Chagrin River Watershed Balanced Growth Plan

Chagrin River
Watershed Partners, Inc.

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PART I: CHAGRIN RIVER WATERSHED BALANCED GROWTH PLAN

Executive Summary

The Chagrin River Watershed Partners, Inc. (CRWP) and Chagrin River watershed communities have collaborated on the development of the *Chagrin River Watershed Balanced Growth Plan*. This *Plan* helps to achieve the goals and objectives of the Lake Erie Balanced Growth Program, the Lake Erie Protection and Restoration Plan, the *Chagrin River Watershed Action Plan,* and promotes the conservation and development goals of Chagrin communities. From 2006-2009, CRWP worked with a Balanced Growth Steering Committee and Chagrin watershed communities to:

- Develop criteria to identify Priority Conservation Areas (PCAs) and Priority Development Areas (PDAs),
- Gain local input on draft maps and revise PCA and PDA maps each watershed community,
- Designate PCAs and PDAs in each community through a resolution,
- Identify implementation measures for each community to realize the PCA and PDA designations as defined in this *Plan*.
- Incorporate the balanced growth planning concepts and PCA and PDA designations into community comprehensive land use plans.
- Draft this *Plan* for endorsement by the State of Ohio,

As PCA and PDA maps were drafted and revised, CRWP and the Balanced Growth Steering Committee focused on the goal of balancing the economic development and conservation goals within the Chagrin watershed by asking the question "What Will Chagrin Watershed Look Like in 20 Years?". CRWP and the Steering Committee determined that the following three goals needed to be accomplished to attain balanced growth in the Chagrin Watershed.

- Accommodate reasonable amount of growth.
- Maintain aesthetic appeal of the watershed.
- Maintain watershed hydrologic and ecologic functions.

These goals link to the Ohio Lake Erie Commission's ten guiding principles for a sustainable Lake Erie Watershed detailed in the Lake Erie Protection and Restoration Plan and this *Plan.* This *Plan* provides a way to coordinate these activities and work together to meet these goals.

CRWP and watershed communities worked to ensure that designated PDAs throughout the Chagrin River watershed linked to transportation, water, and sewer infrastructure and planning. The PCA designations promote the protection of existing green space and preservation of additional critical areas to minimize loss of habitat, farmland, forest, and open space. In addition, the designations of both PCAs and PDAs balance local economic development goals while planning ahead to efficiently use infrastructure and protect the Chagrin River and Lake Erie for future generations. CRWP will continue to work with watershed communities to implement the recommendations from this *Plan* including the use of best local land use practices, incorporation of concepts into local comprehensive land use plans, coordination of mitigation activities for stream and wetland impacts to further implement PCAs and PDAs, continued open space acquisition, and economic development initiatives.

As of June 2009,

28 Communities have endorsed this *Plan*, representing

82.4% of the number of communities in the watershed

80.2% of the watershed population

71.2% of the watershed land area

OHIO LAKE ERIE COMMISSION'S BALANCED GROWTH PROGRAM

In April of 2004, the Ohio Lake Erie Commission (OLEC) adopted task force recommendations for a voluntary, incentive-based program to achieve balanced growth in the Ohio Lake Erie Watershed. The recommendations include a lead role for local governments with state government providing strong support and encouragement. The Lake Erie Balanced Growth Program recommendations include:

A regional focus on land use and development planning in the Lake Erie basin.

The creation of local Watershed Planning Partnerships to designate Priority Conservation Areas and Priority Development Areas.

The alignment of state policies, incentives, funding, and other resources to support watershed balanced growth planning and implementation.

The implementation of recommended model regulations to help promote best local land use practices that minimize impacts on water quality and provide for well planned development efficiently served by infrastructure.

A key focus of this program is the link between land use planning and watershed health. The Balanced Growth Program produced the following documents:

Planning Framework: *Recommends the formation of Watershed Planning Partnerships to draft Watershed Balanced Growth Plans through which communities designate Priority Conservation Areas and Priority Development Areas.*

Best Local Land Use Practices Document: *Recommends model regulations and programs for better land use and development. These are consistent with CRWP recommendations to Member communities.*

In 2006, CRWP began developing the *Chagrin River Watershed Balanced Growth Plan* as a pilot under an OLEC grant, funded by the Ohio Water Development Authority. CRWP received additional funding for comprehensive plan updates from the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET). CICEET is a partnership of the National Oceanic and Atmospheric Administration and the University of New Hampshire. As a pilot program, CRWP demonstrated a local government approach to a balanced growth planning process and development practices based on Priority Conservation Areas (PCAs) and Priority Development Areas (PDAs). This *Plan* details CRWPs process for introducing balanced growth concepts, collaboration as a watershed planning partnership, development of locally determined PCAs and PDAs, and possible tools for implementation of PCAs and PDAs.

Ohio Lake Erie Commission

The Ohio Lake Erie Commission is made up of the directors of the Departments of Agriculture, Development, Health, Natural Resources and Transportation, as well as the Ohio Environmental Protection Agency.

The mission of the Ohio Lake Erie Commission is to preserve Lake Erie's natural resources, protect the ecological quality of its watershed, and to promote economic development on the North Coast.

Ohio | Lake Erie Commission

Department of Agriculture, State of Ohio

Ohio | Department of Development

Ohio Department of Health

Ohio Department of Natural Resources

State of Ohio Department of Transportation

OhioEPA

The Chagrin River Watershed Balanced Growth Plan was prepared with the support of the Ohio Water Development Authority, Ohio Lake Erie Commission, CICEET, and CRWP Members.

10 Guiding Principles for a Sustainable Lake Erie Watershed

To attain a living equilibrium between a strong, diversified economy and a healthy Lake Erie ecosystem, activities in the Ohio Lake Erie watershed should:

1. Maximize investment in existing core urban areas, transportation, and infrastructure networks to enhance the economic vitality of existing communities.
2. Minimize the conversion of green space and the loss of critical habitat areas, farmland, forest and open spaces.
3. Limit any net increase in the loading of pollutants or transfer of pollution leading from one medium to another.
4. To the extent feasible, protect and restore the natural hydrology of the watershed and flow characteristics of its streams, tributaries, and wetlands.
5. Restore the physical habitat and chemical water quality of the watershed to protect and restore diverse and thriving plant communities and preserve rare and endangered species.
6. Encourage the inclusion of all economic and environmental factors into cost / benefit accounting in land use and development decisions.
7. Avoid development decisions that shift economic benefits or environmental burdens from one location to the other.
8. Establish and maintain a safe, efficient, and accessible transportation system that integrates highway, rail, air, transit, water, and pedestrian networks to foster economic growth and personal travel.
9. Encourage that all new development and redevelopment initiatives address the need to protect and preserve access to historic, cultural, and scenic resources.
10. Promote public access to and enjoyment of our natural resources for all Ohioans.

Definitions of PCAs and PDAs

The Ohio Lake Erie Commission's Balanced Growth Program defines Priority Conservation and Development Areas as stated below.

Priority Conservation Areas (PCAs) are locally designated areas for protection and restoration. They may be important ecological, recreational, heritage, agricultural, and public access areas that are significant for their contribution to Lake Erie water quality and general quality of life.

Priority Development Areas (PDAs) are locally designated areas where development and/or redevelopment is to be encouraged in order to maximize development potential, maximize the efficient use of infrastructure, promote the revitalization of cities and towns, and contribute to the restoration of Lake Erie.

To provide further clarification of the role of PCA and PDA designation for local communities, OLEC detailed that adoption of PCAs and PDAs does not require communities to change their zoning and these designations do not change the existing property rights, they simply opens up the possibility of incentives from the State for the development or conservation of the property. Communities may also consider comprehensive planning and zoning changes necessary to implement these designations. Such changes will benefit communities because they will minimize long-term infrastructure and storm water management costs.

As CRWP discussed PCA and PDA designations with local communities, the OLEC definitions were further interpreted per the discussion below.

PDAs may be locations where land use change is predicted to have minimal impact on the watershed and where other conditions, such as access to highways, existing or planned utility service areas, and existing development, suggest that additional development may be appropriate. No law requires that PDAs be planned, zoned, or developed. A high concentration of "PDA characteristics" identifies an area that the community could, after further study, plan as a development opportunity with moderate impacts to flooding, erosion or water quality and take advantage of existing infrastructure such as roads, sewers, and waterlines.

PCAs may be locations where land use change may have a high impact on the watershed including flooding, erosion, and water quality. There is no law mandating protection of a PCA. A high concentration of "PCA characteristics" suggests that a site has unique ecologic or historic considerations or may be particularly difficult to develop. In addition, communities could save time and money working with property owners for preservation or interested developers for alternative site designs that enable development but limit impacts to natural resources on these PCA parcels.

WATERSHED PLANNING PARTNERSHIP

Chagrin River Watershed Partners, Inc.

A Watershed Planning Partnership is defined as an organization within a watershed that will assemble for the purpose of preparing a Watershed Balanced Growth Plan. OLEC envisioned partnerships as a regional effort that can be organized in flexible ways to respond to local conditions. Their work should be open, inclusive, and focused on consensus building. The Chagrin River Watershed Partners, Inc. (CRWP) is acting as the Watershed Planning Partnership for this planning effort.

Starting in the mid-1990's, efforts where initiated to preserve and protect the watershed through the creation of the Chagrin River Land Conservancy (now the Western Reserve Land Conservancy, or WRLC). WRLC's leadership spawned the idea to create the Chagrin River Watershed Partners to serve its Member communities by solving their watershed flooding, erosion, and water quality problems and protecting and maintaining the Chagrin River as a high quality natural resource.

Formed in 1996 by 16 cities, villages, townships, counties, and park districts, CRWP is now an established organization. CRWP's founders understood the need to improve land use decisions and limit the impacts of development and rising infrastructure costs due to increased storm water quantities. The organization has been a leader in Ohio and nationwide in fostering a bottom-up approach that involves key decision makers from Member communities interested in storm water management and natural resources protection. In 2009, CRWP's 36 Members represent 94% of the watershed.

CRWP is organized and operated as an Ohio non-profit corporation, is qualified as a tax exempt entity under Section 501(c)(3) of the Internal Revenue Code, and is a supporting organization under Section 509(a)(3) of the Internal Revenue Code operated exclusively for the benefits of Member organizations. Each Member community elects one Trustee to the Board of Trustees which is authorized to elect At Large Trustees.

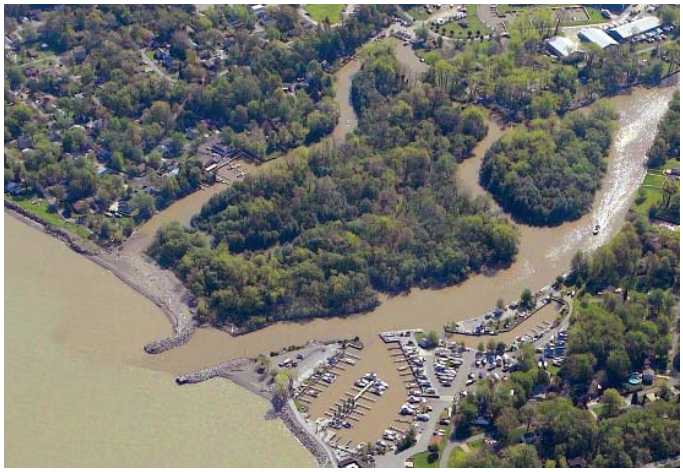
CRWP's mission is to strive to preserve and enhance the scenic and environmental quality of the ecosystem of the Chagrin River and its watershed in a manner that assures a sustainable future for people, plants and animals.

CRWP provides technical assistance to Members and develops cost effective solutions to minimize new, and address current water quality and quantity problems. To prevent and minimize these problems, CRWP recommends that each community have the following best local land use practices:

- *Comprehensive planning*
- *Open space acquisition*
- *Riparian and wetland setbacks*
- *Erosion and sediment control*
- *Comprehensive storm water management*
- *Site design options*

The Chagrin River Watershed Balanced Growth Plan is a natural extension of CRWP's message and goals. CRWP has worked with communities in the Chagrin River basin on many of the best local land use practices since its formation. The Balanced Growth program allows CRWP to present these concepts in the wider context of the health of our region and Lake Erie.

Many communities that drain to the Chagrin River also drain to adjacent watersheds including the Cuyahoga River, Grand River, Euclid Creek and other Lake Erie direct tributaries. CRWP provides services to the entire Member community, regardless of watershed. Communities recognize the drainage area divides within their communities, but the planning and zoning tools that will be used to implement this *Plan* will be implemented throughout the entire community. Thus this *Plan* covers the full extent of the watershed communities, including those areas outside of the Chagrin River Watershed.



Benefits of Participating in the Balanced Growth Program

If local governments agree on areas within a watershed where development is to be encouraged (PDAs) and areas where conservation activities are to be promoted (PCAs), the State of Ohio will support those decisions by aligning state programs to support those decisions, and conversely will not utilize state programs to violate those locally based decisions. In addition, the State created an incentive package for participating local governments, including:

- Develop a State Program Inventory that lists all State programs and funding sources that could be used to support conservation in the PCAs and development or redevelopment in the PDAs.
- Opportunity to work with state agencies through the State Assistance Work Group. This group is charged with assisting the participating local governments in identifying and obtaining technical and financial resources that can be used to support PCAs and PDAs.
- Financial and Technical Special Incentives. Special incentives include specific grant and technical assistance programs that offer added consideration for projects that are within PCAs and PDAs. Incentives are generally in the form of extra priority ranking, interest discounts or special support for applications that will implement specific activities in PCAs and PDAs.

In addition to improved State support and financial and technical incentives, incorporating PDAs and PCAs into community planning will:

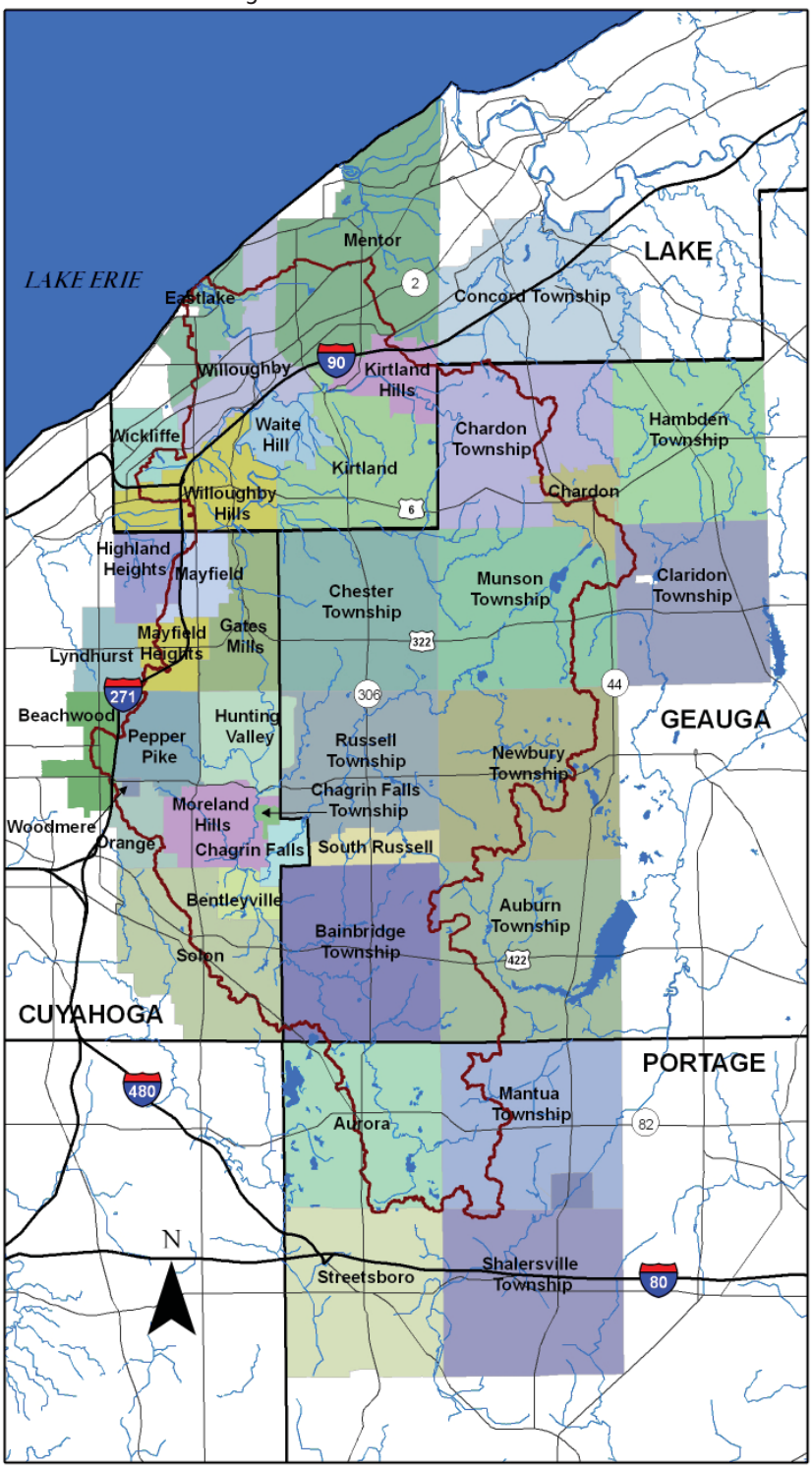
- Provide additional support for low-density zoning, riparian setbacks, and other tools to maintain the flood control, erosion control, and water quality protection functions of natural resources as communities grow.
- Reduce infrastructure costs through better site design.
- Facilitate locally-determined adjustments in planning and zoning to benefit communities by minimizing long-term infrastructure and storm water management costs and by maintaining community character.
- Facilitate planning and projects across communities.
- Provide cost-effective access to current planning technology.
- Address citizen concerns about flooding, erosion, and water quality.
- Improve compliance with NPDES Phase II and 208 Water Quality Plans.

CHAGRIN RIVER WATERSHED COMMUNITIES

The map to the right shows the communities in the Chagrin River watershed. Table 1 on the following page details the populations and total land area for each community from the 2000 Federal Census. Portions of four counties, twenty two municipalities, ten townships, and four park districts govern land use and other activities in the watershed. An additional 100 acres of the Chagrin River watershed is in Streetsboro, Lyndhurst, Shalersville, Beachwood, Concord and Hambden combined. These communities were not included in this *Plan* due to their small contribution areas.

The watershed community populations and land area vary significantly from one community to the next. The City of Mentor has the largest community population with 50,278 residents accounting for 18.6% of the total population. While Chagrin Falls Township has the smallest population with 135 residents. The largest communities by land area in the watershed include Auburn and Newbury Townships at approximately 28 square miles, while the Village of Woodmere is the smallest at 0.33 square miles. These differences in population, land area and population density highlight varying land use patterns and development priorities.

Chagrin River Watershed Communities



CRWP Member Communities

Auburn Township
Aurora
Bainbridge Township
Bentleyville
Chagrin Falls Township
Chagrin Falls Village
Chardon
Chester Township
Claridon Township
Cleveland Metroparks
Eastlake
Gates Mills
Geauga County
Geauga Park District
Hunting Valley
Kirtland
Kirtland Hills
Lake County
Lake Metroparks
Mantua Township
Mayfield Heights
Mayfield Village
Mentor
Moreland Hills
Munson Township
Newbury Township
Orange Village
Pepper Pike
Russell Township
Solon
South Russell
Waite Hill
Wickliffe
Willoughby
Willoughby Hills
Woodmere

Table 1. Municipalities and Townships in the Chagrin Watershed.

Local Government in Control of Land Use	Total Population	Total Land Area (acres)	Percent Total Population	Percent Total Land Area (acres)
Auburn Township	5,158	19,202	1.9%	7.2%
Aurora	13,556	15,439	5.0%	5.8%
Bainbridge Township	10,916	16,533	4.0%	6.2%
Bentleyville	947	1,675	0.4%	0.6%
Chagrin Falls Township	135	330	0.1%	0.1%
Chagrin Falls Village	4,024	1,349	1.5%	0.5%
Chardon	5,378	2,951	2.0%	1.1%
Chardon Township	4,541	14,640	1.7%	5.5%
Chester	10,968	15,033	4.1%	5.7%
Claridon Township	3,173	14,541	1.2%	5.5%
Eastlake	20,224	4,172	7.5%	1.6%
Gates Mills	2,493	5,822	0.9%	2.2%
Hunting Valley	590	5,108	0.2%	1.9%
Kirtland	6,670	10,693	2.5%	4.0%
Kirtland Hills	597	3,620	0.2%	1.4%
Mantua Township	5,109	16,972	1.9%	6.4%
Mayfield Heights	19,386	2,699	7.2%	1.0%
Mayfield Village	3,435	2,514	1.3%	0.9%
Mentor	50,278	17,868	18.6%	6.7%
Moreland Hills	3,298	4,641	1.2%	1.8%
Munson Township	6,450	16,576	2.4%	6.3%
Newbury Township	5,805	18,280	2.2%	6.9%
Orange Village	3,236	2,432	1.2%	0.9%
Pepper Pike	6,040	4,567	2.2%	1.7%
Russell Township	5,674	12,327	2.1%	4.7%
Solon	21,802	13,088	8.1%	4.9%
South Russell	4,022	2,486	1.5%	0.9%
Waite Hill	446	2,734	0.2%	1.0%
Wickliffe	13,484	2,980	5.0%	1.1%
Willoughby	22,621	6,548	8.4%	2.5%
Willoughby Hills	8,595	6,944	3.2%	2.6%
Woodmere	828	211	0.3%	0.1%
Total	269,879	264,975*	100.0%	100.0%

DEVELOPMENT AND FUTURE OF THE CHAGRIN RIVER WATERSHED BALANCED GROWTH PLAN

Development of this Plan

CRWP was awarded a grant from the Ohio Water Development Authority through the Ohio Lake Erie Commission to complete the *Chagrin River Watershed Balanced Growth Plan*. As a part of this application over 75% of CRWP member communities indicated interest in further investigating the Balanced Growth Program via resolutions of support for the initial grant application. In 2006, CRWP convened a Balanced Growth Steering Committee with representatives from each county in the watershed, focusing on planning officials and local elected officials to assist in draft map creation and messaging of the Balanced Growth Pilot Program to CRWP members. This committee and CRWP worked with a consultant to develop draft PCA and PDA maps. CRWP presented these maps to CRWP Board of Trustees at several board meetings and then to each community. Details of the draft map creation are included in Part II of this *Plan*. Each community revised the PCA and PDA maps as appropriate for each community, the adopted the map and this *Plan* with a resolution.

Update of this Plan

CRWP will provide updates to Member communities through CRWP Board of Trustee meetings and annual reports. Updates to the PCA and PDA designations will be completed at the direction of each endorsing community. If a community determines their priorities for PCA or PDA designations have changed, the maps will be revisited through the same process that the maps were developed originally. In most communities this will involve review by staff, CRWP, Planning or Zoning Commission, and final endorsement through a new resolution from Trustees or Council.

CRWP is an established organization that will continue to work with communities within the Chagrin watershed to implement the *Plan*. To accomplish this, CRWP will need further staff support to allow our resources to be utilized to assist Members with comprehensive land use plan updates, review and implementation of best local land use practices, review of site development proposals, and grant applications for protection and restoration activities. CRWP will continue to research additional funding opportunities to meet these needs. To date, CRWP has leveraged additional funding from US Environmental Protection Agency (US EPA), National Oceanic Atmospheric Administration (NOAA), through University of New Hampshire, and Ohio Water Development Authority (OWDA), to assist in funding CRWP staff time for plan review, zoning code review and implementation assistance, comprehensive land use plan updates, and development of a stream and wetland mitigation bank. Finally, CRWP will be responsible for updating and tracking implementation of the *Chagrin River Watershed Balanced Growth Plan*. All activities will be completed in full cooperation with each participating community.

Future Role of CRWP

CRWP will continue to act as the coordinator of the Watershed Planning Partnership and provide updates to the Watershed Planning Partnership through CRWP quarterly Board of Trustees meetings. We will continue this work utilizing funding from CRWP Member communities and will continue to seek additional grant funding to promote adoption of best local land use practices, update community comprehensive land use plans, promote and facilitate conservation activities in PCAs, and promote development or redevelopment activities within PDAs. CRWP is also working to facilitate stream and wetland mitigation within the watershed where impacts to these resources are occurring. The facilitation of stream and wetland mitigation may assist development projects to obtain necessary permits in PDAs and promote restoration activities in PCAs.

Updates to this *Plan* including community driven updates to designations of PCAs and PDAs, addition of communities currently not participating, and implementation of best local land use practices will continue to be a part of CRWP's programs and goals.

Future Role of Communities in Watershed Planning Partnership

Communities participating in the Watershed Planning Partnership may consider changes to their local planning and zoning regulations to implement PCAs and PDAs. Recommendations and tools for implementation of the PCA and PDA designation and balanced growth planning concepts for each community are included with community maps in this *Plan*. Communities may also explore grant funding and assistance from the State Assistance Working Group for continued implementation of this *Plan*. Communities will continue their support of CRWP activities through their membership in CRWP.

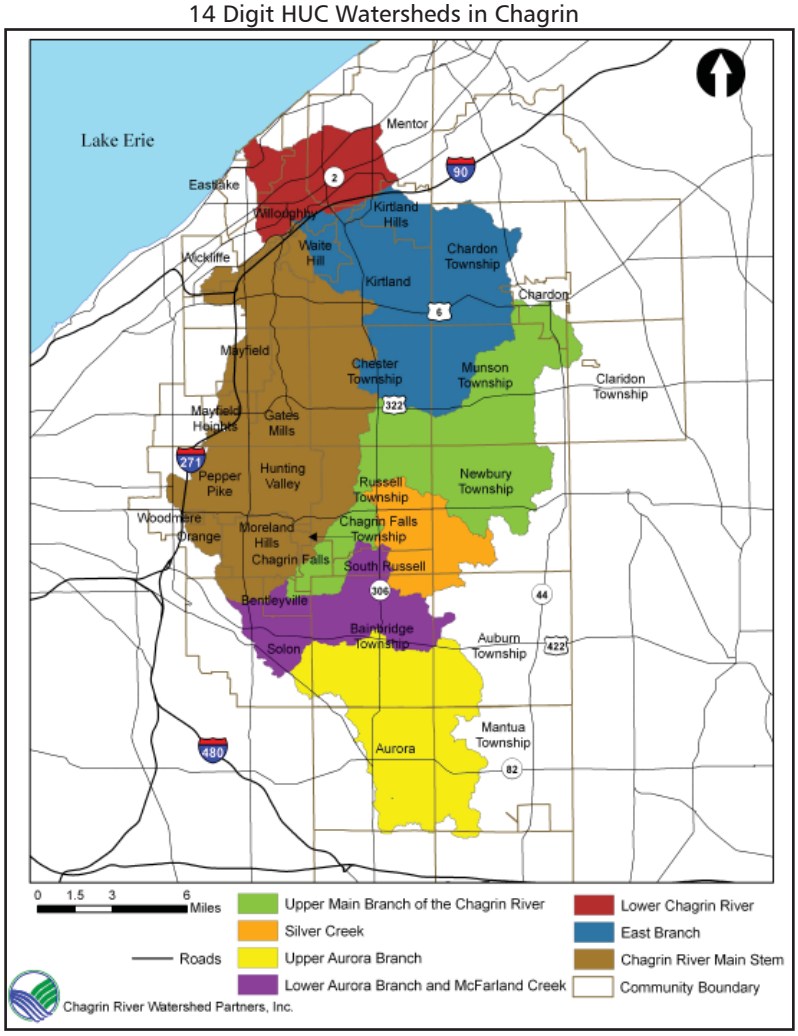
Major Natural Features and Characteristics

The Chagrin River watershed drains 267 square miles in four Northeast Ohio counties: Cuyahoga, Geauga, Lake, and Portage. Seventy one miles of the Chagrin River and tributaries are designated as State Scenic Rivers. The watershed has relatively good water quality and yet changing land use continues to threaten its headwater areas. The Chagrin is home to the last remaining population of native brook trout and has become an important steelhead fishery. The Chagrin still has large areas of forest cover, partially due to 13% of the watershed being protected open space and low density residential development throughout much of the watershed. In recent years, the watershed has experienced changes in land use, which is causing changes in how water runs off the land surface, resulting in increased flooding and erosion.

The Chagrin River watershed, like most of Northeast Ohio, was shaped by glacial activity thousands of years ago. The resulting soils and geologic deposits contribute to the high quality and varied habitats of the watershed. Since the last glaciers retreated approximately 12,000 years ago, the river has progressed from the upland headwater areas to create deep ravines further downstream. There are many areas on the Chagrin River and its numerous tributaries where thick glacial till has eroded, exposing sandstone and Chagrin Shale bedrock. The Chagrin River watershed lies in two distinct physiographic regions: the glaciated Allegheny Plateau and the Ohio Erie Lake plain. Soils that formed in glacial till with relatively clayey textures in the subsoil predominate the watershed, and somewhat poorly drained soils are common in areas with six percent slope or less.

The Chagrin River and its tributaries are of high overall water quality, with good in-stream and riparian habitats at most locations and significant recovery in some areas as point source discharges have been eliminated or upgraded. Many Chagrin River tributaries are high gradient small streams with coldwater habitat attributes where the riparian zones are partially intact or have not been completely degraded by urban/suburban development.

14 Digit HUC Watersheds in Chagrin



14 Digit Hydrologic Unit Code (HUC) Watersheds

04110003-020-010: Upper Main Branch of Chagrin River, except Silver Creek. Includes Beaver Creek, Dewdale Creek, Springbrook, Woodiebrook, and numerous unnamed tributaries.

04110003-020-020: Silver Creek, includes South Branch of Silver Creek

04110003-020-030: Lower Aurora Branch, includes Linton Creek and numerous unnamed tributaries.

04110003-020-040: Upper Aurora Branch, includes McFarland Creek and numerous unnamed tributaries.

04110003-030-030: Lower Chagrin River, below East Branch to Lake Erie, includes Corporation Creek, Ward Creek, and numerous unnamed tributaries

04110003-030-020: East Branch of Chagrin River includes Pierson Creek, Stoney Brook, and numerous unnamed tributaries.

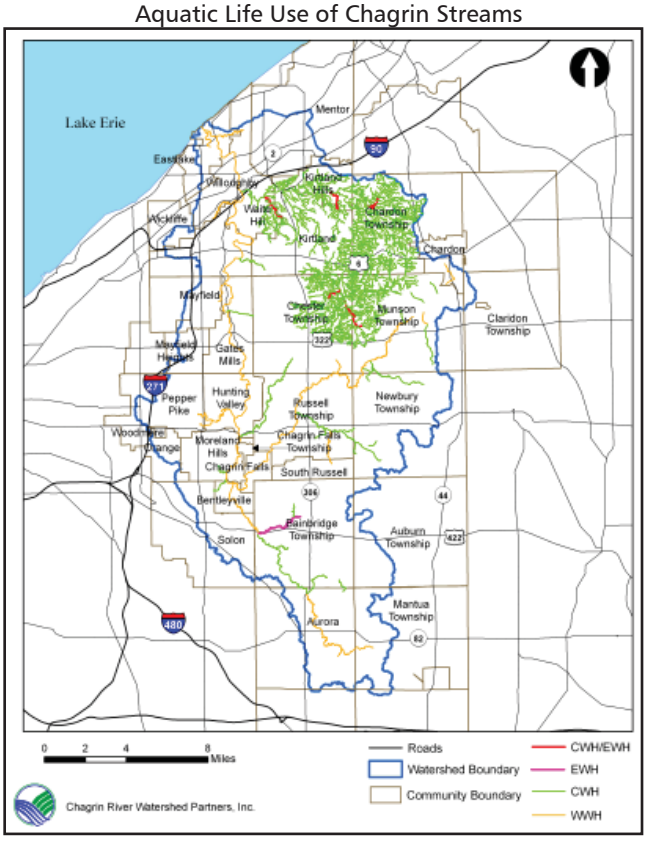
04110003-030-010: Chagrin River Main Stem includes Willey Creek, Pepper/Luce Creek, Griswold Creek, Caves Creek, Beecher's Brook, Upper 40/Foster's Run, Gulley Brook/Deer Creek, and numerous unnamed tributaries.

WATER QUALITY IN CHAGRIN RIVER WATERSHED

Water Quality

The figure below highlights the aquatic life uses as designated by the Ohio Environmental Protection Agency (Ohio EPA). The Chagrin includes more streams designated as coldwater habitat (CWH) and exceptional warmwater habitat (EWH) than any other watershed in Northeast Ohio. As illustrated below the East Branch of the Chagrin River and all of its tributaries are all noted as CWH. According to Ohio EPA all streams draining over 50 square miles in the Chagrin River watershed are in full attainment of their aquatic life uses. However, segments of the Chagrin River, including the upper stretches of the Aurora Branch in Portage County and the Upper Main Branch in the City of Chardon, were not attaining their warmwater habitat water quality standards in the 2004 Ohio EPA sampling event. In addition, several smaller streams are in non-attainment including Newell/Ward Creek, Marsh Hawk Run, portions of Dewdale Creek, lower reaches of East Branch, and lower mile of Griswold Creek. Numerous small streams, including portions of the Aurora Branch, McFarland Creek, portions of Upper Main Branch, Griswold Creek, Stoney Brook, East Branch, are in partial attainment of their water quality uses.

Aquatic Life Use of Chagrin Streams



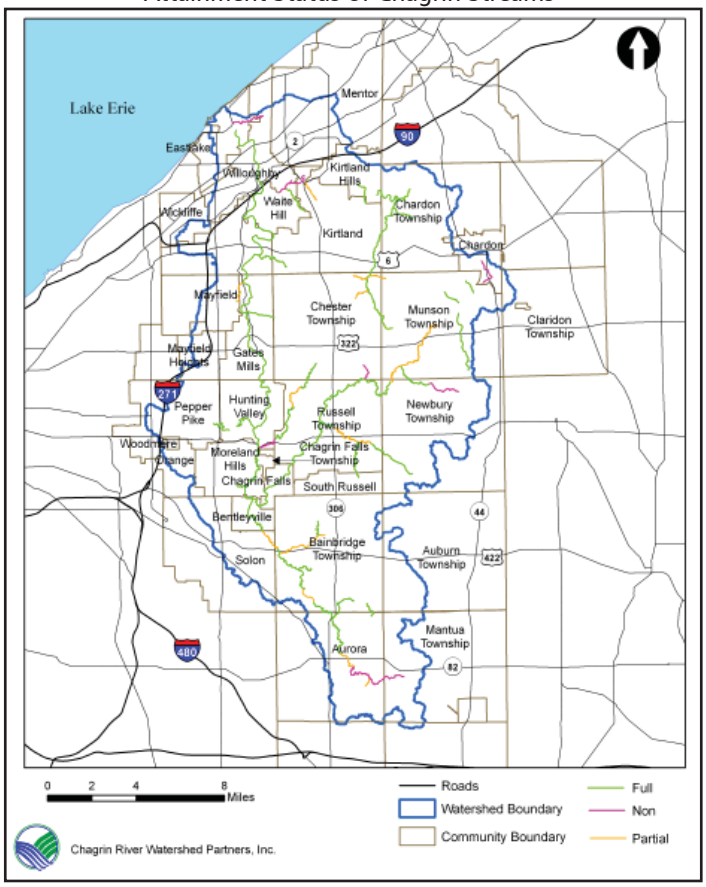
Causes of Impairment

- Direct Habitat Alterations
- Flow Alteration
- Thermal Modifications
- Siltation
- Organic Enrichment/DO
- Nutrients

Nonpoint and point source pollution associated with urbanization threaten the water quality of the Chagrin River. These threats include nutrient enrichment, sedimentation, flow and temperature modifications from retention/detention ponds and other small impoundments, and increased storm water volume. Nutrient enrichment and bacteria from increased wastewater flows from various sources including municipal and regional wastewater treatment plants, small package wastewater treatment plants, on-site septic systems, and storm water runoff is also impacting the Chagrin. Increasing storm water flows, encroaching on riparian areas, and increasing construction activity during development have increased sedimentation.

Concerns of state agencies and local residents and officials include the accumulation of silt and sediment from runoff and erosion; solids associated with increased loadings of nutrients, metals and organic enrichment; and elevated fecal bacteria counts that are

Attainment Status of Chagrin Streams



taxing the assimilative capacity of the watershed. Ohio EPA predicts that continued attainment of designated aquatic life uses will be further threatened if loadings continue to increase. To evaluate these loadings, Ohio EPA developed a Total Maximum Daily Load (TMDL) study for the Chagrin River.

Total Maximum Daily Load

The goal of the Clean Water Act (CWA) is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters". Under the CWA, states are required to develop TMDLs, for stream that are not meeting state water quality standards. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards. As portions of the Chagrin do not meet their designated aquatic life uses, a TMDL for the Chagrin watershed was completed by Ohio EPA in May 2007.

Chagrin River Watershed TMDLs Established for:
Phosphorus
Nitrates
Bacteria
Habitat
Total Suspended Solids

The TMDL report details a number of implementation actions and measures to address the impairments noted in the Chagrin watershed.

- Phase II Storm Water Program: Twenty two communities in the Chagrin watershed have permits under Ohio EPA's MS4 permit. Ohio EPA intends to develop a basin specific storm water permit for construction activities that may include riparian setbacks, groundwater recharge requirements, and protection for coldwater habitat streams.
- Wetlands Protection: TMDL recommends that no new permits to impact Category 2 and 3 be issued in the Chagrin.
- Riparian Protection: Through adoption of riparian setbacks or other site design tools, restoration of streams, and protection of wooded riparian corridors with a focus on Class III headwater Streams and State Scenic River corridors.
- Low Impact Development practices on new and redevelopment sites, including CRWP LID demonstration sites.
- Management of wastewater, including 208 updates, House Bill 110 program, and inspection and maintenance program for household sewage treatment systems.
- Evaluation of all dams in Chagrin River for removal.
- Reduce NPDES Permit Limits for total suspended solids to a permit maximums from 18 mg/l to 15 mg/l.
- Implementation of the *Chagrin River Watershed Action Plan*
- Educational Programs

The Chagrin TMDL report references many ongoing Ohio EPA and CRWP initiatives. In fact the TMDL specifically references the *Chagrin River Watershed Balanced Growth Program* which was in development at the time of publishing the TMDL report. Many of the implementation actions and measures detailed in the TMDL will also act to implement this *Plan*.

CHAGRIN RIVER WATERSHED DEMOGRAPHICS

Land Use in Watershed

The primary land use in the Chagrin River watershed is low density residential. The 2001 land use distribution from LandSat data shows that the Chagrin River watershed was primarily deciduous forest at nearly 65%. Less than 5% of the land use was classified as commercial, industrial, or transportation and residential only comprised 17% of the total land use within the watershed. A comparison of this data with more detailed aerial photography shows that the much of this deciduous forest is actually low density residential areas with quite a few large trees.

Previous studies completed by CRWP of the watershed showed that approximately 9% of the watershed is covered with impervious cover, including roads, roofs, and parking areas. In addition, CRWP completed an analysis of vegetation types that indicated a healthy, largely forested canopy with almost half of the riparian corridor shown as forested.

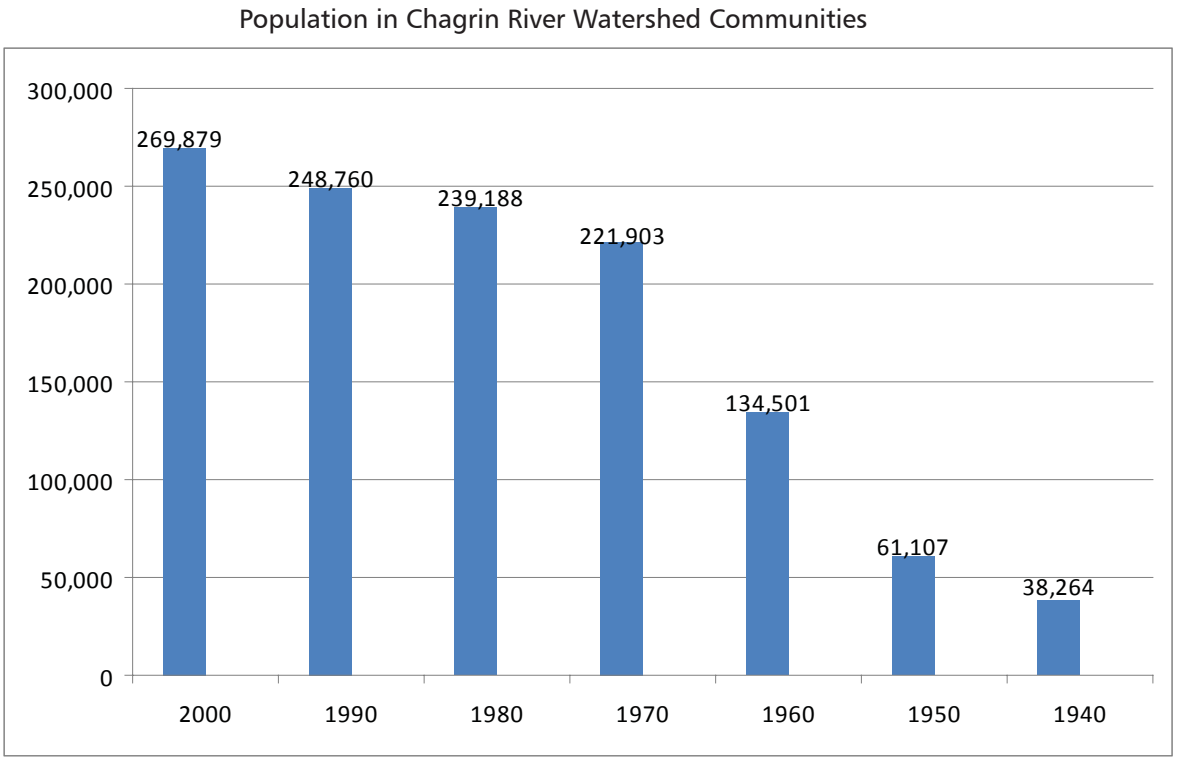
Land cover in the riparian corridor is represented as follows:

- 43% forest
- 29% herbaceous
- 21% open water
- 4 % shrub
- 3 % impervious cover

Further, 75% of the riparian corridor is covered in some vegetation, and the bulk of the remaining area is open water. In the Chagrin watershed, the overall assessment of riparian health is good, given that most of the riparian corridor is vegetated, primarily with forest cover. It is encouraging that most of the measured impervious cover within the watershed is located outside of the riparian corridor.

Population and Demographic

A significant factor influencing the Chagrin River watershed is the continuing dispersal of people and jobs from Cuyahoga County and other built communities into the undeveloped areas of the Chagrin River watershed. Urban population dispersal in the absence of population growth makes the Northeast Ohio



Population Change in Chagrin Communities

- 65% increase from 1960 to 1970
- 120% increase from 1950 to 1960

region as a whole atypical compared to other areas of the United States. The region's largest city, Cleveland, achieved its maximum population in 1950 while its largest county, Cuyahoga, peaked in 1970, as did the Northeast Ohio region as a whole. Since 1970 five counties in Northeast Ohio: Cuyahoga, Geauga, Lake, Lorain, and Medina experienced a combined net population decline of 200,000. Cuyahoga County has lost more than 300,000 residents and Geauga, Lake, Lorain, and Medina Counties gained 100,000 residents. These population gains in surrounding counties can be attributed both to population shifts and natural increase in births.

In the 2000 census, the population of watershed communities was 269,879, 95% of whom are Caucasian, 2% African American, and 2% Asian American. The mean age in the watershed ranged from 31.6 to 59.9 years with an overall watershed mean of 41.3 years. An average household size of 2.5 persons was found throughout the 105,931 total households.

Development Patterns in Chagrin

Development patterns in the Chagrin River watershed are strongly influenced by the availability of roads, water and sewer infrastructure. Interstate 90 crosses the northern portion of the watershed while Interstate 271 nearly follows the watershed boundary on the west. In addition, major US and state highways including State Routes 2, 615, 82, 306 and 44 and US routes 322, 422, and 6 provide access to each community in the watershed. Many of the intersections around these highways highlight the designated PDAs in the Chagrin .

According to interviews with areawide planning agencies, no major road way improvements are planned at this time. Road projects over the last 20 years in the Chagrin watershed included express lanes on Interstate 271, creation and extension of US 422, and the creation of new exchange at Interstate 90 and State Route 615.

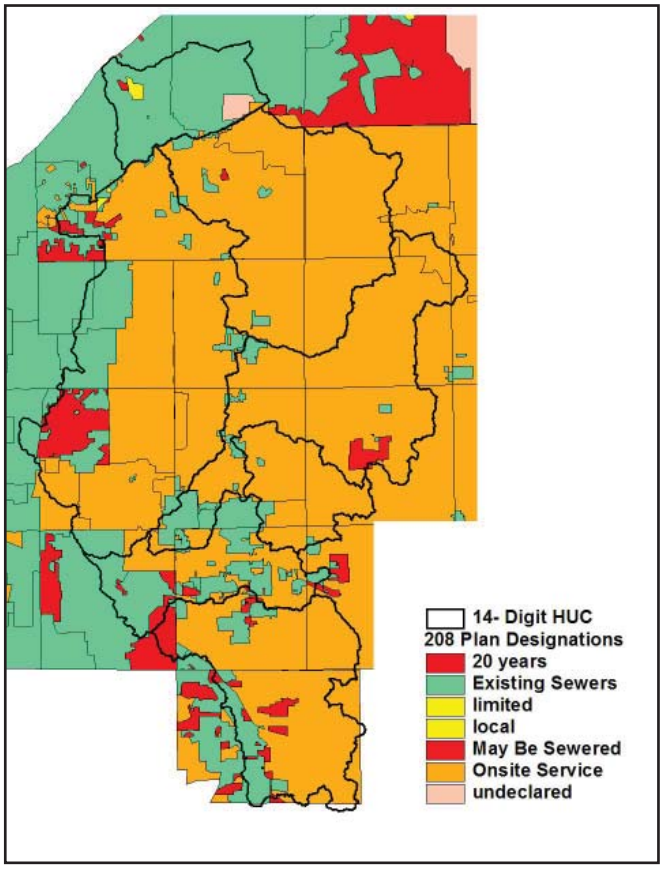
In addition to highway access, the presence or the planning for sewer and water infrastructure drives much of the development pressure in the Chagrin and throughout Northeast Ohio. Public water infrastructure is generally provided by Cleveland Public Water with the exception of a few small public water supplies for groundwater such as Tanglewood in Bainbridge and the Village of Chagrin Falls.

Sanity sewer planning is completed through the 208 Water Quality Management Plans administered by the areawide planning agencies. As noted in area 208 planning, illustrated at right, most (76%) of the Chagrin River watershed is planned to manage sewage with onsite wastewater management. Approximately 20% of the Chagrin is already sewered. The sewered areas and those areas which are planned to be sewered in the next 20 years are concentrated in Lake and Cuyahoga Counties.

Zoning in Chagrin

Zoning also plays a large role in the development patterns seen today in the Chagrin River watershed. Based on an impervious cover study completed by CRWP in 2004, approximately 13% of the Chagrin River watershed communities are either zoned as open space or are protected by a park district or conservation easement. Approximately 50% of the Chagrin watershed communities are not yet developed or are underdeveloped. Of the remaining 37% of the watershed that has been developed, the majority has been developed as residential with low density residential of more than two acres per home representing about half of the developed area of the watershed. The existing land use planning and zoning is also heavily focused on low density residential uses. Under existing zoning, the watershed at build-out would be comprised of 79% residential, of which 46% is low density residential, 8% commercial/retail/industrial and 13% open space, which includes properties currently protected by a park district or conservation easement.

208 Sewer Planning for Chagrin Watershed



DESIGNATION OF PRIORITY CONSERVATION AND DEVELOPMENT AREAS

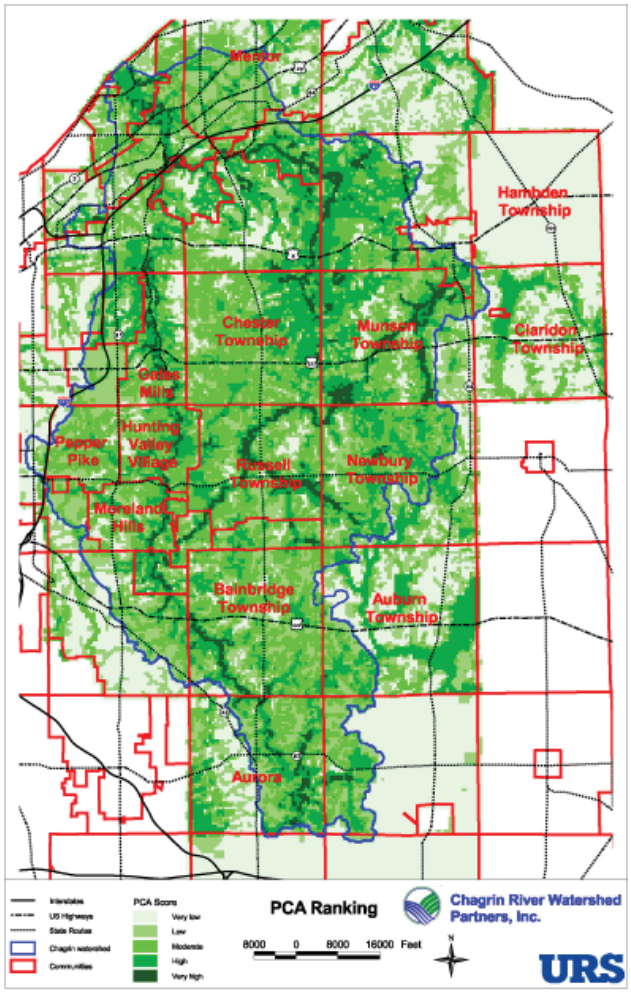
A full description of the initial methodology for developing the draft PCA and PDA maps is included in Part II of this *Plan*. Draft maps, shown below, were completed using digital data and included a range of high to low priority for conservation and development. CRWP convened a Balanced Growth Steering Committee that assisted in determining appropriate criteria and weighting factors for PCAs and PDAs. Criteria, as fully described in Part II of this *Plan*, included:

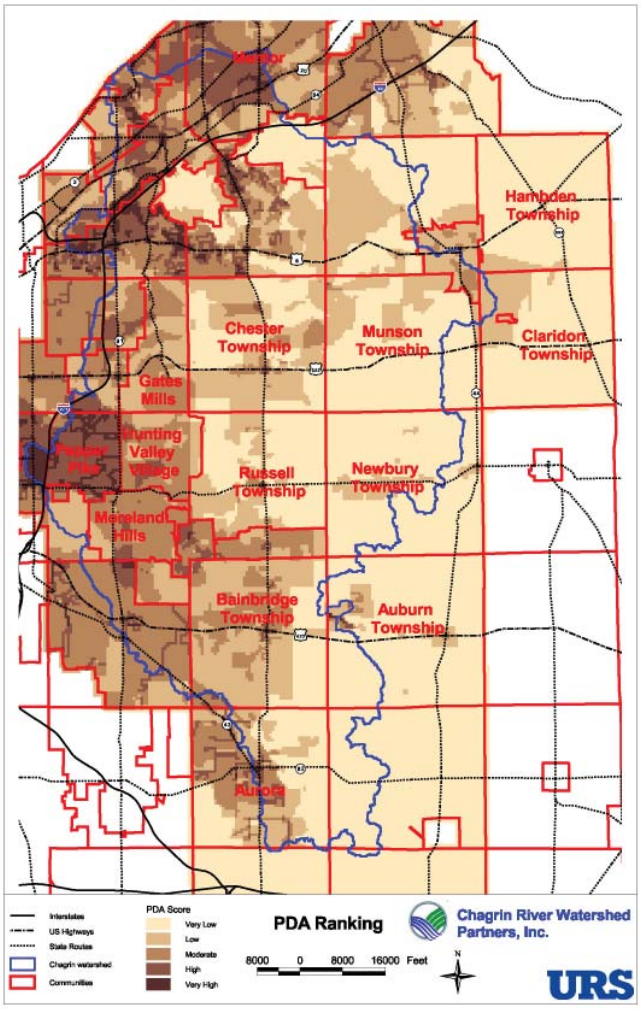
PCA Criteria

- Watershed Sensitivity
- DRASTIC
- Protected Open Space
- Stream Corridors
- Threatened and Endangered Species
- Floodplains
- Coldwater Habitat, Exceptional Warmwater Habitat, and State Scenic Streams
- Steep Slopes
- Brook Trout Streams
- Wetlands
- Ohio Archeological Inventory
- Ohio Historic Inventory
- National Registry

PDA Criteria

- Watershed Sensitivity
- DRASTIC
- Major Intersections
- Urbanized Areas
- Zoning
- Sanitary Sewer Planning
- Impervious Cover





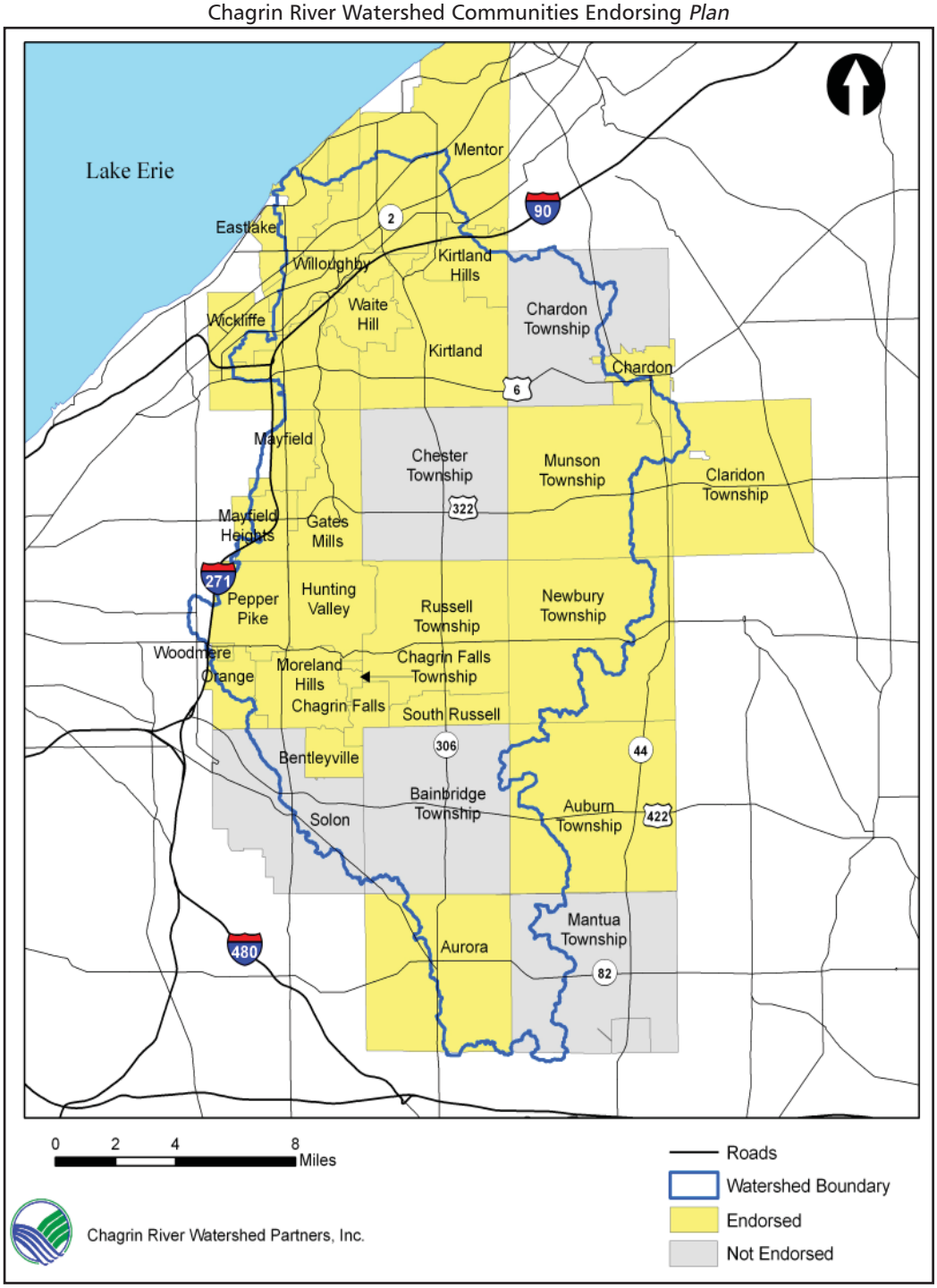
REFINING PCA AND PDA MAPS WITH LOCAL INPUT

CRWP presented Balanced Growth concepts and draft PCA and PDA maps to Chagrin watershed communities and prepared a draft PCA and PDA map for each community. The draft maps were reviewed and discussed by community staff and in public meetings, including Planning and Zoning Commission, Council, and Township Trustee meetings, and revised with community input based on local data and priorities. Ultimately, a local decision making process determined if each map's characteristics were consistent with local priorities. This section includes the map adoption process and implementation measures for each community that has endorsed the *Chagrin River Watershed Balanced Growth Plan* and the PCA and PDA maps.

COMMUNITIES ENDORSING THE *PLAN*

Aurora
Auburn Township
Bentleyville
Chagrin Falls Village
Chagrin Falls Township
City of Chardon
Claridon Township
Eastlake
Gates Mills
Hunting Valley
Kirtland
Kirtland Hills
Lake County
Mayfield Heights
Mayfield Village
Mentor
Moreland Hills
Munson Township
Newbury Township
Orange Village
Pepper Pike
Russell Township
South Russell
Waite Hill
Wickliffe
Willoughby
Willoughby Hills
Woodmere

Chagrin River Watershed Communities Endorsing *Plan*



28 Communities Endorsed the PCA and PDA Designations and this *Plan*

These Communities represent:
82.4% of the Number of Chagrin Watershed Communities
80.2% of Population of Chagrin Watershed Communities
71.2% of Land Area of Chagrin Watershed Communities

COMMON QUESTIONS DURING PCA and PDA MAP REVISION

A number of common questions arose during the discussion of the PCA and PDA maps in Chagrin River watershed communities. A brief summary of the most common topics is included below.

PDAs
Many communities followed their existing zoning for non-residential uses to designate their PDAs. These designations represent a desire to maintain or redevelop existing development areas, with no expansion in many areas. In addition, several Chagrin communities have not designated a PDA within their community boundaries. The lack of PDA designation is consistent with the low density residential land use in these communities.

Existing protected properties
All communities chose to include the existing protected parcels, including existing parks, ODNR parcels, and conservation easements, as PCAs. This will allow groups such as local park districts, land trusts, and non-profit organizations to access incentives on grant applications for park improvements, such as trails and stream and wetland restoration.

Property lines
Some communities chose to use property lines as appropriate to designate their remaining developable lots or existing protected properties. Most communities used lot lines to define their PDAs. However some communities requested that all PCA and PDA designations not follow lot lines. The reasons for not following lot lines ranged from the desire to use the boundaries of natural features (such as slopes, soils, streams, floodplains, or wetlands) to using designations that defined PDAs within a certain distance of roads or to avoid potential conflict with property owners.

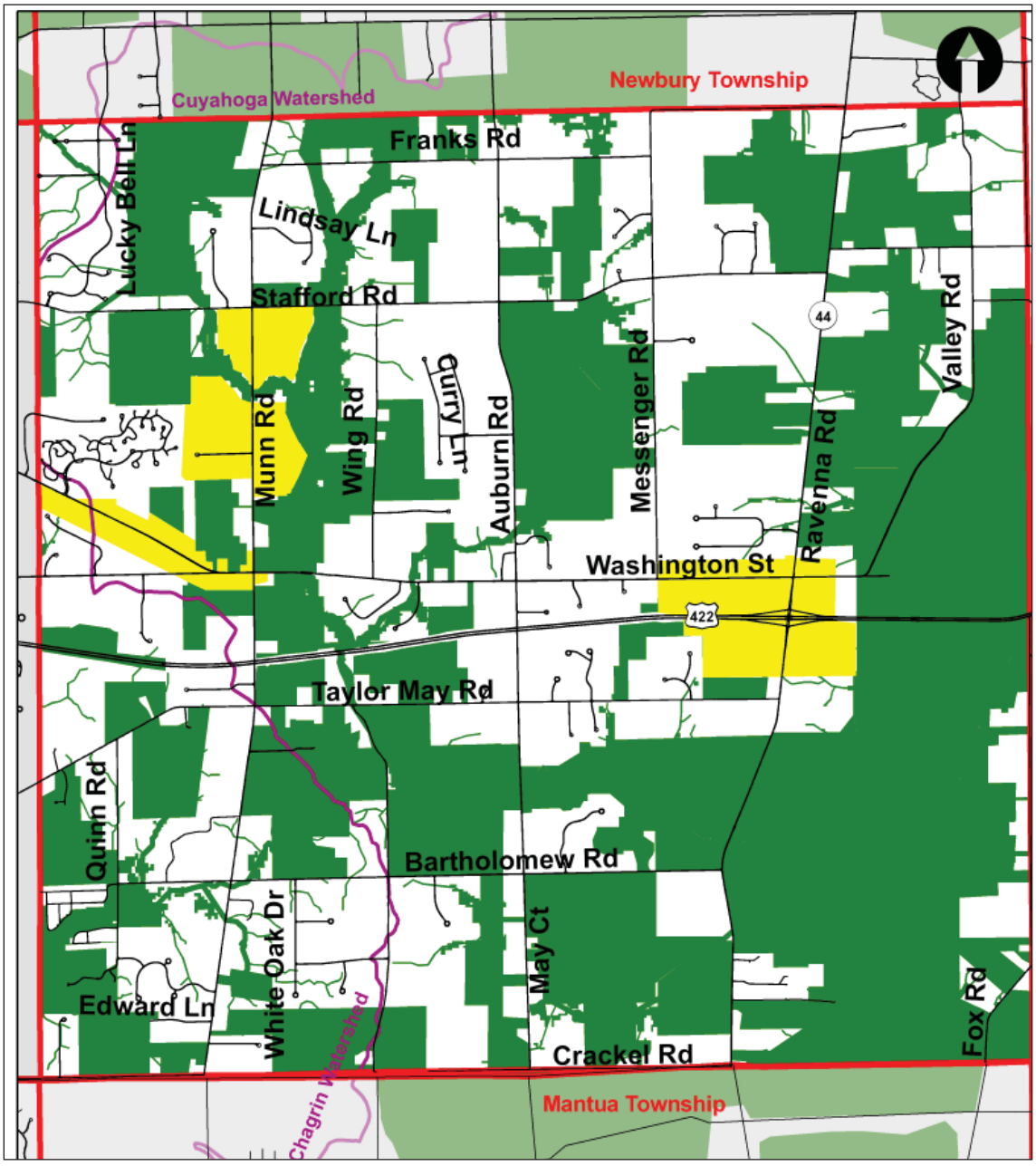
Riparian Areas
Many communities, especially those with riparian setback regulations, chose to include all riparian corridors in PCAs. Even in communities without riparian setback regulations, the riparian corridors were often designated as PCAs to allow property owners to access grant incentives for potential stream bank stabilization or restoration in these areas.

Large lots
Many communities have chosen to designate the remaining undeveloped large lots as PCAs with the recommendation that conservation development principles, riparian setbacks, and good storm water management are used as the lots are developed. The perception of "large lot" is different from community to community. For example, Hunting Valley and Gates Mills define large lots as those that meet the minimum lot sizes in their Conservation Development Zoning District (30 acres). Newbury designated any parcel over 20 acres as a PCA, while Claridon Township designated parcels of 50 acres or larger as large lots. Many communities do not yet have a conservation development code that would facilitate the wise development of these areas. CRWP will continue to work with these communities on options for wise development of large lots, such as storm water management, riparian and wetland setbacks and conservation development.

Support for existing planning and zoning
Most communities acknowledged that the designation of PCAs and PDAs and participation in the balanced growth planning process will assist them in supporting their existing zoning codes, thus most communities' PCA and PDA designations align with existing zoning.

Referendum Zoning
A number of Chagrin communities have referendum style zoning which requires a vote of the electorate to make any changes to zoning categories and land uses. Some of these communities were able to illustrate the communities' priorities for development and conservation activities without going forward with a change to the underlying zoning at this time. In these communities the PCA and PDA designations may not follow the existing zoning uses.

AUBURN TOWNSHIP

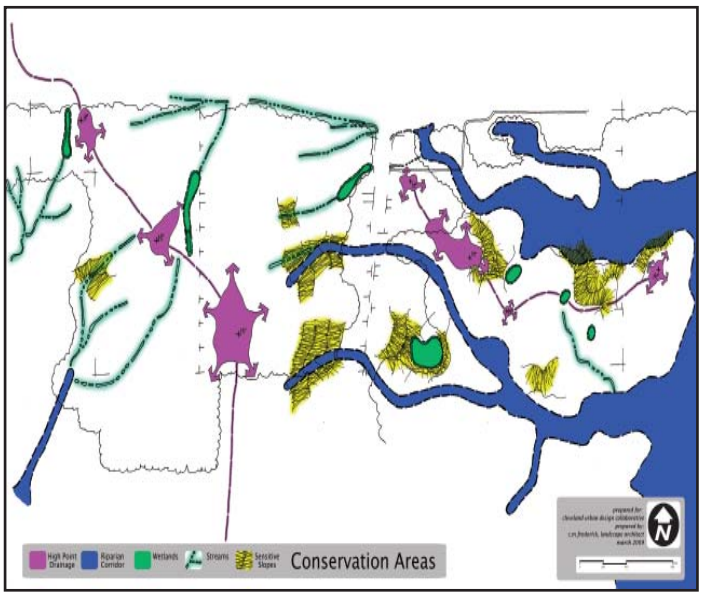


Chagrin River Watershed Partners, Inc.

Map Adoption Process

Auburn Township Zoning Commission revised the PCA and PDA maps which were adopted by the Township Trustees via resolution on May 4, 2009. In addition, CRWP has been working with Auburn Township and the Kent State University Urban Design Center on a concept plan for the PDA at Auburn Corners located at the intersection of Ravenna Road (State Route 44) and Washington Street. The concept plan will be presented along with balanced growth planning concepts to the Auburn Township Trustees and Auburn residents at an open house in July 2009.

PCAs in Auburn Township include riparian corridors, existing parks and conservation easements, City of Akron holdings surrounding LaDue reservoir, and all parcels over 25 acres in size. PDAs in Auburn include the partially developed industrial park on Munn Road, commercial corridor along East Washington Street, and Auburn Corners. Auburn Corners is currently served by a wastewater treatment plant, however no central water service is available. Although this area has ready access to State Route 422, and wastewater services, and is zoned for business, commercial, and light industrial uses, it has not yet developed. Auburn Corners was the subject of an intensive concept planning process completed by CRWP and the Kent State Urban Design Center with input from the Township Trustees, Zoning Commission, County Planning Commission, and residents. Although development of this area is a priority to the Township, it is equally important that it develop at the appropriate scale and density.



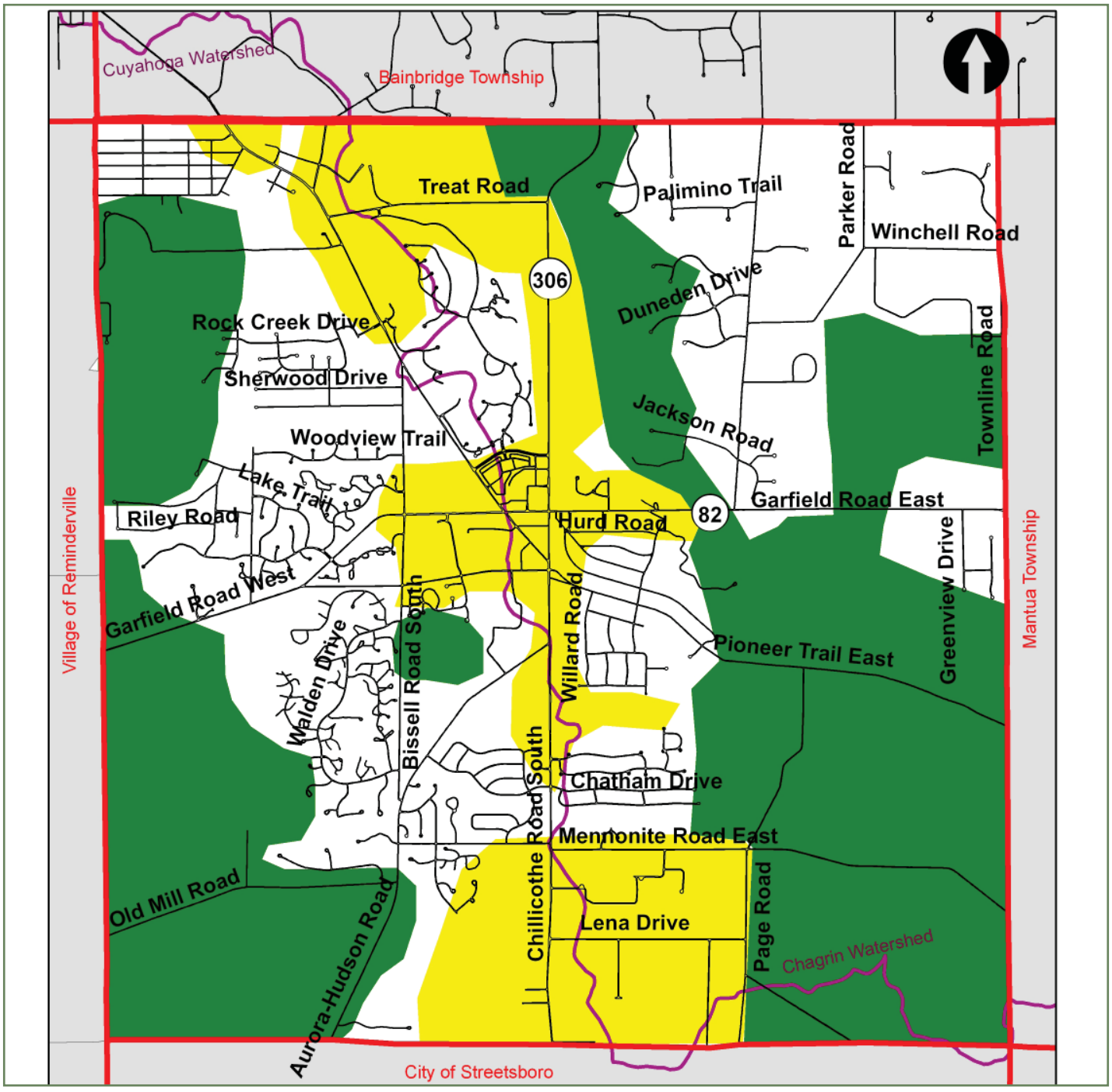
Implementation

The Auburn Corners concept plan identifies development opportunities with an appropriate scale and feel for a Township setting. The concept plan includes possible layouts and uses to maximize connectivity, scale buildings for pedestrians, centralize storm water management, and protect and avoid natural resources.

Much of Auburn Township has large areas of open space and low density residential zoning. Expansion of sanitary services into these residential areas is not anticipated, thus these areas will continue to be served by individual wells and septic systems. Auburn Township has a significant amount of protected open space within the community including conservation easements, City of Akron's LaDue reservoir, and ODNR's Auburn Marsh wildlife area. Auburn Township already has adopted codes for erosion and sediment control, comprehensive storm water management, and riparian and wetland setbacks and may consider conservation development as a land use practice to implement the PCAs as designated. To implement the PDAs and more specifically the Auburn Corners concept plan, adoption of a town center overlay to allow mixed uses at Auburn Corners may be appropriate. The Township must also investigate the opportunities for central water and options for allowing centralized storm water management, possibly through a Township Drainage District or storm water utility.

Auburn Corners Concept Plan

CITY OF AURORA

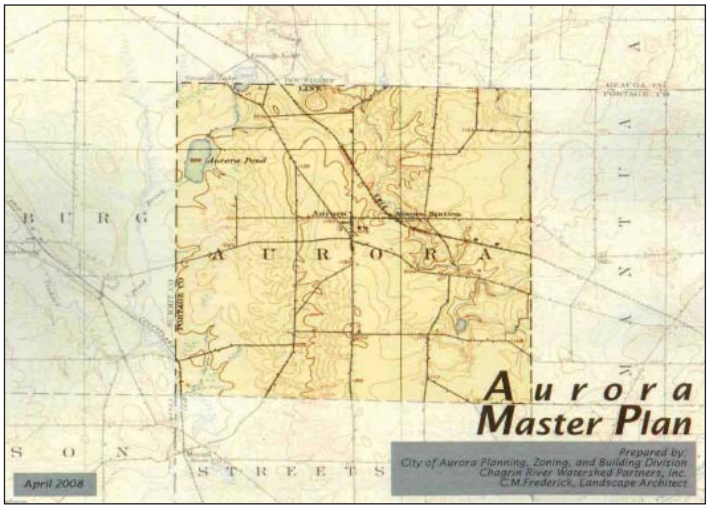


Chagrin River Watershed Partners, Inc.

Map Adoption Process

The City of Aurora endorsed the PCA and PDA map and included this information as well as details of the Balanced Growth program in the updated Aurora Master Plan. The balanced growth concepts were used as guiding principles in the local land use plan. A Master Plan Steering Committee reviewed the existing plan and worked with a planning consultant, Aurora staff, and CRWP to complete the Master Plan. The plan was then presented to Planning Commission where revisions were requested and completed. The Aurora Master Plan, including the PCA and PDA maps, was adopted by City Council in May 2008. Important notes from the PCA and PDA map revisions include:

- *Open Space Connectivity*
- *Historic and Modern Town Center*
- *Economic Development Opportunities*



Town Center Concept Plan

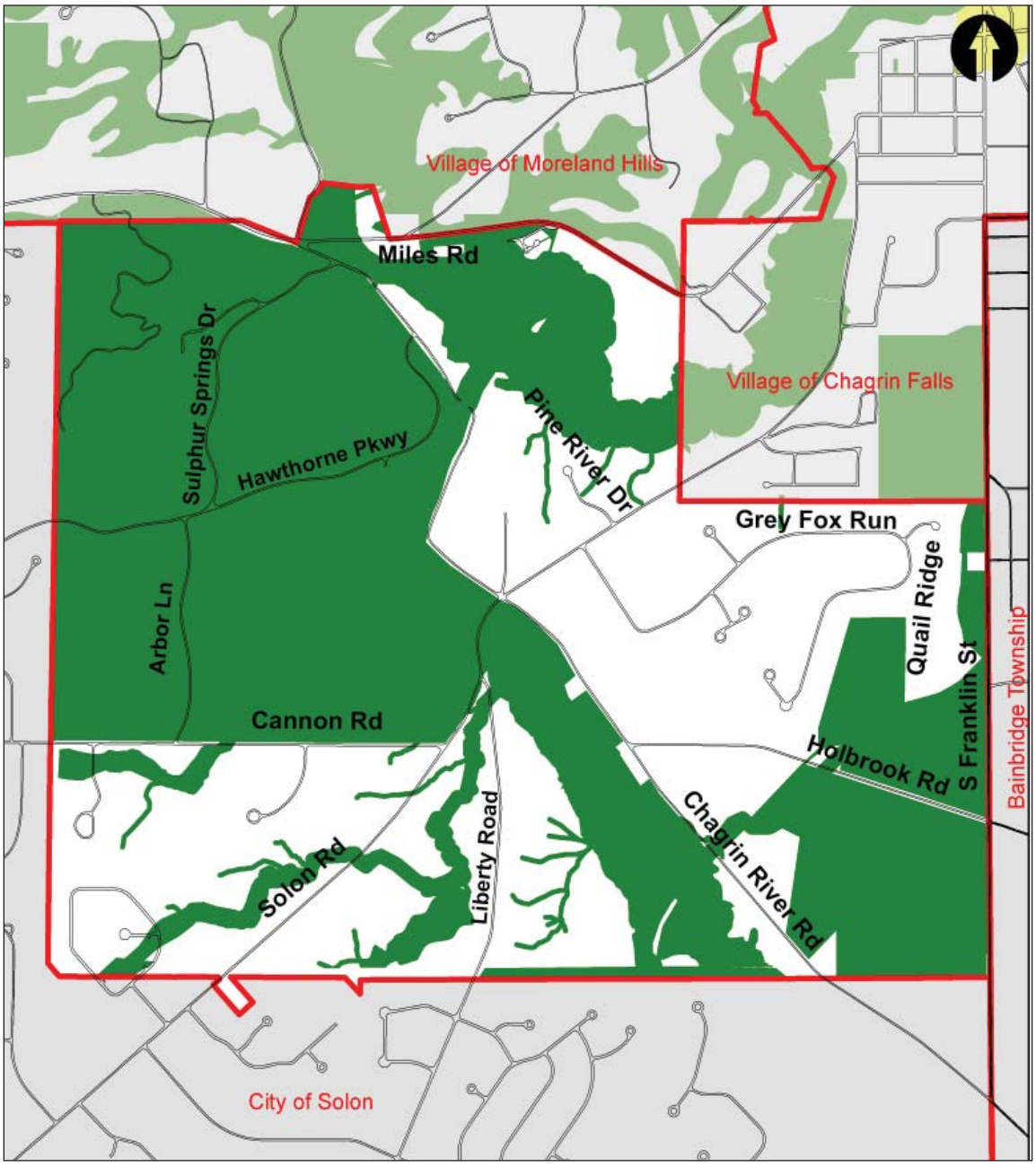
Implementation

The Master Plan identifies a series of objectives and tasks that include continuing practices, action items, and study items for City departments. Recommendations from the Master Plan and CRWP include:

- *Continue to pursue economic development initiatives and open space acquisition.*
- *Review existing conservation development code for possible changes including requiring a yield plan to calculate density.*
- *Further explore options for stream and wetland mitigation.*
- *Coordinate local park and open space planning with Portage Parks and greenways planning.*
- *Develop a maintenance code for rental properties.*
- *Review planning objectives for focus areas, including:*
  - *Central City Overlay District*
  - *Depot Overlay District*
  - *Geauga Lake Park*
  - *Sand and Gravel Area*
  - *Crackle Road YMCA Property*

Aurora's Master Plan also notes the opportunity for the City to create incentives that are aligned with PCA and PDA designations. For example, the City may chose to approve variances to their wetland setback codes and require selection of storm water BMP's that will ensure the remaining wetland resources continue to function and provide valuable services in the existing industrial area.

VILLAGE OF BENTLEYVILLE



Map Adoption Process

Draft PCA and PDA maps were presented to the Village Engineer and Mayor. After initial discussions, the Planning Commission revised the PCA and PDA maps and recommended endorsement to the Village Council. Council adopted the maps via resolution in December 2008. Bentleyville is a residential community with most lots larger than 1.3 acres. The Cleveland Metroparks owns approximately 35% of the Village land area as a part of South Chagrin Reservation. No PDAs were designated which is consistent with lack of commercial or industrial areas within the Village. Components of the designated PCAs include riparian corridors (using CRWP model riparian setback widths, including 100 year floodplain), existing park or conservation easement properties, and several large tracts of vacant land.

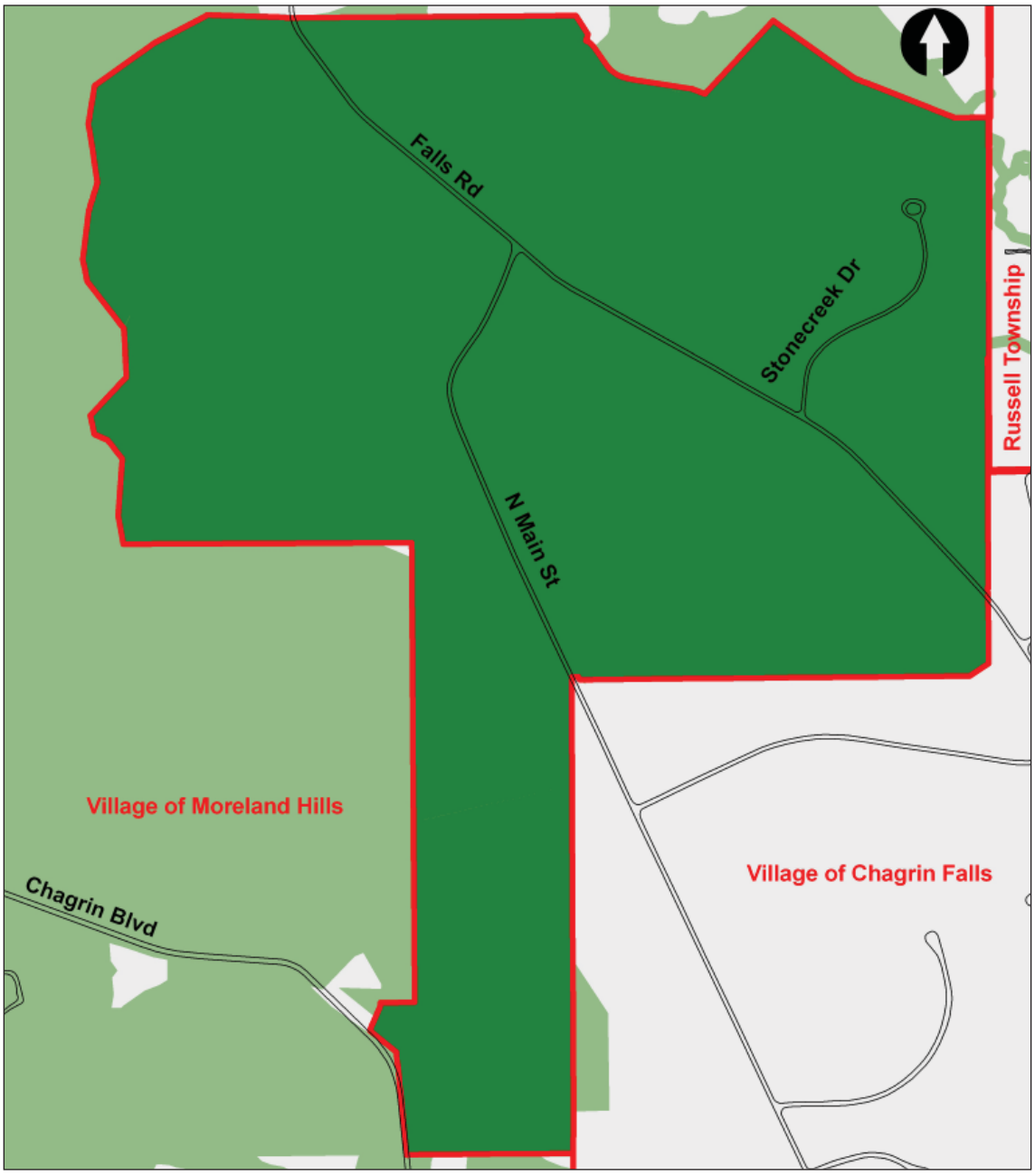
Miles Bridge over Chagrin

Duncan House

Implementation

Much of the PCA implementation has already been completed through conservation easements and Cleveland Metroparks acquisitions. In addition, Bentleyville has adopted a comprehensive storm water management code and riparian setbacks with widths that are currently smaller than those recommended by CRWP. Bentleyville is considering extending the riparian setbacks to the CRWP recommended widths and is also investigating a conservation development district which would allow future development of large parcels to maintain the current zoning density with significant amounts of open space. These best local land use practices would facilitate further implementation of the *Chagrin River Watershed Balanced Growth Plan* and provide linkages and water quality benefits to Bentleyville, the Chagrin River and Lake Erie.

CHAGRIN FALLS TOWNSHIP



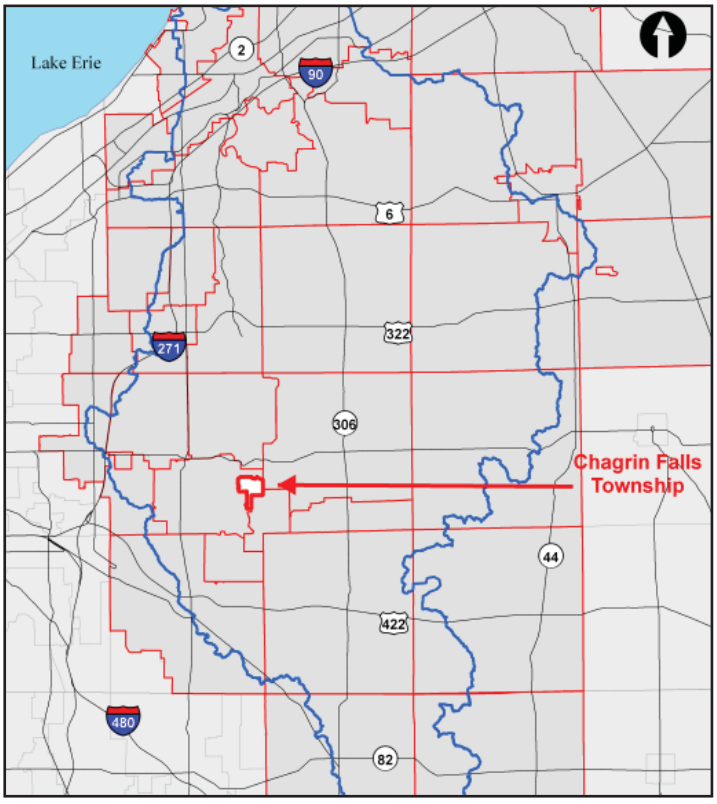
Map Adoption Process

Draft PCA and PDA maps were presented to the Township Trustees. After the Trustees considered several options for revised PCA and PDA maps and the draft resolution, CRWP presented them at a public hearing for any interested Chagrin Falls Township residents. Based on the comments at the public hearing the Township designated the entire community as a PCA. The PCA map was endorsed by the Township Trustees in March 2009.

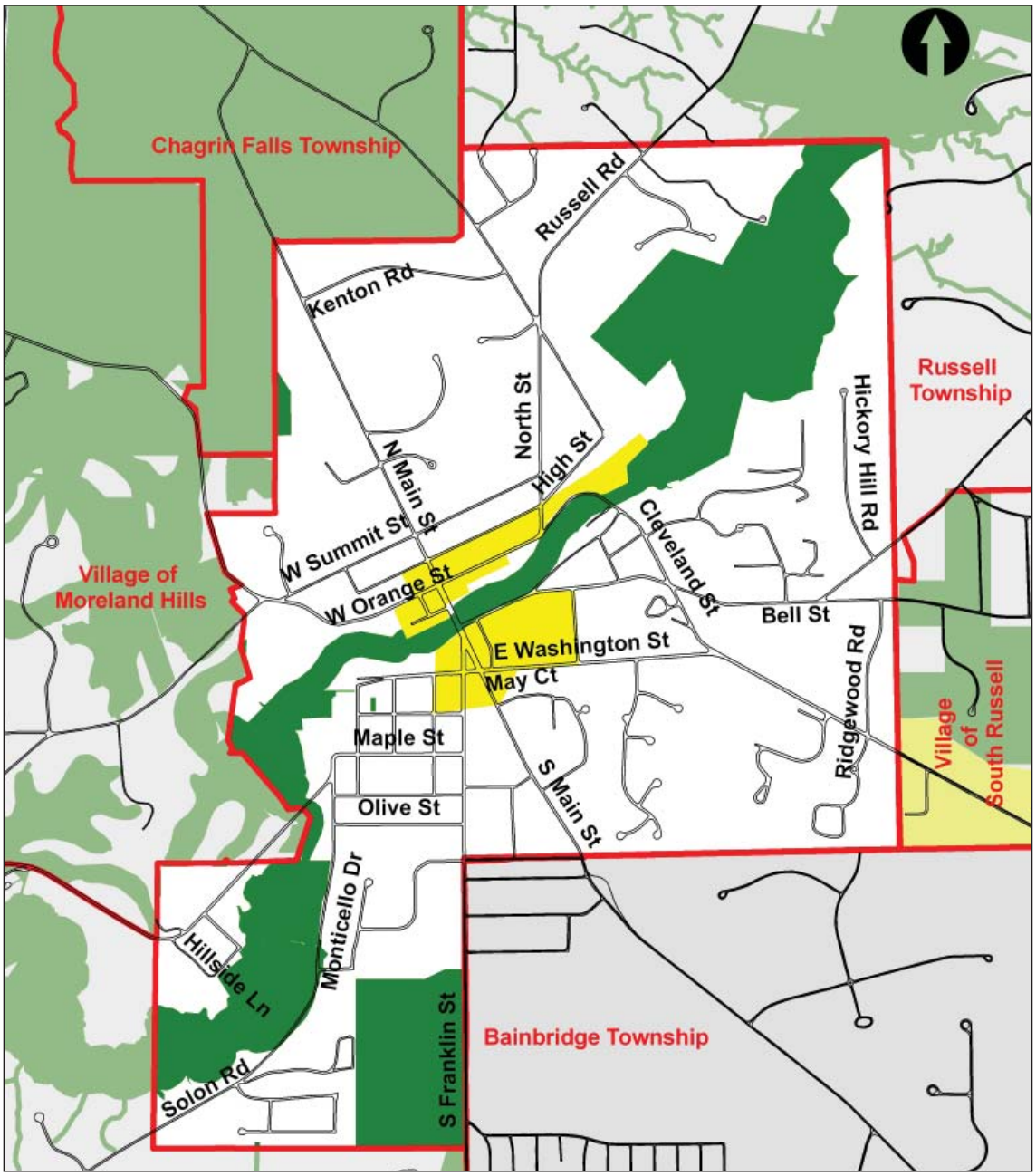
Implementation

Chagrin Falls Township is entirely low density residential with a minimum allowable lot size of 5 acres. Approximately 12% of the Township is protected by either conservation easements or Cleveland Metroparks. Additional open space protection would be appropriate, particularly along the main stem of the Chagrin River. Maintenance of low density residential zoning can effectively implement the PCAs for the Village as very few remaining parcels can be subdivided per the low density zoning. In addition, the Township could consider changes to the local zoning code to include storm water management, riparian and wetland setbacks, or conservation development.

Location Map



VILLAGE OF CHAGRIN FALLS

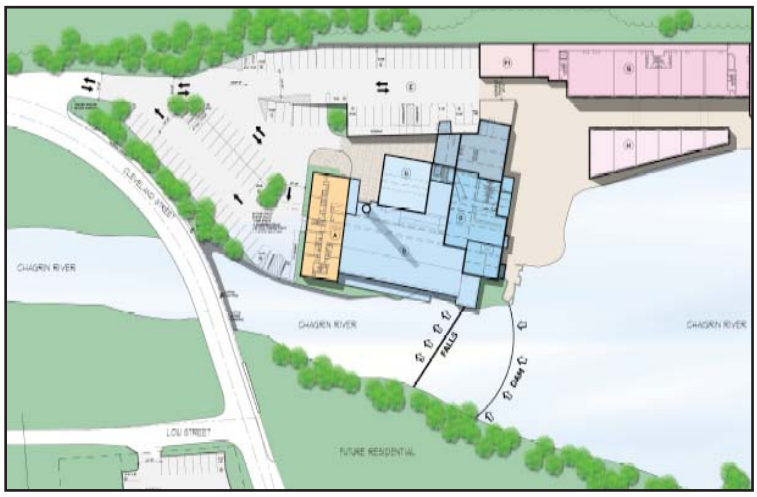


Map Adoption Process

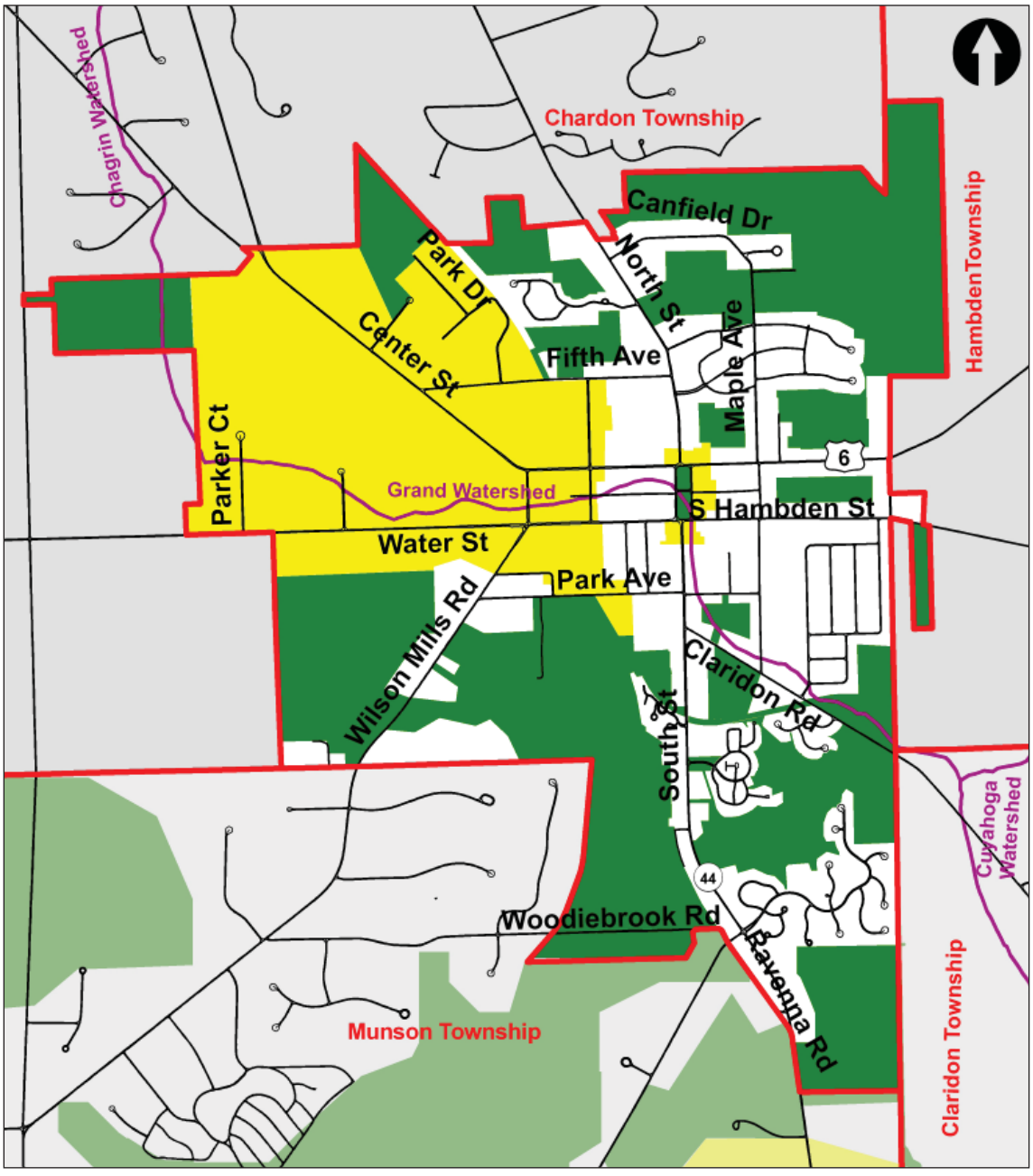
Draft PCA and PDA maps were revised by Village staff and Planning Commission. Planning Commission approved the map, which was endorsed by Council in March 2009. PDAs include the commercial areas along Main, Orange, Washington, and Bell Streets, and the development portions of the former IVEX facility. PCAs in the Village included existing parks, 100 year floodplain, conservation easements and existing riparian buffer.

Implementation

The Village of Chagrin Falls has already adopted a series of best local land use practices that will assist the Village in implementing the PCAs and PDAs. These existing practices include adoption of a comprehensive land use plan, riparian buffer, erosion and sediment control, steep slopes regulations, comprehensive storm water management, and conservation development. As the former IVEX facility redevelopment continues, the Village has opportunities to promote the redevelopment of this site using balanced growth planning concepts. This vacant industrial property is proposed to be redeveloped using many of the historic structures on the property and create a mixed use development as a viable reuse of this property. In addition, the Village of Chagrin Falls sponsored an Ohio EPA 319 grant application to lower the dam on the Chagrin River at this location and restore several thousand feet of the Chagrin River. A photograph of the industrial property, the existing dam and dam pool, and the proposed development are shown at right.



CITY OF CHARDON



Map Adoption Process

Draft PCA and PDA maps were presented to City staff, Council and Planning Commission, and were subsequently revised. Final maps were endorsed by Council in March 2009.

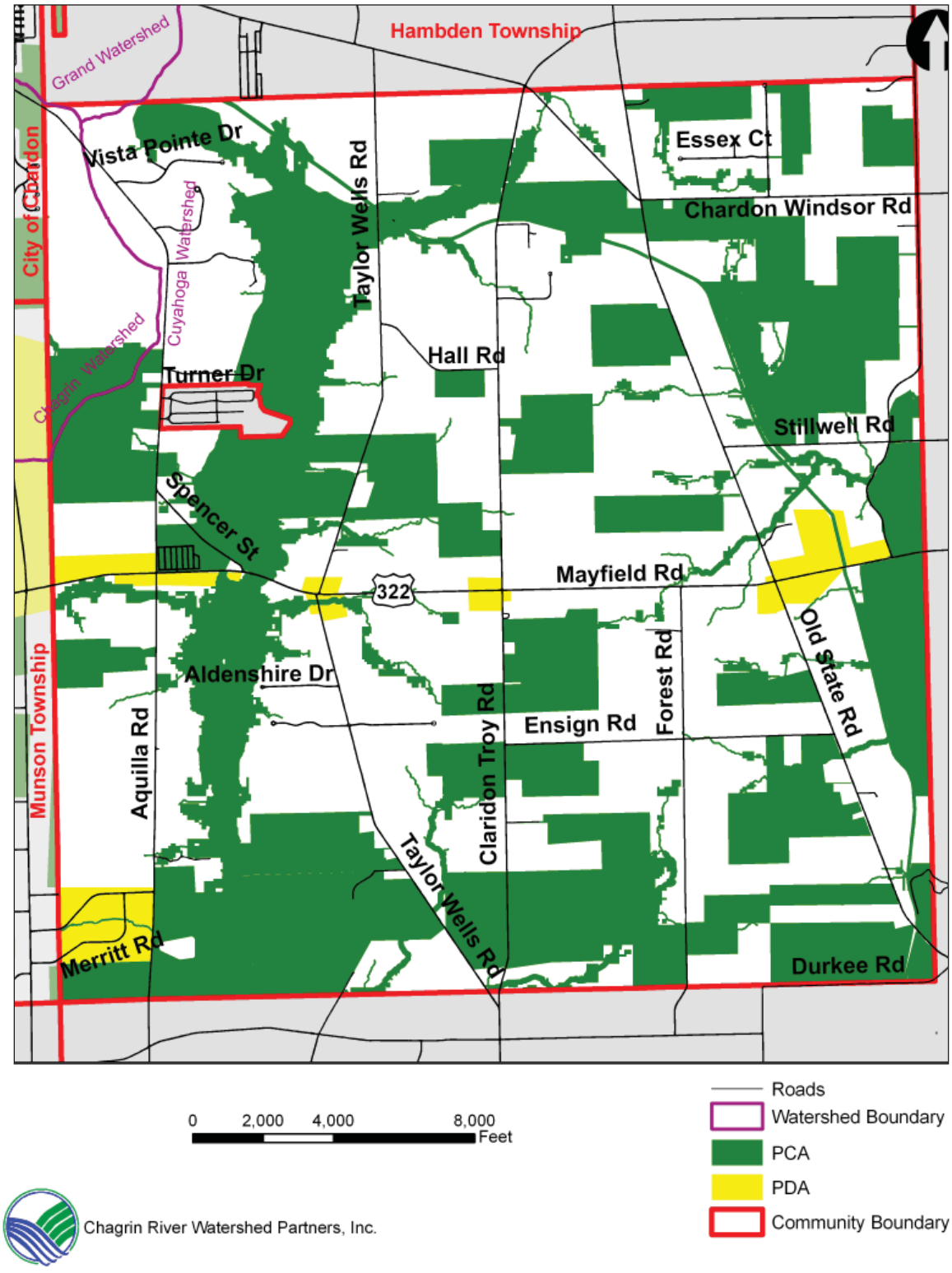
The City of Chardon was designated as the County Seat of Geauga County in 1808. The City includes a historic downtown square as well as a diverse blend of commercial, residential, and institutional and public office space. PDAs in the City of Chardon include the development area around the historic square and commercial and retail uses in the northwest quadrant of the City. PCAs within the City include the City Green in the historic town square, parks including Geauga Park District's Maple Highland Trail, existing open space in planned unit developments, 100 year floodplains, and large parcels in residentially zoned areas. Large parcels and undeveloped areas in existing residentially zoned areas are noted as PCAs to highlight the goal of maintaining the existing density in historic neighborhoods or to promote the use of open space development concepts in residential areas that have not yet been developed.

Implementation

The City of Chardon should continue planning efforts to diversify economic development opportunities in the town square. The City has already made the town square more pedestrian friendly by relocating parking facilities. Further improvement plans include revitalization of existing buildings, improved streetscape and infrastructure. Chardon has also designated Community Reinvestment Areas that include designated PDAs. If the City continues to explore economic development and "main street" improvements, it will promote the appropriate uses in their historic downtown.

To promote the protection of sensitive areas in PCAs, Chardon is updating their floodplain management regulations. In addition, the City should revisit its existing planned unit development code to evaluate opportunities for improvements and tailor this code to represent a conservation development code.

CLARIDON TOWNSHIP

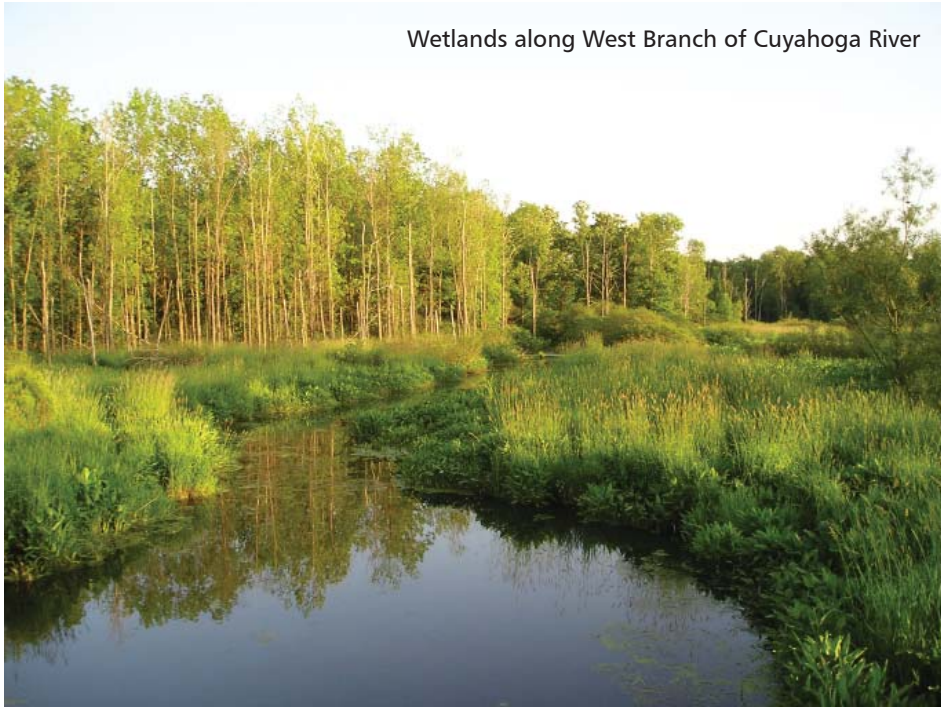


Map Adoption Process

Claridon Township Zoning Commission and Trustees reviewed the PCA and PDA maps. The Zoning Commission revised the maps to highlight existing industrial and commercial zoned areas as PDAs. PCA designations include riparian, floodplain, and wetland corridors as well as existing open space, trails, and large parcels over 50 acres in size. Claridon Township Trustees endorsed the final map in May 2009.

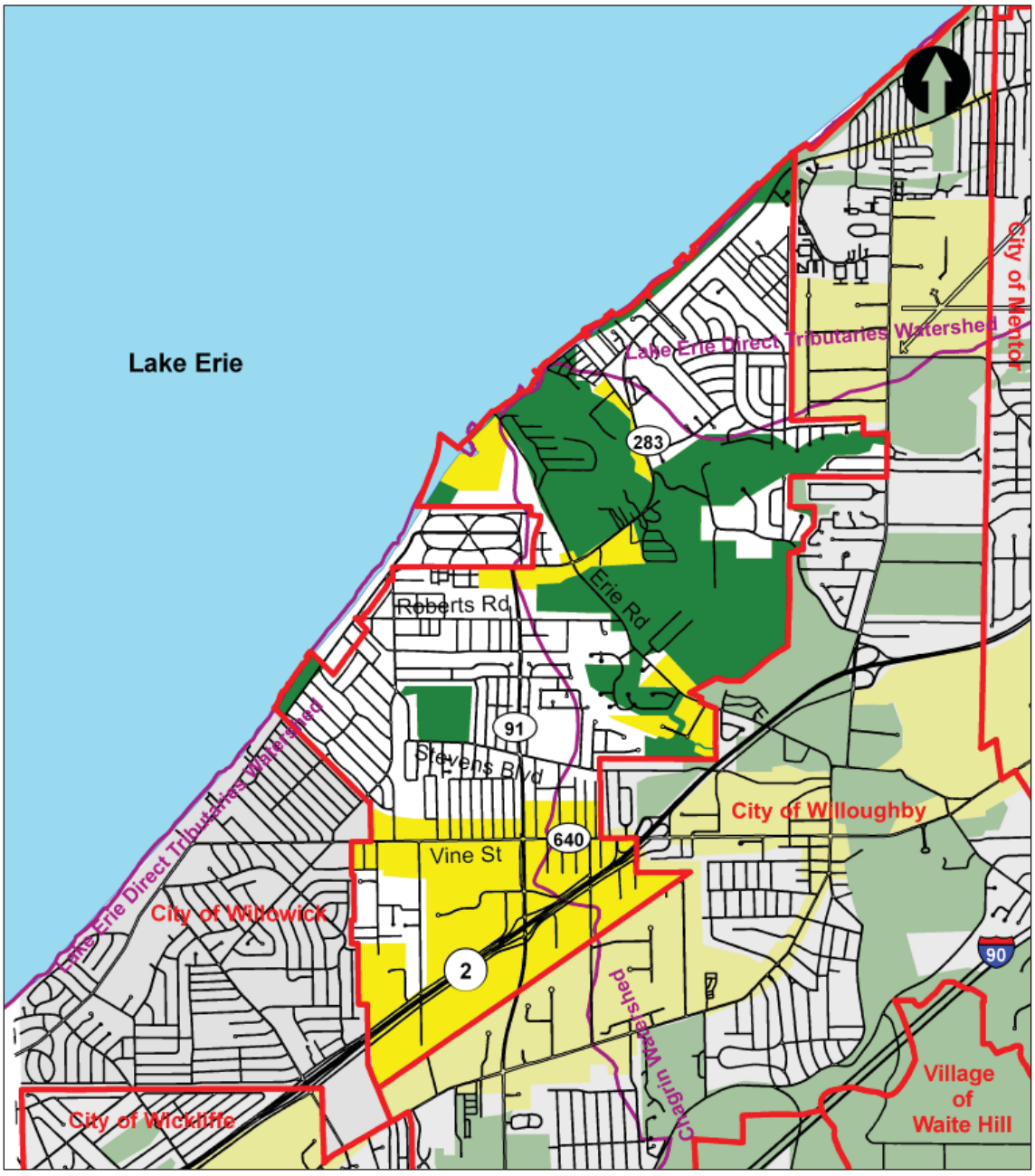
Implementation

Claridon Township may consider changes to their existing zoning code to include erosion and sediment control, comprehensive storm water management, riparian and wetland setbacks, and conservation development. CRWP will continue to work with the Township, Geauga County Planning Commission and Soil and Water Conservation District on these land use tools. Claridon Township also maintains a rich agricultural history. As of 2007, 1,610 acres in the Township were enrolled in the Current Agricultural Use Value (CAUV) program through the County Auditor. CAUV is a differential real estate tax assessment program which allows owners of farmland the opportunity to have their parcels taxed according to their agricultural value, rather than full market value. These CAUV parcels and extensive wetlands provide opportunities for protection of not only the agricultural heritage of Claridon Township, but also the services provided by those natural resources.



Wetlands along West Branch of Cuyahoga River

CITY OF EASTLAKE



Map Adoption Process

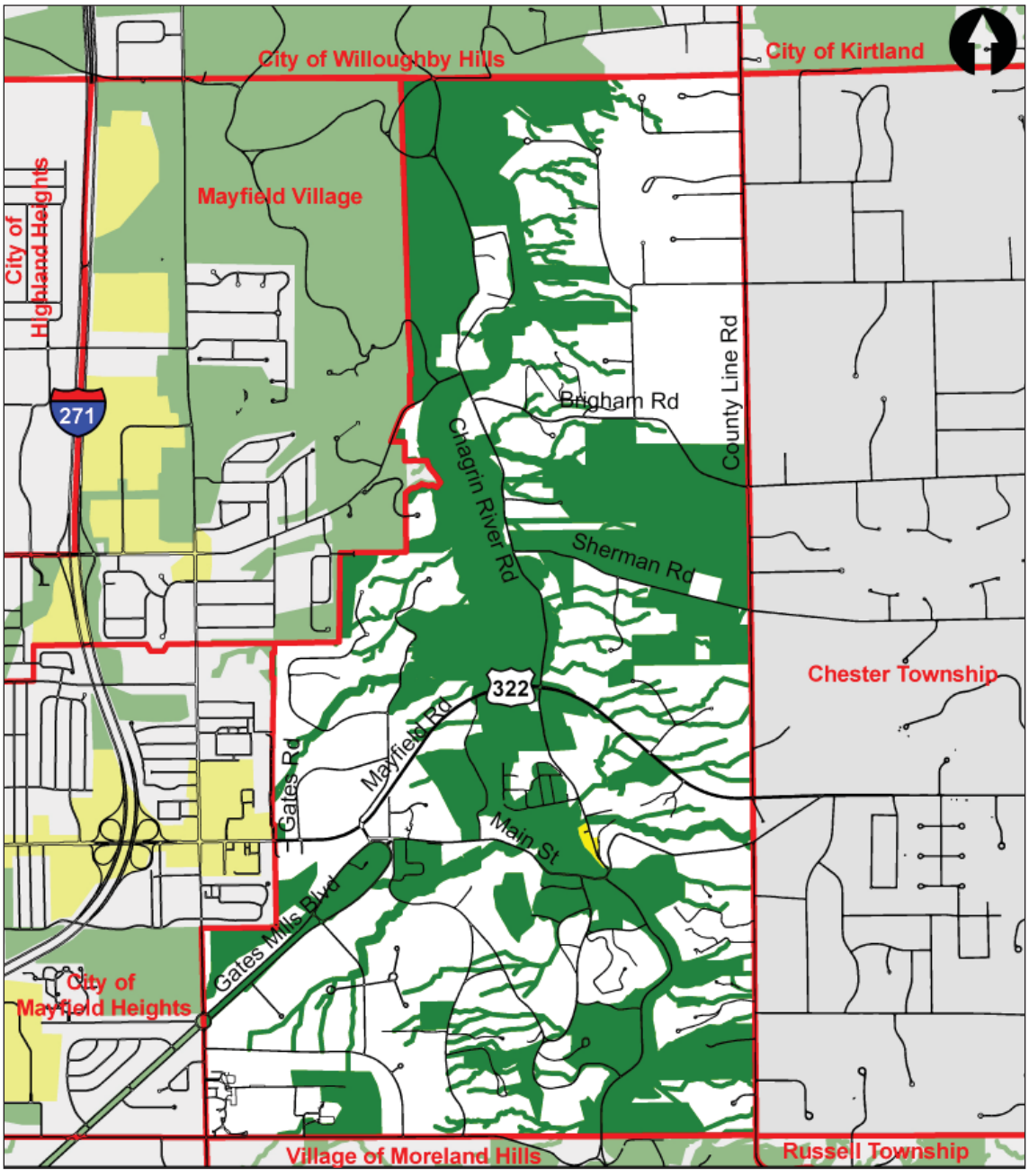
The City of Eastlake extensively reviewed and revised the PCA and PDA maps through the comprehensive plan update process. The City of Eastlake Economic & Community Development Council evaluated the maps and planning concepts prior to adoption by Council in November 2008. These maps and balanced growth planning concepts will be included in the comprehensive land use plan update for the City. This plan is anticipated to be approved in the Summer of 2009. The City of Eastlake is home to the Chagrin River, including the mouth of the Chagrin, access to Lake Erie, and the Lake County Captains' baseball stadium (Classic Park). Much of Eastlake was developed post World War II and numerous opportunities for redevelopment exist.

PCAs in Eastlake focus on the Lake Erie shoreline, Chagrin River, Corporation Creek and Ward Creek corridors, existing parks and easements, and some floodplain areas. PDAs in Eastlake focus on economic development and redevelopment opportunities including Lake Shore Boulevard, the ridge line overlooking the Chagrin River, Vine Street Corridor, commercial and industrial areas surrounding SOM Center Road (State Route 91) and State Route 2, JFK Property (former Nike missile site), and Erie Street industrial park. These PDAs represent a blend of new development and redevelopment opportunities while continuing to focus on retention of existing businesses.

Implementation

To implement the PCAs in Eastlake, protection of the islands at the mouth of the Chagrin (pictured above) remains a critical item. The protection of the smaller of the two islands is currently being negotiated by the Eastlake Port Authority and Lake Metroparks using a grant from ODNR, Coastal Management Program. Acquisition of the larger North Island should be explored. In addition, maintaining marina operations that provide access to Lake Erie and the Chagrin River is important to the economy and sense of place in Eastlake. As areas near Lakeshore Boulevard develop, all development should be maintained out of the floodway areas while applying the appropriate land uses to the ridge line and flood fringe areas. To facilitate this while protecting those residents that already live in the floodprone areas of Eastlake, the City should tailor zoning and building codes to allow alternative arrangement of lots, riparian setbacks, and updated floodplain regulations. To further facilitate implementation of PDAs, Eastlake should consider modifying uses in certain zoning classifications to ensure appropriate uses and density of development are applied. In addition, the City could facilitate development by widening the commercial area along the Vine Street corridor, improve parking regulations to prevent overparking and encourage shared parking agreements, and improve storm water management code. The City of Eastlake could spur economic development on the JFK site and near the baseball stadium through code adoption and tiered parking. The City of Eastlake has many assets and CRWP will continue to work with the City and Lake County Planning Commission to realize the potential from these initiatives.

VILLAGE OF GATES MILLS



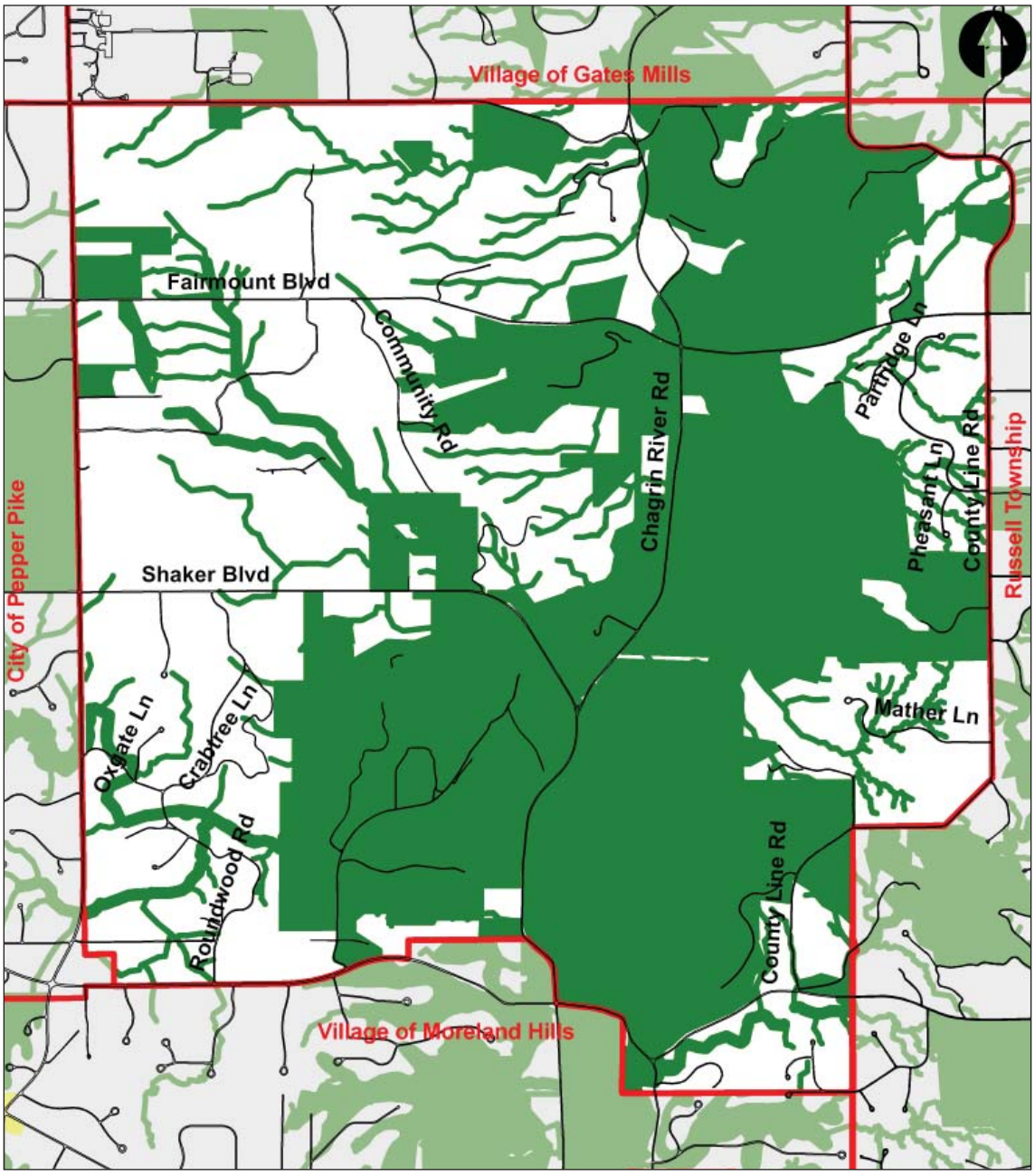
Map Adoption Process

PCA and PDA maps were revised by Village staff, Mayor and Planning Commission prior to endorsement by Council in February 2009. Only one PDA area was designated along the existing commercial/office area on Chagrin River Road in the center of Gates Mills. The PCAs include stream buffers, 100 Year floodplain, parcels protected with a conservation easement, and large parcels which are currently undeveloped. The Gates Mills Land Conservancy reviewed the PCA designations and included all areas with an existing conservation easement and parcels with important conservation areas.

Implementation

In the event that any parcels designated as PCAs are developed, they should consider using Gates Mills' Conservation Development District code. In addition, the Village may consider improved codes for storm water management, floodplain codes with higher standards, or stream and wetland setbacks. The area designated as a PDA should be maintained and redevelop in accordance with existing zoning codes and in such a manner that maintains the historic character of Gates Mills.

VILLAGE OF HUNTING VALLEY



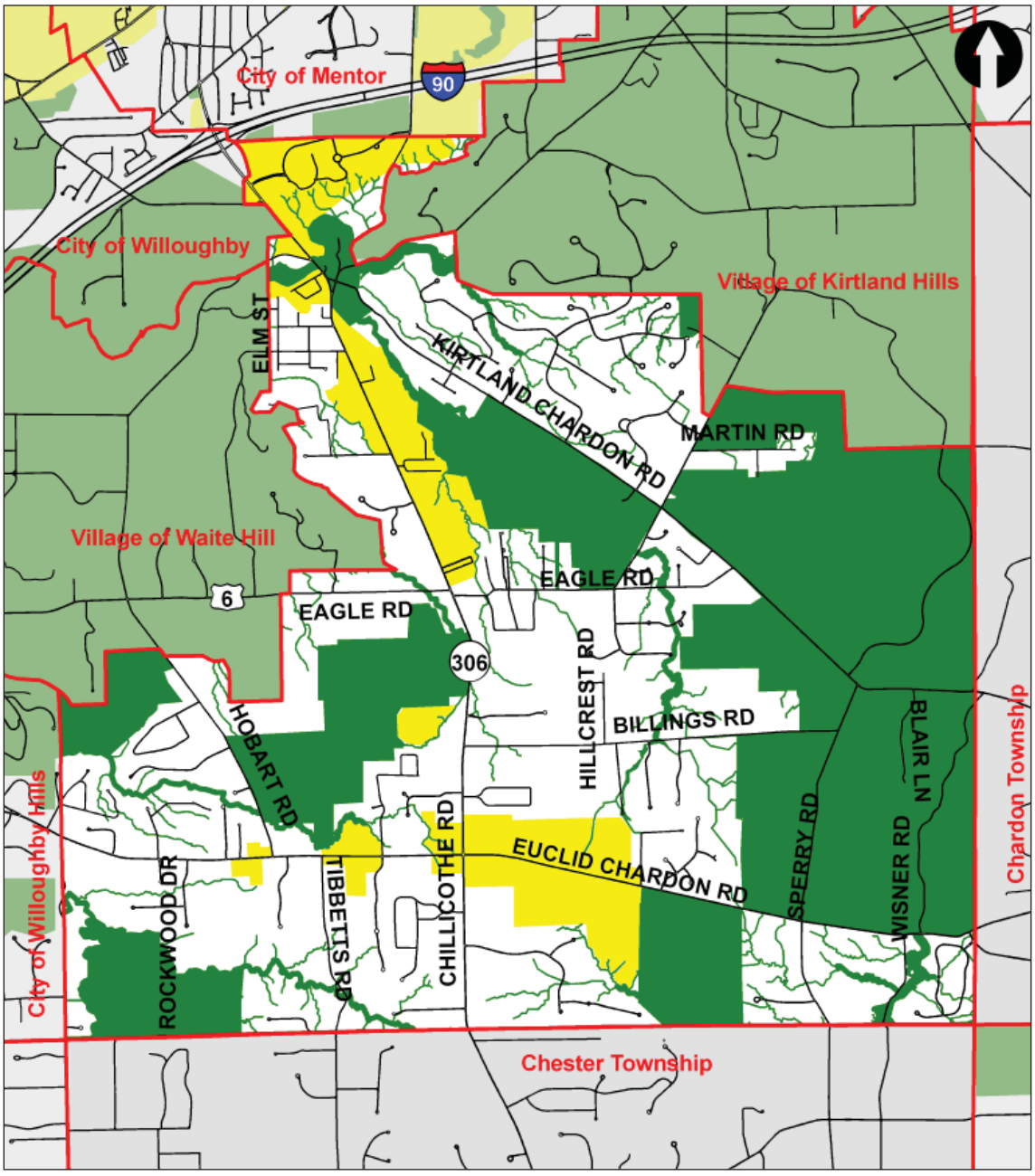
Map Adoption Process

PCA and PDA maps were revised by Village staff and Planning Commission prior to endorsement by Council in November 2008. As Hunting Valley zoning details that the entire village is zoned for 5 acre density residential, no PDAs were designated for Hunting Valley. The PCAs include riparian areas, 100 year floodplain, parcels currently owned by the Village, parcels protected with a conservation easement, and large parcels which are currently undeveloped.

Implementation

The Village of Hunting Valley has already adopted best local land use practices that will assist the Village in implementing the PCAs. These existing practices include protection of open space through easements and acquisition, riparian setbacks through a protected watercourses code, and conservation development. Following the designation of PCAs for the Village, Hunting Valley is considering revisions to their existing protected watercourses code to mirror those areas designated as PCAs along headwater streams and in floodplains. In the event that parcels designated as PCAs are developed, Hunting Valley's Conservation Development District code should be considered, and the Protected Watercourses code implemented. The Village could also consider the adoption of regulations for storm water management and erosion and sediment control.

CITY OF KIRTLAND



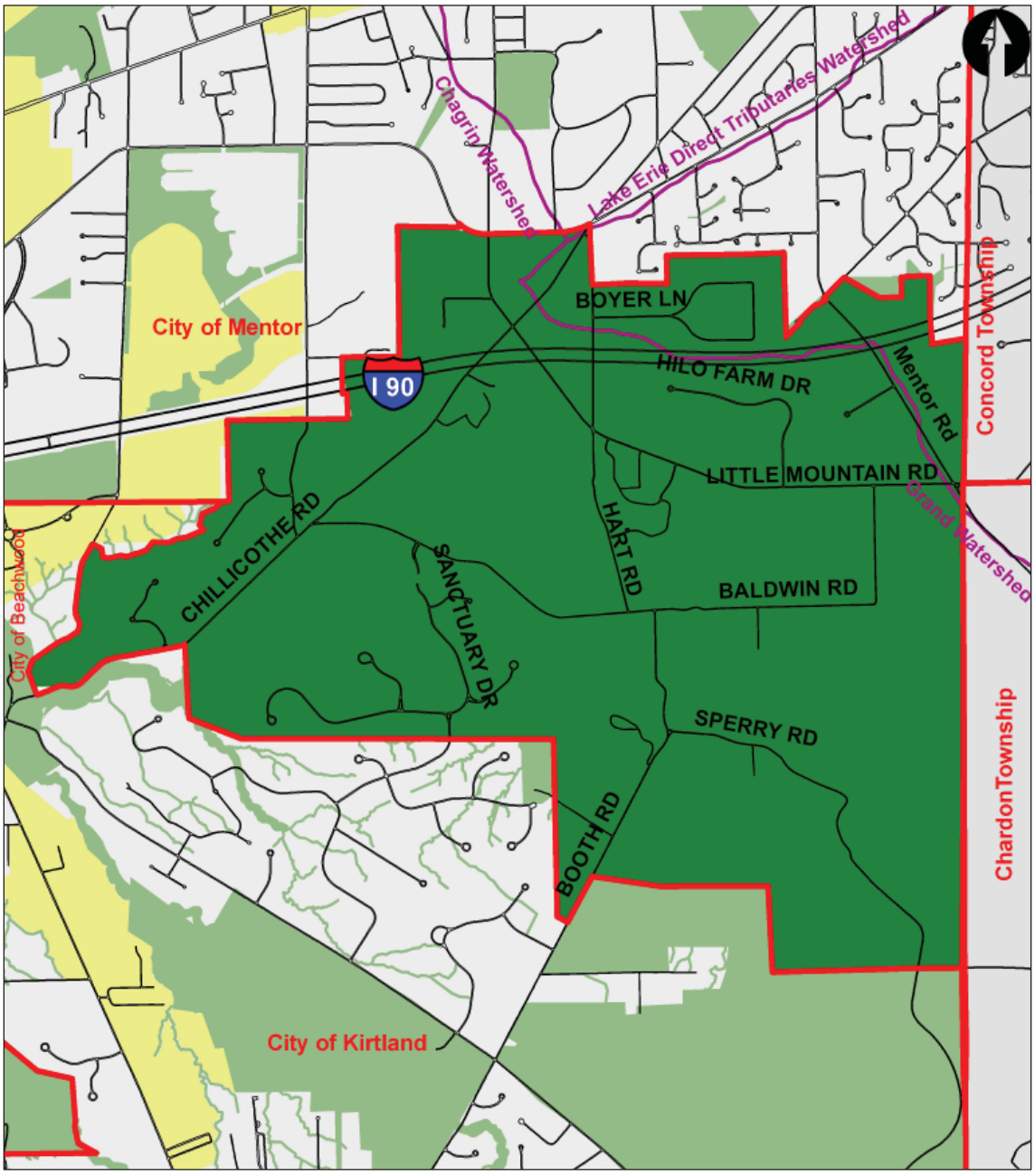
Map Adoption Process

Draft PCA and PDA maps were revised by City staff and Planning Commission before endorsement by Council in November 2008. PDAs include the commercial corridor along State Route 306, other commercial zones and industrial zoned areas. PDAs are aligned with the economic development areas in the City's comprehensive land use plan. PCAs include existing parks, Holden Arboretum properties, conservation easements, existing riparian setbacks, and undeveloped low density (3 acre) zoned areas.

Implementation

The City of Kirtland has already adopted a series of best local land use practices that will assist the City in implementing the PCAs and PDAs. These existing practices include adoption of a comprehensive land use plan, riparian setbacks, erosion and sediment control, comprehensive storm water management, conservation development, and low density residential development. Continued implementation of these codes will allow the City of Kirtland to effectively implement the PCAs and PDAs. The City has also been working on installing central sewers in the PDA along State Route 306 to improve water quality and wastewater treatment.

VILLAGE OF KIRTLAND HILLS



Chagrin River Watershed Partners, Inc.

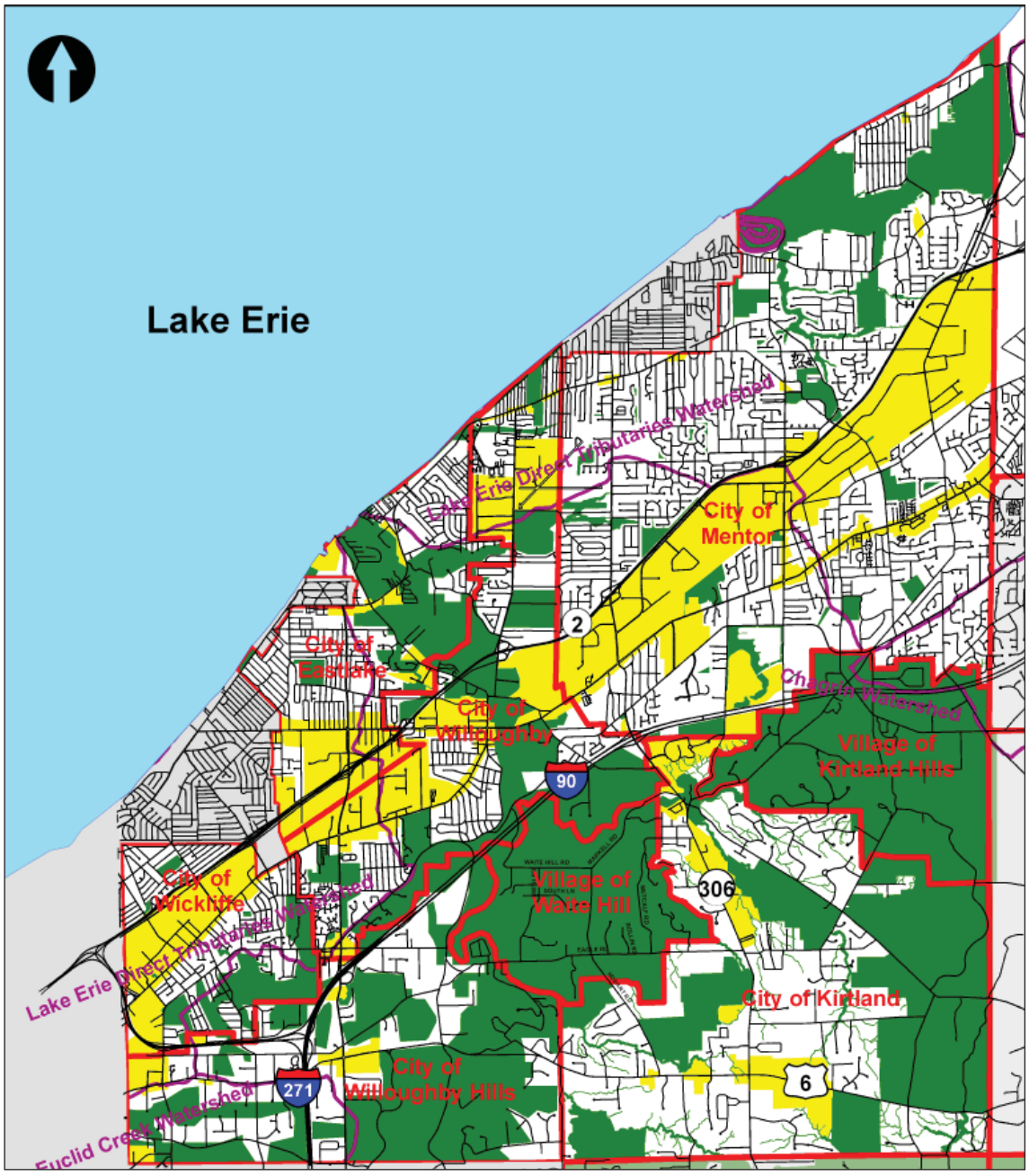
Map Adoption Process

Draft PCA and PCA maps were reviewed by Village Council and they designated the entire community as a PCA via resolution in December 2008. Kirtland Hills is zoned entirely as low density residential with a minimum of 5 acres per lot and is home to the Holden Arboretum. In addition to managing a garden collection and visitor's center, the Arboretum manages a significant amount of acreage as natural areas. Numerous coldwater habitat streams, including Pierson Creek and the East Branch of the Chagrin River run through the Village.

Implementation

Approximately 30% of the land in the Village of Kirtland Hills is protected by conservation easements, Lake Metroparks, or the Holden Arboretum. Any additional open space protection would be appropriate along high quality stream corridors. The Village of Kirtland Hills could consider changes to the local zoning codes to include comprehensive storm water management, riparian setbacks, higher standards for flood damage reduction codes, or conservation development.

LAKE COUNTY



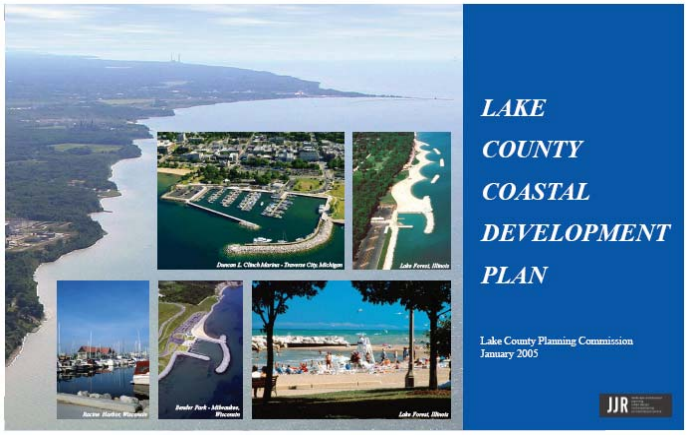
Chagrin River Watershed Partners, Inc.

Map Adoption Process

All of the land area in the Chagrin River watershed portions of Lake County are incorporated communities. As such, Lake County does not directly have any land use authority over these communities, however the Lake County Planning Commission was integrally involved in incorporating balanced growth maps and planning concepts into the Mentor and Eastlake's revised land use plans. After all of the Lake County incorporated communities in the Chagrin watershed revised their PCA and PDA maps, CRWP presented the maps and the *Chagrin River Watershed Balanced Growth Plan* to the Lake County Commissioners. The Commissioners passed a resolution of endorsement in May 2009.

Implementation

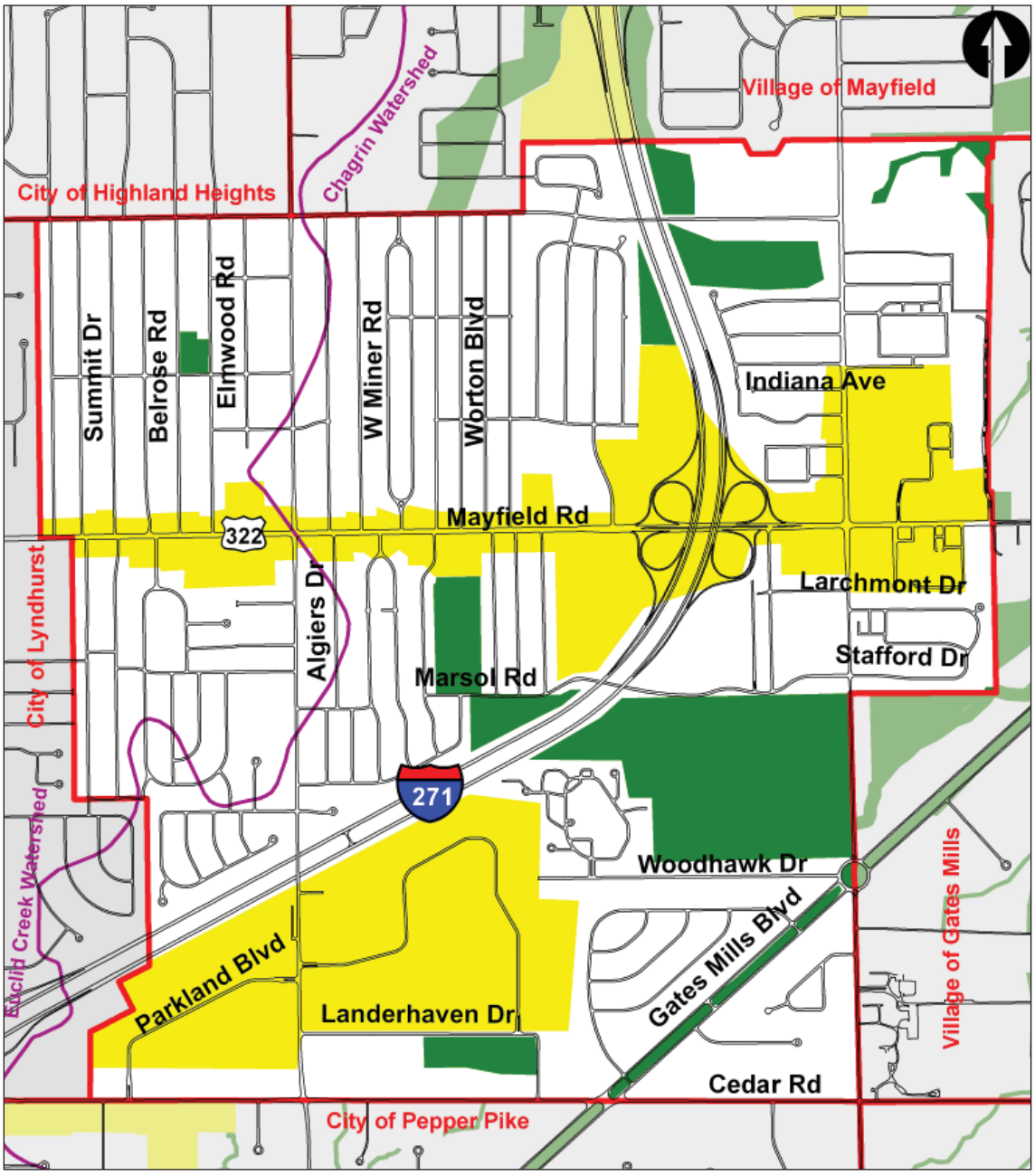
The Lake County Planning Commission has been actively involved in incorporating the balanced growth planning concepts into local land use plans. The Planning Commission will continue to work with communities to adopt best local land use practices. Furthermore, Lake County has developed the Lake County Coastal Plan which may also serve as a mechanism to implement portions of the *Chagrin River Watershed Balanced Growth Plan*. CRWP will continue to work with Lake County and various entities within the County, including the Lake County Storm Water Management Department, Lake Soil and Water Conservation District and Lake County Planning Commission on the implementation of these Plans.




Harbor Concept with discharge


Aerial view of Chagrin River and Navigation channel looking north

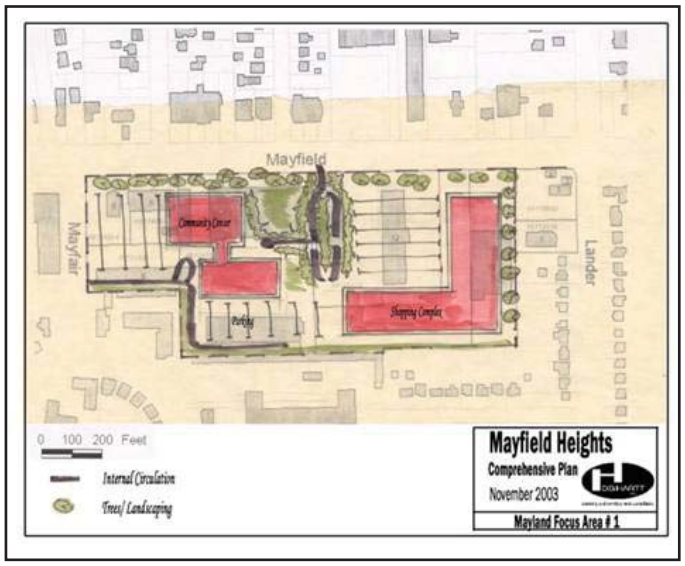
CITY OF MAYFIELD HEIGHTS



Chagrin River Watershed Partners, Inc.

Map Adoption Process

PCA and PDA maps were revised by Mayor, Council, and Planning Commission, then adopted by Council in December 2008. PDAs include existing commercial and business corridors, encompassing the Mayfield Road and Interstate 271 corridors, and align with local zoning for commercial, industrial and office uses. PCAs include existing city parks, possible trail connections along Gates Mills Boulevard, cemeteries, and green space in existing subdivisions.



Implementation

To facilitate implementation of PCAs and PDAs, the City of Mayfield Heights may want to consider an overlay zoning district that includes compact development concepts, or consider modifying to the City's parking codes to allow for shared parking to minimize parking stall widths and numbers. Excerpts from the Mayfield Heights Master Plan highlight opportunities for redevelopment along Mayfield Road including the streetscape improvements as illustrated below.

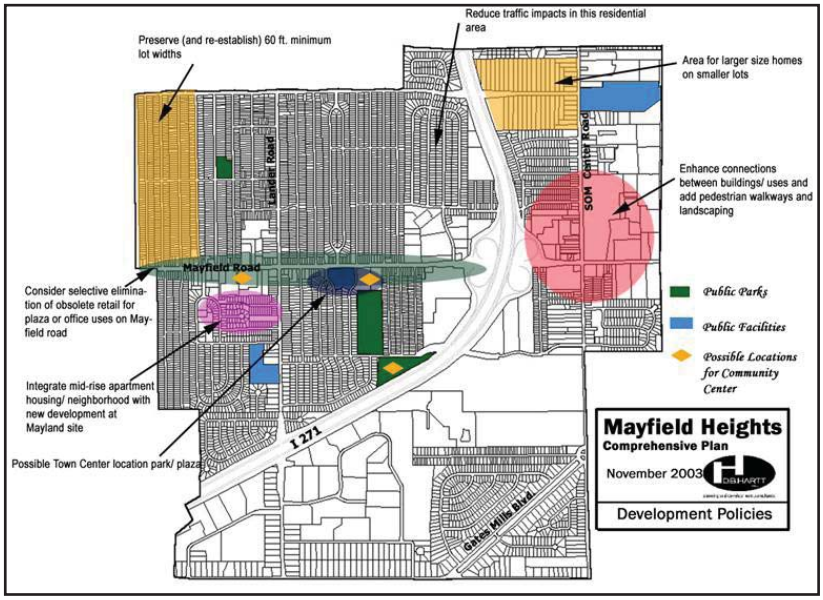
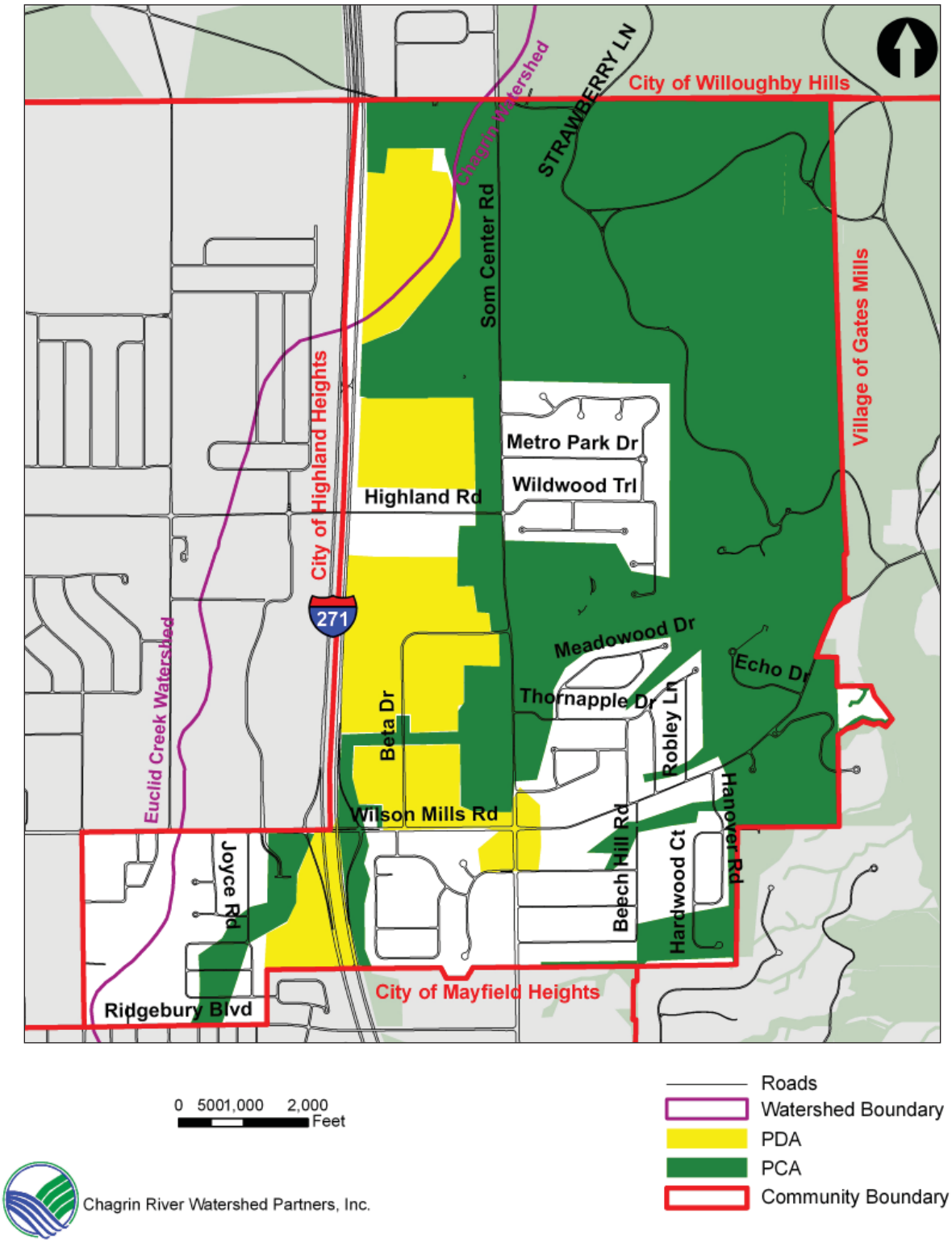


Photo mock up of Mayfield Road. Source: URS

MAYFIELD VILLAGE

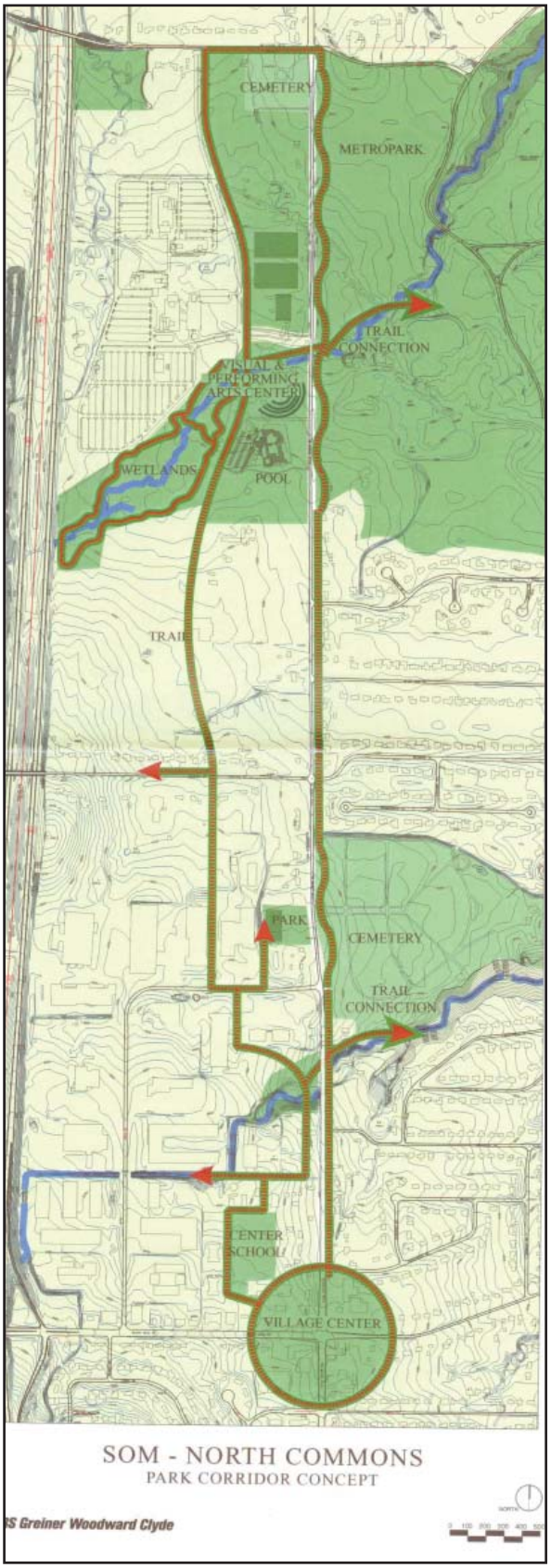


Map Adoption Process

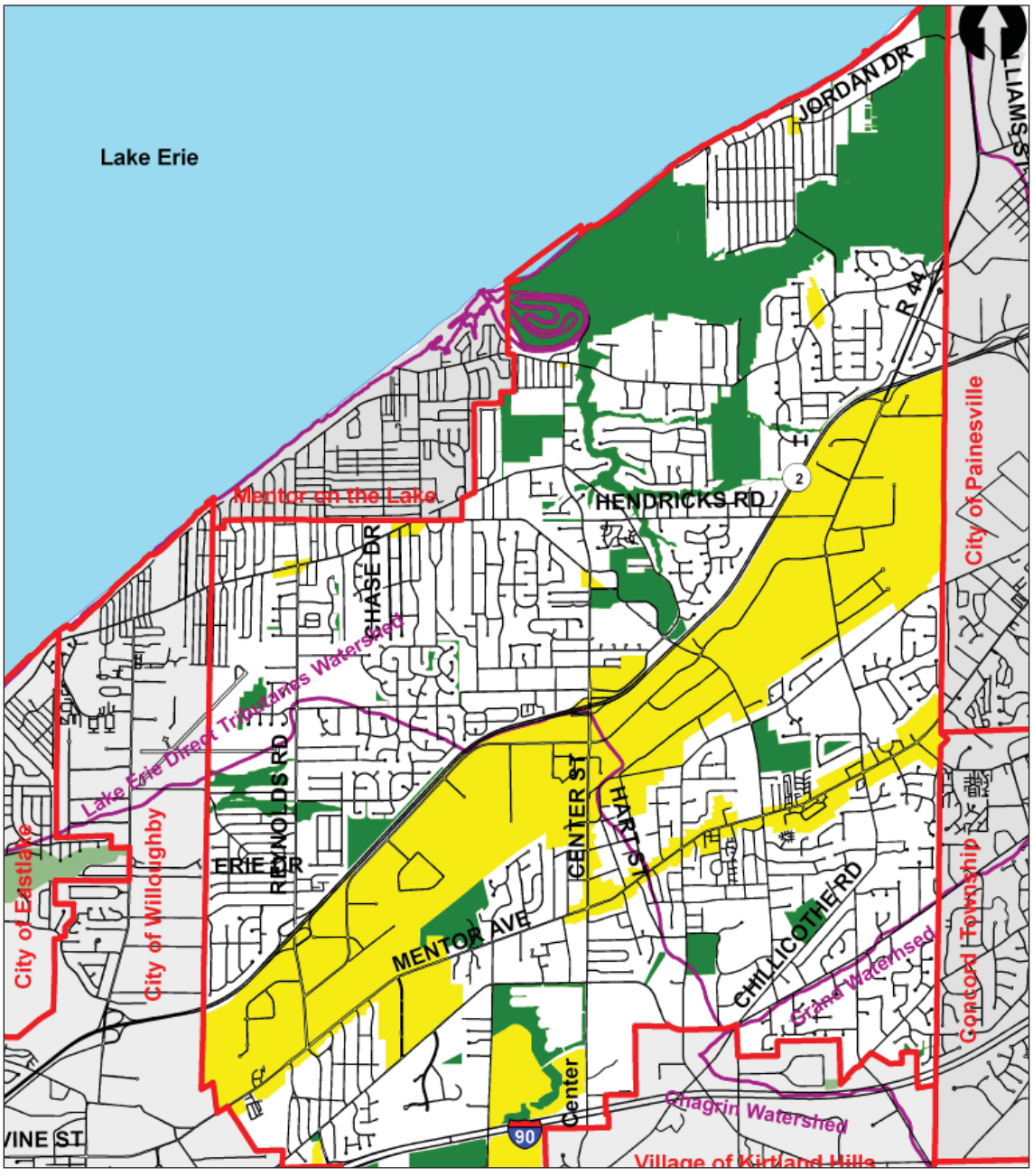
PCA and PDA maps were revised by Village staff, Mayor and Planning Commission, then adopted by Council in December 2008. Discussions regarding PDAs focused on economic development, including possible redevelopment of Beta Park and Progressive Campus 3. PCAs include existing Cleveland Metroparks property, Village parks, stream corridors, greenways and a cemetery along SOM Center Road.

Implementation

Mayfield Village could explore the adoption of riparian setbacks or protection and restoration of remaining streams to maintain the services of these corridors. In addition, the Village could investigate alternative parking codes to allow alternative paving materials, arrangement and numbers of parking spaces to maximize economic development and provide sufficient parking. As the plans move forward for redevelopment of the Beta Park development, the Village could incorporate restoration of the stream that flows through Beta Park. To facilitate a stable stream corridor and cohesive redevelopment in Beta Park, it may be appropriate to relocate this stream to a different location. Redevelopment of Beta Park may also provide links to planned and existing greenways and parks. Greenways and linkages between PCAs and PDAs could be facilitated following the plan to the right. Much of this greenway corridor has already been created to link existing Village Green, school, and parks.



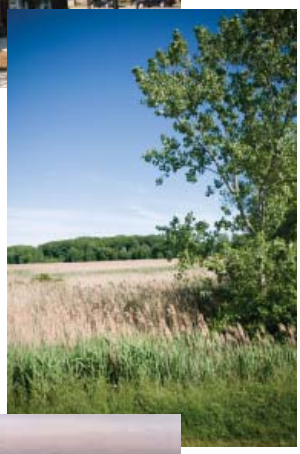
CITY OF MENTOR



Map Adoption Process

With the assistance of the CWRP and the Mentor Open Space Committee (which includes both Council and Administrative participation), City staff prepared a map outlining the PCA's and PDA's within the corporate boundaries. Mentor City Council endorsed the map and *Chagrin River Watershed Balanced Growth Plan* in May 2009. The PCA's include City parks, the City owned golf course, the Mentor Marsh & Lagoons, sensitive drainage courses, open space in subdivisions built under the village green zoning classification, and City owned detention basins. The PDA's include the commercial and industrial zoned property where development already exists or redevelopment may occur, as well as future development in the Newell Creek development. In addition, CRWP and the Lake County Planning Commission are working with the City to update the City's comprehensive land use plan and incorporate the PCA and PDA map and balanced growth concepts. This plan is likely to be completed in the Fall of 2009.


Center Street School




Mentor Lagoons

Possible redevelopment of Great Lakes Mall Area

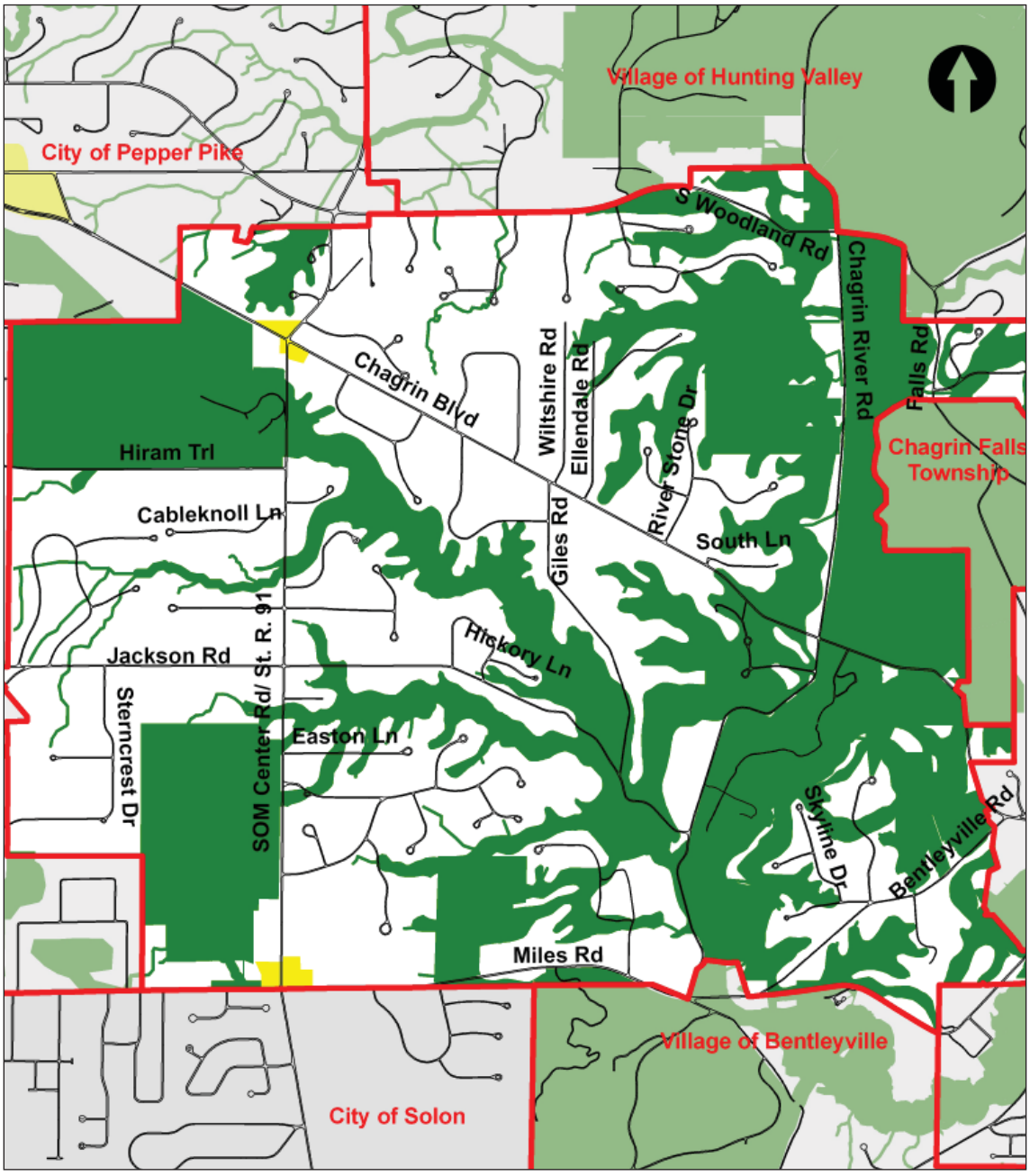
Implementation

Implementation will be linked to the City of Mentor's updated land use plan and capital improvement planning. The City is currently considering the adoption of riparian, lake bluff, and wetland setbacks as well as erosion and sediment control and comprehensive storm water management regulations. The adoption of these codes will support implementation of the PCAs and PDAs as identified in this *Plan.* Further acquisition and protection of stream corridors, floodplains, Mentor Marsh and the lake bluff should be considered to protect these valuable PCAs. In addition focusing several priority planning areas as identified in the Comprehensive Plan, including:

- Old Village Area: Focus on preservation and redevelopment.
- Residential Village Green Zoning: Consider revising code to preserve viable open space.
- Great Lakes Mall: Focus on redevelopment.
- Mentor Lagoons: Focus on accessibility.

Each of these planning areas has special considerations ranging from natural resources to historic concerns, parking , traffic management and economic development. CRWP and Lake County Planning Commission will continue to work with Mentor to implement the Comprehensive Plan for the City while focusing on these special planning areas.

VILLAGE OF MORELAND HILLS



Map Adoption Process

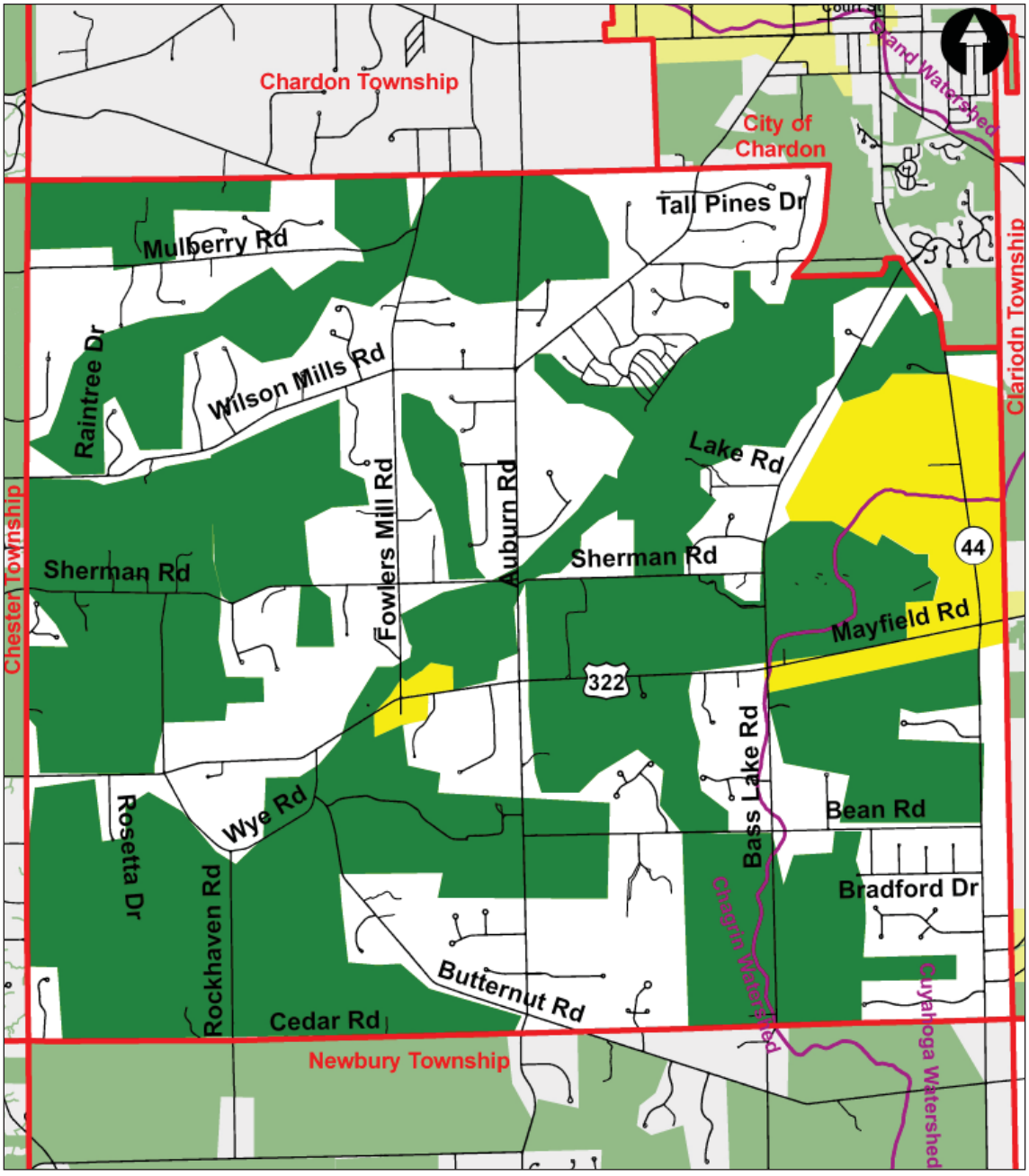
PCA and PDA maps were revised by Village staff, Mayor and Planning Commission, and then adopted by Council in May 2008. PDAs include existing and redeveloping commercial areas. The PCAs were designated based on criteria of existing parks and open areas, including golf courses and Hiram House Camp, existing riparian setbacks, large undeveloped parcels, and soils over 25% slopes, particularly Ellsworth and Geeburg soil types. These soil types on steep slopes have been a significant concern in the Village due to numerous development concerns with the failure of steep slopes, including slope failures along Chagrin River Road as shown to the right.

Slope failure along Chagrin River Road

Implementation

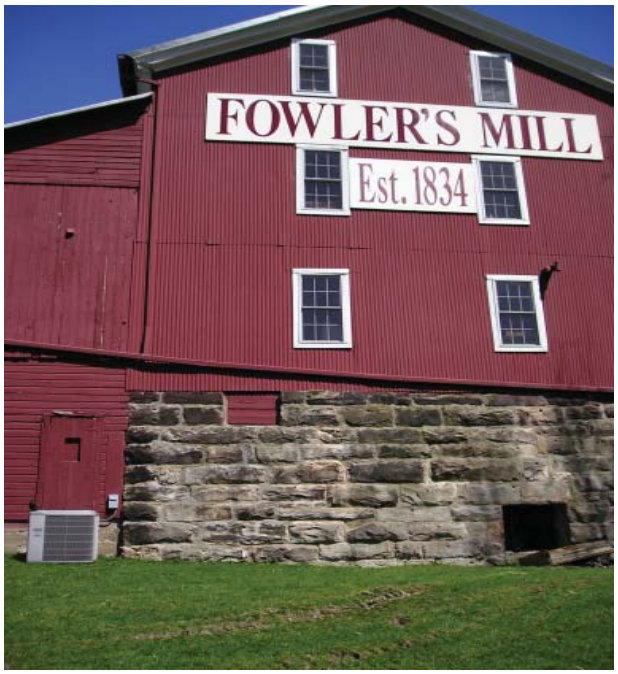
Moreland Hills, in cooperation with the Cleveland Metroparks and Western Reserve Land Conservancy, has protected a large amount of property within the Village. The designated PCAs may assist in guiding any future land acquisitions. Development of PDAs should happen in accordance with Moreland Hills existing zoning code. In addition, commercial uses in the Village should be limited to the designated PDAs. Any future development in PCAs should follow the Village's zoning codes for conservation development, riparian setbacks, and comprehensive storm water management.

MUNSON TOWNSHIP



Map Adoption Process

Balanced Growth concepts and draft PCA and PDA maps were presented to the Munson Township Zoning Commission. The Zoning Commission revised the Munson Township PCA/PDA map to meet local needs and desires. The Township Trustees endorsed the map to be included into the *Chagrin River Watershed Balanced Growth Plan* in April 2009. The designated PDAs highlight the industrial and commercial corridors along Mayfield Road and north of Mayfield Road on State Route 44, as well as the medical zoning along State Route 44 in the southeast corner for the Township. The PCAs include the major stream corridors, floodplains, existing parks, conservation easements, golf courses, and Sisters of Notre Dame School property. The historic Fowler's Mill area was designated as a PCA to maintain the historic integrity of that area. Any future uses in this area should respect the historic nature of the mill and the associated property.

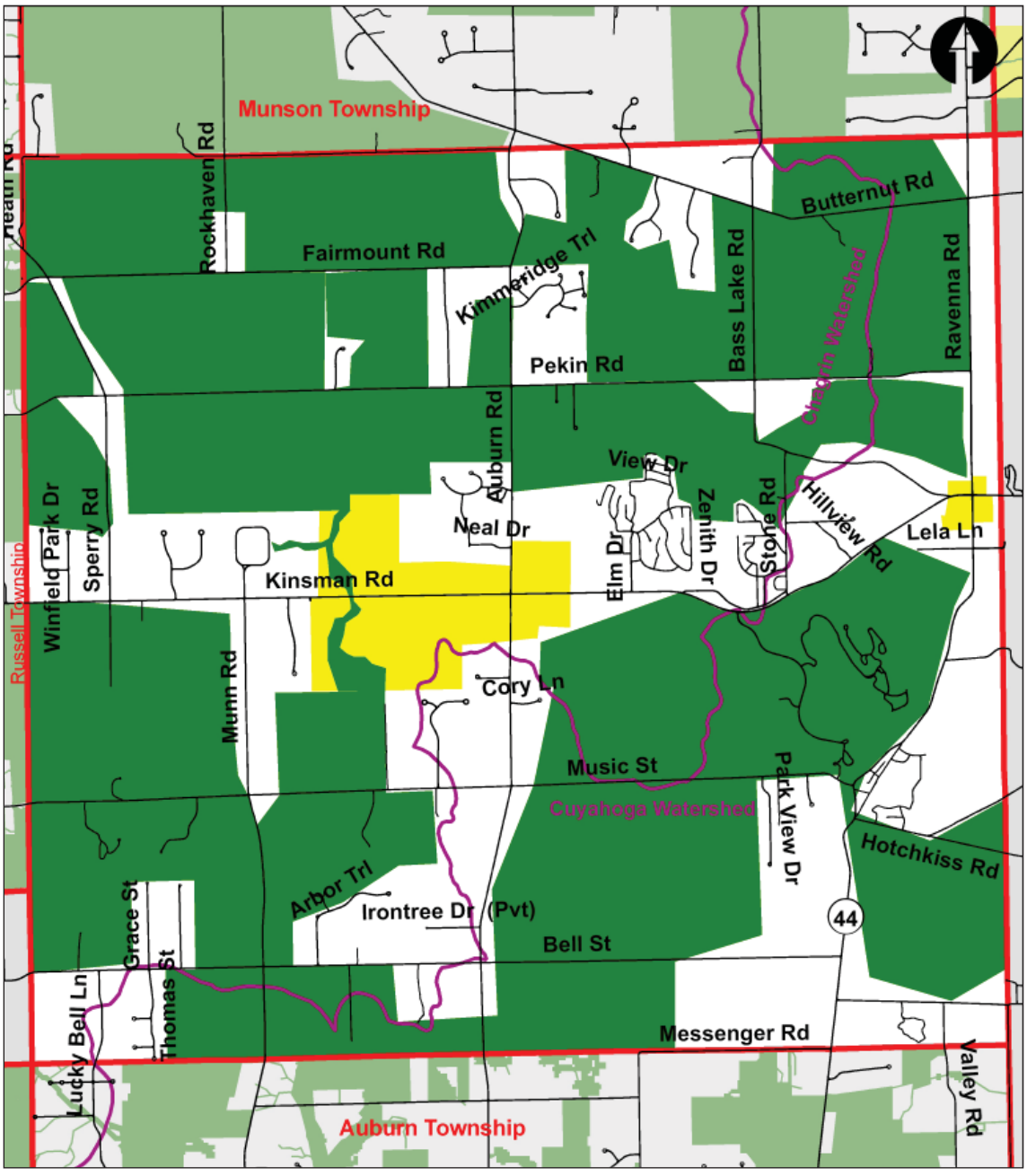


Implementation

Munson Township, in cooperation with the Geauga Park District and the Western Reserve Land Conservancy, has protected a large amount of property including the Munson Township Nero and Scenic River parks, and Geauga Park District's Rookery, Bass Lake, and Walter C. Best Preserves. Munson Township has also adopted regulations for erosion and sediment control and storm water management and has maintained a low density residential zoning within the Township. Implementation of PCAs could be facilitated through adoption of conservation development regulations. In addition, Munson Township should reevaluate the area owned by Best Sand to determine the best reuse of this industrial property once sand and gravel operations cease.

Bass Lake Photo: Geauga Park District

NEWBURY TOWNSHIP

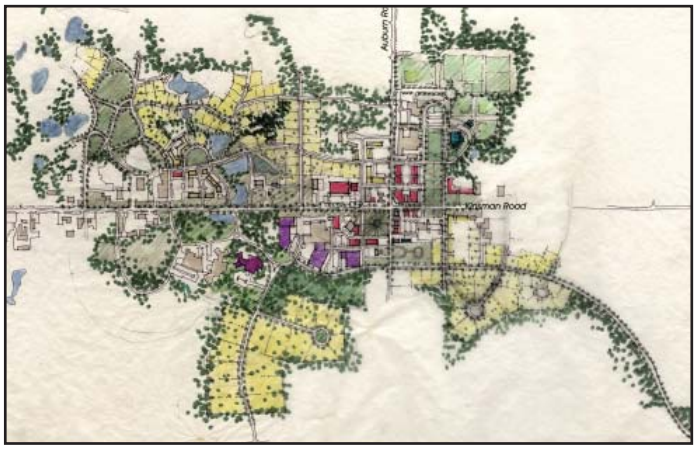


Map Adoption Process

Newbury Township Trustees endorsed the PCA and PDA map in October 2008 and included this information as well as details of the Balanced Growth Program in their comprehensive land use plan. The Kent State University Urban Design Center was contracted to draft conceptual plans for the PDA at State Route 87 and Auburn Road. The Geauga County Planning Commission revised the remainder of the plan in conjunction with a Township steering committee and CRWP.

PCAs in Newbury Township include riparian corridors, existing parks and conservation easements, and large parcels that may be possible open space or conservation easements or that could be developed using conservation concepts.

PDAs in Newbury Township focus on the existing commercial node at State Route 44 and State Route 87 and the intersection of State Route 87 and Auburn Road. This second area was the focus of the Town Center Plan completed with Urban Design Center (excerpts shown to right).

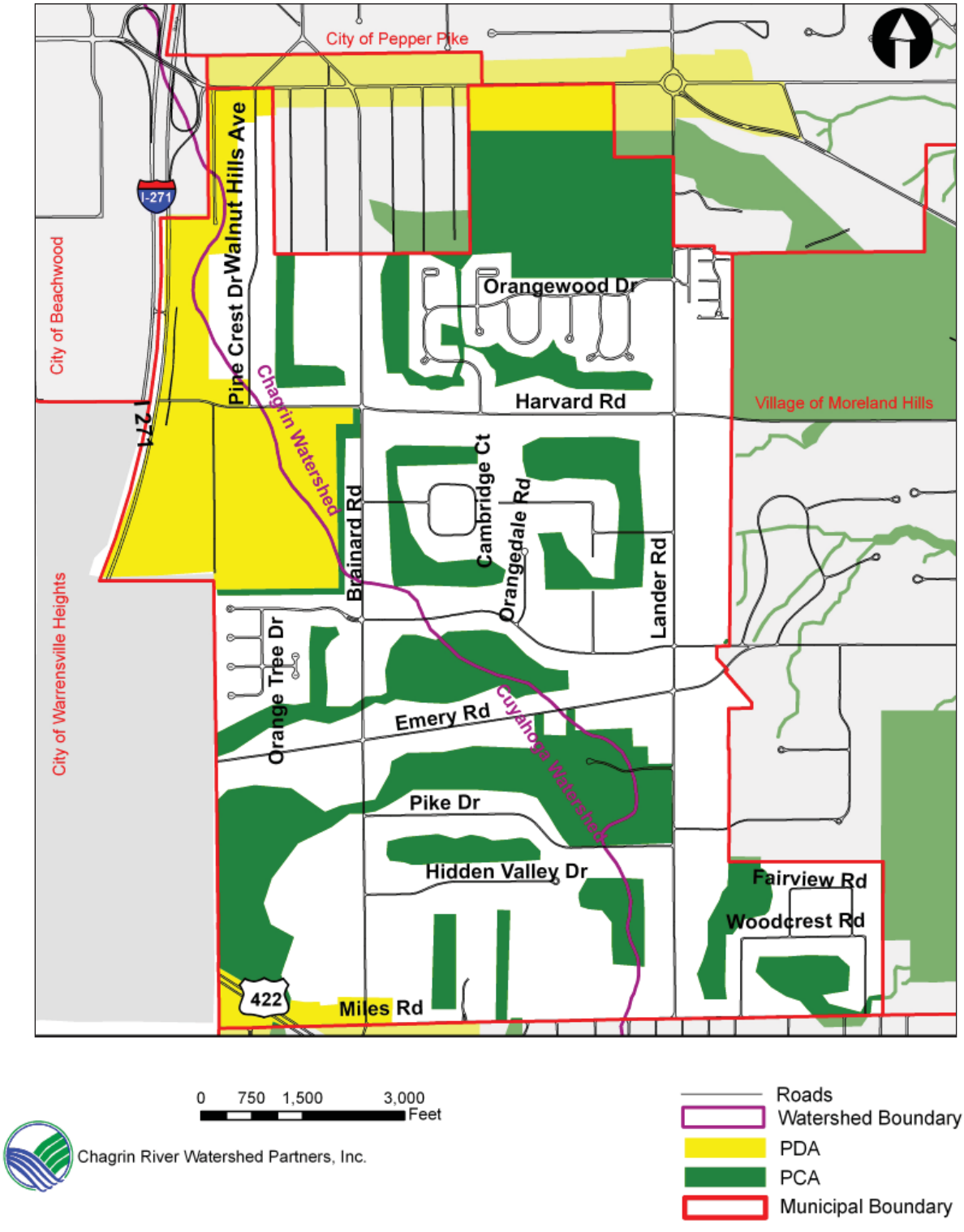


Implementation

Implementation of PCAs could be facilitated partially through existing erosion and sediment control and comprehensive storm water management codes and conservation efforts by local land trusts and Geauga Park District. However adoption of riparian and wetland setbacks as well as conservation development would further facilitate the wise use and potential preservation of the PCAs.

The Urban Design Center plan provides a vision of possible development for the PDAs. Since the development of this plan, the Township has continued discussions with Kinetico, whose world headquarters are located within the designated PDA, about potential development of their property as a small business/ industrial park. Additional sewer infrastructure would be required to fully complete the plan. This plan was a long range vision for the Township to highlight potential infrastructure improvements, pedestrian strategies, public open space, connectivity, and linkages, while promoting economic development and maintaining the rural character and sense of place in Newbury Township.

ORANGE VILLAGE



Map Adoption Process

The balanced growth concepts and draft maps were reviewed and revised by the Orange Village Storm Water Committee, presented to Planning Commission and endorsed by Council in September 2008. Orange Village is concerned with development in existing residential areas where street frontage of lots are developed leaving the back portions vacant. These "backlands" are designated as PCAs to highlight that these open spaces are important to the health of the community. Additional areas of interest were discussed including the area surrounding the Beechmont Country Club, existing retail development, possible locations for a new Village service department building, and the vacant parcel at Harvard Road and Chagrin Highlands.

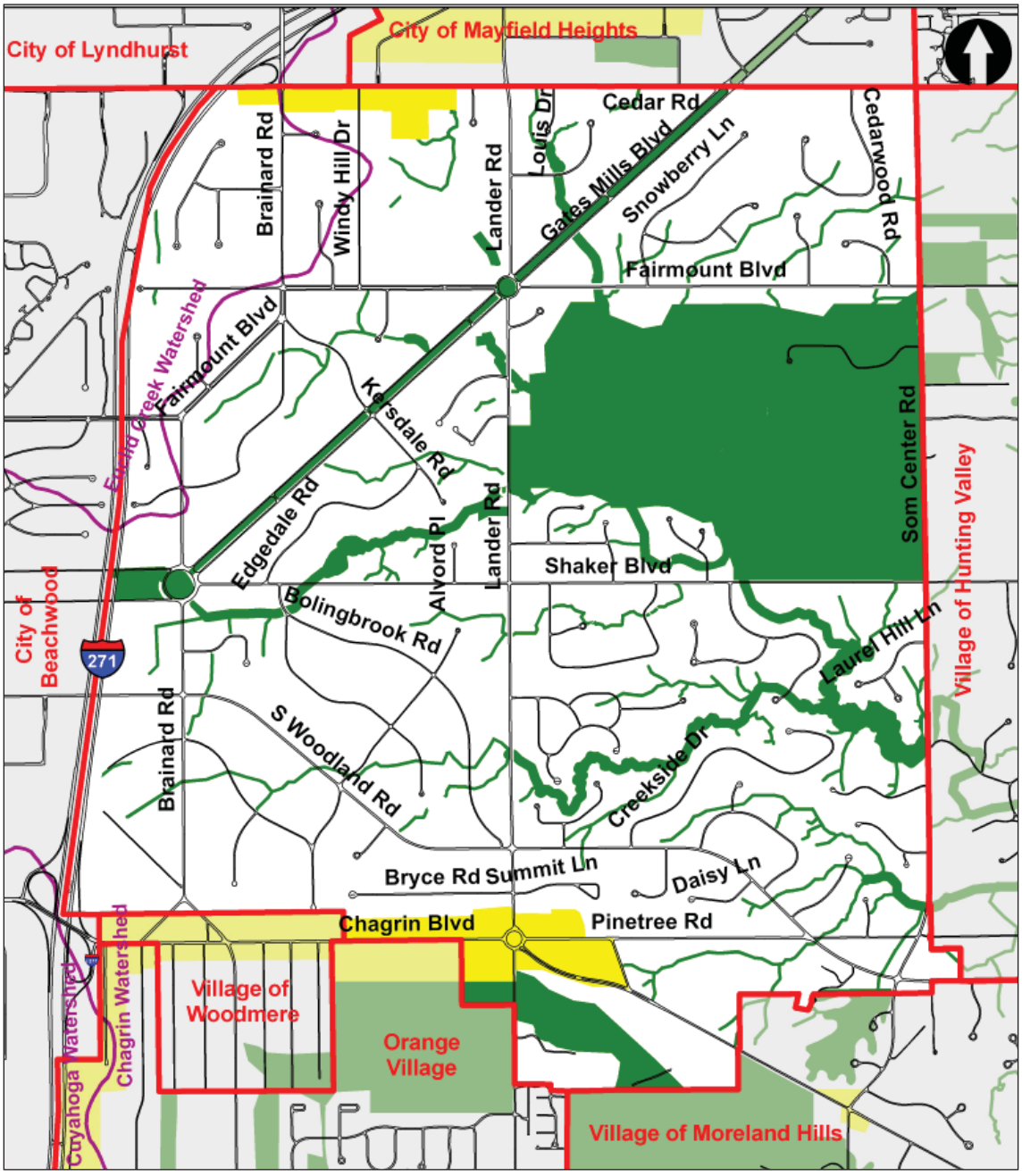
Backlands and vacant lands were identified as PCAs in accordance with comments during committee meetings, the 1998 Orange Village Open Space Preservation Guide and the 2007 Master Plan for Land Use. Stream corridors were represented as PCAs reflecting Orange Village's existing riparian setback regulations. Large areas that may be developed as residential areas in the future, such as southern portion of Beechmont Country Club, were designated as PCAs and should include riparian setbacks, storm water management and open space per the Village's Cluster Residential Development Code.

Orange Village designated existing retail corridors as PDAs. Initial discussions about the retail corridor along Chagrin Boulevard included a PDA designation extending 1,000 to 1,500 feet south of Chagrin Boulevard. After further investigations of adjacent uses in the Village of Woodmere and the City of Pepper Pike, and in order to maintain additional green space and riparian corridors, create uniformity, and cultivate development at a scale appropriate to the Village, the recommendation was changed to designate the PDA as 680 feet south of Chagrin Boulevard, which is in line with adjacent development in the City of Pepper Pike. Although significant wetland resources exist on the proposed development site at Harvard Road and Chagrin Highlands, this area was designated as a PDA. Orange Village will ensure that this area is developed with functional site design, architectural review, extensive landscaping (particularly bordering existing residential development), avoidance of stream and wetland resources, and incorporation of comprehensive storm water management.

Implementation

Orange Village already has adopted many of the codes that will assist in implementing the PCA and PDA designations and balanced growth concepts for the Village including riparian setbacks, comprehensive storm water management, and cluster residential development. Opportunities for the Village acquiring property or easements on backlands should be explored in the future. The Village may also consider additional storm water retrofits such as the roadside bioretention as shown above.

CITY OF PEPPER PIKE



Map Adoption Process

City staff worked with CRWP to revise the draft PCA and PDA maps. The revised maps were presented to the Mayor and Council. After several questions and additional review by the City Law Director, the maps were endorsed by Council in March 2009.

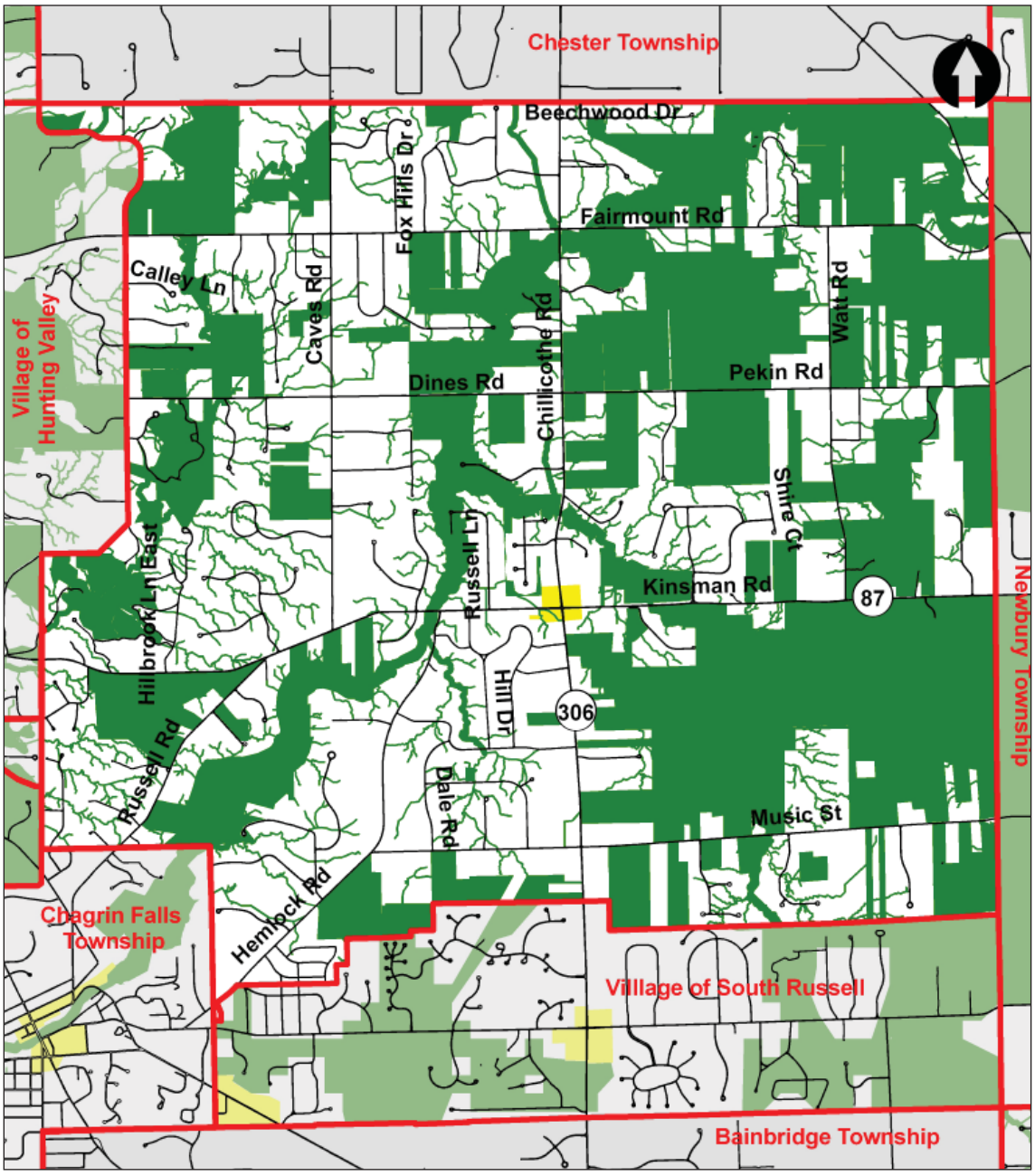
PCAs in Pepper Pike include the riparian corridors, represented by the riparian setbacks, the green corridor on Gates Mills Boulevard, two country clubs, and the hillside and wooded area behind the high school. Pepper Pike designated PDAs in the office and retail corridor along Chagrin Boulevard, between Chagrin Boulevard and Pinetree Road, and South of Cedar near Brainard Road.

Implementation

Pepper Pike has already taken steps to implement the PCAs including adoption of riparian setbacks, comprehensive storm water management, erosion and sediment control and an alternative residential development using townhouses with a minimum of 50% open space. The two Country Clubs represent the largest area of open space within Pepper Pike, however preservation of smaller parcels would add valuable green space to Pepper Pike and should be pursued, particularly near existing open space or stream corridors.

To implement PDAs, the City may want to consider options for alternative site design, stream restoration, access management, and innovative storm water management as the undeveloped area between Chagrin and Pinetree Road east of Lewis Road continues to be developed. Finally, Pepper Pike may consider additional storm water retrofits, such as the bioretention on Chagrin Boulevard in front of the high school and on Fox Hollow Drive (shown below).

RUSSELL TOWNSHIP



Map Adoption Process

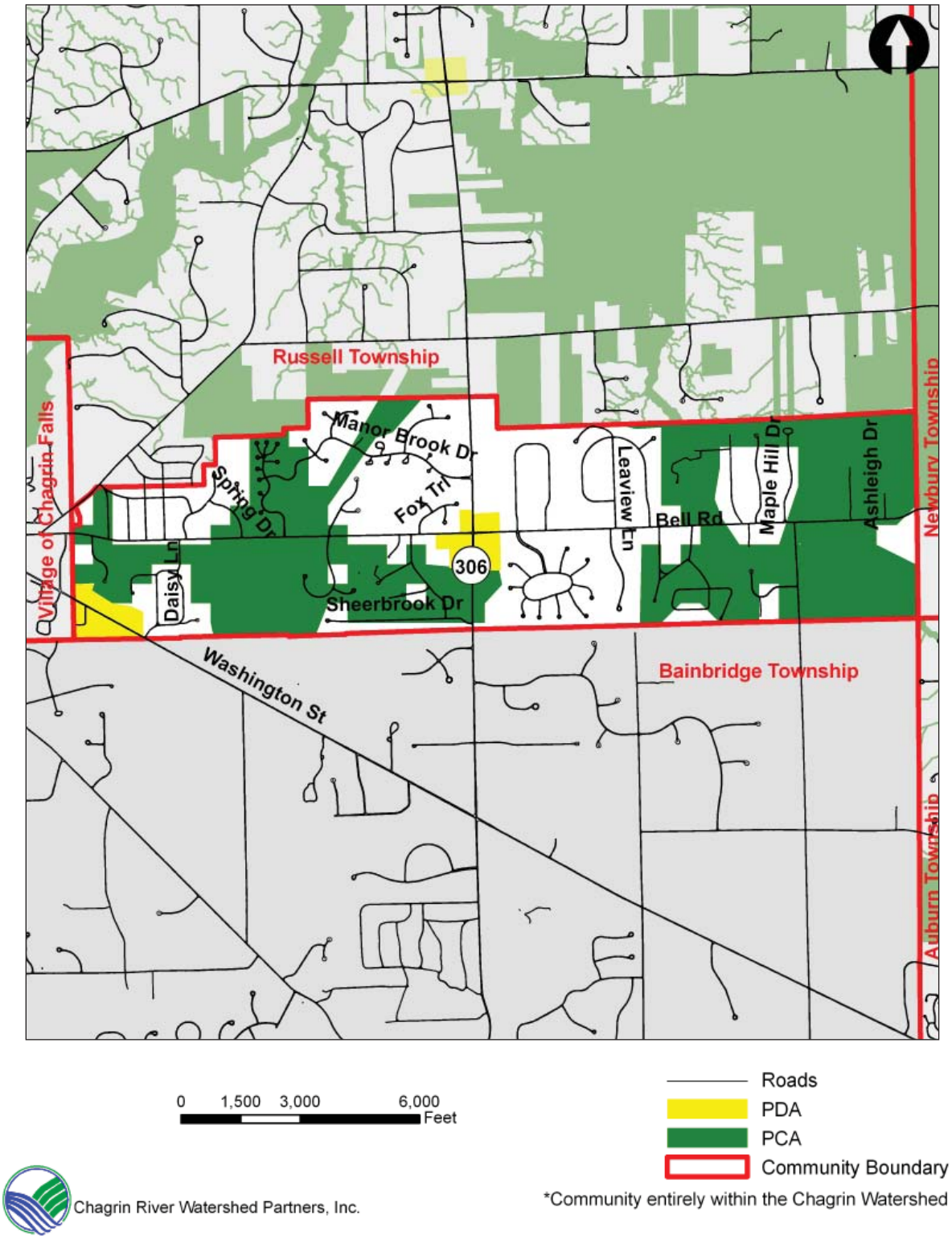
Russell Township Zoning Commission and Trustees reviewed the PCA and PDA maps. The Russell Township Zoning Commission extensively reviewed and revised the maps to conform with local data, priorities and the Township's Comprehensive Land Use Plan. The Township endorsed the maps in May of 2009. PCAs in Russell Township include riparian corridors, existing parks and conservation easements, and all parcels greater than 10 acres in size. The only area currently designated as a PDA in Russell is the commercial area at the intersection of State Routes 87 and 306. This area is planned to be served by a wastewater treatment plant in the future and is noted in the Township's comprehensive plan as the focus for any further commercial or retail development.

Implementation

Russell Township has large areas of open space and low density residential zoning. Expansion of sanitary services into these residential areas is not anticipated, thus these areas will continue to be served by individual wells and septic systems. The significant amount of open space within the community includes Geauga Park District's West Woods, conservation easements, and numerous Russell Township Park Board managed areas. Russell Township adopted codes for erosion and sediment control, comprehensive storm water management, and riparian and wetland setbacks to maintain the services these natural areas provide. Russell Township may want to review their existing planned unit development regulations and evaluate opportunities for improving this code or replacing it with a conservation development code.

The development of the PDA at the corner of State Routes 306 and 87 should be completed in a style and size that is appropriate for a rural township setting. Infrastructure, such as sewer capacity, should be aligned with the amount of proposed development at existing zoning classifications and densities.

VILLAGE OF SOUTH RUSSELL



Map Adoption Process

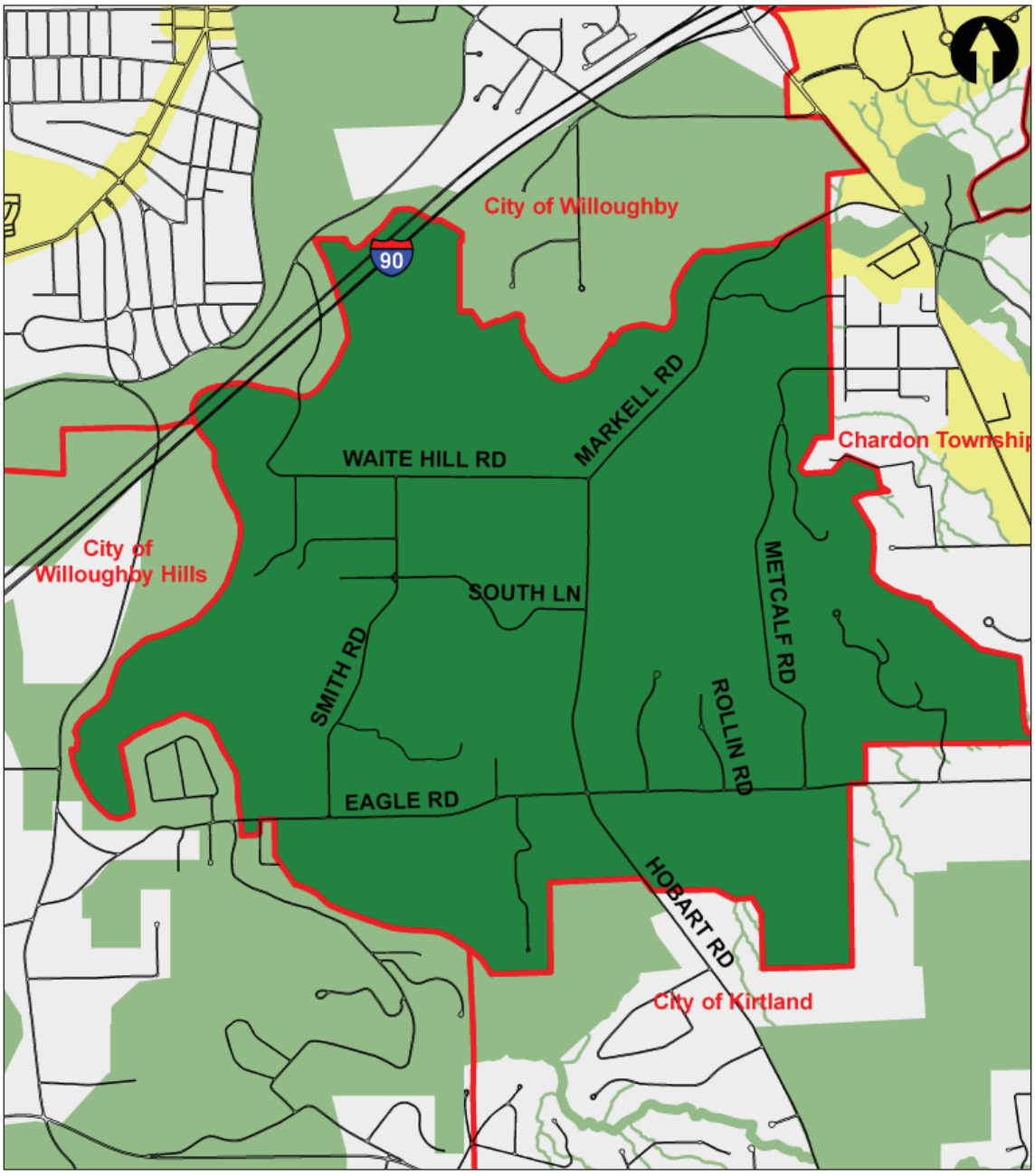
Draft PCA and PDA maps and balanced growth concepts were presented to the Mayor and Village staff. After revisions were made to the map, the information was presented to the Village Planning Commission and endorsed by Council in April 2008, making the Village of South Russell the first community in the Chagrin River watershed to endorse the *Chagrin River Watershed Balanced Growth Plan*. PCAs for the Village include the existing open space within subdivisions, parks, conservation easements, Village cemetery, floodplains, stream corridors, lakes, and large undeveloped parcels in the northeast corner of the Village. The northeast corner of the Village is known to be an area of low ground water productivity, thus development in this area has been restricted to date. PDAs include the commercial office corridors along East Washington Street and the intersection of State Route 306 and Bell Road.

Implementation

Implementation of PCAs could be completed through existing South Russell zoning codes for conservation development. Further review of the storm water management and erosion and sediment control codes, and applicability for riparian setbacks are recommended to assist in implementing the PCAs. In addition, South Russell has a very large number of lakes within the Village limits. Continued coordination with those property owners to ensure that the lakes and their associated dams are maintained is critical. To date, CRWP, Geauga Soil and Water Conservation District, and the Village have worked with lake owners and homeowners associations to address concerns about the lakes.

To further implement the PDAs, South Russell may want to consider allowing alternative configurations and number of parking spaces to allow some infill development or redevelopment within the designated PDA.

VILLAGE OF WAITE HILL



0 1,250 2,500 5,000 Feet

Roads
PDA
PCA
Community Boundary

*Community entirely within the Chagrin Watershed

Chagrin River Watershed Partners, Inc.

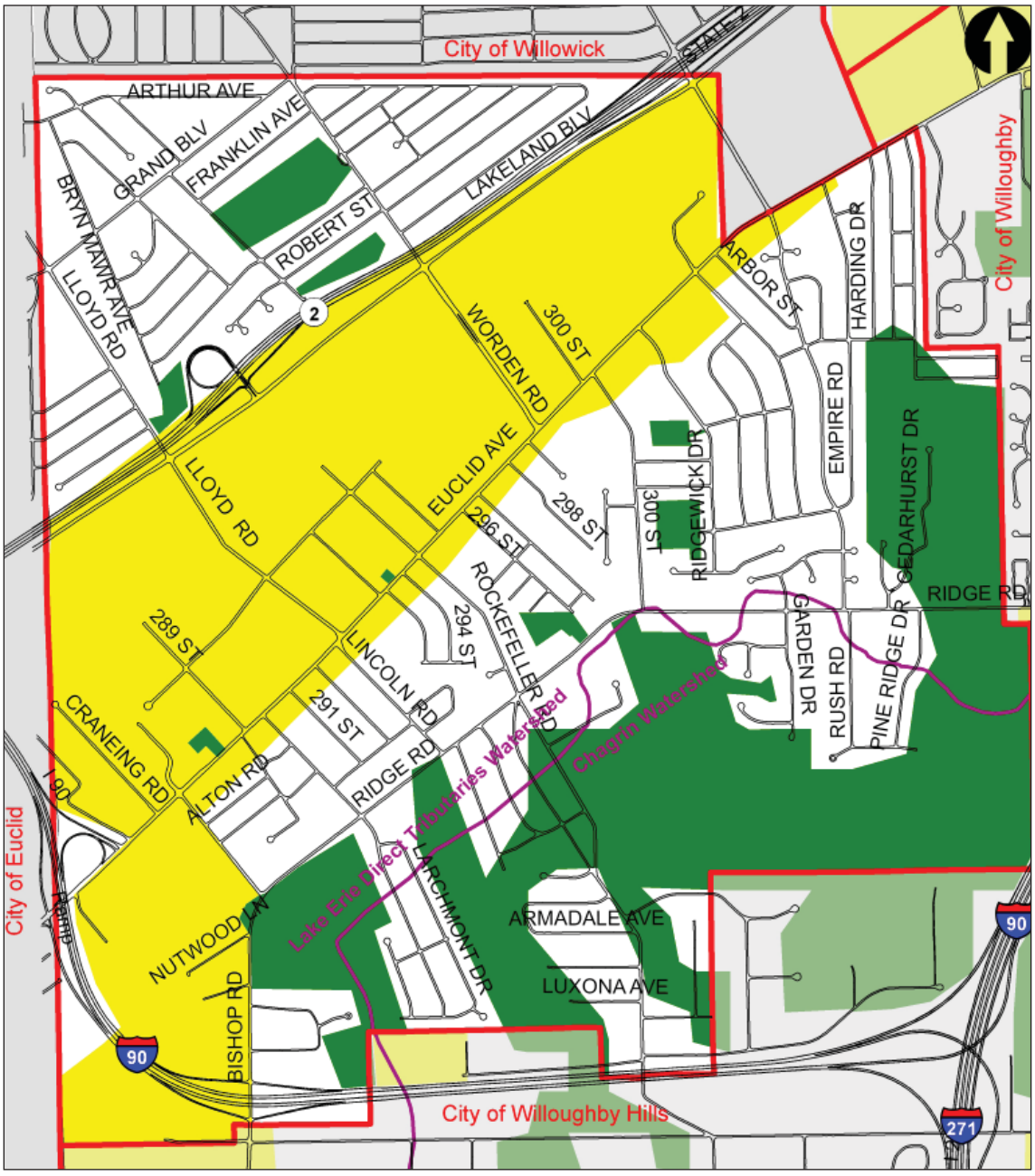
Map adoption Process

Draft maps were revised by the Mayor and Planning Commission. The map and *Chagrin River Watershed Balanced Growth Plan* were then endorsed by Council in November 2008. Waite Hill is entirely low density residential with most lots greater than 5 acres. The Waite Hill Land Conservancy and Western Reserve Land Conservancy both hold easements within the Village on privately owned property. The Village designated the entire community as a PCA.

Implementation

Waite Hill, in concert with local land trusts, has actively protected about 17% of the Village. Any additional open space protection would be appropriate along high quality stream corridors. Maintenance of low density residential zoning and use of the Village's Ecologically Sensitive Areas ordinance to guide development activities can effectively implement PCAs for the Village. In addition, Waite Hill could consider changes to the local zoning code to include storm water management, higher standards for flood damage reduction codes, or conservation development.

CITY OF WICKLIFFE



Map Adoption Process

Draft PCA and PDA maps and balanced growth concepts were presented to City staff. After initial revisions were made to the map, it was sent to the Mayor and City Council for review. CRWP presented information about the balanced growth program o the City Council in October 2008. Council endorsed the map and the *Chagrin River Watershed Balanced Growth Plan* in December 2008.

PCAs in Wickliffe include existing local parks, City owned open space, and golf courses such as Green Ridge and Lake Metroparks Pine Ridge. In addition, the Deer Creek corridor, Pete's Pond and Wickliffe High School properties were designated as PCAs.

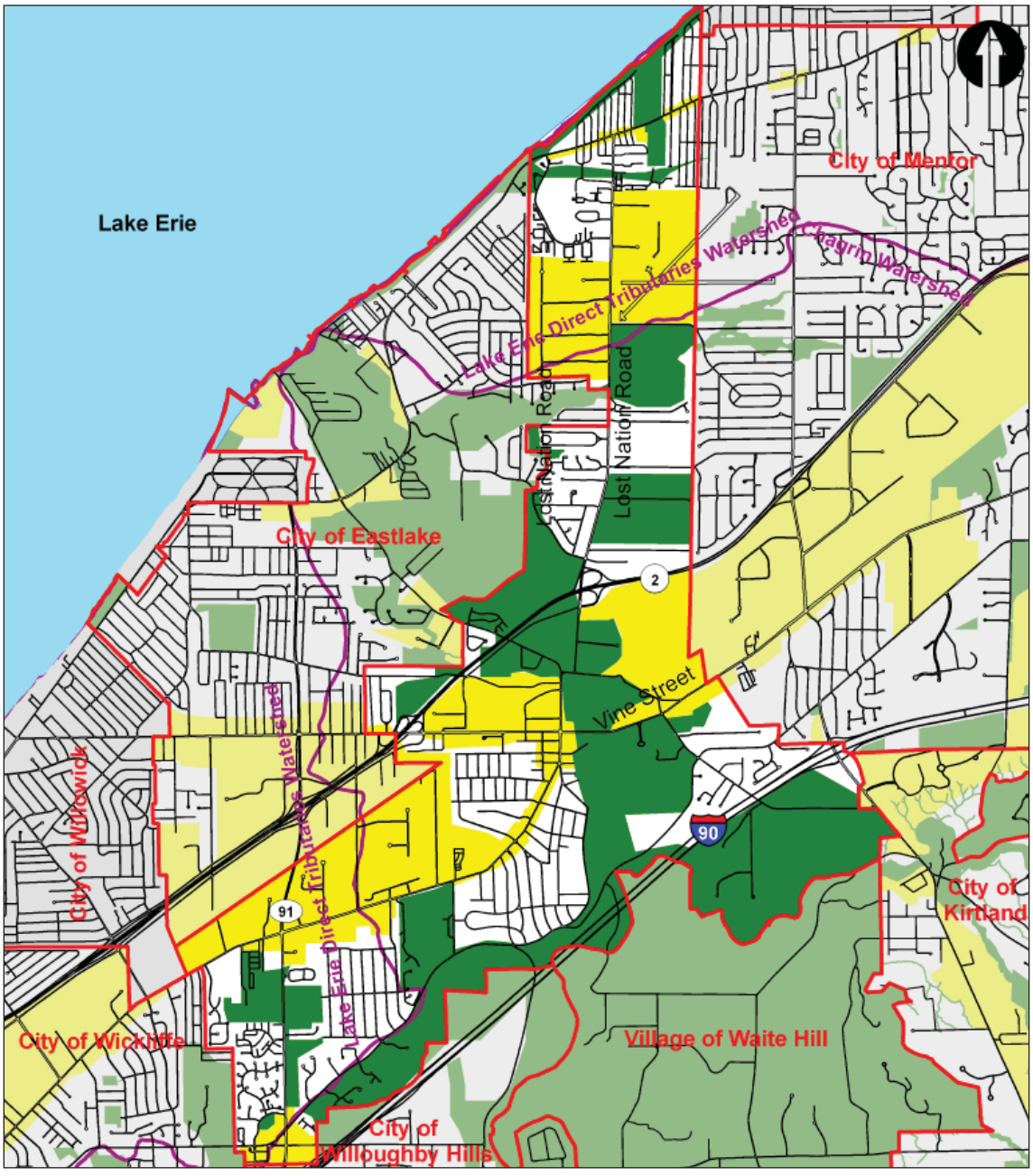
PDAs included the Euclid Avenue commercial corridor. This corridor is the focus of an economic development study, "Euclid Avenue Redevelopment Plan" conducted in 2002. This plan features business building facade improvements, streetscaping, and major infrastructure improvements along Euclid Avenue. Streetscape improvements include repairs and replacement of curbs and sidewalks, installation of brick pavers, enhanced crosswalks, benches, trees with grates, and ornamental light poles, particularly in the Town Center area of Lloyd/Lincoln Road and Worden/Bailey Road. This concept is displayed to the right. The Town Center area zoning now allows a mix of uses to help attract new retail opportunities with pedestrian traffic. In addition to this critical redevelopment corridor, existing industrial areas south of State Route 2 and institutional and business areas surrounding Interstate 90 were also noted as PDAs.

Pete's Pond

Implementation

Continued implementation of the "Euclid Avenue Redevelopment Plan", including streetscaping, zoning and infrastructure improvements should all continue to promote this PDA. In addition, the City should continue to work with Lake Metroparks on potential protection of Pete's Pond and riparian corridors through riparian and wetland setbacks, property purchase or easements. This may include protection of the riparian corridor, wetlands, and forested areas on the Deer Creek corridor, Pete's Pond and Wickliffe High School properties.

CITY OF WILLOUGHBY



Map Adoption Process

Draft PCA and PDA maps and balanced growth concepts were presented to the Mayor and City staff. The initial maps were modified and refined with input from the City Planner and staff to align with the City's planning goals. Further revisions were made to the map through several joint sessions of Council and Planning Commission as a part of the comprehensive land use plan update, as well as discussions with the City Planner and Economic Development Director. After further revisions, Planning Commission recommended endorsement, which was completed by Council in December 2008. The City's comprehensive land use plan, "Willoughby Vision 20/20" incorporated the balanced growth concepts and PCA and PDA maps.

In the City of Willoughby, the PDAs focus on the existing downtown and the corridors of Euclid and Lakeshore Boulevard. Specifically, the PDAs in Willoughby include:

- Existing downtown retail area
- Industrial park west of Lost Nation Road
- Retail areas at the Interstate 90 and State Route 91 intersection
- Lakeshore Boulevard corridor
- Retail and industrial areas north of Euclid and along Vine Street abutting the City of Eastlake
- Industrial areas north of Pelton Road near the Lost Nation Road exchange on State Route 2.

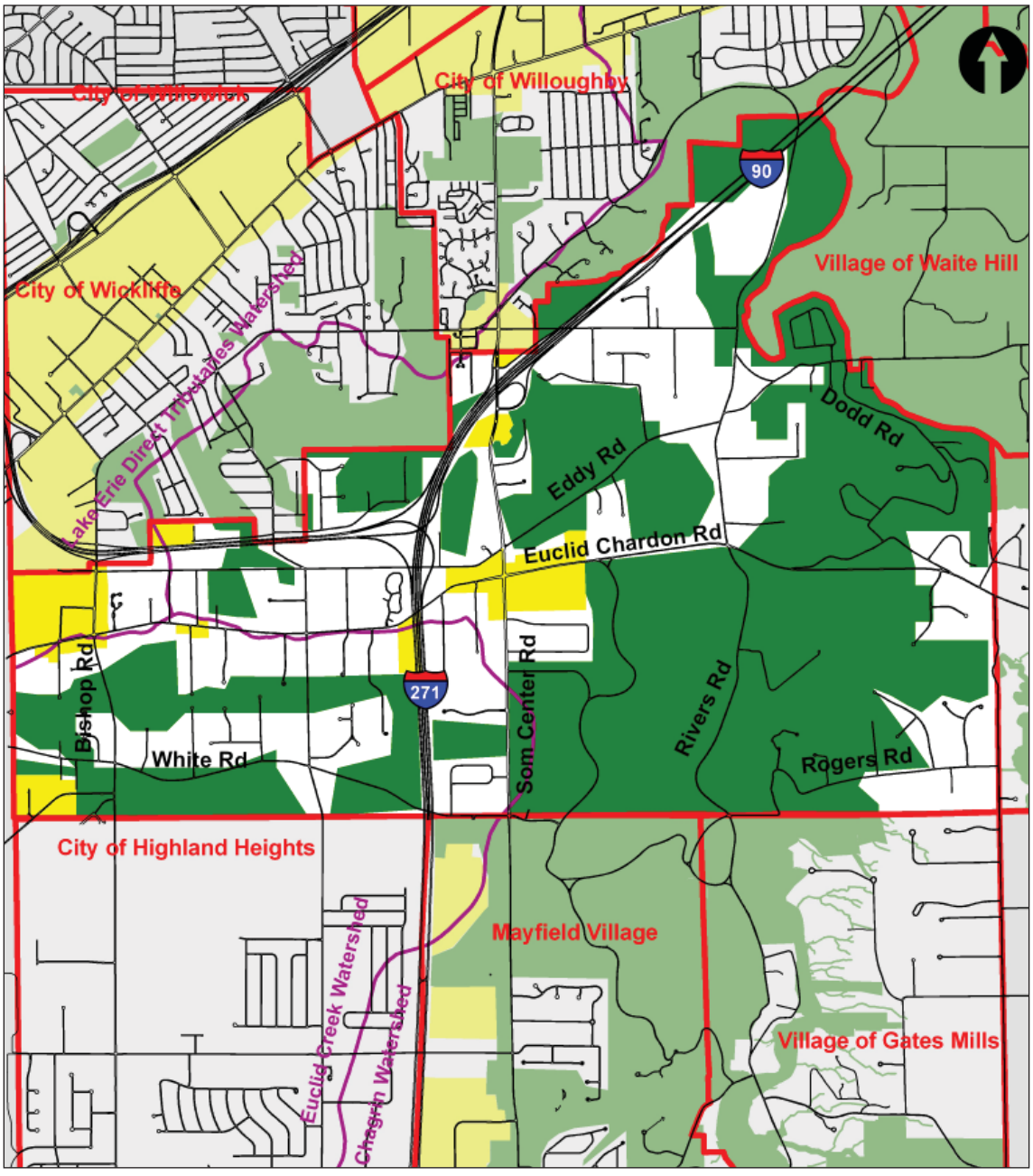
PCA's in Willoughby are focused on the Chagrin River, floodplains, existing parks and conservation easements, sensitive slopes, streams, and wetlands. In addition the scenic areas along Lake Erie and large parcels that may be possible to develop using conservation development layouts are included as PCAs.

Implementation

Willoughby could work with PCA parcel property owners for preservation or with interested developers for alternative site designs that enable development while limiting impacts to natural resources on these PCA parcels. In addition, PCA designations along SOM Center Road and near the roads of Bell, Wood, and Adkins are specifically designated to note areas where single family residential, possibly developed using conservation development principles, would be of highest priority to the City. Willoughby may want to consider updated floodplain regulations, riparian and wetland setbacks, conservation development districts, and trails along the river with links to downtown including the proposed "Magic Mile".

The "Willoughy Vision 20/20" plan incorporates recommendations for changes to regulations, capital investment, and marketing to concentrate on the Historic Downtown and recreational opportunities in the adjacent Chagrin River Valley, historic lakefront and Lakeshore Boulevard area, and maintenance of existing housing. Downtown Willoughby is an example of compact development due to historic development patterns. Much of this area is designated a National Register District. Willoughby can look at additional development in this area that will address existing business needs, create additional parking, allow additional residential uses and create additional linkages and recreation and cultural opportunities in the Chagrin River Valley.

CITY OF WILLOUGHBY HILLS



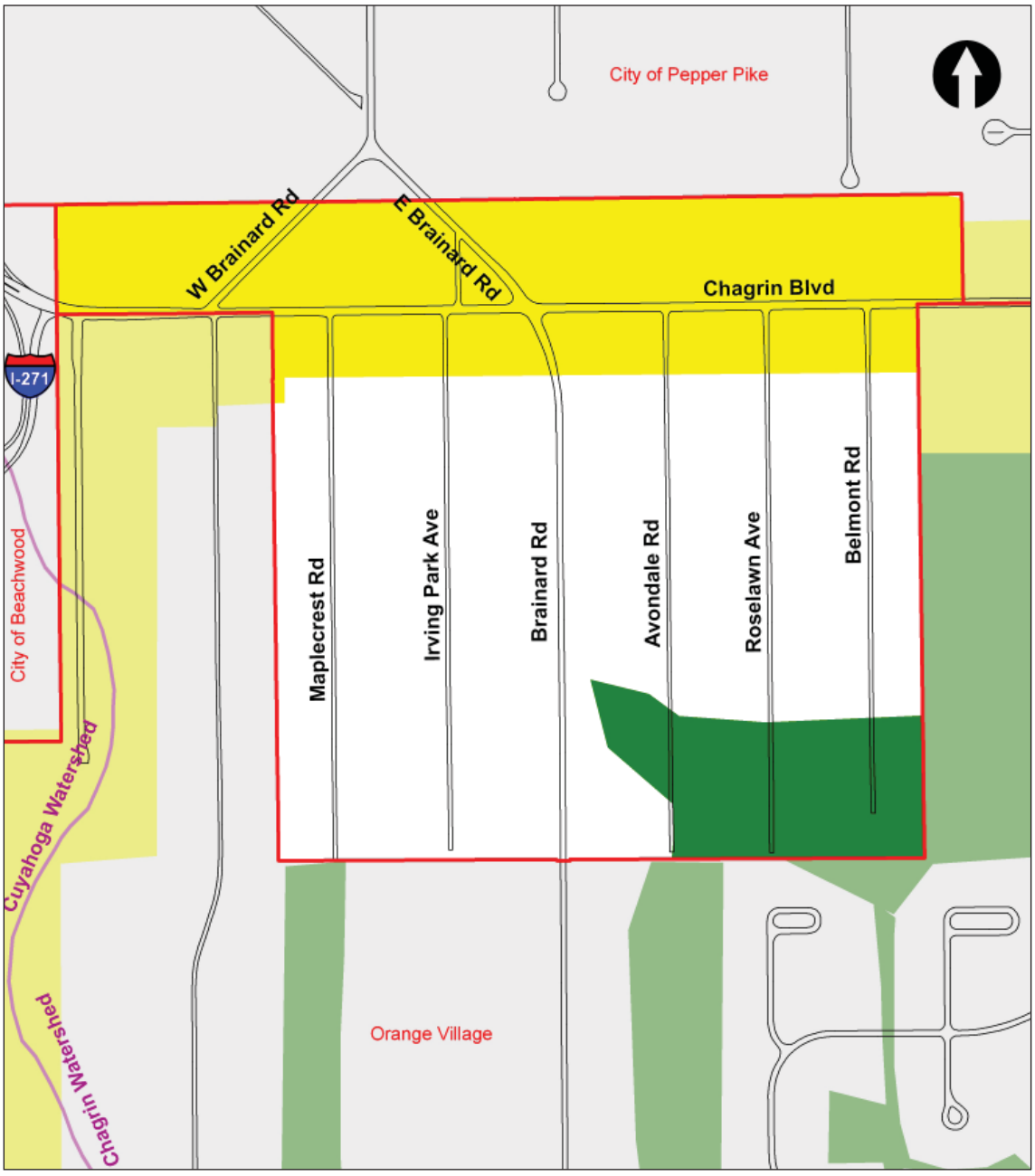
Map Adoption Process

Maps and balanced growth concepts were presented to the Mayor and City staff. Initial revisions were made to the map and the information was presented to a joint meeting of Planning Commission and Council. After further revisions, Planning Commission recommended endorsement which was completed by Council in November 2008. PDAs in Willoughby Hills include existing areas zoned for commercial, office and industrial. PCA designations consist of existing open space, including parks, golf courses, schools, hillside areas, riparian setback encompassing the 100 year floodplain, and parcels greater than 10 acres.

Implementation

To implement PDAs and PCAs in the City of Willoughby Hills, the City can use existing codes for storm water management and zoning classifications. In addition, the City may want to consider evaluating the existing conservation development code which currently only requires a minimal amount of open space. Furthermore, the City should investigate opportunities for storm water retrofits to control existing flooding concerns. As many existing lots contain the main channel of the Chagrin River, associated tributaries and significant floodplain areas, the City may also consider acquisition of key parcels or work with existing property owners for preservation of floodplains and stream corridors.

VILLAGE OF WOODMERE



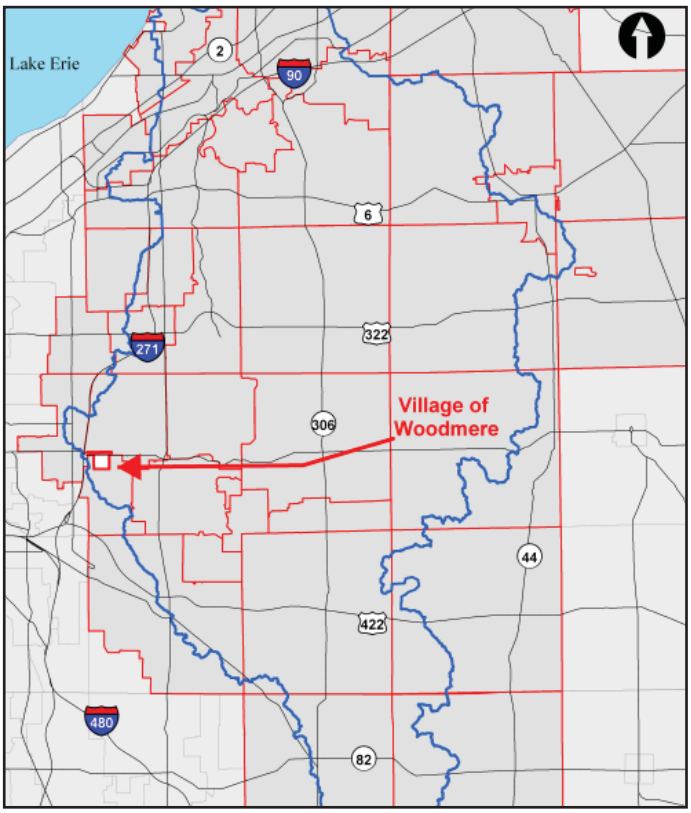
Map Adoption Process

Draft maps and balanced growth concepts were presented to Village staff and Utilities Committee and then to a joint meeting of Planning Commission and Council. After revisions, Planning Commission recommended endorsement which was completed by Council in June 2008. Revisions highlighted the commercial development corridor along Chagrin Boulevard as a PDA and the riparian corridor in the southeast portion of the Village as a PCA. The Village of Woodmere focused the PDA on the area north of Chagrin Boulevard to the Village boundary and the area south of Chagrin Boulevard to a distance of 300 feet. The Village has a priority of maintaining the existing residential neighborhoods beyond 300 feet of commercial and office development south of Chagrin Boulevard.

Implementation

The Village of Woodmere has already implemented riparian setbacks into their zoning code to protect the stream corridor in the southeast corner of the Village. Other implementation tools for the balanced growth concepts in Woodmere include adoption of comprehensive storm water management regulations and investigation of potential changes to parking regulations to minimize the amount of impervious cover created by parking areas while ensuring adequate parking. The photographs below show the Eton Shopping Plaza in Woodmere. This shopping plaza highlights the opportunities for incorporating architectural standards, landscaping, and a mix of office and commercial uses to create a vibrant working and shopping location. As future areas redevelop along Chagrin Boulevard, similar standards can improve the visual impact of development while better managing traffic and storm water.

Location Map



COMMUNITIES THAT HAVE NOT YET ENDORSED MAPS AND PLAN

Bainbridge Township

Bainbridge Township Zoning Commission worked with CRWP to revise the PCA and PDA maps and recommended endorsement to the Township Trustees. In revisions approved by the Zoning Commission, the PDAs aligned with the Township's zoning for commercial and industrial uses. PCA revisions included the existing Township riparian setbacks, parks/open spaces, conservation easements and large parcels that should be developed in accordance with the Township's zoning for low density using storm water management and riparian setbacks, and use of the Township's existing cluster development code. The Township Trustees considered the maps and draft resolution, but are not participating in this *Plan* at this time.

Chardon Township

CRWP discussed the maps with Township Trustee, Mike Brown. Per these discussions, Chardon Township is not participating in this *Plan* at this time.

Chester Township

Chester Township Zoning Commission has worked to revise the PCA and PDA maps and recommended endorsement to the Trustees. The Township Trustees considered the maps and draft resolution, but are not participating in this *Plan* at this time.

Geauga County

Geauga County is not participating in this *Plan* at this time.

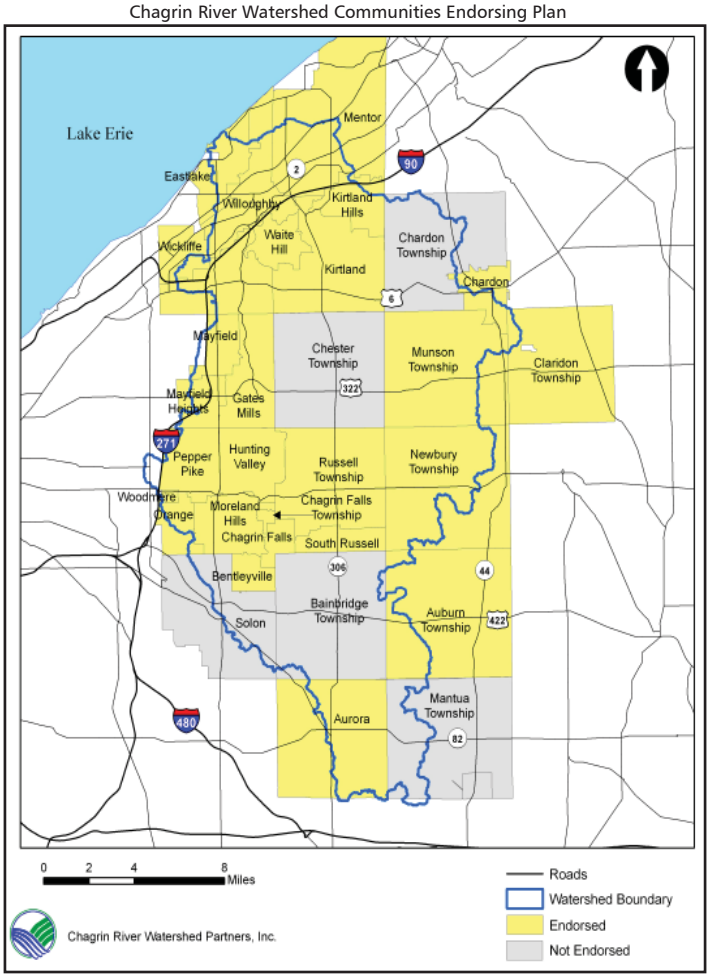
Mantua Township

Mantua Township Trustees, Zoning Commission, and Zoning Board of Appeals reviewed the draft maps and made several revisions to the PCA and PDA maps to align these designations with the Township Comprehensive Land Use Plan. The Township is not participating in this *Plan* at this time.

City of Solon

Maps and concepts have been presented to City of Solon Planning and Engineering staff. Further discussion and revision of maps will be needed to include the City of Solon in this *Plan*. The City is considering including the Balanced Growth maps and planning concepts into their comprehensive land use plan which is currently under revision. CRWP will continue to work with the City of Solon on this process.

Chagrin River Watershed Communities Endorsing Plan



Percent of Watershed Land Area and Population in Communities that have not yet Endorsed the Plan

Bainbridge Township
- 4.0% of Population
- 6.2% of Area

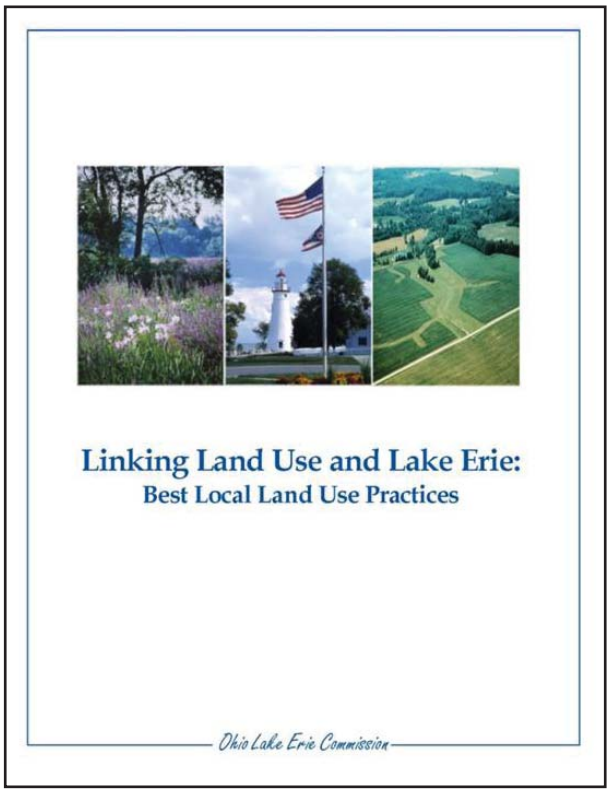
Chardon Township
- 1.7% of Population
- 5.5% of Area

Chester Township
- 4.1% of Population
- 5.7% of Area

Mantua Township
- 1.9% of Population
- 6.4% of Area

City of Solon
- 8.4% of Population
- 4.9% of Area

TOOLS AND STRATEGIES TO IMPLEMENT PDAS AND PCAS



Implementation of the *Chagrin River Watershed Balanced Growth Plan* is initiated through each community's review and revision of the draft PCA and PDA maps to reflect local priorities. Following this, endorsement of the maps and *Plan* occurs through resolutions from each community. Once communities endorse the PCA and PDA designations and this *Plan*, the implementation steps will vary with each community's development and conservation priorities. CRWP will continue to work with all watershed communities on implementing the designations as noted in this *Plan*. Implementation may include:

- Adoption of best local land use practices
- Acquisition of additional open space
- Updates to community comprehensive land use plans to include the balanced growth planning concepts
- Cooperation between jurisdictions through continued participation in CRWP programs
- Continued coordination with local economic development directors and initiatives
- Facilitating implementation of streams and wetland mitigation in line with this *Plan*
- Use of tools such as Transfer of Development Rights (TDR) and revenue sharing

Some of these implementation strategies are currently used in many CRWP communities such as comprehensive planning, open space acquisition, and numerous best local land use practices. However tools such as TDR, revenue sharing, and mitigation credits are relatively new tools that may require additional research and legislation. For many communities in the Chagrin River watershed to use TDR as a tool, the State of Ohio must pass enabling legislation that specifically allows Townships and Counties to use TDR and allows transfers across community boundaries. The alignment of stream and wetland mitigation with the PCA and PDA designations within the Chagrin watershed communities could also be a potential implementation tool. Communities may also use existing tax revenue sharing tools, such as Joint Economic Development Districts to complete economic development initiatives.

There are a variety of tools available to plan PDAs and PCAs to meet community development objectives. The best way to develop a PDA or to protect a PCA is for a community to own those properties and control their development or conservation. This is also the most costly approach. The tools discussed in this section offer lower cost, market driven approaches to manage development and conservation. These tools may include zoning code and development regulations or transfer of development rights.

Comprehensive Planning

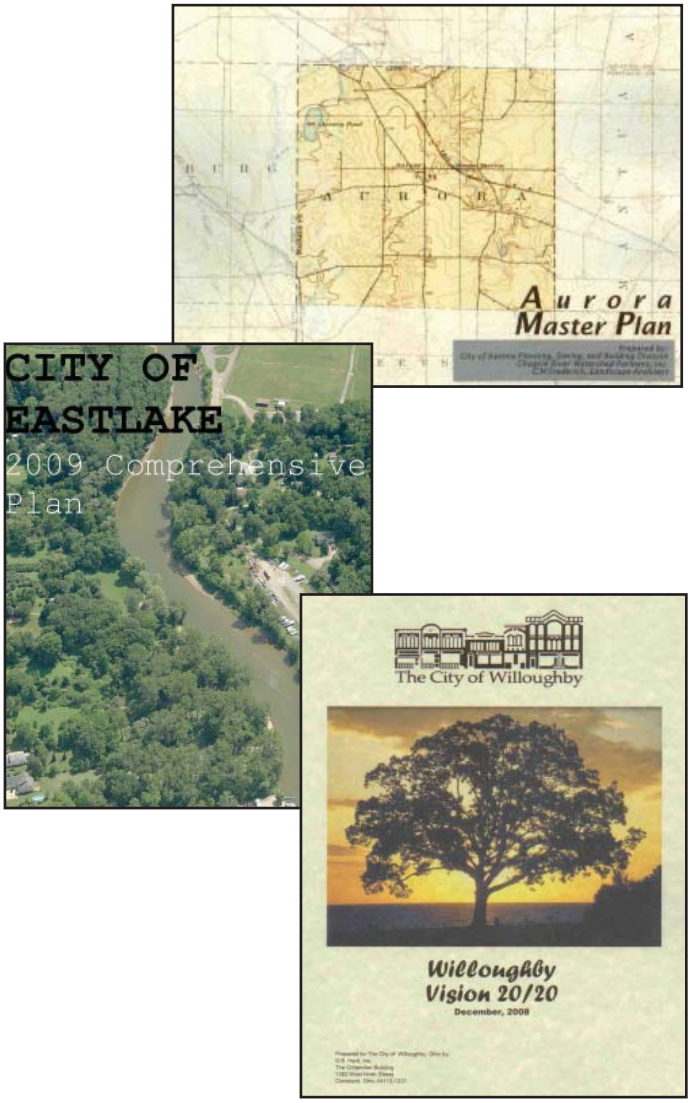
Development decisions are occurring daily that impact flooding, erosion, and water quality in the Lake Erie basin. In Ohio, the planning and regulations governing these decisions are made at the local level. Local governments throughout the Lake Erie basin can improve comprehensive plans, enact forward thinking regulations, require effective best management practices, and make the watershed based decisions necessary to ensure that the Lake Erie coastal watersheds develop with reasonable growth; lowest long term infrastructure costs; and the least impacts to wetlands, streams, floodplains, and open spaces. Local zoning regulations should be supported by local comprehensive planning.

A comprehensive plan should be an all-inclusive approach at addressing a community's growth and serves as a policy guide for decisions about the community's development. In Ohio, comprehensive plans are required for unincorporated areas, such as townships, and are necessary to ensure the defensibility of zoning in any community. A plan generally consists of a study of existing conditions and a discussion of future trends, goals, and objectives. Land-use patterns, housing conditions, population, roadways, and other infrastructure are the principle elements that are studied. The process of developing a comprehensive plan often includes minimal information on the natural resources within a watershed and is completed through an insular process that proceeds unaware of the larger context of the community's watershed.

The majority of CRWP's Member communities have comprehensive plans that were adopted within the past decade. The ages of the local land use plans range from 2009 to the late 1960's. Through the balanced growth planning process, CRWP has worked with the following communities on incorporating the PCA and PDA maps and balanced growth concepts into their land use planning:

- City of Aurora
- Auburn Township, concept plans for PDAs
- City of Chardon
- City of Eastlake
- City of Mentor
- Newbury Township
- City of Willoughby

In addition to the inclusion of the PCa and PDA maps and balanced growth concepts into local land use planning, many communities considered their existing comprehensive land use plans and aligned their PCA and PDA maps with their existing planning documents.

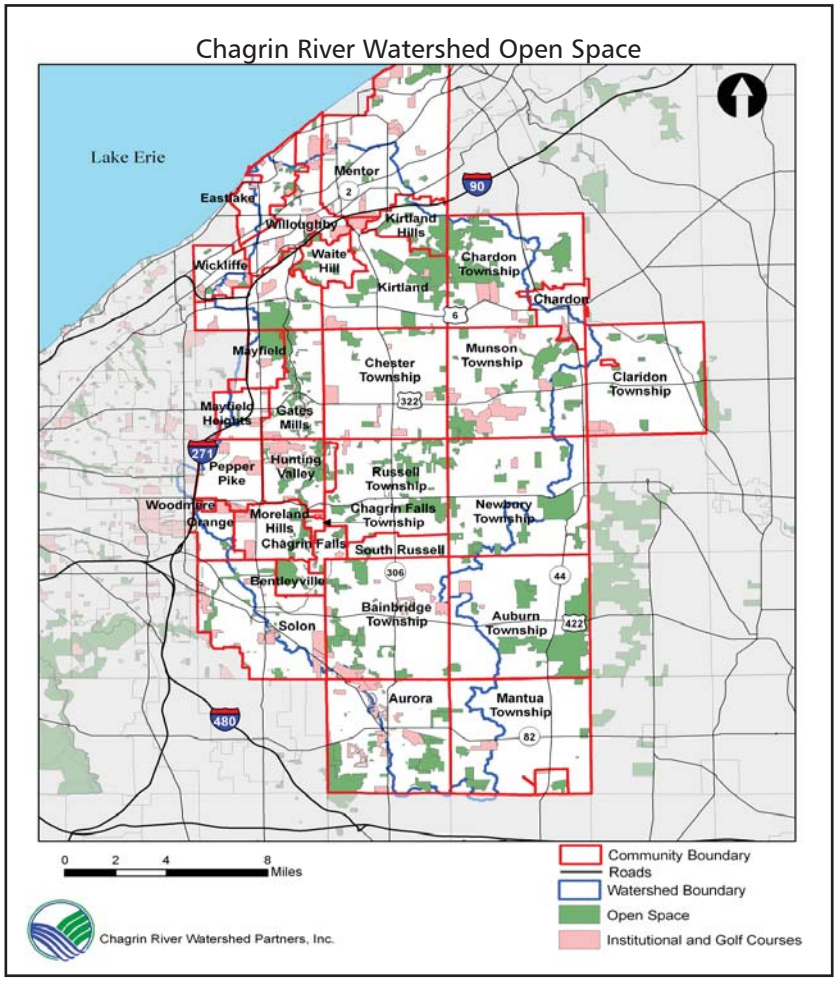


Zoning Map Districts

Communities should align the PCA and PDA designations in this *Plan* with their zoning code to the fullest extent possible. Communities should ensure their zoning uses are in line with desire for development or conservation. PDAs are typically aligned with areas of commercial or industrial activities or higher density residential. To promote a PDA, the zoning map should be amended to a district that permits more intensive development. This may be done through Planned Unit Development overlay districts. To protect a PCA, the zoning could be amended to establish a district with a lower density, maintain low density zoning, or establish PCA overlays that require use of more intensive best management practices for development.

Open Space Acquisition

The best way to protect a PCA is by acquiring the designated PCA as permanent open space. Much of the open space acquisition in the Chagrin watershed is completed by local park districts including Cleveland Metroparks, Geauga Park District, Lake Metroparks, and Portage Park District; conservation organizations such as the Holden Arboretum; and easements through County Soil and Water Conservation Districts and local land trusts such as Western Reserve Land Conservancy, Ohio Streams Preservation, Gates Mills Land Conservancy, and the Waite Hill Land Conservancy. Many Chagrin watershed communities have also taken an active role in preserving property for open space or public park creation. Nearly 60 square miles, approximately 14%, of land in CRWP Member communities has been set aside as open space. The amount of open space for each community ranges from zero to 38% of the community, with an average of 15% of the community as open space. These areas were noted as PCAs in all of the endorsing communities. Links between open spaces and acquisition of additional open space will continue to be a priority in the protection of PCAs.



Cleveland Metroparks

GEAUGA PARK DISTRICT

Portage Park District

LAKEMETROPARKS

The HOLDEN Arboretum

Western Reserve Land Conservancy
OUR LAND. OUR LEGACY.

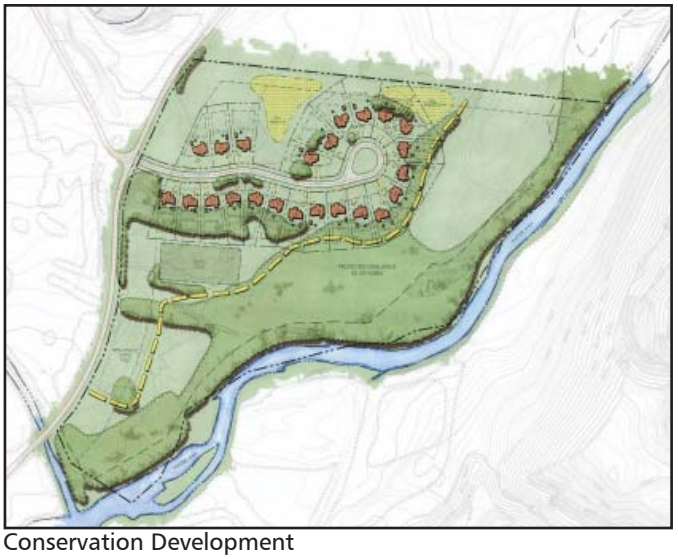
Conservation Development

Conservation development conserves natural resources while allowing for the maximum number of residences under applicable zoning and subdivision regulations. Conservation development may be called Conservation Open Space, Cluster Development, Open Space, or Planned Residential Districts. Conservation development allows the same number of homes to be constructed on a piece of property during development while protecting at least 40% of the property as open space. The open space may serve as a buffer between uses of property, helping protect vegetation, streams, wetlands, floodplains, agricultural or historic resources, and manage storm water through non-structural practices. Conservation development can also apply to commercial and institutional development to create a campus-like layout where buildings and parking can be rearranged to accommodate natural, agricultural, cultural, or scenic resources. Office parks, graduated living facilities, and educational campuses may all be appropriate for a conservation development layout. Conservation development can create a patchwork of open space and development, thus does not preserve large blocks of land. However, this patchwork of open spaces would ideally provide links between existing open space and preserve the character of a community, buffer views of development, provide habitat corridors along streams, reduce and filter storm water runoff from development, and ensure the long-term survival of wetlands, rural views, and historic features.

Much of the Chagrin watershed is planned to develop at a low density residential use of 2-5 acres per residential lot. While the development of areas at a low density may allow for preservation of rural character and natural resources, it often does not. The use of conservation development can provide another tool to develop portions of the property while maintaining an overall low density. Many communities in the Chagrin watershed could consider adoption of a conservation development zoning code or flexible site development through overlay districts to protect the valuable resources while still allowing property owners to realize the development potential of a property. By the end of 2008, seven CRWP Member communities, representing 22% of the watershed, have adopted regulations allowing alternative site design with a minimum of 40% open space. Several additional communities have similar codes that allow 25-33% open space in conservation developments.

CRWP has developed a model regulation for communities. As communities consider this model, they must determine how large a parcel should be to allow the use of conservation development code, required amount of open space, availability of sewer and water infrastructure, and means to permanently protect open space within the development.

Traditional Subdivision



Conservation Development

Graphics by Chagrin River Watershed Partners, Inc.

Erosion and Sediment Control and Comprehensive Storm Water Management

Ohio EPA requires all owners and operators of construction sites disturbing 1 acre or more, or less than 1 acre if part of a larger common plan of development or sale to obtain a permit from Ohio EPA that includes erosion and sediment control requirements and storm water quality requirements. Communities that are designated under Ohio EPA's Phase II Storm Water Program are required to ensure their codes meet or exceed Ohio EPA's requirements. All communities should ensure that their erosion and sediment control and storm water management regulations meet these minimum standards since all construction sites are required to get this permit. Communities should evaluate their existing codes to allow additional storm water best management practices (BMPs) and low impact development strategies such as site design, downspout disconnection, bioretention, and alternative parking arrangements and materials. Further communities can adopt enhanced sediment and erosion control regulations with ability to stop construction work when necessary.

To assist in implementing PCAs and PDAs communities may want to facilitate storm water management in PDAs or require selection of certain BMPs or additional storm water BMPs for development in PCAs. Examples of these tools include the possibility for a centralized storm water management strategy in Auburn Township to facilitate development of the Auburn Corners area in such a way that the storm water is effectively treated to protect downstream resources, such as LaDue reservoir. Alternately, storm water BMPs that promote infiltration and cool storm water discharges may be appropriate in area that have identified coldwater habitat streams. The City of Aurora Master Plan noted that the City could create incentives that allow variances to the wetland setbacks but require more intensive BMP selection near the wetlands in the industrial park noted as a PDA on the south side of the City. At the close of 2008, 24 CRWP Member communities, representing 75% of the watershed, had adopted regulations to control erosion and sedimentation while 23 Members, representing 72% of the watershed, had adopted comprehensive storm water management regulations that comply with Ohio EPA's Phase II Storm Water Program. CRWP will continue to work with all communities to adopt regulations for erosion and sediment control, comprehensive storm water management and retrofit existing regulations based on a community's storm water management concerns.


Sediment in stream due to uncontrolled construction site runoff

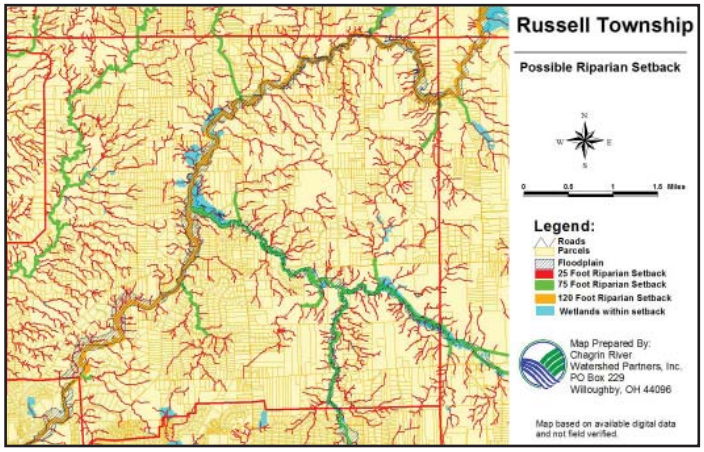

Bioswale and pervious pavers


Bioretention


Erosion control mat

Riparian and Wetland Setbacks

Riparian and wetland setbacks are zoning tools local governments can use to maintain riparian functions as communities grow and land is developed. Riparian setbacks are a preventive tool to minimize encroachment on stream channels while providing a cost-effective alternative that minimizes the need for storm water infrastructure and engineered solutions to flooding, erosion, and water quality problems. CRWP has developed model zoning regulations for riparian and wetland setbacks. These setbacks can be a tool for preservation of stream and wetland resources in PCAs and also a non-structural storm water management tool in PDAs. By December 2009, 14 CRWP Member communities representing 44% of the watershed had adopted regulations to maintain the function of riparian areas and wetlands.



Recommended Widths for Riparian Setbacks

- A minimum of 300 feet on either side of all watercourses draining an area greater than 300 square miles.
- A minimum of 120 feet on either side of all watercourses draining an area greater than 20 square miles and up to 300 square miles.
- A minimum of 75 feet on either side of all watercourses draining an area greater than ½ square mile and up to 20 square miles.
- A minimum of 25 feet on either side of all watercourses draining an area less than ½ square mile and having a defined bed and bank.
- The minimum riparian setback extends to the outer edge of the 100-year floodplain and to the outermost boundary of riparian wetlands.

Recommended Widths for Wetland Setbacks

- A minimum of 120 feet surrounding all Ohio EPA Category 3 wetlands.
- A minimum of 75 feet surrounding all Ohio EPA Category 2 wetlands.

Floodplain Codes with Higher Standards

The National Flood Insurance Program (NFIP) established a federally backed flood insurance program and flood damage reduction regulations in 1968. Communities participating in the NFIP must adopt land use regulations for floodplain areas to make flood insurance available from the federal government. Most communities' existing flood damage prevention regulations are located in the building code as the regulations often require certain building standards. These regulations generally note the flood insurance rate maps and associated flood insurance study as the basis for establishing areas of special flood hazard. These regulations establish minimum flood protection standards for buildings and other types of development in identified floodplains. These minimum standards require structures to be flood proofed or elevated above base flood elevations, anchoring of structures, and prohibit fill in floodways unless a property owner can verify that the base flood elevations will not be increased.

CRWP encourages communities to consider adopting floodplain management standards that are more conservative than the minimum Federal standards, that when implemented, can reduce the potential of flood damage. Examples of higher standards include:

- *One to Two Foot Freeboard*
- *Cumulative Substantial Damage/Substantial Improvement*
- *Fill Restrictions*
- *Foundation Design Guidelines*
- *Ingress/Egress Requirements*

Consideration of higher standards must consider the existing structures in a designated flood hazard area as well as those undeveloped areas within the floodplain. Other considerations may include the community's location within the drainage area, as communities in the downstream portion of the watershed are more likely to experience severe flooding or historic evidence of ice jams that caused localized increases in flood elevations.

Currently, floodplain maps are being updated for all counties within the Chagrin watershed. As of June 2009, the status of map revisions are as follows:

- *Lake County: Appeals resolution process*
- *Portage County: Maps effective on August 18, 2009.*
- *Geauga County: Maps effective on June 16, 2009.*
- *Cuyahoga County: In Map Production, April 2009 for release of draft maps.*

Within six months of a County's final map release by ODNR, communities in the NFIP must update flood damage regulations. CRWP will continue to work with communities on adoption of regulations with higher standards as well as implementation of the codes.

Ice jam on main channel of the Chagrin River in Eastlake

Compact Development

Compact development regulations are sometimes referred to as traditional neighborhood design. Compact development will have a different characteristics, depending on whether it is occurring in an urban neighborhood, a small town center, a rural crossroads, or a major retail center. Compact development design may provide civic spaces in a mix of uses, foster a sense of community and provide opportunities for community interaction. Good examples of compact development already exist in the historic downtown areas of the Village of Chagrin Falls and the City of Willoughby. The use of compact development concepts can continue to be a useful tool in these areas and in redeveloping areas, such as City of Mentor's Center Street School, areas identified at Auburn Corners, and in the City of Eastlake.

Compact Development is a tool applicable for a community's PDAs and can promote infill development and provide a sustainable walkable neighborhood in developing communities. Typically compact development will include a mix of uses and promote pedestrian traffic. This concept can also be used at the development scale in new developments.


Village of Chagrin Falls


City of Willoughby


City of Mentor


City of Mentor

Parking Codes

Improving parking lot design and regulations can assist in meeting a community's economic development goals through the redevelopment of parking areas while improving storm water management and reducing impervious surfaces. Parking lots collect grease, oil, antifreeze, litter and other debris which are washed into the streams following precipitation events. However, existing parking lots provide significant opportunities to reduce the overall parking footprint and improve storm water management. Many communities are "over parked" due to local parking regulations and historic development. However, communities can manage parking areas through changes to their existing parking regulations and by working with developers to incorporate storm water management into the parking lot through paving materials and parking islands.

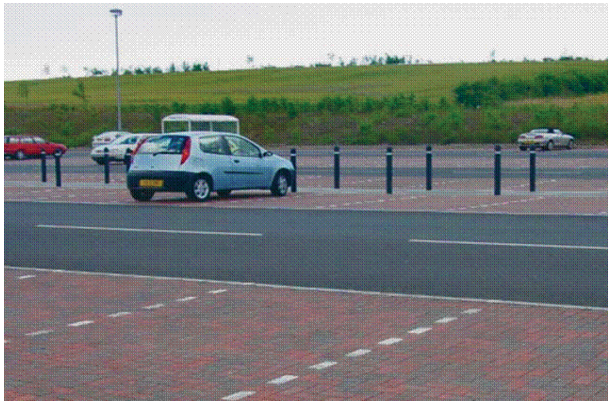
Evaluating the following factors in a community parking code can highlight areas to reduce parking and improve parking lot design:

- *Local parking demand*
- *Building types and sizes*
- *Surrounding land uses*
- *Current and expected population*
- *Potential for additional commercial, industrial and institutional development*

Overall imperviousness or parking areas can be reduced through the use of compact car spaces, minimizing stall dimensions, adoption of parking maximums, using porous surfaces in overflow areas where feasible, and setting a minimum percentage for parking lots' total area for landscaping. Best mangement practices, such as bioretention, porous pavers, and sand filters can also be implemented in parking lot design to reduce impervious surfaces and address nonpoint source pollution. Finally, more developed areas may consider tiered parking as an option for redevelopment of existing parking areas. CRWP has developed a model parking regulation that can be tailored to address parking concerns in each community.

Tiered parking

Shared parking



Compact car spaces on pervious pavement

Hillside/steep slope regulations

Numerous communities in the Chagrin watershed have residents that experience concerns with erosion and slippage along steep slopes. In order to protect the unique geology and natural ecosystems of the ravines and steep slopes, many communities have adopted regulations regarding building on or near steep slopes. These regulations define steep slopes and may provide setbacks, building standards, development limits, or landscaping requirements. Steep slope definitions range from 12-20% slopes and may include details of specific soil types of concern. Steep slope regulations may be a component of a riparian setback regulation, but are often a stand-alone regulation that may complement a riparian setback.

Additional concerns on steep slopes may require construction of retaining walls, more rigorous requirements for storm water management, restrictions on type and location of home sewage treatment systems and landscaping requirements. Because the root systems of even very small trees can help stabilize slopes, tree removal within a steep slope zone should be carefully considered.

Farmland Preservation

Agricultural has always played a strong role in Ohio's history. Many efforts are underway to ensure that farming continues to be a viable way of life for Ohioans. Much of the agricultural activities in the Chagrin River watershed are focused around specialty farming, such as alpaca farms, or equestrian activities, such as stables, riding, and hay fields. There are still several locations with extensive farming activities, particularly in the eastern portions of the watershed in Claridon and Mantua Townships. In addition to maintaining the economic and food production components of agricultural activities, farmland has a strong aesthetic value and adds greatly to the feel and character of the Chagrin River watershed. Finally, the importance of urban and suburban food production has the potential to increase the number of community gardens within the Chagrin watershed. These gardens and local farmer's markets provide fresh local produce and community building events. Smaller PCAs in more urbanized communities may be locations for pursuing suburban agricultural interests.

Transfer of Development Rights (TDR)

TDR is a method for converting development rights, such as the right to build one dwelling unit per two acres, into a marketable commodity. As a commodity, these development rights may be transferred from properties on which development is discouraged by a community to properties where development is encouraged. Under a TDR program, areas where development is encouraged are called "receiving zones" and areas where a community wants to discourage development are referred to as "sending zones."

Sending zones may be areas designated through a comprehensive plan as necessary for flood and erosion control, water quality protection, agriculture, historic preservation, or other purposes. Receiving zones may be designated by a community as suitable for higher density residential, commercial, or industrial development. Receiving zones typically are suitable for more dense development due to the availability of sanitary sewers, water, and other infrastructure.

Communities participating in a TDR program identify sending and receiving zones through a comprehensive planning process. Landowners participate voluntarily in a TDR market and in doing so help to implement local comprehensive plans. By choosing to sell their development rights, they voluntarily and permanently reduce the development permitted on their land in exchange for compensation by another landowner wishing to increase density in areas suitable for more development. Property owners that sell their development rights place a permanent conservation easement on their property to ensure the longevity of the development rights transfer.

Implementation of TDR programs could allow development in rural areas to be transferred to more compact development areas in urban areas, thereby encouraging balanced growth and retaining the quality of life and watershed in the countryside, while enhancing the small town feel and vibrancy of the community site. Enabling legislation is needed at the Ohio State level to specifically authorize communities to develop TDR programs and to allow inter-community transfers and revenue sharing methods. TDR promotes development in PDAs and conservation in PCAs. TDR programs should accompany any increases in allowable density in PDAs.

Before Development

Conventional Low Density Subdivision

Conservation Subdivision

Transfer of Development Rights

Graphics by Brandywine Conservancy's Environmental Management Center

PART II: DEVELOPING DRAFT PRIORITY CONSERVATION AND DEVELOPMENT MAPS

Developing Draft PCA and PDA Maps

This section details the initial methodology for developing the draft PCA and PDA maps through CRWP's work with a Steering Committee and our consultants, URS Corporation and Northstar Planning. CRWP accumulated hundreds of GIS data sets for various features throughout the watershed. The team reviewed available data sets, identified other data sets that could be acquired, and determined whether new data sets should be developed. Data sets changed over time, and were added to the overall project data management scheme as they were updated. This wealth of accurate, recent data was critical to this project.

CRWP Balanced Growth Steering Committee

To gain input from a wide group of stakeholders while maintaining a workable group size, CRWP convened a Steering Committee to assist in draft map creation and messaging of the Balanced Growth Program to CRWP members. This committee was comprised of the following representatives:

- Jason Boyd: Director, Lake County Planning Commission
- David Dietrich: Director, Geauga County Planning Commission
- Chris LeGros: Director of Planning, CT Consultants
- Bruce Rinker: Mayor, Mayfield Village
- Greg Studen: Former Trustee, Russell Township
- Gus Saikaly: Director, Geauga Dept. of Water Resources
- Carol Thaler: Principal Planner, Cuyahoga Countty Planning Commission
- John Trew: Director, Department of Public Service, City of Aurora

Landscape Ecology Concepts

Landscape ecology can offer guidelines for evaluating and selecting potential PDAs and PCAs. Consider Figure 1, where different land uses are represented by different colors. Yellow represents agriculture, red urban areas, gray industrial areas, blue water features, dark green forested areas and light green shrub-dominated old fields. Consider the forested area labeled A. It may contain older trees and offer some habitat value, but it is embedded in a matrix of industrial land use and is rather small. From a landscape ecological perspective, its small size and isolation indicate it is not likely to offer much in the way of ecological function. This area would likely not be a good choice for a PCA, but may be an excellent PDA. Wooded areas B and C may be candidates for preservation. Note that B appears somewhat smaller than C and has an irregular boundary. Thus, it has a rather large amount of edge per unit of interior area. Edges of forests are places where invasive and aggressive native species are found, and where more ecologically desirable interior species are lacking. Area C has a more regular edge, and therefore a lesser amount of edge compared to its interior area. C is likely to harbor more area sensitive and interior species than is B. Note also that C has a stream running through it. Protecting area C as a PCA would help protect a portion of this riparian area.

Landscape ecological theory tells us that ecological functions of small patches can be enhanced when patches are connected by corridors. Corridors can connect two patches, such as B and C, and allow the movement of animals and plant propagules between the patches. Note that a small strip of forest connects patches B and C. In a landscape ecological sense then, patch B might have enhanced value as it is connected by a narrow forested corridor to Patch C. Patch A has no enhanced value in this sense, since it is separated from patch B by industrial and agricultural land uses.

The narrow corridor connecting patches B and C may be too narrow to really function as a corridor. Note though that the corridor is surrounded by patch D, a shrub dominated old field. While not exactly the same plant community as the two forested patches B and C, patch D is a natural community dominated by woody species, and is more likely to be a conduit for animal and plant propagule movement than more dissimilar land uses such as agriculture or residential. Thus, preserving portions of patch D could enhance the functioning of the narrow corridor between B and C. In addition, preservation of patch D would protect additional riparian area around the stream, and buffer patch C from some effects of the nearby residential and agricultural areas.
These concepts were used to provide the scientific

Figure 1. Landscape ecological concepts

underpinnings for the selection of PCAs and PDAs. The Balanced Growth Program specifies that PCAs and PDAs will be locally defined, thus each community will decide what qualifies for either category. This project is designed to provide robust technical support to make these choices more defendable.

Creating the Grid

GIS data on the watershed, compiled by CRWP, and modeling data indicating stream reach and watershed sensitivity, were combined to assign PCA and PDA scores to a rectangular grid covering the study area. The selection of PCAs and PDAs was based on the analysis of several data sets which represented criteria the Steering Committee determined would identify PCAs and PDAs. A sampling grid was created to overlay the other data to determine if a location had attributes that meet the selection criteria. Square shaped cells were selected largely because the math needed to generate the grid is simplified with a square design. Selection of the cell size is a matter of balancing the time and energy required to develop and populate the grid against the level of precision desired. Generally, the smaller the cell size the greater the spatial precision of the resulting data, and the closer the cell boundaries may represent the boundaries of the source data sets used. However, it takes a great deal of processing time to populate a grid with small cell sizes. Several iterative trials were made before the project team settled on a 150 meter x 150 meter grid cell size. The grid allowed the team to create a single data set that represents and summarizes data contained in multiple data sets. The final grid has 43 attribute fields, 62,668 grid features entered, and extends to encompass all of the area occupied by Chagrin watershed communities.

Populating the Grid with Data

Once the grid size was selected, the team began to populate the grid cells with data from the various themes. The fields in the grid are designed to represent the PCA/PDA selection criteria. If the data analysis indicated a cell overlaid an area that met a criterion, the cell was given a score of 1 for that criterion. The tool used to accomplish this was the Select By Theme routine in ArcView. Conversely, if a cell overlaid an area that did not meet the criterion, the cell was given a 0. The grid scores and resulting PCA and PDA maps for each community were used by CRWP to enter into discussion with each community regarding the official creation of PCA and PDA areas. Figures 2 through 4 illustrate the populating of the grid for point, line and polygon data.

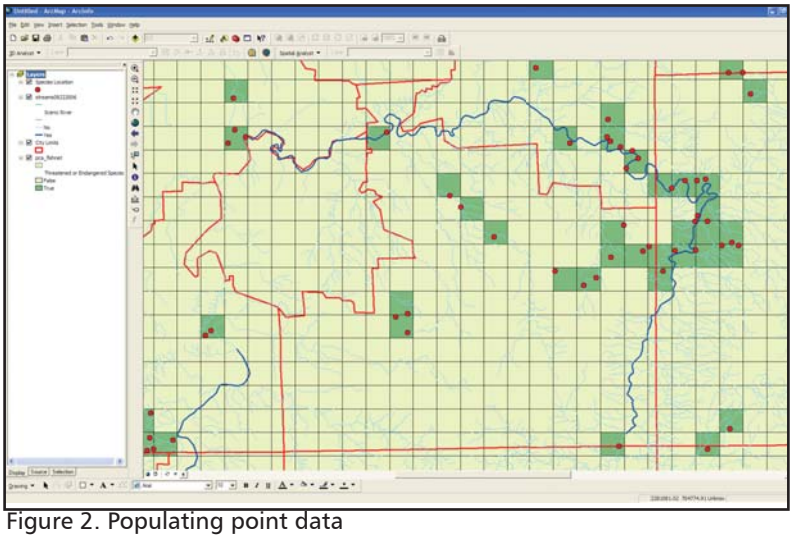


Figure 2. Populating point data

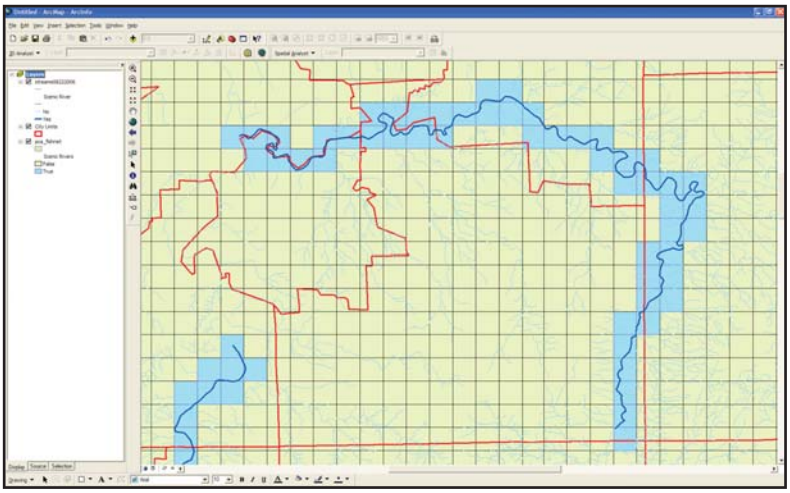


Figure 3. Populating line (stream) data

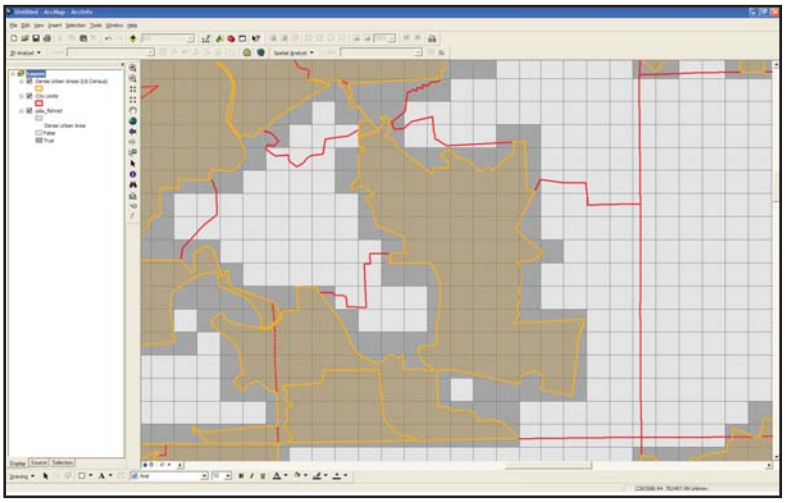


Figure 4. Populating polygon (area) data

PCA and PDA CRITERIA

Table 1 shows the fields in the PCA, and Table 2 shows the fields for the PDA data set, their definitions, and the data sources used to populate the fields. The selection criteria are discussed in detail below. Most of the PCA/PDA grid file was populated by selecting data from existing data files, most of which were collected or developed by CRWP. A few criteria required creating new data sets.

Watershed Sensitivity

Stream reach sensitivity values developed by Dr. Joseph Koonce's lab at Case Western Reserve University. Dr. Koonce's team has been studying the effects of land use on the volume of water conveyed to and flow rates within streams in the Chagrin watershed to develop a model to help facilitate better management of the Lake Erie ecosystem. The work evaluates how various stressors affect ecosystem properties of streams and ultimately the lake. Stressors can include land use changes, nutrient enrichment, modifications to in-stream habitat or flow regimes, introduction of exotic species and fish harvesting rates. This research provided a quantitative link between terrestrial land use practices, stream health, and the health of Lake Erie. Dr. Koonce's work links changes in the landscape to flow, nutrient loading and in-stream habitat. This data is presented in more depth on pages 92 and 93.

DRASTIC

ODNR's DRASTIC groundwater pollution potential data was used to assess the potential that a local aquifer could be polluted by surface activities, based on soil type, permeability, and other factors. The DRASTIC data set expresses this potential as a synthetic numerical index. The team combined the data for the counties in the watershed, and broke the index values into high medium and low categories using the same ArcView statistical techniques for the Koonce lab data. Areas that had a high pollution potential were assigned to the high sensitivity group, areas that had a moderate pollution potential were assigned to the moderate sensitivity group, and areas with a low potential were assigned to the low sensitivity group.

Protected Open Space

Protected open space includes all vacant government owned lands, conservation easements, and park lands obtained from CRWP Protected data set. If a grid cell overlapped a protected parcel, the cell received a score of 1, those cells that didn't overlap received a score of 0.

Stream Corridors

CRWP mapped model riparian setbacks along all streams. This included areas where communities have not yet adopted riparian setbacks. Grid cells were assigned a value of 1 if a riparian corridor overlapped the cells, otherwise the cell was scored a 0.

Threatened and Endangered Species

ODNR's Natural Heritage Database on the locations of state and federally listed threatened and endangered species. Grid cells were assigned a value of 1 if a listed species overlapped the cells, otherwise the cell was scored a 0.

Floodplains

CRWP used data showing the extent of 100 year floodplains. Grid cells were assigned a value of 1 if a floodplain overlapped the cell, otherwise the cell was scored a 0.

CWH and EWH Streams

Coldwater (CWH) and exceptional warm water habitat (EWH) streams are of particular importance for their biological diversity and the particular aquatic species that inhabit these streams. CRWP mapped those stream reaches that have been assigned these designations. GIS analysis was used to determine those grid cells which overlapped CWH and EWH streams. Scoring is as described above.

Brook Trout Streams

Brook trout are known to inhabit high quality cold water streams, and to be sensitive to changes in water temperature, sedimentation and other indicators of water quality. These were mapped using CRWP data, obtained from ODNR. Grid cells were assigned a value of 1 if a stream with native or stocked brook trout overlapped the cell, otherwise the cell was scored a 0.

Wetlands

Wetlands were mapped using several data sources. Sources included NWI and OWI wetland maps, hydric soils, and surveys performed by various groups for CRWP and others. Most of these wetlands were not field delineated, but were determined through a mix of analysis of remote sensing data and a small amount of ground truthing. Wetlands were scored as described above.

Ohio Archeological Inventory

CRWP collected data for this category from the Ohio Preservation Office. These were mapped as point locations. If a point fell in a grid cell, a score of 1 was assigned.

Ohio Historic Inventory

CRWP collected data for this category from the Ohio Preservation Office. These were mapped as point locations. If a point fell in a grid cell, a score of 1 was assigned.

National Registry Properties and Districts

CRWP collected data for this category from the Ohio Preservation Office. These were mapped as point or polygon areas as appropriate. If a point or polygon fell in a grid cell, a score of 1 was assigned.

Major Intersections

One PDA criteria was that the area should be within 500 feet of the intersection of an Interstate, US or State highway. The team used ODOT's ZZINV.shp data set. ODOT created and maintained this data set as the "master data" for the state's highway system. The team used the "Point to Theme" ArcView Extension to place a point at all the intersection of Interstate, US or State highways. The resulting data set was proofed. The team used the buffer tool in ArcView to create a 500 foot buffer around each intersection point. This data set became the Maj_Int.shp file. Grid cells were assigned a value of 1 if a polygon overlapped the cell, otherwise the cell was scored a 0.

Steep Slopes

The presence of steep slopes was a selection criterion for PCAs. The team found steep slopes by using the 2 foot contour data set to identify all areas where the slope was greater than 12%. To accomplish this, the team converted the 2 foot contour files to a TIN (Triangulated Irregular network), essentially a file of irregularly spaced points where each point has an x, y and z (elevation) coordinate. The team then used the TIN to identify areas where the slope (change in elevation over unit area, based on the TIN points) was 12 % or more.

Urbanized Areas

The US Census Bureau created a classification of dense urban areas, defined as a land area comprising 1 or more central places and the adjacent densely settled surrounding area that together have a residential population > 50,000 and an overall population density > 1,000 people per square mile. These polygons were used to score grid cells as described above.

Zoning

The project team added a field for the standardized zoning classification created as part of an earlier study of impervious cover in the watershed (Camp Dresser & McKee, Inc. and Chagrin River Watershed Partners, Inc. 2004. Chagrin River Watershed Impervious Area Study, Final Report). Grid cells were assigned a value of 1 if a zoning category of industrial, commercial, or high density residential overlapped the cell, otherwise the cell was scored a 0.

Sanitary Sewer Planning

CRWP gathered data on sewer service planning in all the member communities. Data from local 208 plans were used to determine whether an area:

- Had existing sewers,
- Was planned to be serviced by on-lot septic systems or,
- Was planned to be served by sewers in the future.

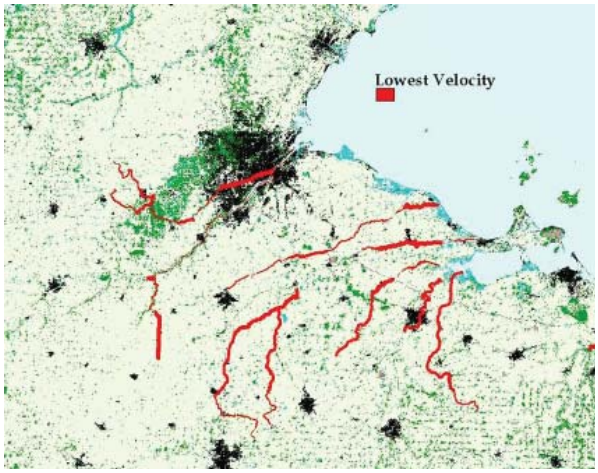
Areas where sewers existed or where sewers were planned, had grid scores of 1 assigned. Otherwise a score of 0 was assigned to the cells.

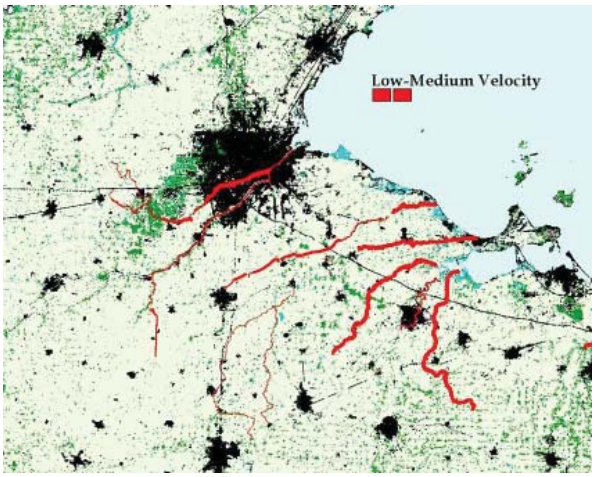
Impervious Cover

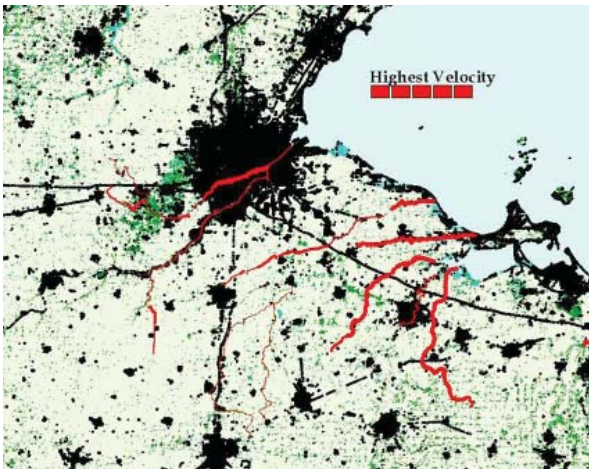
The team wanted to be able to analyze the estimated percent of impervious cover in each sub-watershed. CRWP had developed estimates of average impervious cover for each of the common zoning categories under the previously noted impervious cover analysis. The team used the average percent impervious cover for each zoning category and the size of each parcel to calculate an estimated impervious cover value (in acres) for each parcel. The team also used the watershed boundaries in the files cu96ws.shp, ge78ws.shp and la95ws.shp, provided by CRWP from the NOACA Magic 2002 cd's. The team used an ArcView script called Attribute Overlay to identify the sub-watershed within which each parcel lies. The team was then able to sum the estimated acreage of impervious cover in each parcel to calculate a total impervious cover for the watershed. This was then expressed as a percentage of the total watershed acreage. These data were saved as a new data set called merged_impr_ stdyfinalmarch.shp.

WATERSHED SENSITIVITY: DR. JOSEPH KOONCE, CASE WESTERN RESERVE UNIVERSITY

The images below help illustrate the link between land use and in-stream habitat variables. In these images, which focus on the western end of Lake Erie and surrounding portions of Ohio and Michigan, developed portions of the landscape are shown in black.







Note how stream velocity changes as development progresses. Urbanization brings with it greater volumes of runoff as impervious cover increases. Streams in urban areas often have their channels modified to facilitate rapid movement of these flows. Even when channels are not mechanically modified, the greater run-off volumes generated by developed areas often modify channels. One result can be greater stream velocities. This change in velocity can have important effects on the structure of habitat components in the stream. Smaller substrates may be removed, and even larger structural components may be altered. The invertebrate and other prey communities on which fish depend also change in response to higher velocities.

Dr. Koonce's work resulted in models that allowed the team to explore how land use changes affect water quality and habitat in the receiving streams. The implications for this project are clear. The models are spatially explicit and have a resolution of 30 meters. Therefore they allowed the project team to look at the effects of land use changes at the parcel level. The sensitivity of each stream reach, and its attendant sub-watershed, could be modeled such that the team was able to identify "sensitive" sub-watersheds, where landscape changes could have rather adverse effects on stream hydrodynamics (and therefore stream health), and relatively "insensitive" reaches and sub-watersheds, where it is likely that changes as a result of urbanization would have somewhat lower and more acceptable effects.

Dr. Koonce's data showed that the most reliable predictor of stream sensitivity was slope. Streams with rather steep slopes are relatively insensitive to land use changes, while streams with relatively little slope (generally headwater areas) can be very sensitive. The team used ArcView to statistically group the stream slopes into three categories, for high, medium and low slopes. The stream reaches with low slopes were assigned to the high sensitivity group, those with moderate slopes to the medium sensitivity group, those with high slopes to the low sensitivity group. The team added a field to Dr. Koonce's data set, indicating the sensitivity. Reaches with low sensitivities were assigned a score of 1, moderately sensitive reaches a score of 2, and very sensitive reaches a 3. Figure 5 shows the calculated sensitivities of each of the sub-watersheds modeled by Dr. Koonce's lab. Stream segments in red subwatersheds are very sensitive to increases in impervious cover, streams in yellow subwatersheds have a moderate sensitivity, and streams in green have a low sensitivity. Details of Dr. Koonce's research may be found at: http://www.glc.org/landuse/ohroundtable/documents/BGIPF_002.pdf and http://www.springerlink.com/content/e2744x2r0285422j/

In the data set from Dr. Koonce's lab, the team selected all of the watersheds which were found to be very sensitive to land use changes by selecting all of the watersheds that had a

sensitivity score of 3. The team created a new field in the PCA/PDA grid data set, called K_hi (short for Koonce data, highly sensitive watershed). Similarly fields were also added to represent K_med (short for Koonce data, moderately sensitive watershed) and K_low (short for Koonce data, relatively insensitive watershed.

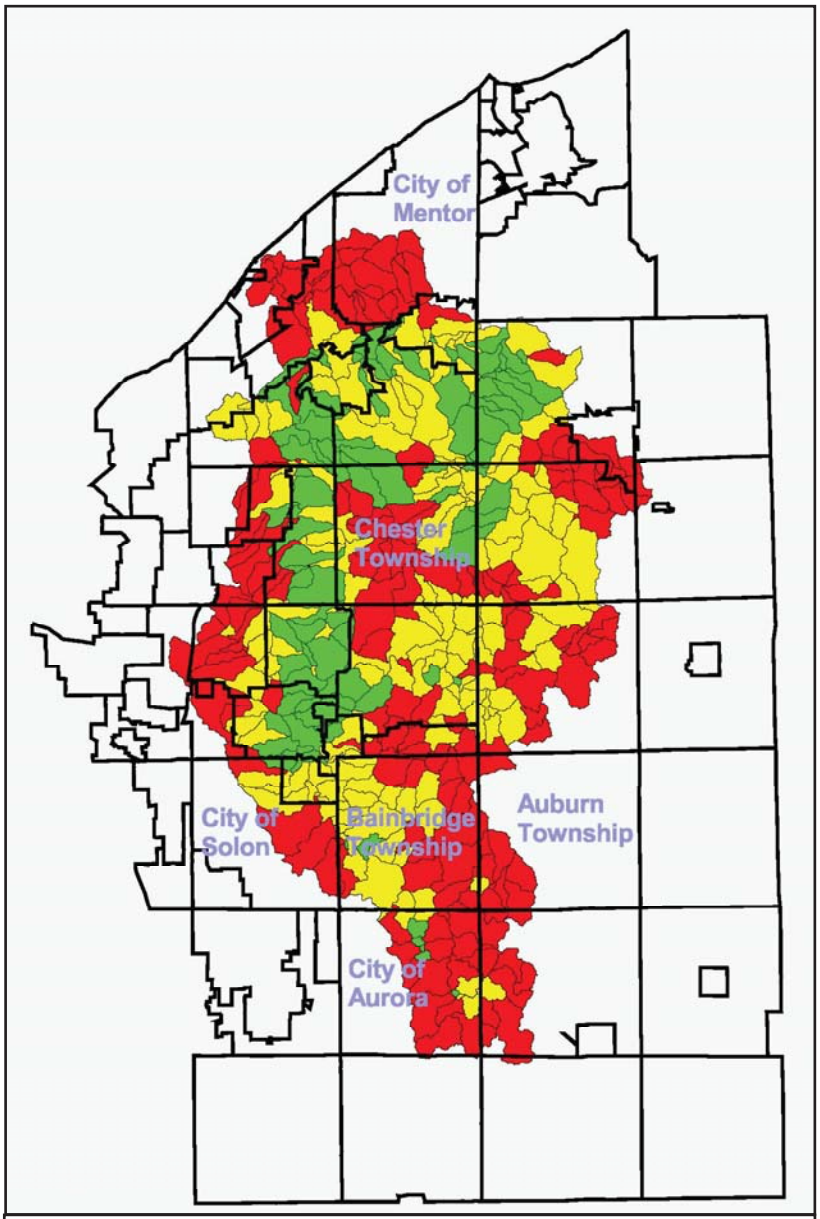


Figure 5: Relative Sensitivity of sub-watersheds to increases in impervious cover.
Red=very sensitive
Yellow=moderately sensitive
Green=relatively insensitive

Calculating Scores Based on Criteria

There are a variety of ways that the individual criteria could be combined to create a PCA/PDA score. The simplest is to sum all of the criteria scores. The team created raw PCA and PDA scores by summing the appropriate criteria. Of course, such a simple summation treats all criteria equally, when in fact it may be desirable to assign different values or priorities to the criteria, recognizing that some are inherently important to PCA and PDA selection than are others. The project team and steering committee met to discuss and assign ranks to each criterion. For PCA selection the team used the ranks shown in Table 1. PDA ranks are shown in Table 2.

To calculate the ranked PCA and PDA scores, the team multiplied the score for each criterion by the ranking value, and calculated the total for each grid square. Using this grid technique, each grid square was assigned a score of 1 or 0 for each of the 43 attributes. Each attribute was given a weight, as shown in Tables 1 and 2. The grid score for each attribute was multiplied by the weight for that attribute, and all of the attributes were summed to create a total score for all PCA attributes, and a similar total score for all PDA attributes. Final PCA and PDA rankings are shown in Figures 6 and 7. The maps show grid cells mapped by the weighted PCA/PDA score. In the PCA map, the darker the green color the higher the area ranked as a PCA, conversely for the PDA map, darker brown colors indicate higher scores for PDA values. CRWP presented these data to their member communities. During these presentations, the PCA/PDA scores were attributed to individual parcels, allowing the communities assign tracts of land to the appropriate category.

Table 1. Summary of data used to assign PCA scores.

Criterion	Explanation	Rank	Primary Data Source	Source Theme Names	Date	Scale	Rationale
K_HI	Koonce score for high sensitivity watersheds, if hi score = 1, if not score = 0	5	Finalhruon.shp, Koonce lab data	Finalhruon.shp	July 2006	1 km^2	PCAs should be used to help protect highly sensitive watersheds. This criterion directly addresses the BGI goal of protecting water quality.
K_MED	Koonce score for medium sensitivity watersheds	3	Finalhruon.shp, Koonce lab data	Finalhruon.shp	July 2006	1 km^2	PCAs should be used to help protect moderately sensitive watersheds. This criterion directly addresses the BGI goal of protecting water quality.
K_LOW	Koonce score for low sensitivity watersheds	1	Finalhruon.shp, Koonce lab data	Finalhruon.shp	July 2006	1 km^2	While there are features in these watersheds that merit protection, land use changes should be directed to the least sensitive watersheds, the watersheds best able to "handle" land use changes.
POLL_HI	DRASTIC groundwater pollution potential data indicates a high potential for groundwater pollution	5	Cuyahogwpoll.shp, geaugwpoll.shp, lakewpollsp.shp, portagewpollsp.shp. Available from ODNR GIMS	Merged_gwpoll2.shp	Oct. 2005	1:24000	PCAs should be used to protect sensitive areas where soil type, infiltration rates and other data indicate a high potential for groundwater pollution.
POLL_MED	DRASTIC groundwater pollution potential data indicates a medium potential for groundwater pollution	3	Cuyahogwpoll.shp, geaugwpoll.shp, lakewpollsp.shp, portagewpollsp.shp. Available from ODNR GIMS	Merged_gwpoll2.shp	Oct. 2005	1:24000	PCAs should be used to protect sensitive areas where soil type, infiltration rates and other data indicate a moderate potential for groundwater pollution.
POLL_LOW	DRASTIC groundwater pollution potential data indicates a low potential for groundwater pollution	1	Cuyahogwpoll.shp, geaugwpoll.shp, lakewpollsp.shp, portagewpollsp.shp. Available from ODNR GIMS	Merged_gwpoll2.shp	Oct. 2005	1:24000	Land use changes should be directed to those portions of the watershed with low potentials for groundwater pollution.
T_E	Grid cell overlaps a T and E species occurrence	4	CRWP data – from Natural Heritage Database	Species.shp	Dec. 2002	1:24000	The presence of a threatened or endangered species may be an indicator of the overall habitat quality of an area
PROT	Grid cell overlaps a protected land	5	Protected 20070221.shp CRWP data	Protected 20070221_urs_revised.shp	Feb. 2007	1:24000	Protected areas can form the core of PCAs.
STEEP_SLOP	Grid cell overlaps a steep slope (12% or greater)	4	CRWP topo data from Community GIS development	Steep_slope.shp	Sep. 2006	1:24000	Land use changes on steeply sloped areas can directly effect the hydrodynamics of the receiving stream.
FPLAIN	Grid cell overlaps a 100 year floodplain	5	CRWP floodplain data from FEMA data	Floodplain_200604.shp	April 2006	1:24000	Land use changes on floodplains can directly effect the hydrodynamics of the receiving stream.
CWH_EWH	Grid cell overlaps a stream listed as CWH or EWH	4	CRWP stream data (Based on ALU designation in OAC as of January 2007.)	Streams20070220.shp	Jan. 2007	1:24000	Cold water and exceptional warm water streams are high-quality resources.
NAT_TROUT	Grid cell overlaps a stream with native trout reproduction	5	CRWP stream data (locations from ODNR, circa September 2005)	Streams20070220.shp	Jan. 2007	1:24000	Native trout streams are high-quality resources.
STOCK_TROU	Grid cell overlaps a stream stocked with trout	5	CRWP stream data (locations from ODNR, circa September 2005)	Streams20070220.shp	Jan. 2007	1:24000	Stocked trout streams are high-quality resources.
WETLAND	Grid cell overlaps a wetland	5	CRWP wetland data	Wetlands12_06.shp	Sep. 2002	1:24000	Wetlands help protect water source and quality.
RIP_SB	Grid cell overlaps a riparian set-back area	5	CRWP Model Riparian Setback	20070220 rip sb.shp	Feb. 2007	1:24000	Riparian setbacks help protect water source and quality.
SCEN_RIV	Grid cell overlaps a scenic river	5	CRWP stream data.	Streams20070220.shp	Jan. 2007	1:24000	Scenic rivers are high-quality resources.
NAT_REG	Grid cell overlaps a property on the National Register of Historic Places	3	CRWP data from SHPO, June 2005	nr_sp.shp & nrdist_sp.shp	Aug. 2006	1:24000	Addresses preservation of cultural resources.
OAI_PROP	Grid cell overlaps an OAI listed property	3	CRWP data from SHPO, June 2005	OAI_sp.shp	Aug. 2006	1:24000	Addresses preservation of cultural resources.
OHI_PROP	Grid cell overlaps an OHI property	3	CRWP data from SHPO, June 2005	OHI_sp.shp	Aug. 2006	1:24000	Addresses preservation of cultural resources.

Table 2. Summary of data used to assign PDA scores.

Criterion	Explanation	Rank	Primary Data Source	Source Theme Names	Date	Scale	Rationale
K_HI	Koonce score for high sensitivity watersheds, if hi score = 1, if not score = 0	0	Finalhruon.shp, Koonce lab data	Finalhruon.shp	July 2006	1 km^2	PDAs should probably not be placed in highly sensitive watersheds. This criterion directly addresses the BGI goal of protecting water quality.
K_MED	Koonce score for medium sensitivity watersheds	2	Finalhruon.shp, Koonce lab data	Finalhruon.shp	July 2006	1 km^2	PDAs may be appropriate in moderately sensitive watersheds. This criterion directly addresses the BGI goal of protecting water quality.
K_LOW	Koonce score for low sensitivity watersheds	5	Finalhruon.shp, Koonce lab data	Finalhruon.shp	July 2006	1 km^2	PDAs should be primarily placed where they are the most appropriate, in those watersheds that are relatively insensitive to land use changes.
POLL_HI	DRASTIC groundwater pollution potential data indicates a high potential for groundwater pollution	0	Cuyahogwpoll.shp, geaugwpoll.shp, lakewpollsp.shp, portagewpollsp.shp. DRASTIC files fore each county available from GIMS	Merged_gwpoll2.shp	Oct. 2005	1:24000	PDAs should not be located in highly sensitive areas where soil type, infiltration rates and other data indicate a high potential for groundwater pollution.
POLL_MED	DRASTIC groundwater pollution potential data indicates a medium potential for groundwater pollution	0	Cuyahogwpoll.shp, geaugwpoll.shp, lakewpollsp.shp, portagewpollsp.shp. DRASTIC files fore each county available from GIMS	Merged_gwpoll2.shp	Oct. 2005	1:24000	PDAs should not be located in moderately sensitive areas where soil type, infiltration rates and other data indicate a moderate potential for groundwater pollution.
POLL_LOW	DRASTIC groundwater pollution potential data indicates a low potential for groundwater pollution	5	Cuyahogwpoll.shp, geaugwpoll.shp, lakewpollsp.shp, portagewpollsp.shp. DRASTIC files fore each county available from GIMS	Merged_gwpoll2.shp	Oct. 2005	1:24000	Land use changes should be directed to those portions of the watershed with low potentials for groundwater pollution.
DENS_URB	Grid cell overlaps a US Census Bureau dense urban area boundary	5	US Census bureau urban area boundaries	Ua_nad83.shp	Jan. 2003	1:100000	Dense urban areas are clearly appropriate for PDAs
MAJ_INTERS	Grid cell overlaps an intersection of an Interstate, State or US highway.	5	ODOT zzinv.shp roadway file	500ft_buff_inetrsect_dec.shp	Dec. 2006	1:24000	Major intersections often serve as hubs for development.
EXIST_SEWE	Grid cell overlaps an area currently sewered according to the 208 plan	5	CRWP 208 plan data	200611_208_plan.shp	November 2006	1:24000	Areas that are sewered are attractive for development.
Z08_ONSITE	Grid cell overlaps an area listed as on-site sewers in the 208 plan	4	CRWP 208 plan data	2006411_208_plan.shp	November 2006	1:24000	Onsite sewage disposal limits some types of development.
Z08_FUTURE	Grid cell overlaps an area listed for future sewers in the 208 plan	4	CRWP 208 plan data	200611_208_plan.shp	November 2006	1:24000	Areas that may be sewered are attractive for development.
IMP_COV_20	Grid cell overlaps a sub-watershed where the impervious cover is 20% or more	4	CRWP members parcel data, plus merged watershed files from: Cu96ws.shp, Ge78ws.shp and La95ws.shp. Where overlaps occurred, the boundaries from Ge78ws.shp were used as guides.	Mrged_impr_stdyfinalmarch.shp	Dec. 2006	1:24000	Areas with a high degree of impervious cover may serve as relatively lower impact areas.
HI_DENS_RE	Grid cell overlaps an area where the land use is high density residential	4	CRWP members parcel data	Mrged_impr_stdyfinalmarch.shp	Dec. 2006	1:24000	Areas zoned as dense residential may attract additional development.
COMM_RET	Grid cell overlaps an area zoned commercial or retail	5	CRWP members parcel data	Mrged_impr_stdyfinalmarch.shp	Dec. 2006	1:24000	Areas zoned as commercial/retail may attract additional development.

FIGURE 6: DRAFT PRIORITY CONSERVATION AREAS

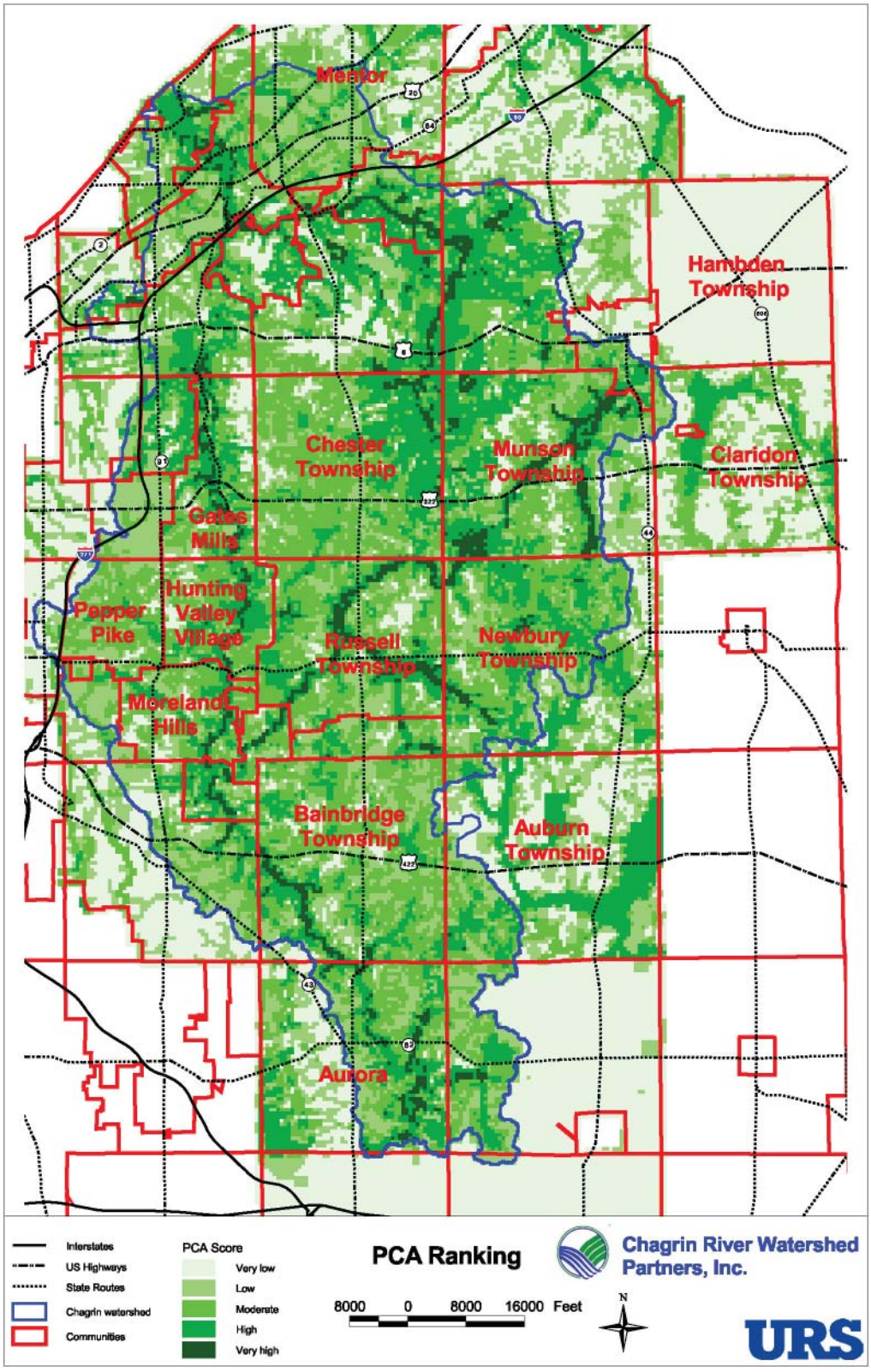
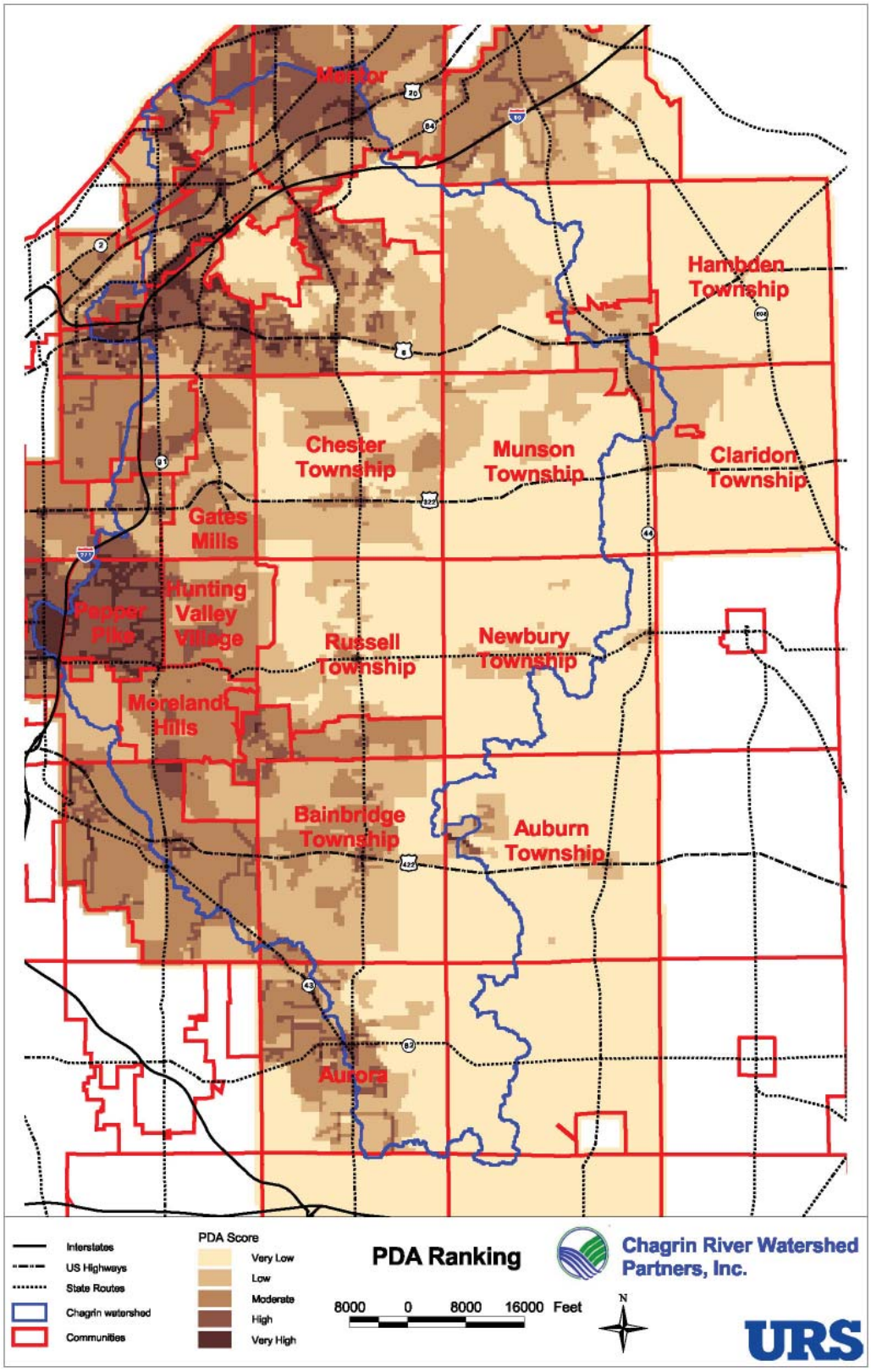


FIGURE 7: DRAFT PRIORITY DEVELOPMENT AREAS



DEFINING DRAFT PCAs and PDAs
ADDITIONAL ANALYSIS

Draft PCA and PDA Map Analysis

The importance of streams as indicators of high PCA scores is apparent in Figure 6. Of the 19 attributes that contribute to a PCA score (Table 1), nine were somehow related to the streams in the watershed. This reflects the clear focus of CRWP on protecting streams and riparian areas, and reflects the Balanced Growth Program's philosophy of ultimately protecting Lake Erie, by protecting streams and riparian areas in the target watersheds. Note too the concentrations of higher PCA scores in those areas of the watershed that are flatter and have substantial wetland areas, such as the darker band starting in Newbury Township, and arcing north through Munson and Chester Townships (Figure 6).

Conversely, Figure 7 shows how the selection of PDAs was largely driven by the presence of developed areas. The darkest, and therefore highest scoring areas are those already more developed areas, where the infrastructure for further development already exists. Note that some areas that are not currently densely developed, such as the east to west US 87 corridor through the center of Newbury Township, achieved relatively high PDA scores. This may reflect the existing zoning, in this case commercial and denser residential, as well as the existence of sufficient infrastructure to support additional development.

All grid cells have both a PCA and a PDA score. Further, it is important to note that Figure 6 and 7 show only the recommended rankings of each grid cell in terms of its PCA and PDA attributes. The process of actually assigning areas, parcels, or groups of parcels to either PCA or PDA category was ultimately made by each community.

Aggregation of PCA and PDA scores on Parcels

Land is held in packets called parcels. The size of a parcel is determined by either historic property ownership or the zoning applied to the parcel. Parcel boundaries do not necessarily equate to plant community or ecosystem boundaries, so from a conservation sense, it seemed likely from the start of the project that the team would need to assemble or "aggregate" parcels into functional ecological units. The landscape ecological literature is replete with information regarding how the size and shape of a community affect the ecological processes, including the hydrologic processes operating in that community, with which CRWP is primarily concerned. The same argument can be made for the developed landscape. Those features that make a more functional biotic community, increased connectivity, a greater interior area to edge ratio, more regular boundaries, increased "infectivity" or patch density, also make a more functional urban landscape.

The team began aggregating PCAs by first assigning an average PCA and PDA scores to each parcel. The parcel boundaries for the entire study area were overlaid on the grid files. By completing iterative select by theme operations, the value of all grid cells touched or covered by the parcel were averaged, and the average PCA and PDA scores were assigned to the parcels.

Next, a core around which to perform the aggregation was needed. The team used lands that are currently open space, identified as land that is currently preserved as a park, nature preserve or under a conservation easement. These properties were selected from the CRWP protected data layer.

One logical way to perform an initial aggregation is to assemble concentric rings of selected parcels around a core. Based on an examination of the parcels layer and the PCA and PDA maps, the team made an assumption that two concentric rings would begin to fill out and connect many of the larger conservation parcels. In order to select the parcels to form the rings, the team used ArcMap to choose parcels adjacent to the cores that were greater than 5 acres and had PCA scores in the upper 2/3 of the range of scores. This formed the first ring of aggregated PCA parcels. The aggregation steps were run again, this time selecting parcels adjacent to the first ring parcels, greater than 5 acres, and had PCA scores in the upper 2/3 of the range of scores.

The team originally assumed that PDAs would be aggregated in a fashion similar to PCAs, however, a core PDA was not always possible to identify. A lengthy examination of the maps and data led the team to conclude this step could not be readily accomplished with the data at hand. Note that this analysis includes most of the important factors in selecting areas appropriate for development. Perhaps most importantly, using the data from Dr. Koonce's lab, the team was able to identify parcels in watersheds that are relatively less sensitive to hydrodynamic changes resulting from increases in impervious cover. This is an important environmental selection criterion that as applied here should allow communities in the Chagrin watershed to channel development to these relatively less sensitive areas. Further, the team was able to perform an analysis of transportation infrastructure, the presence or absence of sewers and zoning and current land use, to further refine the selection of PDAs.

Ultimately, this parcel aggregation analysis was not used by any of the Chagrin communities in revising the PCA and PDA maps.

Conflict and Agreement Identification

One of the more interesting uses of these data is the identification of potential conflicts and agreements between existing land use and zoning, and an area's overall PCA or PDA score. From the beginning of the project the team felt it would be important to use the PCA and PDA maps to examine existing land use patterns for these potential conflicts. Near the southern boundary of the City of Aurora there is an industrial park that is vital to Aurora's economy. Much of the park has already been developed (Figure 8). Grid cells with high PDA ranks are shown in red, those with high PCA ranks are shown in green. Note the presence of some high-value PCA grid cells in the southern portion of the industrial park. From a development point of view, one might conclude that the potential PCA areas have little real value, embedded as they are in an industrial matrix. Conversely, from a conservation point of view, one might conclude that the industrial park was poorly situated, and further development should be curtailed.

The Balanced Growth Program both encourages growth in appropriate areas, while preserving those features critical to preserving and enhancing the aquatic health of the Chagrin watershed and Lake Erie. The potential PCA area, a wetland complex in this case, still supports and provides important ecosystem services. Just as importantly, the industrial park provides needed jobs and tax revenue to the growing City of Aurora. The team suggests the most logical outcome and use of these data, is to allow for future development within the appropriately zoned industrial park, but to use the high ranking PCA area to require the use of best management practices that will protect the important ecosystem services offered by the wetlands and other resources. As the City of Aurora addressed this area in their Master Plan, the City noted that although variances to their wetland setback ordinance may be appropriate they may also need higher quality BMP's to offset these wetland impacts.

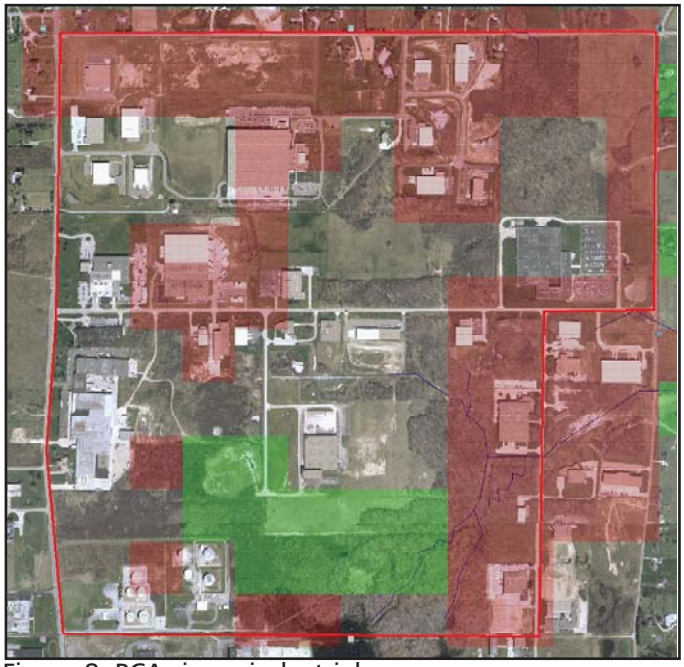


Figure 8. PCAs in an industrial area.

A Look Back at the Process

Many things worked well during this process, but there were many pitfalls encountered. First, the wealth of GIS data accumulated by CRWP was crucial to the analysis portion of the project. Further, the availability of the unique sensitivity data for reaches of the Chagrin and its tributaries from Dr. Koonce's lab allowed the team to link terrestrial land use with aquatic ecosystem functions.

Defining PCAs was relatively easy for this team, defining PDAs took more thought. As discussed above, there are some features such as road and sewer access and appropriate zoning that are easy to evaluate. Other factors of the development decision are more difficult to assess, because they involve economic decisions many of which are based on factors that are not readily predicted.

There are areas that are clearly appropriate for development in that they lie in watersheds that are generally less sensitive to land use changes, have good road and sewer access and appropriate zoning. Similarly, there are areas where the watersheds are highly sensitive, and where other conservation factors are predominant. The analysis pointed out areas where current zoning conflicts with the goal of protecting water quality and natural resources. Existing developed areas, such as residential, that are unlikely to be redeveloped were generally not considered. However, the project data could be used to help indicate the importance of using appropriate best management practices as these areas are further developed, in order to help preserve the functions provided by the high value PCAs.

This analysis was used by CRWP communities to develop their own PDA and PCA maps as detailed in Part I of this *Plan*.

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Hunting Valley
Kirtland
Kirtland Hills
Lake County
Lake Metroparks
Mantua Township
Mayfield Heights
Mayfield Village
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Munson Township
Newbury Township
Orange Village
Pepper Pike
Russell Township
Solon
South Russell
Waite Hill
Wickliffe
Willoughby
Willoughby Hills
Woodmere

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