

Task 7

Development of Recommended Flood Control Project

City of Allen Park

City of Dearborn Heights

City of Ecorse

City of Inkster

City of Lincoln Park

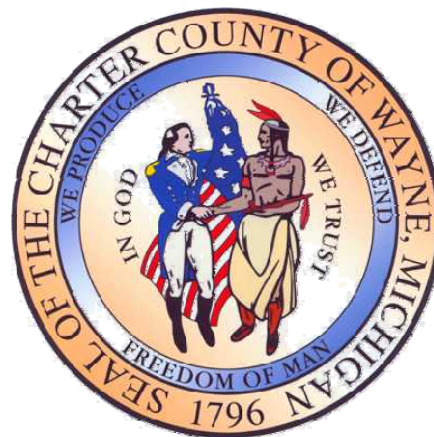
City of Melvindale

City of Taylor

City of Romulus

City of Westland

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Report, Appendix A,
Appendix B, Appendix C, &
Appendix D

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TASK 7 – DEVELOPMENT OF RECOMMENDED FLOOD CONTROL PROJECT

Introduction

The objective of Task 7 is final development of the recommended flood control project. In Task 6, the recommended flood mitigation alternative, being the Greenway Alternative, was identified. Task 7 includes updating the recommended flood mitigation alternative identified in Task 6 to develop the recommended flood control project.

To accomplish this, meetings with each municipality were conducted. Meetings and coordination with the Michigan Department of Transportation (MDOT), the Michigan Department of Environmental Quality (MDEQ), and the United States Army Corps of Engineers (USACE) were also conducted. The meetings included reviewing the Greenway Alternative (identified in Task 6) and obtaining input related to channel alignment, drain crossings, storm water detention basins and right-of-way acquisition. Input was also obtained related to the potential impacts and conflicts with existing municipal infrastructure and planned improvements.

The input received was evaluated and used to develop additional flood mitigation alternatives including Alternatives 18 through 21, which are outlined in this report. Each of these Greenway Alternatives considered variations to channel geometry, drain crossings and storm water detention facilities. The analysis of the additional alternatives culminated with the development of the recommended flood control project, which is presented in this report. This report also includes updated planning level cost estimates, right-of-way acquisition maps, plan and profile drawings, and flood maps.

Initial Coordination with Public Entities

The purpose of completing initial coordination with the various public entities was to communicate the flood control project and obtain final input and suggestions. The following paragraphs provide a general summary of the information and input provided by each municipality.

The flood control project requires right-of-way acquisition in each of the municipalities traversed by the NBECD. Preliminary maps showing the extents of the needed right-of-way were reviewed with each municipality. Municipal representatives provided input and suggestions on potential channel alignments to minimize the impacts of right-of-way acquisition. This input was considered and used to develop the final channel alignment and right-of-way requirements. Right-of-way maps showing the channel alignment and required right-of-way are provided in Appendix E.

The municipalities also provided information related to existing utilities along the NBECD corridor. This information collected during the meetings was used to estimate the number of potential utility conflicts to update planning level cost estimates. Detailed utility mapping or utility elevation was not completed as part of the flood control study and must be completed upon implementation of the project. The following paragraphs summarize the input received from each municipality.

City of Ecorse

The City of Ecorse indicated the following to be in the vicinity of or crossing the NBECD:

- Seven (7) storm water outfalls
- No water main or sanitary sewers crossing the drain

The City of Ecorse's public works and engineering representatives expressed concerns with regards to existing sediment levels in the NBECD and stated that the city storm sewer outlets are obstructed by the sediment. This results in the surcharging of the municipal storm sewer system. It was clarified that the flood control project includes the removal of this sediment. The City stated that sediment removal on the lower end of the NBECD should be considered high priority and completed first.

City representatives also indicated there are preliminary plans to redevelop the property along the NBECD near the confluence with Sexton Kilfoil Drain. In November 2007,

preliminary site plans were under review. The plan may consider improving drain banks and installing a new drain crossing at Mill Street. Prior to implementation of the planned development, it was indicated that coordination with WCDOE must be completed.

City of Lincoln Park

The City of Lincoln Park indicated the following to be in the vicinity of or crossing the NBECD:

- 47 storm water outfalls
- 25 water mains
- 25 sanitary sewers
- 72" sanitary sewer interceptor
- SSO pumping station and force main
- City of Detroit water main transmission line
- Water tanks
- Water metering pits

The City of Lincoln Park's public works representatives expressed concerns regarding the level of sediment in the drain. Similar to the City of Ecorse, many of the Lincoln Park storm sewer outlets are blocked by sediment resulting in surcharging of the municipal storm sewer system. Again, it was clarified the flood control project includes the removal of this sediment.

City of Melvindale

The City of Melvindale indicated the following to be in the vicinity of or crossing the NBECD:

- Two (2) storm sewer outfalls
- One (1) sanitary sewer crossing
- One (1) water service crossing
- A sanitary sewer line that runs parallel along the north side of the drain

The City of Melvindale's public works representative discussed the removal of the Stanley Avenue crossing. The NBECD divides Allen Park and Melvindale except for three (3) homes in the City of Melvindale that is located on the Allen Park side of the drain along Stanley Avenue. It was discussed that are the cost effective channel alignment would require the acquisition of these homes, eliminating the need for the Stanley Avenue drain crossing and the City of Melvindale utility crossings. The flood control project was updated to include the removal of this crossing and acquisition of these properties.

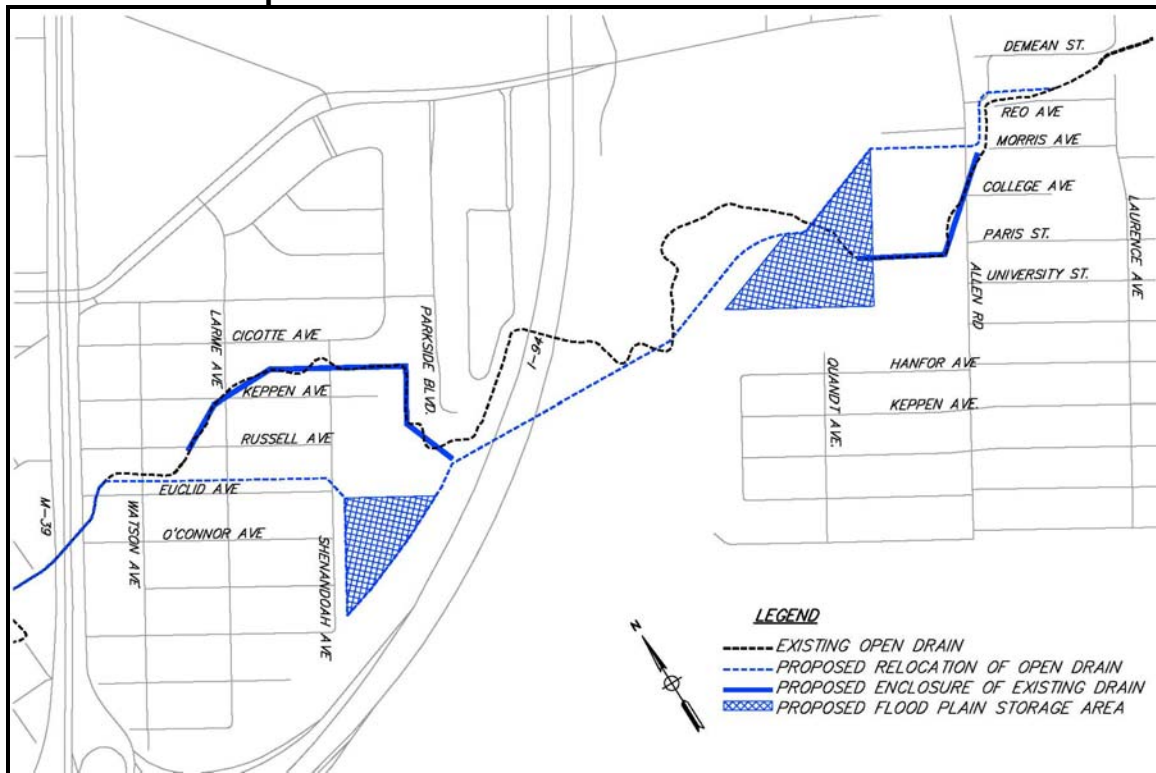
City of Allen Park

The City of Allen Park indicated the following to be in the vicinity of or crossing the NBECD:

- 14 sanitary sewers
- 16 water mains
- 37 storm water outfalls
- Pump station near Allen Road
- Multiple oil or gas transmission lines along the I-94 corridor

The City of Allen Park's Mayor, public works staff, and engineering staff indicated that a new sanitary sewer overflow (SSO) relief tunnel is currently being planned. The tunnel is scheduled for construction in January 2010. The tunnel alignment selection and easement acquisition phases are currently underway. In an effort to coordinate the SSO tunnel, the NBECD project, and to minimize the number of homes that must be acquired, an alternative channel alignment was suggested by Allen Park. Figure 7-1 shows the suggested channel alignment.

**Figure 7-1
Proposed Relocation of the NBECD in Allen Park**



A preliminary analysis and comparison of the new channel alignment with the existing channel alignment concludes the following:

- The new channel alignment has a reduction in number of home acquisitions
- Both alignments provide the same level of flood protection
- Both alignments are similar in cost

The new alignment would reduce the length of the NBECD through Allen Park. Due to the shorter length, a loss of greenway channel floodplain storage occurs. To offset loss of floodplain storage volume, a component of the new alignment would be the addition of the floodplain storage areas as shown in Figure 7-1. The new channel alignment also requires the installation of a relatively small storm sewer along the existing route of the NBECD. This storm sewer would collect existing storm sewer outfalls and direct storm water to the new NBECD channel. The new alignment requires updating the drain

crossing replacement plan. At the request of the City, the relocated channel alignment is included in the flood control project.

City of Dearborn Heights

The City of Dearborn Heights indicated the following to be in the vicinity of or crossing the NBECD:

- 65 sanitary sewers
- LeBlanc interceptor sanitary sewer
- 45 water mains
- 127 storm water outfalls
- Jackson Street SSO pumping station

The City of Dearborn Heights's Mayor, public works staff, and engineering staff expressed concerns regarding the removal of drain crossings and the inclusion of the regional storm water detention basin at the Central Wayne Sanitation Authority Site (Detention Site No. 20).

The Alternative 14 flood mitigation alternative proposed the removal of drain crossings in Dearborn Heights. The primary reason for the proposed removal of the crossings was cost effectiveness. The City emphasized that many of the City's drain crossings along the NBECD have already been removed at the sole expense of the City in attempts to reduce flooding. The crossings that currently exist in Dearborn Heights are needed to maintain adequate traffic flow and emergency services. This is based on input from the police and fire chiefs. Based on these comments, the updated flood control project does not propose removal (without replacement) of any existing City drain crossings.

The City of Dearborn Heights also expressed concern regarding the use of the Central Wayne Sanitation Authority Site (Detention Site No. 20) for a regional storm water detention facility and asked that it be removed from the flood control project. The basis for this request is that a large number of Dearborn Heights' homes along the NBECD

must be acquired to construct the flood control project. The City suggested maximizing the greenway channel to provide floodplain storage and remove Detention Site No. 20 from the flood control project in hopes that this Site No. 20 may be available for private sector development of new housing, enabling residents that must be relocated the opportunity for new housing in Dearborn Heights. Based on these comments, the flood control project does not include Detention Site No. 20.

City of Westland

The City of Westland indicated the following to be in the vicinity of or crossing the NBECD:

- One (1) storm sewer outfall
- Sanitary sewer along Inkster Road
- Water main along Inkster Road

The City of Westland's public works representative indicated that the properties in the City of Westland along Van Born Road are serviced by City of Romulus sanitary sewers and water mains.

City of Romulus

The City of Romulus provided utility maps that indicate the following utilities are in the vicinity of or cross the NBECD:

- 29 storm water outfalls
- 13 sanitary sewers
- 15 water mains

The City of Romulus's public works, engineering, and planning representatives indicated that many properties along the NBECD in the City of Romulus are undeveloped and many new developments are being discussed or planned. Several include the expansion of the Wayne County Detroit Metropolitan Airport (Metro Airport), Metro World, and Aerotropolis. Smaller scale developments are also being planned. The WCDOE staff

emphasized the flood control project is based on adherence with the on-site storm water detention requirements outlined by the Wayne County Storm Water Ordinance. It was also emphasized that proposed relocations of the NBECD to accommodate new development must follow procedures of the Michigan Drain Code and additional enclosures of the drain are not recommended. Also, adequate right-of-way and set backs along the drain must be provided.

The City of Romulus indicated that the property where the proposed Detention Site No. 22 is located is currently planned for development and requested that this site be removed from the flood control project. Additional analysis concluded that this site could be removed. To accomplish this, portions of the channel will need to be enlarged or deepened. Based on these comments and analysis, the flood control project does not include Detention Site No. 22.

The City of Romulus also stated that Detention Site No. 31, along Smith Road, is currently being considered for development related to an expansion of the Metro Airport. The airport is considering extending their runways. This would require the existing rental car services near the airport to be relocated. The site being considered to relocate parking is the same site as Detention Basin No. 31. Portions of this site are owned by the City of Romulus. The City suggested use of adjacent sites or incorporation of regional detention into the planned development of Detention Site No. 31. The City stated there are other vacant parcels in the vicinity of the regional storm water detention, specifically sites located just west of Middlebelt Road and just east of Middlebelt Road.

Placement of a regional storm water detention facility in the vicinity of Merriman and Middlebelt Roads in the City of Romulus is a critical component of the flood control project. The flood control project currently includes the use of Detention Site No. 31. Planning level cost estimates consider this site to be an open detention basin; however, upon coordination, the detention may be considered to be integrated with planned development and this may result in changing the design approach. The style and location

of the regional detention basin may change, but the need for this basin will not be eliminated.

City of Taylor

The NBECD does not traverse through the City of Taylor; however, the Reeck Drain does. The City of Taylor's Mayor, public works staff, and engineering staff expressed concerns related to the Reeck Drain and storm water detention sites in the City.

The City of Taylor stated flooding problems along the Reeck Drain exist. The Reeck Drain was evaluated as part of the NBECD study and flood mitigation alternatives for the Reeck Drain were developed. Concurrent with the engineering evaluation, the WCDOE was evaluating the ability to implement the needed improvements to the Reeck Drain as part of the NBECD project. It was concluded that, in accordance with the Michigan Drain Code, the WCDOE must be petitioned on behalf of the Reeck Drain Drainage District to implement the recommended improvements to the Reeck Drain. The petition for and implementation of improvements to the Reeck Drain must be completed independently of the NBECD flood control project. As a result, the Reeck Drain improvements, although much needed, have been separated from the NBECD improvement project.

The City of Taylor and the City of Allen Park requested that WCDOE complete small scale drain maintenance along the Reeck Drain as an interim measure while the Reeck Drain Drainage District considers whether to petition the WCDOE for the needed flood control improvements along the Reeck Drain.

Regarding storm water detention sites in the City of Taylor, the City requested using several sites that were originally identified in Task 4 including the Beverly site along the Douglas and Kelly Drain (Detention Site No. 17), the German Drain site along Monroe Street (Detention Site No. 12), the Driving Range site (Detention Site No. 16) and old

drive-in site (Detention Site No. 11). The City also requested using the existing Monroe Street Storm Sewer.

Additional analysis to consider incorporating these sites into the flood control project was completed. With the removal of Detention Sites No. 20 and No. 22 in Dearborn Heights and Romulus, additional analysis of incorporating other detention sites was warranted.

Analysis of Site 17, the Beverly site, concluded it was not an efficient location for a regional detention basin specific to serve the NBECD. The site location and elevation is not adequate efficiently use the site. The site is currently connected to the NBECD by the Douglas and Kelly Drain which is an enclosed drain that traverses through a residential neighborhood. Use of this site would require the Douglas and Kelly Drain to be substantially enlarged.

A key conclusion and recommendation related to the Douglas and Kelly Drain is that improvement of the NBECD would allow the existing restriction at the outlet of the Douglas and Kelly Drain to be removed.

Analysis of Site 12, the German Drain site, concluded it was not an efficient location for a regional detention basin specific to serving the NBECD. Use of this site would require diverting storm water from the NBECD into the Leblanc Drain through the Monroe Street Relief Storm Sewer. The Monroe Street Storm Sewer is currently bulk headed near I-94 to prevent this from occurring. It is not recommended to re-establish as the interconnection would enable additional flood water from the NBECD to enter into the Leblanc Drain. The concern is that during large scale flood events, the interconnection would introduce a new flooding risk to the LeBlanc Drain in the City of Taylor.

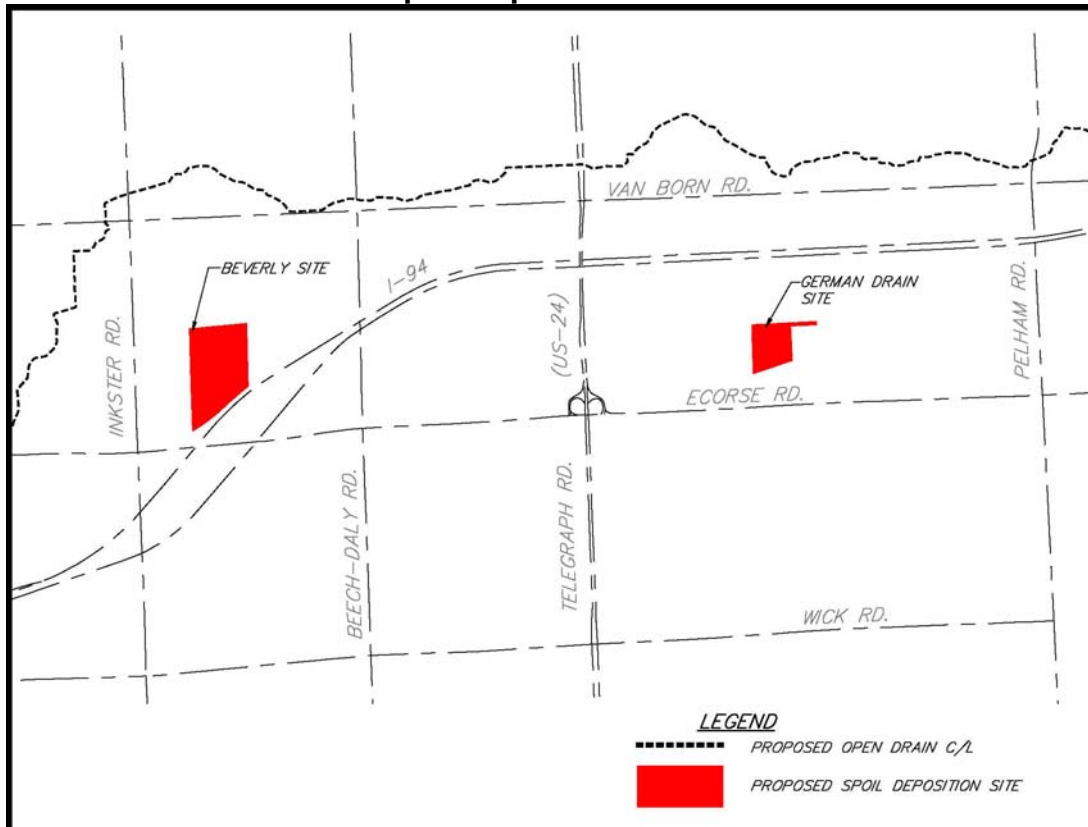
Analysis of Detention Sites No. 11 (Driving Range) and 16 (old Drive-In) conclude the sites are not efficient locations for detention basins specific to serving the NBECD. Both sites are too small to provide adequate detention storage and would require the

construction of an enclosed storm sewer connection to the NBECD. In addition, Detention Site No. 11 is a privately owned business that would have to be acquired.

The Monroe Street storm sewer located north of I-94 is recommended to be integrated into the flood control project. This includes removal of sediment in the storm sewer, enlarging the restriction at the outlet of the storm sewer at the NBECD, and diverting a portion of the Reeck Drain into the storm sewer. A detailed analysis of placement of a small dewatering pump at the outlet of the storm sewer must be completed. The analyses should consider final elevations, available storage capacity in the storm sewer, and cost effectiveness of operating a dewatering pump. The Monroe Street storm sewer north of I-94 has been included in the flood control project.

The Beverly Site and the German Drain site are expected to have soil contamination problems. It was suggested by the City of Taylor that these sites could possibly be used as spoil deposition sites and this may be a cost saving measure to the drainage district. A feasibility analysis was completed by Environmental Consulting and Technology, Inc. and is provided in Appendix D. Based upon the feasibility study and the request from the City of Taylor, the spoil deposition sites are included in the recommended flood control project. Figure 7-2 shows the location of the proposed spoil deposition sites.

**Figure 7-2
NBECD Flood Control Project
Spoil Deposition Sites**



City of Inkster

The NBECD does not flow through the City of Inkster; therefore utility conflicts within the City of Inkster do not exist. The City of Inkster is in the NBECD drainage district as it contributes storm water to the NBECD. The City inquired if modifications to the City infrastructure could be implemented to reduce the area that drains toward the NBECD. It was expressed that it would be a City initiative to implement such measures, if desired.

Coordination with Private Utilities

Private utility companies were notified of the flood control study. The utilities were sent a drainage district map indicating the location of the NBECD and the district line. The following is a list of companies that were identified to own utilities along the NBECD:

- AT&T/SBC
- Buckeye Pipeline
- Canadian National Railway
- CenturyTel
- Comcast
- Consolidated Rail Corporation
- Consumers Energy Electric
- CSX Transportation
- Detroit Edison
- Detroit Water & Sewer
- Elantic Telecom, Inc.
- Ford Motor Company
- Gabes Construction
- HLG Consulting
- International Transmission Company
- Kinder Morgan/BP Pipeline
- Level (3) Communications
- Marathon Pipeline LLC
- MCI
- Nextel Communications
- Norfolk Southern Railway
- Panhandle Eastern Pipeline
- Praxair Inc.
- Qwest Communications
- RKA Petroleum Companies, LLC
- RVP Fiber Company LLC
- Shell Oil Products US
- Sunoco Pipeline LP
- TDS Metrocom
- Wide Open West
- Wolverine Pipeline Co.

It is anticipated that many utility relocation will be required. This includes gas, electric, phone, cable and others. As the flood control project moves forward, coordination with the utility companies will be required. The 31 companies were contacted by letter and the following summarizes information provided at the time this report was developed.

CenturyTel Fiber indicated they have two (2) cables crossing the NBECD in Allen Park, parallel to Norfolk Southern Railroad. The elevation of the cables is unknown.

International Transmission Company (ITC) indicated they have three (3) overhead transmission lines including a line that runs parallel to Norfolk and Southern Railroad, a line that runs parallel to CN/North American Railroad, and a line that runs parallel to Ecorse Road and Wick Road that crosses the NBECD near Middlebelt Road. ITC also

has a 10-inch underground electric cable that crossed the NBECD near Gulley Road. This cable is filled with 220 psi of dielectric fluid.

Kinder Morgan indicated they have two (2) 12-inch natural gas lines crossing the NBECD in Lincoln Park along Electric Avenue. The elevation is unknown.

Wolverine Pipeline indicated that they have a 16-inch diameter liquid petroleum pipeline crossing the NBECD in Allen Park along the east side of I-94. The elevation of the pipeline is unknown at this time.

Marathon indicated that they have a 4-inch propane line that crosses the NBECD at Electric Avenue in Lincoln Park, a 16-inch crude oil line that crosses the NBECD of I-75 and east of John A. Papalas Drive, and a 4-inch butane line east of John A. Papalas Drive. The elevations of these lines are unknown.

Panhandle Eastern Pipeline indicated they have a 16-inch natural gas transmission line in Lincoln Park along Electric Avenue and a 22-inch natural gas transmission line in Allen Park near CN/North American (GTW) Railroad. The elevations are unknown. The maps provided by Panhandle also show a 6-inch gasoline line owned by Susquehania, an 8-inch and 10-inch oil line owned by Buckeye Oil, and 10-inch oil lined owned by Standard Oil in these vicinities as well.

Sunoco indicated that they have in the City of Romulus an 8-inch petroleum line that crosses the NBECD at Inkster Road, a 6-inch line that crosses the NBECD near Ecorse Road and Middlebelt Road. In City of Allen Park they indicated a 6-inch and 8-inch petroleum line that crosses the NBECD near I-94. Elevations are unknown.

Due to the magnitude and need for the NBECD flood control project, it is expected that relocation or lowering of several large utilities and pipelines will be required. It is also expected that minor modification of the NBECD flood control project may occur during

the design phases in attempts to minimize conflicts. Continued coordination with private utilities must be completed including review of elevations.

Modeling of Additional Flood Mitigation Alternatives

Flood Mitigation Alternative 14, referred to as the Greenway Alternative, includes several regional storm water detention sites. During initial development and screening of Alternative 14, the included storm water detention sites were determined viable. As the flood control study progressed, additional input obtained from municipalities deemed Detention Sites No. 20 and No. 22 as non-viable sites. Other updates to Alternative 14 were suggested by municipalities. This prompted the development and analysis of several variations of greenway based alternatives, being Alternatives 18 through 21. The new alternatives are similar to Alternative 14, the initial greenway flood mitigation alternative that was developed in Task 6. It was identified that the new greenway alternatives must provide the same level of flood reduction as Alternative 14 to be viable. The following paragraphs outline Alternatives 18 through 21.

Mitigation Alternative 18

The objective of Alternative 18 was to identify if increasing the capacity of Detention Site No. 31 would offset the impacts of removing Detention Site No. 20 and Detention Site No. 22. Preliminary site plans for the detention site locations are provided in the Task 5 report. The Alternative 18 model was developed by updating the Alternative 14 model as follows:

- Removal of Detention Site No. 22
- Removal of Detention Site No. 20
- Increasing storage volume of Detention Site No. 31
- Modifying control elevations at Detention Site No. 31

The initial Alternative 18 model was developed by increasing the storage volume of Detention Site No. 31 to account for the storage volume lost with the elimination of Sites No. 20 and 22. The combined storage volume of Sites No. 20 and 22 was 105 acre-feet.

The initial Alternative 18 model run predicted that the enlarged Site No. 31 did not completely fill. This was attributed to the site being upstream of Sites No. 20 and 22 and therefore having a smaller watershed that can not contribute enough storm water to fill the enlarged basin. Alternative 18 was then updated by modifying the storage volume and control elevations at Site No. 31 so the site would be efficiently utilized. The storage volume of Site No. 31 was calculated to be 250 acre-feet.

The predicted water surface elevations from the Alternative 18 and Alternative 14 models were compared. The comparison showed Alternative 18 to have increased water surface elevations between Beverly Road (RS 12.46) and Telegraph Road (RS 9.43). The predicted maximum increase occurred near Bayham Street. Table 7-1 presents a summary of the peak flood elevations at this point for Alternative 14, 18, 19, 20 and baseline conditions.

The predicted flooding level for Alternative 18 is higher than Alternative 14 and Alternative 18 was determined a non-viable alternative. It was concluded that additional channel improvements and/or storm water detention are required to maintain the same level of service as Alternative 14.

**Table 7-1
Summary of NBECD Predicted Peak Flooding Levels
Directly Downstream of Bayham Street**

Flood Mitigation Alternative	Predicted Peak Flooding Level (feet)	
	100 Year Storm	10 Year Storm
Baseline	620.2	619.1
Alternative 14	617.7	617.0
Alternative 18	619.4	618.0
Alternative 19A	619.1	617.7
Alternative 19B	618.9	617.6
Alternative 19C	619.1	617.7
Alternative 20	616.5	614.9

Mitigation Alternative 19

The objective of Alternative 19 is to identify if adding an additional storm water detention site to Alternative 18 is viable to provide a level of service similar to Alternative 14. The following sites in the City of Taylor were reconsidered:

- Detention Site No. 16 – Closed Drive-in Site
- Detention Site No. 17 – Beverly Site
- Detention Site No. 11 – Driving Range Site
- Detention Site No. 12 – German Drain Site

Detention Site No. 16 is located along the south side of Van Born Road between Troy Street and Westlake Street. In Task 5, it was estimated that the site could provide approximately 40 acre-feet of storage capacity. This is based on a gravity flow basin that fits the desired land use and area of the site.

Alternative No. 19A was developed by adding Site No. 16 to Alternative 18. A model run of Alternative 19A was completed. The predicted water surface elevations from the Alternative 19A and Alternative 14 models were compared. The comparison showed that Alternative 19A increased water surface elevations between Ecorse Road (RS 13.10) and Pardee Avenue (RS 8.51). The predicted maximum increase occurred near of Bayham Street. Table 7-1 presents a summary of the peak flood elevations at this point.

After review of the Site No.16, existing ground elevations indicated the site to be higher than the flood elevations of the NBECD which would require substantial added excavation that does not provide detention storage value. The site would also require a new enclosed connection under Van Born Road between the site and the NBECD. Based on this, addition of this site was determined a non-viable alternative.

Detention Site No. 17 is located along the south side of Beverly Road between John Daly Street and Sylvia Street. It is the Beverly Road landfill site. In Task 5, it was estimated

that the site could provide approximately 100 acre-feet of storage capacity. This is based on a gravity flow basin that fits the desired land use and area of the site.

Alternative No. 19B was developed by adding Site No. 17 to Alternative 18. A model run of Alternative 19B was completed. The predicted water surface elevations from Alternative 19B and Alternative 14 models were compared. The comparison showed Alternative 19B to have increased water surface elevations between Ecorse Road (RS 13.10) and Pardee Avenue (RS 8.51). The predicted maximum increase occurred near of Bayham Street. Table 7-1 presents a summary of the peak flood elevations at this point.

Also, a review of site elevation concluded the existing ground elevations to be, on average 5 feet, higher than the 100 year water surface elevation along to the NBECD; therefore, a substantial amount of excavation would be necessary before flood levels could even be detained at this site. Furthermore the site is approximately 1 mile south of the NBECD and is connected to the NBECD by the Douglas and Kelly Drain. The Douglas and Kelly Drain between the NBECD and the proposed basin location is currently an enclosed storm sewer system which would have to be replaced and increased in size to convey storm water from the NBECD to the basin. Based on this, addition of this site was determined as a non-viable alternative.

Detention Site No. 11 is located along the south side of Van Born between Roosevelt Street and Pardee Avenue. The site is currently the Midway Golf Practice Club. In Task 5, it was estimated this site could provide approximately 80 acre-feet of storage capacity. This is based on a gravity flow basin that fits the desired land use and area of the site.

Alternative No. 19C was developed by adding Site No. 11 to Alternative 18. A model run of Alternative 19C was completed. The predicted water surface elevations from Alternative 19C and Alternative 14 models were compared. The comparison showed Alternative 19C to have increased water surface elevations between Ecorse Road (RS

13.10) to Pardee Avenue (RS 8.51). The predicted maximum increase occurred near Bayham Street. Table 7-1 presents a summary of the peak flood elevations at this point.

Detention Basin Site No. 11 is an active business and use of the site would impact its regular operations. Furthermore, a new enclosed connection between the site and the NBECD would be necessary to convey water to the storm water detention basin. Based on this, addition of this site was determined a non-viable alternative.

Detention Site No. 12 is located approximately 1 mile south of the NBECD along Monroe Street between I-94 and the railroad tracks. This alternative requires storm water be conveyed from the NBECD through the existing Monroe Street relief storm sewer to Site No. 12. The Monroe Street relief storm sewer is currently bulk headed near I-94 to prevent drainage transfers between the NBECD and the Leblanc Drain. Removal of this bulkhead will result in diversion of storm water from the NBECD into the Leblanc Drain system and potentially result in the increase of water surface elevations in some areas. This potential must be eliminated to effectively use Site No. 12. To do so, modifications to the existing Leblanc Drain drainage system and the existing Monroe Street storm water basin would be required. Based on initial reviews of elevations and existing plans of the Leblanc Drain drainage system in the City of Taylor, it is expected that significant modifications would be required. This was determined a non-viable option.

Mitigation Alternative 20

The objective of Alternative 20 was to evaluate further increasing the channel conveyance capacity and identify if this is a viable alternative to offset the removal of Detention Sites No. 20 and 22. By increasing the depth of the NBECD, the waterway area and the conveyance capacity of the drain is increased without necessarily increasing the top width of the drain. The top width of the drain defines the right-of-way requirements. A goal in developing Alternative 20 is to increase conveyance capacity without significantly increasing the right-of-way acquisition requirements when compared with Alternatives 14, 18, and 19.

For Alternative 20, various combinations of channel geometries were analyzed and the channel geometry outlined in Table 7-2 was selected. Table 7-2 provides a comparison between Alternative 18 and 20 (note that channel improvements of Alternative 18 and 14 are the same). The comparison shows that, in most reaches of the NBECD, the Alternative 20 channel geometry does not require significant channel widening. The exception is the reach between Beech Daly to Van Born Roads. In this reach, the greenway channel must be extended; therefore, associated large scale channel widening is required.

It was concluded that increasing channel conveyance capacity to offset the removal of Detention Sites 20 No. 20 and 22 is more effective and efficient than adding additional detention basins at other locations. Table 7-1 provides a comparison of water surface elevations between several alternatives and shows Alternative 20 to be the most effective. Also, Alternative 20 requires less overall of land acquisition in comparison to Alternative 14 and 19. Increasing channel conveyance capacity is considered a viable alternative to offset the removal of Detention Sites 20 and 22, although Alternative 20 is not the final recommended approach. The final alternative (Alternative 21), which is discussed later in this report, evaluates the storm water detention basins and the drain crossings in greater detail.

**Table 7-2
Summary of Changes in NBECD Channel Geometry
Between Alternatives 18 and 20**

			Alternative 14 & 18		Alternative 20	
Station	Approx. River Mile	Nearest Road Limits	Channel Type	Reach Flow Line	Channel Type	Reach Flow Line
0+00 to 25+00	0.00 to 0.47	Detroit River to 4 th Street	70 ft Trapezoidal	564.51	80 ft Trapezoidal	565.14
25+00 to 156+00	0.47 to 2.95	4 th Street To Layfayette	65 ft Trapezoidal	564.38	64 ft Trapezoidal	565.24
156+00 to 238+00	2.95 to 4.51	Layfayette to Allen	52 ft Greenway	573.18	45 ft Greenway	572.27
238+00 to 254+00	4.51 to 4.81	Allen to Wabash R.R.	52 ft Greenway	579.51	92 ft Greenway	578.61

Table 7-2 continued
Summary of Changes in NBECD Channel Geometry
Between Alternatives 18 and 20

Station	Approx. River Mile	Nearest Road Limits	Alternative 14 & 18		Alternative 20	
			Channel Type	Reach Flow Line	Channel Type	Reach Flow Line
254+00 to 279+00	4.81 to 5.28	Wabash R.R. to Baker College	140 ft Greenway	581.61	140 ft Greenway	580.72
279+00 to 285+00	5.28 to 5.40	Baker College to I-94	140 ft Greenway	582.67	140 ft Greenway	581.78
285+00 to 308+00	5.40 to 5.83	I-94 to Shenandoah	100 ft Greenway	583.74	92 ft Greenway	582.23
308+00 to 331+00	5.83 to 6.27	Shenandoah to Southfield	100 ft Greenway	586.38	92 ft Greenway	585.71
331+00 to 410+00	6.27 to 7.77	Southfield to Hanover	100 ft Greenway	589.08	92 ft Greenway	588.09
410+00 to 487+00	7.77 to 9.22	Hanover to Telegraph	80 ft Greenway	596.28	74 ft Greenway	594.84
487+00 to 534+00	9.22 to 10.11	Telegraph to Gulley	65 ft Greenway	602.87	70 ft Greenway	601.18
534+00 to 550+00	10.11 to 10.42	Gulley to Beech-Daly	65 ft Greenway	605.89	65 ft Greenway	604.35
550+00 to 567+00	10.42 to 10.74	Beech-Daly to Bayham	12 ft Trapezoidal	607.20	50 ft Greenway	605.40
567+00 to 577+00	10.74 to 10.93	Bayham to Princess	12 ft Trapezoidal	607.99	35 ft Greenway	606.46
577+00 to 614+00	10.93 to 11.63	Princess to Van Born	12 ft Trapezoidal	609.78	25 ft Greenway	607.51
614+00 to 687+00	11.63 to 13.01	Van Born to Ecorse	12 ft Trapezoidal	614.07	8 ft Trapezoidal	611.74
687+00 to 751+00	13.01 to 14.22	Ecorse to Smith	12 ft Trapezoidal	619.20	6 ft Trapezoidal	615.96
751+00 to 803+00	14.22 to 15.21	Smith Rd Enclosure	Enclosed	624.34	Enclosed	623.88
803+00 to 893+00	15.21 to 16.91	Smith to Ecorse	12 ft +/- Trapezoidal	632.73	4 ft Trapezoidal	630.57

Recommended Flood Control Project (Mitigation Alternative 21)

The recommended flood control project is Alternative 21. The Alternative 21 model was developed by updating Alternative 20 model to consider the following:

- Adding the drain relocation in the Allen Park
- Updating drain crossings along the NBECD
- Updating storm water detention sites

These updates were based on input received from the municipalities as previously described in this report. Figure 7-3 shows the components of the recommended flood control project. The paragraphs following outline the final modeling and components of the recommended flood control project.

The flood control project (Mitigation Alternative 21) model results were used to develop the flood maps and hydraulic profiles. The flood maps show the limits of flooding, and when compared with flood maps of baseline conditions, show the extent of flood reduction provided by the flood control project. The hydraulic profiles provide a comparison of the modeled water surface elevations between the recommended flood control project and baseline conditions. Flood maps are provided in Appendix B. Figures 7-4 and 7-5 show the hydraulic grade line comparisons. As shown by flood maps and hydraulic profiles, the final flood control project eliminates flooding of the 10 year design storm event and substantially reduces flooding for the 100 year design storm event.

Drain Relocation in Allen Park

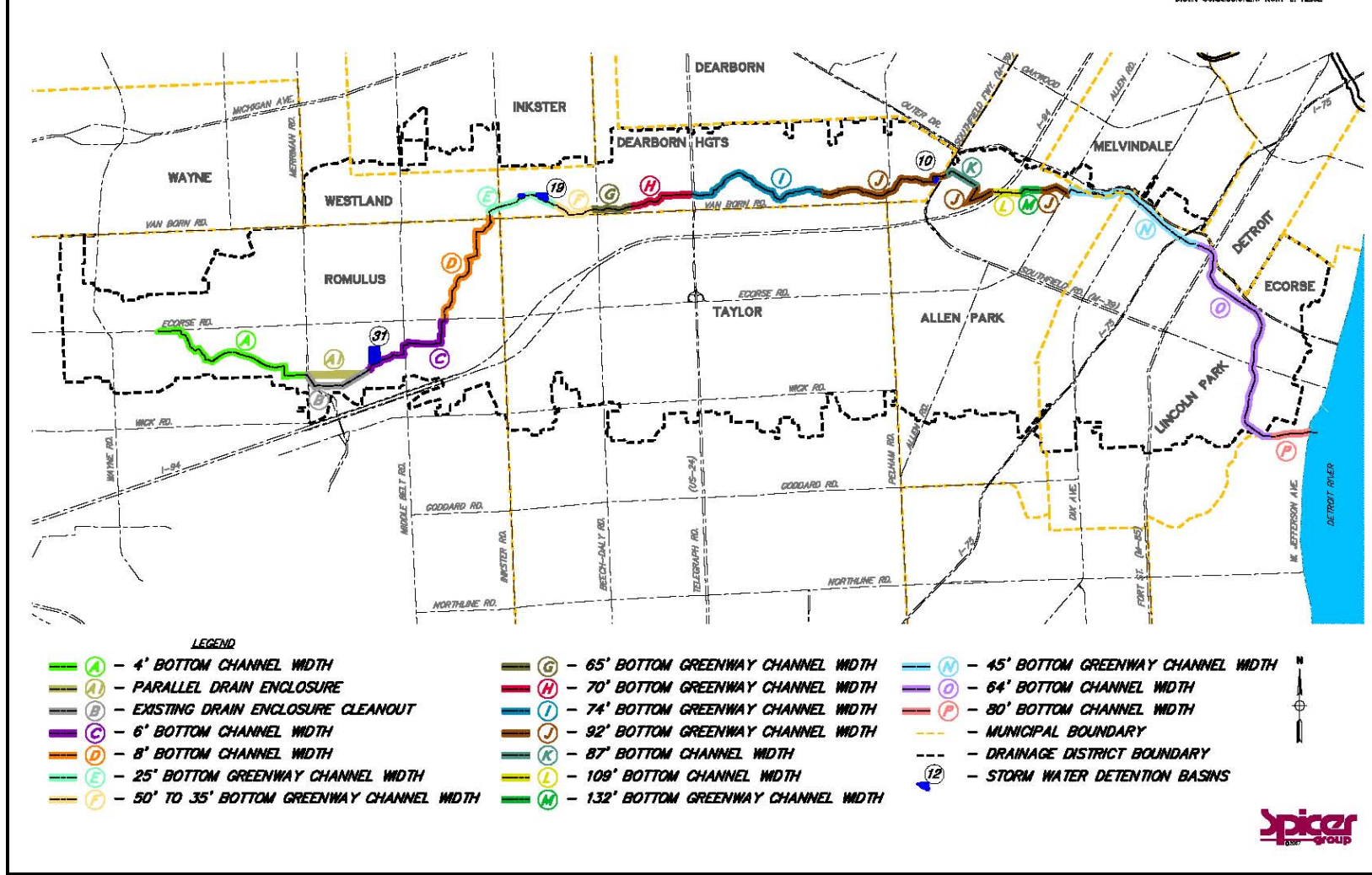
The drain relocation requested by the City of Allen Park as depicted Figure 7-1 is included in flood control project. The request was made to reduce the number of home acquisitions and to correspond with the Allen Park sanitary sewer improvements. The Alternative 21 model was updated to include this drain relocation.

Figure 7-3

NORTH BRANCH OF THE ECORSE CREEK DRAIN FLOOD CONTROL PROJECT COMPONENT MAP



COUNTY EXECUTIVE: ROBERT A. FIGANO
DRAIN COMMISSIONER: KURT L. HERZ



Task 7
North Branch Ecorse Creek Drain
Flood Control Study
February 2008

Figure 7-4
Comparison of Hydraulic Profiles along NBECD
Baseline Conditions vs. Flood Control Project (10 Year Design Storm)

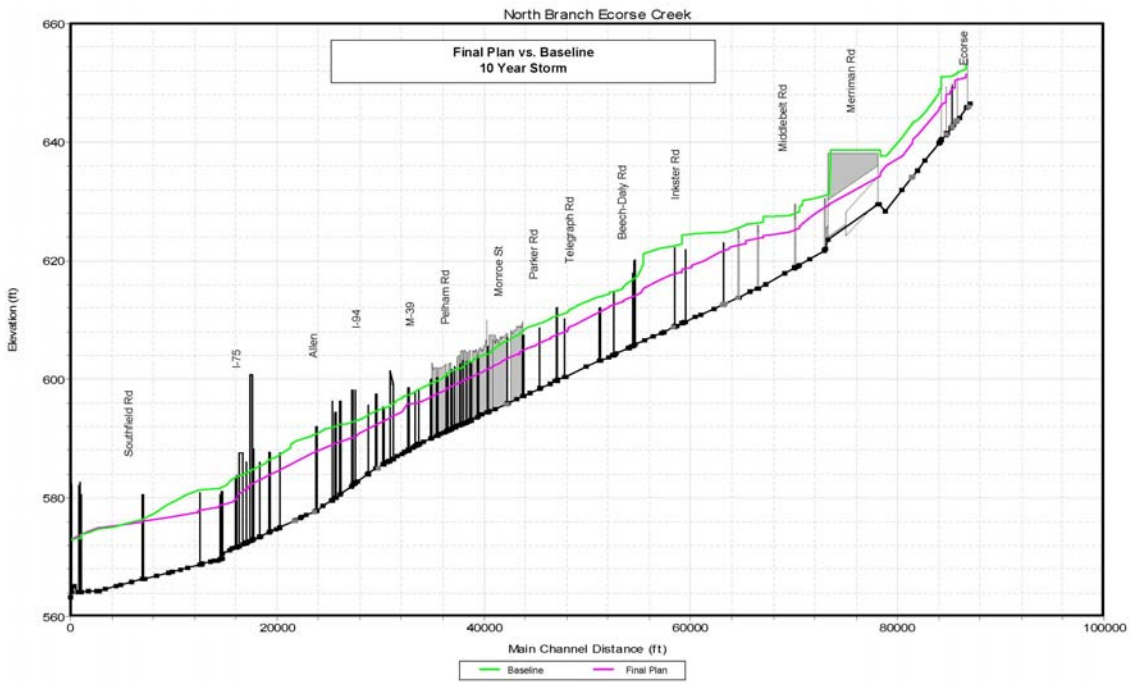
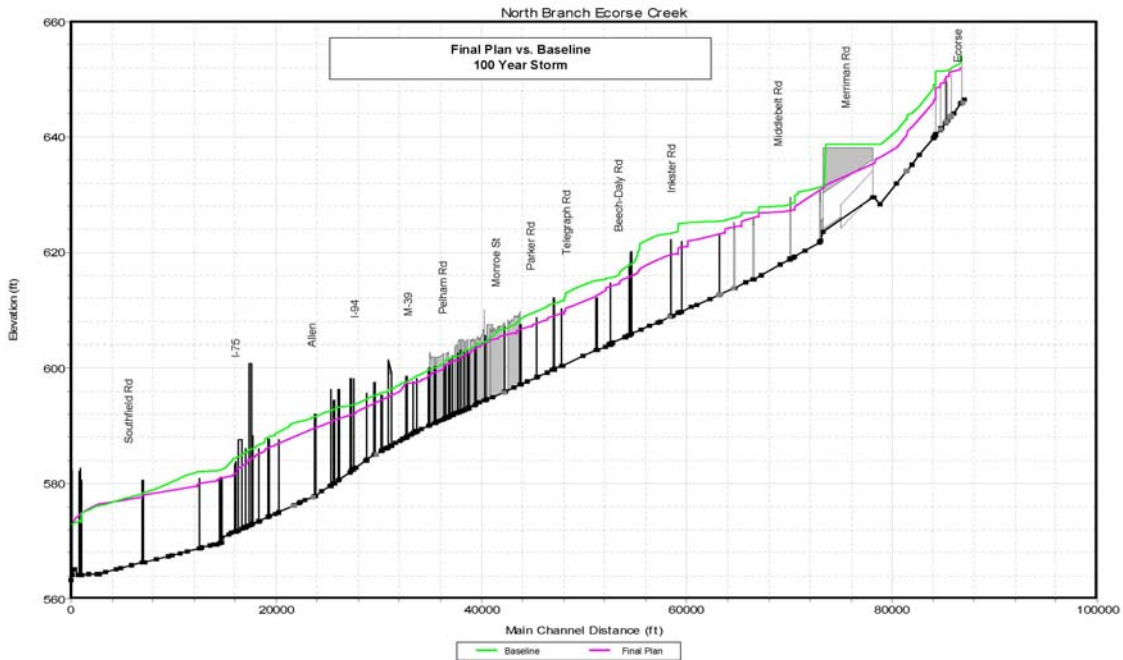


Figure 7-5
Comparison of Hydraulic Profiles along NBECD
Baseline Conditions vs. Flood Control Project (100 Year Design Storm)



The drain relocation results in a reduction in the drain length through Allen Park. Model results indicate the channel geometry must be modified in comparison with Alternative 20 and that additional floodplain storage must be provided to offset the greenway storage capacity lost as a result of shortening the NBECD. Figure 7-1 depicts two (2) locations where floodplain storage can be obtained. Table 7-5 shows the updated channel geometry required for the relocation through Allen Park. Specific changes between the Alternative 20 and Alternative 21 are contained between river mile stations 4.51 to 6.27.

Storm Water Detention Facilities

Table 7-3 summarizes the storm water detention facilities and floodplain storage included in the flood control project. Preliminary site plans for the storm water detention facilities are provided in Appendix A.

**Table 7-3
Storm Water Detention Facilities**

No.	Station	Nearest Road Intersection	Site Acreage	Storage Capacity	Outlet Type
10	345+00	Southfield Rd. & Raymond Ave.	2 Ac	14 ac-ft	Gravity Outlet
19	587+00	Powers Ave. & John Daly St.	5 Ac	26 ac-ft	Gravity Outlet
31	750+00	Smith Rd. & Middlebelt Rd.	19 ac	80 ac-ft	Pumped Outlet
	255+00	Allen Rd. & Morris Ave.	12 Ac	20 ac-ft	Gravity Outlet
	305+00	Shenandoah Ave. & Euclid Ave.	7 Ac	9 ac-ft	Gravity Outlet

A comparison of the required storage volume at Detention Site 31 from Alternative 18 to the Alternative 21 (the recommended plan) shows that the required storage capacity is reduced from 250 acre-feet to 80 acre-feet. The basin size reduced as channel conveyance capacity was increased. For the 10 year design storm event, the peak inflow rate into the basin is 289 cfs at an elevation of 629.2 feet. The model shows that storm water will overflow into the basin for the 10 year design storm events and smaller events. The model shows the basin will fill to a maximum level of 631.1 feet during the 100 year design storm event.

Due to the proximity of the Metro Airport, the basin must be dewatered in accordance with FAA regulations. As this basin is designed, specific design characteristics such as stage storage relationships, the capacity and elevation of the inlet structure, the outlet structure, and final elevations must be reviewed and updated in the model to insure proper capacity is provided.

Detention Sites 10 and 19 are modeled to be gravity flow basins with the inlet and outlet elevations equal to the elevation of the adjacent greenway shelf. It is also expected that wetland features, if feasible, will be incorporated into these sites.

In conjunction with the drain relocation in Allen Park, floodplain storage must be provided as shown on Figure 7-1. The intent is the floodplain storage would not be utilized for the 10 year design storm and smaller events but would be utilized for events exceeding the 10 year design storm. The floodplain storage areas are anticipated to be maintained as lawn/landscaped areas.

Drain Crossing Improvements

Drain crossings were input and updated in the hydraulic model for Alternative 21. The detailed analysis of the drain crossings was the final step in the hydraulic model development. The proposed crossings were model in Alternative 21 assuming the under clearance elevations (low chord), centerline elevations (top of road), and the bridge deck width (in the direction of flow) are unchanged from existing conditions. To obtain adequate conveyance at the crossings, the span was increased. This assumption enables the new crossings to maintain the same number of traffic lanes and road profile.

Table 7-4 summarizes the recommended drain crossing improvements. The recommended drain crossing improvements were evaluated in the final model run to determine the design flow rates and approximate waterway area requirements. It is recommended that the information provided in this table be adopted as the design criteria for drain crossings along the NBECD. As the flood control project and improvements

along the NBECD are implemented, each of the drain crossings must be individually designed to meet the requirements of each drain crossing location. As the crossings are designed, specific design characteristics such as crossing material, number of piers, skew and final elevations must be reviewed and updated in the model to insure the conveyance capacity required to provide the desired level of flood mitigation is provided.

**Table 7-4
NBECD Flood Control Project
Drain Crossing Improvements Design Criteria**

Crossing No.	River Mile	Crossing Name	Crossing Type		Proposed Flow Rates (CFS)*		Minimum Needed Open Water Way Area	Owner	Expected Overtopping for 10 year design storm	Expected Overtopping for 100 year design storm
			Existing	Proposed	10-year	100-year				
1	0.09	W. Jefferson Ave.	Concrete Bridge	No Work	3,570	5,295	N/A	County	No	No
2a	0.22	Railroad Tracks	Steel Truss	No Work	3,570	5,380	N/A	Railroad	No	No
2b	0.23	Railroad Tracks	Steel Truss	No Work	3,570	5,380	N/A	Railroad	No	No
2c	0.24	Railroad Tracks	Steel Truss	No Work	3,570	5,380	N/A	Railroad	No	No
2d	0.26	Railroad Tracks	Concrete Bridge	Increase Bridge Span	3,570	5,380	1345	Railroad	No	No
3	1.40	Southfield Rd.	Concrete Bridge	New Bridge	1,775	2,922	730	County	No	No
4	2.44	Austin Ave.	Concrete Bridge	New Bridge	1,720	2,840	724	Lincoln Park	No	No
5	2.74	Victoria Ave	Concrete Bridge	Remove Crossing	1,654	2,775	N/A	Lincoln Park	N/A	N/A
6a	2.83	Fort St. (85)	Concrete Bridge	New Bridge	1,656	2,784	724	MDOT	No	No
6b	2.85	Fort St. (85)	Concrete Bridge	New Bridge	1,658	2,782	724	MDOT	No	No
7	3.12	Lafayette Blvd.	Concrete Bridge	New Bridge	1,664	2,831	724	Lincoln Park	No	No
8	3.20	Fisher Fwy. (I-75)	Concrete Bridge	New Bridge	1,680	2,874	724	MDOT	No	No

**Table 7-4 continued
 NBECD Flood Control Project
 Drain Crossing Improvements Design Criteria**

Crossing No.	River Mile	Crossing Name	Crossing Type		Proposed Flow Rates (CFS)*		Open Water Way Area	Owner	Expected Overtopping for 10 year design storm	Expected Overtopping for 100 year design storm
			Existing	Proposed	10-year	100-year				
9	3.30	John Papalás Dr.	CMP Low Profile Arch	New Bridge	1,684	2,883	724	Lincoln Park	No	No
10	3.41	Railroad Tracks	Concrete Bridge	New Bridge	1,685	2,890	724	Railroad	No	No
11	3.43	Private Drive	Concrete Bridge	New Bridge	1,686	2,889	724	Private	No	No
12	3.54	Porter Ave.	Concrete Bridge	New Bridge	1,687	2,897	724	Lincoln Park	No	No
13	3.74	Dix Hwy.	Concrete Bridge	New Bridge	1,662	2,858	717	County	No	No
14	3.84	Footbridge	Steel Truss	Remove Crossing	1,664	2,859	N/A	Private	N/A	N/A
15	3.92	Frank Ave.	Concrete Bridge	New Bridge	1,664	2,861	717	Lincoln Park	No	No
16	4.20	Stanley Ave.	Concrete Bridge	Remove Crossing	1,668	2,868	N/A	Melvindale	N/A	N/A
17	4.61	Allen Rd.	Concrete Bridge	New Bridge	1,559	2,617	654	County	No	No
17a	4.61	Allen Rd.	Concrete Bridge	New Bridge	1,559	2,617	654	County	No	No
18	4.83	City Park	Steel Truss Footbridge	Remove Crossing	1,560	2,618	N/A	Allen Park	N/A	N/A
19	4.92	Railroad	Concrete Bridge	New Bridge	1,413	2,445	643	Railroad	No	No
20	4.97	Railroad	Footbridge	New Bridge	1,414	2,445	643	Railroad	No	No
21	5.07	Railroad	Concrete Bridge	New Bridge	1,414	2,445	643	Railroad	No	No
22	5.35	Baker College	Wood Plank Bridge	Remove Crossing	1,418	2,448	643	Private	N/A	N/A
23a	5.43	E. I-94	None	New Bridge	1,419	2,450	643	MDOT	No	No

**Table 7-4 continued
 NBECF Flood Control Project
 Drain Crossing Improvements Design Criteria**

Crossing No.	River Mile	Crossing Name	Crossing Type		Proposed Flow Rates (CFS)*		Open Water Way Area	Owner	Expected Overtopping for 10 year design storm	Expected Overtopping for 100 year design storm
			Existing	Proposed	10-year	100-year				
23b	5.47	W. I-94	None	New Bridge	1,423	2,452	643	MDOT	No	No
23c	5.43	E. I-94	Concrete Bridge	Sediment Removal	N/A	N/A	N/A	MDOT	No	No
23d	5.47	W. I-94	Concrete Bridge	Sediment Removal	N/A	N/A	N/A	MDOT	No	No
24	5.92	Shenandoah Ave	None	New Bridge	1,503	2,529	643	Allen Park	No	No
24a*	5.92	Shenandoah Ave	Concrete footbridge	Enclosed	TBD	TBD	TBD	Allen Park	N/A	N/A
25	6.07	Larme/Keppen	None	New Bridge	1,515	2,570	643	Allen Park	No	No
25a*	6.07	Larme/Keppen	Double CMPA	Enclosed	TBD	TBD	TBD	Allen Park	N/A	N/A
26*	6.16	Russell Ave.	Double CMPA	Enclosed	TBD	TBD	TBD	Allen Park	No	No
27	6.24	Watson Ave.	Double CMPA	New Bridge	1,474	2,522	640	Allen Park	No	No
28	6.31	Euclid Ave.	Double CMPA	Remove Crossing	1,476	2,529	N/A	Allen Park	N/A	N/A
29	6.37	Southfield Rd. (M-39)	Bridge & Double Pipes	New Bridge	1,479	2,536	640	MDOT	No	No
30	6.70	Bedford St.	Concrete footbridge	Retrofit Footbridge	1,489	2,552	640	Dearborn Heights	No	No
31	6.82	Edgewood St.	Concrete Bridge	New Bridge	1,494	2,559	640	Dearborn Heights	No	No
32	6.89	Kingston St.	Concrete Bridge	New Bridge	1,459	2,495	630	Dearborn Heights	No	Yes
33	7.12	Pelham St.	Concrete Bridge	New Bridge	1,465	2,519	630	Dearborn Heights	No	No
34	7.22	Jackson St.	Concrete Bridge	New Bridge	1,468	2,519	630	Dearborn Heights	No	Yes

**Table 7-4 continued
NBECD Flood Control Project
Drain Crossing Improvements Design Criteria**

Crossing No.	River Mile	Crossing Name	Crossing Type		Proposed Flow Rates (CFS)*		Open Water Way Area	Owner	Expected Overtopping for 10 year design storm	Expected Overtopping for 100 year design storm
			Existing	Proposed	10-year	100-year				
35	7.42	Hanover St.	Concrete Bridge	New Bridge	1,348	2,252	565	Dearborn Heights	No	Yes
36	7.48	Hipp St.	Double CMPA	New Bridge	1,348	2,253	565	Dearborn Heights	No	No
37	7.55	Polk St.	Double CMPA	New Bridge	1,348	2,253	565	Dearborn Heights	No	Yes
38	7.65	Hanover St.	Concrete Bridge	New Bridge	1,349	2,255	565	Dearborn Heights	No	No
39	7.70	Harding Ave.	Wood Plank Bridge	Retrofit Footbridge	1,350	2,257	565	Dearborn Heights	No	Yes
40	7.75	Gertrude Ave.	Steel Truss	Retrofit Footbridge	1,352	2,261	565	Dearborn Heights	No	Yes
41	7.83	Campbell St.	Concrete Bridge	New Crossing	1,350	2,259	565	Dearborn Heights	No	Yes
42	7.84	Hanover St.	Concrete Bridge	New Bridge	1,351	2,260	565	Dearborn Heights	No	Yes
43	7.97	Williams St.	Double CMPA	New Bridge	1,362	2,163	544	Dearborn Heights	No	Yes
45	8.16	Monroe St.	Concrete Bridge	New Bridge	1,360	2,178	544	Dearborn Heights	No	No
46	8.51	Pardee Ave.	Concrete Bridge	New Bridge	1,326	1,782	480	Dearborn Heights	No	No
47	8.81	Parker Ave.	Steel Truss Footbridge	Retrofit Footbridge	1,328	1,924	480	Dearborn Heights	No	No
48	9.10	Madison Ave.	Concrete Bridge	New Bridge	1,296	1,876	470	Dearborn Heights	No	Yes
49a	9.41	Telegraph (North)	Concrete Bridge	New Bridge	1,297	1,877	470	MDOT	No	No
49b	9.43	Telegraph (South)	Concrete Bridge	New Bridge	1,297	1,878	470	MDOT	No	No
50	9.57	Banner Ave.	Steel Truss Footbridge	Lower Footbridge Approaches	1,267	1,835	459	Dearborn Heights	No	Yes

**Table 7-4 continued
 NBECF Flood Control Project
 Drain Crossing Improvements Design Criteria**

Crossing No.	River Mile	Crossing Name	Crossing Type		Proposed Flow Rates (CFS)*		Open Water Way Area	Owner	Expected Overtopping for 10 year design storm	Expected Overtopping for 100 year design storm
			Existing	Proposed	10-year	100-year				
51	10.20	Gulley St.	Concrete Bridge	New Bridge	1,231	1,809	452	Dearborn Heights	No	Yes
52	10.46	Beech Daly Rd.	Concrete Bridge	New Bridge	1,227	1,802	450	County	No	No
53	10.74	Old Driveway	CMPA	Remove Crossing	1,229	1,805	N/A	Private	N/A	N/A
54	10.80	Private Footbridge	Concrete I-Beam	New Footbridge	1,014	1,466	366	Private	No	No
55	10.84	Bayham St.	CMPA	New Box Culvert	1,016	1,466	366	Dearborn Heights	No	No
56	11.57	Inkster Rd.	Concrete Bridge	New Box Culvert	621	834	209	County	No	No
57	11.75	Van Born Rd.	Concrete Bridge	New Box Culvert	623	836	209	County	No	No
58	12.46	Beverly Rd.	Concrete Bridge	New Box Culvert	511	705	176	Romulus	No	No
58b	12.77	Private Drive	CMPA	New Box Culvert	323	450	113	Private	No	No
59	13.10	Ecorse Rd.	Concrete Bridge	New Box Culvert	259	340	85	County	No	No
60	13.78	Middlebelt Rd.	Concrete Bridge	New Box Culvert	202	272	50	County	No	No
61	13.84	Private Drive	RCP	Remove Crossing	203	272	N/A	Private	N/A	N/A
62	14.34	Smith Rd.	CMPA	New Box Culvert	97	164	23	Romulus	No	Yes
63*	15.30	Merriman Rd.	N/A	Parallel Enclosure	222 (319 total)	280 (444 total)	120	County	No	No
63a	15.30	Merriman Rd.	Long Enclosure	Sediment Removal	97	164	N/A	County	No	No
64	15.91	Venoy Rd.	Concrete Bridge	Remove Crossing	196	260	N/A	Romulus	N/A	N/A

**Table 7-4 continued
NBECD Flood Control Project
Drain Crossing Improvements Design Criteria**

Crossing No.	River Mile	Crossing Name	Crossing Type		Proposed Flow Rates (CFS)*		Open Water Way Area	Owner	Expected Overtopping for 10 year design storm	Expected Overtopping for 100 year design storm
			Existing	Proposed	10-year	100-year				
65	16.41	Henry Ruff Rd.	CMP	Remove Crossing	163	218	N/A	Romulus	N/A	N/A
66	16.45	Sargent Rd.	CMPA	New Box Culvert	163	218	55	Romulus	No	No
67	16.54	Private Drive	CMPA	Sediment Removal	99	143	36	Private	No	Yes
68	16.55	Private Footbridge	I-Beam	Remove Crossing	99	143	N/A	Private	N/A	N/A
69	16.62	Private Drive	CMPA	New Box Culvert	99	143	36	Private	No	No
70	16.63	Private Drive	I-Beam	Sediment Removal	99	143	36	Private	No	No
71	16.65	Private Drive	I-Beam	New Box Culvert	99	144	36	Private	No	No
72	16.70	Private Drive	RCP	Remove Crossing	99	144	N/A	Private	N/A	N/A
73	16.71	Private Drive	RCP	Sediment Removal	99	145	36	Private	No	No
74	16.75	Private Drive	RCP	Remove Crossing	100	145	N/A	Private	N/A	N/A
75	16.91	Ecorse Rd.	Concrete Box	New Box Culvert	85	128	32	County	No	No

*see discussion on drain enclosures

Drain Enclosures

A portion of the NBECD is currently enclosed near Merriman Road in the City of Romulus. The enclosure consists of a concrete pipe approximately 4,880 feet in length that ranges from a 34-inch by 53-inch elliptical pipe to an 84-inch diameter concrete conduit. As outlined in the Task 4 report, enclosing additional sections of the NBECD is not a viable option for a flood control project. However, since this reach of the NBECD

is currently enclosed, it is recommended to leave this enclosure in-place and install a new parallel enclosure.

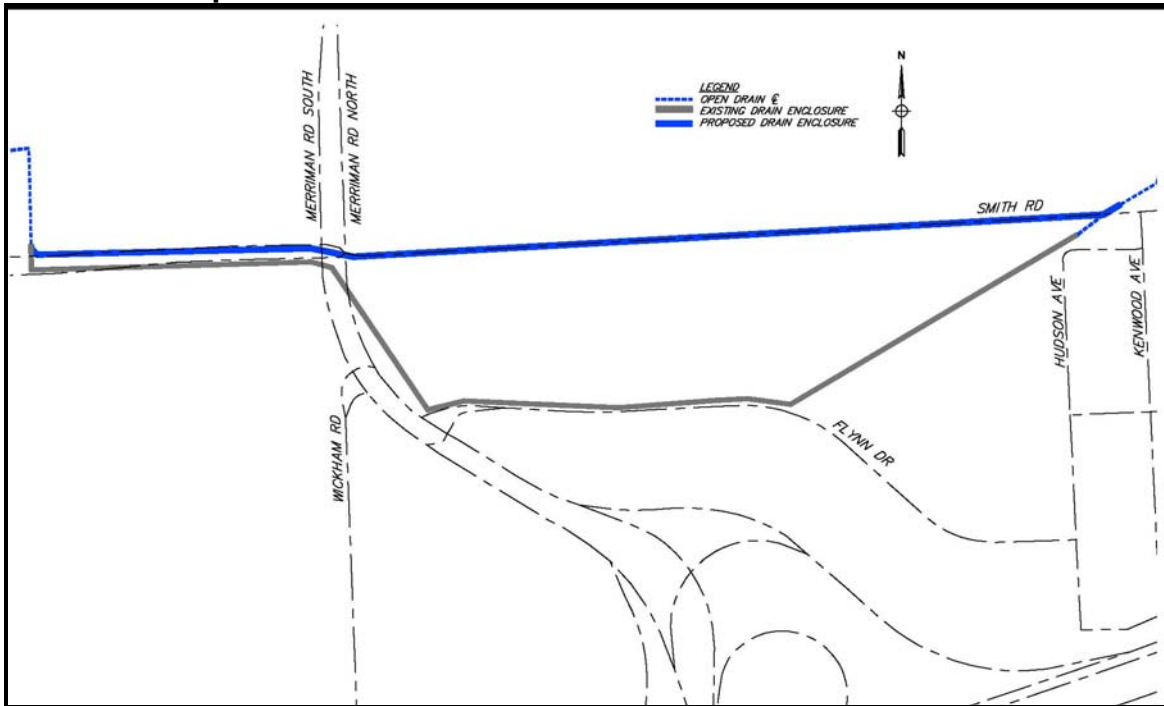
The recommended flood control project requires cleaning of sediment, removal of debris along the existing enclosure, and the construction of a new parallel enclosure. The 10 year and 100 year design storm peak flood flow rates through the existing enclosure (if cleaned) are estimated to be about 97 cfs and 164 cfs, respectively. The 10 year and 100 year design storm flow rates through the proposed enclosure are 222 cfs and 280 cfs, respectively. The total peak flood flow rates through the existing and proposed parallel enclosures are 319 cfs and 444 cfs. Figure 7-6 shows a preliminary plan of the enclosure.

A drain enclosure in Allen Park will be required to allow for the drain relocation as shown in Figure 7-1. A detailed analysis to determine the size, location and elevation of the enclosure must be completed. For estimating purposes, it was assumed that the size of enclosure would range up to a 66-inch diameter pipe and would follow the route of the drain as shown in Figure 7-1.

Channel Improvements

Many small scale drain realignments were considered either at the request of the municipalities or in attempt to minimize right-of-way acquisition. The recommended channel alignment is shown on the right-of-way maps included in Appendix E.

**Figure 7-6
 NBECD Flood Control Project
 Proposed Parallel Drain Enclosure near Merriman Road**



The channel geometry did not change in comparison with Alternative 20 with the exception of the relocation in Allen Park. Table 7-5 summarizes the channel improvements that are included in the final model and flood control project. The scope of the required channel improvements is also shown in the preliminary plan, profile and cross section drawings provided in Appendix A.

Right-of-Way

Due to the magnitude of improvements needed, additional right-of-way must be acquired to implement the flood control project. To secure the necessary right-of-way, it will require a combination of securing drain right-of-way easements and acquiring entire properties. Table 7-5 summarizes the typical right-of-way widths along the drain. Right-of-way maps showing the requirements across individual properties are provided in Appendix E.

**Table 7-5
NBECD Flood Control Project
Summary of Channel Geometry and Right-of-Way**

Station	Approximate River Mile	Nearest Roads	Channel Type	Typical Channel Top Width (ft)	Typical ROW width (ft)
0+00 to 25+00	0.00 to 0.47	Detroit River to 4 th Street	80 ft Trapezoidal	115	165
25+00 to 156+00	0.47 to 2.95	4 th Street To Layfayette	64 ft Trapezoidal	115	165
156+00 to 238+00	2.95 to 4.51	Layfayette to Allen	45 ft Greenway	100	150
238+00 to 254+00	4.51 to 4.81	Allen to Wabash R.R.	92 ft Greenway	125	175
254+00 to 279+00	4.81 to 5.28	Wabash R.R. to Baker College	132 ft Greenway	180	230
279+00 to 285+00	5.28 to 5.40	Baker College to I-94	109 ft Greenway	140	190
285+00 to 308+00	5.40 to 5.83	I-94 to Shenandoah	92 ft Greenway	120	170
308+00 to 331+00	5.83 to 6.27	Shenandoah to Southfield	87 ft Greenway	110	160
331+00 to 410+00	6.27 to 7.77	Southfield to Hanover	92 ft Greenway	115	165
410+00 to 487+00	7.77 to 9.22	Hanover to Telegraph	74 ft Greenway	105	155
487+00 to 534+00	9.22 to 10.11	Telegraph to Gulley	70 ft Greenway	95	145
534+00 to 550+00	10.11 to 10.42	Gulley to Beech-Daly	65 ft Greenway	95	145
550+00 to 567+00	10.42 to 10.74	Beech-Daly to Bayham	50 ft Greenway	85	135
567+00 to 577+00	10.74 to 10.93	Bayham to Princess	35 ft Greenway	70	120
577+00 to 614+00	10.93 to 11.63	Princess to Van Born	25 ft Greenway	70	120
614+00 to 687+00	11.63 to 13.01	Van Born to Ecorse	8 ft Trapezoidal	35	85
687+00 to 751+00	13.01 to 14.22	Ecorse to Smith	6 ft Trapezoidal	35	85
751+00 to 803+00	14.22 to 15.21	Smith Rd Enclosure	Enclosed	N/A	70
803+00 to 893+00	15.21 to 16.91	Smith to Ecorse	4 ft Trapezoidal	35	85

Planning Level Cost Estimates

The basis used to develop the planning level cost estimates is explained in the Task 6 report with the exception of right-of-way estimating which is outlined below. In Task 7, the cost estimate for the flood control project has been updated to include all changes. Table 7-7 summarizes the flood control project planning level cost estimate. A detailed breakdown of the planning level costs is provided in Appendix C.

**Table 7-7
NBECF Flood Control Project
Planning Level Cost Estimates**

Planning Level Cost Estimate Breakdown	
Channel Improvements	\$46 million
Drain Crossing Improvements.....	\$85 million
Storm Water Detention Facilities.....	\$6 million
Right-of-Way Acquisition	\$47 million
Professional Services.....	\$33 million
Contingencies	\$22 million
Total Planning Level Estimate	\$239 million

Table 7-8 summarizes the estimated number of properties and easements that need to be acquired to provide right-of-way for the flood control project. A total of 274 easements acquisitions and 467 property acquisitions are needed. The estimated cost to acquire the right-of-way is \$47 million. Property acquisition was estimated using State Equalized Values (SEV). The SEV was obtained for all but 76 of the properties. For properties to be purchased, the SEV was multiplied by a factor of 2.0 to obtain the market value and then multiplied as a factor of 1.25. Easement acquisition was estimated at \$35,000 per acre.

**Table 7-8
 NBECD Flood Control Project
 Summary of Right-of-way Acquisition**

Community	No. of Property Acquisitions	SEV of Properties	Estimated Purchase Price	No. of Easement Acquisitions	Estimated Easement Price*	Total Acquisition Cost
Allen Park	71	\$4,149,800	\$11,289,900	16	\$786,800	\$12,076,700
Dearborn Heights	301	\$8,636,100	\$22,234,250	103	\$1,621,450	\$23,855,700
Ecorse	12	\$8,500	\$1,146,250	20	\$54,950	\$1,201,200
Lincoln Park	58	\$2,263,200	\$6,208,000	61	\$876,000	\$7,084,000
Melvindale	17	\$207,400	\$521,650	10	\$27,300	\$548,950
Romulus	5	\$13,900	\$983,250	59	\$1,294,300	\$2,304,500
Westland	3	\$16,410	\$41,025	5	\$47,250	\$88,275
TOTAL	467	\$15,295,310	\$42,424,325	274	\$4,735,000	\$47,159,325

**Easements were assumed to cost \$35,000/acre*

Conclusion

As previously described, the recommended flood control project is Alternative 21, the Greenway Alternative. The recommended project was developed based on the ranking of flood control alternatives completed in Task 6 by the municipalities in the drainage district along with input from the Wayne County Drain Commissioner and the flood control study consultant team. This task further refines the details of the alternative.

The flood control study recommendation provides the basis of design for the flood control project. A separate Implementation Plan has been prepared and describes a project schedule and steps that must be considered to move forward with the implementation of the recommended flood control plan.