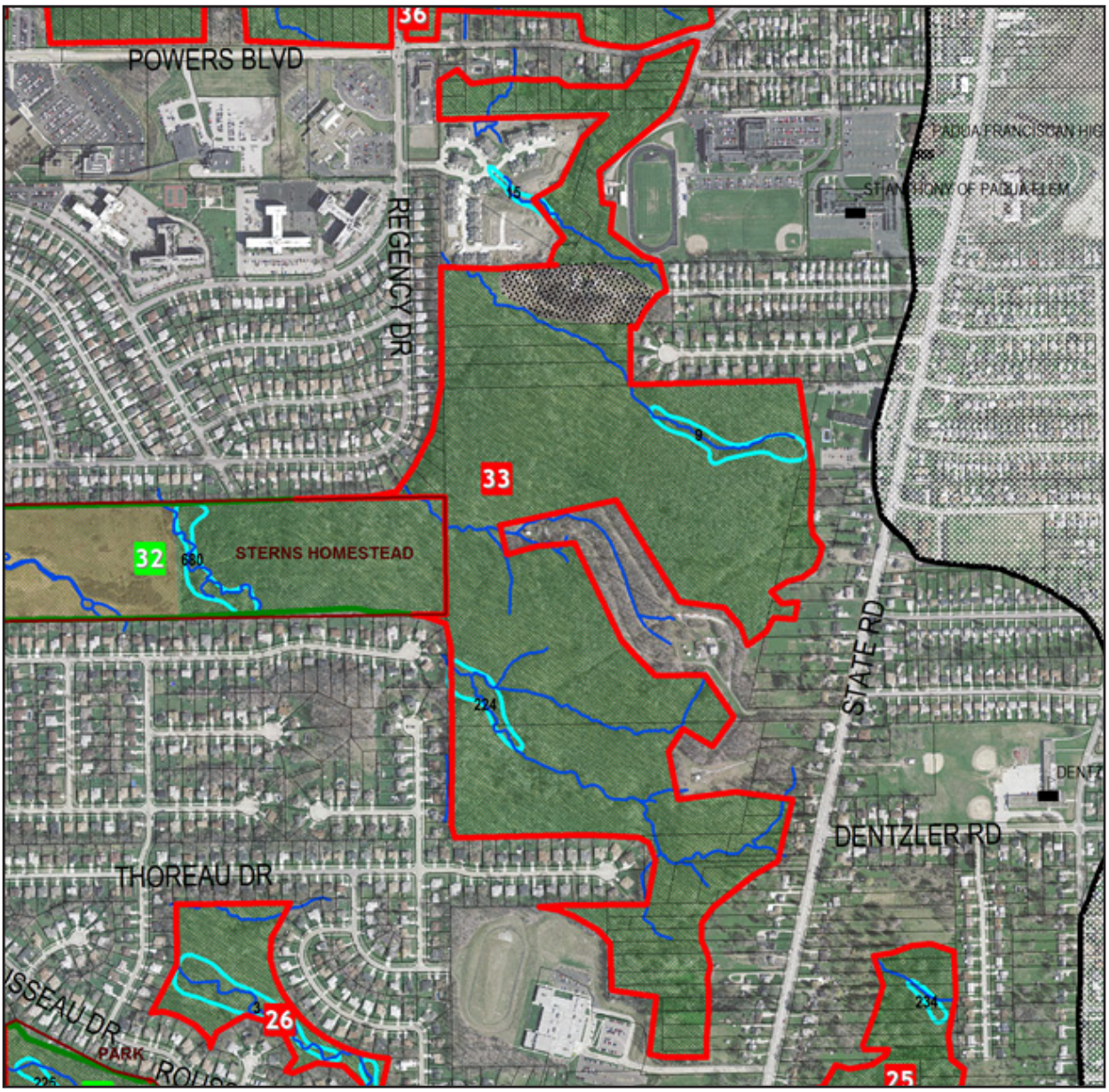
Large Tract #33 – East Branch: Remaining Openspace Analysis

Map ID#	Acres	Percent Remaining Open Acres	Percent Remaining Open Forest	Percent Remaining Open Critical Soils	Percent Remaining Open Riparian	Percent Remaining Open Steep Slope	Percent Remaining Open Critical Areas
33	134.7	6.4%	7.4%	7.1%	3.4%	6.7%	6.9%

Large Tract #33 – East Branch: Watershed-wide Analysis

Map ID#	Acres	Percent Watershed Acres	Percent Watershed Forest	Percent Watershed Critical Soils	Percent Watershed Riparian	Percent Watershed Steep Slope	Percent Watershed Critical Areas
33	134.7	0.5%	7.3%	0.8%	2.3%	2.3%	1.1%

East Branch Priority Conservation Area – Large Tract #33



Lower Big Creek Primary Conservation Area – Large Tract #63

Summary

Large tract #63 is one of the largest openspaces in the Lower Big Creek subwatershed. This openspace is located within Brooklyn but borders the cities of Linndale and Cleveland. This land contains approximately 7 parcels under various ownerships. The major parcel onsite is publically owned by the city of Brooklyn. This site is located between Big Creek and Brookside Reservations.

This site, often referred to as "the oxbow" is part of the lower Big Creek valley that features the original channel alignment of the creek before it was rerouted when I-71 was constructed. The oxbow site contains forests, steep slopes, critical soils, portion of Big Creek mainstem and nearly 8 acres of wetlands.

Conservation / Restoration Options

This is an important and popular open space in Big Creek. It contains a number of watershed resources and should be preserved and restored as an asset to the city of Brooklyn and the nearby park system. The major parcel, #01330004, is publicly owned and should be targeted first. There are also three other parcels that should be pursued for conservation.

The Cuyahoga River RAP identified a wetland/stream restoration opportunity in a separate study. The report identified approximately 2 acres of forested wetland for enhancement and 1,150 linear feet of stream restoration, equally $372,600. This project would restore the oxbow stream creating an inlet and outlet, which would provide stormwater management. (See Appendix B: Big Creek Watershed Wetlands Analysis, Wetland Ranked #5) The Northeast Ohio Regional Sewer District's RIDE study identified flooding and erosion problems along this reach of Big Creek. Flood control options were explored for this site.

A Big Creek Trail Alignment & Neighborhood Connector Plan also identified this area for trail connections. There are proposed trail systems that run through this site and connect Brookside and Big Creek Reservations

Partnerships should be developed to ensure that future projects are multi-objective and integrate trails, flood control, parks and watershed preservation.

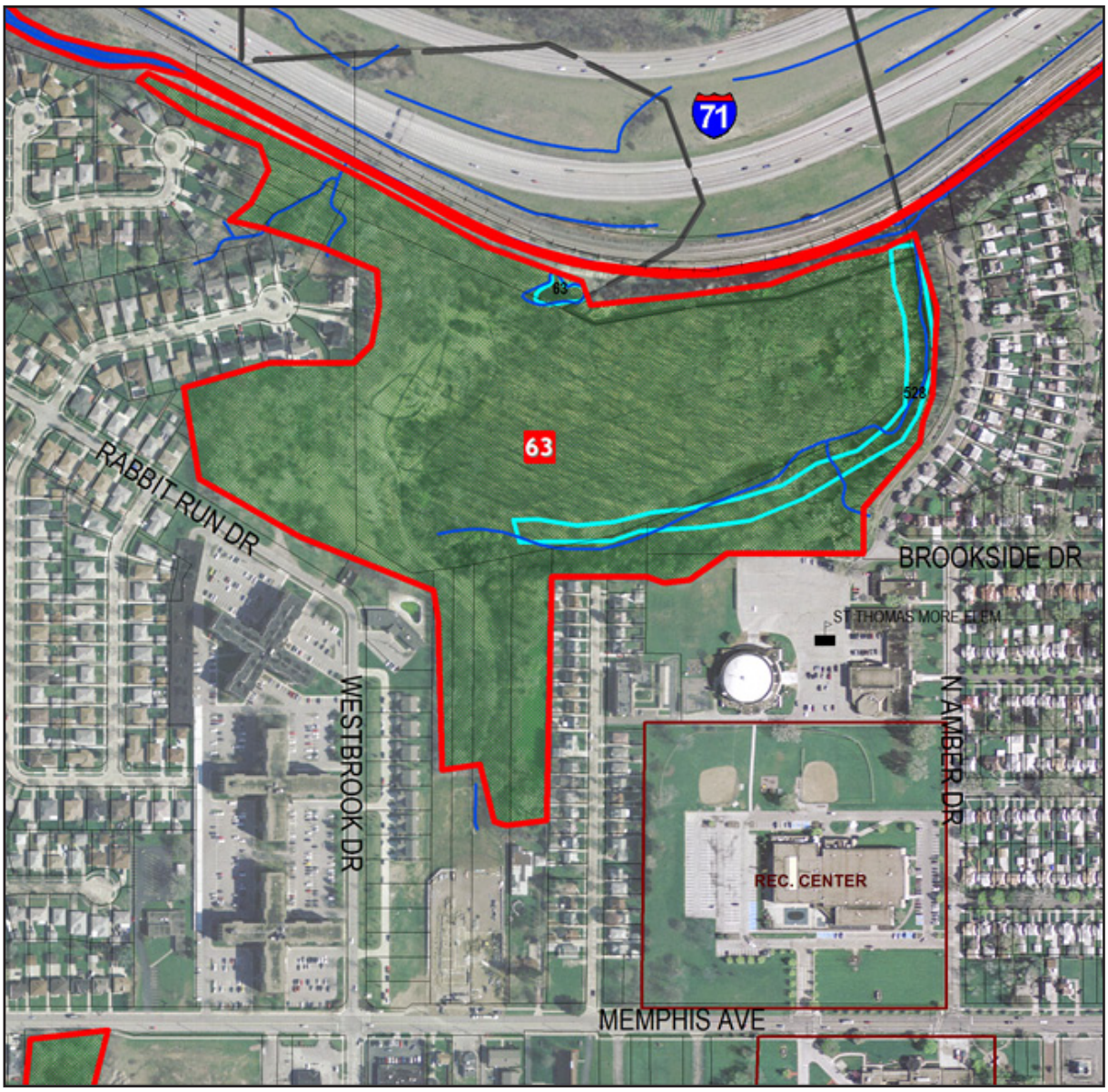
Large Tract #63 – Lower Big Creek: Remaining Openspace Analysis

Map ID#	Acres	Percent Remaining Acres	Percent Remaining Open Forest	Percent Remaining Open Critical Soils	Percent Remaining Open Riparian	Percent Remaining Open Steep Slope	Percent Remaining Critical Areas
63	37.2	1.8%	2.1%	2.8%	2.3%	1.4%	1.9%

Large Tract #63 – Lower Big Creek: Watershed-wide Analysis

Map ID#	Acres	Percent Watershed Acres	Percent Watershed Forest	Percent Watershed Critical Soils	Percent Watershed Riparian	Percent Watershed Steep Slope	Percent Watershed Critical Areas
63	37.2	0.2%	2.1%	0.3%	1.5%	0.5%	0.3%

Lower Big Creek Primary Conservation Area – Large Tract #63



West Branch Priority Conservation Area – Large Tract #73

Summary

Large Tract #73 is one of the larger openspaces in the West Branch of Big Creek. However, when compared to the overall watershed, Large Tract 73 is relatively small in acreage and watershed features. This openspace is located within the city of Cleveland, near Linndale and contains approximately 8 parcels under various ownerships. The openspace is located near Halloran Park and West 117th and Bellaire Road.

This site encompasses the lower reach and the confluence of the West Brach and the Big Creek mainstem. Watershed features include: forested corridor, critical soil, steep slopes and approximately 8 acres of the lower reach of the West Branch.

Conservation / Restoration Options

Openspace and natural streams (not culverted) is at a scarcity in the West Branch, making this large tract an important site. There is close proximity and possible greenspace connections to the Big Creek Reservation, Halloran Park and large tracts #69 and #66. There are many obstacles to overcome including multiple private property and the railroad and interstate highway.

The Northeast Ohio Regional Sewer District's RIDE study identified erosion problems along this stream near I-71. No restoration suggestions were included in the RIDE study. Addressing the erosion problems may be best targeted through multi-stakeholder cooperation and integrating this project into a larger municipal or state construction project.

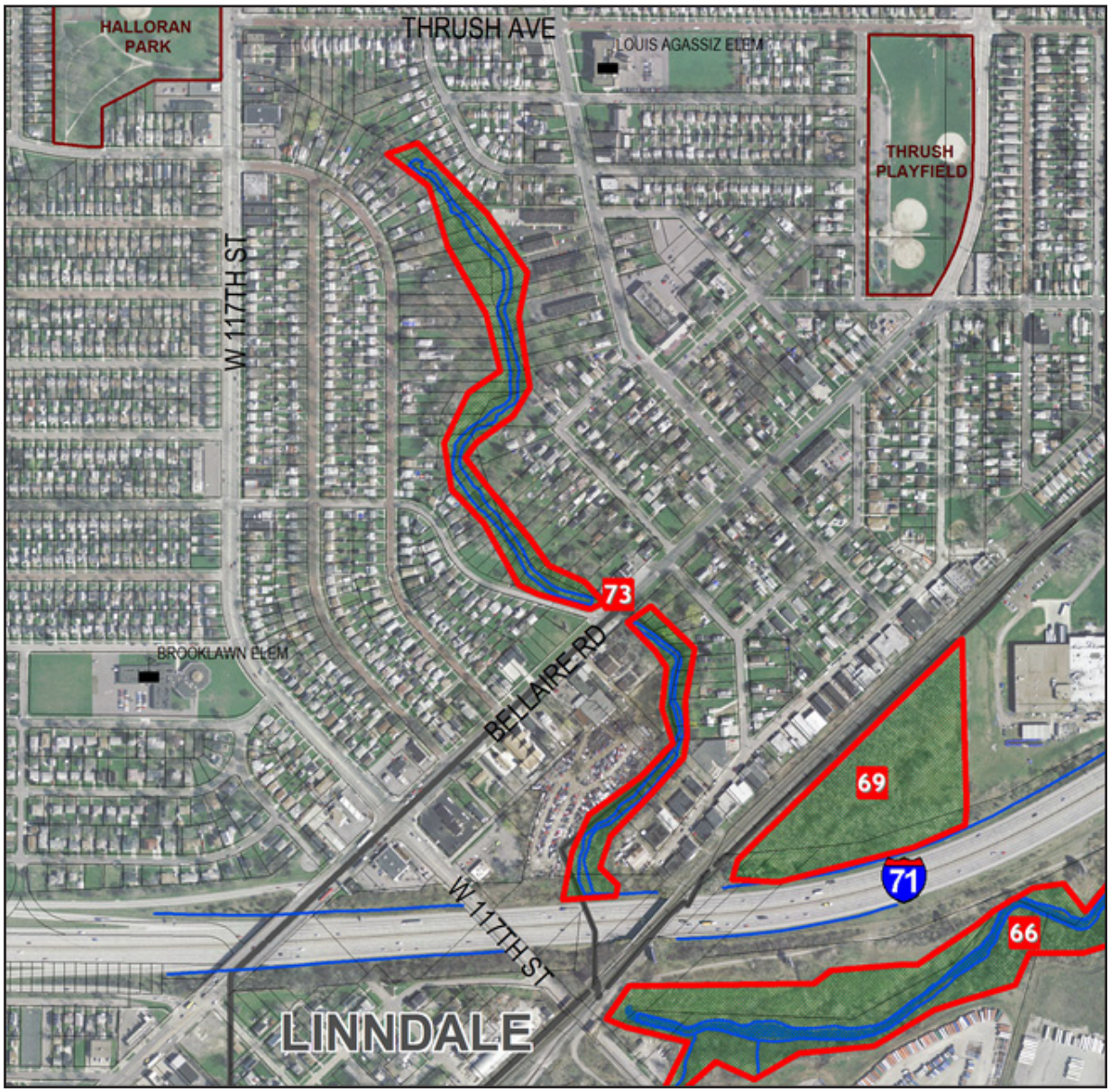
Large Tract #73 – West Branch: Remaining Openspace Analysis

Map ID#	Acres	Percent Remaining Acres	Percent Remaining Open Forest	Percent Remaining Open Critical Soils	Percent Remaining Open Riparian	Percent Remaining Open Steep Slope	Percent Remaining Critical Areas
73	8.8	0.4%	0.5%	0.7%	1.3%	1.0%	0.5%

Large Tract #73 – West Branch: Watershed-wide Analysis

Map ID#	Acres	Percent Watershed Acres	Percent Watershed Forest	Percent Watershed Critical Soils	Percent Watershed Riparian	Percent Watershed Steep Slope	Percent Watershed Critical Areas
73	8.8	0.0%	0.5%	0.1%	0.9%	0.4%	0.1%

West Branch Priority Conservation Area – Large Tract #73



East Branch & Stickney Creek Priority Conservation Area – Large Tract #54

Summary

Large tract #54 is a large openspace that follows portions of the East Branch and Stickney and includes the confluence between the two streams. This openspace is located within the city of Brooklyn and contains approximately 31 parcels under various ownerships. The openspace is a long contiguous site located along Tiedeman Rd and situated between Biddulph Rd and Memphis Avenue.

This is a nice, centrally located openspace between the Big Creek Reservation, Memphis Picnic Area and Veterans Memorial Park. Watershed features include: Forested areas, critical soils, steep slopes and approximately 39 acres of streams (and buffer).

Conservation / Restoration Options

This is a key openspace in Big Creek watershed. It contains a lot of nice watershed resources and should be preserved and restored as an asset to the city of Brooklyn and the nearby park systems. Two key anchor parcels include parcel #43209004 along the East Branch, and parcel #43221001 along Stickney Creek.

The Northeast Ohio Regional Sewer District's RIDE study identified erosion problems in this area. Suggested restoration options include 700 LF of channel restoration, which includes options of rerouting, and 500 SY of stream bank stabilization.

A Big Creek Trail Alignment & Neighborhood Connector Plan also identified this area for trail connections. There are proposed trail systems that run through this site and connect the Big Creek Reservation and Veterans Memorial Park.

Partnerships should be developed to ensure that future projects are multi-objective and integrate trails, stormwater control, parks and watershed preservation. Addressing the erosion problems may be best targeted by integrating this project into a larger municipal construction project. Other options include directing mitigation needs to this area for preservation and restoration.

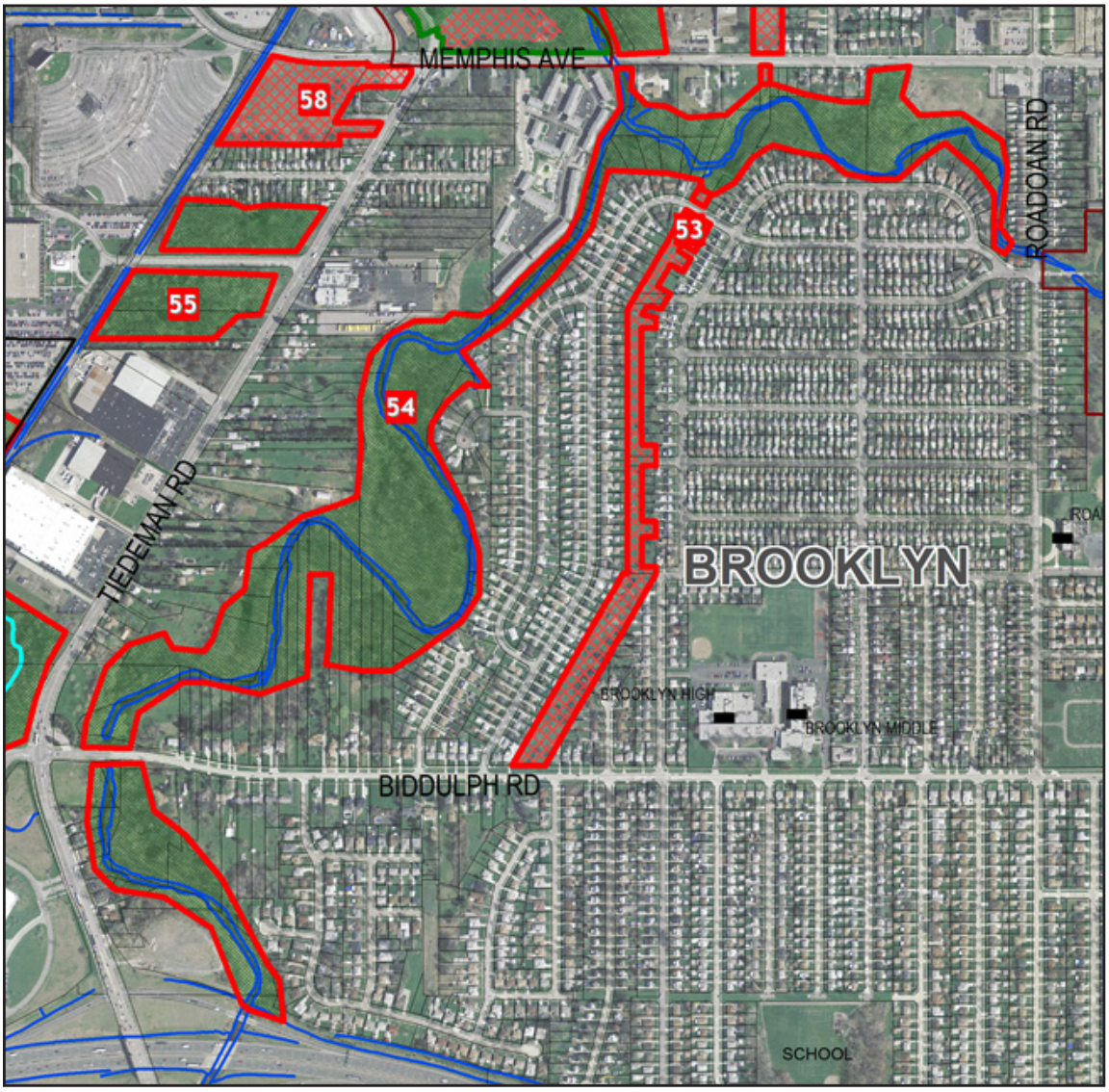
Large Tract #54 – East Branch & Stickney Creek: Remaining Open Analysis

Map ID#	Acres	Percent Remaining Acres	Percent Remaining Open Forest	Percent Remaining Open Critical Soils	Percent Remaining Open Riparian	Percent Remaining Open Steep Slope	Percent Remaining Critical Areas
54	66.4	3.2%	3.8%	5.4%	6.1%	4.2%	3.4%

Large Tract #54 – East Branch & Stickney Creek: Watershed-wide Analysis

Map ID#	Acres	Percent Watershed Acres	Percent Watershed Forest	Percent Watershed Critical Soils	Percent Watershed Riparian	Percent Watershed Steep Slope	Percent Watershed Critical Areas
54	66.4	0.3%	3.7%	0.6%	4.1%	1.5%	0.5%

East Branch & Stickney Creek Priority Conservation Area – Large Tract #54



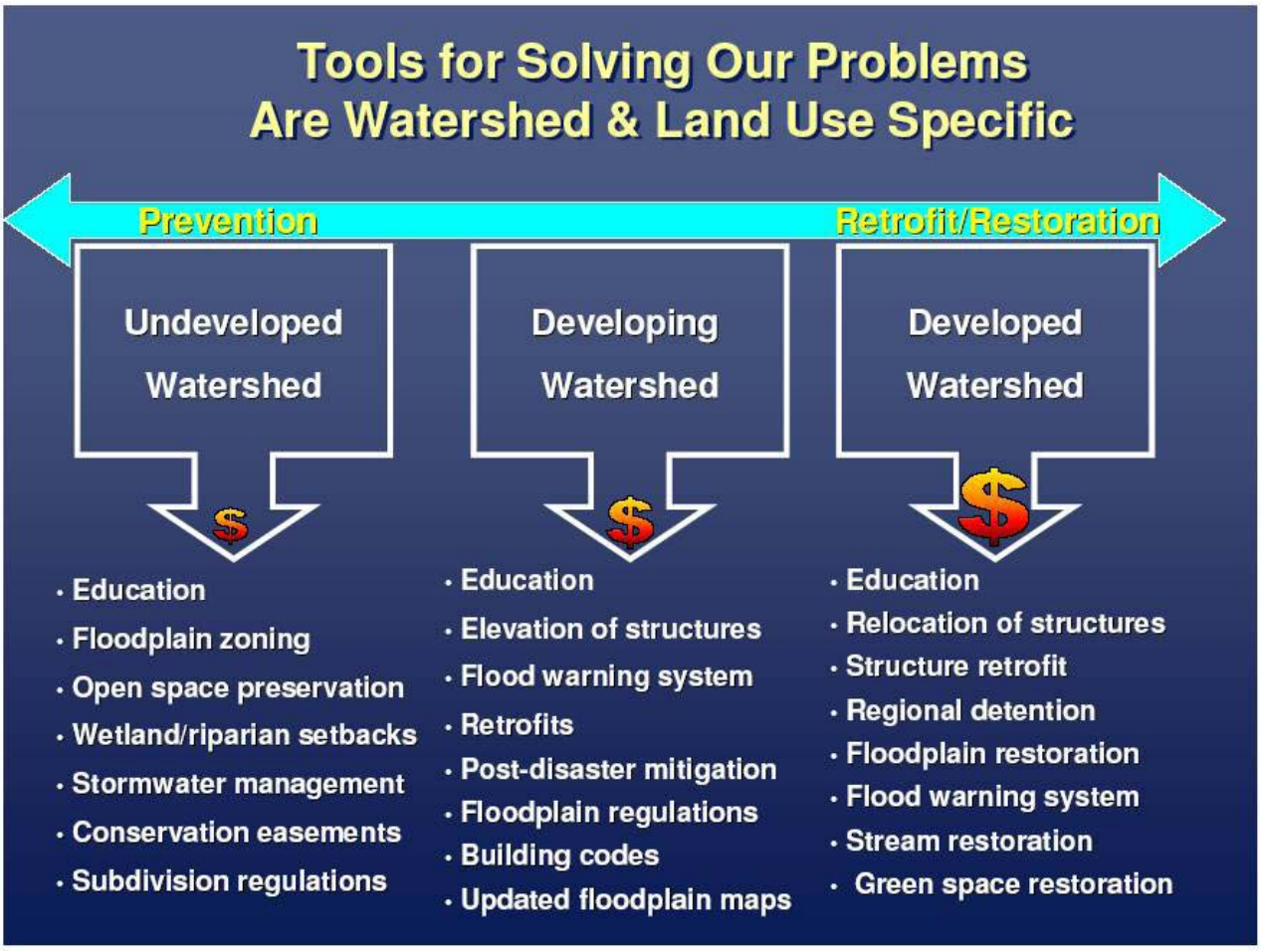
Watershed Restoration Practices

When analyzing areas for conservation or restoration, the variety of options and array of restoration practices must be considered in order to form a meaningful plan. Practices can include the implementation of structural (ex. stormwater basin) and non-structural (ex. preservation) practices within a watershed to improve stream health and reduce erosion and stormwater runoff.

The choice of which combination of restoration practices depends on the community's goals and needs along with the restoration potential of the subwatershed. Restoration potential often depends on the amount of impervious cover or the intensity of development in the surrounding subwatershed. .

In general, non-structural restoration practices such as preservation or riparian and wetland setbacks are more effectively implemented in rural or developing watersheds. These practices are more preventive and less expensive than built remedies. In developed or urban watersheds, preventive measures are limited and it is more effective to implement structural restoration practices such as stormwater retrofits.

The percent of impervious cover in the watershed provides a general sense of restoration potential and options. A basic relationship is presented in this table, to show how impervious cover can influence the effectiveness and viability of certain restoration practices.



Best Management Practices (BMPs) Relative to Percent Impervious Cover

Restoration Practices	Subwatershed Impervious Cover			
	10 to 25%	25 to 40%	40 to 60%	60 to 100%
Stormwater Retrofit Practices				
Storage Retrofit	Yes	Maybe	Rarely	No
On-site Non-Residential Retrofits	Yes	Yes	Maybe	Rarely
On-site Residential Retrofits	Yes	Yes	Maybe	Rarely
Stream Repair Practices				
Stream Clean-ups	Yes	Yes	Maybe	No
Stream Repairs	Yes	Maybe	Maybe	Rarely
Comprehensive Restoration	Maybe	Rarely	Rarely	No
Riparian Management Practices				
Site Preparation	Yes	Maybe	Rarely	No
Active Reforestation	Yes	Yes	Maybe	No
Park/Greenway Plantings	Yes	Maybe	Maybe	No
Natural Regeneration	Yes	Maybe	Maybe	No
Riparian Wetland Restoration	Yes	Maybe	Rarely	No
Discharge Prevention Practices				
Illicit Sewage Connections	Yes	Maybe	Yes	Yes
Other Illicit Connections	Maybe	Yes	Yes	Yes
Failing Sewage Lines	Yes	Yes	Yes	Yes
Industrial and Tranport Spills	Maybe	Yes	Yes	Yes
Watershed Forestry Practices				
Land Reclamation	Yes	Yes	Maybe	Rarely
Upland Revegetation	Yes	Yes	Maybe	Rarely
Natural Area Remnant	Yes	Yes	Maybe	Rarely
Pollution Source Control				
Residential Source Controls	Yes	Yes	Yes	Maybe
Hotspot Source Controls	Maybe	Yes	Yes	Yes
Municipal Practices and Programs				
Street and Storm Drain Cleaning	Maybe	Maybe	Maybe	Yes
Best Practices for Redevelopment	Yes	Yes	Yes	Yes
Stewardship of Public Land	Yes	Yes	Maybe	Rarely
Municipal Stewardship Programs	Yes	Yes	Yes	Yes
Education and Enforcement	Yes	Yes	Yes	Yes

Key

Yes = Technique is normally feasible and can be widely applied across subwatershed.

Maybe = Technique is often feasible, depending on subwatershed characteristics.

Rarely = Individual sites can be found, but widespread implementation across subwatershed is limited.

Technique is generally not feasible in the subwatershed.

From the Center for Watershed Protection

Step 5: Analyze and Identify Priority Areas for Conservation / Restoration Using Stormwater Retrofit Techniques

In watersheds where opportunities for conservation of green fields are limited, green infrastructure can still be expanded and watershed function improved when built areas or unused storage areas are seen as restoration sites. Stormwater retrofits are structural practices installed within the stream corridor or upland areas to capture and treat stormwater runoff before it is delivered to the stream. Considering the urban nature of Big Creek, stormwater retrofits will be the primary practice for restoration, since they can treat stormwater pollutants, minimize channel erosion and help restore stream hydrology.

OBJECTIVES

A good set of restoration objectives helps identify what pollutants need to be treated, how much storage is needed and where the most cost-effective locations are in the subwatershed.

Community objectives identified in the “Goals for the Big Creek Watershed Management Plan” included:

1. Improve Water Quality in Big Creek
2. Reduce Flooding

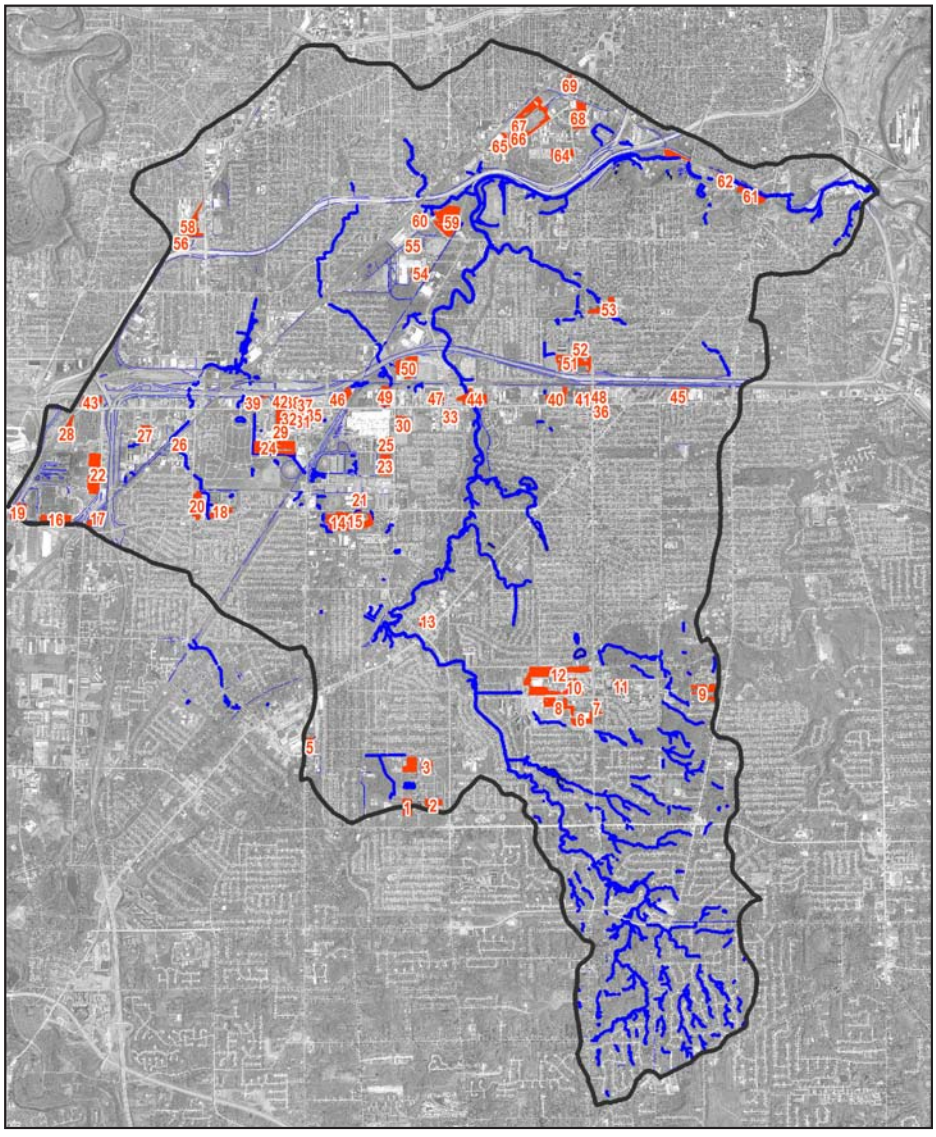
STORMWATER RETROFIT PRACTICES TO TREAT WATER QUALITY AND QUANTITY

LOCATIONS	DESCRIPTIONS
Large Parking Lots (5 acres or greater)	Provide stormwater treatment in open spaces near the outfall the of the parking lot or by incorporating infiltration type best management practices around the perimeter of down the medians of the lot.
Modify Existing Dry Basins	Add water quality treatment/storage to an existing dry pond by excavating new storage on the pond bottom, raising the height of the embankment, modifying riser elevations/dimensions, converting unneeded quantity control storage into water quality treatment storage and/or installing internal design features to improve performance
New Storage Below Outfalls	Flows are split from an existing storm drain or ditch and are diverted to a stormwater treatment area on public land in the stream corridor. Works best for storm drain outfalls in the 12- to 36- inch diameter range that are located near large open spaces, such as parks, golf courses and floodplains.
Storage at Highway Interchanges	Direct runoff to a depression or excavated stormwater treatment area within the right of way of a road, highway, transport or power line corridor. Prominent examples include highway cloverleaf, median and wide right of way areas.

Stormwater Retrofit – Large Parking Lots

Large parking lots are a good retrofit opportunity to treat runoff quality. Large parking lots are defined as five acres or greater in size. Common examples include lots serving municipal buildings, corporations, high schools, shopping malls, community colleges and big box retail stores.

Parking lots are a good retrofit areas because they generate more stormwater runoff and pollutants on a unit area basis than many other land uses. An ideal stormwater retrofit strategy would include installing a stormwater basin in an unutilized land nearby and down gradient. Other retrofit strategies that could be installed onsite include bioretentions, porous pavement and infilrtation trenches.



STORMWATER RETROFIT:
LARGE PARKING LOTS

This map shows locations of 69 large parking lots that could be sites for stormwater retrofits. The sites are concentrated the Brookpark Road corridor, but other sites exist in other portions of the watershed. Some project sites may offer more opportunities than others in terms of cost-effectiveness and desired outcomes.

This is a planning-level analysis; more details will be needed for project implementation.

Priority Conservation / Restoration / Retrofits
Large Parking Lots

STORMWATER RETROFIT STRATEGIES FOR PARKING LOTS

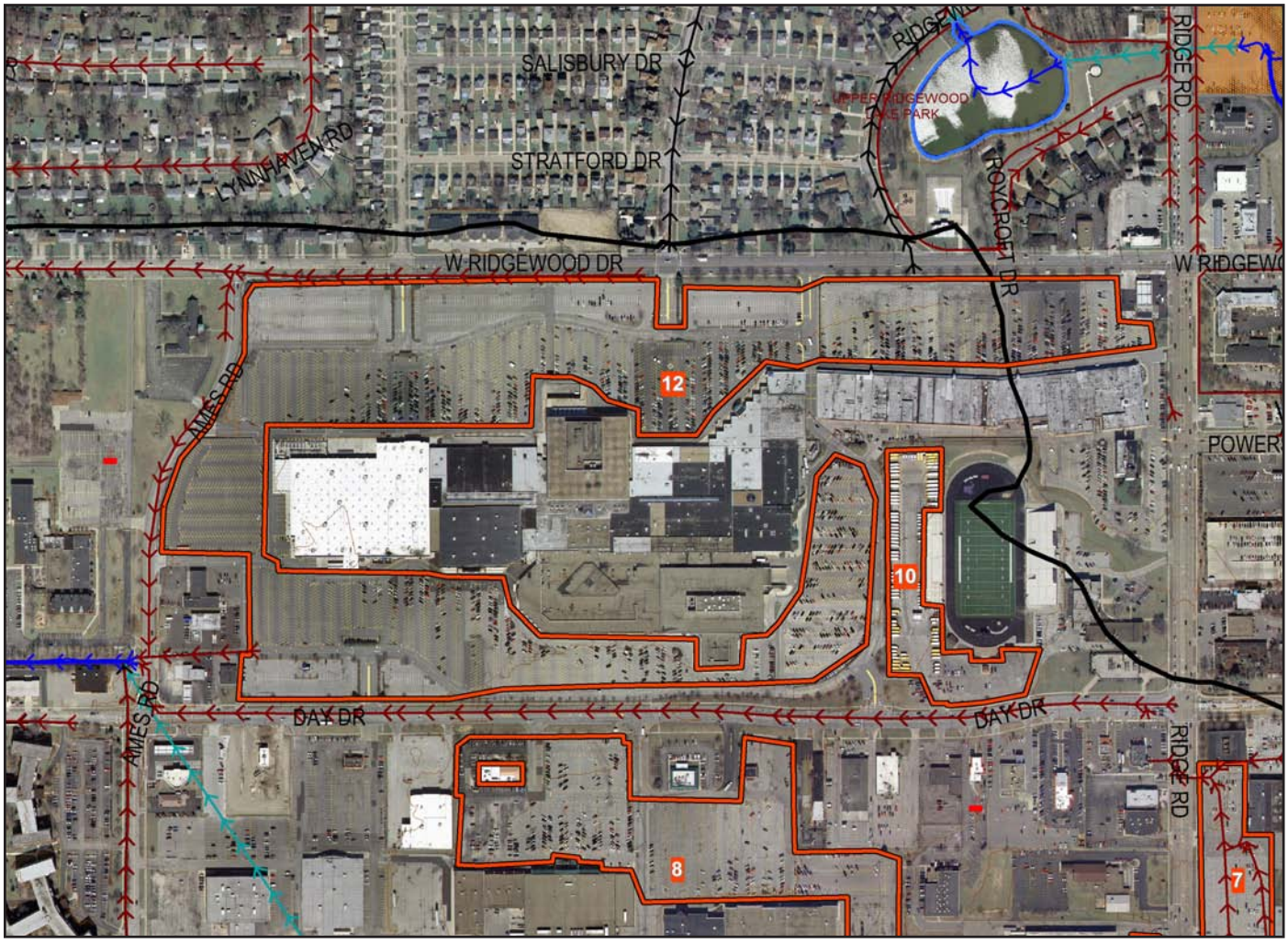
RETROFIT STRATEGIES	DESCRIPTIONS
Wetland Extended Detention Basin	These basins are similar to stormwater basins in that the manage peak flows and flood control. Wetland basins however, are equipped with extra stormwater features such as micropools and wetland habitat to improve the performance in treating the quantity and quality of stormwater.
Bioretention	These practices are designed to treat smaller areas, typically 1 acre or less. Bioretention cells are landscape feature adapted to treat runoff. Runoff is directed and treated to a filter bed similar to a forest floor. Large parking lots can be partitioned with several bioretention areas.
Porous Pavement	Porous pavement consists of multiple layers of various stone and sand size to promote infiltration. Unlike stormwater ponds, porous pavement does not require large amounts of additional space. Instead, rainfall drains through pavement and directly infiltrates the subsurface. This significantly reduces runoff volume, decreases its temperature, improves water quality, and essentially eliminates impervious surface.
Infiltration Trench	Infiltration trenches capture and temporarily store stormwater runoff before infiltrating it into underlying soils, where most pollutants are trapped or storm sewers. Trenches have rock-filled chamber with no outlet, where runoff first passes through a pretreatment, such as a swale or sediment basin. Runoff is then stored in the voids between the stones.

Stormwater Retrofit – Large Parking Lots – EXAMPLE #1`

PARMATOWN MALL IN UPPER BIG CREEK SUBWATERSHED

Parmatown Mall, located in Parma and the Upper Big Creek Subwatershed, contains the largest parking lot measuring at approximately 41 acres. The lot appears not to have any stormwater management practices, contributing large quantities of runoff to Big Creek. This is largely due to the time of development, which occurred prior to current stormwater regulations.

Options- This project area is mostly landlocked without any nearby greenspaces to install a wetland extended detention basin. However, the parking lot itself may offer opportunities. Under-used areas of the lot maybe options for retrofits, such as overflow parking areas for *porous pavement* or even the installation of *extended detention basins*. *Bioretention cells* could be installed as median strips along the parking rows in areas with excessive parking.



Map reference Parking Lot #12

Priority Conservation / Restoration / Retrofits
Large Parking Lots

Stormwater Retrofit – Large Parking Lots – EXAMPLE #2

CLEVELAND METROPARKS ZOO & BROOKSIDE RESERVATION – LOWER BIG CREEK SUBWATERSHED

The Metropark Zoo & Brookside Reservation, located in Cleveland and the Lower Big Creek Subwatershed, contains three parking lots equally approximately 19 acres. These parking lots appear not to have any stormwater management practices, directly contributing runoff to the nearby Big Creek.

Options- This project area offers little in open areas that could be used to install retrofits. However, the parking lots themselves offer opportunities. Areas of the lot offer options for retrofits, such as overflow parking areas or even the entire lot for porous pavement. Bioretention cells could be installed as median strips and/or convert current landscaped islands into the strormwater treatment cells.

Map reference Parking Lots #61, #62 and #63

Stormwater Retrofit – Large Parking Lots – EXAMPLE #3

PARK-N-FLY IN BROOKPARK AND THE COLLEDA SUBWATERSHED

The Park-N-Fly lot, located in Brookpark and the Colleda Subwatershed, contains over 11 acres of impervious cover. The lot appears not to have any stormwater management practices, contributing runoff to Big Creek. This is largely due to the time of development, which occurred prior to current stormwater regulations.

Options- This project area offers little in open areas that could be used to install retrofits. However, the perimeter landscaping around the parking lot offers opportunities. The lot is actively used, but the perimeter landscaping surrounding the lot can be used to install infiltration trenches or bioretention cells.

Priority Conservation / Restoration / Retrofits
Modify Existing Dry Basins

STORMWATER RETROFIT – MODIFY EXISTING DRY BASIN

The first place to look for retrofit storage is within existing ponds. Dry stormwater ponds are an extremely attractive retrofitting target. The most common approach is to enhance the current dry basin with new features to provide extended detention and wetland storage and habitat. Many of these basins can be retrofitted to improve water quality and quantity.

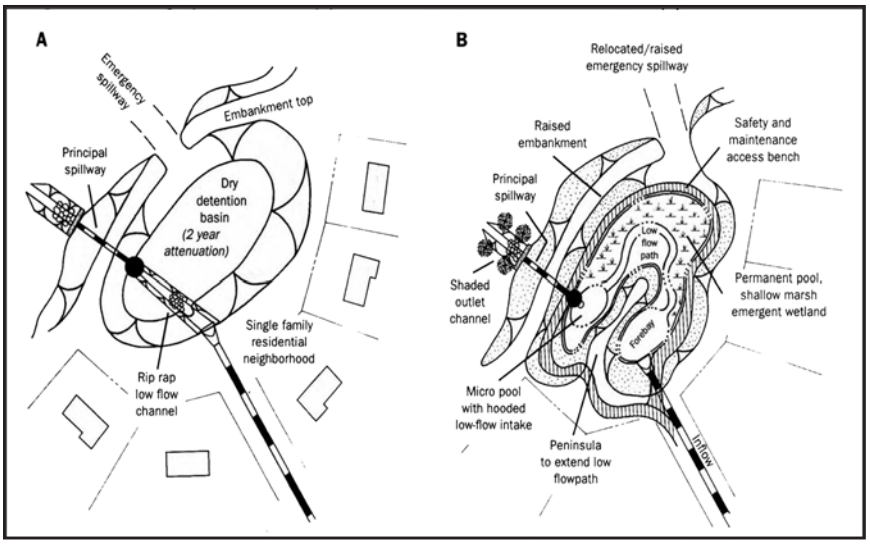
Dry basin retrofits are ideal since land costs are minimal, and construction costs are about 40% less than a new retrofit pond. In addition, since the land is already devoted to

stormwater management, most easements are already in place. Pond retrofits also need fewer permits and approvals compared to other storage retrofits. (CWP-Urban Subwatershed Restoration Manual 3)

Why do these basins need upgrading? Smaller, more frequent storm events that are typical to this region, degrade water quality, increase stream bank erosion and causes property damage. Most stormwater basins built in the past did little or nothing to reduce velocity or filter out pollutants from these smaller storms. Retrofitting existing dry basins can help alleviate these stormwater issues.

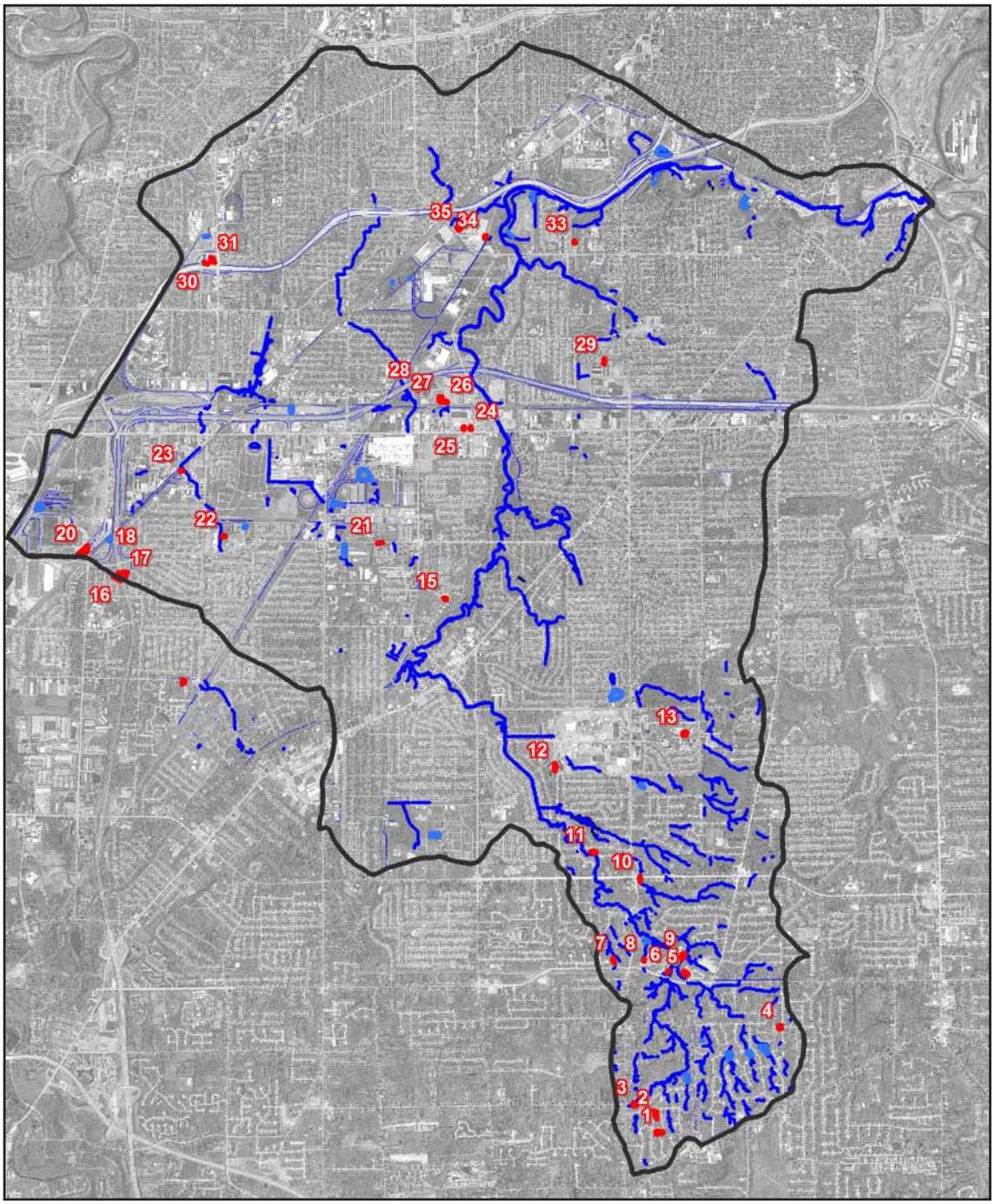
DRY BASIN RETROFIT STRATEGY

Retrofit Strategy	Descriptions
Upgrade Dry Basin to a Wetland Extended Detention Basin	These basins are similar to older stormwater basins in that they manage peak flows and flood control. Wetland extended detention basins, however, are equipped with extra stormwater features such as micropools and wetland habitat to improve the performance in treating the quantity and quality of stormwater.



Conversion of a dry pond to a wetland extended detention basin

Modify Existing Dry Basins



Stormwater Retrofit: Dry Basins

This map includes 35 dry stormwater detention basins. The sites are scattered throughout the entire watershed offering project sites in most subwatersheds. Some project sites may offer more opportunities than others through cost-effectiveness and measurable outcomes.

This is a planning level analysis; more details will *be needed for project implementation. These basins were identified through aerial photography and may not include all existing sites.*

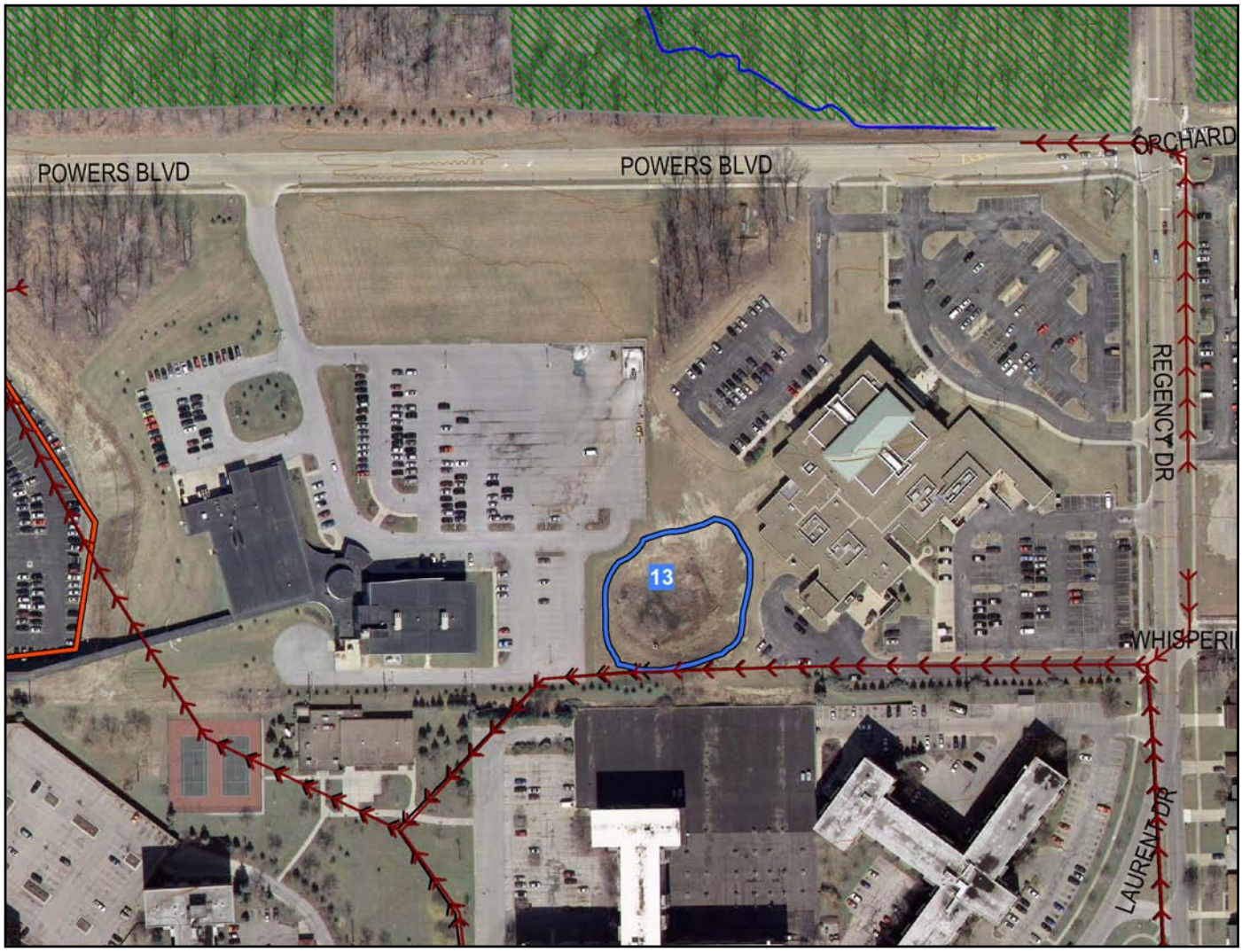
Priority Conservation / Restoration / Retrofits
Modify Existing Dry Basins

Stormwater Retrofit – Modify Existing Dry Basins – EXAMPLE #1

CITY OF PARMA DRY BASIN #12 IN UPPER BIG CREEK SUBWATERSHED

Basin #12 is located in the City of Parma and the Upper Big Creek Subwatershed near the intersection of Ames Rd. and Independence Blvd. The city of Parma is the owner, which provides an excellent opportunity to work on public land. This site is a dry basin with a concrete baseflow channel. Opportunities exist to upgrade this site into a wetland extended detention basin. Modifying this basin would improve stormwater capacity, water quality and neighborhood aesthetics. The modifications could include: excavate pond bottom, raise embankment, add or modify the riser, improve habitat and internal design geometry with a more meandering channel.

Stormwater Retrofit – Modify Existing Dry Basins – EXAMPLE #2

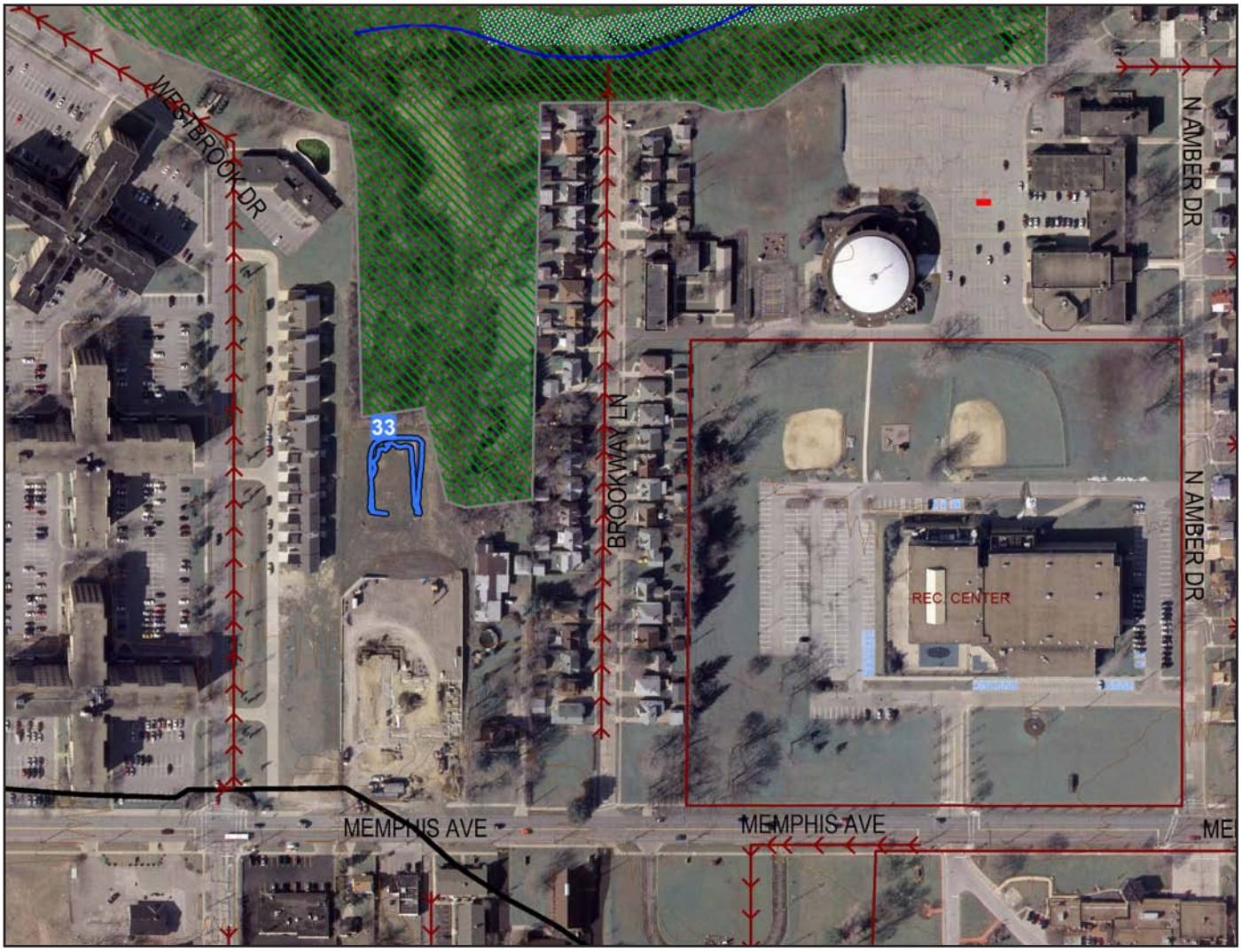


CITY OF PARMA DRY BASIN #13 IN EAST BRANCH SUBWATERSHED

Basin #13 is located in the city of Parma and the East Branch Subwatershed near Powers Blvd and Regency Dr. The city of Parma is the owner, which provides an excellent opportunity to work on public land. This site is a dry basin and offers opportunities to upgrade this site into a wetland extended detention basin. Modifying this basin would improve stormwater capacity, water quality and neighborhood aesthetics. The modifications could include: excavate pond bottom, raise embankment, add or modify the riser, improve habitat with native plantings.

Priority Conservation / Restoration / Retrofits
Modify Existing Dry Basins

Stormwater Retrofit – Modify Existing Dry Basins – EXAMPLE #3



CITY OF BROOKLYN DRY BASIN #33 IN LOWER BIG CREEK SUBWATERSHED

Basin #33 is located in the city of Brooklyn and the Lower Subwatershed near Memphis Ave. and Brookway Ln. The city of Brooklyn is the owner, which provides an excellent opportunity to work on public land. This site is a dry basin with a concrete baseflow channel. Opportunities exist to upgrade this site into a wetland extended detention basin. Modifying this basin would improve stormwater capacity, water quality and neighborhood aesthetics. The modifications could include: excavate pond bottom, raise embankment, add or modify the riser, improve habitat and internal design geometry with a more meandering channel.

STORMWATER RETROFIT – NEW STORAGE BELOW OUTFALLS

This stormwater retrofit creates new treatment adjacent to the stream corridor near the terminus of an existing storm drain outfall. This retrofit, when designed and located properly, can begin to improve the stormwater capacity of an urban watershed, such as Big Creek Outfall retrofits can occur at the terminus of an outfall or off-line by splitting flow from the existing storm drain pipe and diverting it to a stormwater treatment area formed by an existing depression or excavation.

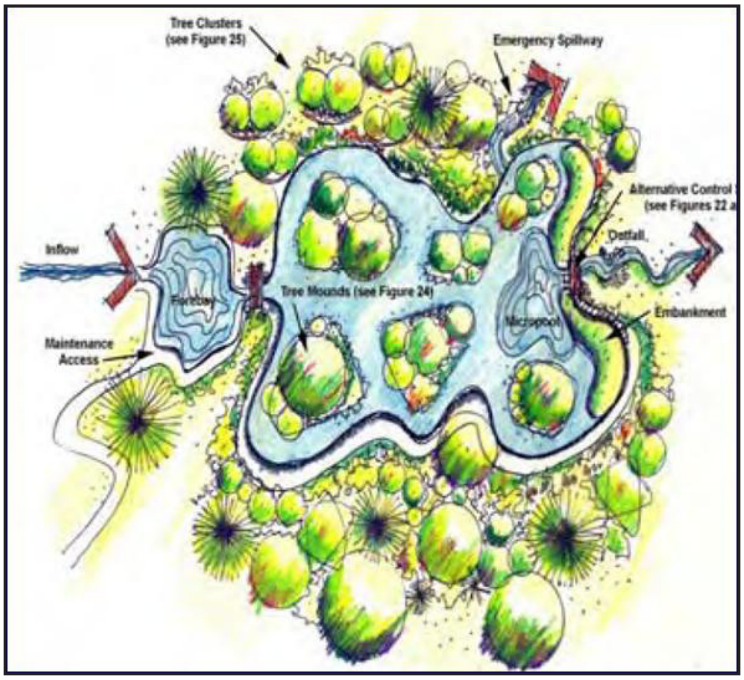
Typical stormwater treatment options at outfall retrofits are a combination of pocket wetland detention or bioretention cells. The placement of these practices are preferred at:

- Outfalls diameters of 12” to 36”
- A stream corridor in public ownership with enough openspace
- Enough pipe/channel gradient to divert flows for treatment and return them to the stream
- Manhole for the installation of a flow splitter.

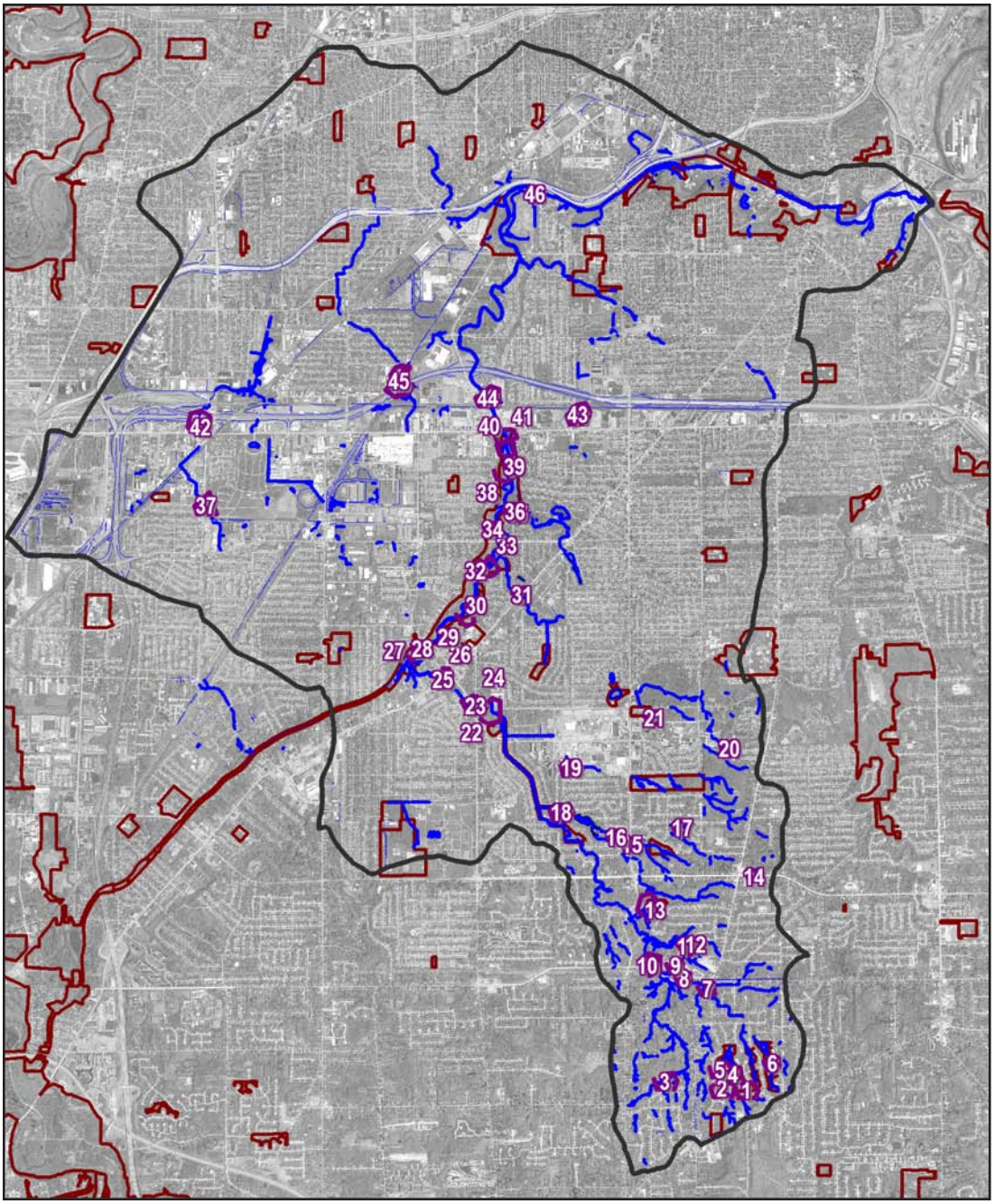
Outfall retrofits are ideal because they are close to the stream and maximize the upland drainage area treated. In addition, their offline location usually means fewer stream permitting problems. Lastly, outfall retrofits only need to be designed to provide the desired storage for water quality and/or channel protection; larger flood flows bypass the retrofit. (CWP-Urban Subwatershed Restoration Manual 3)

NEW STORAGE BELOW OUTFALLS RETROFIT STRATEGY

Retrofit Strategy	Descriptions
New Storage Below Outfalls	This strategy allows storage and treatment of stormwater at points where collected non-point pollution runoff exits the storm drain. Creating pocket wetlands or bioretention cells at select outfalls can help to improve a watershed’s stormwater capacity. Most communities have hundreds of outfalls which provide a number of opportunities to install this retrofit practice.



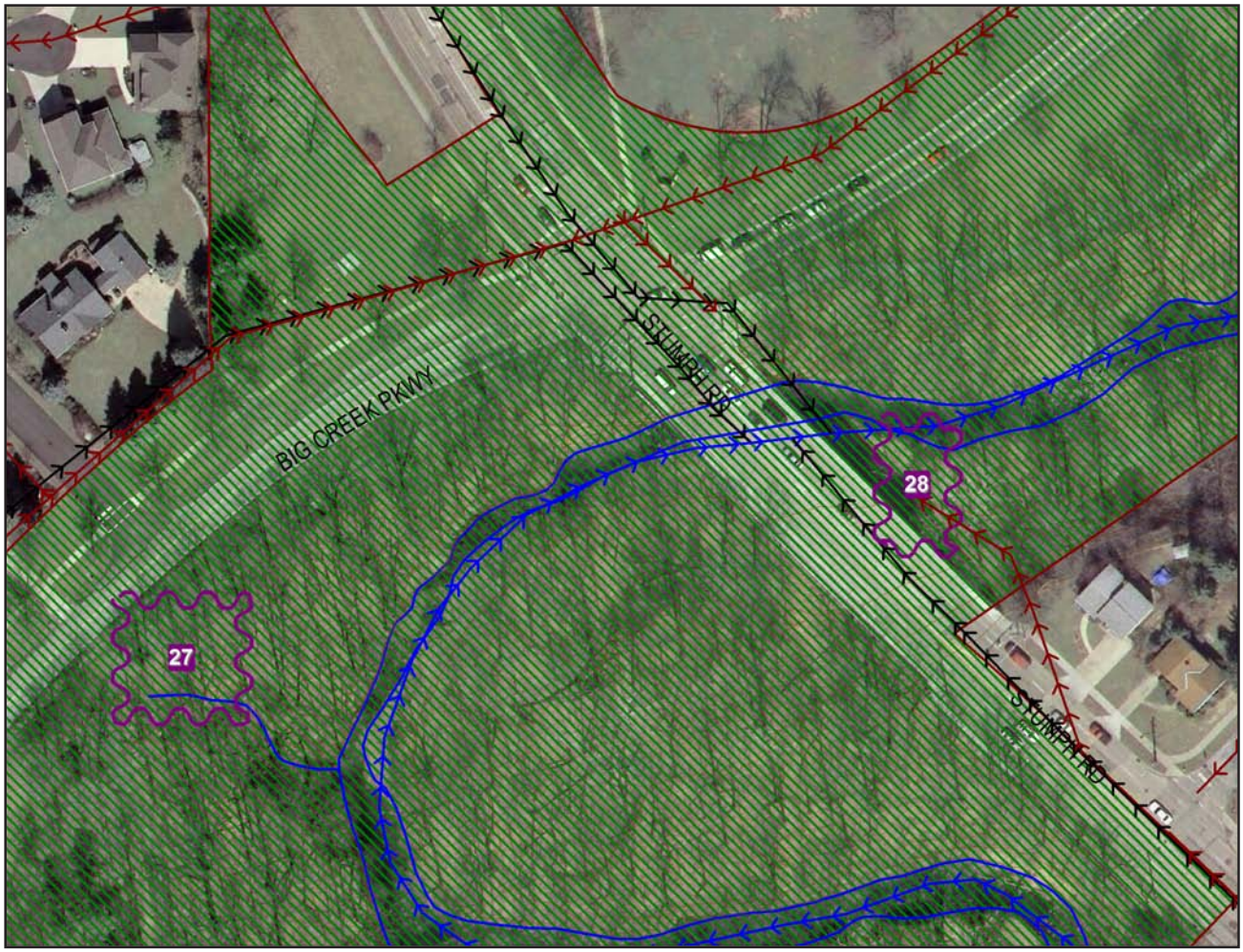
Priority Conservation / Restoration / Retrofits
New Storage Below Outfalls



STORMWATER RETROFIT: NEW STORAGE BELOW OUTFALLS

This map includes 46 outfall retrofit sites. There is a heavy concentration of project sites with the Big Creek Reservation and Upper subwatershed. The sites within the park system could provide excellent implementation and demonstration projects. Some sites may offer more opportunities than others in terms of cost-effectiveness, location and measurable outcomes. This is a planning level analysis; more details will be needed for project implementation. These sites were identified by outfall diameter, topography and nearby public property or openspace.

Stormwater Retrofit – New Storage Below Outfalls – EXAMPLE #1



OUTFALL 27 & 28 AT BIG CREEK RESERVATION

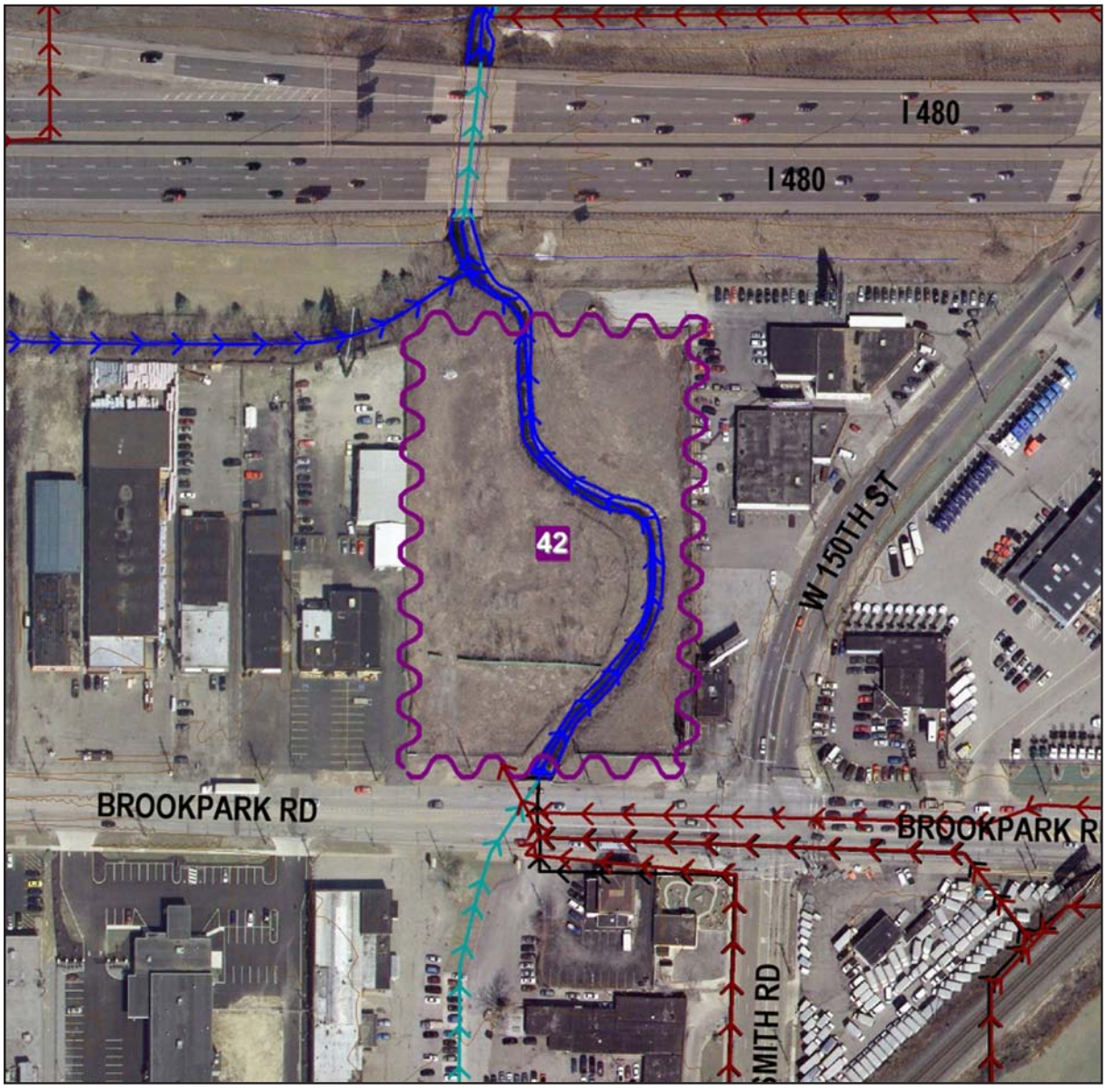
Sites #27 and #28 are 15” and 30” outfalls located in the city of Parma Heights and East Branch Subwatershed. The Cleveland Metroparks is the property owner, which provides an excellent opportunity to work on public land. The outfalls discharge runoff from the nearby road and neighborhood. The extent of the drainage area still needs to be assessed to determine type and size of retrofit practice.

Pocket wetlands or bioretention cells could be installed to help capture and treat some the stormwater runoff entering Big Creek. The NEORSD RIDE study identified flooding and erosion problems in this location. This could be an excellent project area and certainly warrants further investigation with the Metroparks, NEORSD and other stakeholders.

Priority Conservation / Restoration / Retrofits

New Storage Below Outfalls

Stormwater Retrofit – New Storage Below Outfalls – EXAMPLE #2



OUTFALL 42 AT BROOKPARK AND SMITH ROADS

Site #42 is a 24” outfall located on vacant, private property in the city of Brookpark and Colleda subwatershed. The area contains 3.5 acre parcel, zoned commercial and surrounds an open stream channel. The outfall discharges runoff from the nearby road and neighborhood. The extent of the drainage area still needs to be assessed to determine type and size of retrofit practice.

Pocket wetlands or bioretention cells could be installed to help capture and treat some the stormwater runoff entering Big Creek. The NEORSD RIDE study identified intercommunity flooding and erosion problems in this location. This could be a good project area and certainly warrants further investigation with the Brookpark, NEORSD, landowner and other stakeholders.

Stormwater Retrofit – New Storage Below Outfalls – EXAMPLE #3

OUTFALLS 40 & 41 AT BIG CREEK RESERVATION

Sites #40 and #41 are both 36”outfalls located near the boarder of Parma and Brooklyn and East Branch Subwatershed. The Cleveland Metroparks is the property owner, which provides an excellent opportunity to work on public land. The outfall discharges runoff from the nearby road and neighborhood. The extent of the drainage area still needs to be assessed to determine type and size of retrofit practice.

Pocket wetlands or bioretention cells could be installed to help capture and treat some the stormwater runoff entering Big Creek. The NEORSD RIDE study identified intercommunity flooding and erosion problems in this location. This could be an excellent project area and certainly warrants further investigation with the Metroparks, NEORSD, cities and other stakeholders.

Priority Conservation / Restoration / Retrofits

Storage at Highway Interchanges

STORMWATER RETROFIT – STORAGE AT HIGHWAY INTERCHANGES

Highways often contain open and under-used land within their right-of-way where stormwater storage can be obtained by diverting highway runoff into these areas. The most common stormwater treatment options for highway retrofits constructed wetlands or linear bioretention and swales along wider medians and rights-of-way. These options can help to increase the stormwater capacity of an urban Big Creek watershed.

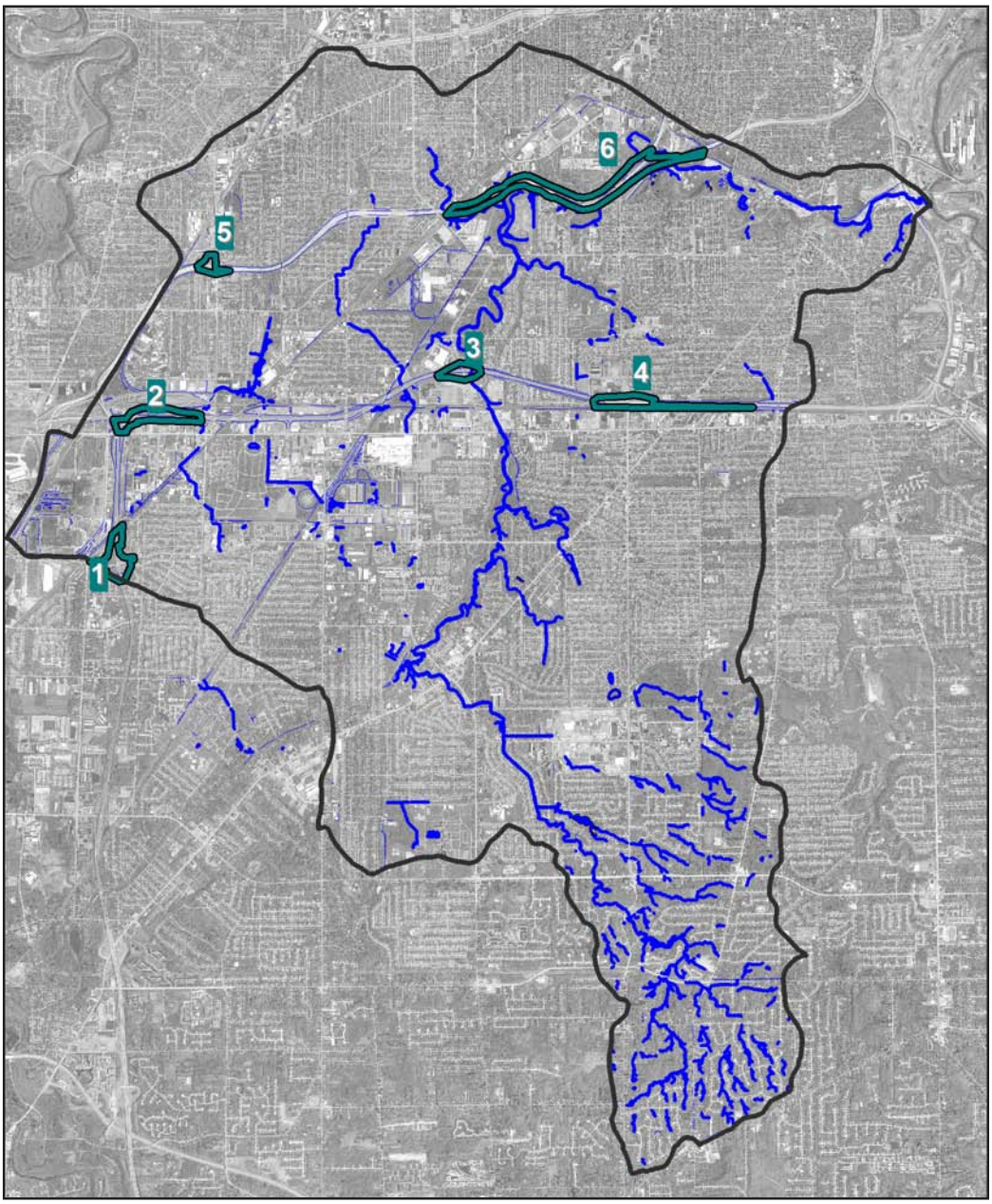
Highway retrofits are ideal because their runoff pollutant concentration is high. Land costs are relatively low since the retrofit is located in a public right of way. The Ohio Department of Transportation (ODOT) would be a good partner, as ODOT and other agencies have to comply with stormwater permit requirements and watershed mitigation.

Lastly, highway agencies are often “good maintainers” and may see retrofits as a means of reducing their ongoing maintenance operations. (CWP-Urban Subwatershed Restoration Manual 3)

HIGHWAY INTERCHANGE RETROFIT STRATEGIES

RETROFIT STRATEGY	DESCRIPTIONS
Wetland Extended Detention	These basins are similar to stormwater basins in that the manage peak flows and flood control. Wetland basins however, are equipped with extra stormwater features such as micropools and wetland habitat to improve the performance in treating the quantity and quality of stormwater.
Linear Bioretention Cells & Swales	Bioretention cells are landscape features adapted to treat runoff. Runoff is directed and treated to a filter bed similar to a forest floor. Linear biorention cells can be placed in medians and right-of-ways where feasible.

Storage at Highway Interchanges

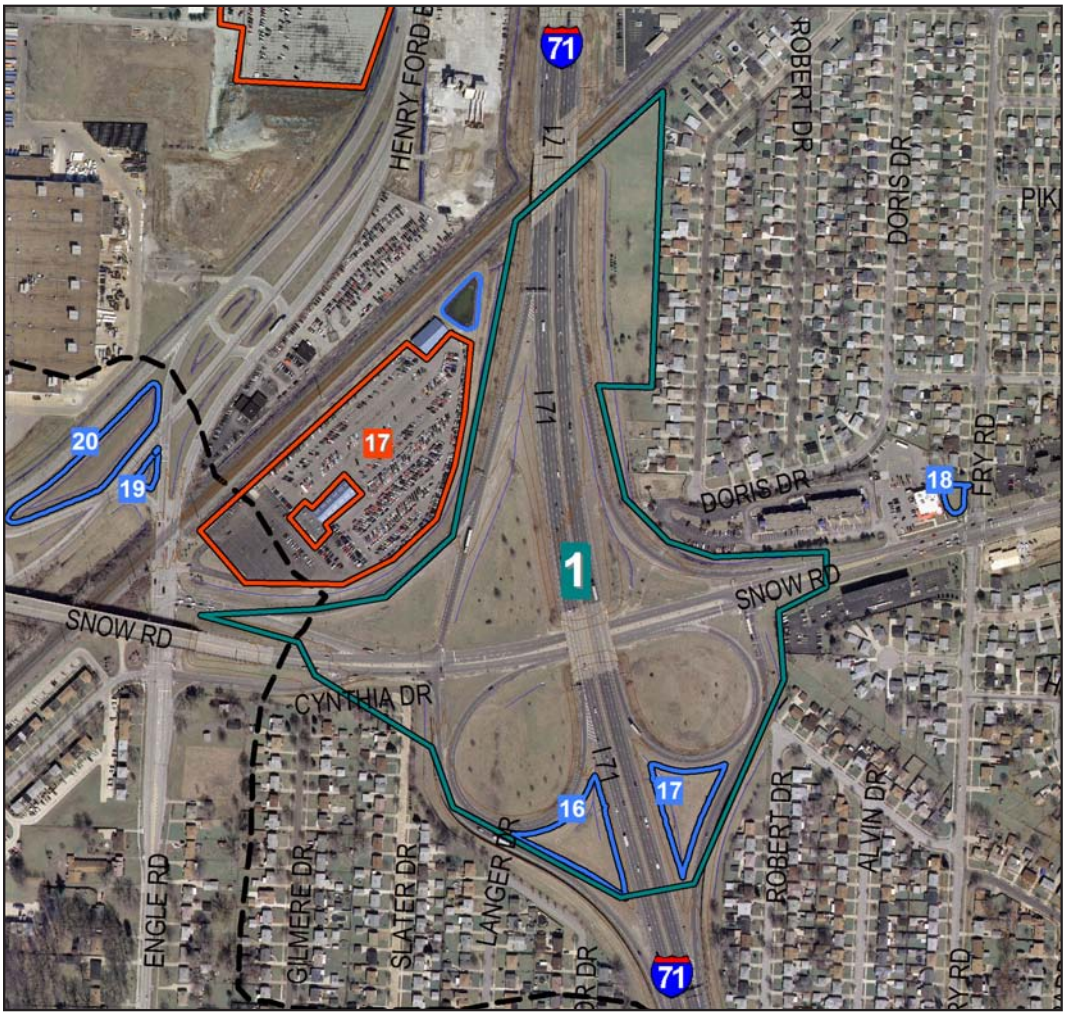


POTENTIAL HIGHWAY INTERCHANGE STORAGE SITES

This map includes six project areas around Interstates 480 and 71. The cloverleaf interchanges and wide medians and right-of-ways offer excellent retrofit areas. Some project sites may offer more opportunities than others through cost-effectiveness, location and measurable outcomes. Selecting project location should coincide with areas in need of immediate flooding and erosion reduction. This is a planning level analysis; more details will be needed for project implementation

Priority Conservation / Restoration / Retrofits
Storage at Highway Interchanges

Stormwater Retrofit – New Storage Below Outfalls – EXAMPLE #1



Highway Interchange #1 at I-71 & Snow Road

Site #1 is located in the city of Brookpark and the Colleda subwatershed. The Colleda basin is the most urbanized subwatershed and could greatly benefit from stormwater retrofits. The interchange at Interstate 71 and Snow road includes large cloverleaf interchanges, right-of-ways, highway buffers and includes dry basins #16 and 17.

Stormwater storage and improved water quality can be obtained by diverting highway runoff into these areas. Creating wetland detention basins or other best management practice could help to increase the stormwater capacity in the Colleda Branch and potentially begin to address nearby stormwater flooding and erosion problems identified in the RIDE Study.

Strategies for implementation would be best pursued through multi-stakeholder cooperation and integrating this project into a larger municipal or state construction project. Also, explore directing compensatory wetland or stream mitigation that ODOT may be required to conduct in the future

Storage at Highway Interchanges

Stormwater Retrofit – New Storage Below Outfalls – EXAMPLE #2

Highway Interchange #3 at I-480 & Tiedeman Road

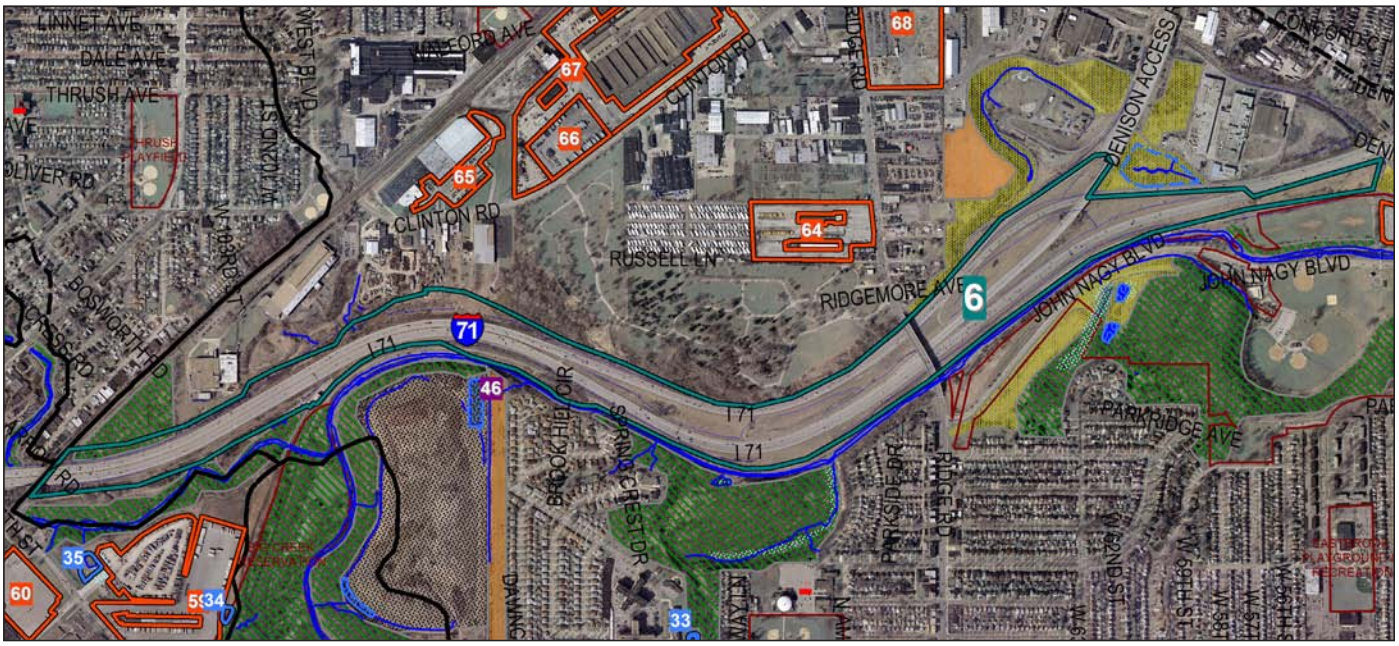
Site # 3 is located in the city of Brooklyn and the East Branch subwatershed. The East basin contains approximately 32% impervious coverage and could greatly benefit from stormwater retrofits. The interchange at Interstate 480 and Tiedeman road includes large interchanges and highway buffers. This area is nearby Large Tract 54 and is also in the vicinity of the proposed greenway trail system.

Stormwater storage and improved water quality can be obtained by diverting highway runoff into these areas. Creating wetland detention basins or other best management practice could help to increase the stormwater capacity in the East Branch and potentially begin to address nearby stormwater flooding and erosion problems identified the RIDE study.

Strategies for implementation would be best pursued through multi-stakeholder cooperation and integrating this project into a larger municipal or state construction project. Also, explore directing compensatory wetland or stream mitigation that ODOT may be required to conduct in the future

Priority Conservation / Restoration / Retrofits
Storage at Highway Interchanges

Stormwater Retrofit – New Storage Below Outfalls – EXAMPLE #3



HIGHWAY MEDIAN AND INTERCHANGE #6 AT I-71 & DENISON ACCESS

Site #6 in the city of Cleveland and Brooklyn and the Lower Big Creek subwatershed. The lower basin contains approximately 41% impervious coverage and could greatly benefit from stormwater retrofits. The I-71 and Denison areas includes large interchanges, medians and highway buffers.

Stormwater storage and improved water quality can be obtained by diverting highway runoff into these areas. Creating wetland detention basins or other best management practice could help to increase the stormwater capacity in the Lower subwatershed and potentially begin to address nearby stormwater flooding and erosion problems identified the RIDE study.

Strategies for implementation would be best pursued through multi-stakeholder cooperation and integrating this project into a larger municipal or state construction project. Also, explore directing compensatory wetland or stream mitigation that ODOT may be required to conduct in the future.

STRATEGIES	DETAILS	POTENTIAL FUNDING SOURCES
Demonstration Projects	Demonstration projects (ex. stream restoration) tend to serve only a small portion of a watershed, but they are an excellent early action projects and are useful educational purposes.	Foundations; Local Community; ODNR Coastal Management; ODNR Coastal and Estuarine Land Conservation Program; National Fish and Wildlife 5 Star; National Fish & Wildlife Keystone Initiative; OEPA 319 Implementation; Lake Erie Protection Fund; Great Lakes Watershed Restoration Grant; Clean Ohio Grants; Northeast Ohio Regional Sewer District's Stormwater Utility
Projects on Public Land	Projects on public land can be located in stream valleys, parks, public rights-of-way and publicly-owned stormwater infrastructure. Public land projects are easier to deliver because they do not require land acquisition.	Foundations; Local Community; ODNR Coastal Management; ODNR Coastal and Estuarine Land Conservation Program; National Fish and Wildlife 5 Star; National Fish and Wildlife Keystone Initiative; OEPA 319 Implementation; Lake Erie Protection Fund; Great Lakes Watershed Restoration Grant; Clean Ohio Grants; Northeast Ohio Regional Sewer District's Stormwater Utility
Projects on Private Property & Neighborhoods	Projects on private property could include low cost on-site residential retrofits such as rain barrels or infiltration practices like a bioretention cell or rain garden. This requires effective education to homeowners to persuade them to install such practices.	Land Owner; Foundations; Local Community; Ohio EPA (Ohio Environmental Education Fund OEEF)
Incorporate Projects into Larger Municipal Construction Project	Restoration or preservation projects can be incorporated into larger municipal construction capital projects, such as streetscape improvements, transportation projects, school construction, sewer line and drainage improvements.	Local Community State and/or County Agency Northeast Ohio Regional Sewer District's Stormwater Utility
Direct Compensatory Mitigation to Big Creek	This method of implementing preservation, restoration and retrofit projects requires good communication and outreach. These projects could be funded by developers, agencies or others that are seeking opportunities to meet offsite environmental mitigation needs.	Land Owner, Developer, Local Community, Utility
Stormwater Treatment for New and Redevelopment Projects	This method requires timely communication and sharing of new practices and strategies during planning and council meetings. Due to new NPDES stormwater Phase II rules all new or redevelopment must meet certain water quality standards. This is an opportunity to ensure projects incorporate new, effective and cost efficient stormwater practices.	Land Owner, Developer, Local Community,

Tools for Watershed Stewardship

PRACTICES & STRATEGIES

Stormwater management begins with site planning and design. Development projects can be designed to reduce their impacts on watersheds when careful efforts are made to conserve natural areas, reduce impervious cover and better integrate stormwater treatment.

By implementing a combination of these nonstructural approaches it is possible to reduce the amount of runoff and pollutants that are generated from a site and provide for some nonstructural on-site treatment and control of runoff.

Better site design for stormwater management includes a number of site design techniques, such as preserving natural features and resources, effectively laying out the site elements to reduce impact, reducing the amount of impervious surfaces, and using natural features on the site for stormwater management. Many of the better site design concepts can reduce the cost of infrastructure while maintaining or even increasing the value of the property.

BALANCED GROWTH LAND USE PRACTICES

- Adopt Watershed Map for Community Guidance
- Conserve Streams and Riparian Corridors
- Conserve Wetlands and Setbacks
- Avoid Floodplains
- Avoid Steep Slopes
- Minimize Development on Critical Soils
- Low Impact Development
- Conservation Development
- Woodland / Tree Canopy Protection

Identifying Conservation Areas & Incorporating Better Site Design

Site design should be done in concert with the design and layout of stormwater infrastructure in order to reach stormwater management goals.

First, significant natural features and resources on a site are identified, such as undisturbed forest areas, stream buffers and steep slopes that should be preserved to retain some of the original hydrologic function of the site.

Next, the site layout is designed such that these conservation areas are preserved and the impact of the development is minimized. A number of techniques can then be used to reduce the overall imperviousness of the development site.

Finally, natural features and conservation areas can be used to manage stormwater quantity and quality.

Use Critical Watershed Feature Map as Guidance for Community Development and Conservation

Design Site Layout to Preserve Conservation Areas and Minimize Impervious Cover & Stormwater Impacts

Use Natural Features and Conservation Areas to Manage Stormwater Quantity and Quality

THE GOALS OF BETTER SITE DESIGN include:

- Managing stormwater (quantity and quality) as close to the point of origin as possible
- Preventing stormwater impacts rather than mitigating them
- Using simple, nonstructural methods for stormwater management that are lower cost and lower maintenance than structural controls
- Using hydrology as a framework for site design

#1
ADOPT CRITICAL WATERSHED FEATURES MAP IN COMPREHENSIVE PLAN for Community Guidance

Important natural features such as primary headwater streams, wetlands and other important site features, when identified in the community's Comprehensive Plan, can assist with development and support conservation efforts.

KEY BENEFITS

Provides an opportunity to update community zoning & plans
- Helps a community plan for, rather that react to proposed development
- Assists in managing floodplains, wetlands, riparian corridors that are currently providing flood control, erosion control and water quality protection.

A community's comprehensive plan helps to provide the framework for zoning that affects watershed quality. Priority Conservation and Development Areas should be included with the plan.
This should be done while examining local economics, plans for densities and land uses.

Preserving natural conservation areas such as undisturbed forested and vegetated areas, stream corridors and wetlands on a development site helps to preserve the original hydrology of the site and aids in reducing the generation of stormwater runoff and pollutants. Undisturbed vegetated areas also promote soil stabilization and provide for filtering, infiltration and evapotranspiration of runoff.

Conservation areas should be delineated before any site design, clearing or construction begins. When done before the concept plan phase, the planned conservation areas can be used to guide the layout of the site.

Conservation areas should be incorporated into site plans and clearly marked on all construction and grading plans to ensure that equipment is kept out of these areas and that native vegetation is kept in an undisturbed state. The boundaries of each conservation area should be mapped by carefully determining the limit which should not be crossed by construction activity.

Once established, natural conservation areas must be protected during construction and managed after occupancy by a responsible party able to maintain the areas in a natural state in perpetuity. Typically, conservation areas are protected by legally enforceable deed restrictions, conservation easements, and maintenance agreements.

RECOMMENDATIONS:

- Review material and support data for Priority Development Areas (PDAs) and Priority Conservation Areas (PCAs).
- Incorporate the Priority Conservation Areas (PCA) and Priority Development Areas (PDA) into the Master Plan.
  - ~ Assess PDAs and PCAs locations as necessary for the nature of current development, ownership, and other relevant characteristics.
  - ~ Modify PDAs and PCAs for your community based on local data and development goals.
  - ~ Accept PDAs and PCAs for your community through resolution or ordinance.
  - ~ Revise comprehensive/master plan to include PDAs and PCAs. Review current zoning for PDAs and PCAs.
  - ~ Discuss possible zoning changes, land owner assistance, and other steps necessary to facilitate development in PDAs and conservation/innovative site design in PCAs.
- Routinely Update Community Master Plans-
  - the best local planning practice is "continuous planning"
  - compare plan to current conditions and update
  - plan for, rather than react to, proposed development.

BIG CREEK PARTNER COMMUNITY	LAST UPDATE TO MASTER PLAN
Brooklyn	2006
Brook Park	No Plan
Cleveland	2006
Linndale	No Plan
North Royalton	2004
Parma	2004
Parma Heights	2004

Adopt Critical Watershed Features Map

KEY ROLES	KEY ACTIONS
Legislators	• Update Community Master Plans, adopting Critical Features Map as overlay to guide land use decisions. • Incorporate Priority Conservation Areas (PCA) and Priority Development Areas (PDA) into community's Comprehensive Plan to guide zoning, and to identify natural areas as storm water management infrastructure assets • Develop or update building codes to include protections for critical areas • Use Map as reference to budget for protection, restoration and/or maintenance of natural infrastructure as is done for structural storm water infrastructure
Planning Commissions	• Develop and adopt Critical Features Map • Define specific allowable adjustments or variances based on the value and location of critical features, to guide appeals process
Zoning Appeals Boards	• Use Map as reference for decision making • Create guidelines, using Map to define allowable variances based on their potential impact on Conservation Areas, and to direct site design adjustments toward Preferred Development Areas.
Administration, Economic Development, Community Development	• Work with communities that share the watershed to approve the Critical Features Map, PCA and PDA designations • Adopt the Map and use it to guide development and conservation • Establish policy to direct new development to Preferred Development Areas and reduce impacts in conservation areas • Educate residents, business owners and developers on the significance of critical watershed features and their roles in stewardship
Service and Engineering	• Use the Map as a guide to take advantage of the natural storm water management infrastructure • Respect the Map designations and establish policies to manage infrastructure improvements or repairs in ways that do not negatively affect conservation areas
Residents, Business Owners and Property Owners or Managers	• Support adoption of the Map in your community • Learn about the areas that hold your watershed's critical features and need conservation • Understand how activities that degrade or change the size, location or character of wetlands, forested areas, streams and soils affects your property
Developers	• Familiarize yourself with the Map and the watershed • Design sites so as not to infringe on critical features or conservation areas

#2
CONSERVE STREAMS & RIPARIAN CORRIDORS

Natural riparian corridors are vegetated lands along rivers and streams. They can stretch from a stream's headwaters down to its mouth.

Key Benefits
- Reduces Flooding and Erosion Problems
- Keep Structures away from Flood Prone Areas
- Filters Storm Water Runoff
- Provides Connected Wildlife Habitat

A riparian buffer is a special type of natural conservation area along a stream, wetland or shoreline where development is restricted or prohibited. The primary function of buffers is to protect and physically separate a stream, lake or wetland from disturbance or encroachment.

A properly designed buffer can provide stormwater management functions, can act as a right-of-way during floods, and can sustain the integrity of stream ecosystems and habitats. Forested riparian buffers should be maintained and reforestation should be encouraged where no wooded buffer exists. Proper restoration should include all layers of the forest plant community, including understory, shrubs and groundcover, in addition to trees.

The setback width needed to perform properly will depend on the size of the stream and the surrounding conditions, The setback should be continuous and not interrupted by impervious areas that would allow stormwater to concentrate and flow into the stream without first flowing through the buffer. Should the 100-year floodplain be wider than the riparian setback on either or both sides of the watercourse, the setback is extended to the outer edge of the 100-year floodplain.

Development within the riparian buffer should be limited only to those structures and facilities that are absolutely necessary. Such limited development should be specifically identified in any codes or ordinances enabling the buffers. When construction activities do occur within the riparian corridor, specific mitigation measures should be required, such as deeper buffers or riparian buffer improvements.

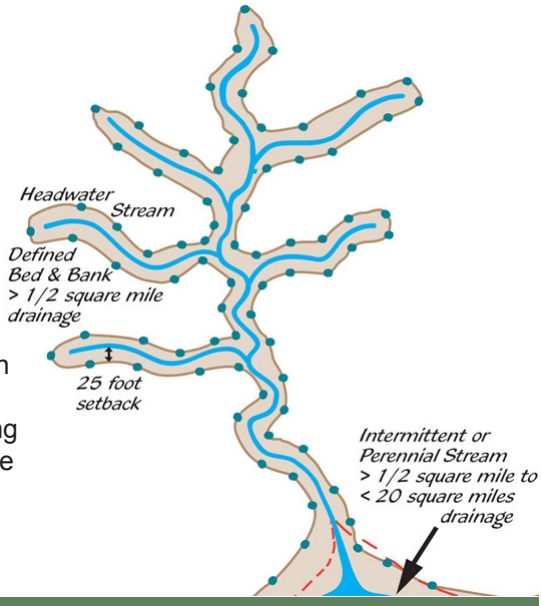
RECOMMENDATIONS:

It is recommended that communities adopt zoning and other appropriate land-use and management provisions to address riparian protection. Protective areas along riparian corridors and around wetlands are best provided through local zoning setbacks.

Communities should adopt the Northeast Ohio Regional Stormwater Task Force Model riparian setback.

The riparian set back should :
- Apply to all designated watercourses in the community
- Conform to minimum widths (see recommended distances)
- Include 100 year floodplain and riparian wetlands
- Prohibit construction in riparian corridor
- Include variance and mitigation provisions to keep function within the same watershed.
- Provide for inspection and enforcement

As with all setbacks, riparian setbacks should be used in conjunction with conservation development design so that an economic hardship is not created for the landowner. The purpose is to preserve and protect existing riparian corridors from degradation and environmental damage, to restore the quality of degraded and damaged corridor, and to plan and control development around the feature with acceptable levels of quality and ecological character.



Conserve Streams & Riparian Corridors

Recommended Riparian Distances

DRAINAGE AREA	SETBACK DISTANCE
<0.5 sq. miles	25 ft
0.5-20 sq. miles	75 ft.
20-300 sq. miles	100 ft.*
>300 sq. miles	300 ft.

COMMUNITY RIPARIAN SETBACKS

COMMUNITY	Riparian Setback	Setbacks Meet Recommended Standards	Lists Prohibited/ Permitted Uses	Variance Procedures	Provisions to Keep Mitigation w/in Same Watershed
Brooklyn	No	No	No	No	No
Brook Park	No	No	No	No	No
Cleveland	No	No	No	No	No
Linndale	N/A	N/A	N/A	N/A	N/A
North Royalton	Yes	Yes	Yes	Yes	Considering
Parma	Yes	Yes (75', 25')	Yes	Yes	Yes, though immediate watershed not mentioned
Parma Heights	Yes	Yes (300', 120', 75', 25')	Yes	Yes	No

Current Requirements in Big Creek Communities:

The communities of Brooklyn, Brook Park and Cleveland have not adopted riparian setback ordinances, though Cleveland is in the process or developing a stream protection ordinance. Linndale's ordinances were not available.

North Royalton- Section 1492.06c – provides min. 300 ft seback on both sides of all streams draining >300 sq. mi; min. 120 ft setback on both sides of all streams draining > 20 sq. mi. & < 300 sq.mi; a min. 75 ft. setback on both sides of all streams draining >0.5 sq mi. & < 20 sq.mi.; and min. 25 ft on both sides of all streams draining <0.5 sq mi.

Parma- provides adopted riparian setbacks with a greater than or equal to 75ft. setback on Big Creek, West Creek, other water course draining >.5 sq mi. and < 20 sq mi.; and 25ft. setback on watercourses draining <.5 sq m, with defined bank.

Parma Heights- Min. 300' on both sides of all watercourses draining an area greater than 300 sq. miles. Min. 120' on both sides of all watercourses draining an area greater than 20 sq. miles and up to and including 300 sq. miles. Min. 75' on both sides for watercourse draining an area greater than 1/2 sq. mile and up to an including 20 sq. miles. Min. 25' on both sides for less than 1/2 sq. mile and having a defined bed and bank.

KEY ROLES	KEY ACTIONS

Legislators, Planning Commissions	• Include Riparian Setbacks in zoning
	• Apply the setback to all designated watercourses in the community
	• Design setback codes to:
	  • Conform to minimum widths and recommended distances
	  • Include 100 year floodplain and riparian wetlands
	  • Prohibit construction in riparian corridor
	  • Include variance and mitigation provisions to keep function within the same watershed
	  • Provide for inspection and enforcement
	• Extend setbacks at least to the 100-year floodplain

Zoning Appeals Boards	• Respect riparian setback codes and be reluctant to allow incursions into riparian buffer areas
Administration, Economic Development, Community Development	• Create incentives for preservation and improvement of existing vegetated buffers, and restoration of areas where riparian plantings have been lost
Service and Engineering	• Limit incursions into riparian zones when doing structural infrastructure repairs or improvements by adding a “no dig zone” beyond the setback written in the code, and/or use proper protection at zone edges. • Reduce the burden on riparian zones adjacent to paved or turf areas, where excessive runoff is common, by using infiltration calculations that reflect the actual soil infiltration conditions in the area.

Tree Commissions	• Institute a forest mitigation program wherein developers or property owners who remove trees and/or forested areas can replant trees or replace forest cover in riparian zones
	• Use riparian zones as forest mitigation banks to receive trees and forest cover
	• Create a forest mitigation fund to receive payments in lieu of planting from developers or property owners who remove trees or forest cover, and:
	  • use the funds to improve riparian areas on public lands,
	  • work with private property owners to restore riparian areas if buffer zones on public land are not available,
	• in cases where neither of the above solutions are applicable, use the funds to support the city’s urban forest/street tree planting program

Residents, Business Owners and Property Owners or Managers	• Plant or improve riparian zones using the full range of forest vegetation – tree canopy, understory trees and shrubs, floor vegetation and ground cover, giving preference to native species and totally avoiding invasive or exotic species. • Commercial property owners can take advantage of the increase in bird life resulting from healthy riparian areas by working with local birding clubs and producing birdwatchers’ guides.
Developers	• Familiarize yourself with the Map and the watershed • Design sites so as not to infringe on critical features or conservation areas

Tools & Practices
#3
CONSERVE WETLANDS & SETBACKS

Wetlands are areas that are inundated or saturated by surface or ground water at a duration sufficient to support vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

Key Benefits
- Reduces Flooding and Erosion Problems
- Keep Structures away from Flood Prone Areas
- Filters Storm Water Runoff
- Provides Wildlife Habitat

Wetlands are important and complex ecosystems in the Big Creek Watershed. Wetlands function as natural sponges, to absorb excess stormwater and as natural kidneys, to filter pollutants from the water. Wetlands minimize flooding problems by retaining stormwater and allowing the water to either evaporate or slowly release into stream systems.

In Big Creek many wetlands are located along the stream and therefore fall within the riparian corridor and proposed setback. A properly sized riparian setback will completely include the wetlands plus a 50-foot setback extending beyond the outer boundary of a category 3 wetlands and a 30-foot setback extending beyond the outer boundary of a category 2 wetlands. As for category 1 wetlands no setback has been suggested in the model ordinance. However, these wetlands have the potential for enhancements and can be improved to category 2 wetlands.

It is also important to protect wetlands that do not fall within the riparian corridor or termed isolated wetlands. Isolated wetlands should receive the same amount of attention and setback protection. Many communities in Ohio require isolated wetlands buffers and have adopted policies of no net loss of wetlands for mitigation required for destroyed wetlands.

WETLAND CATEGORIES

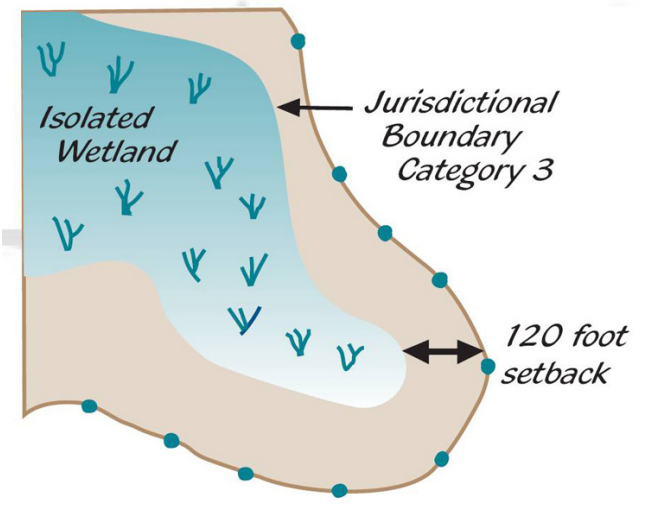
Category 3 wetlands have superior habitat, or superior hydrological or recreational functions. They are typified by high levels of diversity, a high proportion of native species, and/or high functional values.

Category 2 wetlands support moderate wildlife habitat, or hydrological or recreational functions, and as wetlands which are dominated by native species but generally without the presence of, or habitat for, rare, threatened or endangered species; and have a potential for reestablishing lost wetland functions."

Category 1 wetlands support minimal wildlife habitat, and minimal hydrological and recreational functions. They do not provide critical habitat for threatened or endangered species or contain rare, threatened or endangered species. In addition, Category 1 wetlands are often hydrologically isolated, and usually have: low species diversity, no significant habitat or wildlife use, limited wetland functions, and/or a predominance of non-native species.

Recommended Wetland Setbacks

WETLAND CLASS	SETBACK DISTANCE
1	Protect and enhance
2	75 ft.
3	120 ft.



RECOMMENDATIONS:

It is recommended that communities adopt zoning and other appropriate land-use and management provisions to address wetland protection. Protective areas along riparian corridors and around wetlands are best provided through local zoning setbacks.

- Communities should adopt the Northeast Ohio Regional Stormwater Task Force Model Wetland Setback. The Northeast Ohio Regional Stormwater Model ordinance are available to protect and mitigate wetlands as part of a community's management program for flood control, erosion control, ground water recharge, and water quality protection.
- Include variance and mitigation provisions to keep function within the same watershed.
- As with all setbacks, wetlands setbacks should be used in conjunction with conservation development design so that an economic hardship is not created for the landowner. The purpose is to preserve and protect existing wetlands from degradation and environmental damage, to restore the quality of degraded and damaged wetlands, and to plan and control development around wetlands with acceptable levels of quality and ecological character.
- Conserve and enhance Category 1, 2 and 3 Wetlands. It is recommended that when wetlands are scarce in a drainage basin, the low quality wetlands still provide a valid public health and safety water quality and quantity function- and deserve protection. Category 1, 2 and 3 wetlands are defined by Ohio EPA using a qualitative assessment form.

COMMUNITY WETLAND SETBACKS

COMMUNITY	Wetland Setback	Meets Recommended Standard	Prohibited / Permitted Uses Are Listed in Setback Code	Includes Variance Procedures	Provisions to Keep Mitigation w/in Same Watershed
Brooklyn	No	No	No	No	No
Brook Park	No	No	No	No	No
Cleveland	No	No	No	No	No
Linndale	N/A	N/A	N/A	N/A	N/A
North Royalton	Yes	Yes (120', 75')	Yes	Yes	Considering
Parma	Yes	Yes (120', 75')	Yes	Yes	Yes, but immediate watershed not mentioned
Parma Heights	Yes	Yes (120', 75')	Yes	Yes	No

Brooklyn- currently does not have wetland setback measures in their ordinances. However, section 929.07 Storm Water Management Plan suggests following and incorporating measures listed in the Rainwater and Land Development manual.

Brook Park and Cleveland do not currently have wetland setback measures in their ordinances.

North Royalton- has adopted wetland setbacks using the Northeast Ohio Regional Stormwater Model. The setback includes 120ft (category 3) and 75ft (category 2) but does not provide a minimum setback or protection measures for category 1 wetlands.

Parma- has adopted wetland setbacks using the Northeast Ohio Regional Stormwater Model. The setback includes 120ft (category 3) and 75ft (category 2) but does not provide a minimum setback or protection measures for category 1 wetlands.

Parma Heights- has adopted wetland setbacks using the Northeast Ohio Regional Stormwater Model. The setback includes 120ft (category 3) and 75ft (category 2) but does not provide a minimum setback or protection measures for category 1 wetlands

Conserve Wetlands

KEY ROLES	KEY ACTIONS

Legislators,
Planning Commissions
	• Include Wetland Setbacks in zoning
	• Apply the setback to all category 2 and 3 wetlands, and on a selective basis to category 1 wetlands (if only as flood control resources)
	• Design setback codes to:
	  • Conform to minimum widths and recommended distances:
	  • Category 3 – 120 ft.
	  • Category 2 – 75 ft.
	  • Include 100 year floodplains
	  • Include variance and mitigation provisions to keep function within the same watershed
	  • Provide for inspection and enforcement
	• Integrate in Conservation Development zoning

Zoning Appeals Boards	• Enforce wetland protection codes
Administration, Economic Development, Community Development	• Create incentives for preservation and improvement of existing wetlands, and restoration of category 1 wetlands to provide in-watershed mitigation sites
Service, Engineering, Building Inspectors	• Observe Clean Water Act regulations and enforce US Army Corp of Engineers permits • Monitor construction sites closely for deviation from approved plans • Require construction vehicles to stay proper distances away from wetlands
Residents, Business Owners and Property Owners or Managers	• See wetlands as enhancements and scenic, educational or recreational resources • Maintain a dense buffer of native vegetation between any paved surfaces and the wetland • Do not plant invasive species where seeds can be blown or washed into wetlands
Developers	• Recognize the value of wetlands and preserve whenever possible • Mitigate lost wetlands on site when possible • Building “up” rather than “out” can help you use a site footprint limited by setback requirements • Respect permit requirements and keep construction vehicles far away
Stewardship Groups	• Use wetlands as educational resources • Create a guide to the birds and animals that live in or visit the wetland • Raise funds and work with landowners, city governments, state agencies, land conservancies and others to conserve strategic wetlands and setback areas.

#4
CONSERVE FLOOD PLAINS

Floodplains are the low-lying flat lands that border streams and rivers. When a stream reaches its capacity and overflows its channel after storm events, the floodplain provides for storage and conveyance of these excess flows.

Key Benefits

- Preserving floodplains provides a natural right-of-way and temporary storage for large flood events
- Keeps people and structures out of harm's way
- Helps to preserve riparian ecosystems and habitats
- Can be combined with riparian buffer protection to create linear greenways

Floodplain areas should be avoided for homes and other structures to minimize risk to human life and property damage, and to allow the natural stream corridor to accommodate flood flows. In their natural state they reduce flood velocities and peak flow rates by the passage of flows through dense vegetation.

Floodplains also play an important role in reducing sedimentation and filtering runoff, and provide habitat for both aquatic and terrestrial life. Development in floodplain areas can reduce the ability of the floodplain to convey stormwater, potentially causing safety problems or significant damage to the site in question, as well as to both upstream and downstream properties. Most communities regulate the use of floodplain areas to minimize the risk to human life as well as to avoid flood damage to structures and property.

Floodplain protection is complementary to riparian corridor preservation. Both of these better site design practices preserve stream corridors in a natural state and allow for the protection of vegetation and habitat. Depending on the site topography, 100-year floodplain boundaries may lie inside the riparian setback, in other cases the riparian corridor should be extend outward to meet the flood zone boundary.

RECOMMENDATIONS:

Floodplain areas should be avoided on a development site in the Big Creek Watershed. Ideally, the entire 100-year floodplain should be avoided for clearing or building activities, and should be preserved in a natural undisturbed state where possible.

Review Ohio Department of Natural ResourceS latest floodplain regulations and map modernization program

- Incorporate most up-to-date maps into zoning
- Riparian setback should extend out to FEMA 100 year floodplain.
- Review ODNR Floodplain Regs. for adoption.
- Focus development in areas where they will have the least impact - out of the floodway.

Conserve Flood Plains

COMMUNITY 100-YEAR FLOODPLAIN SETBACK

COMMUNITY	RIPARIAN SETBACK INCLUDES 100-YEAR FLOOD PLAIN
Brooklyn	No
Brook Park	Yes
Cleveland	Yes
Linndale	N/A
North Royalton	Yes
Parma	Yes
Parma Heights	Yes

Brooklyn- does not have any specific floodplain protection ordinance. However, section 929.07 Storm Water Management Plan suggests following and incorporating measures listed in the Rainwater and Land Development manual.

Brook Park- section 1353.19 Floodways designates the floodzones as an area that should be preserved to provide flood water storage. The section references the flood insurance rate map, flood hazard boundary map and suggests looks for more detailed resources to indentify floodzones.

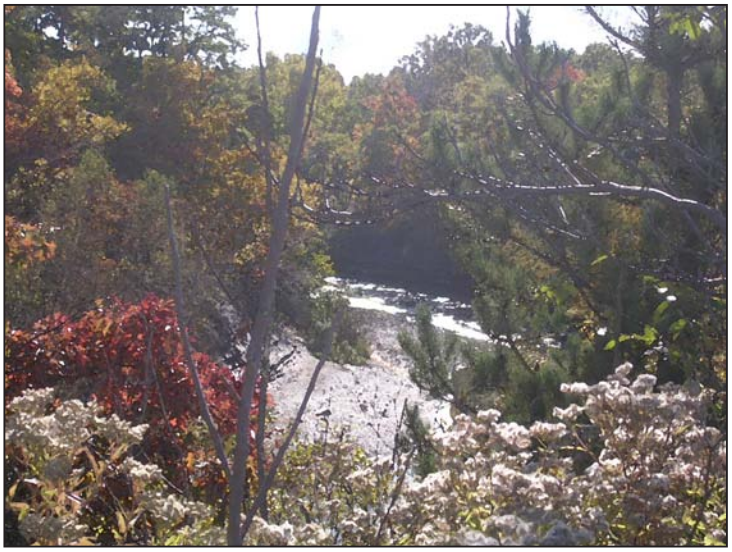
Cleveland- section 3167 — Flood Plain Management recognizes floodzones as areas that should be preserved to protect public health and welfare, flood plain function, limit property damage and public funds used to remediate properties damaged by flooding.

Linndale- ordinance not available

North Royalton- provision, “Where the 100-year floodplain is wider than a riparian setback on either or both sides of a designated watercourse, the riparian setback shall be extended to the outer edge of the 100-year floodplain. The 100-year floodplain shall be determined by the project engineer conducting a hydrologic analysis of the project area in conformance with standard engineering practices and approved by the City Engineer”.

Parma- Chapter. 1111.05(d)(3) “Where the 100-year floodplain is wider than a riparian setback on either or both sides of a watercourse, the riparian setback shall be extended to the outer edge of the 100-year floodplain”.

Parma Heights- “Where the 100-year floodplain is wider than a riparian setback on either or both sides of a watercourse, the riparian setback shall be extended to the outer edge of the 100-year floodplain”.

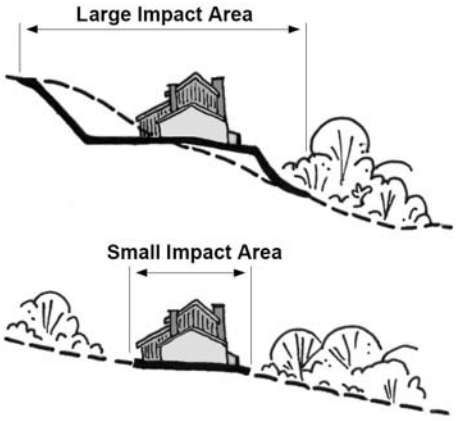


KEY ROLES	KEY ACTIONS
Legislators, Planning Commissions	• Incorporate the most up-to-date flood plain maps into zoning and building codes • Recognize that increased impervious surfaces in one area will have the effect of enlarging flood plains of downstream areas • Provide incentives or relief to landowners in areas where floodplains create un-buildable areas • Allow increased density on development sites in lowest-impact areas • Change codes to allow higher “weed” growth in flood plains
Zoning Appeals Boards	• Respect floodplain boundaries • Recognize that variances allowing structures to encroach on floodplains will inevitably create problems
Administration, Economic Development, Community Development	• Support floodplain preservation with policies that support generous setbacks and encourage landowners to vegetate and maintain riparian corridors and floodplains • Focus development in areas where they will have the least impact • Encourage developers to design sites with structures away from flood plains, and with pervious surfaces and dense, natural landscaping close to flood plain boundaries
Service and Engineering	• Use structural flood management systems only as complements to natural systems. • Reduce channelization and culverts upstream so that floodplains downstream can handle increased loads • Keep riparian areas and flood plains vegetated by reducing mowing
Residents, Business Owners and Property Owners or Managers	• Be aware that solutions to “rush and flush” water off your land will invariably create flooding problems downstream • Accept the fact that streams will flood on occasion, and keep any structural solutions such as berms or dikes as far from the stream and as close to your buildings as possible • Use permeable paving surfaces in areas near flood zones to increase the speed at which the water infiltrates into soils • Let vegetation grow higher along flood plains
Developers	• Design sites so as to leave plenty of room beside flood plains • Keep areas along flood plain boundaries heavily vegetated • Use permeable paving throughout the site, and include vegetated areas to hold excess water (rain gardens, etc.)

#5
AVOID STEEP SLOPES

Steep slopes should be avoided due to the potential for soil erosion and increased sediment loading; especially those with a grade of 12% or greater. Excessive grading and flattening of hills and ridges should be minimized.

Key Benefits
- Prevents soil erosion and stormwater runoff
- Prevents property damage
- Building on flatter areas reduces the need for cut-and-fill and grading
- Keeping steep slopes vegetated helps to stabilize hillsides
- Maintains aesthetics



Vegetated steep slopes provide an important resource to be preserved because any significant disturbance to the hillside's environment may result in:
- Landslides or land instability;
- Unacceptable alteration in the drainage patterns and
- Loss of scenic value.

When development takes place on or near steep slopes, vegetative cover is greatly reduced. Loss of this vegetative cover on steep terrain significantly increases soil instability, and thus the risk of erosion.

Soil erosion and sedimentation into waterways poses several threats to public health and safety, which are difficult and expensive to correct. Property damage is commonly associated with development on steep slopes. Soil erosion and sedimentation into nearby waters increase the potential for flooding. In addition, the nature of steep slopes means that greater areas of soil and land area are disturbed to locate facilities on them compared to flatter slopes

The need to protect these slopes is based on percent slope, the length of that percent slope, soil erodibility, percent of vegetation, and proximity to streams or wetlands. The maximum retention of natural topographical features such as natural drainage swales, slope ridge lines, and trees and other natural plant formations should be encouraged. Steep slope protection will conserve and promote public health and safety by minimizing problems due to water runoff and soil erosion incurred in adjustments of topography to meet developmental needs. In addition to public health and safety concerns, protecting steep slopes preserves the unique scenic resources and habitats.

COMMUNITY STEEP SLOPE SETBACKS

COMMUNITY	Permit-Based	Setback% Slope	Setback Based on Analysis
Brooklyn	Yes	No	No
Brook Park	No	No	No
Cleveland	No	No	No
Linndale	N/A	N/A	N/A
North Royalton	No	Yes	No
Parma	Yes	No	No
Parma Heights	No	No	No

Brooklyn- Steep slope protection exists within their Storm Water Pollution Prevention Plan General Construction Permit. 1351.07- A vicinity sketch locating the site, and the larger common plan of development if applicable, and all pertinent surrounding features within 200 feet of the site including wetlands, streams, steep slopes, and other sensitive areas receiving runoff from the development area.

Brook Park and Cleveland currently do not have steep slope protection ordinances

North Royalton- included in the riparian setback provisions to protect steep slopes. Because the gradient of the riparian corridor significantly influences impacts on the stream, the following adjustment for steep slopes will be integrated into the riparian setback formula for width determination: Average Percent Slope (APS) = 15-20%, add 25 feet to the setback width; if APS = 20-25%, add 50 feet to the setback width; if APS >25%, add 100 feet to the setback width

Parma- Steep slope protections exist within their Open Space Zoning District only. 1179.01- Open Space Zoning District- To provide protection, preservation and proper maintenance of biologically significant habitat, threatened habitat, and/or areas which contribute to the ecological health of the community including but not limited to forested areas, steep slopes, wetlands, watercourses and floodplains;

Parma Heights- Currently does not have steep slope protection ordinances

RECOMMENDATIONS:

The development of areas containing steep slopes should generally be discouraged. In situations where this is not feasible, development should be done with the intent of minimizing soil disturbances, maximizing retention of trees and vegetation, and complementing steep slope character. Existing patterns of vegetation should be retained on all slopes over 15% to avoid erosion or slippage.

Three options can assist in establishing setback widths that provide the same watercourse protection as flatter areas.

Option 1: Permit Based Hillside Protection Zones

Regulations are passed that limit development activity in areas with slopes between 15% and 30%. In order for permits to be given for disturbances in these areas, additional information including topographic maps, grading and site plans, geotechnical reports, details on future and present site stability, and an erosion and sediment control plan must be submitted for review. Option 1 focuses mainly on structural integrity and not the functioning of the riparian area and watercourse. The recommendations given under this option may also not be appropriate for all areas of the watershed.

Example- Summit County Ordinance- steep slope development a conditional use

Option 2: Expansion of Riparian Setback for % Slope

For many communities in the nation, minimum widths are usually established for riparian setbacks. In areas in which steep slopes exist within the designated riparian setbacks, these widths are expanded.

The expansions to the original widths are as follows:
- Add 10 feet for slopes between 15-17%
- Add 30 feet for slopes between 18-20%
- Add 50 feet for slopes between 21-23%
- Add 60 feet for slopes between 24-25%

Option 2 (Preferred) focuses on the degree of sloping and may not cover other important factors that play a role in riparian effectiveness into consideration. An example is North Royalton's riparian setback adjustment, which is based on % slope.

Option 3: Expansion of Riparian Setbacks Based on Analysis of Slope, Slope Length, Soil Erodibility and Existing Vegetation

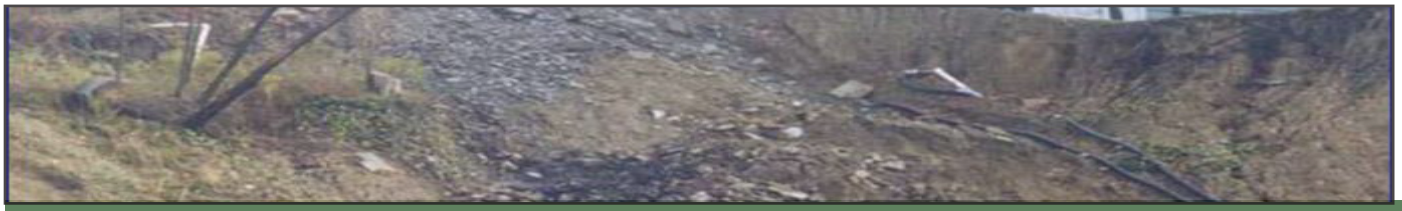
Riparian setbacks are adjusted where steep slopes, 10% or greater, exist within 500 feet of a watercourse. In these areas, a plan is required that details information regarding the degree of sloping, the slope length, soil erodibility, vegetative cover, and sediment delivery.

Option 3 (Preferred) provides the best alternative, as it based on site-specific conditions and recommendations.

Percent Slope is the ratio of the vertical distance to the horizontal distance, or the elevation change in feet divided by the distance in feet.

Tools & Practices
Avoid Steep Slopes

KEY ROLES	KEY ACTIONS
Legislators, Planning Commissions	• Expand riparian setbacks based on site-specific conditions, especially where slopes are greater than 10% and are within 500 feet of a watercourse. • Conserve steep slopes, especially those close to riparian corridors, with special permitting that limits development and disturbances in areas with slopes greater than 15%.
Zoning Appeals Boards	• Do not allow variances that encroach on setbacks from steep slopes • Do not allow replacement of vegetation around steep slopes with impervious surfaces, including turf grass.
Administration, Economic Development, Community Development	• Discourage development on or adjacent to steep slopes • Work with private landowners to establish conservation areas where steep slopes exist. • Invest in restoration where development may already be negatively impacting soils and degrading slopes.
Developers	• Design sites to avoid building near steep slopes. Structural solutions may be short term remedies, but soils erode. Period. • Avoid disturbing steep slopes during construction. Construction equipment will change soil character and compaction. • Replace any disturbed soils with native vegetation, preferably those with large and/or dense root systems
Stewardship Groups	• Support preservation and enhancement of these areas, which are usually wooded • Educate landowners about the importance of conservation



#6 USE LOW IMPACT DEVELOPMENT (LID)

Low-impact development (LID) is a site design approach, which seeks to integrate hydrologically functional design with pollution prevention measures to compensate for land development impacts on hydrology and water quality.

Key Benefits
- Reduces Impervious cover
- Manages stormwater onsite
- Minimizes downstream flooding
- Maintains predevelopment runoff concentrations through innovative best management practices.

LID's goal is to mimic natural hydrology and processes by using small-scale, decentralized practices that infiltrate, evaporate, detain, and transpire stormwater. LID stormwater controls are uniformly and strategically located throughout the site.

LID is achieved by:
- Minimizing stormwater runoff impacts to the extent practicable through preservation of existing landscape features and their hydrologic functions.
- Maintaining predevelopment time of concentration through strategic routing of flows using a variety of site design techniques.
- Dispersing runoff storage measures through a site's landscape through the use of a variety of detention, retention, and runoff practices.

LID practices manage stormwater at its source. LID measures reduce impervious cover, minimize disturbance, preserve and recreate natural landscape features, increase hydrologic disconnects and facilitate infiltration and detention opportunities. LID creates a multifunctional landscape which relies on natural features and processes and emphasizes simple, nonstructural, low-tech methods.

Due to maintenance considerations, LID may be most appropriately used on institutional, industrial, commercial and governmental developments. However, LID in tandem with conventional stormwater control features can be successfully integrated into any development. LID has been demonstrated to work in new developments and constrained sites involving urban infill.

RECOMMENDATIONS:

Allow for the Implementation of Low Impact Development Techniques.

- Adopt Low Impact Development Provisions: Adopt zoning and other appropriate land-use and management provisions to allow for the use of low impact development techniques for residential, business and industrial districts. This may be done through a comprehensive regulation related to site development or a set of related regulations.
- Parking Lot Standards: Include setting maximums of parking lots created (using average demand rather that peak demand), minimizing the dimensions of lot spaces, using alternative pavers in overflow parking areas, using bioretention areas to treat stormwater.
- Impervious Surface Limits: Place a percentage limit on impervious surface coverage. Examples include 10-20% in residential areas and 30% and up in commercial/high density residential.
- Compacted Soils: Unpaved areas of pervious soils should be left undisturbed. Retaining natural drainage features and encouraging conservation site design to protect against excessive soil compaction.
- Allow for Integrated Stormwater Management Practices: The LID principles are designed to minimize disturbance and manage storm water as close to its source as possible. Specific low impact development controls, called Integrated Management Practices (IMP's), are tools for developers to use to manage storm water at its source rather than relying solely on centralized Best Management Practices (BMP's), such as detention basins. These IMPs include a variety of non-structural and structural practices such as:

o Riparian and wetland setbacks o Biofiltration facilities o Vegetated swales

o Cistern & rain barrels o Infiltration trenches o Green roofs

Examples: 1. City of Kent's Low Impact Development Ordinance- Chapter 1203

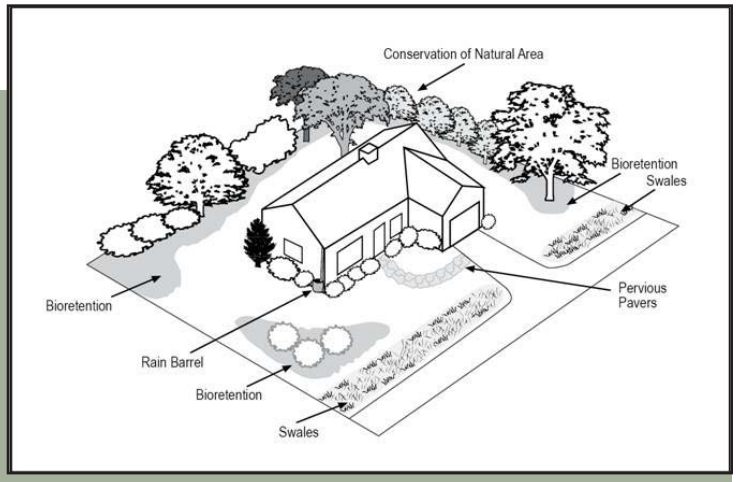
Use Low Impact Development (LID)

Brooklyn- currently does not have a comprehensive Low Impact Development option. Their Storm Water Pollution Prevention Plan General Construction Permit 1351.07, calls for a vicinity sketch locating the site, and the larger common plan of development if applicable, and all pertinent surrounding features within 200 feet of the site including wetlands, streams, steep slopes, and other sensitive areas receiving runoff from the development area.

Brook Park, Cleveland, Parma and Parma Heights do not currently have Low Impact Development options.

Linndale- ordinances not available.

North Royalton- currently does not have a Low Impact Development ordinance. They do have a provision that promotes porous pavement should development occur within setback areas. It states, “Variances should not be granted for asphalt or concrete paving in the riparian and wetland setbacks in any situation where gravel or porous pavement (i.e., porous pavers, and similar products) will do the job”.



LOW IMPACT DEVELOPMENT ORDINANCES

COMMUNITY	Low Impact Development Ordinances	Impervious Surface Limits	Provisions for Pervious Pavers	Minimize Disturbance to Natural Site Features	Promote Decentralized Stormwater BMPs	Retail Parking: Max Demand & # of spaces / 1,000 ft^2
Brooklyn	No	No	No	Yes	No	No 4 per 1K ft^2
Brook Park	No	No	No	No	No	No 6.6 per 1K ft^2
Cleveland	No	No	No	No	No	No 6.6 per 1K ft^2
Linndale	N/A	N/A	N/A	N/A	N/A	N/A
North Royalton	No	No	Yes	Yes	No	No 7 per 1K ft^2
Parma	No	No	No	Yes	No	No 4.25 per 1K ft^2
Parma Heights	No	No	No	No	No	No 5.5 per 1K ft^2

* Porous pavement- Porous pavement is a permeable pavement surface with a stone reservoir underneath. The reservoir temporarily stores surface runoff before infiltrating it into the subsoil or discharging into a sewer system.

Use Low Impact Development (LID)

KEY ROLES	KEY ACTIONS
Legislators, Planning Commissions	• Allow for implementation of LID techniques in building codes • Adopt LID provisions in zoning of residential, commercial and industrial districts • Set maximum parking lot size rather than minimum. Size for average demand rather than peak demand • Limit area of impervious surface allowed, including roofs and impervious paving, as percentage of total area.
Zoning Appeals Boards	• Allow variances for LID techniques
Administration, Economic Development, Community Development	• Encourage residents and businesses to retrofit properties with LID elements, and support code changes if necessary • Incentivize installation of LID practices on existing properties; recognize the stormwater management value and contribution to reduction of cost and burden on municipal systems • Reward developers who use LID practices and reduce your stormwater infrastructure costs
Service and Engineering	• Adopt LID for community-owned properties and offer as demonstration sites
Stewardship Groups	• Train residents and landscapers to build raingardens, and sponsor demonstrations • Encourage installation of rainbarrels, ponds and other backyard-friendly water storage and management practices
Residents, Business Owners and Property Owners or Managers	• Use the areas on your property the way they want to work – an area that holds water wants to be a raingarden or pond, so surround it with decorative rocks and native plants or build a raingarden there, and direct roof runoff to your yard, not to the storm sewer. • Install pervious pavers in place of concrete or asphalt. • Replace turf grass with more pervious ground cover. • Plant trees.

Developers	• Use Integrated Stormwater Management Practices that minimize disturbance and manage stormwater at its source, rather than relying on BMPs such as detention basins. IMPs include structural and non-structural methods such as:
	  • Riparian and wetland setbacks
	  • Biofiltration facilities to hold and filter discharge
	  • Vegetated swales to absorb and drain water
	  • Green roofs to reduce runoff
	  • Cisterns & rainbarrels for water harvesting and temporary storage
	  • Infiltration trenches
	• Use Pervious/Permeable paving materials for significant portions, if not all, of paved walkways and parking surfaces
	• Replant trees and forest cover lost during construction

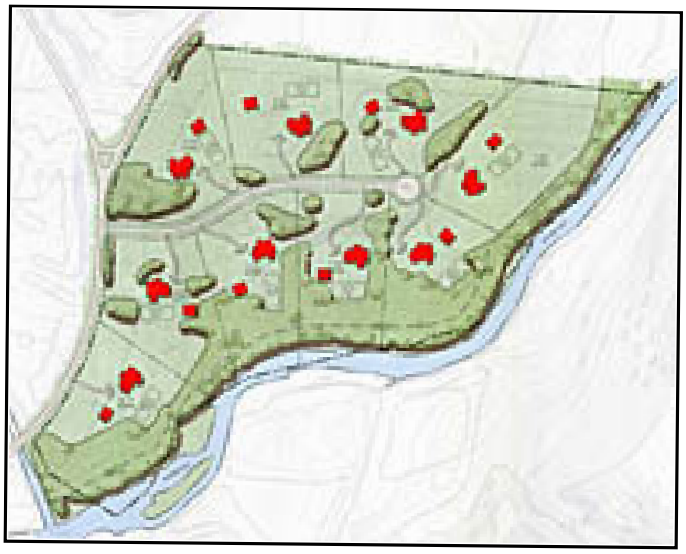
#7 CONSERVATION DEVELOPMENT

Conservation Development refers to development practices that allow land to be developed while conserving a sense of rural character, protecting natural resource features, and insuring water quality. In the process, property rights are protected, the community retains its unique identity and resources, the developer benefits with a high-quality project, and the environmental impacts of development are reduced.

Key Benefits

- Reduces impervious surface area
- Reduces development and community infrastructure costs
- Protects and integrates openspace areas into neighborhoods
- Open space can be used to protect natural resources onsite
- Reduces stormwater runoff
- Allows communities to retain rural character

Conservation Development typically allows higher density on a portion of the site in order to leave the rest of the site undeveloped. This results in the same number of structures that would be allowed in a traditional development on a particular parcel of land being located with more flexibility. This flexibility in housing lot sizes and setbacks makes it much more palatable to developers. As part of the site design, at least 40% of the land should be set aside as permanent open space. The resulting protected open space provides room for conservation practices that serve to buffer the impacts of the development.



Traditional Dispersed Development

Conservation Development

Conservation Developments should not be confused with Low Impact Development.

- Conservation Development involves the overall layout of the property to retain open space. It may or may not include Low Impact Development measures in its site plan.
- Low Impact Development practices apply to on-site measures used for stormwater retention and management.

RECOMMENDATIONS:

- Make Conservation Development the Easiest Development Option Available: This can be done be making conservation development permitted by right (the best option) or as an overlay district (second best option). Add these provision to residential, commercial and industrial codes.
- Permanent Protection of Open Space: At least 40% open space should be permanently protected through conservation easements, deed restriction or a combination. Provisions should be made for, including provisions for maintenance and capital improvements.
- Open Space is High Quality and Used for Resource Protection: Provisions must be made to minimize fragmentation of open space. The open space should provide for linkages with other open spaces in the community. Requirement should be made for developer to prove that highest quality resources on the site were evaluated and are protected via the open space.
- A Minimum Project Size Should Be Designated: In order for projects to have a beneficial impact upon natural resource conservation, a minimum project size of 25 acres should be considered.
- Density Bonuses (no more than 10%): when specific conservation criteria are met, proposed developments can be approved with more use of a site (such as more dwelling units per acre) than would otherwise be permitted by the community. Density bonuses are a form of incentive that a community can offer to a developer who does the kind of development that a community seeks.

Residential Conservation Development

- At least a 40% open space requirement must be included for lot sizes less than one acre, with 50% for lot sizes greater than one acre
- Density bonuses should not exceed 10% in order to ensure a conservation benefit result
- Maximum access to the open space by private users should be required

Office Park Conservation Development

- At least 40% open space requirement, of which 25% is natural open space

Commercial Conservation Development

- For areas already zoned commercial, open space requirement is 25%
- Open space requirement should be at least half of the natural functioning open space

Examples:

- Richfield Township, OH Planned Residential District- Chapter 404
- Hudson, OH Rural Residential Conservation- Chapter 1205

CONSERVATION DEVELOPMENT (SINGLE FAMILY) IN BIG CREEK COMMUNITIES

COMMUNITY	Flexible Development Options	Permitted-By-Right	40% Open Space Required	Density Bonuses	Open Space Used for Resource Protection
Brooklyn	Yes	No	750 ft^2/du	Yes	No
Brook Park	No	No	No	No	No
Cleveland	Yes	No	No	No	No
Linndale	N/A	N/A	N/A	N/A	N/A
North Royalton	Yes	Yes	Yes - 50%	No	No
Parma	Yes	No	No - 25%	No	No
Parma Heights	Yes	No	No - 25%	Yes	Can include natural areas

Conservation Development

CONSERVATION DEVELOPMENT IN BIG CREEK COMMUNITIES

Brooklyn- section 1117.04 has a multi-family planned development mf-pd that offers some flexible development options with modest amounts of openspace.

Brook Park- does not have a flexible development options for watershed purposes, only for airport expansion.

Cleveland- has a flexible development option. Section 334 — Planned Unit Development Overlay District offers a more flexible approach to land use control where such an approach is necessary to achieve a higher quality of development and to facilitate development that is sensitive to special site constraints. However, the provisions offer little in the way of openspace and watershed preservation.

Linndale- ordinances not available.

North Royalton- has a Single Family Cluster development option which is to help conserve the natural amenities of the landscape, which is in accordance with the goals set forth in their Master Plan

Parma- has a Single Family Cluster District which encourages the conservation of any natural amenities on a site, including, but not limited to, steep slopes, wooded areas, floodplains and wetlands.

Parma Heights- has an Planned Unit Development (PUD) overlay district section 1186. It has a 1 acre minimum project size with a 25% minimum openspace requirement. The “common open space” may include, but is not limted to, educational and recreational facilities, natural areas, landscaped areas, flood protection, bikeways, public parking, street rights-of-way.

CONSERVATION DEVELOPMENT

KEY ROLES	KEY ACTIONS
Legislators, Planning Commissions	• Make Conservation Development the default site design option • Require minimum 40% naturalized open space • Reduce open space credit for heavily-fertilized, barely pervious turf grass cover, and increase for forest area or use as mitigation bank.
Zoning Appeals Boards	• Do not allow variances post-construction or post-occupancy that would reduce conservation area percentage. • Require that variances you must approve be mitigated on site in comparable size or watershed function.
Administration, Economic Development, Community Development	• Offer incentives for Conservation Development • Use density bonus as incentives to cluster impervious surfaces
Developers	• Choose site design options that maximize preservation and function of natural areas. • Avoid filling open space with barely-pervious turf grass • Use Low Impact Design practices on parcel design

#8
WOODLAND/TREE CANOPY PROTECTION

A Tree Canopy Program helps communities preserve existing canopy (or restore) to maintain a certain percent coverage. The percent coverage often depends on the underlying zoning (ie. residential, commercial) of the community.

Key Benefits
- Stabilizes soils
- Cleanses stormwater helping to improve water quality
- Reduces flooding problems by managing stormwater
- Conserves household energy costs
- Provide wildlife habitat

Trees help support a community's quality of life by maintaining the proper functions of watersheds. A healthy forest system can reduce storm water infrastructure costs by intercepting rain, increasing ground absorption and slowing the rate of runoff. Other community benefits include: protecting drinking water supplies, enhancing property values and reducing household energy costs.

RECOMMENDATIONS:

- Communities should protect woodlands and valuable canopy cover by adopting measures in their codified ordinances. In the ordinances, woodland areas of likely high value to the community should be identified for further attention at the site design level.
- A minimum % coverage of forest cover should be determined for post construction goals for residential, nonresidential and varying densities. Example: The City of Roanoke, Virginia has recently adopted a 40% canopy goal with targets of 20% for commercial and industrial areas, and 50% for residential areas. Urban areas in Maryland have a target of 40% overall coverage.
- Require professional evaluation of blocks of woodland at the preliminary design stage (avoid the requirement for every tree on a site to be identified). The code should require a tree protection plan and its approval prior to permit, and assure that the plan is implemented and monitored during construction. Provisions for monitoring for at least a year after construction should be included.
- Allow applicants to seek variance to reduce lot sizes in order to preserve more natural features (i.e. forest cover, riparian zones etc.)

In order to establish canopy cover goals, a community must first assess existing tree cover. There is an array of technology to accomplish this including GIS, aerial photographs, satellite images, and/or ground surveys. Using this benchmark data, the community must then decide, "What is a reasonable canopy goal for them to try to attain in a given period of time"? These goals should reflect both conservation efforts and planned restoration activities on public and private lands. Goals may be set for an overall canopy target for the jurisdiction or they may vary by land use—such as residential, industrial/commercial, streets, and/or parks and open spaces. American Forests recommends that urban areas strive for 40% canopy overall, 50% canopy in suburban residential areas, 25% canopy in urban residential areas, and 15% canopy in commercial areas.

There are four stages in the development process at which tree protection provisions can be applied:

(1) Preliminary design – identifying woodland areas on a site or in a community which are of high value for preservation

(2) Specific design – identifying specific trees on the site which will be preserved and those which will be removed, and specifying methods for protection of those to remain

(3) Construction protection – implementation of the specifications for protection of trees during the construction process;

(4) Post construction monitoring – ongoing evaluation of tree health after construction and implementation of recommendations for remedial care if necessary

Tools & Practices
Woodland/Tree Canopy Protection

Community Forest/Tree Canopy Protection

COMMUNITY	Woodland or Canopy Protection Ordinance	Provision to Protect Trees During Construction	Required # or % of Canopy Coverage Post Construction
Brooklyn	No	No	No
Brook Park	No	No	No
Cleveland	No	No	No
Linndale	N/A	N/A	N/A
North Royalton	No	No	No
Parma	No	No	No
Parma Heights	No	No	No

Brooklyn- does not have a comprehensive tree protection ordinance. The city has programs for street trees and protection of trees on public property.

Brook Park- does not have a comprehensive tree protection ordinance. The city has a Master Tree Plan which requires a street tree for new development. The city also has an arborist, which has full jurisdiction, authority, control, supervision, and direction over all trees on public or private property, whenever such trees constitute a menace or nuisance to the public health, safety or welfare. The Arborist also manages the permits.

Cleveland- does not have a comprehensive tree protection ordinance. The city has a Commissioner of Shade Trees and a Street Tree Program. The commissioner has the authority to order the trimming, preservation or removal of any dead or diseased tree located on private property when it is necessary to prevent injury to person or damage to property, or to prevent the spread of disease to trees located upon or adjacent to public land or a dedicated street.

Linndale- ordinance not available

North Royalton- has a street tree “Master Shade Tree Program”.

Parma- has a simple tree protection provision which states, “In the erection, alteration or repair of any building, structure or other work, the owner, his agent or individual contractor shall take all measures necessary to prevent injury to public, commercial, multi-family and single family residential trees.” Ordinance also mentions relying on ODNR City Forester for technical assistance.

Parma Heights- does not have a comprehensive tree protection ordinance.

A street tree program is not a substitute for a forest canopy plan. Ordinances protecting individual trees do not address the protection or conservation of forests, which are their own living systems and include the many layers and wide variety of plants living from the forest floor to the top of the canopy.

Caliper Inches is the diameter in inches of the tree trunk twelve (12) inches above the base of the tree

KEY ROLES	KEY ACTIONS
Legislators, Planning Commissions	• Establish forest cover goals for your community. American Forests recommends that urban areas strive for 40% canopy overall, 50% canopy in suburban residential areas, 25% canopy in urban residential areas, and 15% canopy in commercial areas. • Goals should reflect both conservation efforts and planned restoration activities on public and private lands. • Apply forest protection provisions at various stages in development: • Preliminary Site Design – Identify high value woodland areas for preservation • Identify specific trees to be preserved and specify protection methods. Measure canopy cover and/or caliper inches of trees to be removed and determine th method of replacing a comparable volume of forest cover on site or in a forest mitigation bank. • Mandate protection of trees and avoidance of soil compaction during construction • Monitor tree/forest health and require maintenance on an ongoing basis post-construction • View forest cover as infrastructure, and provide funds to maintain and improve your urban forest • Require developers to follow forest cover goals and integrate planting areas into parking lots to reduce runoff.
Zoning Appeals Boards	• Enforce codes that support preservation • If variances are allowed that remove forest cover, require mitigation
Administration, Economic Development, Community Development	• Work with private landowners to establish forest mitigation banks of land to accommodate replacement of lost canopy cover • Recognize the infrastructure value of woodlands and factor into the equation as assets
Tree Commissions	• Educate and encourage landowners to preserve, restore or increase tree and forest cover on private land • Create a forest mitigation fund where developers or landowners who remove trees, but whose site cannot accommodate replanting, can contribute payments in lieu of planting, and use those funds to plant, improve or maintain tree canopy and forest cover on public lands and rights-of-way.

Examples of Forest Management Programs:

Maryland Forest Conservation Act- Areas that are deforested by development must be partially reforested to:
- 25% of the pre-development forest for medium density residential development;
- 20% for high-density residential;
- 15% for commercial, industrial, or mixed use and
- 50% for agricultural and resource areas.

Woodland/Tree Canopy Protection

KEY ROLES	KEY ACTIONS
Stewardship Groups	• Support forest preservation, and especially increased planting, throughout the community • Sponsor tree planting events, seedling giveaways, and adopt-a-forest programs • Work with governments and private landowners to designate planting sites. • Educate landowners, especially in commercial and residential areas, about the importance of letting forested areas "go natural", letting volunteer understory trees, shrubs and vegetation take hold, and allowing leaves to remain to form new soil. Discourage the practice of removing fallen leaves and replacing with store-bought mulch. Let the trees mulch themselves.
Residents, Property Owners and Property Managers	• Retain and maintain forested areas, including tree canopy, understory and ground level vegetation. • Restore forested connections between segments of woodland to support wildlife habitat, establish greenways and improve forest function. • Do not rake leaves from woodlands. • Allow "volunteer" seedlings to grow. • Aim for at least 40% of property to be planted, to to naturally revert to woodland. • Plant native trees and understory vegetation.
Developers	• Design sites to include ample forest cover, preferably in areas where they can reduce surface water runoff. • Incorporate trees throughout parking areas to absorb water and shade vehicles. Surround "tree boxes" with pervious paving strips and fashion the boxes or curbs with ground-level holes to allow runoff from paved areas to enter the root system. • Resist the temptation to rake and mulch under trees – use lower level plantings and ground cover that requires minimal maintenance and reduces root disturbance

Olmsted Falls' Tree Preservation & Management (Chapter 1218) ordinance helps preserve and replant trees.
The ordinance organizes tree management into
A. Natural Undisturbed Areas;
B. Buffer Zones or Screening Areas and
C. Wooded Areas within Buildable Property.
All new development must be designed to preserve healthy trees and woodlands.
Minimum standards-
- minimum of 40 caliper inches /acre (not including the natural undisturbed, buffer zones or wooded area within buildable property
- Newly planted trees have a minimum size of 2 caliper and maximum size of 6 caliper.

Springfield Township's Tree Preservation Ordinance (Chapter 550.5) states existing woodlands shall be maintained and preserved. On residential and nonresidential development:
- A minimum of 50% of mature woodlands shall be preserved
- A minimum of 25% of young woodlands shall be preserved and
- Large, solitary trees (of a certain caliper), not in conflict with structures, shall be preserved to the extent practicable.

Big Creek Balanced Growth Plan

In Conclusion:

Continuing leadership on the part of the Friends of Big Creek, and collaboration by the communities of Big Creek, the Watershed Planning Partnership and the Cuyahoga River RAP will be essential for ongoing improvement and stewardship within the watershed.

Recommendations

Short Term

- Support the Friends of Big Creek.

  This Plan will be implemented by the FOBC and the local communities.
  This planning process identified policies, tools and strategies, which must be carried forward by the watershed partnership. Communities and partners must, in turn, commit to continue to support the Friends in this mission.
- Adopt a resolution among the watershed communities to formally recognize the Balanced Growth Plan.

  The participating jurisdictions should agree to a Resolution which outlines the relationship and obligations of the jurisdictions within the Big Creek BGI Watershed Plan. This step is crucial in order to receive state endorsement and future financial incentives.
- Submit BGI Plan to the State for approval.

  The final BGI Plan will be submitted to the Ohio Lake Erie Commission for approval. Once the plan has endorsement from the State, financial incentives for conservation and development areas become available.

Friends of Big Creek will serve as Plan Implementation Coordinator - working closely with the local governments of the watershed on action steps, funding, and a timetable to achieve implementation of the stated plan goals and action elements.

FOBC will convene meetings as necessary and continue to be the communications hub for stewardship activities in the watershed, as it has been for many years.

Long Term

- **Incorporate the PCA / PDA map into local master plans and zoning maps.** Each jurisdiction should submit and adopt the PCA/PDA Map to elected officials and approving bodies for review and approval. Each jurisdiction should follow its established public review processes for plan adoption.
- **Update local ordinances and zoning codes as recommended in the plan.** Each jurisdiction should update land use policies and documents, including comprehensive plans, zoning and subdivision regulations, to ensure consistency with the BGI Plan.
  Jurisdictions should work together on this task.
- **Create uniform storm water codes throughout the watershed** to ensure that watershed protection and site development review processes are fair, consistent and apply evenly to all areas of the watershed as development and plan implementation moves forward.
- **Implement conservation, restoration and retrofit programs** at sites that have been identified, as well as the top ten wetland project sites identified in Big Creek through the RAP's prioritization study. Use this information to capture funding and assemble willing land owners and project partners. Identifying these sites allows projects to be expedited to meet mitigation needs and attract public and private funds.
- **Explore developing a Transfer of Development Rights / Purchase of Development Rights / Density Transfer Program** as a long term goal.

  Development Rights Programs should be considered as part of the tool kit of options to achieve conservation and direct development away from sensitive areas.
- **Revise and update plan when needed.** As different projects or watershed needs become apparent, additional chapters should be added to the BGI Plan.

Appendices

A. Demographics, Land Use and Development of the Big Creek Watershed

B. Big Creek Watershed Wetlands Analysis 2008

C. Outline of a Watershed Plan (Appendix 8)

Land Use in Big Creek Watershed

Land use provides an insight into development patterns and target populations for education, and influences the health of the watershed. How land is developed and maintained has an impact on the waterway system, transportation system, and the general character of the community. Figure 22 shows the distribution of the major land uses within the Big Creek Watershed.

During the period immediately following World War II, many communities sought to attract business, industrial, and residential growth for a number of reasons. Among these reasons was the thought that economic growth would raise the property tax base and generate increased revenues for local infrastructure, including schools, roads, and fire and police protection.

More recently, studies on the cost of community services for residential development have shown that the actual cost of services is substantially higher than tax revenues collected. Thus residential land is a net drain on local government budgets. Conversely, the cost of services for commercial/industrial land, as well as open space and agriculture, is substantially less than what a community collects; providing a greater benefit to local communities.

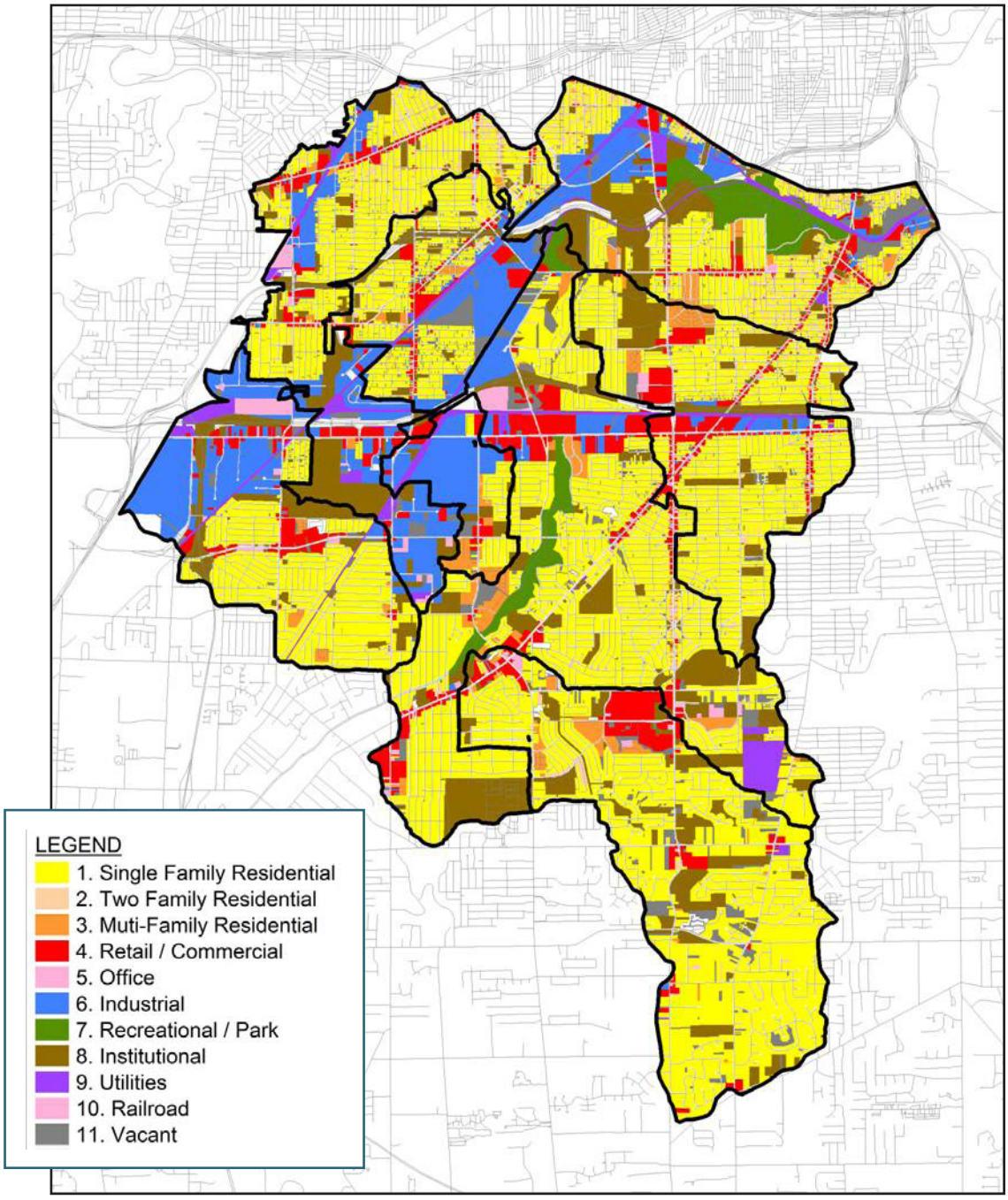
In Big Creek residential land use (single, two and multi-family) comprised the largest percentage of the watershed with approximately 52%. This was followed by institutional land use at 15%, industrial 11% and retail commercial with 7%.

Since residential land comprises over half of the watershed, stormwater practices should be directed toward as many homeowner properties as possible.

Policies, incentives and funding should be used to assist homeowners in retrofitting their properties with best management practices to reduce stormwater runoff and pollution.

Big Creek Watershed			Cuyahoga County	
Land Use	Acres	Pct of Watershed	ACRES	PERCENT
1. Single Family Residential	9,545	47.0%	118,135	45.0%
2. Two Family Residential	489	2.4%	6,674	2.5%
3. Multi Family Residential	639	3.1%	6,035	2.3%
4. Retail Commercial	1,525	7.5%	11,843	4.5%
5. Office	197	1.0%	3,373	1.3%
6. Industrial	2,306	11.4%	18,342	7.0%
7. Recreational, Park, Playground,	557	2.7%	19,678	7.5%
8. Institutional	3,118	15.4%	39,568	15.1%
9. Utilities	652	3.2%	3,856	1.5%
10. Railroads	49	0.2%	49	0.0%
11. Vacant Land	966	4.8%	25,941	9.9%
12. Agricultural		0.0%	1,151	0.4%
N/A	258	1.3%	7,783	3.0%
Total Watershed:	20,301	100.0%	262,429	100.0%

Land Use in Big Creek Watershed

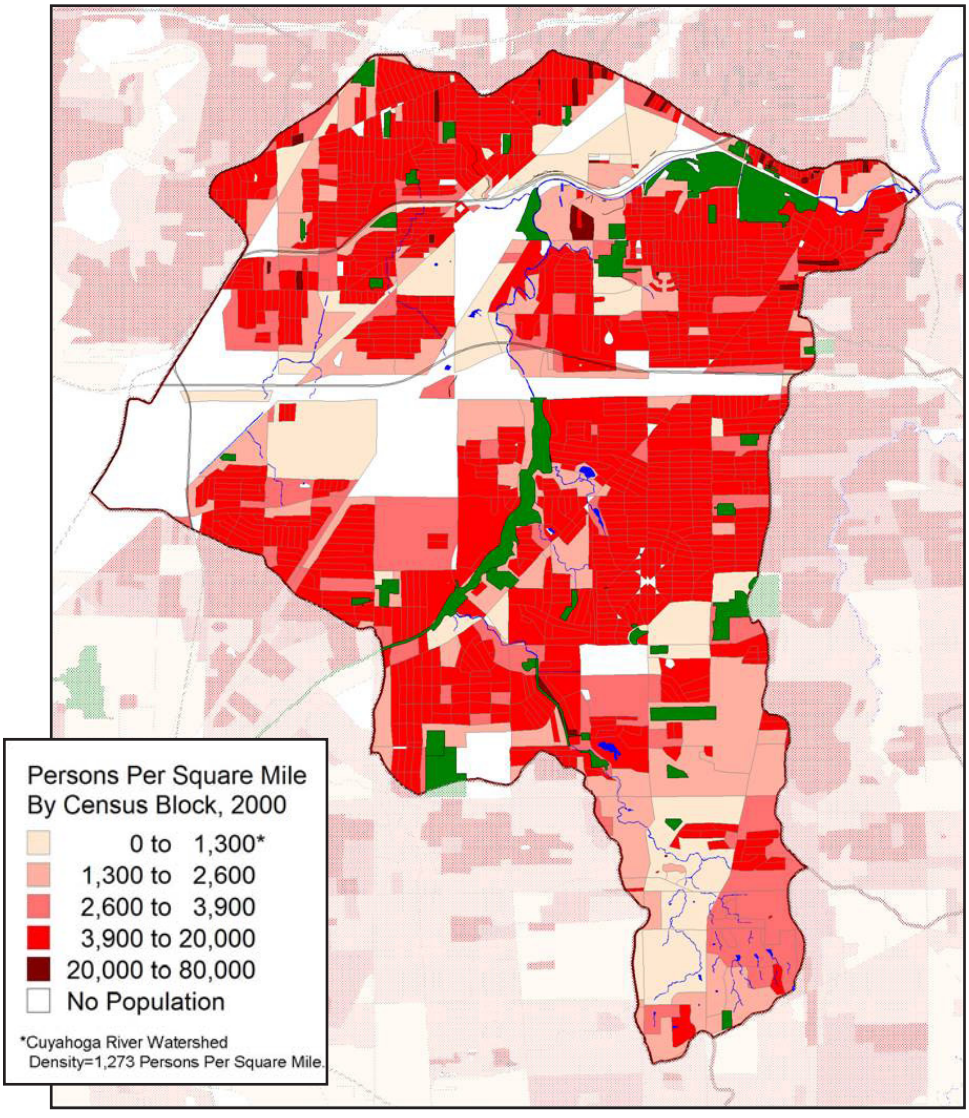


Demographics of the Big Creek Watershed

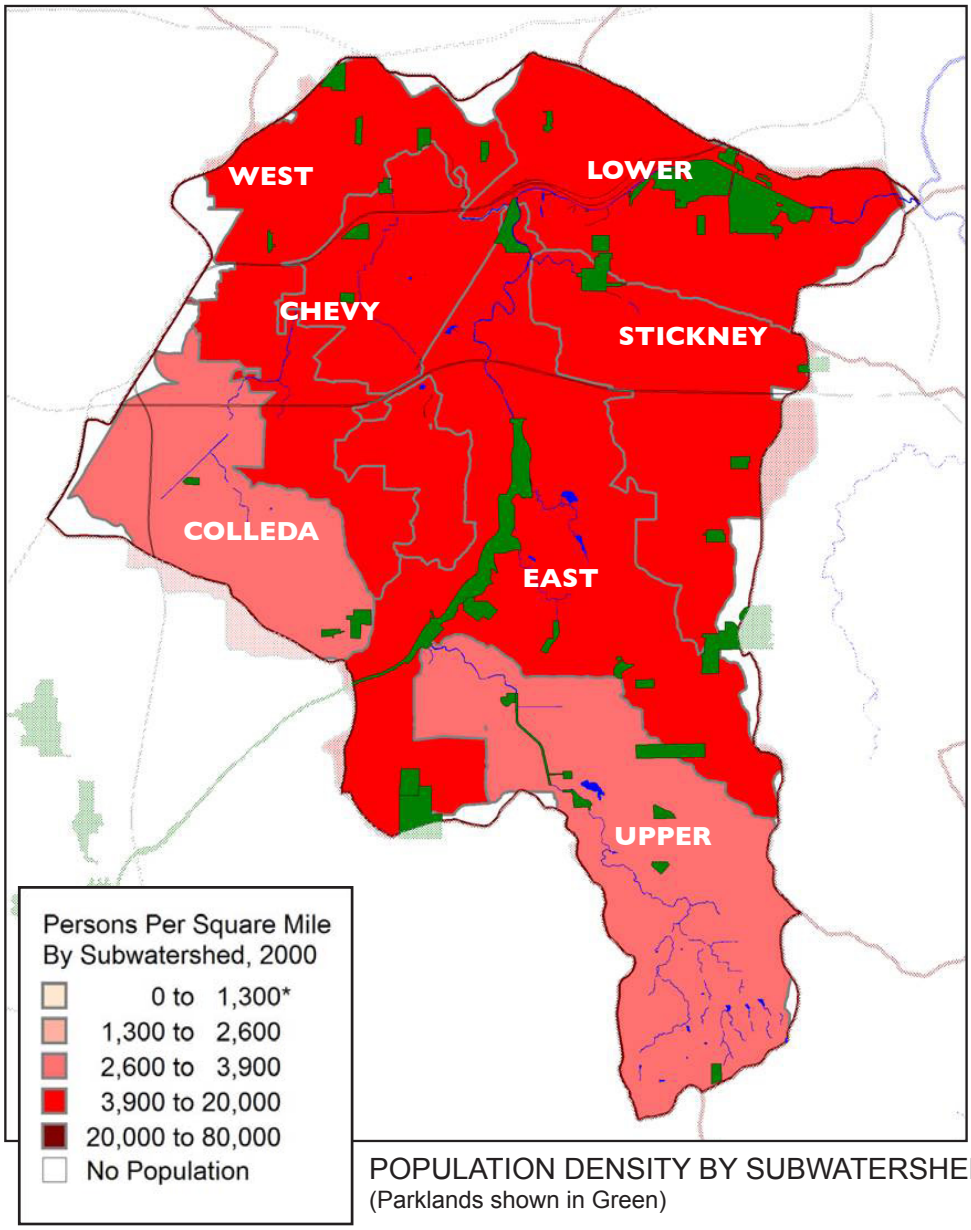
Future patterns of growth in the region show that the trend of migration away from the larger cities is expected to continue. Overall, the total population of northeast Ohio is expected to grow very little over the next 20 years. However, the population base is expected to continue its shift away from the traditional urban population centers in the region. While the region is not adding a significant number of new people, we are still consuming new land.

The Big Creek Watershed is one of the most highly urbanized watersheds within the Cuyahoga River Watershed and northeast Ohio. According to 2000 Census figures, Big Creek watershed contains approximately 168,727 people within the watershed boundary. The average number of persons per square mile equals 4,594. The Stickney Creek subwatershed contains the most people per square mile with 6,350 and the Upper subwatershed contains the least with 3,208. For reference, the Cuyahoga River Watershed averages 1,273 persons per square mile.

Most of the Big Creek Watershed Census Blocks contain 3,900 to 20,000 people per square mile.



POPULATION DENSITY BY CENSUS BLOCKS
(Parklands shown in Green. Industrial and Businesses shown in White)

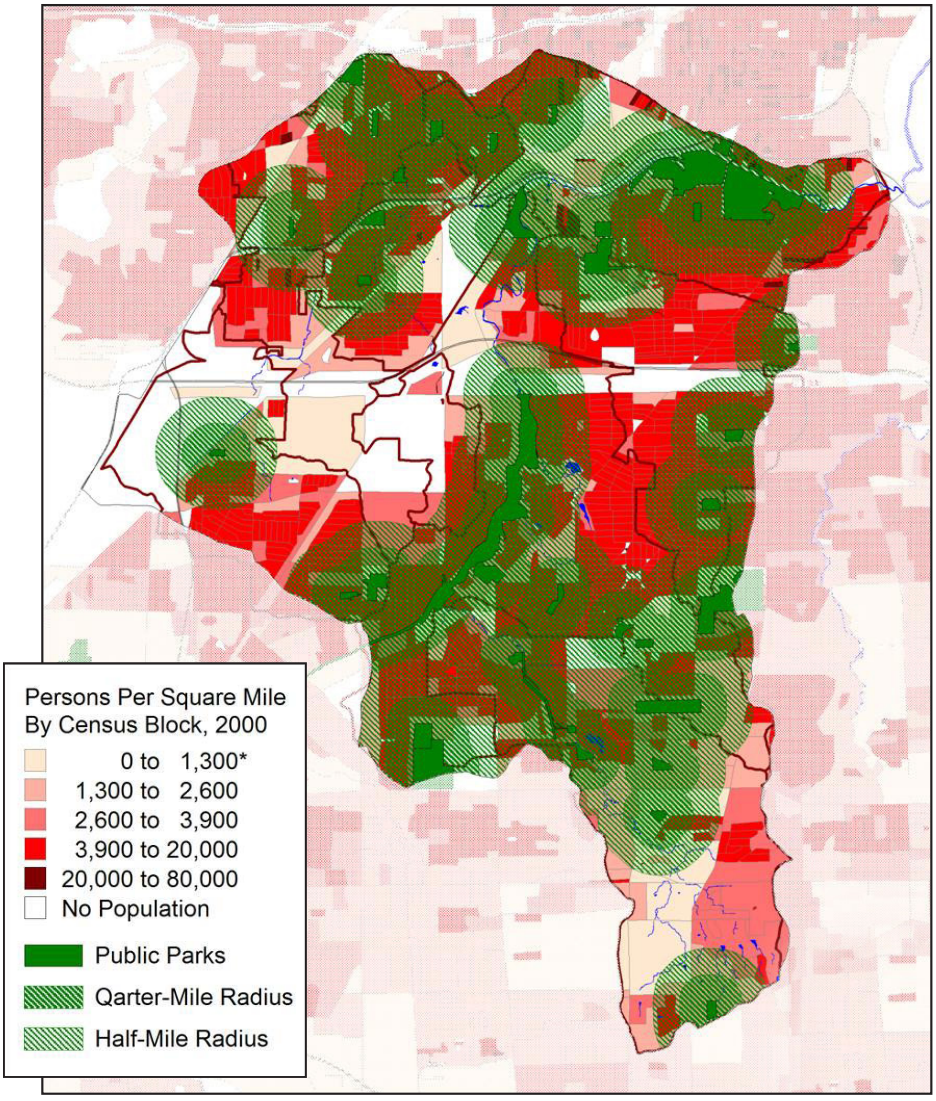


POPULATION DENSITY BY SUBWATERSHED
(Parklands shown in Green)

TRIBUTARY	POPULATION	SQUARE MILES	DENSITY (PERSONS/ SQUARE MILE)	RANK
Stickney Creek	28,768	4.53	6,350.55	1
Lower Big Creek	27,875	4.85	5,747.42	2
West Branch	26,536	4.88	5,437.70	3
Chevy Branch	16,039	3.51	4,569.52	4
East Branch	35,403	8.49	4,169.96	5
Colleda Branch	13,539	4.06	3,334.73	6
Upper	20,567	6.41	3,208.38	7
TOTAL	**168,727**	**36.73**	**4,593.71**	

Park Systems & Proximity to Population

The map below shows that the established park systems in the watershed are extremely valuable as they serve very large populations. We measured populations within 0.25 and 0.50 mile radii from the parks within the Big Creek Watershed. Such a measurement provides an insight into the
usability and proximity of people to greenspaces. There are approximately 74,016 people (42% of the watershed population) within 0.25 mile distance from a park. There are also 128,287 people (74% of the watershed population) within 0.50 mile distance from a park.

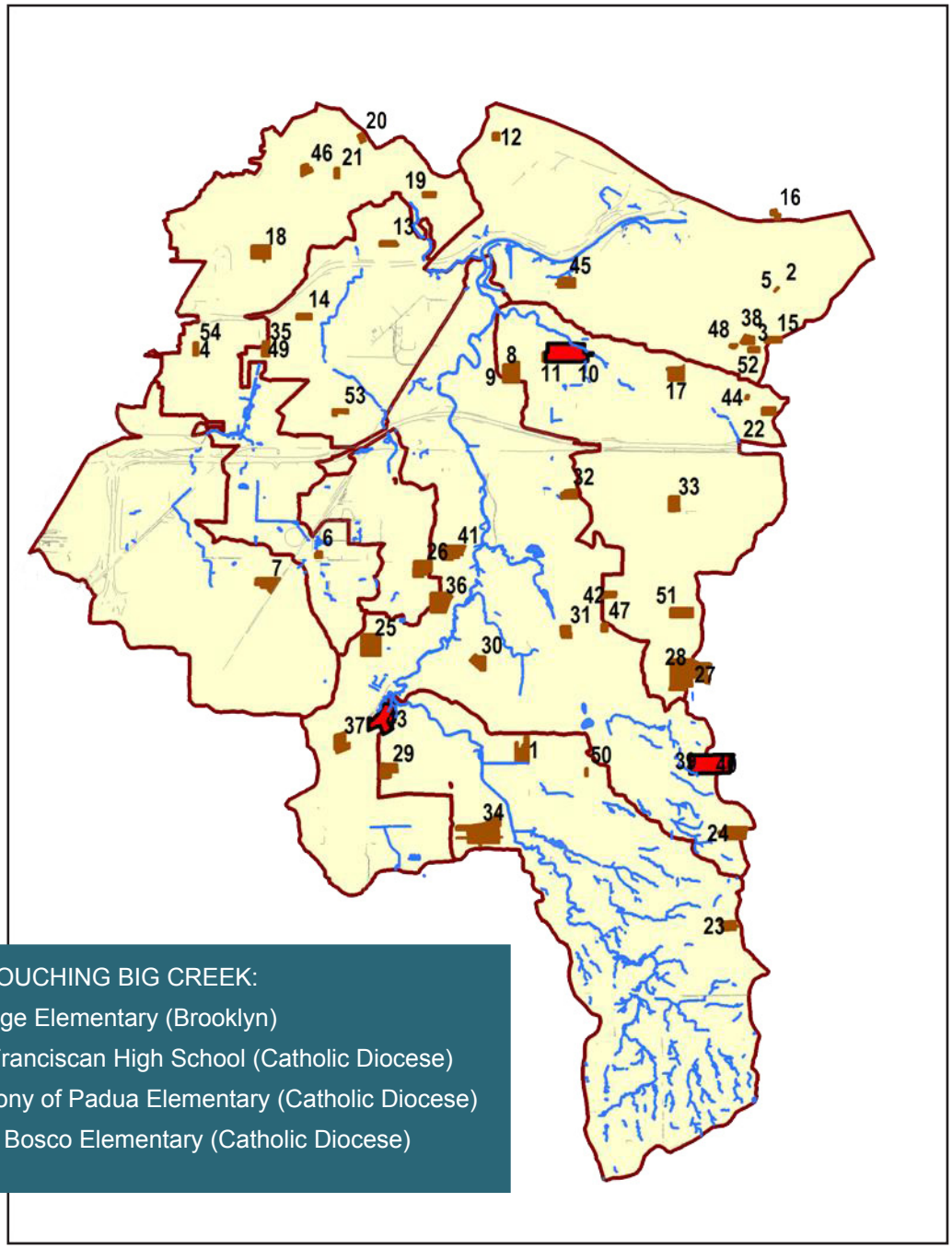


POPULATION DENSITY & DISTANCE FROM PUBLIC PARKS

DISTANCE	AREA	POPULATION	PERCENT
0.25 mi	14.1623 mi^2	74,016	42.8%
0.50 mi	25.1511 mi^2	128,187	74.2%
TOTAL		172,890	100%

Primary & Secondary School Systems in Big Creek Watershed

The Big Creek watershed contains numerous schools to engage in watershed stewardship related activities. Each one of these schools presents an opportunity to educate the public and implement watershed restoration projects. In the Big Creek Watershed there are 54 primary and secondary schools, which includes 24,533 students and 2,380 teachers. This amount of students and teachers represent a big educational opportunity and potentially a significant number of volunteers for projects. Also, there are four school properties that touch Big Creek or a tributary. These properties are a particular interest for restoration projects.



SCHOOLS TOUCHING BIG CREEK:

#10: Brookridge Elementary (Brooklyn)

#39: Padua Franciscan High School (Catholic Diocese)

#40: St. Anthony of Padua Elementary (Catholic Diocese)

#43: Stl John Bosco Elementary (Catholic Diocese)

Big Creek Watershed Wetlands Analysis 2008

Appendix B: Big Creek Watershed Wetlands Analysis 2008

PRIORITIZING WETLAND RESTORATION POTENTIAL IN THE TRIBUTARIES OF THE CUYAHOGA RIVER AREA OF CONCERN (AOC)

CUYAHOGA RIVER
COMMUNITY PLANNING
ORGANIZATION

JUNE 2008

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Table of Contents

INTRODUCTION

Many organizations and agencies in the region, when asked to identify wetland sites for conservation projects, focus primarily on opportunistic or "easy" sites. Opportunistic models lack the strategy to identify key wetland sites that provide optimal watershed benefits and tend to overlook long-term restoration potential of the site. With limited resources and funding for watershed protection, we need to be strategic in where and how we conserve our remaining wetlands.

Wetlands are complex and fascinating ecosystems that perform a variety of functions. Wetlands regulate water flow by detaining storm flows for short time periods. This reduces flood peaks and improves water quality by retaining or transforming excess nutrients and by trapping sediment and heavy metals. Wetlands also provide many other habitat and recreational benefits. However, not all wetlands perform all functions nor do they perform all functions equally well. The size and location of a wetland within a watershed determine its hydrologic and water-quality functions.

Since wetlands provide valuable ecosystem services, a watershed planning model is needed to strategically identify key wetlands for conservation. Systematically identifying and conserving such sites can help maximize stormwater management, non-point source pollution control and watershed protection efforts in the Cuyahoga River AOC.

GOALS & OBJECTIVES

Goals

The goal of this project is to identify wetland sites to target for future conservation efforts. A ranking model has been developed to assist in identifying the "top wetland sites" in each tributary watershed of the Cuyahoga River AOC. By identifying wetland sites, this project will help expedite and focus efforts to meet mitigation needs, as well as make the best use of other public or private funding sources.

A watershed-level model was developed by using Geographic Information System (GIS) to identify wetland sites based on analysis of overall:

1) Watershed Performance- We identified key wetland sites based on a ranking system. The ranking system highlights wetland sites that are specifically important for managing water quality and quantity. Directing conservation efforts at these sites can help maximize the improvement of our stream resources.

   We used GIS data to analyze several landscape variables on a watershed basis to help determine wetland performance. The size of a wetland, its location in the watershed, and other performance-based characteristics were considered. This kind of watershed analysis provides a means to prioritize conservation activities for organizations and agencies in the field of watershed protection.

The top wetland sites identified through the ranking system are then examined for restoration potential.

2) Restoration Potential- We analyzed land cover in the 50m buffer surrounding the key wetland sites. The intensity of land cover (measured in percent) surrounding a wetland affects restoration and enhancement options and influences the long-term effectiveness of projects. Many wetland functions are affected by land use activities; on the other hand these same functions can be enhanced or restored by addressing and minimizing the impacts from those same stressors. Restoration and enhancement options are examined in relation to land cover stressors. Options will be examined in the wetland itself and the land area or buffer around the wetland.

   Options for restoration and enhancement are analyzed from field analysis data and/or aerial photography. Not all wetland sites in the study area have field data. However, when available, field data is the primary source for guiding conservation options. Aerial photography, supporting literature and best professional judgment will guide conservation options for wetland sites lacking field data.

We define restoration, enhancement, preservation, and conservation as:

- *Restoration* the rehabilitation of a degraded wetland or a hydric soil area that was previously a wetland.
- *Enhancement* means improving upon the function of an already existing wetland
- *Preservation* means the protection of ecologically important wetlands, other aquatic resources, or other natural habitats in perpetuity through the implementation of appropriate legal and physical mechanisms.
- *Conservation* refers to any one or combination of: restoration, enhancement and preservation.

Objectives

The objectives in this project included:

1. Identify all existing wetlands in each tributary watershed. This involves gathering and integrating data from multiple credible sources.

2. Develop a ranking methodology to prioritize all the wetland sites, within each tributary, based on water quantity and quality performance.

3. Identify the top ten wetland sites in each of the eleven tributary watersheds to the Cuyahoga River in the AOC, with a goal of 110 wetland project sites assembled.

4. Establish restoration and enhancement options for each wetland site.

5. Assemble a library of cost estimates for the various types of conservation options.

Detailed Site Descriptions

Each selected wetland site has a detailed site description. Due to the multiple data sources used for this project some sites may have more detailed data than others, such as field visit observations.

The detailed site description includes:

- Map of Wetland- Orthophoto basemap with:
  - Wetland Boundary
  - Streams
  - Parcel Lines
  - Roads
- Wetland Classification- Hydrogeomorphic and/or Cowardin Class (based on plant community type)
- Size- acreage
- Ohio Rapid Assessment Method (ORAM) Score: Indicates wetland ecological condition: Category 3 (High), Category 2 (Medium), Category 1 (Low)
- Wetland Buffer Condition- Surrounding 50m Buffer (forest cover quantity)
  - Based on Forest Cover Condition Category
    - >75-100% Forest Cover- "High Quality
    - >50-75% Forest Cover- "Moderate Quality"
    - 25-50% Forest Cover-"Low Quality"
- Ownership- Public or Private
- Number of Parcels- An indication the of possible number of owners
- Impacts- Stressors identified during Field Visits (if available)
- Restoration Potential- Restoration, Enhancement or Preservation
- Cost Estimates- Estimated costs for restoration or enhancement options
- Latitude/Longitude- lat/long was established by calculating the centroid point of the wetland polygon
- Community- Local jurisdiction of the wetland site

Classification

Cowardin wetland classifications identified in this study include palustrine emergent (PEM), these are marshes and wet meadows; palustrine scrub/shrub (PSS), which are wetlands dominated by shrubs and saplings; and palustrine forested (PFO), that include all forested wetlands.

Common species in the PEM (emergent) and PSS (scrub/shrub) wetlands include:

- *Cornus amomum* (silky dogwood)
- *Viburnum recognitum* (northern arrow-wood)
- *Rhamnus frangula* (European buckthorn)
- *Ulmus americana* (American elm)
- *Fraxinus pennsylvanica* (green ash)
- *Euthamia graminifolia* (fragrant flat-topped goldenrod)
- *Aster* spp. (asters)
- *Onoclea sensibilis* (sensitive fern)

• *Typha* spp. (cattails)
• *Leersia oryzoides* (rice cutgrass)

Common species found in the PFO (forested wetlands) include:
• *Ulmus americana* (American elm)
• *Fraxinus pennsylvanica* (green ash)
• *Acer rubrum* (red maple)
• *Glyceria striata* (fowl manna grass)
• *Rhamnus frangula* (European buckthorn)
• *Viburnum recognitum* (northern arrow-wood)
• *Carex* spp. (wetland sedges)

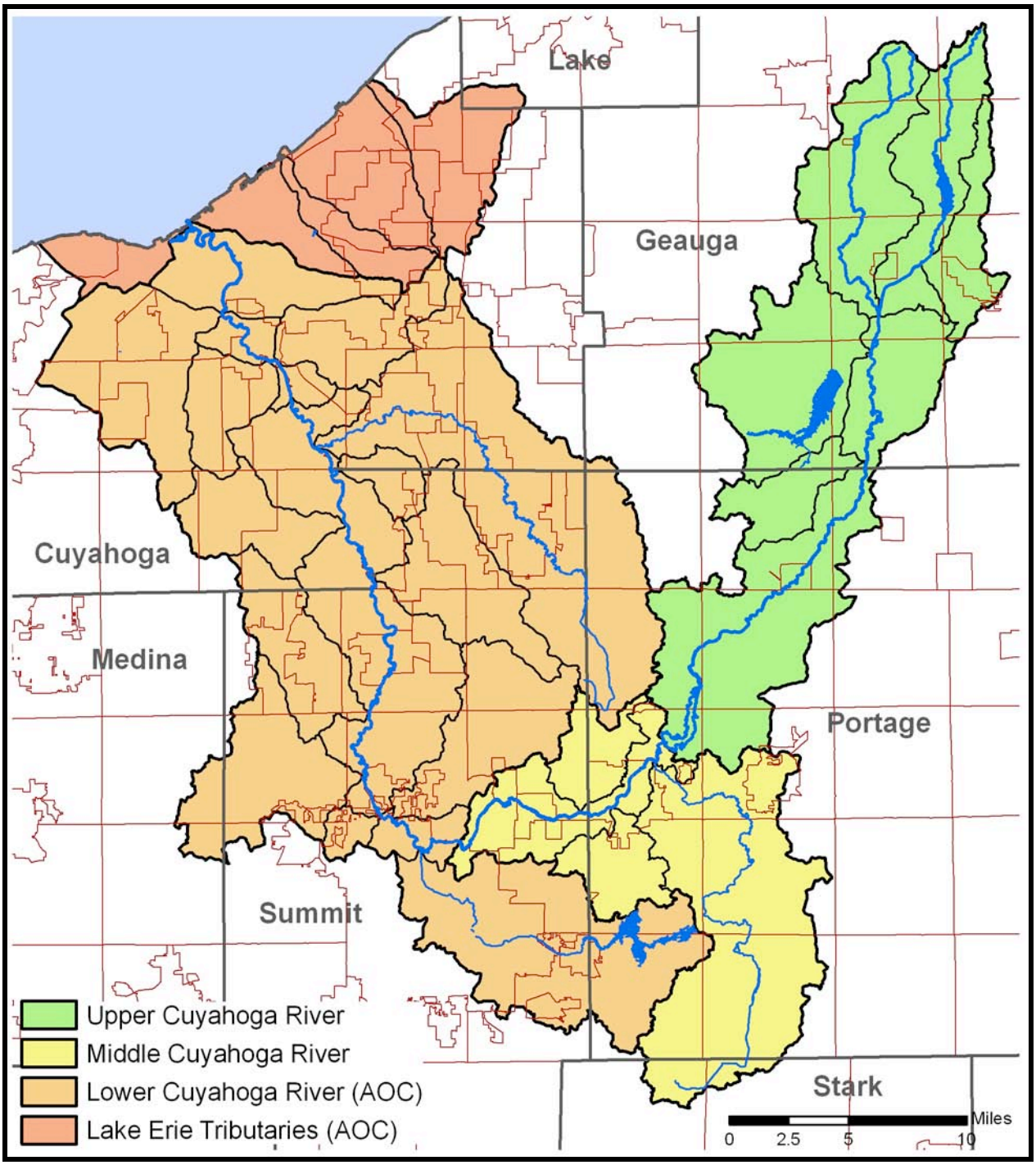
Hydrogeomorphic classification organizes wetlands based on hydrology and geomorphology.
1. Depression (Permanent inundation / Regular inundation / Seasonal inundation / Seasonal saturation)
2. Impoundment (Beaver / Human)
3. Riverine (Headwater / Mainstem / Channel)
4. Slope (Headwater / Mainstem / Isolated / Fringing)
5. Fringing (Reservoir / Natural lake)
6. Bog (Strongly ombrotrophic / Moderately ombrotrophic / Weakly ombrotrophic)
(Ombrotrophic ("cloud-fed") refers to soil or vegetation which receive all of their water and nutrients from precipitation, rather than from streams or springs.)

This model, developed for the Cuyahoga River, serves as an initial study that can be expanded and improved upon as newer data becomes available for each tributary watershed. Our model could be easily applied or adapted in different watershed settings and prove useful for other organizations and agencies. This study was undertaken to address the problems of stormwater quantity, water quality degradation and dwindling wetland habitat.

Study Area: Cuyahoga River Watershed & Area of Concern

The U-shaped Cuyahoga River basin, located in northeast Ohio, drains 813 square miles and includes 1,220 stream miles spanning parts of 83 local jurisdictions and 6 counties.
The Cuyahoga River Watershed is organized into three sections: Upper River (Geauga and Portage Counties), Middle River (Portage and Summit Counties) and Lower River (Summit and Cuyahoga Counties). The Lower Cuyahoga River is part of the Area of Concern (AOC) designation. (See Map 1 on next page.)

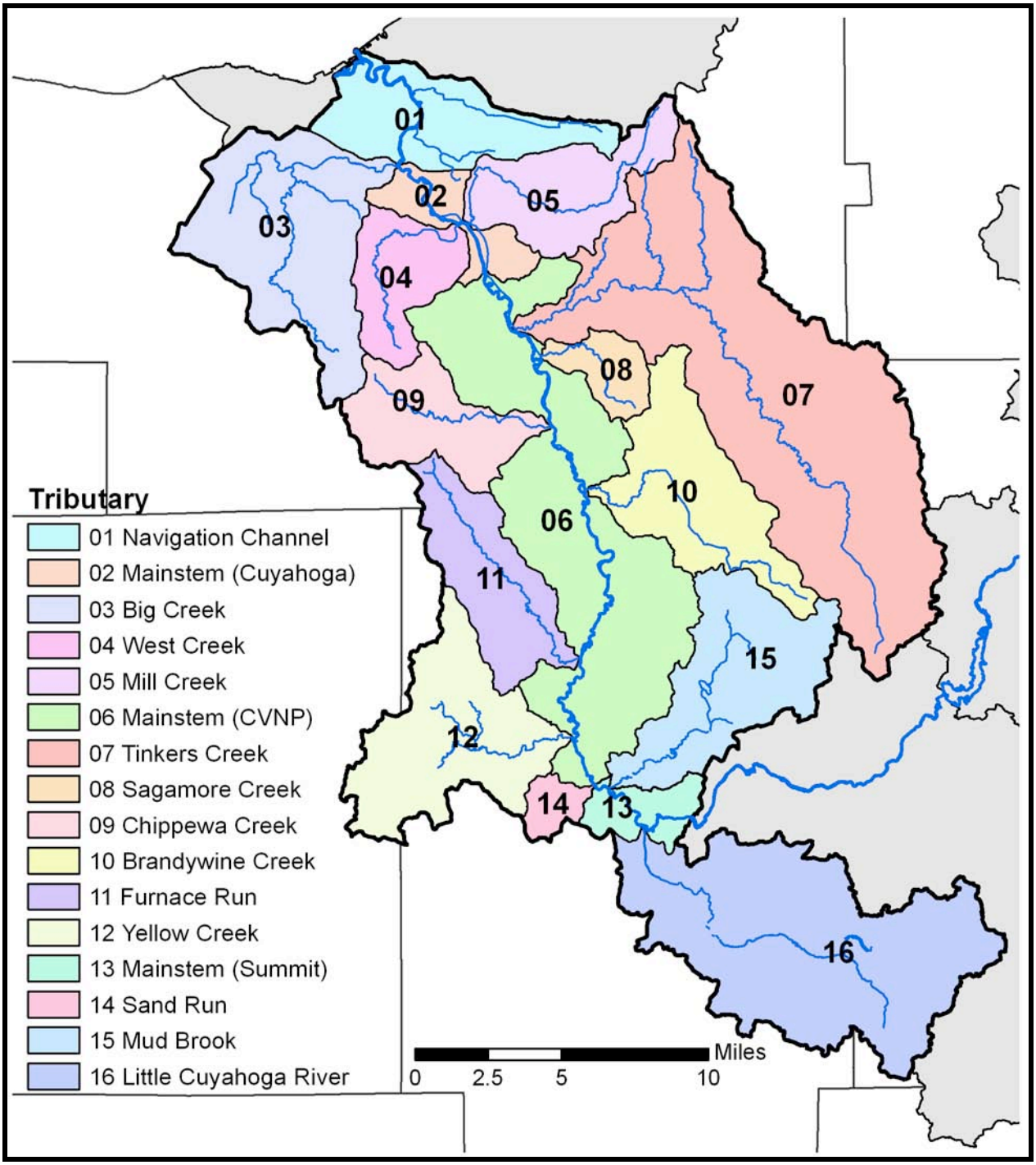
The river's headwaters originate in northeastern Geauga County and flow southwest to Akron. The river turns sharply to the northwest at the confluence with the Little Cuyahoga River in northern Akron, and then winds through the Cuyahoga Valley National Park before reaching the City of Cleveland and emptying into Lake Erie. The geo-political complexity of the watershed adds a unique dimension to achieving sustainable improvements in water quality.



Map 1: Cuyahoga River Watershed and Lake Erie Tributaries

Land use patterns vary greatly throughout the Cuyahoga River Watershed. The Upper and Middle River are still relatively healthy with an abundance of wetlands and a State Scenic River designation. The health of the Upper River can be attributed to a low level of urban development and 19,000 acres the City of Akron has preserved for drinking water purposes. Organic and nutrient enrichment, flow and habitat alterations are cited as the primary pollutants or impacts in

these reaches, which restricts sections of the river from meeting Ohio EPA's water quality standards. The major sources of these impacts come from channelization, home sewage treatment systems, reservoirs and agriculture.



Map 2: Lower Cuyahoga River Watershed Tributaries within the Area of Concern

Cuyahoga River Area of Concern (AOC)

The lower 50 miles of the Cuyahoga River and its tributary watersheds between the city of Akron and Cleveland are part of the Area of Concern. The Lower River is among the most densely populated and industrialized urban areas in the state. In 1985, the International Joint Commission identified the area from the Ohio Edison Dam to the mouth and the Lake Erie near-shore areas as one of 43 Areas of Concern on the Great Lakes. In 1988, a Remedial Action Plan (RAP) was formed to address pollution problems affecting the Lower River's beneficial use impairments. This includes concerns about the health and habitat of fish and other aquatic life, limited recreation and public access to the river and harbor areas and human health and socio-economic concerns. The primary pollutants or impacts that restrict the Lower River and its tributaries from meeting Ohio EPA's water quality standards include organic and nutrient enrichment, low dissolved oxygen, toxicity, sedimentation, and habitat degradation. Sources of these impacts include combined sewer overflows, urban development and stormwater runoff. Twenty-two miles of the Lower Cuyahoga River flow through the Cuyahoga Valley National Park, before entering the 5.6 mile Navigation Channel and discharging into Lake Erie.

Wetland Resources in the Area of Concern

Recent studies have shown that wetland resources are scarce, the majority are small ($\leq$ 1 acre), privately held and are showing signs of stress from the surrounding development. All together, this presents many challenges from accessing property to addressing land use stressors in order for restoration to occur.

Mack et al (2007) found that the ecological condition of wetlands deteriorates from the Upper and Middle to the Lower Cuyahoga River watershed. There are two indicators of this trend: the number of high quality (Category 3) wetlands and the acreage of low quality wetlands.

The first indicator is a *decrease* in the number of high quality wetlands from Upper to Middle to Lower portions of the watershed. In the Upper watershed, in Geauga county, 49.3% of the wetlands were Category 3. While in the Middle watershed, in Portage and Summit counties, 18.5% and 19.6% of the wetlands were Category 3. The Lower Cuyahoga River Watershed (AOC) had merely 8.3% of its wetlands as Category 3.

The second indicator is the *increase* in acreage of lower quality Category 1 and Modified Category 2 wetlands from Upper to Middle to Lower portions of the watershed. Category 1 and Modified Category 2 combined represent 4.5% and 5.6% of wetland acres in the Upper and Middle portions of the watershed, respectively. While in the Lower Cuyahoga River Watershed (AOC) 19.3% of the wetland acres are Category 1 and Modified Category 2. The ecological conditions of wetlands in the Lower Cuyahoga River Watershed are due to the relatively small wetland sizes and fragmented landscapes within the AOC.

Causes & Sources of Degradation

There is an inverse relationship between the quality of a wetland and the number of land use stressors. Category 3 and 2 wetlands have a lower number of hydrologic and habitat stressors compared to a higher number of stressors found at Category 1 and Modified Category 2 wetland sites. In the Cuyahoga River Watershed the most important hydrologic stressors related to condition were ditching, dikes, stormwater input, filling, and roads.

Habitat Stressors in the Cuyahoga River Watershed												
Region of Watershed	Mowing	Grazing	Clear Cutting	Select Cutting	Woody Debris Removal	Sediment-ation	Toxic Pollutant	Shrub Removal	Aquatic Bed Removal	Farming	Nutrient Enrich-ment	Dredging
Upper River	32%	4%	4%	15%	5%	4%	1%	11%	0%	5%	4%	6%
Middle River	25%	4%	4%	10%	12%	16%	1%	12%	1%	14%	18%	8%
Lower River (AOC)	29%	2%	2%	16%	9%	13%	2%	11%	0%	13%	11%	9%

Hydrologic Stressors in the Cuyahoga River Watershed									
Region of Watershed	Ditching	Tiling	Dikes	Weirs	Stormwater Input	Point Source	Filling	Roads	Dredging
Upper River	33%	5%	12%	3%	10%	0%	18%	29%	3%
Middle River	27%	1%	4%	0%	6%	3%	31%	40%	6%
Lower River (AOC)	27%	7%	13%	2%	4%	2%	24%	38%	7%

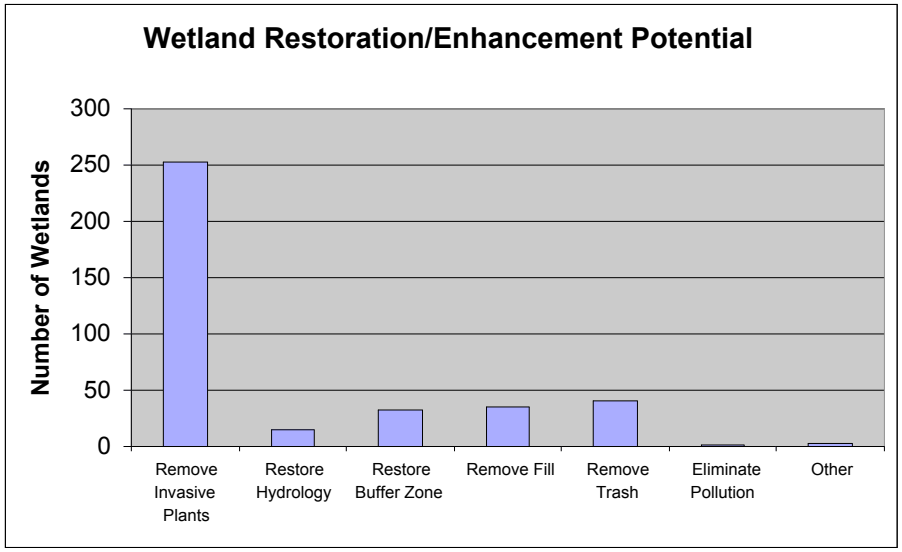
A 2002-03 field analysis of wetlands in the Lower Cuyahoga River showed adjacent land use as the most commonly noted impact. In most cases, this was the result of development on the adjacent land. Impacts associated with development of adjacent land include destruction of the buffer zone, isolation from adjacent natural areas, and runoff from lawns and impervious surfaces.

Another commonly noted impact is addition of fill. The old fill occurs mostly in small, isolated areas. The fill consists of subsoil, concrete, block, brick, and household debris. Some of the filled areas may contain hazardous waste or other unknown materials; on-site testing would be required to determine actual contents. In most areas, the extent and thickness of the fill is difficult to determine because of its age. New fill is in many cases associated with recent development projects.

Scattered debris, such as bottles, cans, tires, furniture, appliances, and car parts, is common within the wetlands, particularly the floodplain areas where these items are deposited by flood waters. Household dumps ranging in age from around 1880 to the present were found throughout the study area. These dumps tend to occur near old house sites, in ravines, and along roadsides. Dumping was noted where relatively large areas of household debris appear to have impacted the wetlands.

Drainage ditching and drainage tiling were observed in some areas. The ditches and tiles are old, and, in most cases, are only partially functioning to drain wetlands. Most of the ditches and tiles were associated with former agricultural fields. It is likely that tiles exist in more areas than

noted. Tiled areas are not easy to identify without a more detailed study. Table 6 provides a summary of wetlands impacts identified in the field (Cuyahoga River RAP 2003).



The Cuyahoga River AOC- Priority Area for Wetland Mitigation

The current mitigation rules do not adequately address the inequity of mitigation that occurs in the Cuyahoga River Watershed. A recent study shows that the Cuyahoga River Watershed has experienced a net loss of wetland acres due to the exportation to mitigation banks located outside the watershed. Furthermore, the majority of projects (67%) that restored or created wetlands independently (not a wetland bank) inside the watershed were not successful at meeting permit requirements (Kettlewell et al. 2008).

Mitigation has evolved into a barter system where the scales are tipped in favor of higher quality, rural watersheds; leaving the move heavily degraded urban watersheds at a disadvantage. Mitigation rules require that restoration projects must be available for a developer to mitigate. However, eligible projects that do exist in the Cuyahoga River AOC sub- watersheds are generally:

1) Very expensive, and
2) Above and beyond the requirements a typical developer would need to compensate for their impacts.

This in addition to the cheaper property values that exist outside the AOC makes it more economical for developers to perform mitigation outside the Cuyahoga River Watershed and therefore, far removed from the initial impact. The AOC needs to be a Priority Area for Compensatory Mitigation. We must have a net gain in high quality habitat to help improve watershed resources and move toward delisting.

This project identifies mitigation projects for each tributary watershed in the Lower Cuyahoga River Watershed, making in-kind mitigation within in the HUC-12 unit possible.

METHODS OF ANALYSIS

Phase I- Collect, Analyze & Integrate Existing Wetland Data

Summary of Wetland Data Sources

Each of the files listed below exists as a separate GIS polygon file.

1. Ohio EPA & Cuyahoga River RAP ORAM Analysis Summer 2005
   -Actually two projects completed together:
   -Ohio EPA project covers the entire Cuyahoga River Watershed
   -RAP project is a more in-depth analysis of three tributaries to the Cuyahoga River

2. Cuyahoga River RAP & Davey Resource Group Study 2001-03
   -Interpretation of aerial photos (1993-Cuyahoga County Engineer) & field work December 2002–April 2003
   -Covers only the Cuyahoga County portion of the Cuyahoga River Watershed

3. Cleveland Metroparks ORAM analysis Summer 2005 & 2006
   -Covers park reservations in Cuyahoga County portion of the Cuyahoga River Watershed
   -Follows same protocols as Ohio EPA & Cuyahoga River RAP ORAM project

4. Davey Resource Group Summit County Wetlands Project 2000
   -Interpretation of orthophotos photos (2000-Summit County Engineer)

5. Portage County Natural Resource Inventory compiled by Davey Resource Group, Inc
   -Interpretation of aerial photos (ASMAT 2000) & field work in 2004 & 2005

6. Cuyahoga Valley National Park Wetlands Inventory (covered in Summit County file)

7. Metroparks Serving Summit County Wetlands Project (covered in Summit Co. file)

In order to produce the best quality model for each tributary watershed, each data source, or GIS file, was divided into tributary watershed files, and then each set of tributary watershed files was combined and then updated to the 2006 orthophotos provided by Ohio DNR. In areas where wetland boundaries overlapped, ORAM boundaries were kept and others were edited.

Phase II- Developing the Cuyahoga River Wetlands Model Ranking System

The basic premise of the Cuyahoga River Wetland Model is to numerically evaluate conservation alternatives by developing a set of criteria that can be used to judge each wetland. Each criterion was assigned either a positive or negative point range that reflects its importance to the function or dysfunction of the wetland within the tributary watershed. Each wetland earns numerical scores that depend on how well the wetland meets that particular criterion. The positive and negative points are each summed separately for each wetland. For the purpose of this project, the numeric totals for each potential conservation site were compared with all other sites within the tributary watershed and then a rank order was assigned. The rationale for the scoring system was to equate high positive scores with the most important wetland sites, while keeping separate negative scores that indicate the amount of stressors for each wetland.

The model is broken into two categories:

Positive Attributes looked at specific criteria that were both useful in evaluating a wetland's ecological importance and were supported in scientific literature. We used a Geographic Information System (GIS) to analyze several landscape variables on a watershed basis as indicators of wetland performance. Three of the variable pertained to the wetland itself: wetland size, proximity to riparian corridor, and proximity to mapped flood zones. Two other variables pertained to the 50m buffer surrounding the wetland: the amount of area of other wetlands within the buffer, and the overall quality of the buffer based on the percent of forest cover area in the buffer.

The top wetland sites identified through the ranking system are then examined for Stressor Attributes which helps identify restoration potential.

Stressor Attributes included the wetland's proximity to roadways and three types of land cover in the 50m buffer surrounding the wetland sites. The percent of urban, residential and agricultural land covers were analyzed, since the intensity of these land uses surrounding a wetland affects restoration and enhancement options and influences the long-term effectiveness of the project.

Additional options for restoration and enhancement are gathered from either field analysis data or aerial photography. Not all wetland sites in the study area have field data. However, when available, field data is the primary source for guiding conservation options. Orthophotography (2005), supporting literature and best professional judgment will guide conservation options for wetland sites lacking field data.

MODEL RANKING SYSTEM

CUYAHOGA RIVER WETLANDS MODEL			
POSITIVE ATTRIBUTES (+)		**STRESSORS (-)**	
Wetland Size Groups	**Points**	**LAND COVER**	
<.5 acre	0	**Urban Area in 50m Buffer**	**Points**
>.5-1 acre	1	>75% thru 100%	-7
>1 thru 5 acres	2	>50% thru 75%	-6
>5 thru 10 acres	3	25% thru 50%	-5
>10 thru 20 acres	4	**Residential Area in Buffer**	**Points**
> 20 thru 100 acres	5	>75% thru 100%	-6
>100 thru 150 acres	6	>50% thru 75%	-5
>150 thru 200 acres	7	25% thru 50%	-4
>200 thru 250 acres	8	**Agriculture Area in Buffer**	**Points**
>250 thru 300 acres	9	>75% thru 100%	-3
>300 acres	10	>50% thru 75%	-2
Wetland's Proximity to Riparian Setback	**Points**	25% thru 50%	-1
Beyond 100m	0	**Wetland's Proximity to Roadways**	**Points**
75m thru 100m	1	0m thru 25m	-6
50m up to 75m	2	25m thru 50m	-5
25m up to 50m	3	50m thru 75m	-4
0m up to 25m	4	75m thru 100m	-3
Intersect with	5	100m thru 125m	-2
Fully within	6	125m thru 150m	-1
Wetland's Proximity to Flood Zones	**Points**	>150m	0
None	0		
Intersect with	1		
Fully within	2		
Forests in Buffer of Wetland			
>75% thru 100%	5		
>50% thru 75%	4		
25% thru 50%	3		
Other Wetland Area in Buffer	**Points**		
61% thru 100%	3		
26% thru 60%	2		
4% thru 25%	1		

Rationale for the Cuyahoga Model

Size (*Wetland Size*)- Larger wetlands are better protected from the negative impact of external inputs. This is due to the greater distance between the core habitat and input sources, and larger areas of vegetation that can act as sediment and nutrient sinks.

Hydrology (*Proximity to Riparian Corridor and/or Flood Zone)*- For the purpose of this project, we identified wetlands associated with the riparian corridor and 100 year flood zone. In most cases these wetlands could be classified as riverine wetlands. "Riverine" refers to a class of wetlands that has a floodplain or riparian geomorphic setting with a dominant water source being over bank flow. These types of wetlands are especially valuable in their ability to absorb stormwater and slow the discharge of stormwater downstream (Krieger 2001). An urban wetlands study (Mack et al. 2007) found that riverine wetlands were clearly valuable in desynchronizing stream flood events (ie. capturing and slowly releasing precipitation). Desynchronizing helps to alleviate large peak flows in streams, which minimizes flooding and erosion downstream.

Vegetative Cover *(Forest Cover in Wetland Buffer)*- Houlahan et al. (2006) found a relationship between forest cover and exotic plant species richness, suggesting that loss of forest cover facilitates the infiltration of exotic plant species. The amount of natural vegetation adjacent to a wetland affects the quantity and quality of surface runoff in a wetland, particularly nutrient and sediment loads. In Wardrop et al. (2007) they developed a landcover condition category for forest cover surrounding wetlands. We adapted their category table for this project and rated forested cover by "High, Moderate and Low" quality.

Wetland Connectivity *(Other Wetlands within Buffer*)- Fenessey, Sullivan 2008 found a correlation between predicting ecological condition of a wetland and the presence of other wetlands located with the surrounding 50m buffer. This "wetland connectivity" is quite possibly functioning as a complex of wetlands, providing a buffering effect from upland stressors and enhancing watershed benefits.

Stressors

Land Cover- Research shows that surrounding land-use affects ecological condition of a wetland. The condition of a wetland declines significantly as the surrounding land use changes from natural to urban. This is demonstrated by the change of wetland conditions from the Upper to the Lower Cuyahoga River Watershed. Research by Fennessy & Sullivan (2008) examines this issue by analyzing land-uses within different size buffers (30m 50m, 100m, 500m, 1000m) around the wetlands. Results show that land use characteristics in the 30m and 50m buffers had the strongest correlation with ecological condition of a wetland. This indicates that preservation of the buffer areas around wetlands can offer substantial protection and dramatically increase their conservation value.

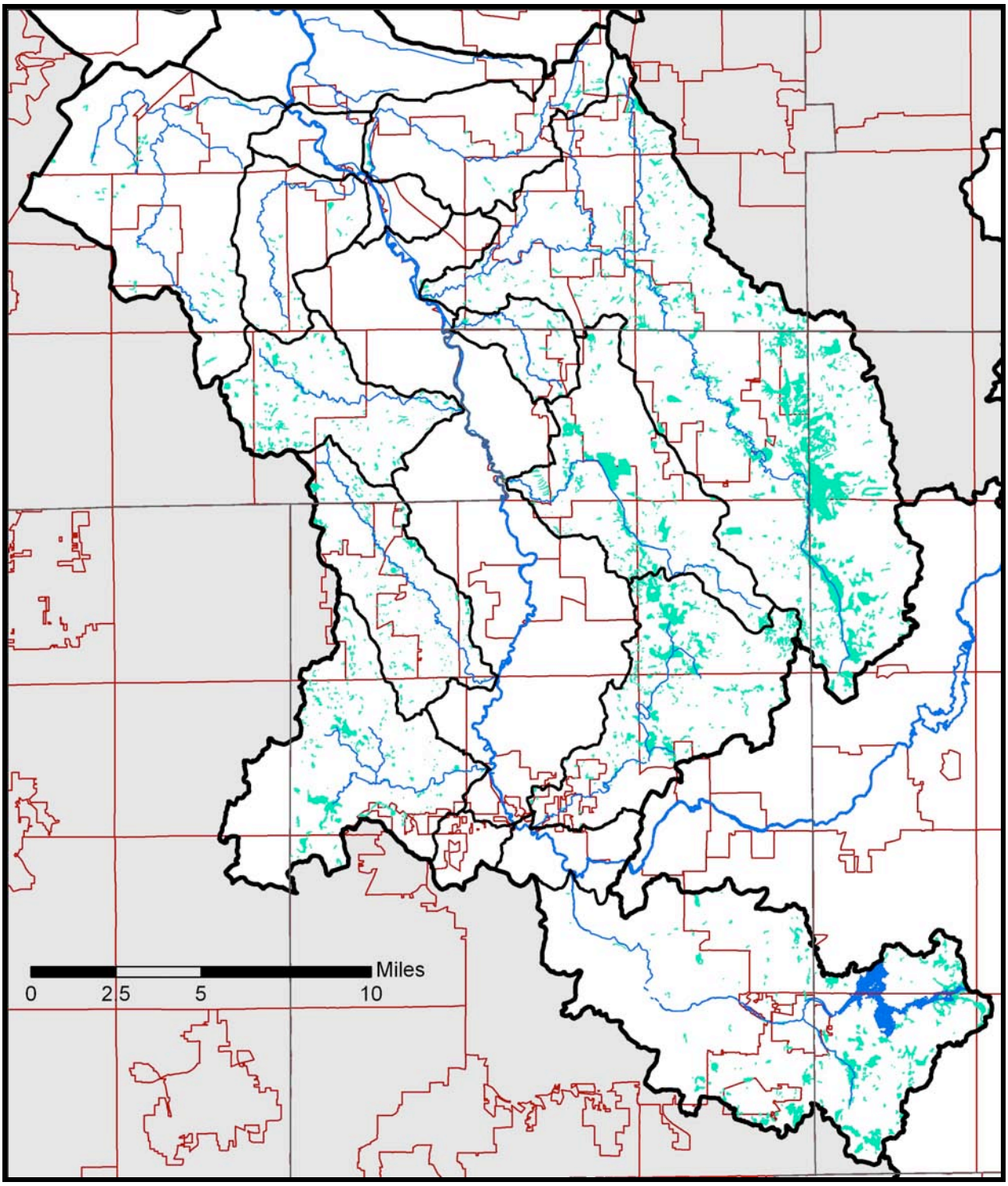
For the purpose of the project, the land cover scoring coefficients were adapted from the Landscape Development Intensity (LDI) index. LDI integrates the impacts of human land use on a given site (Brown and Vivas 2005).

Distance to Roadways- Proximity of wetlands to road systems is correlated with higher levels of polluted runoff, and poorer water and sediment quality. There is evidence that wetlands located downstream of a road system are at an increased risk of receiving sodium, potassium and nitrate pollutants (Houlahan and Scott 2004). These pollutant loadings result from road salt applications and soil erosion due to increased stormwater runoff. The ranking model provides a range of negative scores based on a wetland's distance to a roadway. The closer a wetland is to a roadway, the higher the risk of impacts from polluted runoff and therefore the more negative the score.

RESULTS & SELECTION OF WETLAND SITES

The study identified a total of 3,007 wetlands covering 9,710 acres within the tributary watersheds of the Cuyahoga River Area of Concern. All of the wetlands were analyzed within the context of their individual tributary watershed. Together, the top wetlands of each tributary watershed received further examination. These wetlands are highlighted in this report. 2459 acres of wetlands or 25.3% of total AOC tributary wetlands as part of the wetland analysis.

Wetlands Summary- Cuyahoga River Area of Concern (AOC)	
Total Number of Wetlands	3,007
Total Acres of Wetlands	9,710
Average Wetland Size (acres)	2.4
Average Wetland Buffer Condition (Percent Forest Cover)	Low Quality (25- 50%)
All Top Selected Wetlands Total Acres (160 total)	**2473**
All Top Selected Wetlands Average Size (acres)	22.3
All Top Selected Wetlands Average Buffer Condition (Percent Forest Cover)	High Quality (>75-100%)
Total Restoration Potential Costs	$17,522,144



Map 3: Wetlands in the Tributaries of the Lower Cuyahoga River Watershed Area of Concern

BIG CREEK

General Watershed Characteristics

Big Creek, in northeast Ohio, is the third largest tributary in the Lower Cuyahoga River Watershed. This urban watershed has some of the highest population densities in the region. Big Creek's original drainage patterns and riparian zones have been altered and fragmented as a result of channelization, spillway structures, culverts, and changing land-use. This has increased flow volumes and polluted runoff, decreased diversity and livability of habitat, and limited the potential for stream recovery.

Location: Northeast Ohio, Cuyahoga County and drains the communities of: Cleveland, Brooklyn, Linndale, Brook Park, Parma, Parma Heights and North Royalton

Characteristics:

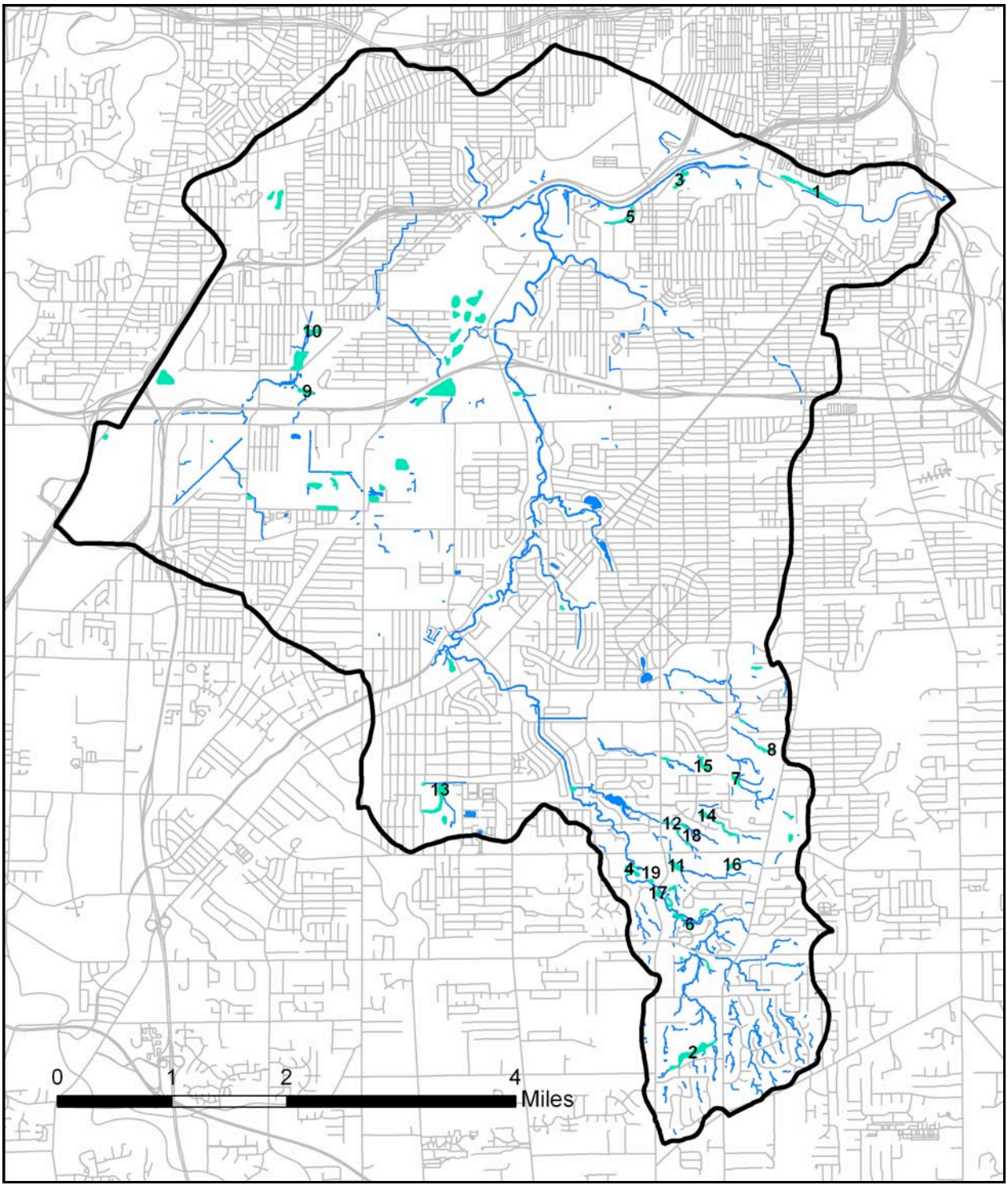
Drainage: 38 square miles
Length: mainstem is 12 miles.
Gradient: creek drops an average of 23ft/mile.

Land Cover Characteristics (2001)	Percent of Drainage Area
Urban	52.06
Agriculture & Open Urban	31.78
Shrub & Scrub land	3.49
Wooded	13.91
Barren & Unclassified	1.00
Streams & Surface Water	.21

Wetlands Summary- Big Creek Watershed	
Number of Wetlands	74
Total Acres	137.52 acres
Average Size	1.86 acres
Average Wetland Buffer Condition (FC)	Low Quality (25-50%)
Top Ten Wetland Acres	28.20 acres
Top Ten Average Size	2.82 acres
Top Ten Average Wetland Buffer Condition (FC)	High Quality (>75-100%)
Total Restoration Potential Costs	$1,801,406

Big Creek Wetland Results

A total of 137.5 acres of wetlands were identified in the Big Creek Watershed. Through our analysis we picked the top 10 wetlands. These 10 sites equal 28 acres, or nearly 20% of the total wetland acreage in the watershed. Of the selected wetlands, sizes ranged from 9 acres to 0.75 acres.



Big Creek Watershed Locator Map for Ranked Wetlands
(Map shows top 19 of 74 identified wetlands.)

Big Creek Watershed Wetland Maps

BIG CREEK WETLAND ID# RAP_BC97 **Ranked No. 1**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Forested Wetland (PFO)
Size (*acres*)	3.33
Wetland Buffer Condition	Moderate Quality
Impacts (*Field Assessments*)	N/A
Restoration Potential	Remove Invasive Plants* Riparian/Wetland Plantings*
Ownership (*Public or Private*)	Private
Number of Parcels	4 Parcels / 2 Owners
Cost Estimates	$12,648
Location (Lat/Long)	41.447197326681 / -81.707625155485
Community	Cleveland

* Extrapolated Restoration Potential

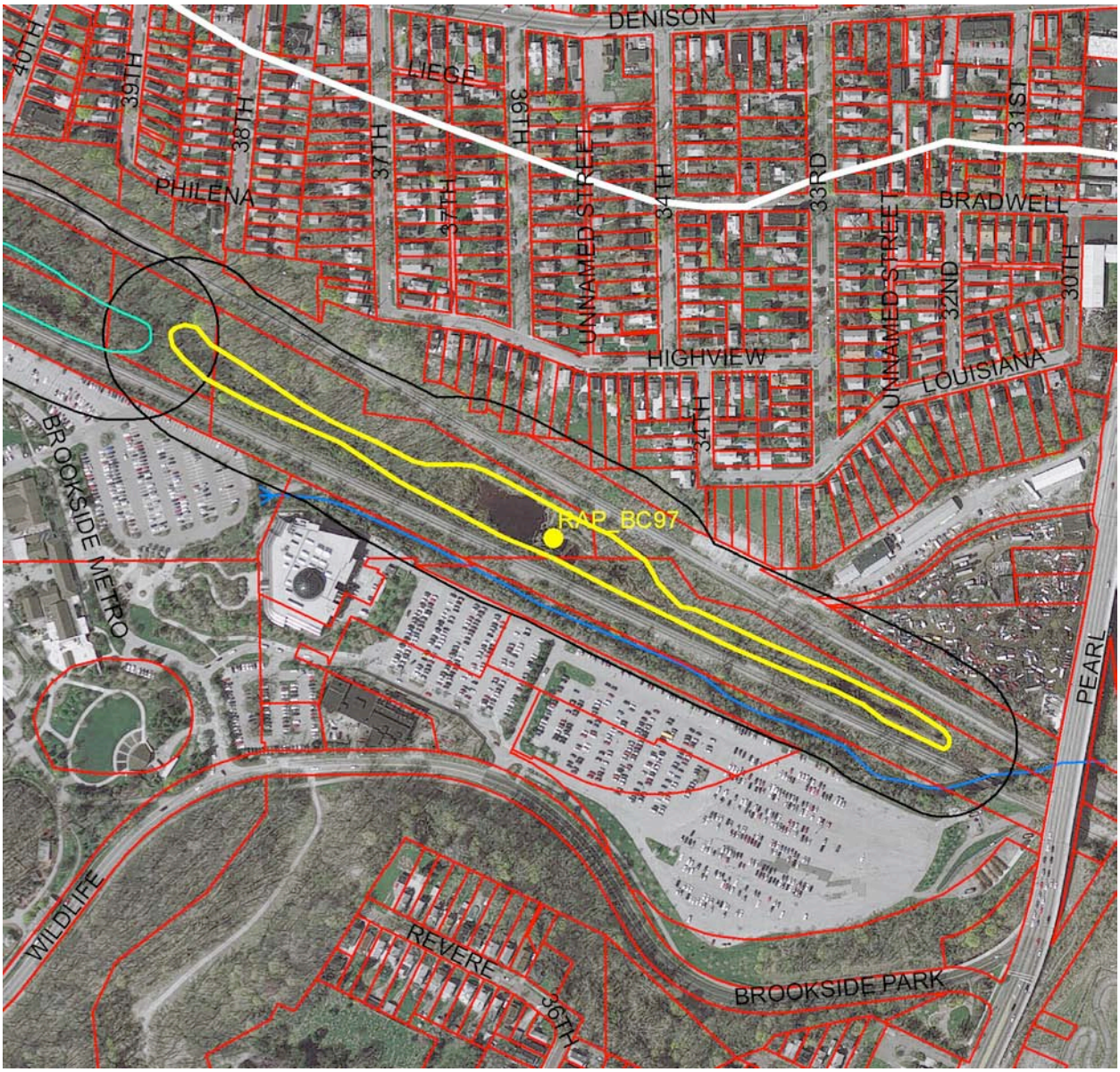
Wetland BC97 is a 3-acre forested wetland on the lower mainstem of Big Creek, just upstream from the confluence with the Cuyahoga River. Notable features include a moderate forested buffer, neighboring wetland to the west and the connection with Big Creek's riparian corridor and floodplain. Wetland BC97 is located in the city of Cleveland. Ownership complexity is fairly easy with 4 parcels and 2 property owners. B & O Railroads owns 3 out of the 4 parcels.

Wetland BC97 is most likely a moderate to moderately low quality wetland. This is due to the intensity of land use in the surrounding urban watershed. Further investigation may show that BC97 and its neighboring wetland are part one large wetland system.

Next steps include a more detailed site assessment of this wetland. The site assessment should include completion of an ORAM and Penn State Stressor Checklist. This will help provide the location and extent of surrounding impacts, restoration potential and ultimately cost estimates. Preliminary cost estimates for this site are based on and extrapolated from previous wetland assessment projects. This site is landlocked and further development in this area is unlikely. This site should be targeted for a conservation easement and invasive species removal. Wetland and riparian plantings should be native, but also tolerant of urban conditions.

Cost Estimate

Item	**Unit Cost**	**Unit**	**Cost**
Detailed Sight Assessment	$720	1	$720
Plans & Specification	$5,000	1	$5,000
Remove Invasive Plants	$660	0.8acres	$528
Riparian / Wetland Plantings	$8,000	0.8acres	$6,400
Conservation Easement	$???	3.3acres	$???
TOTAL			**$12,648**



Big Creek Wetland Ranked #1: RAP_BC97 Scale: 1:5,000

Map Key

Yellow Lines	-Wetland boundary
Yellow Points	-Centroid point calculated from wetland polygon
Black Lines	-Wetland 50m buffer
Green Lines	-Other wetlands
Blue Lines	-Streams
Red Lines	-Parcel boundary

Base Layer	-Ohio 2006 orthophotos
Projection	-Ohio State Plane North, NAD83

BIG CREEK WETLAND ID# RAP_BC501 **Ranked No. 2**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Forested & Shrub/Scrub Wetland (PFO) (PSS)
Size (*acres*)	9.59
Wetland Buffer Condition	Moderate Quality
Impacts (*Field Assessments*)	New Fill Adjacent Land Use
Restoration Potential	Remove Invasive Plants Seeding/Wetland Planting Restore Buffer Zone
Ownership (*Public or Private*)	Private
Number of Parcels	12 Parcels / 12 Property Owners
Cost Estimates	$36,308
Location (Lat/Long)	41.338571793973 / -81.729672609727
Community	North Royalton

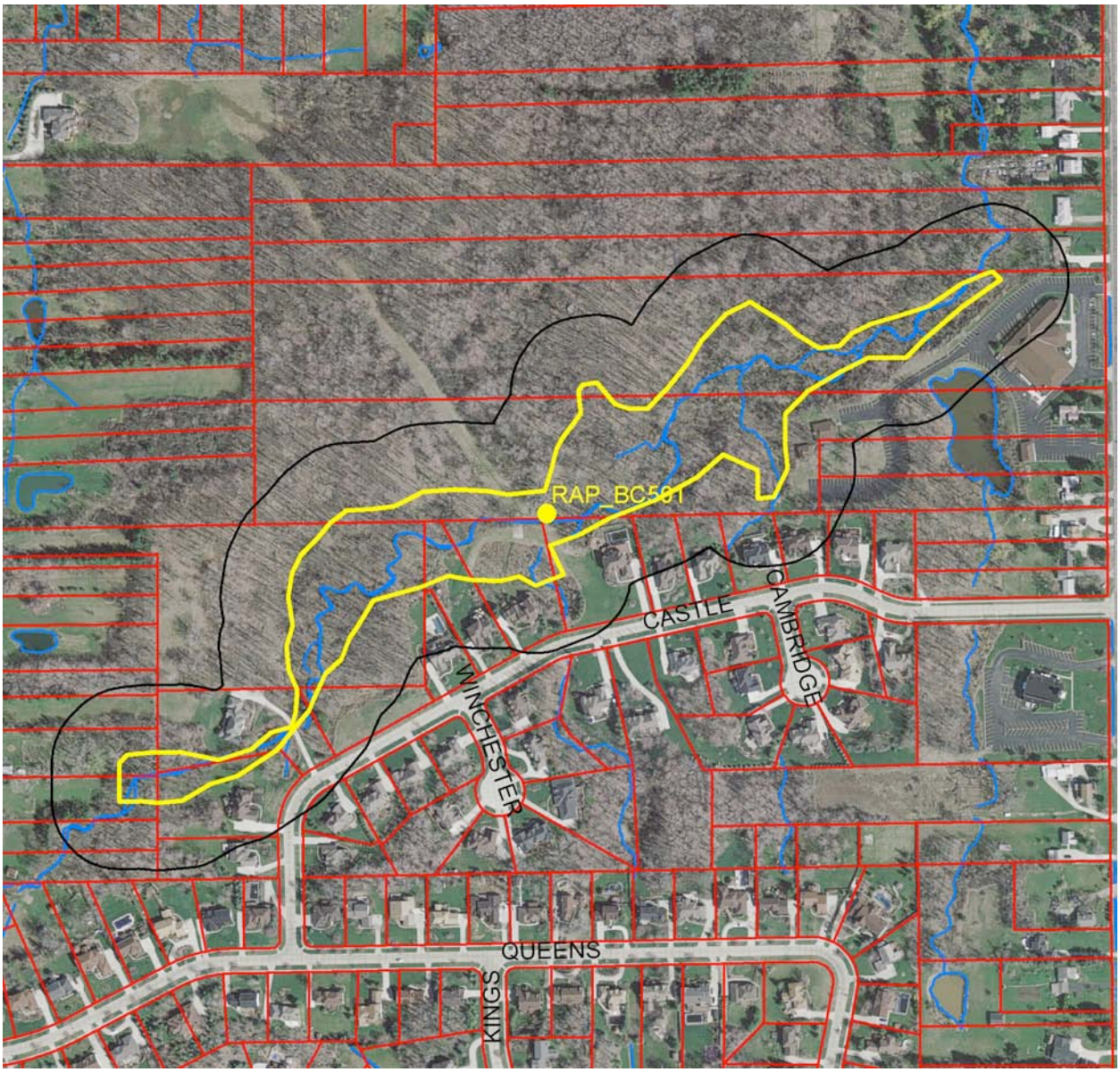
Wetland BC501 is a nice 9-acre forested and shrub/scrub wetland located in the headwaters of the Big Creek Watershed. Notable features include a headwater stream, forested buffer zone along the north perimeter and the connection with the riparian corridor and floodplain. Wetland BC501 is located in the city of North Royalton. Ownership complexity is relatively high with 12 parcels and approximately 12 property owners.

Wetland BC501 is most likely a moderate quality wetland. This is due to the urban nature of the watershed, the relatively light residential land use surrounding the site and the moderate quality forested buffer. Sources of water include precipitation, seasonal surface water and groundwater.

This site has been field visited in a 2003 RAP funded project. Field notes indicate new fill and adjacent land use (i.e. residential development) were impacts on-site. A future enhancement project should include, targeting the sparse amounts of invasive plants (Glossy Buckthorn, Narrow Leafed Cattail) and restoring the buffer zone along the southern perimeter. This site should also be targeted for conservation easements on the developed parcels.

Cost Estimate

Item	**Unit Cost**	**Unit**	**Cost**
Plans & Specification	$5,000	1	$5,000
Remove Invasive Plants	$220	1.4acres	$308
Seeding / Wetland Plantings	$5,000	1.4acres	$7,000
Riparian Planting/ Buffer Zone	$8,000	3acres	$24,000
Conservation Easement	$???	3.3acres	$???
TOTAL			**$36,308**



Big Creek Wetland Ranked #2: RAP_BC501 Scale: 1:5,000

Map Key

Yellow Lines -Wetland boundary
Yellow Points -Centroid point calculated from wetland polygon
Black Lines -Wetland 50m buffer
Blue Lines -Streams
Red Lines -Parcel boundary

Base Layer -Ohio 2006 orthophotos
Projection -Ohio State Plane North, NAD83

BIG CREEK WETLAND ID# RAP_BC529 **Ranked No. 3**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Forested Wetland (PFO)
Size (*acres*)	2.15
Wetland Buffer Condition	Moderate to High Quality
Impacts (*Field Assessments*)	None
Restoration Potential	Remove Invasive Plants Riparian/Wetland Planting
Ownership (*Public or Private*)	Public & Private
Number of Parcels	4 Parcels / 3 Property Owners
Cost Estimates	$9,330
Location (Lat/Long)	41.44888022871 / -81.730643155097
Community	Cleveland

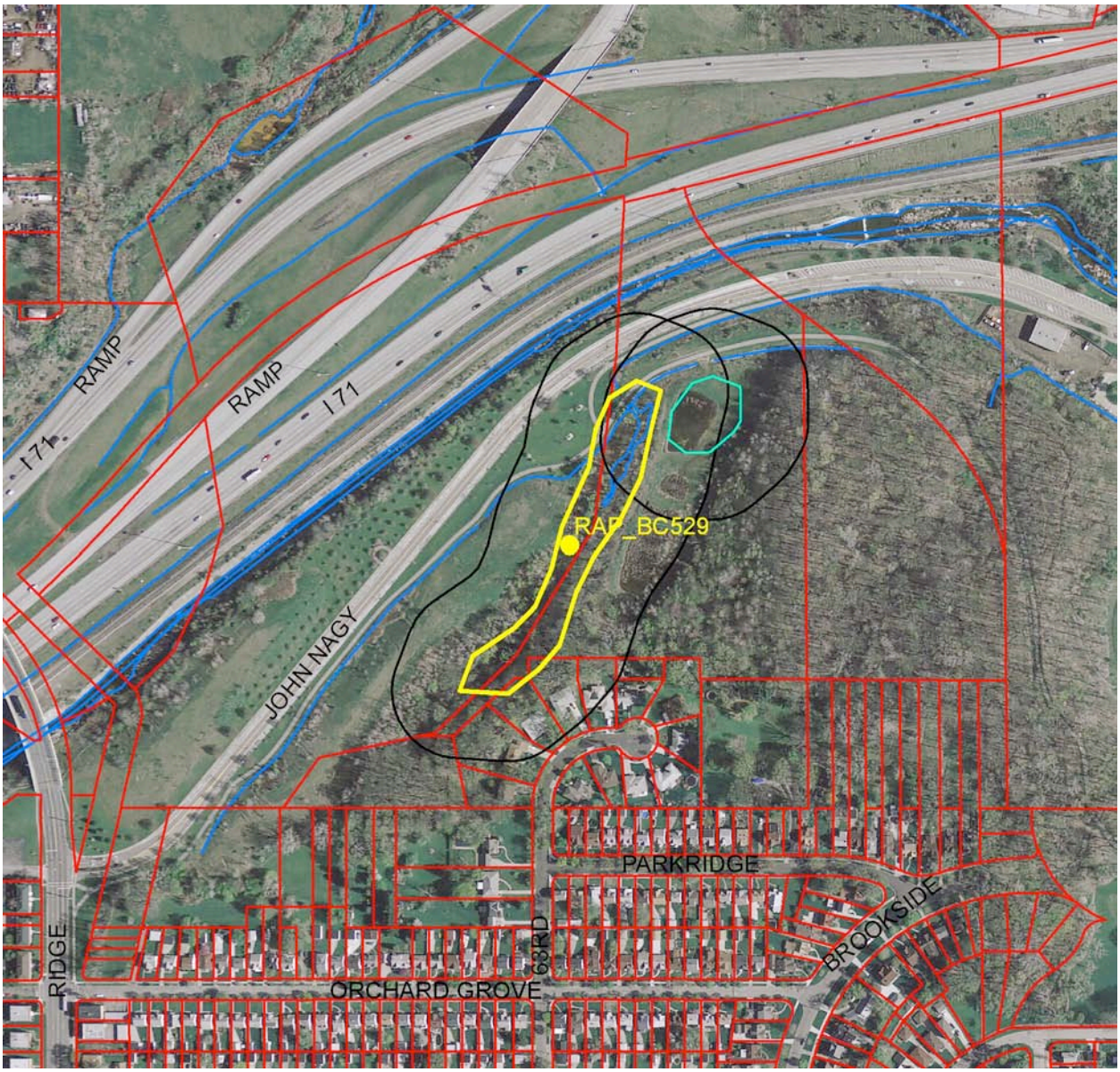
Wetland BC529 is a 2-acre forested wetland, dominated by Black Willow, along a tributary stream near the mainstem of Big Creek. Notable features include the connection with Big Creek and the riparian corridor, a neighboring wetland to the northeast, moderate quality forested buffer zone and the nearby Cleveland Metroparks' Brookside Reservation. Wetland BC529 is located in the city of Cleveland. Ownership complexity is relatively easy with 4 parcels and 3 property owners. City of Cleveland owns two of those parcels.

Wetland BC501 is most likely a moderately low quality wetland. This is due to the urban nature of the watershed, the altered tributary stream, potential runoff from upstream residential development and the moderate quality forested buffer. Sources of water feeding this wetland site include precipitation and surface water.

This site has been field visited in a 2003 RAP funded project. Field notes indicate no impacts to the wetland site. Future enhancement project should include removing invasive plants (Common Reed), which covers approximately 25% of the area, and adding riparian/wetland plantings. These plans should be made in cooperation with the city of Cleveland, other property owners and possibly Cleveland Metroparks. Equipment accessibility is easy.

Cost Estimate

Item	**Unit Cost**	**Unit**	**Cost**
Plans & Specification	$5,000	1	$5,000
Remove Invasive Plants	$660	0.5acres	$330
Riparian / Wetland Plantings	$8,000	0.5acres	$4,000
TOTAL			**$9,330**



Big Creek Wetland Ranked #3: RAP_BC529 Scale: 1:5,000

Map Key

Yellow Lines -Wetland boundary
Yellow Points -Centroid point calculated from wetland polygon
Black Lines -Wetland 50m buffer
Green Lines -Other wetlands
Blue Lines -Streams
Red Lines -Parcel boundary

Base Layer -Ohio 2006 orthophotos
Projection -Ohio State Plane North, NAD83

WETLAND ID# RAP_BC544 **No. 4**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Emergent Wetland (PEM)
Size (*acres*)	1.99
Wetland Buffer Condition	High Quality
Impacts (*Field Assessments*)	None
Restoration Potential	Remove Invasive Plants Seeding/Wetland Planting
Ownership (*Public or Private*)	Private
Number of Parcels	3 Parcels / 3 Property Owners
Cost Estimates	$10,094
Location (Lat/Long)	41.361832489482 / -81.740126096022
Community	Parma

Wetland BC 544 is a nice 1.99-acre emergent wetland along the upper reaches of the Big Creek Watershed. Notable features include the connection with the riparian corridor, three neighboring wetlands including BC546, high quality forested buffer zone and the tributary stream. Wetland BC544 is located in the city of Parma. Ownership complexity is relatively easy with 3 parcels and 3 property owners. One of the parcels covers nearly 80% of the site.

Wetland BC544 is most likely a moderately quality wetland. This is consideration of the urban nature of the watershed, high quality forested buffer and 50% coverage of invasive plant species. Sources of water feeding this wetland site include surface water.

This site has been field visited in a 2003 RAP funded project. Data indicates no habitat and water quality impacts to the wetland site. A noted plant on-site was the Green Ash. A future enhancement project should include targeting invasive plants (Reed Canary Grass) covering approximately 50% of the site and enhancing with seeding/wetland plantings. A conservation easement should be pursued on the developed parcels to help preserve any future enhancements. Equipment accessibility is medium.

Cost Estimate

Item	**Unit Cost**	**Unit**	**Cost**
Plans & Specification	$5,000	1	$5,000
Remove Invasive Plants	$660	0.9acres	$594
Seeding / Wetland Plantings	$5,000	0.9acres	$4,500
Conservation Easement	$??	1.99	$???
TOTAL			**$10,094**

Big Creek Wetland Ranked #4: RAP_BC544 Scale: 1:5,000
(Big Creek Wetland Ranked #19: RAP_BC546)

Map Key

Yellow Lines	-Wetland boundary
Yellow Points	-Centroid point calculated from wetland polygon
Black Lines	-Wetland 50m buffer
Green Lines	-Other wetlands
Blue Lines	-Streams
Red Lines	-Parcel boundary

Base Layer -Ohio 2006 orthophotos

Projection -Ohio State Plane North, NAD83

WETLAND ID# RAP_BC528 **No. 5**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Forested Wetland (PFO)
Size (*acres*)	2.05
Wetland Buffer Condition	Moderate Quality
Impacts (*Field Assessments*)	None
Restoration Potential	Stream Restoration Riparian Plantings
Ownership (*Public or Private*)	Public & Private
Number of Parcels	3 Parcels / 3 Property Owners
Cost Estimates	$372,600
Location (Lat/Long)	41.44424936687 / -81.739892552962
Community	Brooklyn

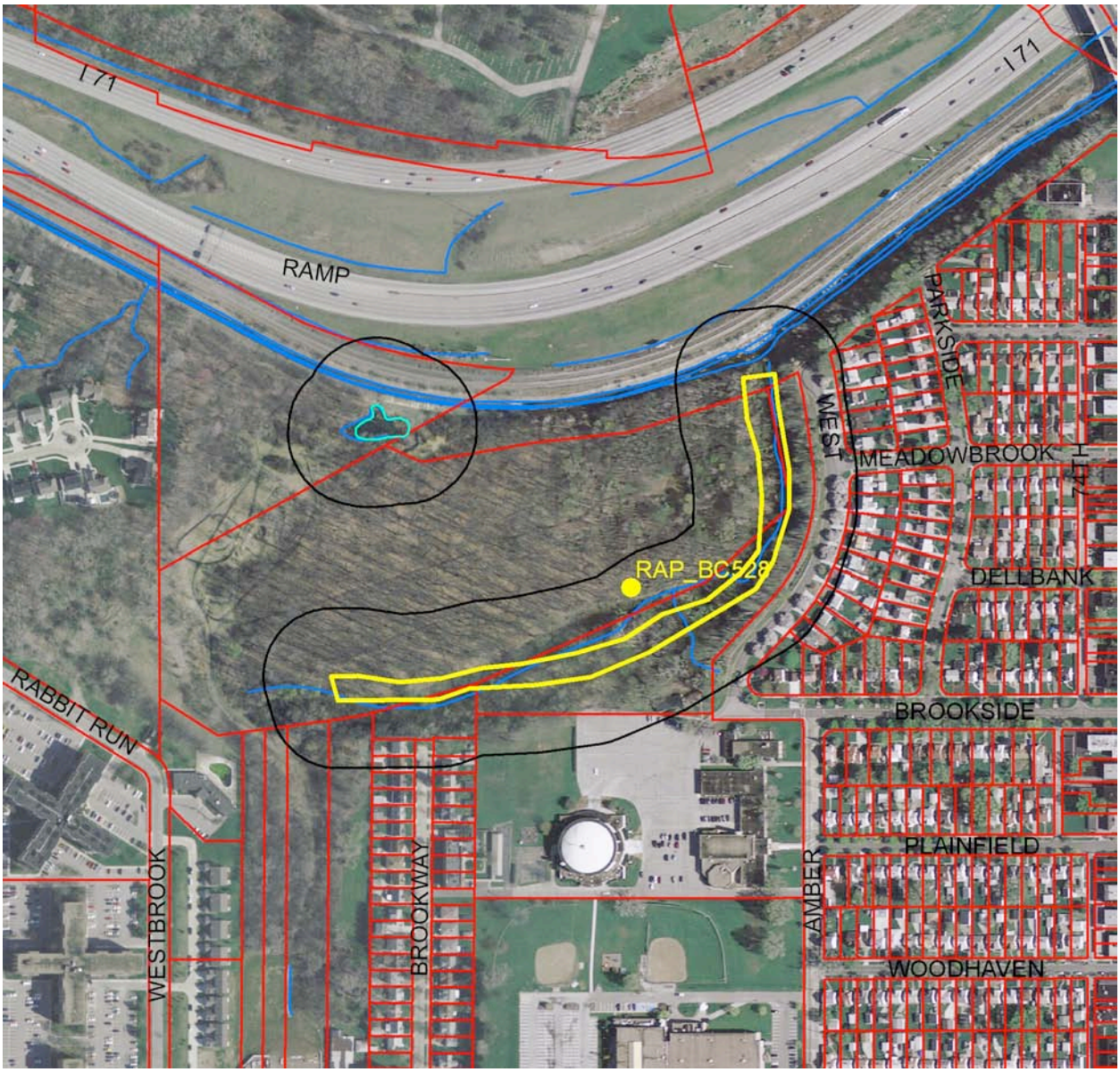
Wetland BC528 is a nice 2-acre forested wetland located along the lower reaches of the Big Creek Mainstem. The wetland is located in the area referred to as the "Oxbow Property". Notable features include a small neighboring wetland, the mainstem of Big Creek, the connection with the riparian corridor and floodplain and the oxbow, which is an abandoned meander in the river. This wetland is located in the city of Brooklyn. Ownership complexity is easy with 3 parcels and 3 property owners, in the city of Brooklyn owns 2 parcels.

Wetland BC528 is most likely a moderately to moderately low quality wetland. This is consideration of the urban nature of the watershed, residential land use intensity surrounding the site and the moderate quality forested buffer zone. Sources of water feeding this wetland site include seasonal surface water, precipitation and groundwater.

This site has been field visited in a 2003 RAP funded project. Field notes indicate no habitat and water quality impacts to the wetland site. A future conservation project should include preserving this site, possibly by purchasing parcel 431-21-001. Parcels 431-20-009 and 013-30-004 are owned by the city of Brooklyn. These parcels could be protected through and easement or other form of protection. A stream restoration will be needed to create a connection (inflow) with the mainstem of Big Creek. Discussions should begin with the city of Brooklyn considering they own majority of the site. This site would make an attractive project due to the close proximity of the Metroparks and the unique situation along the oxbow of lower Big Creek.

Cost Estimate

Item	**Unit Cost**	**Unit**	**Cost**
Plans & Specification	$5,000	1	$5,000
Mobilizing Equipment	$2,500		$2,500
Parcel 431-20-009	City property		
Parcel 013-30-004	City Property		
Purchase Parcel 431-21-001	Market Land Value		$4,100
Stream Restoration	$300/LF	1,150/LF	$345,000
Riparian Plantings	$8,000	2acres	$16,000
TOTAL			**$372,600**



Big Creek Wetland Ranked #5: RAP_BC528 Scale: 1:5,000

Map Key

Yellow Lines	-Wetland boundary
Yellow Points	-Centroid point calculated from wetland polygon
Black Lines	-Wetland 50m buffer
Green Lines	-Other wetlands
Blue Lines	-Streams
Red Lines	-Parcel boundary

Base Layer	-Ohio 2006 orthophotos
Projection	-Ohio State Plane North, NAD83

WETLAND ID# RAP_BC229 **No. 6**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Forested Wetland (PFO)
Size (*acres*)	1.16
Wetland Buffer Condition	High Quality
Impacts (*Field Assessments*)	Old Fill
Restoration Potential	Remove Invasive Plants Riparian/Wetland Plantings Wetland Expansion
Ownership (*Public or Private*)	Private
Number of Parcels	1 Parcel / 1 Property Owner
Cost Estimates	$73,737
Location (Lat/Long)	41.354784046663 / -81.730015992294
Community	Parma

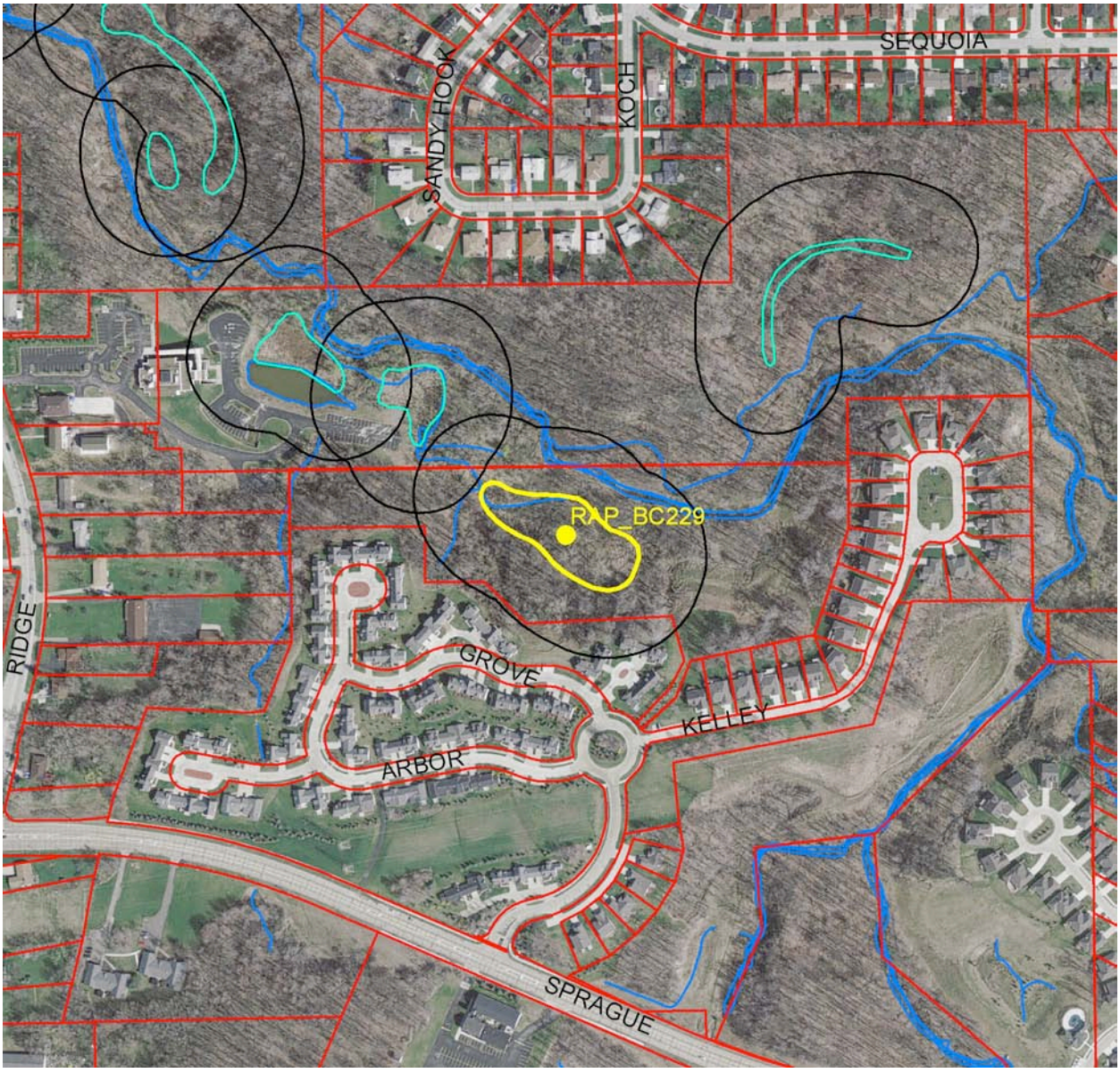
Wetland BC229 is a nice 1.16-acre forested wetland located in the upper reaches of the Big Creek Watershed. Notable features include the high quality forested buffer, numerous adjacent wetlands and the location along multiple tributary streams and related riparian corridors. Wetland BC229 is located in the city of Parma. Ownership complexity is easy with only one parcel and owner. Arbor Park Village Homeowners currently own this site.

Wetland BC229 is most likely a moderately quality wetland. This is consideration of the urban nature of the watershed, adjacent land use intensity and the high quality forested buffer zone. Sources of water feeding this wetland site include seasonal surface water and precipitation.

This site has been field visited in a 2003 RAP funded project. Field notes indicate the site was impacted from old fill, most likely resulting from the neighboring land use. However, no water quality impacts were noted. A plant noted on-site was the Green Ash. A future enhancement project should include targeting invasive plant species and enhancing with riparian/wetland plantings. Small areas of invasive plants cover the site, these include Reed Canary Grass and Buckthorn. Also, suitable hydric soils exist onsite to allow for a wetland expansion project (expand 3 acres). Discussion should begin the Village to discuss long-term management options, purchasing or a conservation easement.

Cost Estimate

Item	**Unit Cost**	**Unit**	**Cost**
Plans & Specification	$5,000	1	$5,000
Mobilize Equipment	$2,500		$2,500
Remove Invasive Plants	$220	0.17acres	$37
Riparian / Wetland Plantings	$8,000	3.17acres	$25,360
Onsite Excavation	$1.75CY	9,680CY	$16,940
Purchase Property 454-28-004	Land Market Value		$23,900
TOTAL			**$73,737**



Big Creek Wetland Ranked #6: RAP_BC229 Scale: 1:5,000

Map Key

Yellow Lines	-Wetland boundary
Yellow Points	-Centroid point calculated from wetland polygon
Black Lines	-Wetland 50m buffer
Green Lines	-Other wetlands
Blue Lines	-Streams
Red Lines	-Parcel boundary

Base Layer	-Ohio 2006 orthophotos
Projection	-Ohio State Plane North, NAD83

WETLAND ID# RAP_BC224 **No. 7**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Forested Wetland (PFO)
Size (*acres*)	1.46
Wetland Buffer Condition	High Quality
Impacts (*Field Assessments*)	N/A
Restoration Potential	Remove Invasive Plants* Riparian/Wetland Plantings* Wetland Expansion
Ownership (*Public or Private*)	Private
Number of Parcels	2 Parcels / 2 Property Owners
Cost Estimates	$1,416,158
Location (Lat/Long)	41.372992972344 / -81.721973172006
Community	Parma

* Extrapolated Restoration Potential

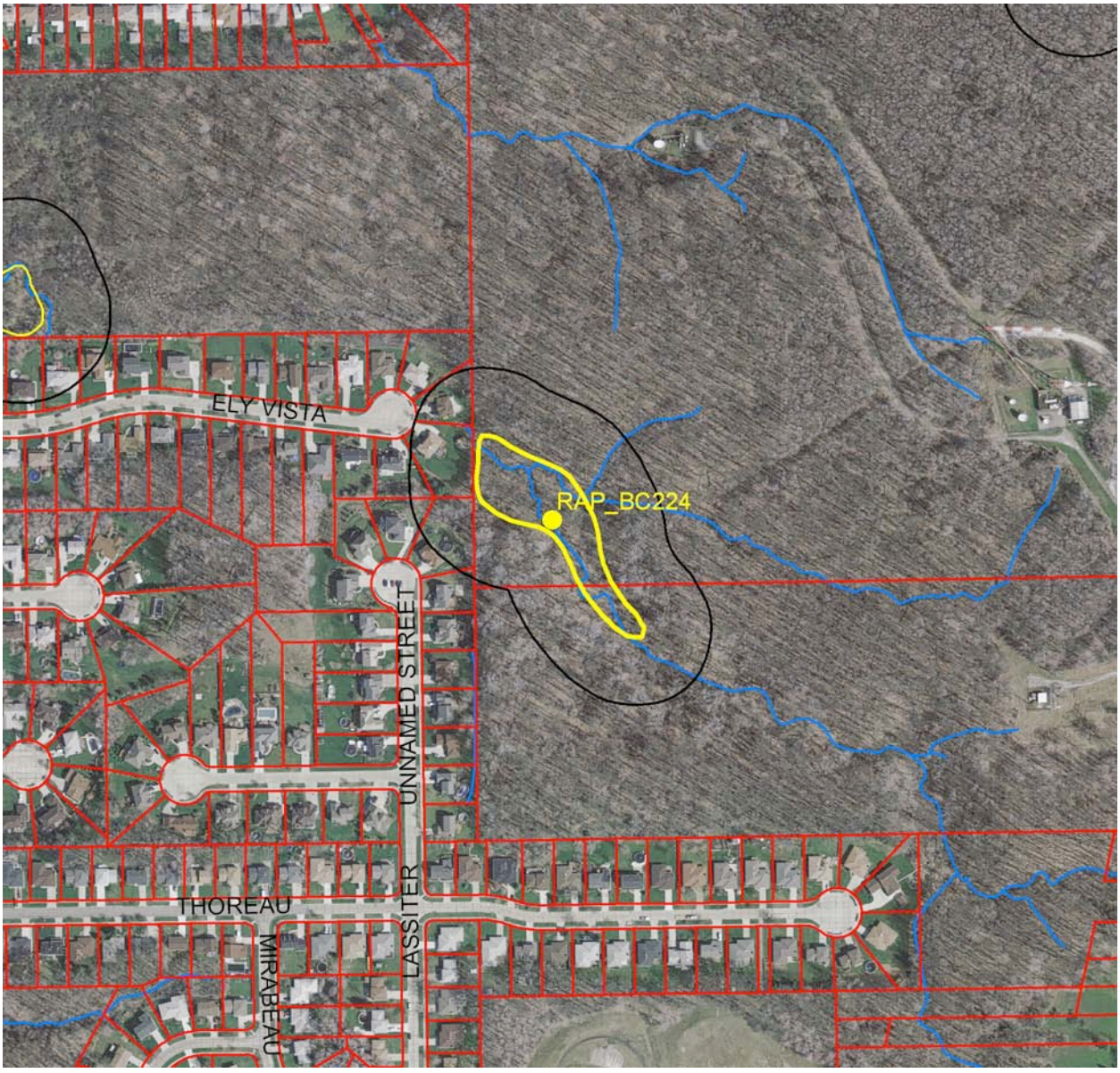
Wetland BC224 is a nice 1.46-acre forested wetland located on a tributary to Big Creek, just upstream from Stearns Farm Homestead. Notable features include a high quality forested buffer zone, the location along multiple tributaries and riparian corridors and this site is nearby both Stearns Farm and West Creek Preserve. Plans have been discussed to preserve this site as a greenway connector for both parks. Wetland BC224 is located in the city of Parma. Ownership complexity is fairly easy with 2 parcels and 2 property owners. Citicasters Co. and Scripps Howard Radio Inc. are the owners.

Wetland BC224 is most likely a moderate quality wetland. This is consideration of the urban nature of the watershed, relatively low land use intensity, the location along an altered tributary stream and high quality buffer zone.

Next steps include a more detailed site assessment of this wetland. The site assessment should include an ORAM and Penn State Stressor Checklist completed. This will help provide the location and extent of surrounding impacts, restoration potential and ultimately cost estimates. Preliminary cost estimates for this site are based on and extrapolated from previous wetland assessment projects. A future conservation project should include preserving this site through a conservation easement or purchasing the parcels. Invasive specie removal and enhancements with riparian/wetland plantings will be likely needed. Also, suitable hydric soils exist onsite to allow for a wetland expansion project (expand 3 acres)

Cost Estimate

Item		**Unit Cost**	**Unit**		**Cost**
Detailed Sight Assessment		$720	1		$720
Plans & Specification		$5,000	1		$5,000
Mobilize Equipment		$2,500			$2,500
Remove Invasive Plants	$660	0.3acres		$198	
Riparian / Wetland Plantings		$8,000	3.3acres		$26,400
Onsite Excavation		$1.75CY	9,680CY		$16,940
Parcel 450-26-002		Land Market Value			$836,300
Parcel 450-27-001		Land Market Value			$528,100
TOTAL					**$1,416,158**



Big Creek Wetland Ranked #7: RAP_BC224 Scale: 1:5,000

Map Key

Yellow Lines -Wetland boundary
Yellow Points -Centroid point calculated from wetland polygon
Black Lines -Wetland 50m buffer
Blue Lines -Streams
Red Lines -Parcel boundary

Base Layer -Ohio 2006 orthophotos
Projection -Ohio State Plane North, NAD83

WETLAND ID# RAP_BC9 **No. 8**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Forested Wetland (PFO)
Size (*acres*)	1.82
Wetland Buffer Condition	High Quality
Impacts (*Field Assessments*)	N/A
Restoration Potential	Remove Invasive Plants* Riparian/Wetland Plantings* Wetland Expansion
Ownership (*Public or Private*)	Private
Number of Parcels	3 Parcels / 3 Owners
Cost Estimates	$30,063
Location (Lat/Long)	41.376832375224 / -81.716885024115
Community	Parma

* Extrapolated Restoration Potential

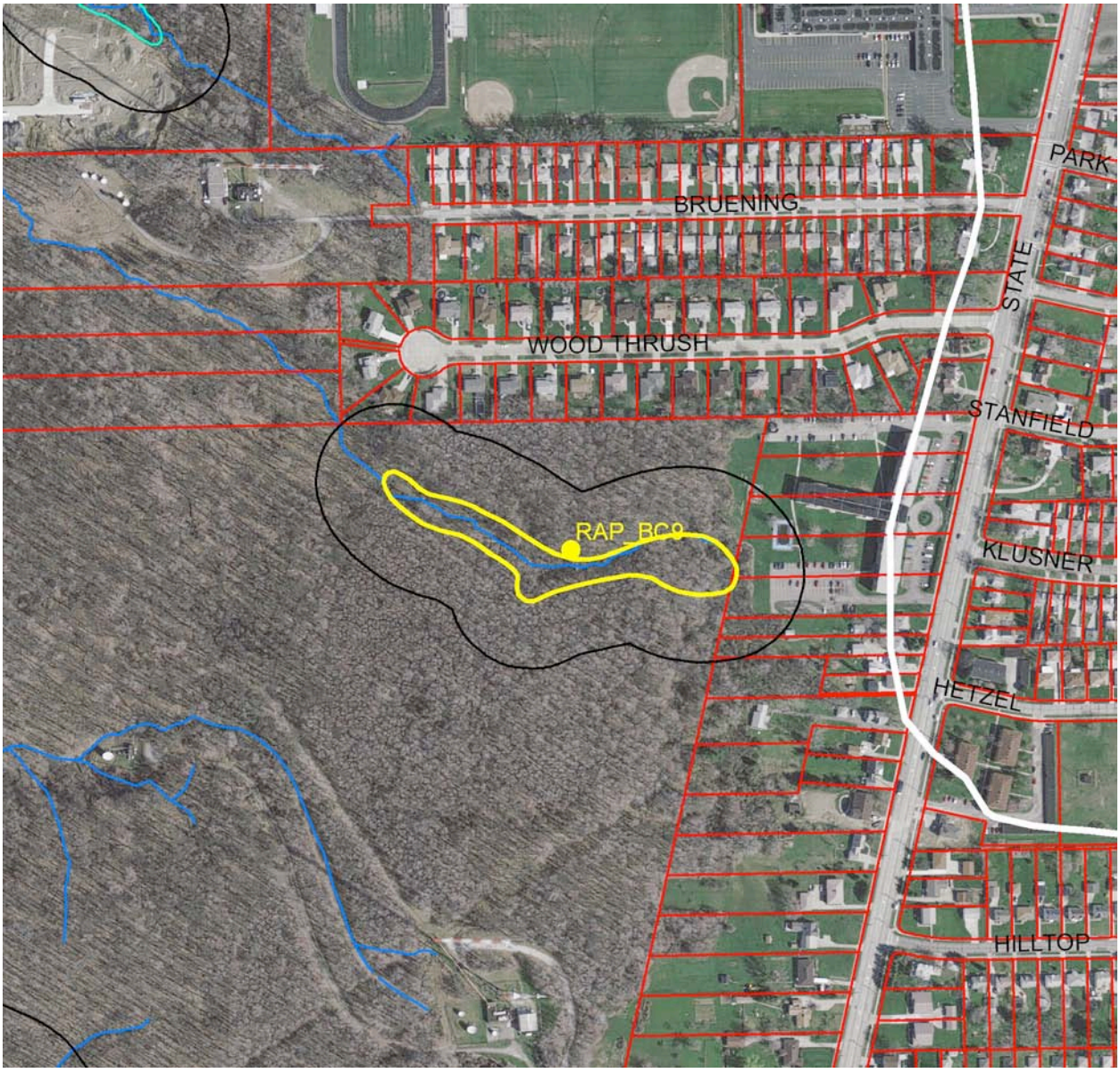
Wetland BC9 is a nice 1.82-acre forested wetland located on a tributary to Big Creek, just upstream from Stearns Farm Homestead. Notable features include a high quality forested buffer zone, location along a tributary stream and related riparian corridor this site is nearby both Stearns Farm and West Creek Preserve. Plans have been discussed to preserve this site and connect the two parks. Wetland BC9 is located in the city of Parma. Ownership complexity is fairly easy with 3 parcels and 3 property owners. Scripps Howard Radio Inc. is the major landowner.

Wetland BC9 is most likely a moderate quality wetland. This is consideration of the surrounding urban watershed and fairly low land use intensity, its location along an altered tributary stream and high quality buffer zone.

Next steps include a more detailed site assessment of this wetland. The site assessment should include an ORAM and Penn State Stressor Checklist completed. This will help provide the location and extent of surrounding impacts, restoration potential and ultimately cost estimates. Preliminary cost estimates for this site are based on and extrapolated from previous wetland assessment projects. A future conservation project should include preserving this site, which would help link the West Creek Preserve and Strearns Farm. Invasive specie removal and enhancements with riparian/wetland plantings will be likely needed. Buffer Plantings should also be targeted on the two homeowner properties. Also, suitable hydric soils exist onsite to allow for a wetland expansion project (expand 1 acre).

<u>Cost Estimate</u>

Item		**Unit Cost**	**Unit**		**Cost**
Detailed Sight Assessment		$720	1		$720
Plans & Specification		$5,000	1		$5,000
Mobilize Equipment		$2,500			$2,500
Remove Invasive Plants	$660		0.3acres	$198	
Riparian / Wetland Plantings		$8,000	2acres		$16,000
Onsite Excavation		$1.75CY	3,226CY		$5,645
Purchase Property# 450-26-002		Land Market Value			<u>$836,300</u> (not included in total- Calculated in BC224)
TOTAL					**$30,063**



Big Creek Wetland Ranked #8: RAP_BC9 Scale: 1:5,000

Map Key

Yellow Lines	-Wetland boundary
Yellow Points	-Centroid point calculated from wetland polygon
Black Lines	-Wetland 50m buffer
Green Lines	-Other wetlands
Blue Lines	-Streams
Red Lines	-Parcel boundary

Base Layer	-Ohio 2006 orthophotos
Projection	-Ohio State Plane North, NAD83

WETLAND ID# RAP_BC677 **No. 9**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Emergent & Forested Wetland (PEM) (PFO)
Size (*acres*)	1.29
Wetland Buffer Condition	Moderate Quality
Impacts (*Field Assessments*)	N/A
Restoration Potential	Remove Invasive Plants* Riparian/Wetland Plantings*
Ownership (*Public or Private*)	Private
Number of Parcels	1 Parcel / 1 Property Owner
Cost Estimates	$8,318
Location (Lat/Long)	41.422453410072 / -81.793402877907
Community	Cleveland

* Extrapolated Restoration Potential

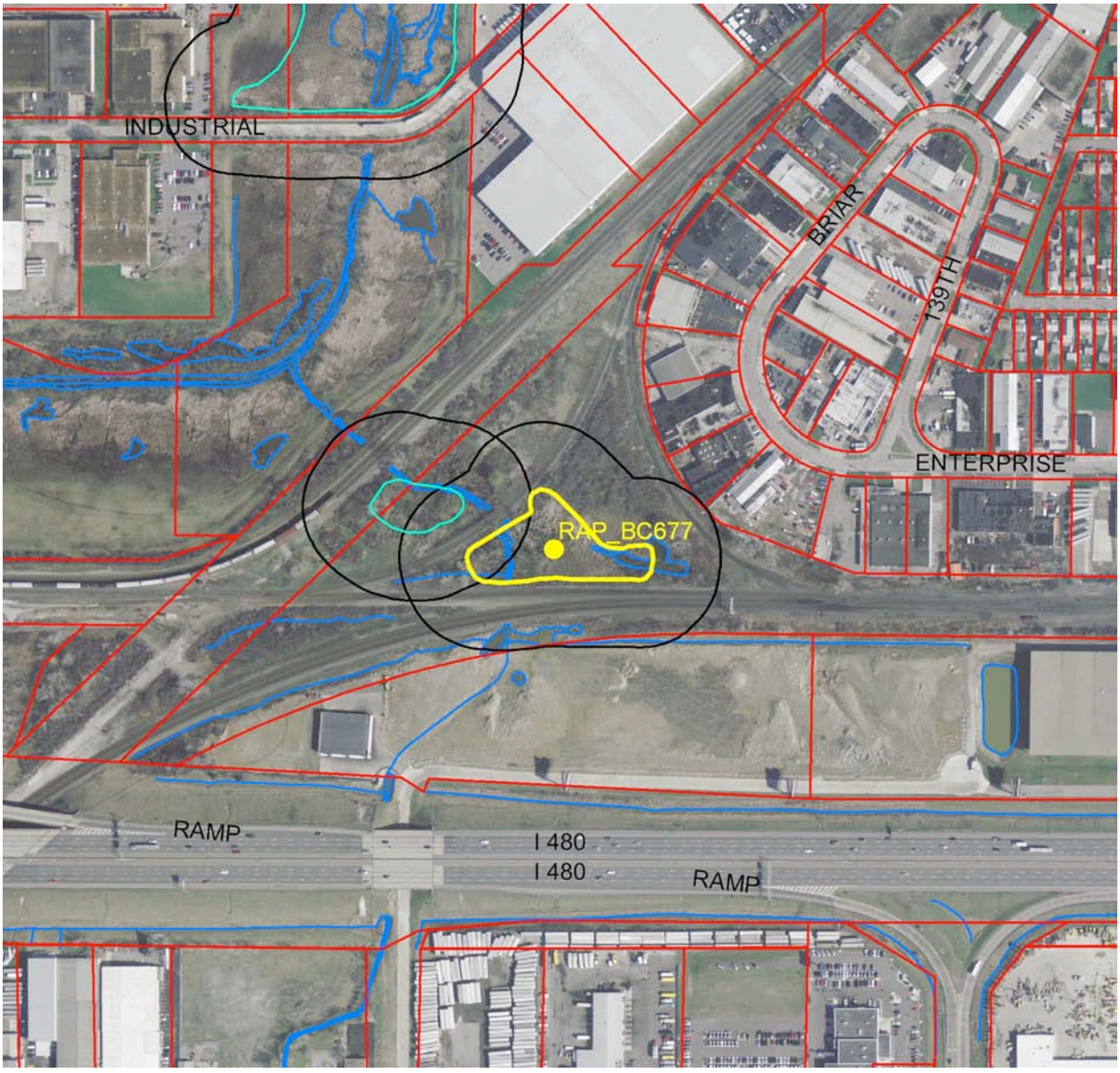
Wetland BC677 is a 1.29-acre emergent and forested wetland located near an industrial park on a tributary to the West Branch of Big Creek. Notable features include a neighboring wetland, a moderate quality forested buffer zone and the location along a tributary stream and related riparian corridor. Also notable is the Puritas stormwater basin located north of this site. Puritas basin is large birding habitat and has evolved into an urban wetland area. Wetland B677 is located in the city of Cleveland. Ownership complexity is fairly easy with 1 parcel and 1 property owners. Consolidated Rail Corp. is the landowner.

Wetland BC677 is most likely a moderate to moderately low quality wetland. This is consideration of the surrounding urban watershed, nearby industrial park and rail system and its location along an altered tributary stream. A sustainable restoration could be challenging in this area due to the intensity of land use.

Next steps include a more detailed site assessment of this wetland. The site assessment should include an ORAM and Penn State Stressor Checklist completed. This will help provide the location and extent of surrounding impacts, restoration potential and ultimately cost estimates. Preliminary cost estimates for this site are based on and extrapolated from previous wetland assessment projects. This site should be targeted for invasive plant removal and enhancements with seeding / wetland plantings.

Cost Estimate

Item	**Unit Cost**	**Unit**	**Cost**
Detailed Sight Assessment	$720	1	$720
Plans & Specification	$5,000	1	$5,000
Remove Invasive Plants	$660	0.3acres	$198
Seeding / Wetland Plantings	$5,000	0.3acres	$2,400
TOTAL			**$8,318**



Big Creek Wetland Ranked #9: RAP_BC677 Scale: 1:5,000

Map Key

Yellow Lines	-Wetland boundary
Yellow Points	-Centroid point calculated from wetland polygon
Black Lines	-Wetland 50m buffer
Green Lines	-Other wetlands
Blue Lines	-Streams
Red Lines	-Parcel boundary

Base Layer	-Ohio 2006 orthophotos
Projection	-Ohio State Plane North, NAD83

WETLAND ID# RAP_BC521 **No. 10**	
Site Description	
Wetland Classification (*Hydrogeomorphic or Corwardin*)	Palustrine Emergent Wetland (PEM)
Size (*acres*)	3.37
Wetland Buffer Condition	Low Quality
Impacts (*Field Assessments*)	Old & New Fill Adjacent Land Use Drainage Ditch
Restoration Potential	Remove Invasive Plants Seeding/Wetland Planting
Ownership (*Public or Private*)	Public
Number of Parcels	1 Parcel / 1 Property Owner
Cost Estimates	$23,960
Location (Lat/Long)	41.430260643306 / -81.792454232715
Community	Cleveland

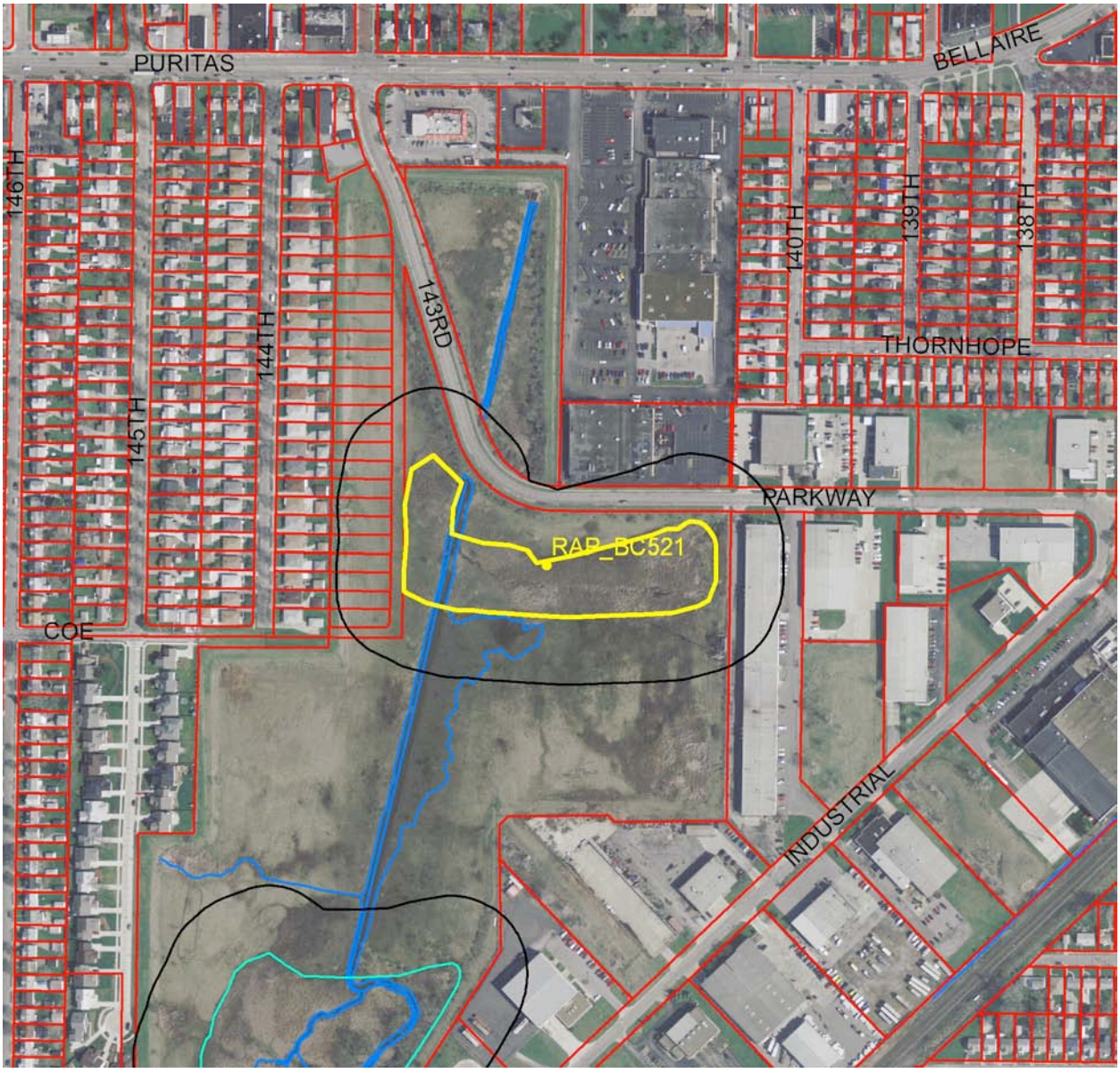
Wetland BC521 is a 3-acre emergent wetland located in what is a large detention basin of the West Branch of the Big Creek Watershed. Notable features include its location within the Puritas stormwater basin. This basin, over the years, has turned into a large wetland habitat in the middle of an industrial park. This site has also been noted by the Museum of Natural History as a great birding habitat. In addition, a small wetland enhancement project occurred in the spring of 2008 just to the south in the same detention basin. Wetland BC521 is located in the city of Cleveland. Ownership complexity is easy with only one parcel and owner. City of Cleveland Water Pollution Control is the landowner.

Wetland BC521 is most likely a low to moderate quality wetland. This is consideration of the urban nature of the watershed, adjacent land use intensity and this site receives runoff directly from I-480. Sources of water feeding this wetland site include seasonal surface water, precipitation and one or more storm drains.

This site has been field visited in a 2003 RAP funded project. Data indicates the site was impacted from old and new fill, adjacent landuse and a concrete drainage ditch flows through the site. Invasive species is a big problem not only at this site but the entire detention basin. Wetland BC521 is has approximately 90% coverage of narrow leaved cattail. An invasive species removal project should target this site and the rest of the basin, along with enhancements of seeding/wetland plantings. Costs will be approximated just for site BC521.

Cost Estimate

Item	**Unit Cost**	**Unit**	**Cost**
Plans & Specification	$5,000	1	$5,000
Remove Invasive Plants	$1,320	3acres	$3,960
Seeding / Wetland Plantings	$5,000	3acres	$15,000
TOTAL			**$23,960**



Big Creek Wetland Ranked #10: RAP_BC521 Scale: 1:5,000

Map Key

Yellow Lines -Wetland boundary
Yellow Points -Centroid point calculated from wetland polygon
Black Lines -Wetland 50m buffer
Green Lines -Other wetlands
Blue Lines -Streams
Red Lines -Parcel boundary

Base Layer -Ohio 2006 orthophotos
Projection -Ohio State Plane North, NAD83

Appendix C
Big Creek Watershed Action Plan - 319 Appendix 8 elements and GAP List

During the development of this watershed plan for Big Creek, FOBC and RAP/CRCPO have determined that it would be very hard to qualify Big Creek or the Plan as a State Endorsed 319 Watershed Plan for any 319 restoration funding.

The original project grant application was based on the Mill Creek and Euclid Creek efforts, and was prepared when the Ohio Lake Erie Commission Balanced Growth Initiative was in its pilot stage. The Big Creek project team was advised during a review of the Mill Creek Plan (for which RAP/CRCPO provided substantial support to the Cuyahoga County Board of Health) that it would not qualify for 319 funding support. The Team was further advised that the already approved Euclid Creek Plan would not qualify for approval under the current 319 guidelines. This led to a deliberate decision by FOBC to morph the Big Creek effort into a Balanced Growth Initiative Watershed Plan.

Big Creek is so urbanized that it borders on being slightly better than an open storm drain and does not fit well with 319 style plans that focus on water quality improvements from non-point sources. There is little, if any, feasibility to significantly reduce urbanized stream discharge – the fire hose effect – which dominates watershed issues for Big Creek.

There is a paucity of relevant data for actionable water quality stewardship. RAP/CRCPO had much more data available for Mill Creek than for Big Creek. Further, nothing we have found, and which is presented below, changes the watershed management strategy to promote Watershed Stewardship under the aegis of the Ohio Lake Erie Commission Balance Growth Initiative.

CRCPO has developed very useful BGI model for watershed planning and management, especially useful for urban streams; and which fits closely to RAP Strategic Delisting Objectives. Since the State's approval of the Chippewa BGI plan CRCPO has also completed Phase I of a BGI plan for Brandywine Creek. We are also well underway on a BGI plan for Furnace Run. The project team - FOBC and RAP- believe the Big Creek Plan will function well as a BGI plan and serve the interests of the watershed, the local watershed communities and the RAP restoration goals.

Going forward, FOBC may choose to pursue funding eligibility under the EPA 319 program.
In order to establish eligibility a State Qualified 319 Plan will have to be produced.

Below is a discussion of the "319 Appendix 8" items in this BGI Plan; the Elements are discussed and gaps noted:

Table of Contents for a 319 Qualified Big Watershed Action Plan
The Table of Contents for a 319 Qualified Big Watershed Action Plan will need to include the following major elements:

Introduction

1. Watershed Plan Development
2. Watershed Inventory
3. Water Resource Quality
4. Watershed Impairments
5. Big Creek Watershed Protection and Restoration Goals
    a. Problem Statement-
    b. Purpose of the Big Creek Watershed Plan-
    c. Implementation Goals –
    d. Timetable-

e. Performance Indicators –
f. Education and Outreach -
g. Funding-

6. Evaluating Plan Progress
7. Ohio Coastal Zone Management Plan Benefits

1. Watershed Plan Development

Watershed Group / Mission / Governance -
It is an ongoing RAP strategic goal to incubate functional trib-based watershed organizations to facilitate stewardship and plan implementation at the local level. CRCPO helped to incubate the Friends of Big Creek (FOBC) as a stakeholder committee. During the course of the plan development Friends of Big Creek matured into a 501(c) 3 NGO for the purpose of supporting implementation of the plan.
This is important to CRCPO as FOBC will be the implementing mechanism for the Watershed Plan in close cooperation with the local communities.

FOBC plan development has been by consensus led by the chair of FOBC. Community endorsement and participation in remedial actions requires the public vote by the Community governing body.

Friends of Big Creek's mission is "to conserve, enhance, and bring recognition to the natural and historic resources of the Big Creek Watershed and develop a recreational trail network that joins these resources to each other and the community. FOBC shall advocate, develop, and execute programs and activities incidental to the foregoing."

The organization's Bylaws, adopted on December 5, 2007, call for "a Steering Committee of voting, dues-paying members, a non-voting Advisory Committee, and a non-voting General Body of dues-paying members. All classes of membership shall be entitled to full participation in all functions and discussions, with the only distinction being that only Steering Committee members shall vote on matters before FOBC."

Four Standing Committees, "consider matters which exist continually.
Greenway and Trails: works to establish and expand a network of recreational trails and public spaces that join watershed amenities to neighborhoods, adjoining communities, and regional attractions.

Watershed Stewardship: promotes, plans, and implements conservation and restorationbased activities throughout the watershed; fosters environmentally sensitive development of the landscape.

Education and Outreach: raises awareness of and encourages public/private involvement in FOBC, its activities, and the watershed; supports publicity and membership activities, presentations, heritage tours, nature walks, newsletter, brochure development, displays.

Finance and Development: works to expand membership and donor base in public and corporate sectors; prepares grant applications in conjunction with an initiating committee or on its own initiative; organizes fund raising activities."

Friends of Big Creek STEERING COMMITTEE
Mary Ellen Stasek, Chair

Jeffrey Lennartz, Vice-Chair
Diana Slobodian, Treasurer
Bob Gardin, Project Manager
Thomas Coyne
Greg Cznadel

Friends of Big Creek STEERING COMMITTEE (continued)

James A. Gazda
Kim Knall
Ann M. Kuula
Donald C. Martin
David McBean, RLA
Alfred Penko, P.E.
Dennis Petro
Jim Wohl

Friends of Big Creek ADVISORY COMMITTEE
Gayle Albers, Conservation Coordinator, Cleveland Metroparks Zoo
Regis Barrett, Chair, City of Brooklyn Zoning Board of Appeals
Sean Brennan Parma City Council - Ward 2
George Cantor, Senior Planner, Cleveland City Planning
Brian J. Cummins, Cleveland City Council - Ward 15
Mary Galinas, Parma City Council - Ward 1
Kevin Kelley, Cleveland City Council - Ward 16
David Lincheck, Director, West Creek Preservation Committee
James McCall, Parma Heights City Council
Melissa Miller, Planning and Safety Coordinator, Bellaire-Puritas Development Corporation

Kathleen Pucci, Brooklyn City Council
Carla Regener, Associate Senior Planner, Cuyahoga County Planning Commission
Janine Rybka, District Administrator, Cuyahoga Soil and Water Conservation District
Lester Stumpe, Manager of Watershed Programs, Northeast Ohio Regional Sewer District
Laura Travers, Sanitarian, Cuyahoga County Board of Health
Andy Vidra, Senior Environmental Planner, Northeast Ohio Areawide Coordinating Agency
Jim White, Executive Director, Cuyahoga River Remedial Action Plan

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2. Watershed Inventory

The majority of the watershed inventory items listed in “Appendix 8” has been included in this Balanced Growth Watershed Plan. However, due to the extensive urbanization of the watershed, much of the other information is not relevant to this plan.

Due to the historic and extensive urbanization of this watershed, a modified inventory pertaining to natural stream conditions was assembled.

For the purposes of this plan, landforms and land cover were inventoried and analyzed as part of the process for selecting Priority Conservation, Priority Development and Priority Redevelopment Areas. A discussion of this is contained on pages 19, 7 21-41.

a. Description of the watershed - see page 5-6 for general description of the watershed
   i. Geology –Topography & Soils – Topography on page 10; Soils on pages 5, 9, 23-25; Steep Slopes on pages 9, 26
   ii. Biological Features – use attainment and IBI discussed on pages 6, 16-17
   iii. Water resources
      a. Climate and Precipitation

Big Creek Watershed has the same climate and weather as the City of Cleveland and Cleveland International Airport. Therefore the following climate and weather description would also be valid for the Big Creek Watershed.

> *"Cleveland features a continental climate and is typical of Ohio weather. Standing alongside Lake Erie, the weather in Cleveland is moderated by this vast expanse of water, keeping the winters fairly mild at times.*

The summer climate in Cleveland can be hot, although rarely excessively humid, feeling pleasant on even the sunniest of days. Between June and September, temperatures average 25°C / 77°F or more, exceeding 30°C / 86°F during the hottest weather. The average annual daytime temperatures in Cleveland are around 15°C / 59°F.

Cleveland Climate Description: Continental climate
Cleveland Hopkins Airport (CLE) Location: Northern Hemisphere, USA, Ohio
Annual High / Low Daytime Temperatures at Cleveland: 28°C / 0°C (82°F / 32°F)
Average Daily January Temperature at Cleveland Airport (CLE): 0ºC / 32ºF
Average Daily June Temperature at Cleveland Airport (CLE): 26ºC / 79ºF
Annual Rainfall / Precipitation Cleveland at Airport (CLE): 941 mm / 37 inches" .
Source: www.cleveland-cle.airports-guides.com/cle_climate.html

b. Surface Water
   1. Wetlands – see pages 29-31 & Appendix A: Big Creek Watershed Wetlands Analysis 2008 & 2 additional projects CRCPO, 2008 & Fennessey, 2007.
   2. Subwatershed & Streams – Subwatersheds on page 7; Streams page 27, 34
   3. Groundwater & DRASTIC maps (groundwater pollution potential)
      -available, but determined not relevant due to the urban nature of the watershed

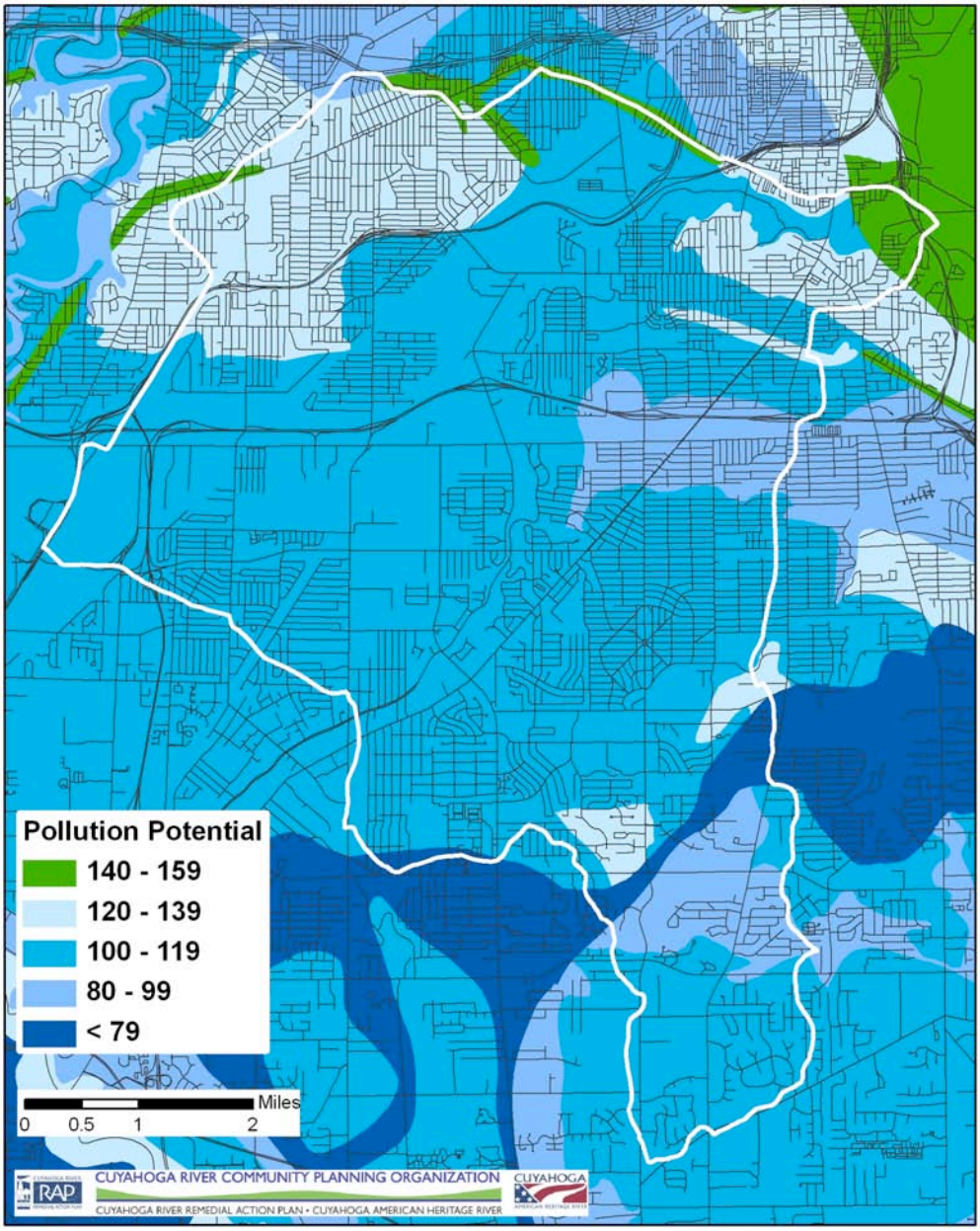
Ground Water - There is no reliance on groundwater within the watershed; the entire watershed is served by the City of Cleveland municipal water supply from Lake Erie.

Aquifers (location, recharge rates, uses) Due to the extensive amount of impervious cover within the watershed, there is very little recharge of aquifers.

Flow regime Due to the extensive amount of impervious cover, the flow regime is "flashy" – stormwater enters the stream system directly and is quickly conveyed downstream, causing numerous out of bank events.

DRASTIC maps- groundwater pollution potential The groundwater pollution potential is very low since stormwater remains on the surface and runs off into surface water bodies. Overall DRASTIC map categories range from , 79 to > 200, the range for the Big Creek Watershed is from 40 to 145.

See map below.



iv. Land Use/Land Cover pages 19-20

1. Land cover description (with percentages by subwatershed*)
   Several sources (NOAA, OEPA) exist for land cover data, however due to the extensive urbanization of the watershed, quantification of the imperviousness of the watershed is more meaningful for the purpose of this plan. See pages 12-15.

2. Status and Trends –RIDE Study, Section 4, Table 4.1
   -watershed is fully developed & fully impacted

v. Cultural Resources

Protected Land – Parklands see page 36.

vi. Previous and Complementary Efforts (Project / Reports)

Cuyahoga River Community Planning Organization, 2008. ***Prioritizing Wetland Restoration Potential in the Tributaries of the Cuyahoga River Area of Concern (AOC)***

The goal of this project is to identify the "top wetland sites" in each tributary watershed of the Cuyahoga River AOC. This project will help expedite and focus efforts to meet mitigation needs, as well as make the best use of other public or private funding sources.

Cuyahoga River Remedial Action Plan, 2001. ***State of Big Creek Report***

The purpose of this report was to provide an update on stewardship and outreach efforts within the Big Creek Watershed.

Fennessy, M. S., J. J. Mack, E. Deimeke, M. T. Sullivan, J. Bishop, M. Cohen, M. Micacchion and M. Knapp, 2007. ***Assessment of wetlands in the Cuyahoga River watershed of northeast Ohio. Ohio EPA Technical*** Report WET/2007-4. Ohio Environmental Protection Agency, Division of Surface Water, Wetland Ecology Group, Columbus, Ohio.

The goal was to assess wetlands using the Ohio Rapid Assessment Method (ORAM) to determine their ecological condition and report on how ecological condition changes as surrounding land-use changes (urban, agricultural, natural). Sample sites were randomly selected using wetlands mapped by the Ohio Wetland Inventory.

Floyd Browne Group, 2009. ***Big Creek Greenway Trail Alignment & Neighborhood Connector Plan***

The purpose of this study was "to develop a greenway and trail system that protects community natural resources and provides connections among communities. The Big Creek Greenway Trail Alignment & Neighborhood Connector Study completes the prior efforts by assessing the feasibility of developing a system of trails and preservation areas for the City of Brooklyn."

Floyd Browne Group, 2008. Lower ***Big Creek Greenway Redevelopment & Restoration Plan***

This plan "builds on previous efforts by blending the best concepts of each study with new ideas developed by the planning team to create a new vision for the Lower Big Creek Greenway. The creation of this vision incorporates detailed future land use, public access, infrastructure, ecological restoration and environmental regeneration, open space and trail linkages and economic development concepts."

Northeast Ohio Areawide Coordinating Agency, 2002. ***Lower Big Creek Study - Phase I Report***

The purpose of this study was *"to plan for and implement long and short-term actions and policies to stabilize and improve physically and environmentally sensitive natural areas in the study area with the intention of eventually connecting the Cleveland Metroparks Zoo with the Canal Towpath".*

Northeast Ohio Regional Sewer District. ***DRAFT Regional Intercommunity Community Drainage Evaluation (R.I.D.E) Study***

This DRAFT report presents a comprehensive management plan for intercommunity drainage within the Big Creek Watershed. The RIDE Study evaluated Big Creek and its major tributaries at a watershed scale.

Northeast Ohio Regional Sewer District, 1999. ***Regional Plan for Sewerage and Drainage - Phase I Study***

The purpose of this study was to collect and organize existing data related to storm water problems. The study was designed to identify: existing regional storm water drainage network, current watershed problems, legal and regulatory issues, funding options, community awareness and concerns regarding storm water regulations and management.

Northeast Ohio Regional Sewer District, 1999-2002 & 1987-1998. ***Greater Cleveland Area Environmental Water Quality Assessment.***

Reports document water quality status and improvements due to NEORSD facilities; determine sources of environmental disruption and recommendations; provide a scientifically sound current information basis for environmental planning and future abatement projects.

Ohio Environmental Protection Agency, Division of Surface Water, 2003. ***Total Maximum Daily Loads for the Lower Cuyahoga River***

This report covers the Lower Cuyahoga River Watershed, from Akron north to Cleveland, which includes the Big Creek Watershed.

"The Total Maximum Daily Load (TMDL) program, established under Section 303(d) of the Clean Water Act (33 U.S.C. 1313), focuses on identifying and restoring polluted rivers, streams, lakes and other surface water bodies. A TMDL is a written, quantitative assessment of water quality problems in a water body and contributing sources of pollution. It specifies the amount a pollutant needs to be reduced to meet water quality standards (WQS), allocates pollutant load reductions, and provides the basis for taking actions needed to restore a water body."

URS Corporation, 2000. ***Flood Relief Options for the Cleveland Metroparks Zoo.***

"The goal of this study was to evaluate options to maximize flood protection for the Zoo, minimize loss of Zoo land for flood control purposes, evaluate stream restoration options, perform flood modeling to verify flood elevations, and identify flood prone locations and areas to avoid for future Zoo development."

ii. Physical attributes of streams and floodplain areas that support habitat, recreation, water quality.

The Stream is highly channelized, especially in the lower reaches where it was at one time a concrete trough and there are no natural floodplains. There is a flood zone in the lower reaches. In the upper watershed the stream is highly entrenched.

Vegetated riparian corridor -minimal amounts and only exists in parks and a few unprotected upper reaches.

Dams -flow alteration structure in the lower portion of the watershed

Eroding banks –Because of the narrow stream channel and high peak discharge volumes the stream has endured historic bank erosion. As urban land uses encroached on the filled flood plains significant sections of the stream's banks have been lined with a variety of armoring devices. While this has reduced erosion and bank failures it also serves to compound the volume and energy of water which the stream discharges. Many of the retrofit sites and devices are intended to reduce the effects from Stream channelization.

Status and Trends – see pages 16-17; suitable habitat is the limiting factor; extensive urbanization has encroached upon the riparian corridor leaving no room for the stream to meander, no floodplains and since the water enters and moves through the stream rapidly after a storm there is very little instream habitat.

3. Water Resource Quality

(to meet the requirements of the Clean Water Act, lakes, streams and wetlands must be included in this assessment)

a. Use designations/use attainment see pages 6, 16-17
   i. Number of water-body miles in full, partial, non-attainment (see TMDL)
   ii. Number of streams designated but not monitored - unknown
   iii. Wetlands/quality **-** – see pages 29-31 & Appendix A: Big Creek Watershed Wetlands Analysis 2008 & 2 additional projects CRCPO, 2008 & Fennessey, 2007.
   iv. Groundwater/quality (N/A)

b. Causes and sources of impairment or threats 305(b) 303 (d)

c. Point sources (by subwatershed or stream segment)
   i. Permitted discharges (NPDES) – available from Ohio EPA
   ii. Spills and illicit discharges – available from Ohio EPA

d. Non point sources (by subwatershed or stream segment)
   i. Inventory of home sewage treatment systems, and a projected number of failing systems - N/A
   ii. Number of new homes being built. - N/A
   iii. Acres of Highly Erodible Land and potential soil loss. These areas were identified on page 25 and protection of the most and areas identified as "highly erodible land" are included as Critical Soils in need of protection.
   iv. Culverted streams – numerous culverts exist in the Big Creek Watershed streams – those on the mainstems were identified for the NEORSD RIDE Study. Bu t due to the highly urbanized nature of the watershed their locations are not relevant for the BGI plan.

e. Status and trends

"Big Creek (Confluence RM 7.2)

The results of the three sites monitored on Big Creek in 1996 (RMs 7.8, 3.1 and 0.2) indicated no Ohio WQS criteria exceedences excepting numerous violations of the Primary Contact Recreation criterion for Fecal Coliform bacteria. Predominant sources of impairment include CSOs, sanitary sewer overflows (SSOs), and urban runoff. NEORSD and Ohio EPA personnel have responded to numerous reports of sanitary discharges into Big Creek. Many of these were illegal tie-ins to storm sewers that were easily remediated, while other problems such as blockages or breaks have become more frequent. Many problems seem to stem from Parma and other areas in the Stickney Creek watershed (confluence RM 4.91).

Though warmwater habitat attributes were more prevalent than modified attributes, macrohabitats at the three sites evaluated in Big Creek were marginally suited to supporting warmwater stream faunas owing to storm water and urban runoff. Flashy scouring flows denuded the channel of natural cover, leaving behind fractured shale bedrock and artificial substrates (concrete and bricks) as the principle cover type. Riffles were embedded with silt and pulverized bedrock.

Effects of urban runoff were most manifest at the mouth, where the channel was braided with small gravel and pulverized shale. Because of the erodible nature of the parent shale bedrock, the channel was generally well developed and sinuous, especially at the most upstream site, and recovered free flowing character within the confines of revetments.

The fish communities lacked sensitive species, darters, insectivores and simple lithophils, implying habitat limitation and Stoneroller minnows dominated the catch at all sites. This combination of community attributes reflects habitat impacts, organic and nutrient enrichment related to urban storm water and CSOs. Community performance improved in 1996 when compared to the grossly polluted conditions observed in 1984. Compared to 1991 sampling, conditions near the mouth in 1996 (poor) were similar between surveys. Big Creek was not sampled in 2000 but the Cuyahoga River showed substantial improvement immediately downstream from the confluence. The results suggest an improving trend in Big Creek following CSO remediation projects conducted after 1996.

Big Creek Tributaries

Ford Branch Big Creek (Confluence RM 3.95)

This tributary to Big Creek receives the effluent from the Ford engine plant. The stream has been modified throughout its length and the majority of the stream is culverted and impacted by urban land use. Elevated metals in sediments compared to Ohio EPA least impacted reference sites were documented in 1996." (pages 21-22, Ohio EPA's 2003, Lower Cuyahoga River TMDL Report)

4. Watershed Impairments - Identify and quantify the sources of pollution.

a. TMDL & other WQ info by stream segment
   Sampling has been and continues to be done in the mainstem of the Lower Big Creek by the Northeast Ohio Regional Sewer District & the Ohio Environmental Protection Agency. The main issue continues to be the presence of *E. coli* due to combined sewer overflows (CSOs). As NEORSD continues to eliminate CSOs, water quality will continue to improve.
b. Habitat conditions (dams, corridor and riparian cover)
   Habitats are limited and degraded due to the amount of urbanization within the watershed. Much of the riparian corridor has been encroached upon, the stream is highly entrenched, and there is little or no floodplain, and due to channelization there are few riffle, pools or other instream habitat.
c. Review and assess habitat modification inventory (QHEI, IBI, ICI, RIDE Info.)
   Though some data exists for the Lower Big Creek, there is nearly no data for the upper reaches of the watershed. Since areas of the upper watershed have been identified as possible conservation areas various sampling efforts would prove useful in monitoring these areas.

5. Big Creek Watershed Restorations and Protection Goals

a) Problem Statement-
Big Creek is so urbanized it borders on being slightly better than an open storm drain and it is barely relevant to focus on water quality goals unless and until urban stream discharge flow variability is effectively managed. The Watershed Partnership's assessment of the stream and watershed conditions indicated there is no feasible way to significantly reduce urbanized stream discharge, "the fire hose effect", which dominates watershed issues for Big Creek and Watershed Stewardship.

b) Purpose of the Big Creek Watershed Plan-
The purpose and goals of the plans are focused on protection of the scarce remaining natural stream features and implementation of flow attenuation devices at several sites in an effort to provide mechanism to reduce the effects from excess peak discharge.

- The Big Creek Plan included an assessment of the watershed and stream features.
- The plan applies a carefully developed methodology used by the Watershed Partnership to define Priority Conservation Areas including opportunities for storm water attenuation retrofits and Priority Development Areas which are identified in the plan.
- The plan also includes a suite of actions for local governments to adopt Low impact-watershed friendly -land development codes.

c) Implementation Goals -
The Big Creek Watershed Plan identifies a series of actions for implementation under the leadership of FOBC.

The Action Elements include five general goals:

1) Securing adoption of the Plan by the local government in the watershed.
2) Securing State endorsement of the Plan by the Ohio Lake Erie Commission
3) Updates to local development codes to promote low impact, " watershed friendly" development, and redevelopment,
4) Installation of Storm water retrofit devices, and
5) Preservation of Priority Conservation Areas

d) Timetable-
Action on the items is difficult to define, since there are factors beyond the control of the FOBC that will impact progress. FOBC is committed to develop and pursue implementation efforts based on:

- Legislative priorities of the local governing bodies;
- Willingness of land owners to participate in retrofit or preservation actions; and
- Availability of funding sources to implement physical projects.

e) Performance Indicators-
Ecosystem and stream quality response will be very difficult to assess, due the magnitude and complexity of urban-based stressors which impact overall stream health. There are no established science-based parameters which can definitively link actions and stream restoration achievement in a highly urbanized set of conditions. While each of the defined projects may exert some watershed benefit, it is unclear and doubtful that any single action will yield measurable outcomes.

The 40 year's of steady recovery in the Cuyahoga River Area of Concern clearly indicates that the collective and cumulative effect from restoration efforts will produce incremental improvements to the water body.

Plan implementation activities can, however be measured and reported:

- Plan adoption and State endorsement is its own desired outcome
- Code updates will be measured by the actual number of communities updating their codes as described in the plan.
- Installation of retrofit flow attenuation devices can be measured by the number of devices and related upstream acres impacted.
- Preservation of priority conservation sites can be measured by the number of sites and acres, which are contained in PCAs.

f) Education and Outreach-
FOBC has developed a website to provide ongoing information in the watershed. The plan will also be available for download or linked from the FOBC website.

FOBC also regularly organizes and leads hikes, programs and tours - all aimed at promoting the stream and community watershed stewardship.

In order to keep the local governments engaged FOBC regularly reports to the participating local governments regarding planning efforts, programs and emerging restoration opportunities.

CRCPO also includes Big Creek Info on its website and provides links to FOBC.

The plan and summary posters of the plan will be printed and distributed to Big Creek Communities and Libraries, and partner agencies including NEORSD, Cleveland Metroparks and Cuyahoga Soil and Water, County Board of Health, NOACA and Cuyahoga River RAP.

g) Funding-
As previously noted, during the course of the development of the Plan, FOBC matured into its own 501c3 NGO. Operationally it receives modest revenue from local members. It also received a grant for operating support from NEORSD. It seeks grants from a variety of sources. FOBC also benefits from significant support from volunteers.

Funding sources for project implementation is uncertain. Like most Great Lakes Watershed Organizations there is no defined, stable and sufficient revenue source available.

FOBC will seek grants for projects and will proceed with implementation for those which are funded.

Many of the local governments, which might serve as a local match resource, are fiscally stressed further compounding the challenge of providing local match for projects if needed.

6. Evaluating Plan Progress

As noted above, water quality outcomes will be virtually impossible to assess in this high density urban stream setting.

The RAP will support FOBC develop efforts to develop programs to monitor and report Plan implementation progress.

Periodic assessments of overall stream health will be conducted in cooperation with the scheduled stream assessments conducted by OEPA, in collaboration with NEORSD and Metroparks.
FOBC will review projects and build on ‘lessons learned“, guiding future actions.

RAP/CRCPO will monitor project activities and provide support and collaborative support as requested.

RAP/CRCPO is in the process of developing a long-term program to train and implement stream monitoring teams for use in the various tributaries of the Area of Concern.

7. Ohio Coastal Zone Management Plan Benefits

Flowing into the Cuyahoga River at mile 7.4, Big Creek is the closest stream to the river's mouth at Lake Erie. As a highly urbanized stream, its' excess discharge and pollutants enter the Cuyahoga River unabated.

Pollutants from stream attach to sediments which gather in the Ship Channel adding extra expense to dredging and sediment disposal costs for the important maritime economy.

Consistent with the goals of the Ohio Lake Erie Commission Balance Growth Initiative, any improvements in stream discharge will yield benefit to the Cuyahoga River and Lake Erie.

The plan places significant emphasis on flow attenuation relying on a variety of restoration, preservation and non-structural techniques.

Big Creek
Balanced Growth Initiative Watershed Plan

produced by

CUYAHOGA RIVER COMMUNITY PLANNING

CUYAHOGA RIVER RAP REMEDIAL ACTION PLAN

CUYAHOGA AMERICAN HERITAGE RIVER

www.crcpo.org

in cooperation with

Friends of Big Creek

www.friendsofbigcreek.org

and the

Big Creek Watershed Planning Partnership

For more information on the

OHIO BALANCED GROWTH PROGRAM

go to www.balancedgrowth.ohio.gov