Detroit Water and Sewerage Department

Wastewater Master Plan

DWSD Project No. CS-1314

Urban Streams Restoration, City of Detroit

Technical Memorandum
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Urban Stream Restoration, City Of Detroit

1. Purpose and Scope

The purpose of this technical memorandum is to provide a description of urban stream restoration, identify the benefits and challenges to restoration and to apply this information to a specific area in the City of Detroit.

The scope of the investigation is to learn from what others have done and to apply the concepts to an area on the west side of the City of Detroit.

2. Identification of Components

The components of this tech memo are the studies that have been published on urban stream restoration and information on specific projects where urban streams have been restored. With this background, an area on the West Side of Detroit was examined as an example of how stream restoration might benefit that area. Examples of urban stream restoration in other cities are summarized along with the benefits and challenges restoration presents. Historical maps have been consulted along with current sewer maps. Analysis of the impact of removal of stormwater from the DWSD sewerage system are provided for this hypothetical project of restoring an urban stream and diverting stormwater to this stream.

3. Methods

Information on projects in other cities was evaluated and benefits and challenges are summarized. Detroit City maps were consulted to find areas in the city with enclosed drains that might be changed to open drains. Information on housing vacancy, topographic maps and sewer maps was consulted. Once an area was identified, specific information was reviewed on housing vacancy, USGS maps, aerial photos, and sewer maps to select an area for detailed review.

4. Findings

Richard Pinkham's report titled "Stream Restoration and Daylighting: Opportunities in the Pittsburgh Region", 2001, describes the process for developing a daylighting project. "Daylighting is the act of removing streams from underground pipes and culverts, restoring some of the form and function of historic streams." (P. 5 Pinkham 2001). His information is intended to be a 'road map' for developing projects.

He advocates starting with small projects, exploring funding assistance, reaching out to the community and stakeholders that would be impacted, collaborating with landowners and politicians, taking a watershed approach, seeking technical help, assembling a competent team, doing follow-up, education, and documenting

everything. A copy of the full text of the advice on starting a daylighting project is found in Appendix A.

Types of properties that have had streams restored to surface access are listed by Pinkham (2001, p. 51). They are:

- vacant land;
- former railyards;
- school properties;
- open space and playing fields at parks;
- farm fields;
- golf courses;
- parking lots;
- extended "bridges" and parking decks;
- brownfield sites;
- former and active lumber mills;
- residential backyards;
- commercial properties in downtown areas.

4.1 Benefits of Daylighting

The Rocky Mountain Institute (RMI) report, titled, "Daylighting New Life for Buried Streams", (Richard Pinkham, 2000) reviewed several projects around the country that converted enclosed streams to open streams. Some of the benefits of creating a surface waterway, or daylighting as they call it, are described below.

"As the case studies in this report show, daylighting projects can:

- relieve choke points and flooding problems caused by under-capacity culverts;
- increase hydraulic capacity over that provided by a culvert, by recreating a floodplain;
- reduce runoff velocities-thus helping prevent erosion-as a result of a natural channel meandering and the roughness of the stream bottom and banks;
- replace deteriorating culverts with an open drainage system that can be more easily monitored and repaired;
- cost less, or only marginally more, than replacing a culvert;
- **divert urban runoff from combined sewer systems before it mixes with sewage, reducing combined sewer overflows and burdens on treatment plants;(emphasis added)**
- improve water quality by exposing water to air, sunlight, vegetation and soil, all of which help transform, bind up, or otherwise neutralize pollutants;
- recreate aquatic habitat and improve fish passage;
- recreate valuable riparian habitat and corridors for wildlife movement;…"
- "beautify neighborhoods, perhaps serving as a focal point of a new park or neighborhood revitalization project; . . ."

- "reconnect people to nature through the look, feel, and smell of open water and riparian vegetation;" pages IV and V of the report.

Common goals of urban stream projects include:

1. Replace deteriorated culverts - in some cases it was less expensive
2. Divert urban runoff and reduce wastewater flows
3. Increase recreational opportunities
4. Provide education about the area, history, stream
5. Promote development and increase property values.

4.2 Challenges of Daylighting

RMI's research also identified challenges to daylighting urban streams. The construction involved can disturb a large area. Soil and groundwater may be contaminated. The flood plain may impact properties. Education of the public to obtain their support could involve many outreach efforts. Ownership, maintenance and liability responsibilities could become difficult issues to resolve. Pinkham identifies costs as $15 to $5,000 per foot of stream restored. (Pinkham, 2001, p.9)

4.3 Kalamazoo Project

RMI describes the daylighting project in the City of Kalamazoo, Michigan. (Pinkham, 2000 p. 32) Part of Arcadia creek was restored in the downtown area of Kalamazoo. The area that was restored was rundown, had crime problems, flooded, and was a risky area for investing. The stream had been buried for 100 years. Approximately 1,600 feet of new channel was built as part of a major redevelopment project. The project started in 1995 and cost $7.5 million. It was financed by bonds based on tax-increment financing.

The design of the stream channel opened the stream for 5 blocks in the city. Three blocks of the city had a concrete channel 20 feet by 12 feet deep and included 6 weirs 1.5 feet deep, and 2 blocks had a pond and grassy slopes. The channel was designed to handle a 500-year flood. This construction eliminated the need for flood insurance for the downtown area. The tax revenues in the area have increased from $60,000 to $400,000. The Downtown Development Authority pays for maintenance, which can be $50,000 per year.

4.4 Jackson Project

RMI also describes a project in Jackson Michigan. (Pinkham, 2000, p. 50) This was a $2 million project to restore the open channel of the Grand River. Part of the stream has concrete walls and a concrete bottom and part of the channel has a gravel bottom.

A summary of the Jackson project was provided by Wilcox Associates through their power point presentation at the Michigan Stormwater Floodplain Annual Conference. The title of the presentation was, "Daylighting of the Grand River". Information from the slides provides more details of the project.

- About 3,500 feet of the Grand River channel in downtown Jackson had been enclosed in a concrete box culvert.
- The river was enclosed to eliminate odors, minimize insect problems and reduce exposure to polluted water.
- A dam had also been constructed at the upstream end of the box culvert.
- The box culvert created a community hazard leading to the drowning of six people.
- Phase I was a demonstration project to work on a 300-foot section. This helped in planning for the larger project.
- Funding sources included MDNR Waterfront Redevelopment Grant Funds, Federal Economic Development Agency Community Development Block Grant Funds, MDEQ Clean Michigan Initiative and city and private funds.
- Regulatory oversight included - MDEQ Joint Permit, MDOT Right of Way permit, soil erosion permit, and NPDES certified stormwater operator required.
- Geo-Web filled with concrete and finished with pebbles was used for bank stabilization.
- The culvert top removal resulted in a reduced flood plain elevation for the area.
- The daylighting project has led the way for redevelopment of the city's farmers market and increased recreation through a bike trail along the length of the project.

4.5 Pittsburgh Projects

Stream Restoration & Daylighting, Phase I - 2001, p. 5, 6 by Pinkham describes the methods used in Allegheny County and the City of Pittsburgh to identify locations where old streambeds existed and the criteria used to evaluate the potential for daylighting of the buried streams. Economics and water pollution prevention needs encouraged this examination of the ALCOSAN sewer system. Public participation identified social and urban living issues that supported the concept of daylighting streams in Junction Hollow and Four Mile Run. Additional sites are under consideration for daylighting in Allegheny County. Pittsburgh began sewer separation projects to remove dry and wet weather flows and to reduce sediments. Two daylighting projects have been started in Allegheny County and Pittsburgh Pennsylvania.

In the Pittsburgh, Pennsylvania study (Pinkham 2001), Pinkham adds a new concept called cultural restoration of a buried stream. Cultural restoration identifies a buried stream by markers and public art and informs people about the stream. (p.9)

4.6. Nine Mile Run

This project is being funded by the Corp of Engineers and is supplemented by public and private funds. The restoration cost of over a mile of stream is estimated to be $7.7 million. The project will rework the stream channel, create meanders, riffles, pools, wetlands and help control stormwater and includes plantings. "The project will

daylight 200 feet of the Falls Ravine stream, reconnecting it via a surface channel and wetland with the stream running through Fern Hollow, a major tributary to Nine Mile Run." (Pinkham, 2001, p. 60)

4.7 Jack's Run

This project is being undertaken by ALCOSAN, the regional sewer provider. This project will divert a direct stream connection from the combined sewer system. Jack's Run contributes dry weather flow and large volumes of wet weather flows. The project will remove all dry and wet weather flows from the sewer system through a combination of storm sewers and daylighting of the stream near the Ohio River. (Pinkham 2001, p. 60-61)

4.8 City of Detroit

The possibility of urban stream restoration and daylighting was explored for the west side of Detroit. Urban stream restoration and daylighting is not a city-wide proposal. It is one tool that may be attractive for a specific area of the city and would need case-by-case review. As an option, urban stream restoration is worth considering when culverts and storm sewers need replacement, when redevelopment is being planned and where additional recreational and educational opportunities exist. Urban stream restoration could add a positive benefit to the city by promoting development and increasing property values. Also, it can increase tax revenues, as has happened in Kalamazoo. Urban stream restoration could also remove dry and wet weather flows to the Detroit sewerage system.

Historic Detroit Watersheds are shown on Figure 1. Some of the streams on this map have been enclosed. The sewer maps for the west side of the City of Detroit were compared to the Historic Detroit Watersheds to provide a location as an example of an urban stream restoration project. The sewer maps reviewed are from the City of Detroit Water and Sewerage Department. Maps of the City of Detroit Wastewater System, 1979, West - Maintenance District. Maps 87C, 87D, 110B, 111C, 111D 103C, 103D, 112A, 113A, 113F, 118A, 119F, show storm drains and storm sewers connected to the combined sewer system. Other maps show ditches that drain to the combined sewer system (101F, 88D, 101A, 105F, 115A, 115B, 118F, 122A).

The area south of I-96 and east of Outer Drive, along the Rouge River, was selected for a more detailed look at as an example of urban stream restoration.

This location fits several of the types of property Pinkham identified as having been restored in other projects. This area is mostly vacant property, has open space west and south of it, including the golf course, and would back up to residential yards. Vacant parcels are shown on Figure 2, Existing Land Use, CRS Cluster 8 Brightmoor Subsector.

The Reconnaissance Survey of Wayne County Drainage, prepared in 1970 by Hubbell Roth and Clark, shows a proposed enclosed drain in this area. The U. S. Geological

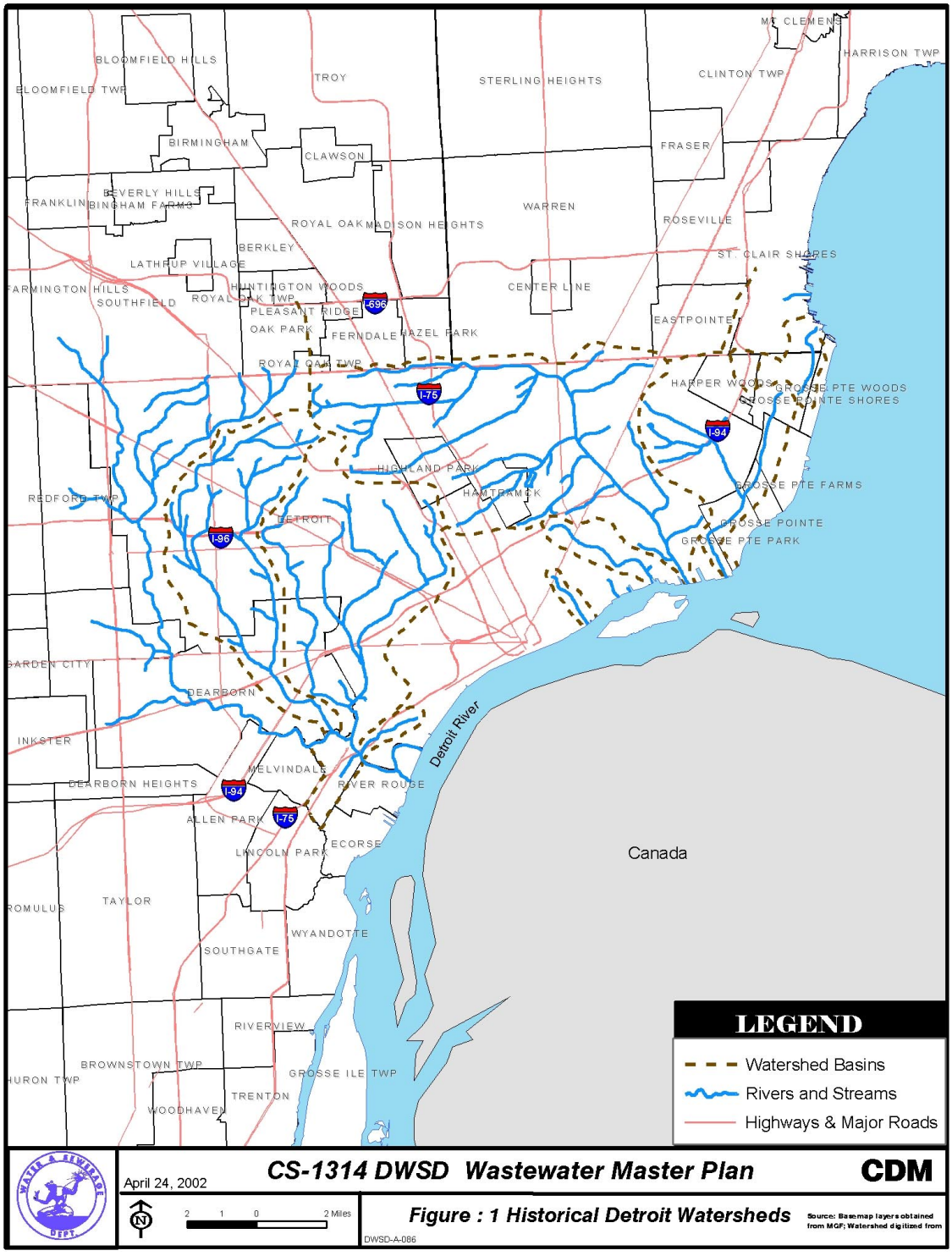


Figure 1. Historical Detroit Watershed

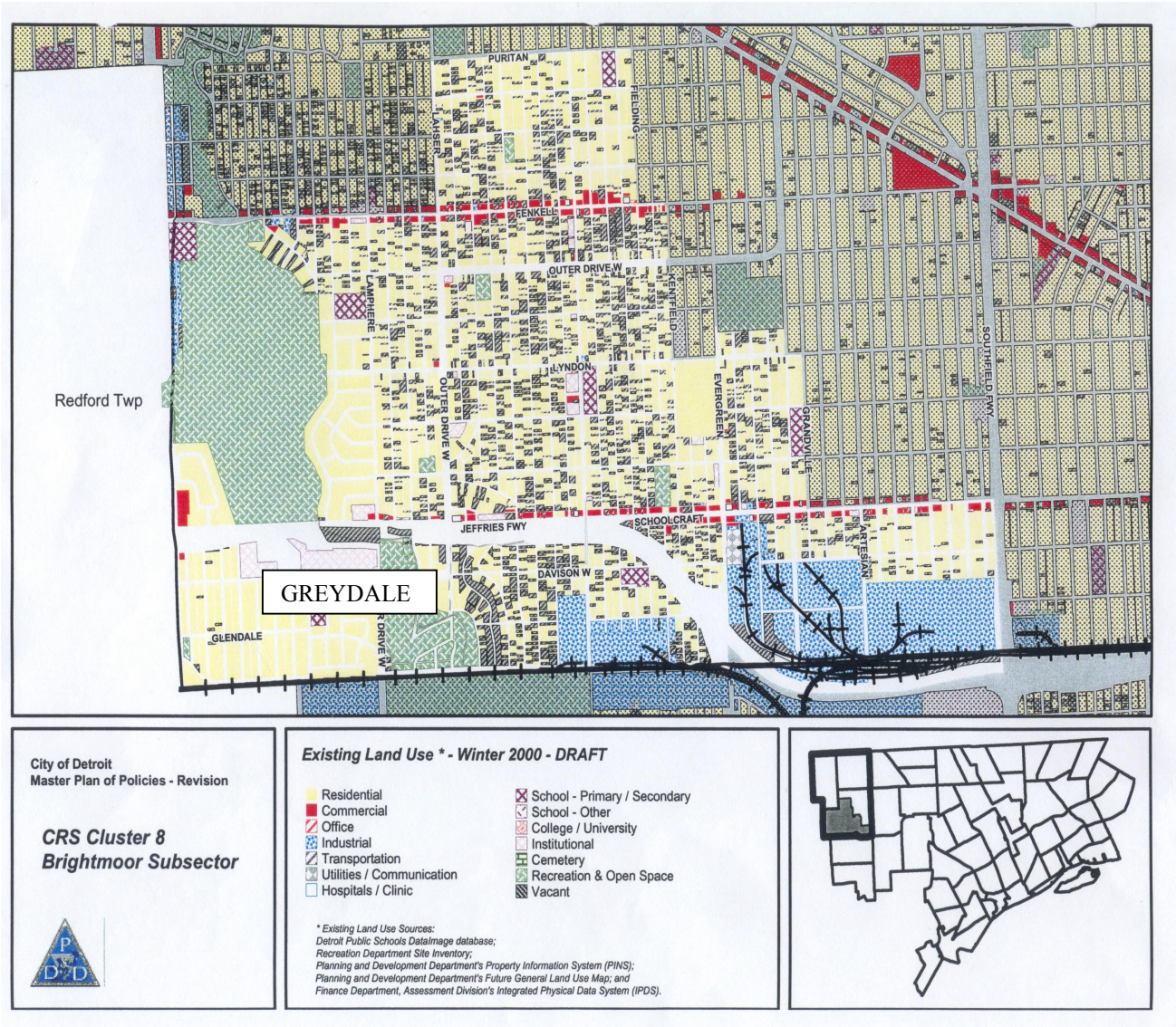


Figure 2. Existing Land Use

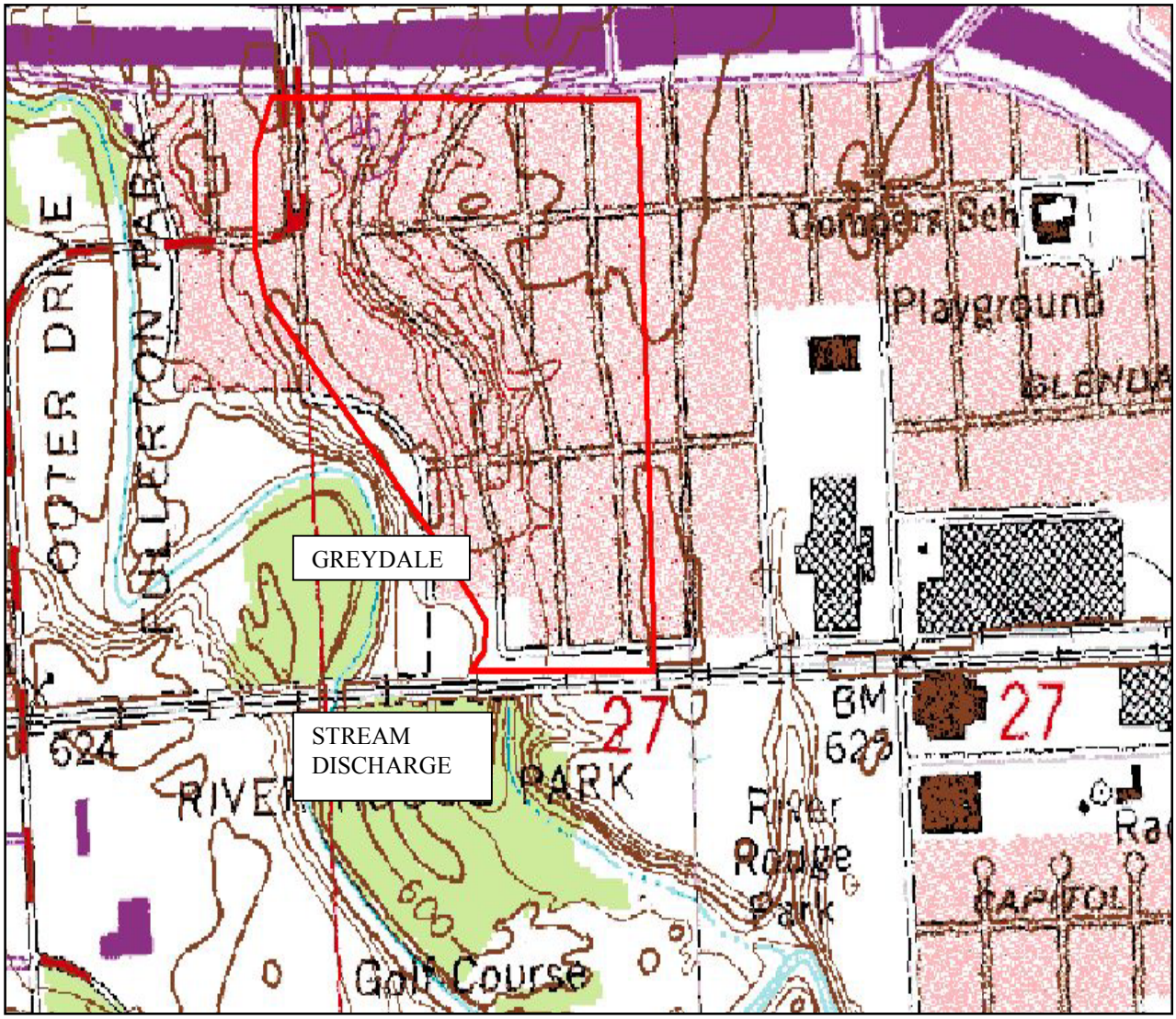


Figure 3. USGS Map of Greydale Area. Drainage area tributary to Greydale is shown by the outline.

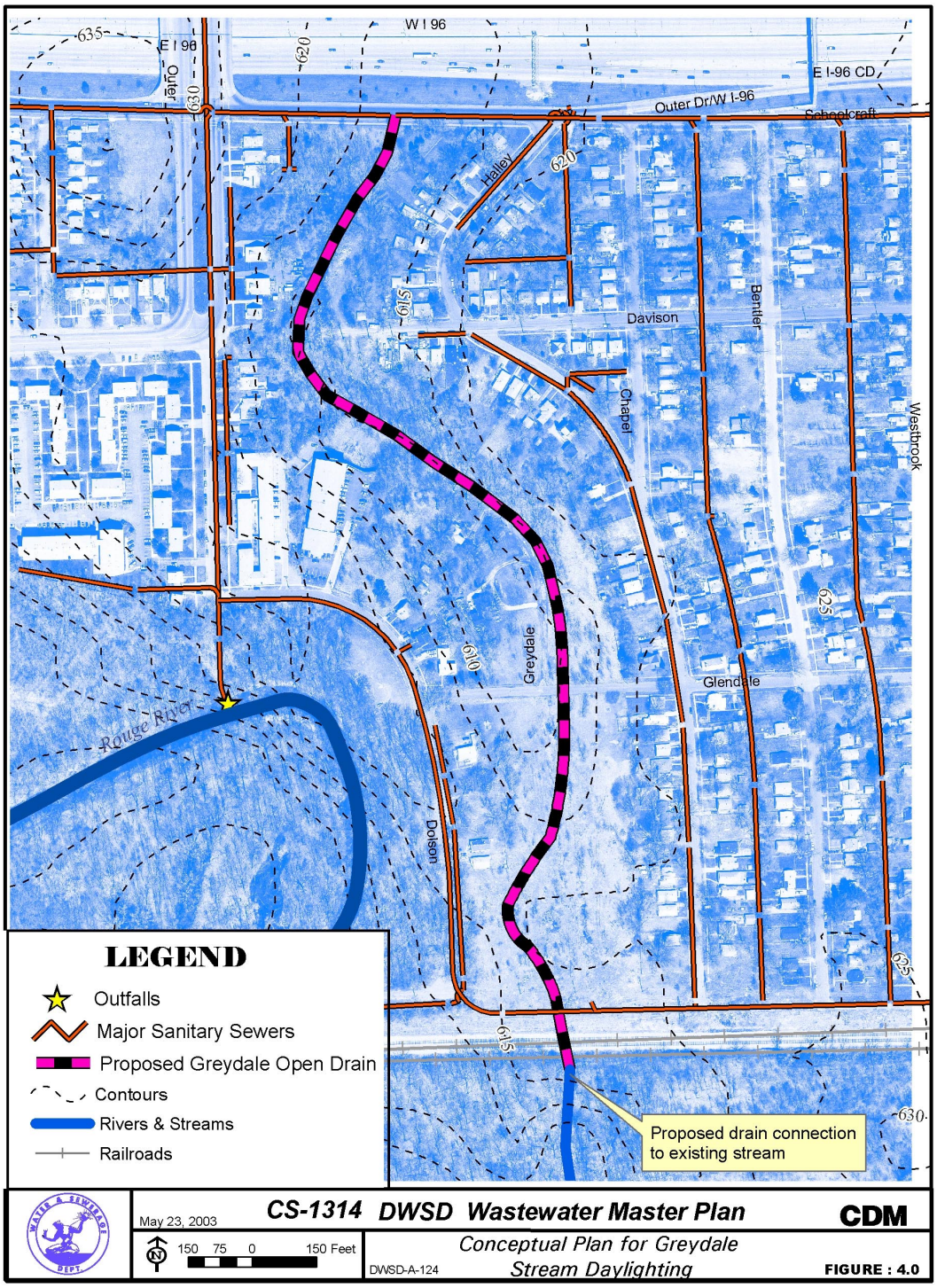
Survey map of this area, Figure 3, shows an intermittent stream discharge south of the Chesapeake Ohio railroad tracks and crosses the Rouge Park Golf Course. The area that has been covered over appears to be under Greydale Street.

Figure 4 is part of the sewer map from the City of Detroit Water and Sewerage Department, Maps of the City of Detroit Wastewater System. This map shows Greydale and the storm and combined sewers in this area. The daylighting of the buried stream under Greydale could be done in conjunction with redevelopment of the area. If street drainage that currently flows to the combined sewer were directed to this old streambed, it would benefit the Detroit sewerage system by removing the stormwater from draining to the sewers in the area.

An estimate was made of the impact of removing stormwater from the combined sewer systems in the area tributary to Greydale. The approximate area that would drain to a restored stream in the Greydale area was calculated from the USGS map of the area. The approximate drainage area tributary to Greydale is shown on Figure 3.

Runoff rates were estimated and the model was run for overland runoff from this site. The approximate area that would drain to the restored stream is 65.1 acres. The amount of stormwater that would flow to the river or to the combined sewers is 10-11 million gallons per year. The data used to project this is from the model used for the DWSD sewer system. The stormwater is based on the average rainfall for the last 40 years. Removing 10-11 million gallons per year from the combined sewer would reduce transportation and treatment costs to DWSD. This amount of stormwater would increase the wet weather flow in the Rouge River.

An additional feature that could be considered for this area is a constructed wetland just south of the railroad tracks. The property south of the railroad tracks is the Rouge Park Golf Course. A constructed wetland would benefit the environment by controlling flow to the Rouge River during rainfall, improve the water quality of the storm drainage to the river, increase wildlife habitat and could be a positive attraction for the golf course. A constructed wetland in Inkster has demonstrated these benefits. The fish and wildlife have improved in the area of the Inkster Wetland, suspended solids removal averages 80%, and phosphorous removal averages 70% and BOD and heavy metals removals average 60%. A description of the Inkster Wetlands can be found on the Rouge River website http://www.rougeriver.com. Constructed wetlands could also be part of a wetlands banking project that Wayne County has established. Including new wetlands in the banking system is expected to provide economic benefits.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Outer Dr/W I-96
Schoolcraft
Outer
Halley
Davison
Bentler
Chapel
Westbrook
Greydale
Glendale
Dolson
Rouge River
635
630
620
615
610
625
LEGEND
Outfalls
Major Sanitary Sewers
Proposed Greydale Open Drain
Contours
Rivers & Streams
Railroads
Proposed drain connection to existing stream
May 23, 2003
CS-1314 DWSD Wastewater Master Plan
CDM
150 75 0 150 Feet
Conceptual Plan for Greydale Stream Daylighting
DWSD-A-124
FIGURE : 4.0

5. Conclusions

There are areas in Detroit that could be considered for urban stream restoration. Areas that have storm sewers, storm drains and ditches connected to the combined sewer system could be restored so that surface water flows in streams and open channels. These could be attractive additions to the area. The restoration of an urban stream would also reduce the wet weather flows to the wastewater plant. Adding a wetland to the restored urban stream would improve water quality in the receiving streams and help reduce the peak flows to the river. Redevelopment of an area provides the opportunity to include stream restoration in the construction.

The example provided in Detroit could reduce the wet weather flow to the DWSD wastewater plant and could be a catalyst for development of this area. Adding a constructed wetland could provide economic benefits from the wetland banking program and ecological benefits to wildlife. It could also be a natural attraction for the golf course and add to the recreation pleasure of those that use the golf course.

When starting a stream restoration project, it will be helpful to review the material Pinkham has prepared that is in Appendix A. Public involvement and collaboration will greatly improve the project's chance of success.

6. References

- Pinkham, Richard, "Daylighting New Life for Buried Stream", Rocky Mountain Institute, Snowmass Colorado, 2000.
- Pinkham, Richard, "Stream Restoration and Daylighting: Opportunities in the Pittsburgh Region", Studio for Creative Inquiry, Carnegie Mellon University, Pittsburgh, Pennsylvania, Phase I - 2001, Edited by Tim Collins, STUDIO for Creative Inquiry, Carnegie Mellon University, Pittsburgh PA.
- City of Detroit Water and Sewerage Department, Maps of the City of Detroit Wastewater System, 1979, West - Maintenance District
- Reconnaissance Survey of Wayne County Drainage, Wayne County, Michigan, July 1970, Hubbell Roth & Clark
- "Daylighting the Grand River, Culvert Cap Removal & Bank Stabilization Project", City of Jackson, Michigan, presentation to the Michigan Stormwater Floodplain Annual Conference, City of Jackson Michigan and Wilcox Associates

Appendix A

Tools and Resources for Stream Restoration and Daylighting

Stream Restoration and Daylighting: Opportunities in the Pittsburgh Region, also provides a summary for use in developing daylighting projects. Permission was granted by Tim Collins of STUDIO for Creative Inquiry, to include the following summary in this technical memorandum. (Pinkham, 2001, p. 82)

"Tools and Resources for Stream Restoration and Daylighting

THE DAYLIGHTING PROJECT PROCESS

Here are some pointers about the daylighting project process, offered as a rough "road map" to those who wish to advocate for and develop specific day(lighting) projects. This advice on project implementation is drawn from discussions with dozens of people experienced with daylighting projects around the country.

Initiate

- Start small. Small projects give a community a feel for the value created and can generate support for doing more later.
- Begin to pursue funding early on. Try to leverage small grants into more funding.
- Do a thorough historical analysis of the site. What's underneath will affect project costs from excavation effort to soil amendments.

Reach out

- Get the community involved right away. Make sure residents understand what is involved, and be sure this is something they want. Outreach is very important. How it is done can determine the community reaction. Make the process very inclusive. Most of the neighbors can, and must, buy in. Design and construction get a lot of emphasis, but working with the community is a big part of the total effort involved. Carole Schemmerling, a daylighting project coordinator with the California Urban Creek Council advises, "Get as much information out there as possible in whatever ways you can do it. Tell people: here are the benefits, here are problems people perceive might occur, and here is the reality of other, completed projects. They have to have the pros and cons, and every situation is different."
- Work hard to develop a constituency for the project. Fostering supportive neighbors and users pays off politically and economically (in the form of volunteer labor and site stewards).
- Get schools involved. Schemmerling again: "Kids will be in the creek right away anyway, and involving them creates an incentive to do it right." Get lots of press coverage. Organize tours, host receptions, and so on. Get the word out and solicit ideas and concerns. Handle the concerns early.
- Enlist community help in planning and maintaining the project. Hold a community design "charrette"—an intensive workshop to develop objectives and design ideas. Organize planting and clean-up days. To stem vandalism, seek to involve kids and youths: they are less likely to pull the new willows for sword fights if they planted them.

Collaborate

- Work diligently with affected landowners. Note their concerns and adjust designs to allay fears and produce value for them.
- Link the project into a larger-area development scheme or master plan. This is especially helpful in more urban areas, where the expense and politics of right-of-way acquisition necessitate broad support. Also, a larger project with multiple benefits may be easier to fund than a more narrowly-focused one.
- Take a watershed approach. Look upstream and downstream for potential allies, like people affected by flooding or erosion problems that daylighting may help address. Don't take no for an answer. Work with local agencies and politicians to help them recognize the value being created.
- Obtain the enthusiastic support of one or more influential politicians. This can make everything else come much more easily.

Seek assistance

- Design the channel carefully, with competent technical help. The last thing daylighting proponent's need is to have a project blow out, so it's imperative to get the hydraulics right.
- Look for solutions that reduce technical or construction complexities. For example, find ways to do appropriate parts of the restoration work using volunteers and the local conservation corps. This cuts costs, creates jobs, and connects local people to the local environment.
- Use technical and construction contractors who understand stream restoration well. Engineers who haven't done this sort of work may not fully appreciate the differences between the hydraulics of rigid channels and living streams, or the biologic and aesthetic issues. Earthmoving contractors must have a feel for what the designers want, and an ability to make field adjustments as required by the supervising engineer or designer.
- Pull together a competent team. It takes many types of expertise to pull off projects like these.
- Find a qualified generalist to pull it all together—someone with broad enough training or experience to understand the approaches, language, and data of all the various experts participating in the project, and with the requisite intuition to envision the desired outcome and steer the project toward it. Plan the logistics of construction carefully, especially if the seasonal window for earthmoving and planting is narrow due to wet weather or other conditions. Have everyone lined up to go.

Follow-up

- Prepare for strong follow-up. Most daylighting projects need continued planting and maintenance in their early years.
  It may be necessary to try many different plantings to see which work best with the site's soils, hydrology, etc. Plant and replant what can survive until a vegetative canopy gets established.
- Develop a budget for the first two to three years of follow-up. Ideally this should be incorporated into the overall project budget and funded before construction begins. This budget should include monitoring and evaluation of channel and bank stability and revegetation dynamics; training and supervision of volunteers and any paid maintenance personnel; tools; and an allowance for additional plants and other materials.
- Educate neighbors and users about the beauty and value of native species. People often expect more conventional landscaping.
- Educate them as well about the successional stages of the restoration. Landscape architect Gary Mason notes that a naturalized daylighting project will go from infancy to adolescence to maturity, with a different look and feel at each stage. The project will look like a mess as it's being done, then in the first years, shrubs and weeds will predominate. These are necessary for stabilizing the soil, and are part of the evolution toward a vegetative canopy, but they may prevent people from seeing or accessing the creek for a time.
- Document everything! Says Carole Schemmerling; "There is nothing so powerful as pictures of the culvert coming out, of the first fish, the first crayfish, the first bird's nest along the new stream."
- Take plenty of time. Be in it for the long haul. Successful daylighting projects are an incremental learning process."