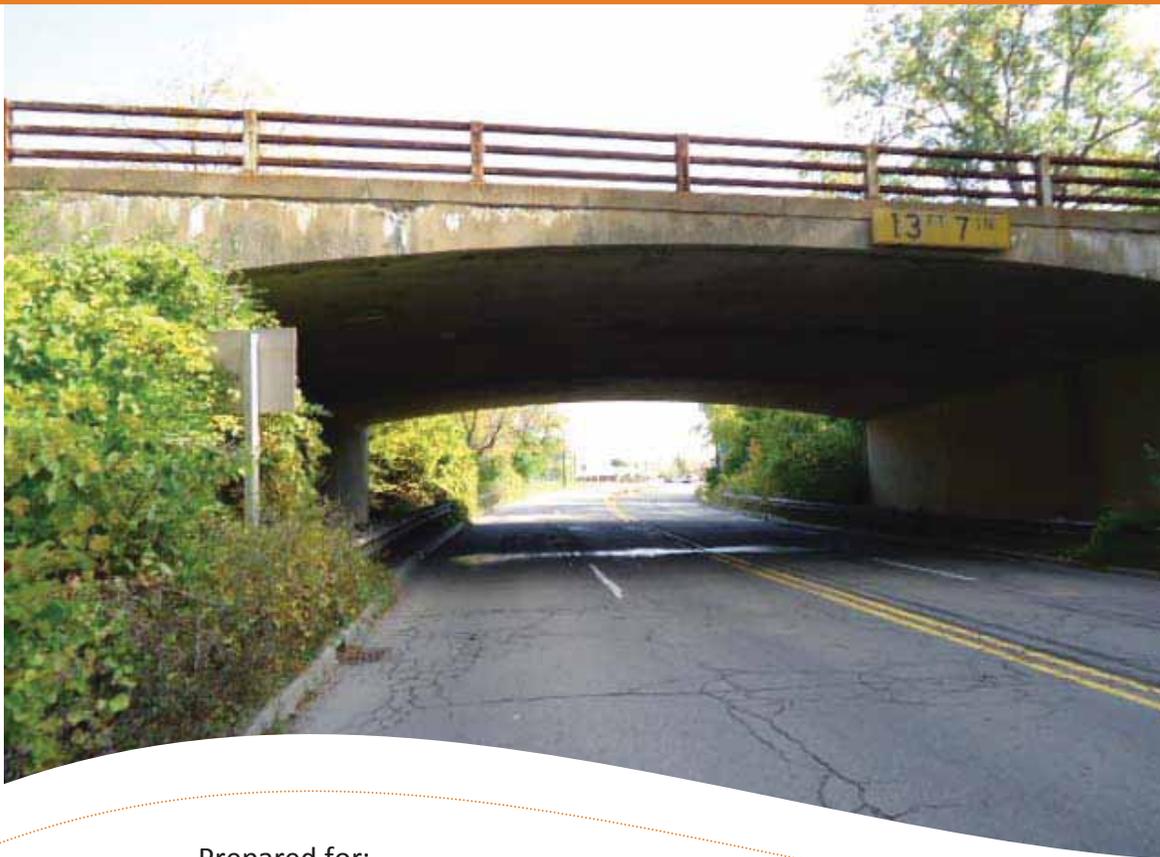


# Final Feasibility Report

## Old M-14, Newburgh Road to Market Street

### CS 82101 – JN 106621

June 27, 2012



Prepared for:



34000 Plymouth Road

Livonia, MI 48150

[www.ohm-advisors.com](http://www.ohm-advisors.com)



# Table of Contents

Executive Summary .....	ES1
<b>1.0 INTRODUCTION .....</b>	<b>1</b>
<b>1.1 Project History .....</b>	<b>1</b>
<b>1.2 Study Area.....</b>	<b>1</b>
Figure 1-01: Location Map .....	1
<b>1.3 Study Scope of Work .....</b>	<b>1</b>
<b>1.4 Steering Committee Members.....</b>	<b>2</b>
<b>2.0 EXISTING CONDITIONS.....</b>	<b>3</b>
<b>2.1 Roadway and Non-Motorized Facilities.....</b>	<b>3</b>
Table 2-01: Past Projects Occurring Within Study Area Limits .....	4
Table 2-02: Existing Cross Section .....	4
Table 2-03: 2011 ADT.....	5
Table 2-04: Design Speed.....	5
<b>2.2 Structures.....</b>	<b>6</b>
Table 2-05: Design Load of Structures within the Study Area .....	6
Table 2-06: Existing Structure Description .....	7
Figure 2-01: Railing and Roadway Condition.....	7
Figure 2-02: Arch Condition .....	8
Table 2-07: Existing Structure Description .....	8
Table 2-08: Vertical Clearance of Structures within the Study Area.....	8
Figure 2-03: Hines Bridge Surface Condition .....	9
Figure 2-04: Hines Bridge Railing Condition .....	9
Figure 2-05: Hines Bridge Superstructure Condition .....	10
<b>2.3 Traffic .....</b>	<b>10</b>
Figure 2-06: Existing Traffic Volumes .....	10
Figure 2-07: 2035 Traffic Volumes.....	11
Table 2-09: Crash Analysis Summary (Primary Study Area and Adjacent Intersections).....	12
Table 2-10: Level of Service Criteria for Unsignalized Intersections .....	13
Table 2-11: Level of Service Criteria for Signalized Intersections .....	14
Table 2-12: Existing Operation Analysis .....	15
Table 2-13: Future (No Build) Operation Analysis .....	16
<b>2.4 Environmental .....</b>	<b>17</b>
Table 2-14: Middle Rouge Parkway (Hines Parkway) Recreation Grant History .....	19
Table 2-15: Historic/Potentially Historic Properties within the Old M-14 Study Area .....	20
Table 2-16: Protected Species in Wayne County or Vicinity of Old M-14 Study Area.....	22
Exhibit 2-01: Environmental Features.....	23
Exhibit 2-02: Existing Land Use .....	24
Exhibit 2-03: Existing Zoning .....	25
Exhibit 2-04: Wetlands and 100 Year Flood Plain.....	26
<b>3.0 ALTERNATIVES EVALUATED .....</b>	<b>27</b>
<b>3.1 Methodology.....</b>	<b>27</b>
<b>3.2 Refinements of Alternatives.....</b>	<b>28</b>
Exhibit 3-01: Illustrative Alternative 2A.....	30
Exhibit 3-02: Illustrative Alternative 2B .....	31
Exhibit 3-03: Illustrative Alternative 2C .....	32
Exhibit 3-04: Illustrative Alternative 3.....	33
Exhibit 3-05: Illustrative Alternative 6 (Roundabout) .....	34

Exhibit 3-06: Illustrative Sub-Alternative 6 (Signalized) .....	35
Exhibit 3-07: Illustrative Alternative 8 (Roundabout) .....	36
Exhibit 3-08: Illustrative Sub-Alternative 8 (Signalized) .....	37
<b>3.3 Illustrative Alternatives Evaluation .....</b>	<b>38</b>
<b>4.0 PRACTICAL ALTERNATIVES .....</b>	<b>39</b>
<b>4.1 Description of Practical Alternatives .....</b>	<b>39</b>
<b>4.2 Alternative 2A .....</b>	<b>39</b>
Table 4-01: Proposed Cross Section .....	39
Figure 4-01: Elevation Looking North, North Fascia .....	40
Figure 4-02: Proposed Elevation, Looking North .....	41
Figure 4-03: Proposed Deck Section, Looking East .....	41
Figure 4-04: Proposed Deck Section, Looking North .....	42
Table 4-02: Alternative 2A Operation Analysis .....	43
Exhibit 4-01: Alternative 2A .....	46
<b>4.3 Alternative 2B .....</b>	<b>47</b>
Table 4-03: Proposed Cross Section .....	47
Figure 4-05: Elevation Looking North, North Fascia .....	48
Figure 4-06: Proposed Elevation, Looking North .....	48
Figure 4-07: Proposed Deck Section, Looking East .....	49
Figure 4-08: Proposed Deck Section, Looking North .....	49
Table 4-04: Alternative 2B Operation Analysis .....	50
Exhibit 4-02: Alternative 2B .....	54
<b>4.4 Alternative 2C .....</b>	<b>55</b>
Table 4-05 Proposed Cross Section .....	55
Figure 4-09: Elevation Looking North, North Fascia .....	56
Figure 4-10: Proposed Elevation, Looking North .....	57
Figure 4-11: Proposed Deck Section, Looking East .....	57
Figure 4-12: Proposed Deck Section, Looking North .....	57
Table 4-06: Alternative 2C Operation Analysis .....	59
Exhibit 4-03: Alternative 2C .....	63
<b>4.5 Alternative 3 .....</b>	<b>64</b>
Table 4-07: Proposed Cross Section .....	64
Figure 4-13: Proposed Deck Section, Looking North .....	65
Table 4-08: Alternative 3 Operation Analysis .....	66
Exhibit 4-04: Alternative 3 .....	70
<b>4.6 Evaluation of Practical Alternatives .....</b>	<b>71</b>
Exhibit 4-05: Old M-14 Detour Route .....	72
Exhibit 4-06: Hines Drive Detour Routes .....	73
Exhibit 4-07: Environmental Evaluation .....	74
Exhibit 4-08: Roadway Evaluation .....	75
<b>5.0 SUMMARY .....</b>	<b>76</b>

## APPENDICES

- Appendix A: Illustrative Alternatives Assessment Report
- Appendix B: Old M-14 Feasibility Study - Reduction of Final Practical Alternatives Memo
- Appendix C: Old M-14 Preliminary Pavement Recommendation Memo
- Appendix D: Old M-14 Hydraulic Report
- Appendix E: Old M-14 Maintenance of Traffic Alternatives Analysis Memo

# EXECUTIVE SUMMARY

The key elements and processes for the Old M-14 (Ann Arbor Road) roadway study are summarized in this report. This report includes four feasible “Practical Alternatives” for repairing and upgrading the current roadway to improve safety, capacity, and pedestrian mobility while minimizing impacts to the adjacent Edward Hines N. Parkway and maintaining the rural feel of the corridor. These roadway improvements were chosen from more than one dozen conceptual alternatives.

This study is a cooperative effort between the Michigan Department of Transportation, the Wayne County Road Commission, and the City of Livonia. These three agencies came together and formed a Steering Committee that met and communicated regularly during the study process.

Public involvement also played a key role in the study. The public provided important feedback after being presented with several Alternatives. These comments were key in determining the Practical Alternatives.

## **Practical Alternatives**

As a result of the collaboration between the public, Steering Committee and study team, four, feasible, “Practical Alternatives” were chosen. These alternatives were developed based on Michigan Department of Transportation (MDOT) and Federal Highway Administration (FHWA) guidelines.

Key elements of the four Practical Alternatives chosen include:

- ▶ Geometric Improvements
- ▶ Pedestrian Accessibility
- ▶ Capacity Improvements
- ▶ Safety Improvements
- ▶ Structural Improvements

The four Practical Alternatives chosen are described below:

- ▶ **Alternative 2A** – Reconstruct Old M-14 with only minor geometric changes
- ▶ **Alternative 2B** – Reconstruct Old M-14 and “T” Plymouth Road into Old M-14
- ▶ **Alternative 2C** – Reconstruct Old M-14 (Ann Arbor Road) and “T” Old M-14 into Plymouth Road
- ▶ **Alternative 3** – Reconstruct Old M-14 and create an at-grade, signalized intersection of Old M-14 at Hines Drive

After finalizing the Practical Alternatives, two Evaluation Matrices were developed to define benefits and impacts of each alternative.

## **Final Implementation**

The purpose of this study was not to identify a “Preferred Alternative” at this stage. As the “Practical Alternatives” are reviewed in future phases of the project development process. The Steering Committee members should strive to work together to continue exploring innovation to upgrade this corridor, providing an improved road for the driver and a better corridor for the public.

## 1.0 INTRODUCTION

### 1.1 Project History

OHM has been directed by the Michigan Department of Transportation (MDOT) to perform a Feasibility Study focused on Old M-14 (Ann Arbor Road) from Newburgh Road to Market Street, including the structure over the Middle Rouge River, the Edward N. Hines Drive Bridge over Old M-14 and the intersection with Plymouth Road. The deteriorating physical condition of the roadway and structures, along with safety and geometric considerations, is driving the need for this study.

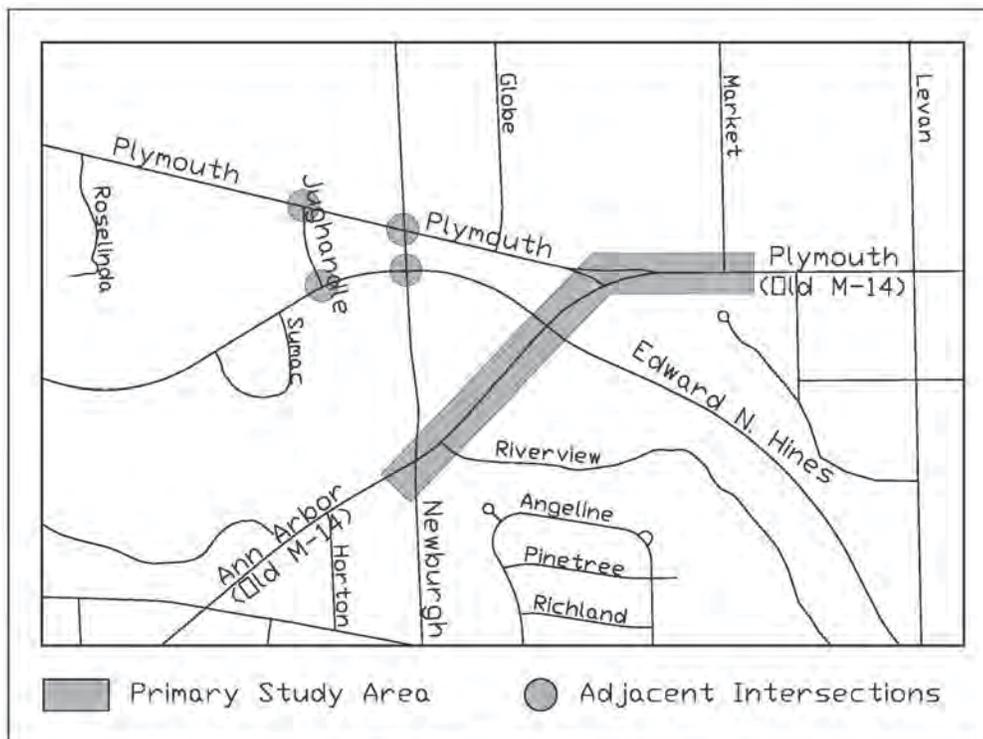
This report is a presentation of the alternatives investigated, reviewed, and structures discussed from the initial concepts presented at the first Steering Committee Meeting held on November 29, 2011 through the final public meeting on March 15, 2012.

### 1.2 Study Area

The study encompasses five roadways including:

- Old M-14 - Newburgh Road to Market Street
- Edward N. Hines Drive – Jughandle Road to east of Old M-14
- Newburgh Road – Old M-14 to Plymouth Road
- Plymouth Road – Jughandle Road to Old M-14
- Jughandle Road – Edward N. Hines Drive to Plymouth Road

Figure 1-01: Location Map



### 1.3 Study Scope of Work

The scope of this study was to analyze rehab alternatives for the reconstruction of Old M-14 (Ann Arbor Road) from Newburgh Road to Market Street including the structure over the Middle Rouge River (B03 of 82101), the Edward N. Hines Drive Bridge over Old M-14 (S02 of 82101) and the intersection with Plymouth Road. All elements involved in reconstructing the roadways were investigated to identify the

issues that could eliminate alternatives based on their impacts. Alternatives considered included work on Hines Drive, Newburgh Road and Plymouth Road.

#### **1.4 Steering Committee Members**

A study Steering Committee was assembled under MDOT's direction with the goal of guiding the development of the Feasibility Study. Steering Committee members are listed below.

MDOT		Wayne County	City of Livonia	OHM	PB
Gorette Yung	Najim Salman	Ken Kucel	Todd Zilincik	Pat Wingate	Steve Ott
Jeff Horne	John Bugg	Chuck Nnaji	Mark Taormina	Jesse Morgan	
Adam Penzenstadler	Erik Carlson	Noel Mullett		Steve Dearing	
Mike Budai	David Dortman			Jim Marcinkowski	
Kay Adefeso	John Paepke			Craig Dashner	
Mike Bellini					

## 2.0 EXISTING CONDITIONS

### 2.1 Roadway and Non-Motorized Facilities

A field investigation was conducted by MDOT on June 14, 2011. The pavement from Newburgh Road to the Middle Rouge River Bridge showed slight distress of the longitudinal construction joint and some oxidation. Low severity map type cracks were observed.

The pavement from the Rouge River Bridge to Market Street showed distressed areas with both longitudinal and transverse reflective cracking, in addition to areas with possible settlement. Using the latest Concrete Pavement Condition Survey Manual (1991) metrics as a guide, the underlying concrete pavement is believed to have many underlying Severity Level 1 distresses. The cracks in these limits were unsealed at the time of inspection.

The existing crown is located in the center of the roadway. This does not meet current MDOT design standards for five-lane sections. Concrete curb or concrete curb and gutter exists throughout the entire length of the study area. From Newburgh Road to the Middle Rouge River Bridge there is a 2.5 foot curb and gutter in fair condition. From the Middle Rouge River Bridge to Market Street there is a 0.5 foot curb at the edge of pavement in poor condition.

Slopes in the vicinity of the existing structures are steeper than 1:3 and are currently protected by guardrail.

#### **Existing Drainage**

The drainage system along the study area is made up of a network of drainage inlets and storm sewer. The outfall for the system is the Middle Rouge River. No existing facilities are present that meet the National Pollutant Discharge Elimination System (NPDES) requirements to treat “first flush” storm water prior to discharge to receiving waters.

#### **Right-of-Way (ROW)**

The existing ROW plans depict the ROW as 106 feet along Old M-14 from Newburgh Road to the Old M-14/Plymouth Road intersection. From the Old M-14/Plymouth Road intersection to Market Street the ROW is 120 feet. The existing ROW for Hines Drive is 66 feet and for Riverview Drive is 30 feet.

The rehab history of the roadway in the study area is listed in **Table 2-01**.

**Table 2-01: Past Projects Occurring within Study Area Limits**

Year	Work Description	Pavement Section	Remarks
1924	20-ft, two lane road construction, with 4-ft unpaved shoulders.	9-in concrete pavement placed on subgrade, this is believed to be plain concrete.	Limits of this project were from Newburgh Road to Market Street, open ditch drainage systems, believed to be parabolic.
1928	Road widened to 40-ft with 8-ft unpaved shoulders.	Matched adjacent	Limits of this project were from Newburgh Road to Market Street.
1967	Road widened to 60-ft; paved shoulders with curb and gutter.	8-in reinforced concrete pavement placed on subgrade with a 2.2-in bituminous overlay.	Limits of this project were from Old M-14/Plymouth Road split to Market Street.
1974	Road widened to total lane width of 60-ft. Curb and gutter included.	8-in reinforced concrete pavement placed on subgrade with a 2.2-in bituminous overlay.	Limits of this project were from Newburgh Road to Old M-14/Plymouth Road split.
1993	1.5-in mill and resurface	--	Limits of this project were from Newburgh Road to Market Street.
2001	Reconstruct	7.5-in HMA on 6.3-in aggregate base. Approach to river was 3.5-in HMA on 9.5-in reinforced concrete on 6.3-in aggregate base.	Limits of this project were from the Newburgh Road to the Rouge River.

Information provided in the above table is from the July 13, 2011 memo from Lex Kinter (Metro Region C&T – Area Soils Engineer), to Jeff Horne (Transportation Engineer, Taylor TSC). The table may not represent every project or maintenance activity completed within the subject limits. The full report is located in the Appendices.

Roadway widths, laneage and approximate locations of the roadway are listed in **Table 2-02**.

**Table 2-02: Existing Cross Section**

Roadway	Existing Laneage	Road Width (ft)	Existing Edge of Pavement Treatment
Old M-14, 200 feet west of Newburgh to 200 feet east of Newburgh	5	59	Curb and Gutter
Old M-14, 200 feet east of Newburgh to West Middle Rouge Bridge approach	4	44	Curb and Gutter
Old M-14, West Middle Rouge Bridge approach to west face of Hines Bridge	4	40	Curb and Gutter
Old M-14, west face of Hines Bridge to Market	5	59	Curb and Gutter
Hines Drive Bridge	2	44	Shoulder

The Average Daily Traffic (ADT) volumes for roadway segments within the study area are shown in **Table 2-03**

**Table 2-03: 2011 ADT**

Roadway	Segment	2011 ADT	Number of Travel Lanes
Old M-14	Newburgh Road to Plymouth Road	34,830	4-5
Hines Drive	Jughandle Road to Newburgh Road	12,700	2
Hines Drive	Newburgh Road to Levan Road	14,700	2
Newburgh Road	Plymouth Road to Hines Drive	39,662	4-5
Newburgh Road	Hines Drive to Old M-14	28,111	4-5
Plymouth Road	Jughandle Road to Newburgh Road	20,175	4
Plymouth Road	Newburgh Road to Old M-14	4,014	4
Plymouth Road	Old M-14 to Levan Road	37,917	5

Existing posted speed limit and proposed design speed are listed in **Table 2-04**.

**Table 2-04: Design Speed**

Location	Posted Speed Limit	Proposed Design Speed
Old M-14, Newburgh Road to Plymouth Road	45	50
Old M-14, Plymouth Road to Market Street	40	45
Plymouth Road	45	50
Newburgh Road	40	45
Hines Drive	40	45

### Existing Multi-Modal Operations

#### Transit

SMART does not operate bus service in Livonia, thus this study area is not served by transit.

#### Bicycle

The Hines Drive HMA pathway and on-street bike lanes traverse the study area. While these facilities cross Old M-14 on Hines Drive, there are no direct connections from Old M-14 or the sidewalk system along Old M-14 directly to Hines Park within the primary study area. Sidewalks along both sides of Newburgh Road tie into the Hines Drive pathway system at the Newburgh Road and Hines Drive intersection.

#### Pedestrians

Concrete sidewalk is currently located at the Old M-14/Newburgh Road intersection and is in poor condition. No sidewalk is located on Old M-14 from just east of the Old M-14/Newburgh Road intersection to the Old M-14/Plymouth Road intersection. Pedestrians have been observed walking through the Old M-14 corridor which is also evident by the “goat paths” along the road. There is an existing concrete sidewalk

on both sides of Plymouth Road, east of the Plymouth Road/Old M-14 intersection. Most of the sidewalk is in poor to fair condition and does not meet current Americans with Disabilities Act (ADA) accessibility standards.

A separate Hot Mix Asphalt (HMA) pathway parallels the south side of Hines Drive. The 8 foot HMA path crosses over Old M-14 on the same structure as Hines Drive. The HMA pathway has been recently overlaid and is in very good condition.

Due to limited space, there are locations, particularly near the Hines Drive Bridge, where pedestrians are forced onto Old M-14. Sidewalk is located at the limits of the primary study area and tie into the City of Livonia sidewalks.

Overall pedestrian connectivity for the study area and neighboring vicinity is depicted in **Exhibit 2-01**.

## 2.2 Structures

Two structures are located within the study area. Structure B03 of 82101 carries Hines Drive traffic over the Middle Rouge River and structure S01 of 82101 carries Old M-14 over Hines Drive. Both structures are aging and have areas in need of repair or replacement. The condition and the geometric data of the structures were taken into consideration during the review.

### Existing Design Load

**Table 2-05** lists the existing design load of the structures within the study area. The design loading of the two existing structures do not meet current standards and are shaded in yellow.

**Table 2-05: Design Load of Structures within the Study Area**

Structure ID	Facility Carried	Over	Design Load	
			Current Standard	Existing
S01 of 82101	Hines Drive	Old M-14	HS-25 / HL-93-Mod	HS20
B03 of 82101	Old M-14	Middle Rouge River	HS-25 / HL-93-Mod	HS20

### B03 of 82101 – Old M-14 over Middle Rouge River

#### Field Site Review Findings

Old M-14 over the Rouge River is a single-span earth (or closed) spandrel concrete arch structure constructed in 1925. In 1934, the structure was widened by adding overhanging fascias and in 1970 the bridge railing was replaced with a solid concrete parapet with a single aluminum tube railing. The concrete deck carries four travel lanes (two in each direction) of Old M-14 traffic over the Middle Rouge River. The structure is 76.8 feet long with an HMA driving surface.

There is evidence of erosion along the wingwalls in all quadrants. It appears that concrete curb and HMA pavement were placed where the existing curb failed to keep road drainage from running off the side slopes and causing erosion. The slopes appeared stable at the time of the field investigation.

### Clear Width

Width across the structure is 40-feet from face of curb to face of curb. This provides four 10-foot travel lanes with no shoulders or shy distance. The clear roadway width based on MDOT Bridge Design Guide 6.05.02 should provide for through lanes and 2 foot of shy distance on each side. **Table 2-06** lists the current standard and existing widths, with the substandard width shaded in yellow.

**Table 2-06: Existing Structure Description**

Structure ID	Facility Carried	Over	# of Lanes	Clear Width (ft)	
				Current Standard	Middle Rouge River Bridge
B03 of 82101	Old M-14	Middle Rouge River	4	52	41.3

Note: Clear deck width is the distance from bridge railing to bridge railing or curb face to curb face.

### Road Surface

The construction of the bridge is such that the pavement over the structure is a normal pavement section, as opposed to a bridge deck. The existing road surface over the bridge and on the approaches is HMA overlaying concrete pavement. The HMA is in poor condition with extensive cracking. There are catch basins in all four quadrants and the pavement around them has failed. The basin covers have settled and are impacting the ride quality of the pavement. See **Figure 2-01**.

### Railings

There is concrete parapet with an aluminum tube on top, across the structure (**Figure 2-01**). The railings were replaced in 1970 on a widened concrete fascia overhanging the concrete arch. The concrete railings are in poor condition with heavy spalling and scaling of the entire railing. There are sections of exposed rebar throughout the railing length. The existing brushblock across the structure is also spalled to steel and is in poor condition.

The overhanging portion of the fascia and sidewalks are spalled to steel over the entire length. There are also heavy amounts of efflorescence present on the overhangs.

### Arch

The existing arch is in very good condition (**Figure 2-02**). According to existing plans, the structure is founded on piles and is therefore not scour critical. There are a few small spots of spalled concrete with rebar exposed. The rebar has small amounts of pack rust and does not appear to have much section loss. These spalls appear to be due to insufficient cover.

**Figure 2-01: Railing and Roadway Condition**



The existing spandrel walls are in good condition. There is some honeycombing at the bottom of the walls near the high water mark. The bridge was constructed in sections and there is a crack at the section construction joints. These cracks do not pose a structural issue at this time.



**Figure 2-02: Arch Condition**

**S01 of 82101 – Hines Drive over Old M-14  
Clear Width**

On Hines Drive, the clear roadway width should provide for through travel lanes, shoulder and 2 foot of shy distance on each side according to the MDOT Bridge Design Guide 6.05.02. The existing width meets/exceeds current design standards as shown in **Table 2-07**.

On Old M-14 the clear distance from substructure unit to substructure unit should provide for thru lanes plus 10 feet clear width on each side according to MDOT Bridge Design Guide 6.06.04. The existing width does not meet current design standards as shown in **Table 2-07**. The substandard clear width is shaded in yellow.

**Table 2-07: Existing Structure Description**

Structure ID	Roadway	# of Lanes	Clear Width (ft)	
			Current Standard	Existing
S01 of 82101	Hines Drive	2	40	64.3
	Old M-14	4	52	40

Note: Clear deck width is the distance from bridge railing to bridge railing or curb face to curb face.

**Vertical Clearance**

The minimum vertical clearance for a non-National Highway System roadway (NHS) route is 14.5 feet according to the Michigan Bridge Design Manual (MBDM) 7.01.08. The existing vertical clearance is 13.75 feet. **Table 2-08** lists the current standard and existing clearance with the substandard clearance shaded in yellow.

**Table 2-08: Vertical Clearance of Structures within the Study Area**

Structure ID	Facility Carried	Over	Vertical Clearance (ft)	
			Current Standard	Old M-14
S01 of 82101	Hines Drive	Old M-14	14.5	13.7

**Field Site Review Findings**

Hines Drive over Old M-14 is a one-span concrete rigid frame structure built in 1948. The structure is 73.0 feet long and carries two lanes (one lane in each direction) and a guardrail separated HMA pathway (south side only) of Hines Drive traffic. Old M-14 consists of four lanes of traffic (two in each direction).

The existing HMA approaches are in fair condition with longitudinal and transverse cracking. The pavement at the reference lines are heavily cracked for approximately 1 foot and are failing.

The concrete sidewalk approaches are in good condition with a few cracks and some vegetation in the joints.

### Surface

The HMA surface is in poor condition (**Figure 2-03**). Nearly the entire northbound lane on Hines Drive has been repaired with cold patch and has heavy cracking. The southbound lane is cracking and contains areas of cold patch.

### Railings

The railings consist of steel posts with three longitudinal steel tubes between them. The surface is rust covered, however the railings are soundly attached to the sidewalk and are in good condition. The current height of the railings does not meet standards for bicycle railing as described in the 2010 LRFD AASHTO Bridge Design Specifications, Chapter 13. See **Figure 2-04**.

The railing separating the HMA pathway from the vehicle lanes is steel posts with guardrail on the traffic side and a cable stringing between them at the top. The posts have some surface rust but appear to be attached soundly to the sidewalk, however the railing does not meet the 2010 LRFD AASHTO Bridge Design Specifications, Chapter 13 Standards.

### Fascias

Both fascias are in fair condition with one small area of delamination and one small area of spalling. The spalled areas are at the deck/substructure interface and are fairly minor. There is leaching at the points of deterioration. There is also some minor leaching along the deck/ substructure interface, and on the west fascia.

### Superstructure

Overall the superstructure is in fair to poor condition. The rigid frame has three segments and the joints between segments appear to line up with the toe of sidewalk. The joints are leaking heavily and there were stalactites present from the efflorescence build up. The concrete superstructure is spalled at each joint for approximately 2 feet to 4 feet on each side of the joint (**Figure 2-05**). In the spalled area, there are several

**Figure 2-03: Hines Bridge Surface Condition**



**Figure 2-04: Hines Bridge Railing Condition**



exposed lengths of reinforcing steel. Some of the reinforcing steel was broken or cut off and no longer serves a structural purpose. Approximately 15% of the underside is spalled.

The vertical legs of the frame are in fair condition with some deficiencies. At the bottom there are some spalls and cracks. There was no exposed rebar at the time of the investigation.

### 2.3 Traffic

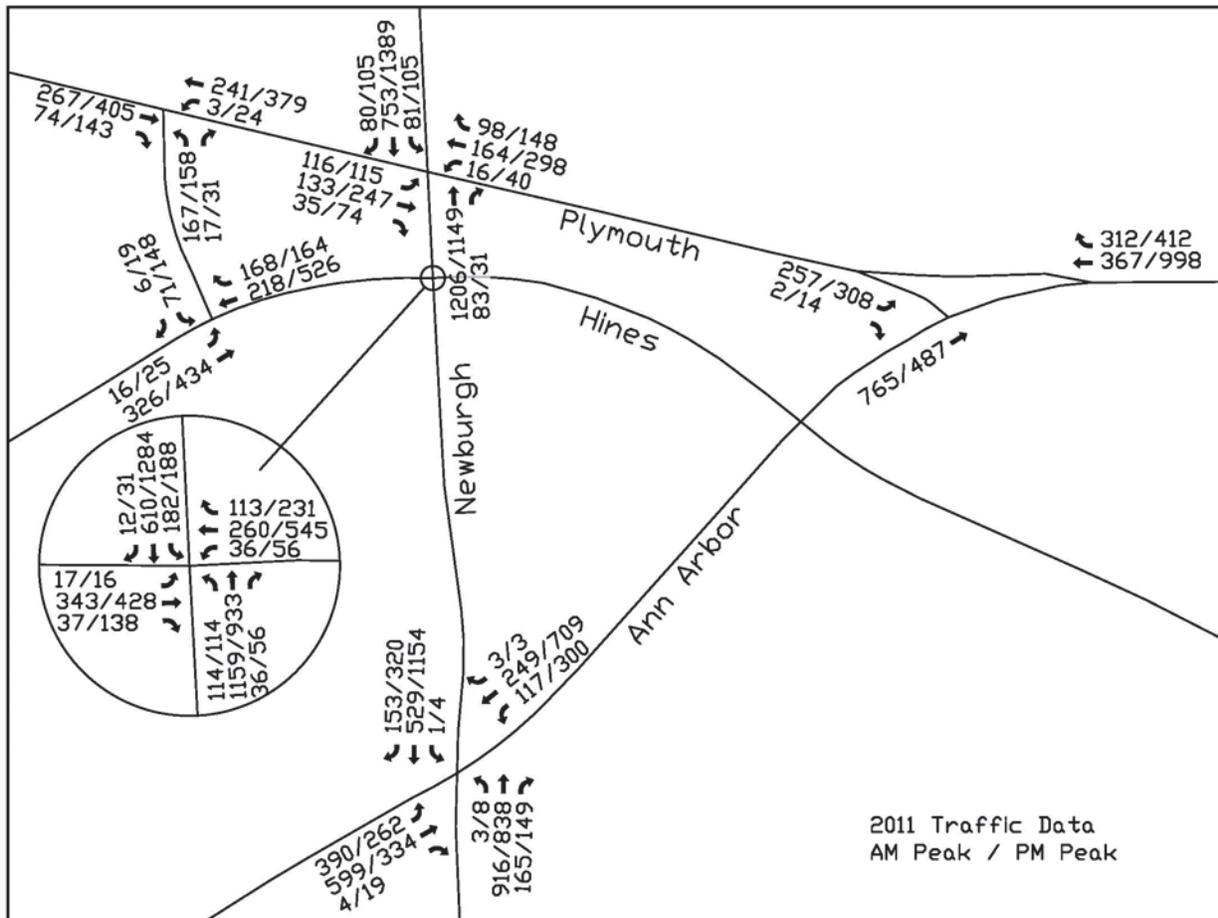
#### Background Traffic Information

Previous studies in the study area identified the AM peak period as 7 AM to 9 AM, and the PM peak period as 4 PM to 6 PM. Turning movement counts were performed for this study during these peak hours at the intersections within the study area as well as neighboring intersections. These counts provided existing data for the study area traffic patterns. The existing traffic volumes are shown in Figure 2-06.

Figure 2-05: Hines Bridge Superstructure Condition

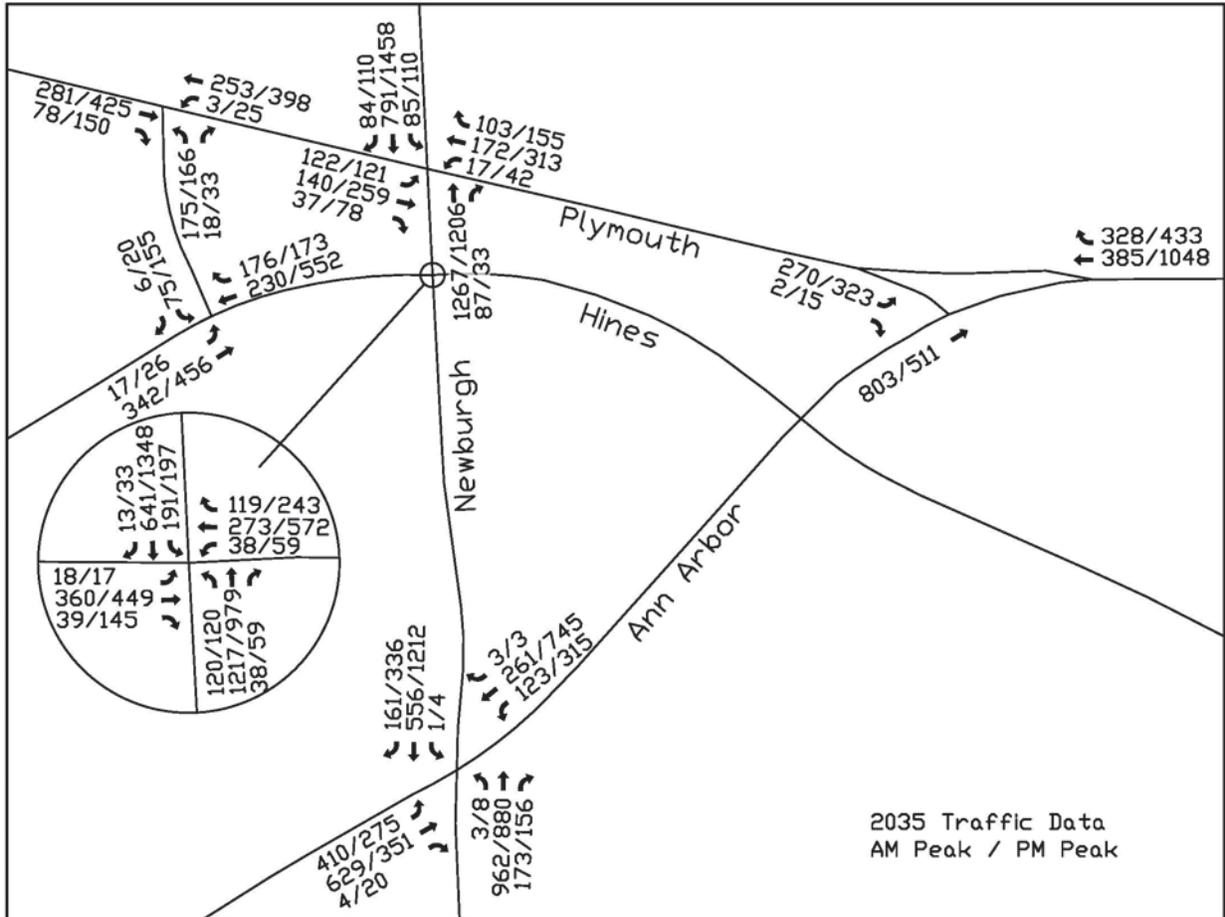


Figure 2-06: Existing Traffic Volumes



Current regional and state economic factors have caused a drop in travel in recent years. Forecasted recovery projections indicate a slow future growth. In order to account for the impacts of future growth, a cumulative growth factor of 5% was selected for the study year of 2035. Projected trips were added to the existing volumes in order to develop 2035 traffic volumes. Potential 2035 traffic volumes are shown in Figure 2-07.

**Figure 2-07: 2035 Traffic Volumes**



**Safety Analysis**

Crash data was obtained from the Traffic Improvement Association for the study area and the adjacent intersections of Newburgh Road/Hines Drive, Newburgh Road/Plymouth Road, Hines Drive /Jughandle Road, Plymouth Road/Ann Arbor Road, and Plymouth Road/Jughandle Road. The data encompassed all crashes occurring within this area from January 1, 2009 through December 31, 2011. The crash data was analyzed to identify correctible crash trends and patterns. The analysis featured focus on the following crash types: angle, head-on left-turn, single vehicle, sideswipe and rear-ends and consisted of verifying the location and type of all the reported crashes, then reviewing the weather and pavement conditions for each crash. A summary of the data collected and analyzed can be found in **Table 2-09**.

**Table 2-09: Crash Analysis Summary (Primary Study Area and Adjacent Intersections)**

		Intersection					
		Ann Arbor at Newburgh	Ann Arbor at Plymouth	Plymouth at Newburgh	Hines at Newburgh	Jughandle at Hines	Plymouth at Jughandle
Crash Types	Side Swipe Opp	1		1			
	Side Swipe Sm	9	3	4	1		1
	Head On	2					
	Head On-LT	5		9	3		1
	Angle Str	6	1	7	2	3	1
	Rear End Str	32	1	27	12	1	3
	Rear End Left		1	1			
	Single Vehicle		1		1		1
	Unknown	1					
	Total	56	7	49	19	4	7
	Crashes per year	19	2	16	6	1	2
Injuries Types	A	4	0	0	1	0	0
	B	4	1	4	3	0	0
	C	11	2	7	3	0	1
	Fatal Crashes	0	0	0	0	0	0
ADT (entering intersection)		62941	38844	44633	47767	13160	23735
Crash Rate (crashes per million entering vehicles)		0.813	0.165	1.003	0.363	0.278	0.269

Note: Type A Crash–Incapacitating Injury, Type B Crash–Non-Incapacitating Injury, Type C–Possible Injury.

Over the three year period from which crash data was obtained, the primary study area and adjacent intersections experienced crash rates typical for the intersection types. Within the primary study area, there were four incapacitating injury crashes (Type A), five non-incapacitating injury crashes (Type B) and 13 possible injury crashes (Type C). At the adjacent intersections, there was one Type A crash, seven Type B crashes and 11 Type C crashes. No fatalities occurred in the study area during the analysis period. There is also no identifiable pattern in the Type A injury crashes. The available data indicates a steady trend in fewer numbers of crashes per year, which tracks the reduction in traffic.

The Old M-14/Newburgh Road intersection experienced 56 crashes during the study period. There was a pattern of low severity crashes related to the lack of a left turn lane for north and southbound Newburgh Road. The Old M-14/Plymouth Road intersection experienced seven crashes, a mix typical for a signalized intersection. The Plymouth Road/Newburgh Road intersection experienced 49 crashes during the study period. This intersection had a high number of southbound rear end and head-on left-turn crashes. The head-on left-turn crash pattern appears to be related to the lack of southbound left turn signal phasing at this intersection. The intersections of Hines Drive/Newburgh Road, Hines Drive/Jughandle Road and Plymouth Road/Jughandle Road experienced nineteen, four and seven crashes respectively, during the study period. The crashes for these locations had no discernable correctable patterns.

### Capacity Analysis

Capacity analysis was performed for both the Old M-14 corridor and adjacent intersections that could be impacted by alterations to the primary study area. This analysis was completed according to the methodologies published in the Highway Capacity Manual, 2000 Edition. For this study, Synchro, Version 7 software was used to conduct the analysis of the traditional intersections. This analysis is used to determine the Level-of-Service (LOS) values for each intersection movement.

Level-of-Service (LOS) is based on factors such as number and types of lanes, intersection controls such as “STOP” signs or traffic signals, traffic volumes, pedestrian volumes, and other operational features. LOS is expressed as a letter grade, ranging from A through F. In this context, LOS A represents the best conditions, with very little or no average delay to vehicles. LOS F represents the worst conditions, equated with excessive delay to vehicles. **Table 2-10** summarizes the range in LOS as it relates to average vehicle delay at intersections under unsignalized intersections. **Table 2-11** summarizes the range for signalized intersections.

**Table 2-10: Level of Service Criteria for Unsignalized Intersections**

Level of Service	Avg. Delay/ Veh. (Seconds)	Description
A	< = 10	Little or no delay, very low main street traffic
B	> 10 to 20	Short traffic delays, many acceptable gaps
C	> 20 to 25	Average traffic delays, frequent gaps still occur
D	> 25 to 35	Longer traffic delays, limited number of acceptable gaps
E	> 35 to 50	Very long traffic delays, very small number of acceptable gaps
F	> 50	Extreme traffic delays, virtually no acceptable gaps in traffic

SOURCE: Transportation Research Board, Highway Capacity Manual, Special Report 209, 1998.

**Table 2-11: Level of Service Criteria for Signalized Intersections**

Level of Service	Avg. Delay/ Veh. (Seconds)	Description
A	< = 10	Most vehicles do not stop at all. Most arrive during the green phase. Little or no delay.
B	> 10 to 20	More vehicles stop than for LOS A. Still good progression through lights. Short traffic delays.
C	> 20 to 35	Significant number of vehicles stop, although many pass through without stopping.
D	> 35 to 55	Many vehicles stop. Individual signal cycle failures are noticeable. Progression is intermittent.
E	> 55 to 80	Considered to be the limit of acceptable delay. Individual cycle failures are frequent, progression is poor.
F	> 80	Extreme and unacceptable traffic delays.

SOURCE: Transportation Research Board, Highway Capacity Manual, Special Report 209, 1998.

Level-of-Service C is considered by many traffic safety professionals to be the minimum acceptable condition in rural areas, and LOS D is the minimum for urban/ suburban areas. Given the location of this site within the urbanized boundary of southeast Michigan, LOS D was used as the threshold for acceptable delay under existing operations.

**Existing Operations**

The intersection of Hines Drive and Jughandle Road is an unsignalized intersection with the Jughandle Road approach under “STOP” control. Traffic signals along Old M-14 are operating with a 100 second cycle length during both peak periods. The remaining traffic signals are operating with an 80 second cycle length. The discrepancy in cycle length results in a lack of predictable signal progression along Newburgh Road. Delay and LOS information for the existing operations during PM peak conditions can be found in **Table 2-12**. Current operations within the majority of the study area are within acceptable levels of delay during the PM peak period. However, the intersections of Old M-14/Newburgh Road and Hines Drive/Jughandle Road are not within acceptable delay levels.

Sim Traffic, Version 7 was used to evaluate system wide measures of effectiveness. During the PM peak period the study area experiences a total delay of 204.8 hours. The total peak period travel time for the study area is 294.5 hours. This data reflects average values from three simulation runs.

**Table 2-12: Existing Operation Analysis**

Network		Intersection			Approach		
Total Delay (hr.)	Travel Time (hr.)		Delay (Sec.)	LOS		Delay (Sec.)	LOS
204.8	294.5	Old M-14 (Ann Arbor) and Newburgh	55.7	E	NB	43.7	D
					SB	<b>75.5</b>	<b>E</b>
					NEB	52.4	D
					SWB	40.9	D
		Old M-14 (Ann Arbor) and Plymouth	12.1	B	SEB	31.0	C
					NEB	1.1	A
					WB	11.3	B
		Plymouth and Newburgh	26.8	C	NB	9.7	A
					SB	42.6	D
					EB	25.6	C
					WB	21.7	C
		Hines and Newburgh	35.1	D	NB	26.6	C
					SB	43.9	D
					EB	22.5	C
					WB	40.8	D
		Plymouth and Jughandle	14.8	B	NB	20.7	C
					EB	12.7	B
					WB	14.5	B
		Hines and Jughandle	79.3	F	SB	<b>561.9</b>	<b>F</b>
					EB	1.5	A
WB	0.0				A		

### Future Operations (No Build)

In order to analyze future conditions, this study uses 2035 as the design year. Delay, travel time and LOS information for the projected 2035 traffic under PM peak conditions are shown in **Table 2-13**.

**Table 2-13: Future (No Build) Operation Analysis**

Network		Intersection			Approach		
Total Delay (hr.)	Travel Time (hr.)		Delay (Sec.)	LOS		Delay (Sec.)	LOS
291.4	384.3	Old M-14 (Ann Arbor) and Newburgh	64.9	E	NB	46.6	D
					SB	85.6	F
					NEB	83.5	F
					SWB	31.9	D
		Old M-14 (Ann Arbor) and Plymouth	12.3	B	SEB	31.3	C
					NEB	1.1	A
					WB	11.6	B
		Plymouth and Newburgh	29.6	C	NB	9.3	A
					SB	47.8	D
					EB	29.1	C
					WB	23.9	C
		Hines and Newburgh	46.6	D	NB	25.6	C
					SB	42.9	D
					EB	28.7	C
					WB	93.6	F
		Plymouth and Jughandle	16.6	B	NB	17.9	B
					EB	15.6	B
					WB	17.4	B
		Hines and Jughandle	112.0	F	SB	797.1	F
					EB	1.6	A
WB	0.0				A		

The anticipated growth in traffic will have negative impacts on all of the intersections within the study area. During the PM peak period the intersections of Old M-14/Newburgh Road, Hines Drive/Newburgh Road and Hines Drive/Jughandle Road are not within acceptable delay levels. In addition to these three intersections, the southbound approach of the Newburgh Road/Plymouth Road intersection is also not within acceptable delay levels during the PM peak period.

Under future (no build) conditions the study area will experience a total delay of 291.4 hours during the peak period. The total peak period travel time for the study area is 384.3 hours.

## **2.4 Environmental**

The following environmental features have been identified.

### **Social**

The study area is defined primarily by light industrial land uses along the north side of Plymouth Road between Globe Street and Market Street, and recreation/open space along Hines Drive and portions of Newburgh Road and Old M-14, south of Plymouth Road. Commercial and office space are located along Newburgh Road at the north and south ends of the study area and along portions of Plymouth Road at the east end of the study area. Single-family residential areas are limited to the south side of Old M-14 and northwest of the Plymouth Road/Newburgh Road intersections. Some community service land uses are also present in the study area including a church at the northwest corner of the Newburgh Road/Plymouth Road intersection and a church-associated property along Newburgh Road south of Old M-14. Also within the study area is the Wayne County Sheriff mini-station and mounted police force located in the former Newburgh Mill building and adjacent property at the southwest corner of Newburgh Road and Hines Drive.

The City of Livonia's future land use plan retains the majority of the aforementioned existing land uses with only a few revisions. These revisions include expanding the industrial land uses west to Newburgh Road as well as increasing office land uses at the southwest corner of the Newburgh Road/Old M-14 intersection. Future land uses also include a proposed park at the southwest corner of the Newburgh Road/Plymouth Road intersection, according to the City of Livonia School Park Plan, Part V of the Master Plan. The existing land use plan is shown in **Exhibit 2-02**.

### **Parks and Potential Section 4(f) Issues**

The 2,300-acre Hines Parkway, consisting of Hines Park and Hines Drive, and its associated facilities are centrally located in the study area just south of Plymouth Road and intersected by Newburgh Road. The Parkway is owned by Wayne County and is managed by the Wayne County Division of Parks. The approximately 17-mile Hines Drive extends east to west from Dearborn to Northville and passes through Hines Park, which is a flood basin of the Middle Rouge River.

Named for former Wayne County Road Commissioner Edward N. Hines, the Hines Parkway was completed in 1949, although efforts to construct the parkway began in the 1920s. Prior to World War II, the parkway was established as far east as Newburgh Road; after the war, it was extended to its eastern terminus at Ford Road and Rouge Park in Dearborn. This extension included the construction of 18 bridges to serve the parkway and intersecting roads. Within the study area parkway boundaries, the Hines Drive Bridge carries Hines Drive over Old M-14. Southwest of the Hines Drive Bridge over Old M-14, the Middle Rouge River Bridge carries Old M-14 over the Middle Rouge River.

An 8 foot wide asphalt-paved pedestrian pathway is located along the south side of Hines Drive and was newly repaved in 2011. Numerous turnouts and scenic areas are located along Hines Drive as part of Hines Park and one of these small parks, Sumac Pointe, is located within the study area. Located just

west of Newburgh Road, Sumac Pointe is a small scenic park overlooking Newburgh Lake and it contains a playground, picnic shelter, fishing spots and a rest area facility.

In subsequent phases of this study, the various repair alternatives will be evaluated for their respective potential impacts to Section 4(f) resources. Regulations protect public parklands and recreational lands, wildlife refuges and historic sites of federal, state or local significance. These resources are commonly referred to as Section 4(f) properties. All possible measures will need to be taken to avoid potential Section 4(f) impacts however, minor or incidental encroachment may be considered for those alternatives resulting in a "*de minimis* impact" finding.

Section 4(f) regulations are satisfied if it is determined a transportation project would have a "*de minimis* impact" on the Section 4(f) property. The provision allows avoidance, minimization, mitigation and enhancement measures to be considered in making the "*de minimis*" determination. The agencies with jurisdiction must concur in writing with the determination.

Agency consultation will be necessary in the event impacts are contemplated for Section 4(f) resources. For historic sites, consultation with the State Historic Preservation Officer is required. For parklands, consultation with the agency having jurisdiction over the properties is required.

### **Potential Section 6(f) Issues**

A review of recreation grant history was conducted for the Middle Rouge Parkway (Hines Parkway) based on information compiled by the Michigan Department of Natural Resources (April 19, 2010). According to this data, **Table 2-14** was prepared summarizing the recreation grants received by the Wayne County Division of Parks. A total of seven grants were made totaling approximately \$1.475 million. Of these grants, descriptions for four of them include a specific reference to "LWCF sign." Two of these grants, Project No. 26-00597 (1975) and No. 26-00785 (1976), were for the Middle Rouge Bikeway, an 8 foot HMA pathway along the Middle Rouge Parkway. Based on this information, it appears Section 6(f) resources are present within and in the immediate vicinity of the Old M-14 project area.

**Table 2-14: Middle Rouge Parkway (Hines Parkway) Recreation Grant History<sup>1</sup>**

Project Title	Year	Grant Amount	Type
Middle Rouge Bike/Parkway <sup>2</sup>	1966	\$14,849.53	Four standard concrete courts, including backstops and nets, LWCF sign.
Four Parks – Wayne County <sup>2</sup>	1967	\$5,605.51	Install 200 picnic tables, 100 outdoor picnic stoves, 13 stainless steel slides, two kindergarten swing sets, four see-saw units, LWCF sign at Elizabeth Park, John F. Kennedy Park, and Lower and Middle Rouge Parkways.
Middle Rouge Bikeway – Phase II <sup>2</sup>	1975	\$50,018.25	Construct 14.875 feet [sic] of 8 foot asphalt surfaced bike trail along Middle Rouge Parkway and LWCF sign.
Middle Rouge Bikeway <sup>2</sup>	1976	\$50,388.75	Site clearing and landscaping, 3 miles of 8 foot wide asphalt surfaced bikeway, grading, and guard rail, culvert extensions, signing, and LWCF sign.
MRP – Newburgh Pointe Improvement	1990	\$414,750.00	Restoration of comfort station. Building repair, lake front walkway.
Restoration Nankin Mills	1991	\$750,000.00	Develop addition to Nankin Mills for nature center and park offices. Restoration, mechanical, new construction, site improvements, museum equipment/furniture
Middle Rouge Parkway/Picnic Shelter	1992	\$189,750.00	Development of 3 picnic shelters, 3 play shelters in Middle Rouge Parkway (Parkland, Nankin Mills Area, Waterford Bend Area)
Total Grant Amount		\$1,475,362.04	

<sup>1</sup> Michigan Department of Natural Resources Grants Management. "Recreation Grant History." April 19, 2010.

<sup>2</sup> Includes specific reference to Land and Water Conservation Fund (LWCF) sign.

### Architectural History Issues

Under Section 106 of the National Historic Preservation Act of 1966 (as amended), historic properties are generally those more than 50 years of age and listed in or eligible for listing in the National Register of Historic Properties (NRHP) using established criteria. Although detailed plans have not been developed and the study's Area of Potential Effects (APE) cannot be defined at this early study phase, the APE for architectural history resources would likely be much more constrained and limited to an area flanking the limits of disturbance. However, for the purposes of this initial assessment, architectural historians determined that the current study area would be assessed for the presence of historic properties. To accommodate future project design and construction, built resources more than 45 years of age were identified for NRHP evaluations. Other built resources more than 45 years of age may be present within the area directly outside of the study area. When more study information is known and an APE is delineated in consultation with the Michigan State Historic Preservation Office, these resources may need to be considered as well.

The study area contains 14 built resources more than 45 years of age according to City of Livonia GIS data, the National Park Service NRHP database, the Michigan State Register of Historic Sites database, and the National Bridge Inventory Database. Of these 14 resources, three have been evaluated for NRHP and/or state register eligibility: the Middle Rouge River Bridge was previously determined ineligible, the Hines Drive Bridge over Old M-14 was previously determined eligible, and the Newburgh Mill was listed on

the Michigan State Register of Historic Sites. These properties are listed in **Table 2-15** and shown in **Exhibit 2-01**.

**Table 2-15: Historic/Potentially Historic Properties within the Old M-14 Study Area**

Property Name	Location	Construction Date	Status
Hines Parkway	Approximately 0.633 miles of the 17-mile parkway, just west of Jughandle Road to approximately 0.317 miles southeast of Old M-14.	1949	Not Evaluated
Newburgh Mill	37401 Hines Drive	1934	State Register-Listed
Newburgh Dam	Newburgh Road Bridge between Old M-14 and Hines Drive	1933	Not Evaluated
Middle Rouge River Bridge	Old M-14 over Middle Rouge River between Newburgh Road and Plymouth Road	1925	Previously determined not eligible in the National Bridge Inventory
Hines Drive Bridge over Old M-14	Hines Drive over Old M-14 (Ann Arbor Road)	1947	Previously determined eligible for NRHP in the 2006 Michigan bridge inventory
Herc's Prime Beef & Seafood	36685 Plymouth Road	1957	Not Evaluated
Riverside Arena	36635 Plymouth Road	1945	Not Evaluated
Belle Tire	36951 Plymouth Road	1954	Not Evaluated
House	37470 Plymouth Road	1941	Not Evaluated
House	9980 Newburgh Road	1953	Not Evaluated
House	9900 Newburgh Road	1925	Not Evaluated
House	9846 Newburgh Road	1942	Not Evaluated
Lake Pointe Yacht Club	37604 Ann Arbor Road	1928	Not Evaluated
Smokler Rousseau Subdivision	Located north of Ann Arbor Trail, backing onto Riverview Drive	Circa 1950s residential subdivision	Not Evaluated

The presence of eligible or listed historic properties does not preclude project activity. Some project impacts may not constitute adverse effects. Other potential adverse effects may be avoided or minimized with careful project planning. In some instances, adverse effects to historic properties are not avoidable and mitigation is developed to compensate for these adverse effects. Per Section 106 guidelines, appropriate consultation with consulting parties will be conducted.

### Zoning

Existing zoning is shown in **Exhibit 2-03**.

### Wetlands/Streams

Wetlands are present in the study area and directly adjoin the Middle Branch Rouge River, including the immediate vicinity of the Middle Rouge River Bridge. Preliminary boundaries are shown on **Exhibit 2-04**, based on Michigan Department Natural Resources reference map information as determined from the National Wetland Inventory (NWI) and Michigan Resource Inventory System (MIRIS). It should be noted the boundaries shown are inclusive of both mapped wetlands and areas of wetland (hydric) soils, and that field investigations will be required to confirm the actual wetland boundaries.

### Floodplain

There are portions of the 100-year floodplain present within the study area and directly adjoin the Middle Rouge River and Newburgh Lake. Floodplain information was obtained from Federal Emergency Agency (FEMA) and is shown in **Exhibit 2-04**.

### Protected Species

Protected species are known to occur in Wayne County, and include both federal and state-listed species. **Table 2-16** lists the species listed for Wayne County or in the general vicinity of the study area (Sections 29-32). More detailed habitat evaluations would be necessary to make a final determination of occurrence. The status of each species is also noted.

**Table 2-16: Protected Species in Wayne County or Vicinity of Old M-14 Study Area**

Common Name	Scientific Name	State Status	Federal Status	Last Observed Date	Element Category
Rayed Bean <sup>1</sup>	<i>Villosa fabalis</i>	-	Endangered	03-15-2012 <sup>2</sup>	Mussel
Northern Riffleshell <sup>1</sup>	<i>Epioblasma torulosa rangiana</i>	-	Endangered	01-22-1993 <sup>2</sup>	Mussel
Eastern prairie fringed orchid <sup>1</sup>	<i>Platanthera leucophaea</i>	-	Threatened	09-28-1989 <sup>2</sup>	Plant
Indiana Bat <sup>1</sup>	<i>Myotis sodalis</i>	-	Endangered	03-11-1967 <sup>2</sup>	Mammal
Eastern Massasauga <sup>1</sup> (rattlesnake)	<i>Sistrurus catenatus</i>	-	Candidate	-	Reptile
Climbing fumitory <sup>3</sup>	<i>Adlumia fungosa</i>	Special Concern	-	07-09-1929	Plant
Showy orchis <sup>3</sup>	<i>Galearis spectabilis</i>	Threatened	-	07-11-1933	Plant
Smokey rubyspot <sup>3</sup>	<i>Hataerina titia</i>	Special Concern	-	10-14-2010	Insect
Twinleaf <sup>3</sup>	<i>Jeffersonia diphylla</i>	Special Concern	-	1933-SP	Plant
Red Mulberry <sup>4</sup>	<i>Morus rubra</i>	Threatened	-	-	Plant

<sup>1</sup> U.S. Fish and Wildlife Service, last updated March 2012.

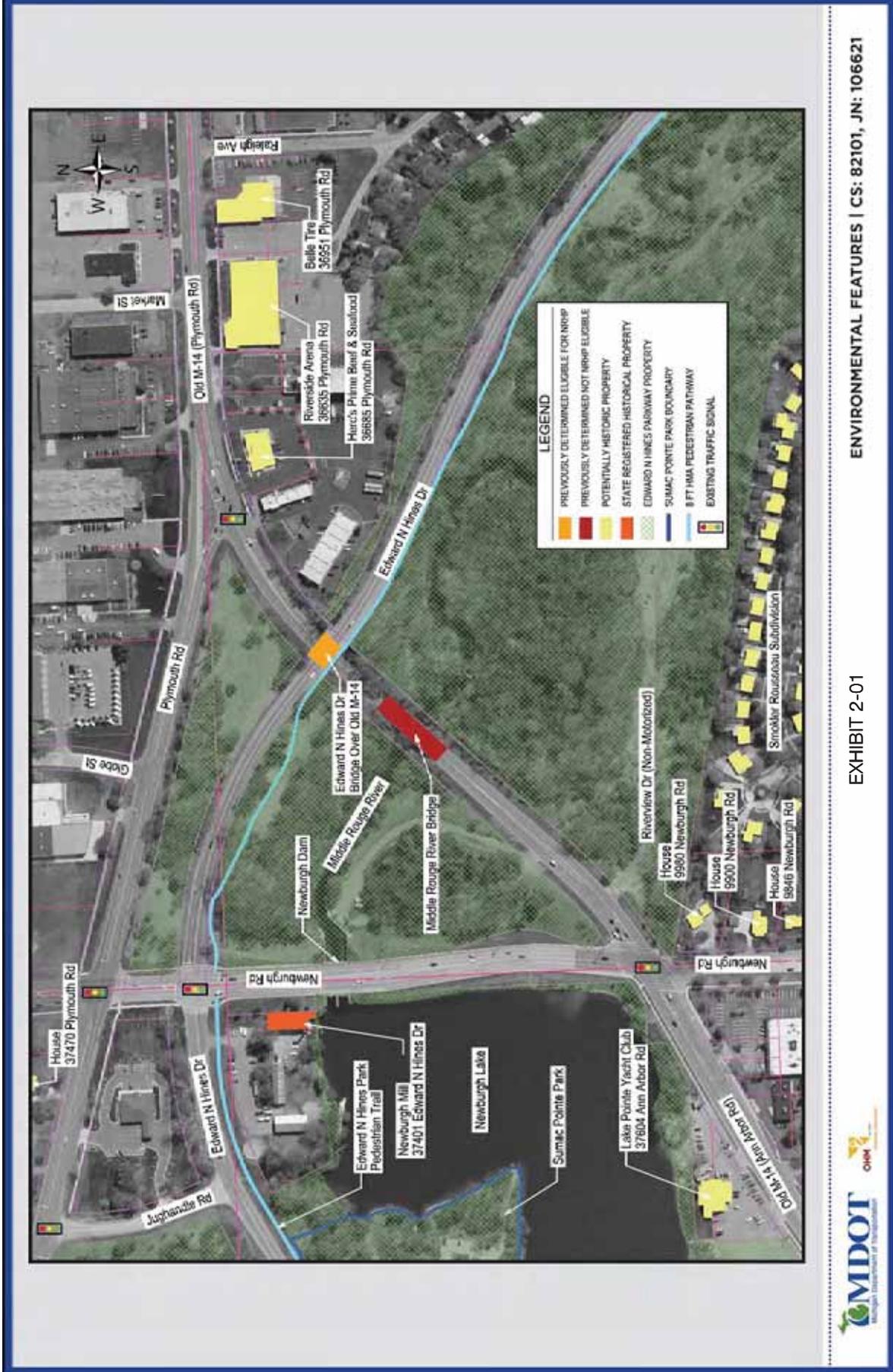
<sup>2</sup> Date listed by the U.S. Fish and Wildlife Service.

<sup>3</sup> Michigan Natural Features Inventory, last updated March 2012.

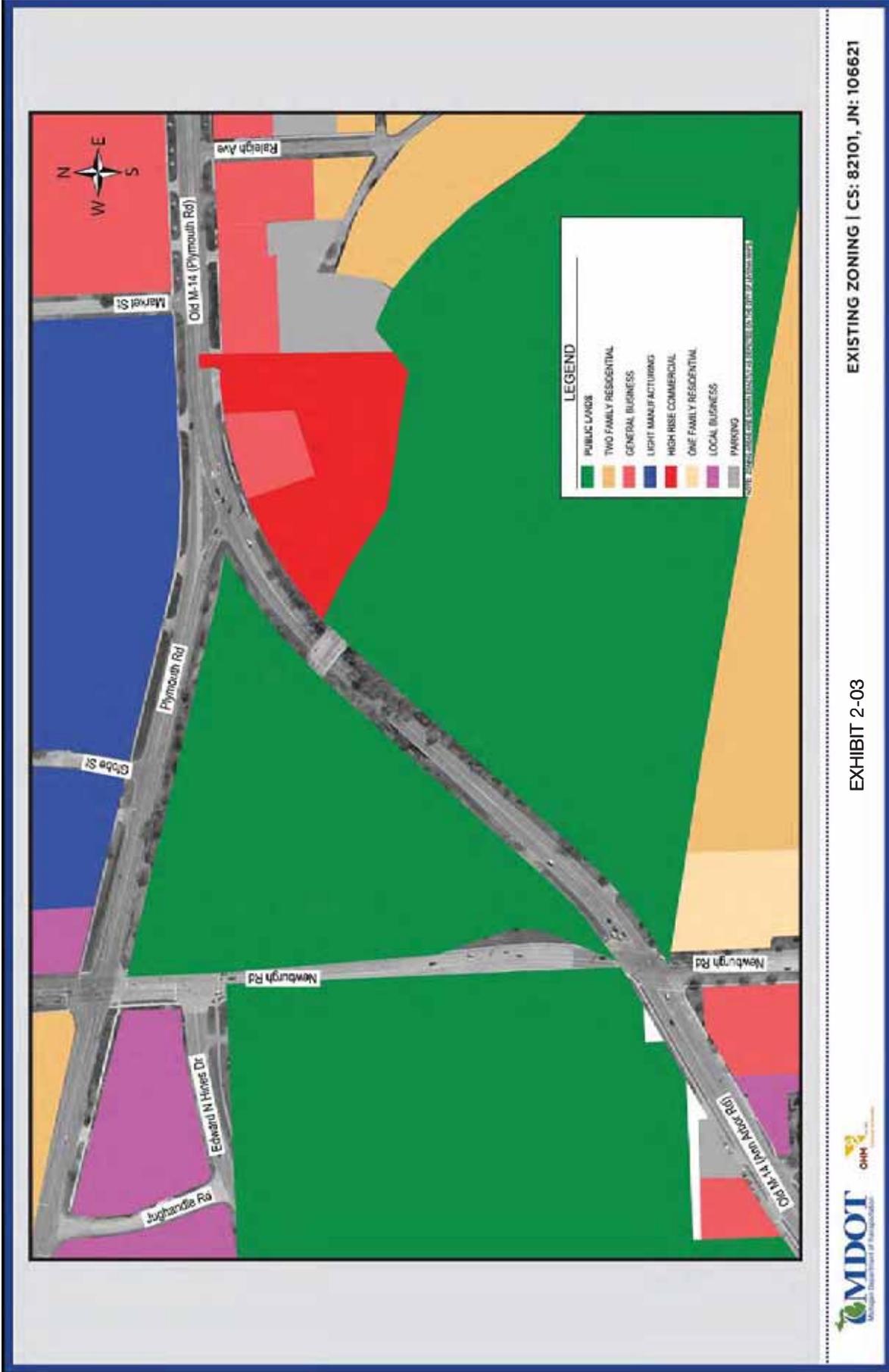
<sup>4</sup> As reported by the Michigan Department of Transportation, June 2012.

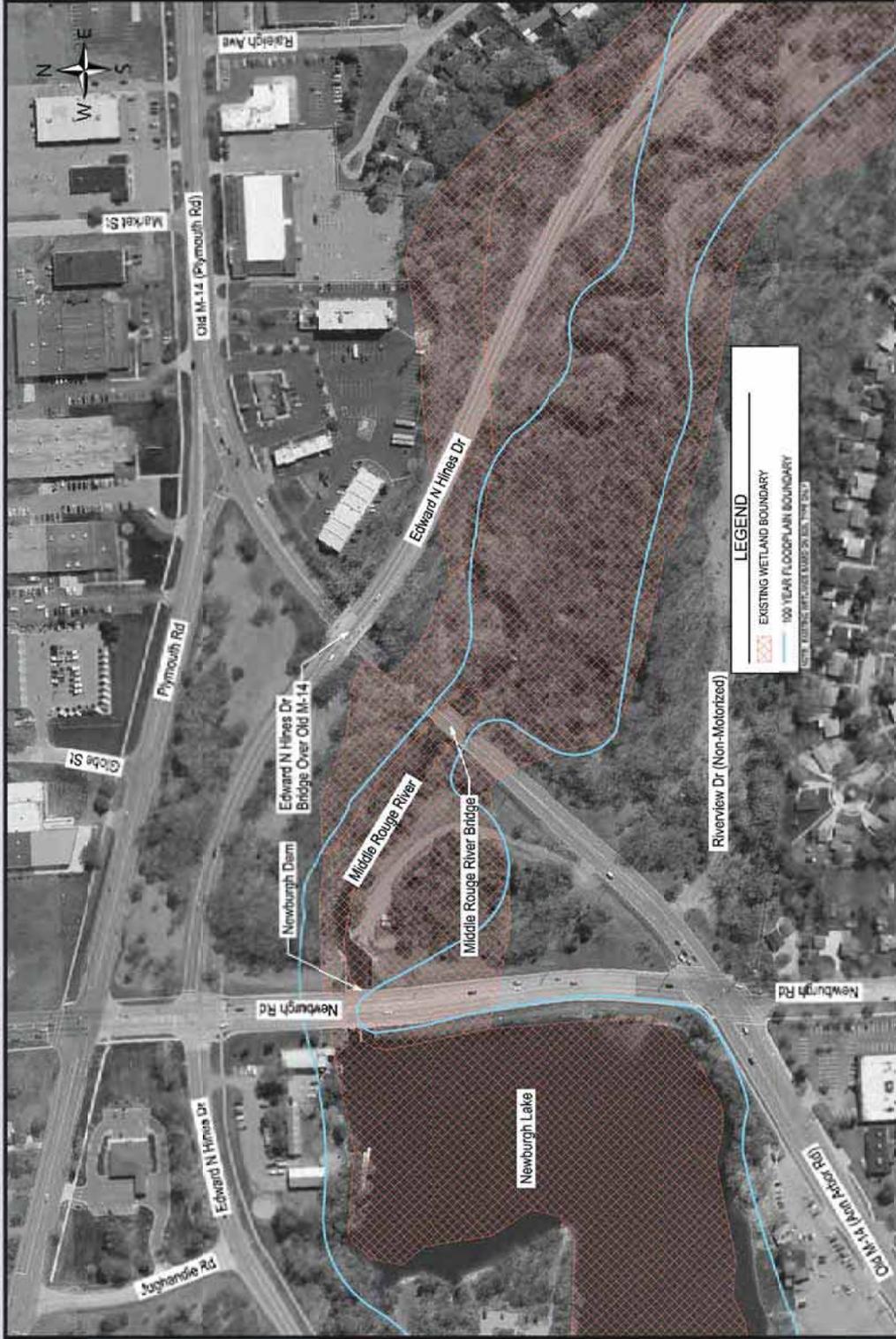
### Visual and Aesthetic Resources

A number of visual and aesthetic resources are present in the study area. Mature wooded vegetation, variable topographic relief and a more natural, undeveloped landscape is present in the eastern half of the study area, particularly in the Hines Parkway. In many instances, views along Hines Drive and Old M-14 are confined and relatively short in distance. West of Newburgh Road, the landscape becomes more open and dominated by the presence of Newburgh Lake. In this area, more extensive vistas are present from Hines Drive, Newburgh Road and Old M-14, though scattered commercial is more prominent along Plymouth Road to the north and Old M-14 to the south.









WETLANDS AND 100 YEAR FLOOD PLAIN | CS: 82101, JN: 106621

EXHIBIT 2-04



## 3.0 ALTERNATIVES EVALUATED

As part of this study, alternatives were developed, evaluated and refined to “Practical Alternatives.” The following section provides an overview of the process used to determine the Practical Alternatives presented in **Section 4**.

### 3.1 Methodology

A variety of conceptual alternatives of potential rehabilitation improvements were developed for the study area. These alternatives ranged from a simple rehabilitation of Old M-14 (Ann Arbor Road) to a full reconstruction and reconfiguration of the route. The conceptual alternatives were evaluated based on specific criteria developed throughout the study and through Steering Committee involvement to determine which alternatives should be moved forward in the study process. The remaining alternatives, known as “Illustrative Alternatives,” were further evaluated according to the established criteria, presented to the Steering Committee and further reduced to initial “Practical Alternatives.” These were then evaluated and presented to the public. A February 2011 *Illustrative Alternatives Assessment Report* and March 2012 *Old M-14 Reduction of Alternatives Memo*, included in the Appendices, detail the alternatives evaluation process. From this evaluation process, four final Practical Alternatives were selected.

#### Conceptual Alternatives

The conceptual alternatives presented at the first Steering Committee Meeting are described below:

- ▼ **Alternative 1A** – Mill and Overlay – Maintain existing lane configuration and alignment.
- ▼ **Alternative 1B** – Mill and Overlay – Widen to five 12 foot lanes centered on the existing alignment.
- ▼ **Alternative 2A** – Reconstruct Old M-14 – Re-align and widen to five 12 foot lanes.
- ▼ **Alternative 2B** – Reconstruct Old M-14 on the existing alignment and re-align Plymouth Road to “T” into Old M-14.
- ▼ **Alternative 2C** – Reconstruct and re-align Old M-14 to “T” into Plymouth Road.
- ▼ **Alternative 3** – Reconstruct Old M-14 with a signalized intersection at Old M-14 and Hines Drive.
- ▼ **Alternative 4** – Reconstruct Old M-14 with roundabout intersections at Hines Drive and at Plymouth Road.
- ▼ **Alternative 5** – Reconstruct Old M-14 with a five legged roundabout, consisting of Old M-14, Hines Drive and Plymouth Road.
- ▼ **Alternative 6** – Remove Old M-14 from Newburgh Road to Plymouth Road, provide a grade separation of Hines Drive over Newburgh Road, and construct roundabouts at the Newburgh Road/Plymouth Road and Newburgh Road/Old M-14 intersections.
- ▼ **Alternative 7** – Remove Old M-14 from Newburgh Road to Plymouth Road and remove Hines Drive from Jughandle Road to Globe Street.
- ▼ **Alternative 8** – Reconstruct Old M-14 and Plymouth Road as one-way roads from Newburgh Road to Market Street and provide a grade separation at Hines Drive over Newburgh Road.

## 3.2 Refinements of Alternatives

### Conceptual Alternatives

The conceptual alternatives were evaluated based on the goals, key strategies, benefits/impacts and Steering Committee input. The following alternatives were eliminated for reasons described below:

- ▼ **Alternative 1A** – Eliminated based on pavement design life and MDOT C&T direction supporting a pavement reconstruct.
- ▼ **Alternative 1B** – Eliminated based on pavement design life and MDOT C&T direction supporting a pavement reconstruct.
- ▼ **Alternative 4** – Eliminated based on potential impacts to Hines Park due to the size of the intersection footprint. This alternative also incorporated two closely spaced roundabouts which is an intersection configuration that would be unique and unexpected for users within this and the surrounding traffic corridors.
- ▼ **Alternative 5** – Eliminated due to the roundabout size and realignment of Old M-14 impacts to City of Livonia property and Hines Park. The proposed realignment of Old M-14 also impacts the currently undisturbed natural features of the Middle Rouge River. Finally, the geometric configuration and the intersection treatment, a roundabout with 5 entry and exit points, will alter how users are accustomed to traversing the study area.
- ▼ **Alternative 7** – Eliminated due to the impact to City of Livonia park/recreational property and Hines Park as well as potential development on Plymouth Road. The realignment of Jughandle Road, Hines Drive and the footprint required for the roundabouts has a greater impact to these facilities than the other alternatives. The roundabout intersection treatments result in three new roundabouts on Plymouth Road which changes the nature expectations for users of this county road.

After the initial alternatives were evaluated, six alternatives were chosen by the Steering Committee and further evaluated. These alternatives are depicted on **Exhibit 3-01 to Exhibit 3-08**.

Intersections for each alternative were designed with a minimum Level-of-Service (LOS) of C. The LOS is based on guidance from AASHTO's 2004 Geometric Design of Highways and Streets, Exhibit 2-32. Alternatives 6 and 8 include sub-alternatives depicting signalized intersections in place of roundabouts. The refined alternatives and sub-alternatives are described below:

- ▼ **Alternative 2A – Reconstruct Old M-14, re-align and widen to five 12 foot lanes**  
Alternative 2A will provide LOS B at the Plymouth Road/Old M-14 intersection and would re-align Old M-14.
- ▼ **Alternative 2B – Reconstruct Old M-14, re-align Plymouth Road to “T” into Old M-14**  
Alternative 2B will provide LOS B at the Plymouth Road/Old M-14 intersection and would re-align Plymouth Road to “T” into Old M-14.
- ▼ **Alternative 2C – Reconstruct Old M-14, re-align to “T” into Plymouth Road**  
Alternative 2C will provide LOS B at the Plymouth Road/Old M-14 intersection and would re-align Old M-14 to “T” into Plymouth Road.
- ▼ **Alternative 3 – Reconstruct Old M-14 with signalized intersection at Hines Drive and Plymouth Road**  
Alternative 3 will provide LOS B at both the Old M-14/Hines Drive and Old M-14/Plymouth Road intersections and would replace the Hines Bridge over Old M-14 with a signalized at-grade intersection.

▼ **Sub-Alternative 6 (Single Roundabout (RAB)) – Remove Old M-14 from Newburgh Road to Plymouth Road**

Alternative 6 (Single RAB) will provide LOS B at the Newburgh Road/Plymouth Road and Newburgh Road/Old M-14 Intersections. Hines Drive will be grade separated over Newburgh Road. The Middle Rouge River Bridge could be eliminated as well as the Hines Bridge with the removal of Old M-14 from Newburgh Road to Plymouth Road.

▼ **Sub-Alternative 6 (Signals) – Remove Old M-14 from Newburgh Road to Plymouth Road**

Alternative 6 (Signals) will provide LOS C at the Newburgh Road/Plymouth Road, Newburgh Road/Hines Drive, and Newburgh Road/Old M-14 Intersections and also at the Jughandle Road/Plymouth Road Intersection. The Middle Rouge River Bridge could be eliminated as well as the Hines Bridge, with the removal of Old M-14 from Newburgh Road to Plymouth Road.

▼ **Alternative 8 (Single RAB) – Reconstruct Old M-14 and Plymouth Road as one-way roads from Newburgh Road to Market Street.**

Alternative 8 (Single RAB) will provide a LOS B at the Newburgh Road/Plymouth Road, Newburgh Road/Hines Drive, and Newburgh Road/Old M-14 intersections. Hines Drive will be grade separated over Newburgh Road.

▼ **Sub-Alternative 8 (Signals) – Reconstruct Old M-14 and Plymouth Road as one-way roads from Newburgh Road to Market Street.**

Alternative 8 (Signals) will provide a LOS C at the Newburgh Road/Plymouth Road, Newburgh Road/Hines Drive, and Newburgh Road/Old M-14 Intersections and also at the Jughandle Road/Plymouth Road intersection.

The refined alternatives are depicted in illustrated exhibits on the following pages:

**Illustrative Alternative 2A: Reconstruct Old M-14 - Re-Align and Widen to Five - 12 ft Lanes**



EXHIBIT 3-01

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621



**Illustrative Alternative 2B: Reconstruct Old M-14 on Existing Alignment - Realign Plymouth Road to "T" into Old M-14**



EXHIBIT 3-02

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621



**Illustrative Alternative 2C: Reconstruct and Realign Old M-14 to "T" into Plymouth Road**



EXHIBIT 3-03

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621



**Illustrative Alternative 3: Reconstruct Old M-14 with Signalized Intersection at Old M-14 and Hines Dr**



EXHIBIT 3-04

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621



Illustrative Alternative 6 (Roundabout): Remove Old M-14 from Newburgh Road to Plymouth Road. | Grade Separate Hines Road over Newburgh Road



MDOT  
Michigan Department of Transportation

EXHIBIT 3-05

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621

Illustrative Sub-Alternative 6 (Signalized): Remove Old M-14 from Newburgh Road to Plymouth Road | Grade Separate Hines Road over Newburgh Road



MDOT Michigan Department of Transportation

EXHIBIT 3-06

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621

Illustrative Alternative 8 (Roundabout): Reconstruct Old M-14 and Plymouth Road as One Way from Newburgh Road to Market Street. | Grade Separate Hines Road over Newburgh Road



EXHIBIT 3-07

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621



Illustrative Sub-Alternative 8 (Signalized): Reconstruct Old M-14 and Plymouth Road as One Way from Newburgh Road to Market Street | Grade Separate Hines Road over Newburgh Road

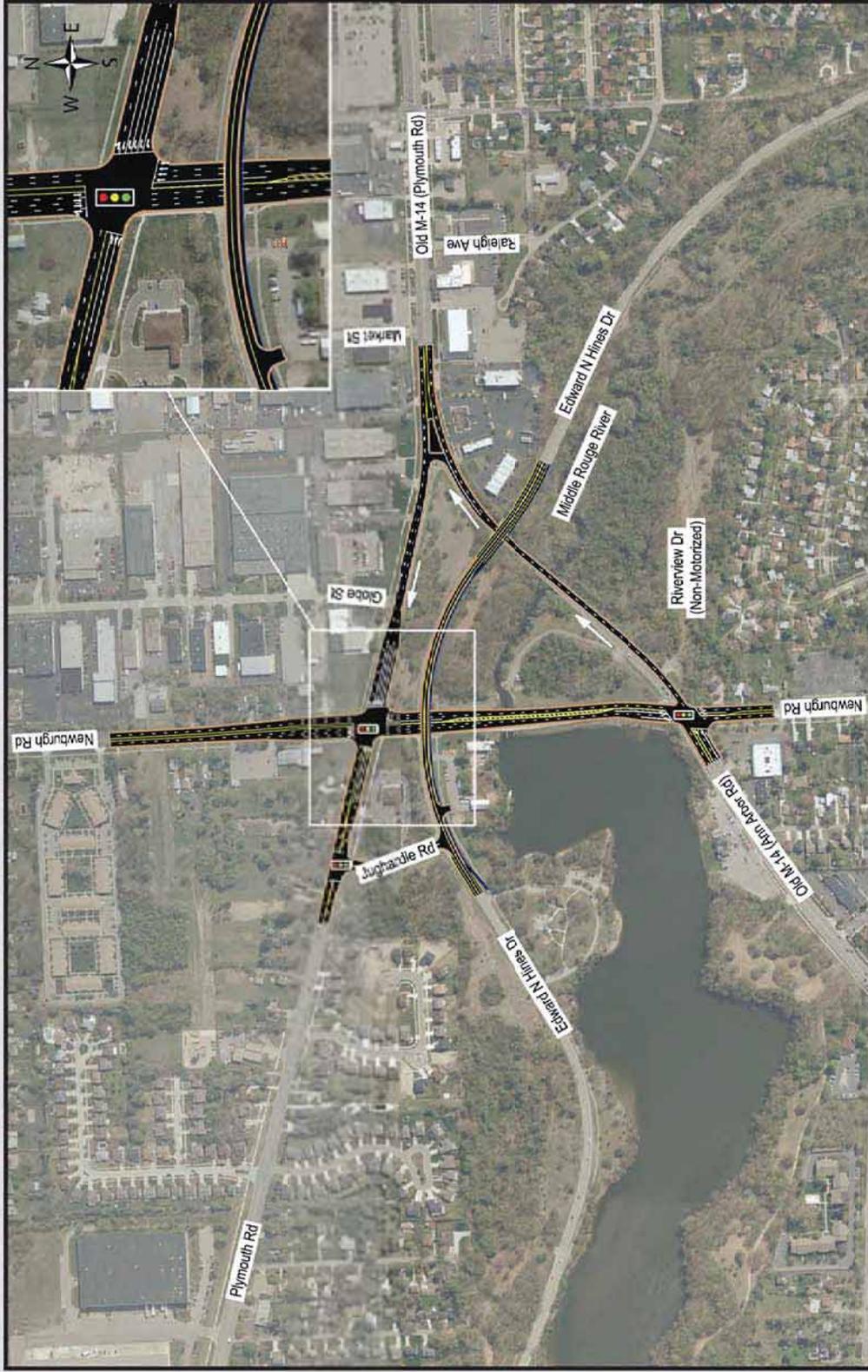


EXHIBIT 3-08

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621



### **3.3 Illustrative Alternatives Evaluation**

The Illustrative Alternatives were further evaluated and presented at a second Steering Committee meeting. From the Steering Committee meeting, five alternatives were chosen to further refine and evaluate for presentation at the first public meeting. The March 2012 *Old M-14 Reduction of Alternatives Memo* summarize the findings of the evaluation and public input. The five alternatives evaluated in the memo are described below:

- ▼ **Alternative 2A** – Reconstruct Old M-14 (Ann Arbor Road) with only minor geometric changes
- ▼ **Alternative 2B** – Reconstruct Old M-14 (Ann Arbor Road) and “T” Plymouth Road into Old M-14
- ▼ **Alternative 2C** – Reconstruct Old M-14 (Ann Arbor Road) and “T” Ann Arbor Road into Plymouth Road
- ▼ **Alternative 3** – Reconstruct Old M-14 (Ann Arbor Road) and create an at-grade, signalized intersection at Old M-14 and Hines Drive
- ▼ **Alternative 6** – Remove the Old M-14 (Ann Arbor Road) roadway segment from Newburgh Road to Plymouth Road, grade-separate Hines Drive over Newburgh Road

The four alternatives chosen for final evaluation and study are:

- ▼ **Alternative 2A** – Reconstruct Old M-14 (Ann Arbor Road) with only minor geometric changes
- ▼ **Alternative 2B** – Reconstruct Old M-14 (Ann Arbor Road) and “T” Plymouth Road into Old M-14
- ▼ **Alternative 2C** – Reconstruct Old M-14 (Ann Arbor Road) and “T” Ann Arbor Road into Plymouth Road
- ▼ **Alternative 3** – Reconstruct Old M-14 (Ann Arbor Road) and create an at-grade, signalized intersection at Old M-14 and Hines Drive.

## 4.0 PRACTICAL ALTERNATIVES

Four Practical Alternatives that were chosen for continuation in the study are detailed in the following section. Benefits and impacts based on the proposed geometry are described for each alternative.

### 4.1 Description of Practical Alternatives

After completion of the evaluation process, four alternatives selected for final analysis and became the Practical Alternatives. The Practical Alternatives were developed in more detail based on Michigan Department of Transportation (MDOT) and Federal Highway Administration (FHWA) guidance. The following are key features developed with each alternative:

- ▶ Geometry
- ▶ Pedestrian Accessibility
- ▶ Capacity Improvements
- ▶ Safety Improvements
- ▶ Structural Improvements

### 4.2 Alternative 2A

Reconstruct Old M-14 (Ann Arbor Road) from west of Newburgh Road to Market Street, shifting the alignment to improve sight distance. Replace two structures and reconstruct a portion of Hines Drive. This alternative is depicted in **Exhibit 4-01**.

#### Roadway

##### Horizontal Alignment

Starting 180 feet west of the Newburgh Road intersection, this alternative follows the existing Old M-14 alignment to the Middle Rouge River Bridge. From this point the alignment shifts north over the Middle Rouge River Bridge, under the Hines Drive Bridge and ties back into the existing Old M-14 alignment 100 feet west of Market Street. Hines Drive, Plymouth Road and Newburgh Road follow their existing alignments.

##### Vertical Alignment

Old M-14, Newburgh Road and Plymouth Road follow their existing vertical alignment. Beginning 200 feet east of Newburgh Road, the vertical alignment of Hines Drive is raised from zero feet to 3.6 feet above the existing vertical alignment at the existing Hines Drive Bridge. The proposed Hines Drive ties into the existing vertical alignment 475 feet east of the Hines Drive Bridge.

#### Roadway Cross Section

**Table 4-01: Proposed Cross Section**

Roadway	Proposed Laneage	Proposed Turn Lanes	Road Width (ft)	Proposed Edge of Pavement Treatment
Old M-14 (Ann Arbor Road)*	4	1	60	Curb and Gutter
Hines Drive	2	0	24	10 ft Paved Shoulder
Newburgh Road*	4	1	60	Curb and Gutter
Plymouth Road	4	0	48	Curb and Gutter

\* Note: The intersection of Old M-14 and Newburgh Road includes a 12 foot right turn lane at the north, south and west approaches.

#### Pathway

The Hines Drive hot mix asphalt (HMA) pathway and on street bike lanes traverse this study area. This alternative widens the pathway from 8 feet to 10 feet and provides a connection to the pedestrian access route along Old M-14.

## Pedestrians

Concrete sidewalk currently exists intermittently along Old M-14 and Newburgh Road. There is an existing concrete sidewalk on both sides of Plymouth Road, east of the Plymouth intersection with Old M-14. This alternative provides a 7 foot pedestrian access route attached to the curb between Newburgh Road and Plymouth Road and fills in the sidewalk gaps along Newburgh Road. As mentioned above, a connection to the Hines Drive pathway is provided at the Hines Drive Bridge.

## Drainage

A preliminary drainage evaluation was completed for the storm systems located within the limits of this alternative. Based on analysis of the drainage area, the existing storm system and outlets have adequate capacity and will be replaced in kind. Drainage Best Management Practices (BMPs) will also need to be considered for any storm outlets into the Middle Rouge River during the design phase.

## Proposed Right-of-Way (ROW)

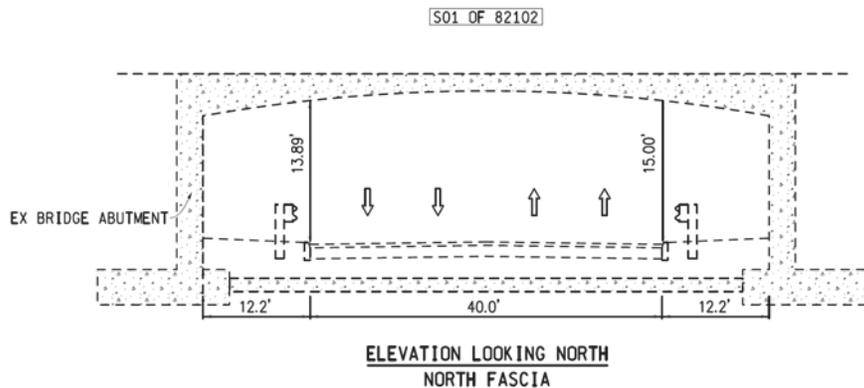
This alternative requires proposed ROW at multiple locations. Due to safety and capacity improvements of the Old M-14/Newburgh Road intersection, proposed ROW will be required in the NE, NW and SE quadrant from parcels 121-99-0023-000, 126-99-0014-000 and 126-99-0013-000 respectively. Proposed ROW will also be required on the north side of Old M-14 from the Plymouth Road/Old M-14 intersection to 330 feet south, from parcel 115-99-0001-000. Proposed ROW will also be required in the SE quadrant from parcels 126-99-0008-000 and 126-01-0733-000 from the addition of a right turn lane and sidewalk. Additional grading permits will be required based on the proposed construction limits. The potential proposed ROW and grading is depicted in **Exhibit 4-01**. Costs for ROW will be determined during the design phase.

## Structures

As part of the reconstruction of Old M-14 between Newburgh Road and Plymouth Road the Hines Drive over Old M-14 (S01 of 82101) structure and Old M-14 over the Middle Rouge River (B03 of 82101) structure will be replaced.

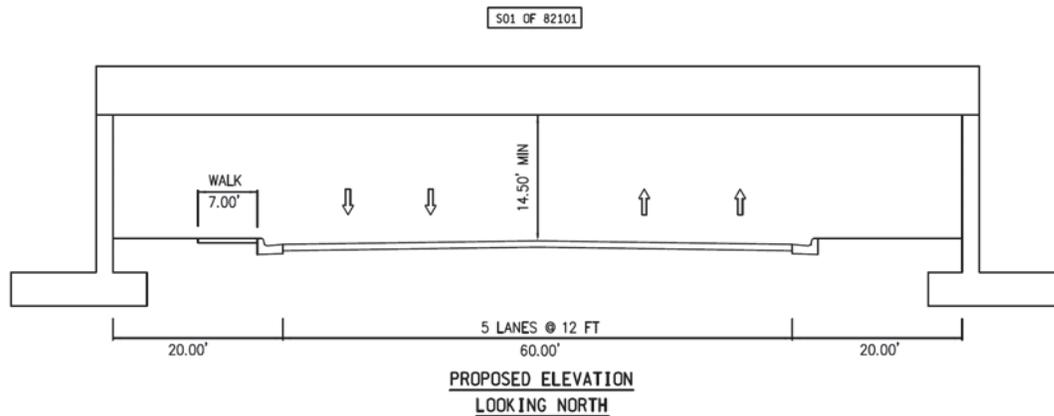
### Hines Drive over Old M-14 (S01 of 82101)

The existing structure carrying Hines Drive over Old M-14 is an aging structure with some deterioration and is proposed to be replaced as part of this alternative. The existing vertical clearance of the structure is 13.89 feet at the west edge of metal of the north fascia. The existing structure has an arch shape on the underside, which depending on the cross slope of the road under, reduces the vertical clearance at the vertical walls. The required vertical clearance for this grade separation is 14.5 feet (according to the Michigan Bridge Design Manual (MBDM) 7.01.08). To obtain this clearance, Old M-14 will need to be lowered. From existing plans, the existing vertical wall foundations have approximately 3.4 feet of cover and there are existing struts under Old M-14 connecting the two vertical walls. Lowering Old M-14 could impact the struts, reduce the amount of cover over the foundations and have structural implications. The existing underclearance of S01 of 82101 and clear width are depicted in **Figure 4-01**.



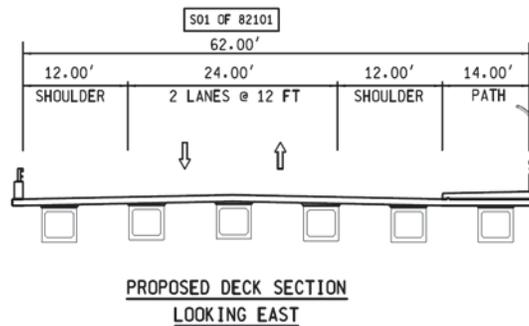
**Figure 4-01**

The existing structure has a span of 64.4 feet over Old M-14. To place the abutments outside the clear zone of Old M-14, the length of the proposed structure is approximately 100 feet as shown in **Figure 4-02**.



**Figure 4-02**

The speed limit on Hines Drive is 40 mph, which does not require pedestrians to be separated from the travel lanes by a barrier. If there is a desire to separate the pedestrians and vehicles, the clear roadway width would need to be increased by the width of a barrier wall (approximately 1.5 feet). The clear width of the proposed structure carrying Hines Drive over Old M-14 required to include two 12 foot lanes, two 12 foot shoulders, and a 14 foot bike path is 62 feet, as depicted in **Figure 4-03**. The required clear roadway width on Hines Drive is 62 feet. The existing width is 64.3 feet.

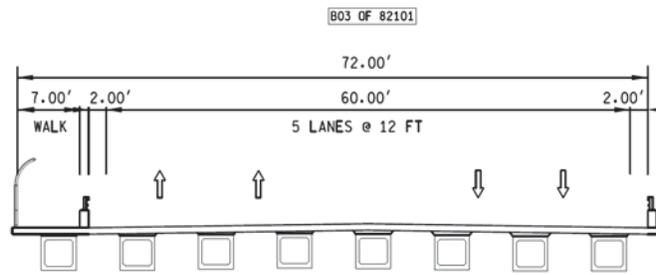


**Figure 4-03**

### Old M-14 over Middle Rouge River (B03 of 82101)

The existing structure for Old M-14 over Middle Rouge River is a filled spandrel arch. Due to the proposed geometry of this alternative, this structure will require replacement.

The existing clear roadway width from face of barrier to face of barrier is 41.3 feet. The proposed cross section requires a clear roadway width of 72 feet to accommodate five 12-foot lanes, two 2-foot shoulders and a 7-foot pedestrian walkway separated by barrier, shown in **Figure 4-04**.



**PROPOSED DECK SECTION  
LOOKING NORTH**  
**Figure 4-04**

### Hydrology

The analysis performed indicates an improved condition with the proposed geometry for the 1% chance (100-year) storm event, as detailed in the Old M-14 Hydraulic Report, included in the Appendices.

### Retaining Walls

The reconstruction of the Old M-14 and Newburgh Road intersection will incorporate a center turn lane and right turn lane for the north leg on Newburgh Road. The wider road cross section necessitates the use of a retaining wall in the northwest quadrant of the Newburgh/Old M-14 intersection to prevent the road cross section from encroaching on Newburgh Lake.

Retaining wall options include a wire mesh face reinforced earth or other mechanically stabilized earth system (MSE), modular block wall or a cast in place concrete wall. The type of wall system will depend on the soil condition found during the design phase. Geotechnical analysis will be critical in determining the stability of retaining wall types in the area of the lake. Generally the modular block walls and MSE walls are cost effective wall systems if soil condition are found to be stable. A poured in place wall, while generally more expensive, can be placed on piles, if necessary for stability.

### Traffic Operations

Alternative 2A includes the reconstruction of Old M-14 with adjustments to the alignment and lane widths. This alternative includes the provision of a common signal cycle length and coordination between MDOT and local agency signals. Delay, travel time and Level-of-Service (LOS) information for Alternative 2A can be seen in **Table 4-02**.

The capacity analysis for this alternative followed the same procedure used for the analysis of existing conditions. The analysis was performed according to the methodologies published in the Highway Capacity Manual, 2000 Edition. For this project Synchro, Version 7 software was used to conduct the analysis. The capacity analysis was performed for the PM peak hour.

**Table 4-02: Alternative 2A Operation Analysis**

Network		Intersection			Approach		
Total Delay (hr.)	Travel Time (hr.)		Delay (Sec.)	LOS		Delay (Sec.)	LOS
283.6	376.9	Old M-14 (Ann Arbor) and Newburgh	33.5	C	NB	28.5	C
					SB	31.8	C
					NEB	<b>49.3</b>	<b>D</b>
					SWB	29.6	C
		Old M-14 (Ann Arbor) and Plymouth	12.3	B	SEB	33.2	C
					NEB	2.2	A
					WB	10.5	B
		Plymouth and Newburgh	28.7	C	NB	5.9	A
					SB	<b>45.7</b>	<b>D</b>
					EB	33.9	C
					WB	26.7	C
		Hines and Newburgh	<b>45.0</b>	<b>D</b>	NB	25.9	C
					SB	<b>52.0</b>	<b>D</b>
					EB	26.1	C
					WB	<b>72.2</b>	<b>E</b>
		Plymouth and Jughandle	16.6	B	NB	17.9	B
EB	15.6				B		
WB	17.4				B		
Hines and Jughandle	<b>68.5</b>	<b>F</b>	SB	<b>485.9</b>	<b>F</b>		
			EB	1.6	A		
			WB	0	A		

During the PM peak period the intersections of Hines Drive/Newburgh Road and Hines Drive/Jughandle Road will continue to operate with delay levels in excess of the minimum acceptable condition of LOS C. The unsignalized intersection of Hines Drive/Jughandle Road will continue to operate with excessive delays as show in **Table 4-02**.

The southbound approach of the Newburgh Road/Plymouth Road intersection and the northeastbound approach of the Old M-14/Newburgh Road intersection are also not within acceptable delay levels during the PM peak period.

Under the proposed condition of this alternative, the study area will experience a total system delay of 283.6 hours during the peak period. The total PM peak travel period time for the study area is 376.9 hours, an improvement of 7.4 hours over the system conditions of the future (2035 no build) operations.

**Safety**

A high number of head on left type crashes were noted at the Old M-14/Newburgh Road intersection and attributed to the absence of left turn lanes. To improve safety at this intersection, a 12 foot left turn lane is proposed at the north and south approach. There were no other safety concerns identified within the study area.

## Maintenance of Traffic (MOT)

All MOT concepts considered for this alternative are summarized in the *Old M-14 MOT Analysis Memo* included in the Appendices. The preferred option for this alternative is described below.

### Old M-14

Old M-14 is anticipated to be constructed under a complete closure. This option will allow construction to be completed in one construction season. The cost to construct the Old M-14 over Middle Rouge River Bridge as a full closure is an approximate reduction of \$480,000 over part width construction, which would also necessitate two construction seasons to complete.

To facilitate a full closure of Old M-14, the detour route is a hybrid of local and state roads. This detour utilizes a portion of local roadways, though it is not expected to require temporary improvements or signal modifications to implement. The detour route is depicted in **Exhibit 4-05**.

### Hines Drive

Hines Drive is anticipated to be constructed part width. This will allow construction to proceed quickly, while not impeding recreational access along the park corridor. This option balances time of construction and cost-effectiveness with the value of maintaining pedestrian access and avoiding a lengthy pedestrian detour.

## Environmental

A summary of potential environmental impacts and mitigation is provided in the following section. **Exhibit 4-07** provides a summary of the potential environmental impacts.

### Land Use and Zoning

It is anticipated that this alternative will not change existing land use and zoning patterns in the area and should have no impact on future development plans as existing traffic patterns remain generally unchanged.

### Parklands and Special Lands

The widening of Old M-14, the reconstruction of the Middle Rouge River Bridge, and the construction of a new seven foot pedestrian route will require ROW acquisition and will represent an encroachment onto park property under Section 4(f). The existing pedestrian route along Edward N. Hines Drive is a Section 6(f)-eligible property; however, construction activities would not represent a use of the property as the pedestrian route would not be altered. The widening of Old M-14, construction of a seven foot pedestrian route, and the reconstruction of the Middle Rouge River Bridge represents an approximately 1.3 acre encroachment, outside of the existing ROW, into park property. This alternative will require consultation to be initiated for a possible *de minimis* finding with the official with jurisdiction.

### Architectural History

This alternative will likely have an adverse effect to the previously determined National Register of Historic Places (NRHP)-eligible Edward N. Hines Drive Bridge, due to reconstruction and re-grading to raise the new structure three feet. Reconstruction and re-grading will alter the structure's original physical features and setting that contribute to its historic significance and has the potential to adversely affect Edward N. Hines Parkway, which includes the roadway and the structure. Based on preliminary research and field survey, the Edward N. Hines Parkway appears to be eligible for the National Register of Historic Places (NRHP); however a formal determination of eligibility will need to be completed and coordinated with the Michigan State Historic Preservation Office (SHPO) prior to the commencement of construction activities.

A formal Section 106 review will be required prior to the commencement of construction activities to formally determine the eligibility of the parkway and to assess effects to each of the NRHP-eligible properties in consultation with the SHPO. Specific mitigation would be developed at that time for any identified adverse effects. Typical mitigation for structure replacement projects is recordation of the

structure to be replaced, including a narrative and context description, and photographs. The presence of eligible or listed historic properties does not preclude project activity.

Mitigation concepts that could be used in the next phase of study to resolve adverse effects to historic properties include:

- ▶ Recordation of buildings and structures, such as HABS/HAER/HALS documentation (may be applicable for the replacement of the Edward N. Hines Drive Bridge).
- ▶ Redesign of projects to preserve specific characteristics of cultural resources.
- ▶ Relocation of buildings and structures.
- ▶ Creation and implementation of maintenance and management plans.
- ▶ Donation of easements.
- ▶ Establishing historic preservation funds to support specific preservation purposes.
- ▶ Installation and maintenance of interpretive features.
- ▶ Public education and outreach programs.
- ▶ Intentional and monitored deterioration.
- ▶ Establish managed open space.

Per Section 106 guidelines, consultation with the Michigan State Historic Preservation Office will be required to complete a formal Section 106 review in order for the project to proceed to construction. At that time, appropriate mitigation will be developed for adverse effects to historic properties.

### **Wetlands/Streams**

It is expected that this alternative will have an impact to wetlands in the project vicinity due to the widening of Old M-14 to five 12-foot lanes, the Middle Rouge River Bridge reconstruction, and construction of a new pedestrian route within existing wetlands boundaries. Wetland delineation will be required to determine the type and extent of wetland impacts. Coordination with the Michigan Department of Environmental Quality (MDEQ) will be necessary to permit bridge reconstruction.

### **Floodplain**

It is expected that this alternative will encroach on the 100 year floodplain at the Middle Rouge River. Coordination with the MDEQ will be necessary to permit bridge reconstruction.

### **Endangered Species**

The Michigan Natural Features Inventory has confirmed ten historical records of occurrence in the project vicinity indicating the presence of protected species in the general vicinity of the project (see **Table 2-16**). Field surveys will be required to identify what species or habitats may be present and affected.

### **Visual and Aesthetic Resources**

It is anticipated that this alternative will not impact existing wooded vegetation, the variable topography and the more natural, undeveloped landscape that characterizes the project area as most of the project plans are confined to the existing ROW. In areas where additional ROW will be acquired, the changes to the landscape would not be inconsistent with the character of the existing landscape.

### **Hazardous Materials**

A preliminary Potential Area of Contamination Survey (PACS) has been completed. There were no specific locations of contamination identified within the area of this alternative.

### **Cost**

The potential construction cost of this alternative is \$10.1 million for an HMA section and \$10.2 million for a concrete section. These costs include inflation for an expected construction year of 2015, however the costs do not include potential ROW. The pavement design memo is included in the Appendices.

**Alternative 2A:Reconstruct Old M-14 (Ann Arbor Rd) - Re-Align and Widen to Five - 12 ft Lanes**



EXHIBIT 4-01

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621



### 4.3 Alternative 2B

Reconstruct Old M-14 (Ann Arbor Road) from west of Newburgh Road to Market Street on the existing alignment. “T” Plymouth Road into Old M-14, replace two structures, and reconstruct a portion of Hines Drive. This alternative is depicted in **Exhibit 4-02**.

#### Roadway

##### Horizontal Alignment

Starting 180 feet west of the Newburgh Road intersection, this alternative follows the existing Old M-14 alignment and ends at Market Street. Hines Drive and Newburgh Road follow their existing alignments. Starting 350 feet east of Newburgh Road, Plymouth Road shifts south and “T”s into Old M-14, 275 feet south of the existing Plymouth Road/Old M-14 intersection.

##### Vertical Alignment

Old M-14 and Newburgh Road follow their existing vertical alignment. Beginning 200 feet east of Newburgh Road, the vertical alignment of Hines Drive is raised from zero feet to 3.6 feet above the existing vertical alignment at the existing Hines Drive Bridge. The proposed Hines Drive ties into the existing vertical alignment 475 feet east of the Hines Drive Bridge. Starting 350 feet east of Newburgh Road, the proposed Plymouth Road vertical alignment is lowered and ties into the vertical alignment of Old M-14, 275 feet south of the existing Plymouth Road/Old M-14 intersection.

##### Roadway Cross Section

**Table 4-03: Proposed Cross Section**

Roadway	Proposed Laneage	Road Width (ft)	Proposed Edge of Pavement Treatment
Old M-14 (Ann Arbor Road)*	5	60	Curb and Gutter
Hines Drive	2	24	10 ft Paved Shoulder
Newburgh Road*	5	60	Curb and Gutter
Plymouth Road	4	48	Curb and Gutter

\* Note: The intersection of Old M-14 and Newburgh Road includes a 12 foot right turn lanes at the north, south and west approaches.

##### Pathway

The Hines Drive hot mix asphalt (HMA) pathway and on street bike lanes traverse this study area. This alternative widens the pathway from 8 feet to 10 feet and provides a connection to the pedestrian access route along Old M-14.

##### Pedestrians

Concrete sidewalk currently exists intermittently along Old M-14 and Newburgh Road. There is an existing concrete sidewalk on both sides of Plymouth Road, east of the Plymouth intersection with Old M-14. This alternative provides a 7 foot pedestrian access route attached to the curb between Newburgh Road and Plymouth Road and fills in the sidewalk gaps along Newburgh Road. As mentioned above, a connection to the Hines Drive pathway is provided at the Hines Drive Bridge.

##### Drainage

A preliminary drainage evaluation was completed for the storm systems located within the limits of this alternative. Based on analysis of the drainage area, the existing storm system and outlets have adequate capacity and will be replaced in kind. Drainage Best Management Practices (BMPs) will also need to be considered for any storm outlets into the Middle Rouge River during the design phase.

**Proposed Right-of-Way (ROW)** This alternative requires proposed ROW at multiple locations. Due to safety and capacity improvements of the Old M-14/Newburgh Road intersection, proposed ROW will be required in the NE, NW and SE quadrant from parcels 121-99-0023-000, 126-99-0014-000 and 126-99-

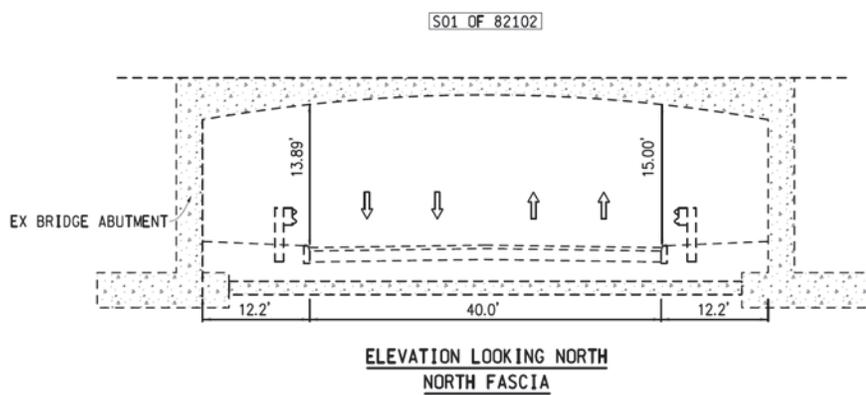
0013-00 respectively. Proposed ROW will be required due to the realignment of Plymouth Road from 550 feet east of Newburgh Road, east to Old M-14, from parcel 115-99-0001-000. Proposed ROW will also be required in the SE quadrant from parcels 126-99-0008-000 and 126-01-0733-000 from the addition of a right turn lane and sidewalk. Additional grading permits will be required based on the proposed construction limits. The potential proposed ROW and grading is depicted in **Exhibit 4-02**. Costs for ROW will be determined during the design phase.

### Structures

As part of the reconstruction of Old M-14 between Newburgh Road and Plymouth Road the Hines Drive over Old M-14 (S01 of 82101) structure and Old M-14 over the Middle Rouge River (B03 of 82101) structure will be replaced.

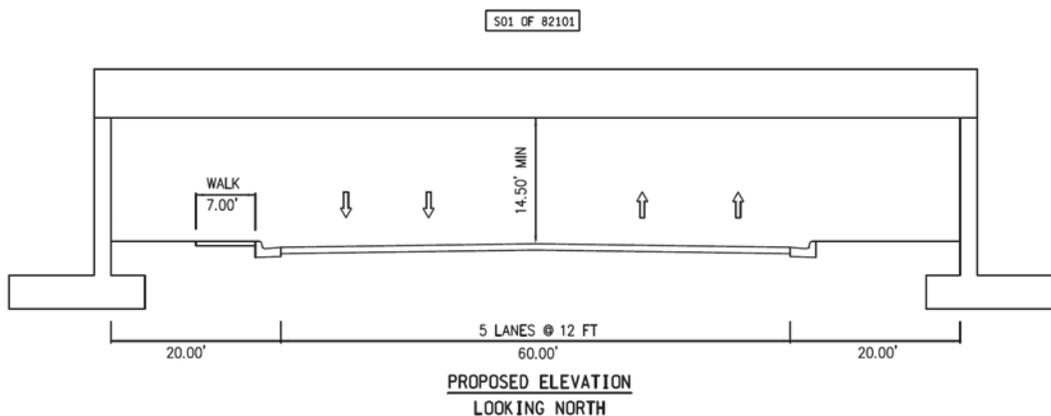
#### Hines Drive over Old M-14 (S01 of 82101)

The existing structure carrying Hines Drive over Old M-14 is an aging structure with some deterioration and is proposed to be replaced as part of this alternative. The existing vertical clearance of the structure is 13.89 feet at the west edge of metal of the north fascia. The existing structure has an arch shape on the underside, which depending on the cross slope of the road under, reduces the vertical clearance at the vertical walls. The required vertical clearance for this grade separation is 14.5 feet (according to the Michigan Bridge Design Manual (MBDM) 7.01.08). To obtain this clearance, Old M-14 will need to be lowered. From existing plans, the existing vertical wall foundations have approximately 3.4 feet of cover and there are existing struts under Old M-14 connecting the two vertical walls. Lowering Old M-14 could impact the struts, reduce the amount of cover over the foundations and have structural implications. The existing underclearance of S01 of 82101 and clear width are depicted in **Figure 4-05**.



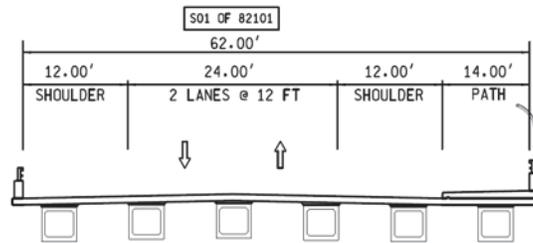
**Figure 4-05**

The existing bridge has a span of 64.4 feet over M-14. To place the abutments outside the clear zone of Old M-14, the length of the proposed structure is approximately 100 feet as shown in **Figure 4-06**.



**Figure 4-06**

The speed limit on Hines Drive is 40 mph, which does not require pedestrians to be separated from the travel lanes by a barrier. If there is a desire to separate the pedestrians and vehicles, the clear roadway width would need to be increased by the width of a barrier wall (approximately 1.5 feet). The clear width of the proposed structure carrying Hines Drive over Old M-14 required to include two 12 foot lanes, two 12 foot shoulders, and a 14 foot bike path is 62 feet, as depicted in **Figure 4-07**. The required clear roadway width on Hines Drive is 62 feet. The existing width is 64.3 feet.



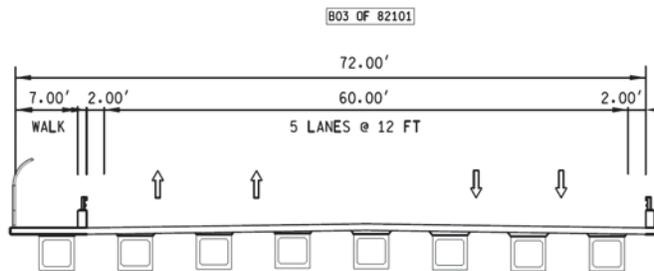
**PROPOSED DECK SECTION  
LOOKING EAST**

**Figure 4-07**

### Old M-14 over Middle Rouge River (B03 of 82101)

The existing structure for Old M-14 over Middle Rouge River is a filled spandrel arch. Due to the proposed geometry of this alternative, this structure will require replacement.

The existing clear roadway width from face of barrier to face of barrier is 41.3 feet. The proposed cross section requires a clear roadway width of 72 feet to accommodate five 12 foot lanes, two 2 foot shoulders and a 7 foot pedestrian walkway separated by barrier, shown in **Figure 4-08**.



**PROPOSED DECK SECTION  
LOOKING NORTH**

**Figure 4-08**

### Hydrology

The analysis performed indicates an improved condition with the proposed geometry for the 1% chance (100-year) storm event, as detailed in the Old M-14 Hydraulic Report, included in the Appendices.

### Retaining Walls

The reconstruction of the Old M-14 and Newburgh Road intersection will incorporate a center turn lane and right turn lane for the north leg on Newburgh Road. The wider road cross section necessitates the use of a retaining wall in the northwest quadrant of the Newburgh/Old M-14 intersection to prevent the road cross section from encroaching on Newburgh Lake.

Retaining wall options include a wire mesh face reinforced earth or other mechanically stabilized earth system (MSE), modular block wall or a cast in place concrete wall. The type of wall system will depend on the soil condition found during the design phase. Geotechnical analysis will be critical in determining the stability of retaining wall types in the area of the lake. Generally the modular block walls and MSE walls are

cost effective wall systems if soil condition are found to be stable. A poured in place wall, while generally more expensive, can be placed on piles, if necessary for stability.

**Traffic Operations**

Alternative 2B includes the reconstruction of Old M-14 and the intersection of Old M-14 and Plymouth. This reconfiguration will allow for eastbound Old M-14 vehicles to make a left turn onto westbound Plymouth. A common signal cycle length and coordination between MDOT and local agency signals is proposed. Delay, travel time and Level-of-Service (LOS) information for this alternative can be seen in **Table 4-04**.

The capacity analysis for this alternative followed the same procedure used for the analysis of existing conditions. The analysis was performed according to the methodologies published in the Highway Capacity Manual, 2000 Edition. For this project Synchro, Version 7 software was used to conduct the analysis. The capacity analysis was performed for the PM peak hour.

**Table 4-04: Alternative 2B Operation Analysis**

Network		Intersection			Approach		
Total Delay (hr.)	Travel Time (hr.)		Delay (Sec.)	LOS		Delay (Sec.)	LOS
275.0	369.5	Old M-14 (Ann Arbor) and Newburgh	35.5	D	NB	26.9	C
					SB	31.9	C
					NEB	44.5	D
					SWB	42.4	D
		Old M-14 (Ann Arbor) and Plymouth	16.5	B	SEB	31.3	C
					NEB	11.1	B
					WB	15.0	B
		Plymouth and Newburgh	32.0	C	NB	10.0	A
					SB	52.1	D
					EB	31.3	C
					WB	25.2	C
		Hines and Newburgh	45.3	D	NB	24.6	C
					SB	52.7	D
					EB	26.1	C
					WB	73.1	E
		Plymouth and Jughandle	16.5	B	NB	16.0	B
					EB	15.6	B
					WB	17.8	B
		Hines and Jughandle	71.5	F	SB	491.2	F
					EB	1.5	A
WB	0				A		

During the PM peak period, the intersections of Old M-14/Newburgh Road, Hines Drive/Newburgh Road and Hines Drive/Jughandle Road experience modest improvements over the no build alternative but are still not within acceptable delay levels. The southbound approach of Newburgh at Plymouth is also not within acceptable delay levels during the PM peak period.

Under the proposed condition of this alternative, the study area will experience a total system delay of 275.0 hours during the PM peak period. The total PM peak period travel time for the study area is 369.5 hours, an improvement of 14.8 hours over the system conditions of the future (2035 no build) operations.

## Safety

A high number of head on left type crashes were noted at the Old M-14/Newburgh Road intersection and attributed to the absence of left turn lanes. To improve safety at this intersection, a 12 foot left turn lane is proposed at the north and south approach. There were no other safety concerns identified within the study area.

## Maintenance of Traffic (MOT)

All MOT concepts considered for this alternative are summarized in the *Old M-14 MOT Analysis Memo* included in the Appendices. The preferred option for this alternative is described below.

## Old M-14

Old M-14 is anticipated to be constructed under a complete closure. This option will allow construction to be completed in one construction season. The cost to construct the Old M-14 over Middle Rouge River Bridge as a full closure is an approximate reduction of \$480,000 over part width construction, which would also necessitate two construction seasons to complete.

To facilitate a full closure of Old M-14, the detour route is a hybrid of local and state roads. This detour utilizes a portion of state and local roadways, though it is not expected to require temporary improvements or signal modifications to implement. The detour route is depicted in **Exhibit 4-05**.

## Hines Drive

Hines Drive is anticipated to be constructed part width. This will allow construction to proceed quickly, while not impeding recreational access along the park corridor. This option balances time of construction and cost-effectiveness with the value of maintaining pedestrian access and avoiding a lengthy pedestrian detour.

## Environmental

A summary of potential environmental impacts and mitigation is provided in the following section. **Exhibit 4-07** provides a summary of the potential environmental impacts.

## Land Use and Zoning

This alternative will diminish the existing parkland use where Plymouth Road is realigned through the Rouge River National Wet Weather Demonstration Project (NWDP) "Grow Zone" bounded by Old M-14, Plymouth Road, Newburgh Road, and Edward N. Hines Drive. However, Alternative 2B should not impact future development plans as most of the City of Livonia's new development plans are focused northwest of the proposed project.

## Parklands and Special Lands

It is anticipated that the widening of Old M-14, the reconstruction of the Middle Rouge River Bridge and the construction of a new seven foot pedestrian route will require ROW acquisition and will represent an encroachment onto park property under Section 4(f). The new seven foot pedestrian route along Old M-14 will be located in the existing ROW, and a new connector pedestrian route to an existing pedestrian route along Edward N. Hines Drive outside of the existing ROW will require minor ROW acquisition. The existing pedestrian route along Edward N. Hines Drive is a Section 6(f)-eligible property; however, construction activities would not represent a use of the property as the pedestrian route would not be altered. The widening, structure reconstruction, and new pedestrian routes represent approximately 1.1 acres of encroachment into park property.

It is anticipated that the realignment of Plymouth Road into a "T" at Old M-14 through the "Grow Zone" will impact the "Grow Zone" as it is part of Hines Park, a Section 4(f)-eligible property. The realignment will impact approximately 0.90 acre of the "Grow Zone." This alternative will require consultation for a possible *de minimis* finding to be initiated with the official with jurisdiction.

## Architectural History

This alternative will likely have an adverse effect to the previously determined National Register of Historic Places (NRHP)-eligible Edward N. Hines Drive Bridge due to reconstruction and re-grading to raise the new structure three feet. Reconstruction and re-grading will alter the structure's original physical features and setting that contribute to its historic significance and has the potential to adversely affect Edward N. Hines Parkway, which includes the roadway and the structure. Based on preliminary research and field survey, the Edward N. Hines Parkway appears to be eligible for the National Register of Historic Places (NRHP); however a formal determination of eligibility will need to be completed and coordinated with the Michigan State Historic Preservation Office (SHPO) prior to the commencement of construction activities.

A formal Section 106 review will be required prior to the commencement of construction activities to formally determine the eligibility of the parkway and to assess effects to each of the NRHP-eligible properties in consultation with the SHPO. Specific mitigation would be developed at that time for any identified adverse effects. Typical mitigation for structure replacement projects is recordation of the structure to be replaced, including a narrative and context description, and photographs. The presence of eligible or listed historic properties does not preclude project activity, and some project impacts may not constitute adverse effects.

Mitigation concepts that could be used in the next phase of study to resolve adverse effects to historic properties include:

- ▶ Recordation of buildings and structures, such as HABS/HAER/HALS documentation (may be applicable for the replacement of the Edward N. Hines Drive Bridge).
- ▶ Redesign of projects to preserve specific characteristics of cultural resources.
- ▶ Relocation of buildings and structures.
- ▶ Creation and implementation of maintenance and management plans.
- ▶ Donation of easements.
- ▶ Establishing historic preservation funds to support specific preservation purposes.
- ▶ Installation and maintenance of interpretive features.
- ▶ Public education and outreach programs.
- ▶ Intentional and monitored deterioration.
- ▶ Establish managed open space.

Per Section 106 guidelines, consultation with the Michigan State Historic Preservation Office will be required to complete a formal Section 106 review in order for the project to proceed to construction. At that time, appropriate mitigation will be developed for adverse effects to historic properties.

## Wetlands/Streams

It is expected that this alternative will have a minor impact to wetlands in the project vicinity due to the widening of Old M-14 to five 12-foot lanes, the Middle Rouge River Bridge reconstruction, and the construction of a new pedestrian route within existing wetlands. Wetland delineation will be required to determine the type and extent of wetland impacts. Coordination with the Michigan Department of Environmental Quality (MDEQ) will be necessary to permit bridge reconstruction.

## Floodplain

It is expected that this alternative will encroach on the 100 year floodplain at the Middle Rouge River. Coordination with the MDEQ will be necessary to permit bridge reconstruction.

## Endangered Species

The Michigan Natural Features Inventory has confirmed ten historical records of occurrence in the project vicinity indicating the presence of protected species in the general vicinity of the project (see **Table 2-18**). Field surveys will be required to identify what species or habitats may be present and affected.

### **Visual and Aesthetic Resources**

It is anticipated that this alternative will impact the existing terrain and the more natural, undeveloped landscape that characterizes the Edward N. Hines Drive and Old M-14 area due to the realignment of Plymouth Road at Old M-14 and the raising of the Edward N. Hines Drive Bridge three feet. The realignment of Plymouth Road into a “T” at Old M-14 through the “Grow Zone” will diminish the undeveloped landscape of this parkland as well as change the sightline to and from these roads at this new intersection. In areas where additional ROW will be acquired, the changes to the landscape would not be out of character with the existing landscape.

### **Hazardous Materials**

A preliminary Potential Area of Contamination Survey (PACS) has been completed. There were no specific locations of contamination identified within the area of this alternative.

### **Cost**

The potential construction cost of this alternative is \$10.5 million for an HMA section and \$10.6 million for a concrete section. These costs include inflation for an expected construction year of 2015, however the costs do not include potential ROW. The pavement design document, *JN106621\_MDOT Pavt Rec*, provided by MDOT, is included in the Appendices.

**Alternative 2B:Reconstruct Old M-14 (Ann Arbor Road) - "T" Plymouth Road into Old M-14**



EXHIBIT 4-02

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621



#### 4.4 Alternative 2C

Reconstruct Old M-14 (Ann Arbor Road) from west of Newburgh Road to “T” into Plymouth Road. Reconstruct Plymouth Road from Newburgh Road to west of Market street. Replace two structures, and reconstruct a portion of Hines Drive. This alternative is depicted in **Exhibit 4-03**.

#### Roadway

##### Horizontal Alignment

Starting 180 feet west of the Newburgh Road intersection, this alternative follows existing Old M-14 alignment to the north approach of the Middle Rouge River Bridge. The alignment then shifts northwest to “T” into Plymouth Road 350 feet east of Globe Street. Hines Drive and Newburgh Road follow their existing alignments. Starting at Newburgh Road, Plymouth Road follows the existing alignment, ending 275 feet east of Market Street.

##### Vertical Alignment

Starting 85 feet south of the Middle Rouge River Bridge, the vertical alignment of Old M-14 is raised to match Plymouth Road 350 feet East of Globe Street. The vertical alignment requires the Middle Rouge River Bridge surface to be potentially raised 1.5 feet from the existing grade at the north match line. Plymouth Road and Newburgh Road follow their existing vertical alignment. Beginning 150 feet east of Newburgh Road, the vertical alignment of Hines Drive is raised from zero feet to 7.0 feet above the existing vertical alignment at the existing Hines Drive Bridge. The proposed Hines Drive ties into the existing vertical alignment 560 feet east of the Hines Drive Bridge.

##### Roadway Cross Section

**Table 4-05: Proposed Cross Section**

Roadway	Proposed Laneage	Road Width (ft)	Proposed Edge of Pavement Treatment
Old M-14 (Ann Arbor Road)*	5	60	Curb and Gutter
Hines Drive	2	24	10 ft Paved Shoulder
Newburgh Road*	5	60	Curb and Gutter
Plymouth Road*	4-5	48-60	Curb and Gutter

\* Note: The intersection of Old M-14 and Newburgh Road includes a 12 foot right turn lanes at the north, south and west approaches. The intersection of Old M-14 and Plymouth Road includes two – 12 foot left turn lanes at the east approach.

##### Pathway

The Hines Drive hot mix asphalt (HMA) pathway and on street bike lanes traverse this study area. This alternative widens the pathway from 8 feet to 10 feet and provides a connection to the pedestrian access route along Old M-14.

##### Pedestrians

Concrete sidewalk currently exists intermittently along Old M-14 and Newburgh Road. There is an existing concrete sidewalk on both sides of Plymouth Road, east of the Plymouth intersection with Old M-14. This alternative provides a 7 foot pedestrian access route attached to the curb between Newburgh Road and Plymouth Road and fills in the sidewalk gaps along Newburgh Road. As mentioned above, a connection to the Hines Drive pathway is provided at the Hines Drive Bridge.

##### Drainage

A preliminary drainage evaluation was completed for the storm systems located within the limits of this alternative. Based on analysis of the drainage area, the existing storm system and outlets have adequate capacity, however additional storm sewer and inlets will be required to incorporate storm runoff from Plymouth Road. Drainage Best Management Practices (BMPs) will also need to be considered for any storm outlets into the Middle Rouge River during the design phase.

### Proposed Right-of-Way (ROW)

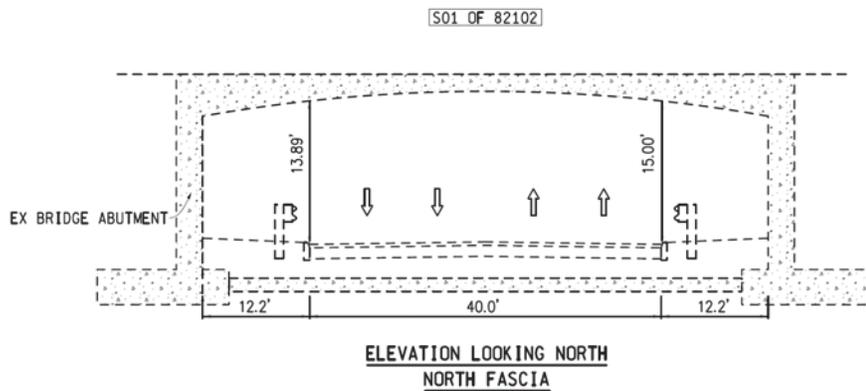
This alternative requires proposed ROW at multiple locations. Due to safety and capacity improvements of the Old M-14/Newburgh Road intersection, proposed ROW will be required in the NE, NW and SE quadrant from parcels 121-99-0023-000, 126-99-0014-000 and 126-99-0013-000 respectively. Proposed ROW will be required due to the realignment of Old M-14 from 770 feet east of Newburgh Road, east to Old M-14, from parcel 115-99-0001-000. Proposed ROW will also be required in the SE quadrant from parcels 126-99-0008-000 and 126-01-0733-000 from the addition of a right turn lane and sidewalk. Additional grading permits will be required based on the proposed construction limits. The potential proposed ROW and grading is depicted in **Exhibit 4-03**. Costs for ROW will be determined during the design phase.

### Structures

As part of the reconstruction of Old M-14 between Newburgh Road and Plymouth Road the Hines Drive over Old M-14 (S01 of 82101) structure and Old M-14 over the Middle Rouge River (B03 of 82101) structure will be replaced.

#### Hines Drive over Old M-14 (S01 of 82101)

The existing structure carrying Hines Drive over Old M-14 is an aging structure with some deterioration and is proposed to be replaced as part of this alternative. The existing vertical clearance of the structure is 13.89 feet at the west edge of metal of the north fascia. The existing structure has an arch shape on the underside, which depending on the cross slope of the road under, reduces the vertical clearance at the vertical walls. The required vertical clearance for this grade separation is 14.5 feet (according to the Michigan Bridge Design Manual (MBDM) 7.01.08). To obtain this clearance, Old M-14 will need to be lowered. From existing plans, the existing vertical wall foundations have approximately 3.4 feet of cover and there are existing struts under Old M-14 connecting the two vertical walls. Lowering Old M-14 could impact the struts, reduce the amount of cover over the foundations and have structural implications. The existing underclearance of S01 of 82101 and clear width are depicted in **Figure 4-09**.



**Figure 4-09**

The existing bridge has a span of 64.4 feet over M-14. To place the abutments outside the clear zone of Old M-14, the length of the proposed structure is approximately 100 feet as shown in **Figure 4-10**.

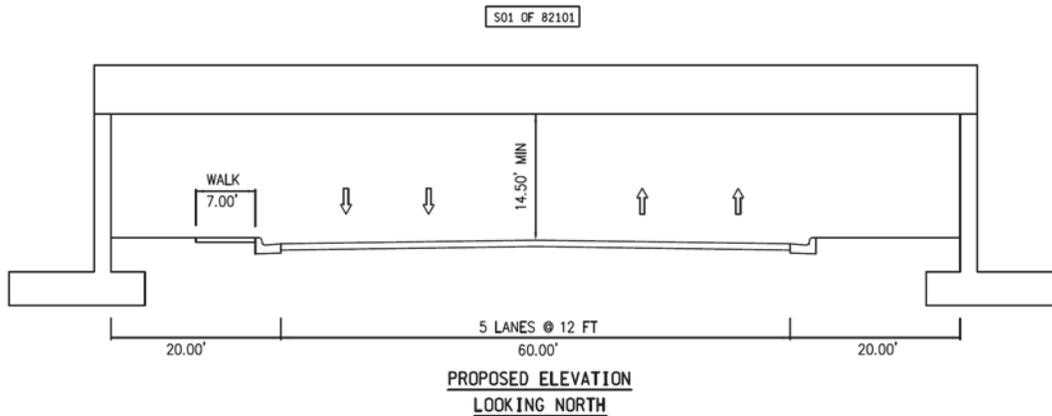


Figure 4-10

The speed limit on Hines Drive is 40 mph, which does not require pedestrians to be separated from the travel lanes by a barrier. If there is a desire to separate the pedestrians and vehicles, the clear roadway width would need to be increased by the width of a barrier wall (approximately 1.5 feet). The clear width of the proposed structure carrying Hines Drive over Old M-14 required to include two 12 foot lanes, two 12 foot shoulders, and a 14 foot bike path is 62 feet, as depicted in **Figure 4-11**. The required clear roadway width on Hines Drive is 62 feet. The existing width is 64.3 feet.

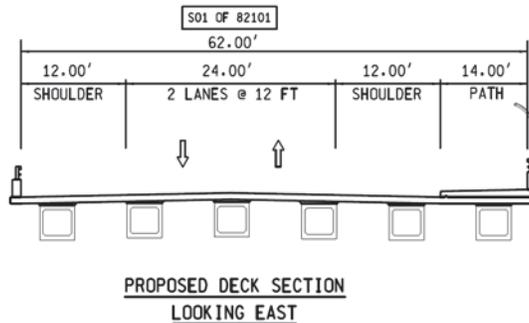


Figure 4-11

### Old M-14 over Middle Rouge River (B03 of 82101)

The existing structure for Old M-14 over Middle Rouge River is a filled spandrel arch. Due to the proposed geometry of this alternative, this structure will require replacement.

The existing clear roadway width from face of barrier to face of barrier is 41.3 feet. The proposed cross section requires a clear roadway width of 72 feet to accommodate five 12 foot lanes, two 2 foot shoulders and a 7 foot pedestrian walkway separated by barrier, shown in Figure 4-12.

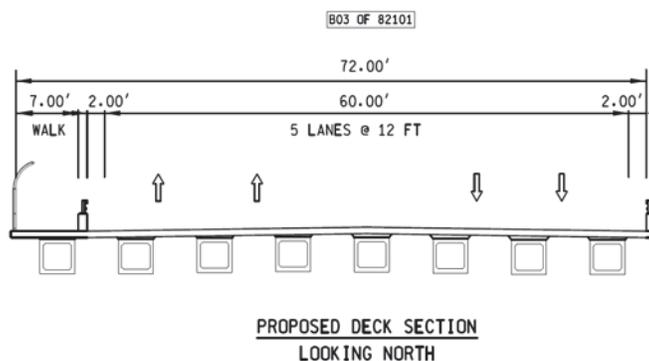


Figure 4-12

## Hydrology

The analysis performed indicates an improved condition with the proposed geometry for the 1% chance (100-year) storm event, as detailed in the Old M-14 Hydraulic Report, included in the Appendices.

## Retaining Walls

The reconstruction of the Old M-14 and Newburgh Road intersection will incorporate a center turn lane and right turn lane for the north leg on Newburgh Road. The wider road cross section necessitates the use of a retaining wall in the northwest quadrant of the Newburgh/Old M-14 intersection to prevent the road cross section from encroaching on Newburgh Lake.

Retaining wall options include a wire mesh face reinforced earth or other mechanically stabilized earth system (MSE), modular block wall or a cast in place concrete wall. The type of wall system will depend on the soil condition found during the design phase. Geotechnical analysis will be critical in determining the stability of retaining wall types in the area of the lake. Generally the modular block walls and MSE walls are cost effective wall systems if soil condition are found to be stable. A poured in place wall, while generally more expensive, can be placed on piles, if necessary for stability.

## Traffic

### Operations

Alternative 2C includes reconstruction of Old M-14 and of the intersection of Old M-14 and Plymouth. This proposed reconfiguration will allow for eastbound Old M-14 vehicles to make a left turn onto westbound Plymouth. It includes a provision of a common signal cycle length and coordination between MDOT and local agency signals. Delay, travel time and Level-of-Service (LOS) information for Alternative 2C can be seen in **Table 4-06**.

The capacity analysis for this alternative followed the same procedure used for the analysis of existing conditions. The analysis was performed according to the methodologies published in the Highway Capacity Manual, 2000 Edition. For this project Synchro, Version 7 software was used to conduct the analysis. The capacity analysis was performed for the PM peak hour.

**Table 4-06: Alternative 2C Operation Analysis**

Network		Intersection			Approach		
Total Delay (hr.)	Travel Time (hr)		Delay (Sec.)	LOS		Delay (Sec.)	LOS
331.0	428.7	Old M-14 (Ann Arbor) and Newburgh	32.9	C	NB	26.8	C
					SB	31.8	C
					NEB	<b>49.3</b>	<b>D</b>
					SWB	28.6	C
		Old M-14 (Ann Arbor) and Plymouth	15.7	B	SEB	32.1	C
					NEB	1.1	A
					WB	17.5	B
		Plymouth and Newburgh	32.0	C	NB	10.0	A
					SB	<b>52.1</b>	<b>D</b>
					EB	31.3	C
					WB	25.2	C
		Hines and Newburgh	<b>45.3</b>	<b>D</b>	NB	24.6	C
					SB	<b>52.7</b>	<b>D</b>
					EB	26.1	C
					WB	<b>73.1</b>	<b>E</b>
		Plymouth and Jughandle	15.0	A	NB	18.1	B
EB	13.6				B		
WB	15.6				B		
Hines and Jughandle	<b>71.5</b>	<b>F</b>	SB	<b>491.2</b>	<b>F</b>		
			EB	1.5	A		
			WB	0.0	A		

During the PM peak period, the intersections of Hines Drive/Newburgh Road and Hines Drive/Jughandle Road will continue to operate with delay levels in excess of the minimal acceptable condition of LOS C. The unsignalized intersection of Hines Drive/Jughandle Road continues to operate with excessive delays as shown in **Table 4-06**.

The southbound approach of the Newburgh Road/Plymouth Road intersection and the northeastbound approach of the Old M-14/Newburgh Road intersection are also not within acceptable delay levels during the PM peak period.

Under the proposed condition of this alternative, the study area will experience a total system delay of 331.0 hours during the PM peak period. The total travel PM peak period time for the study area is 428.7 hours, an increase of 44.4 hours over the system conditions of the future (2035 no build) operations.

**Safety**

A high number of head on left type crashes were noted at the Old M-14/Newburgh Road intersection and attributed to the absence of left turn lanes. To improve safety at this intersection, a 12 foot left turn lane is proposed at the north and south approach. There were no other safety concerns identified within the study area.

## Maintenance of Traffic (MOT)

All MOT concepts considered for this alternative are summarized in the *Old M-14 MOT Analysis Memo* included in the Appendices. The preferred option for this alternative is described below.

### Old M-14

Old M-14 is anticipated to be constructed under a complete closure. This option will allow construction to be completed in one construction season. The cost to construct the Old M-14 over Middle Rouge River Bridge as a full closure is an approximate reduction of \$480,000 over part width construction, which would also necessitate two construction seasons to complete.

To facilitate a full closure of Old M-14, the detour route is a hybrid of local and state roads. This detour utilizes a portion of local roadways, though it is not expected to require temporary improvements or signal modifications to implement. The detour route is depicted in **Exhibit 4-05**.

### Hines Drive

Due to raising the Hines Drive Bridge 7 feet, this alternative will require Hines Drive to close during construction. There are two detour options, using local roads, which should be considered during the design phase of this project. These detour routes are depicted in **Exhibit 4-06**.

## Environmental

A summary of potential environmental impacts and mitigation is provided in the following section. **Exhibit 4-07** provides a summary of the potential environmental impacts.

### Land Use and Zoning

It is anticipated that this alternative will diminish the existing parkland use where Old M-14 is realigned through the Rouge River National Wet Weather Demonstration Project (NWDP) “Grow Zone” bounded by Old M-14, Plymouth Road, Newburgh Road, and Edward N. Hines Drive. However, this alternative should not have any impact on future development plans as most new development is focused northwest of the proposed project.

### Parklands and Special Lands

The widening of Old M-14, the reconstruction of the Middle Rouge River Bridge, and the construction of a new seven foot pedestrian route will require ROW acquisition and will represent an encroachment onto park property under Section 4(f). The new seven foot pedestrian routes will be located along Old M-14 in the existing ROW, and the new connector pedestrian route to an existing pedestrian pathway along Edward N. Hines Drive outside of the existing ROW will require additional ROW acquisition. The existing pedestrian route along Edward N. Hines Drive is a Section 6(f)-eligible property; however, construction activities would not represent a use of the property as the pedestrian route would not be altered. The widening, structure reconstruction, and new pedestrian routes represent approximately 2.0 acres of encroachment into park property.

It is anticipated that the realignment of Old M-14 into a “T” at Plymouth Road through the “Grow Zone” will impact the “Grow Zone” as it is a Section 4(f)-eligible property. The realignment will require additional ROW acquisition, impacting approximately 0.80 acre of the “Grow Zone”. This alternative will require consultation for a possible *de minimis* finding to be initiated with the official with jurisdiction.

### Architectural History

This alternative will likely have an adverse effect to the previously determined National Register of Historic Places (NRHP)-eligible Edward N. Hines Drive Bridge due to reconstruction and relocation of the original structure, and re-grading to raise the new structure seven feet. Reconstruction and re-grading will alter the structure’s original physical features and setting that contribute to its historic significance. The realignment of Old M-14 under the structure would also diminish the structure’s integrity of setting and significance.

Structure reconstruction and re-grading also has the potential to adversely affect Edward N. Hines Parkway, which includes the roadway and the structure. Based on preliminary research and field survey, the Edward N. Hines Parkway appears to be eligible for the National Register of Historic Places (NRHP); however a formal determination of eligibility will need to be completed and coordinated with the Michigan State Historic Preservation Office (SHPO) prior to the commencement of construction activities.

A formal Section 106 review will be required prior to the commencement of construction activities to formally determine the eligibility of the parkway and to assess effects to each of the NRHP-eligible properties in consultation with the SHPO. Specific mitigation would be developed at that time for any identified adverse effects. Typical mitigation for structure replacement projects is recordation of the structure to be replaced, including a narrative and context description, and photographs. The presence of eligible or listed historic properties does not preclude project activity.

Mitigation concepts that could be used in the next phase of study to resolve adverse effects to historic properties include:

- ▶ Recordation of buildings and structures, such as HABS/HAER/HALS documentation (may be applicable for the replacement of the Edward N. Hines Drive Bridge).
- ▶ Redesign of projects to preserve specific characteristics of cultural resources.
- ▶ Relocation of buildings and structures.
- ▶ Creation and implementation of maintenance and management plans.
- ▶ Donation of easements.
- ▶ Establishing historic preservation funds to support specific preservation purposes.
- ▶ Installation and maintenance of interpretive features.
- ▶ Public education and outreach programs.
- ▶ Intentional and monitored deterioration.
- ▶ Establish managed open space.

Per Section 106 guidelines, consultation with the Michigan State Historic Preservation Office will be required to complete a formal Section 106 review in order for the project to proceed to construction. At that time, appropriate mitigation will be developed for adverse effects to historic properties.

### **Wetlands/Streams**

It is expected that this alternative will impact wetlands and streams in the project vicinity due to the widening of Old M-14 to five 12 foot lanes, the Middle Rouge River Bridge reconstruction, and the construction of a new pedestrian route within existing wetlands. Proposed grading along Edward N. Hines Drive substantially extends into wetlands, outside of the existing ROW. Wetland delineation will be required to determine the type and extent of wetland impacts. Coordination with the Michigan Department of Environmental Quality (MDEQ) will be necessary to permit bridge reconstruction.

### **Floodplain**

It is expected that this alternative will encroach on the 100 year floodplain at the Middle Rouge River. Coordination with the MDEQ will be necessary to permit bridge reconstruction.

### **Endangered Species**

The Michigan Natural Features Inventory has confirmed ten historical records of occurrence in the project vicinity indicating the presence of protected species in the general vicinity of the project (see Table 2-18). Field surveys will be required to identify what species or habitats may be present and affected.

### **Visual and Aesthetic Resources**

It is anticipated that this alternative will impact the existing terrain and the more natural, undeveloped landscape that characterizes the Edward N. Hines Drive and Old M-14 area due to the relocation of the

Edward N. Hines Drive Bridge to accommodate the realignment of Old M-14 at Plymouth Road. The center of the Edward N. Hines Drive Bridge will be shifted approximately 30 feet west of its current location and raised approximately seven feet. This will change views along Edward N. Hines Drive and views to and from Old M-14 and Plymouth Road. The realignment of Old M-14 into a “T” at Plymouth Road through the “Grow Zone” will diminish the undeveloped landscape of this parkland as well as change the sightline to and from these roads at this new intersection.

### **Hazardous Materials**

A preliminary Potential Area of Contamination Survey (PACS) has been completed. There were no specific locations of contamination identified within the area of this alternative.

### **Cost**

The potential construction cost of this alternative is \$11.4 million for an HMA section and \$11.5 million for a concrete section. These costs include inflation for an expected construction year of 2015, however the costs do not include potential ROW. The pavement design memo is included in the Appendices.

**Alternative 2C:Reconstruct Old M-14 (Ann Arbor Road) - "T" into Plymouth Road**



EXHIBIT 4-03

OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621



### 4.5 Alternative 3

Reconstruct Old M-14 (Ann Arbor Road) from west of Newburgh Road to Market Street on the existing alignment. Replace the Middle Rouge River Bridge and remove the Hines Drive Bridge, replacing it with an at-grade signalized intersection and reconstruct a portion of Hines Drive. This alternative is depicted in Exhibit 4-04.

#### Roadway

##### Horizontal Alignment

This alternative follows the existing Old M-14 alignment. Hines Drive, Newburgh Road, and Plymouth Road follow their existing alignments.

##### Vertical Alignment

Newburgh Road matches the existing vertical alignment. Beginning 100 feet east of Newburgh Road, the grade of Old M-14 is raised 7 feet to match the proposed grade of Hines Drive. The vertical alignment matches existing 150 feet west of Market Street. The Old M-14 over Middle Rouge Bridge will be raised approximately 4.5 feet. Beginning 350 feet east of Newburgh Road, the vertical alignment of Hines Drive is lowered from zero feet to 11 feet below the existing vertical alignment at the existing Hines Drive Bridge. The proposed Hines Drive ties into the existing vertical alignment 500 feet east of the existing Hines Drive Bridge. Starting 200 feet west of Old M-14, the proposed Plymouth Road vertical alignment is raised and ties into the vertical alignment of Old M-14 at the existing Plymouth Road/Old M-14 intersection location.

##### Roadway Cross Section

Table 4-07: Proposed Cross Section

Roadway	Proposed Laneage	Road Width (ft)	Proposed Edge of Pavement Treatment
Old M-14 (Ann Arbor Road)*	5	60	Curb and Gutter
Hines Drive	2	24	10 ft Paved Shoulder
Newburgh Road*	5	60	Curb and Gutter
Plymouth Road	4	48	Curb and Gutter

\* Note: The intersection of Old M-14 and Newburgh Road include 12 foot right turn lanes at the north, south and west approaches.

##### Pathway

The Hines Drive hot mix asphalt (HMA) pathway and on street bike lanes traverse this study area. This alternative widens the pathway from 8 feet to 10 feet and provides a connection to the pedestrian access route along Old M-14.

##### Pedestrians

Concrete sidewalk currently exists intermittently along Old M-14 and Newburgh Road. There is an existing concrete sidewalk on both sides of Plymouth Road, east of the Plymouth intersection with Old M-14. This alternative provides a 7 foot pedestrian access route attached to the curb between Newburgh Road and Plymouth Road and fills in the sidewalk gaps along Newburgh Road. As mentioned above, a connection to the Hines Drive pathway is provided at the Hines Drive Bridge.

##### Drainage

A preliminary drainage evaluation was completed for the storm systems located within the limits of this alternative. Based on analysis of the drainage area, the existing storm system and outlets have adequate capacity and will be replaced in kind. Drainage Best Management Practices (BMPs) will also need to be considered for any storm outlets into the Middle Rouge River during the design phase.

### Proposed Right-of-Way (ROW)

This alternative requires proposed ROW at multiple locations. Due to safety and capacity improvements of the Old M-14/Newburgh Road intersection, proposed ROW will be required in the NE, NW and SE quadrant from parcels 121-99-0023-000, 126-99-0014-000 and 126-99-0013-000 respectively. Proposed ROW will be required due to the proposed signalized intersection at Old M-14/Hines Drive from parcels 126-99-0013-00 and 126-99-0011-000. Proposed ROW will also be required in the SE quadrant from parcels 126-99-0008-000 and 126-01-0733-000 from the addition of sidewalk. Additional grading permits will be required based on the proposed construction limits. The potential proposed ROW and grading is depicted in **Exhibit 4-04**. Costs for ROW will be determined during the design phase.

### Structures

As part of the reconstruction of Old M-14 between Newburgh Road and Plymouth Road, one structure will be replaced and one structure will be eliminated with this alternative. Both the Hines Drive over Old M-14 (S01 of 82101) and Old M-14 over the Middle Rouge River (B03 of 82101) will be impacted.

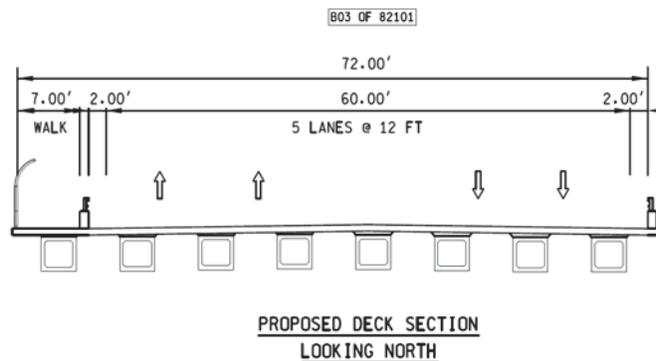
### Hines Drive over Old M-14 (S01 of 82101)

As part of this alternative, the Hines Drive Bridge will be eliminated and replaced with an at-grade signalized intersection of Old M-14/Hines Drive.

### Old M-14 over Middle Rouge River (B03 of 82101)

The existing structure for Old M-14 over Middle Rouge River is a filled spandrel arch. Due to the proposed geometry of this alternative, this structure will require replacement.

The existing clear roadway width from face of barrier to face of barrier is 41.3 feet. The proposed cross section requires a clear roadway width of 72 feet to accommodate five 12 foot lanes, two 2 foot shoulders and a 7 foot pedestrian walkway separated by barrier, shown in **Figure 4-13**.



**Figure 4-13**

### Hydrology

The analysis performed indicates an improved condition with the proposed geometry for the 1% chance (100-year) storm event, as detailed in the Old M-14 Hydraulic Report, included in the Appendices.

### Retaining Walls

The reconstruction of the Old M-14 and Newburgh Road intersection will incorporate a center turn lane and right turn lane for the north leg on Newburgh Road. The wider road cross section necessitates the use of a retaining wall in the northwest quadrant of the Newburgh/Old M-14 intersection, to prevent the road cross section from encroaching on Newburgh Lake.

Retaining wall options include a wire mesh face reinforced earth or other mechanically stabilized earth system (MSE), modular block wall or a cast in place concrete wall. The type of wall system will depend on the soil condition found during the design phase. Geotechnical analysis will be critical in determining the stability of retaining wall types in the area of the lake. Generally the modular block walls and MSE walls are

cost effective wall systems if soil condition are found to be stable. A poured in place wall, while generally more expensive, can be placed on piles, if necessary for stability.

### Traffic Operations

Alternative 3 includes the reconstruction of Old M-14 and the addition of an at grade intersection at Old M-14 and Hines. This reconfiguration will allow for direct movements between Old M-14 and Hines. This alternative also includes a provision of a common signal cycle length and coordination between MDOT and local agency signals. These modifications will have minor impacts on the operations of the study area. Delay, travel time and Level-of-Service (LOS) information for Alternative 3 can be seen in **Table 4-08**.

The capacity analysis for this alternative followed the same procedure used for the analysis of existing conditions. This analysis was completed according to the methodologies published in the Highway Capacity Manual, 2000 Edition. For this project Synchro, Version 7 software was used to conduct the analysis. The capacity analysis was performed for the PM peak hour.

**Table 4-08: Alternative 3 Operation Analysis**

Network		Intersection			Approach		
Total Delay (hr.)	Travel Time (hr)		Delay (Sec.)	LOS		Delay (Sec.)	LOS
270.1	364.7	Old M-14 (Ann Arbor) and Hines	32.3	C	NEB	41.5	D
					SWB	15.5	B
					SEB	28.7	C
					NWB	49.9	D
		Old M-14 (Ann Arbor) and Newburgh	29.6	C	NB	27.0	C
					SB	30.7	C
					NEB	42.4	D
					SWB	21.7	C
		Old M-14 (Ann Arbor) and Plymouth	12.2	B	SEB	31.0	C
					NEB	1.5	A
					WB	11.7	B
		Plymouth and Newburgh	29.6	C	NB	8.3	A
					SB	48.1	D
					EB	31.8	C
					WB	23.2	C
		Hines and Newburgh	37.1	D	NB	25.2	C
					SB	53.1	D
					EB	25.8	C
					WB	34.4	C
		Plymouth and Jughandle	16.6	B	NB	17.9	B
EB	15.6				B		
WB	17.4				B		
Hines and Jughandle	68.5	F	SB	486.0	F		
			EB	1.6	A		
			WB	0.0	A		

During the PM peak period the intersections of Hines and Newburgh and Hines and Jughandle will continue to operate with delay levels in excess of the minimal acceptable condition of LOS C. The unsignalized intersection of Hines Drive/Jughandle Road continues to operate with excessive delays as shown in **Table 4-08**.

The overall operations at the new intersection of Old M-14 and Hines will be within acceptable delay levels. However two approaches of this intersection will experience delays in excess of the minimal acceptable condition. The northeastbound and northwestbound approaches of Old M-14 at Hines are not within acceptable delay levels.

In addition to these intersections, the southbound approach of Newburgh at Plymouth and the northeastbound approach of Old M-14 at Newburgh are also not within acceptable delay levels during the PM peak period.

Under the proposed condition of this alternative, the study area will experience a total system delay of 270.1 hours during the PM peak period. The total travel PM peak period time for the study area is 364.7 hours, a decrease of 19.6 hours over the system conditions of the future (2035 no build) operations.

### **Safety**

A high number of head on left type crashes were noted at the Old M-14/Newburgh Road intersection and attributed to the absence of left turn lanes. To improve safety at this intersection, a 12 foot left turn lane is proposed at the north and south approach. There were no other safety concerns identified within the study area.

### **Maintenance of Traffic (MOT)**

All MOT concepts considered for this alternative are summarized in the *Old M-14 MOT Analysis Memo* included in the Appendices. The preferred option for this alternative is described below.

### **Old M-14**

Old M-14 is anticipated to be constructed under a complete closure. This option will allow construction to be completed in one construction season. The cost to construct the Old M-14 over Middle Rouge River Bridge as a full closure is an approximate reduction of \$480,000 over part width construction, which would necessitate two construction seasons to complete.

To facilitate a full closure of Old M-14, the detour route is a hybrid of local and state roads. This detour utilizes a portion of state and local roadways, though it is not expected to require temporary improvements or signal modifications to implement. The detour route is depicted in **Exhibit 4-05**.

### **Hines Drive**

Due to the substantial grade change of Hines Drive to meet Old M-14, alternative will require Hines Drive to close during construction. There are two detour options, using local roads, which should be considered during the design phase of this project. These detour routes are depicted in **Exhibit 4-06**.

### **Environmental**

A summary of potential environmental impacts and mitigation is provided in the following section. **Exhibit 4-07** provides a summary of the potential environmental impacts.

### **Land Use and Zoning**

It is anticipated that this alternative will not change existing land use and zoning patterns in the area and should have no impact on future development plans. Most new development plans are focused primarily northwest of the proposed project.

### **Parklands and Special Lands**

It is anticipated that the widening of Old M-14, the reconstruction of the Middle Rouge River Bridge, and the construction of a new seven-foot pedestrian route will require ROW acquisition and will represent an encroachment onto park property under Section 4(f). The existing pedestrian route along Edward N. Hines

Drive is a Section 6(f)-eligible property; however, construction activities would not represent a use of the property as the pedestrian route would not be altered. The widening of Old M-14, construction of a seven foot pedestrian route, and the reconstruction of the Middle Rouge River Bridge represents an approximately 1.0 acre encroachment, outside of the existing ROW, into park property. This alternative will require consultation to be initiated for a possible *de minimis* finding with the official with jurisdiction.

### Architectural History

It is anticipated that this alternative will have an adverse effect to the previously determined National Register of Historic Places (NRHP)-eligible Edward N. Hines Drive Bridge due to its demolition. Eliminating the structure from its historic location constitutes an adverse effect.

The structure demolition and associated re-grading efforts to create a new signalized intersection at Old M-14/Edward N. Hines Drive has the potential to adversely affect Edward N. Hines Parkway, which includes the roadway and the structure. Edward N. Hines Parkway would be lowered 11 feet to meet Old M-14, which would be raised seven feet; this would change the setting and layout of the parkway. Based on preliminary research and field survey, the Edward N. Hines Parkway appears to be eligible for the National Register of Historic Places (NRHP); however a formal determination of eligibility will need to be completed and coordinated with the Michigan State Historic Preservation Office (SHPO) prior to the commencement of construction activities.

A formal Section 106 review will be required prior to the commencement of construction activities to formally determine the eligibility of the parkway and to assess effects to all NRHP-eligible properties in consultation with the SHPO. Specific mitigation would be developed at that time for any identified adverse effects. Typical mitigation for structure replacement projects is recordation of the structure to be replaced, including a narrative and context description, and photographs. The presence of eligible or listed historic properties does not preclude project activity.

Mitigation concepts that could be used in the next phase of study to resolve adverse effects to historic properties include:

- ▶ Recordation of buildings and structures, such as HABS/HAER/HALS documentation (may be applicable for the replacement of the Edward N. Hines Drive Bridge).
- ▶ Redesign of projects to preserve specific characteristics of cultural resources.
- ▶ Relocation of buildings and structures.
- ▶ Creation and implementation of maintenance and management plans.
- ▶ Donation of easements.
- ▶ Establishing historic preservation funds to support specific preservation purposes.
- ▶ Installation and maintenance of interpretive features.
- ▶ Public education and outreach programs.
- ▶ Intentional and monitored deterioration.
- ▶ Establish managed open space.

Per Section 106 guidelines, consultation with the Michigan State Historic Preservation Office will be required to complete a formal Section 106 review in order for the project to proceed to construction. At that time, appropriate mitigation will be developed for adverse effects to historic properties.

### Wetlands/Streams

It is anticipated that this alternative will have a minor impact to wetlands in the project vicinity due to the widening of Old M-14 to five 12 foot lanes, the Middle Rouge River Bridge reconstruction, and the construction of a new pedestrian route within existing wetlands. Wetland delineation will be required to determine the type and extent of wetland impacts. Coordination with the Michigan Department of Environmental Quality (MDEQ) will be necessary to permit bridge reconstruction.

## **Floodplain**

It is expected that this alternative will encroach on the 100 year floodplain at the Middle Rouge River. Coordination with the MDEQ will be necessary to permit bridge reconstruction.

## **Endangered Species**

The Michigan Natural Features Inventory has confirmed ten historical records of occurrence in the project vicinity indicating the presence of protected species in the general vicinity of the project (see Table 2-18). Field surveys will be required to identify what species or habitats may be present and affected.

## **Visual and Aesthetic Resources**

It is anticipated that this alternative will impact the existing variable topography and the more natural, undeveloped landscape that characterizes the Edward N. Hines Drive and Old M-14 area due to the demolition of the Edward N. Hines Drive Bridge and the re-grading of Edward N. Hines Drive and Old M-14 for a signalized intersection. Sightlines along these roads will be substantially changed by lowering Edward N. Hines Drive 11 feet and raising Old M-14 seven feet at this new intersection. In areas where additional ROW will be acquired, the changes to the landscape would more likely to be seen as out of character with the existing landscape.

## **Hazardous Materials**

A preliminary Potential Area of Contamination Survey (PACS) has been completed. There were no specific locations of contamination identified within the area of this alternative.

## **Cost**

The potential construction cost of this alternative is \$8.2 million for an HMA section and \$8.3 million for a concrete section. These costs include inflation for an expected construction year of 2015, however the costs do not include potential ROW. The pavement design memo is included in the Appendices.

**Alternative 3: Reconstruct Old M-14 (Ann Arbor Road) adding a Signalized Intersection at Old M-14 and Hines Drive**



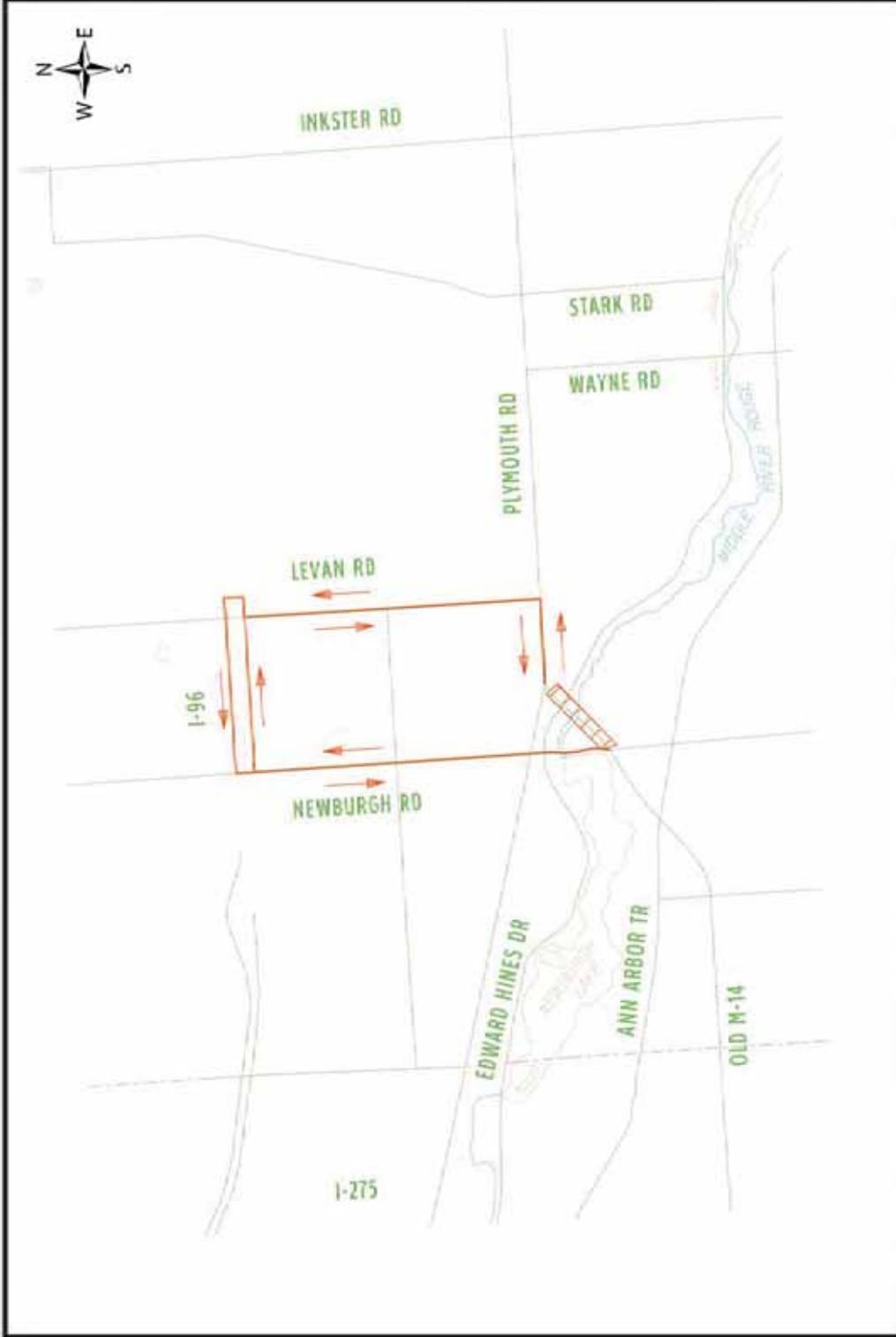
**EXHIBIT 4-04 OLD M-14 FEASIBILITY STUDY | CS: 82101, JN: 106621**

**OHM**



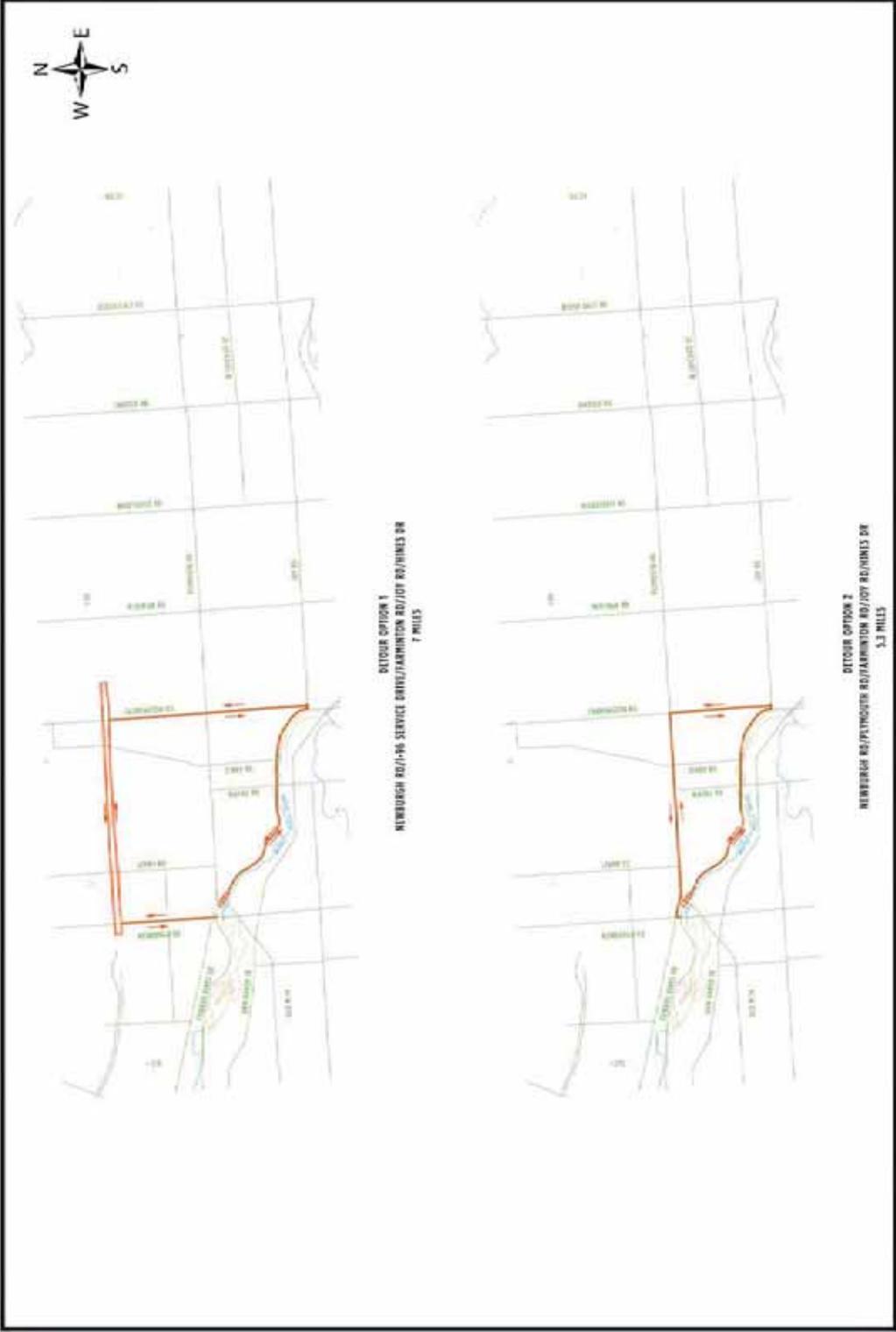
## 4.6 Evaluation of Practical Alternatives

The Practical Alternatives were further evaluated upon completion of alignments, profiles and geometrics. Construction limits were developed to evaluate ROW impact. Other evaluation criteria developed by the Steering Committee include operations, 4(f)/6(f) impacts, safety and cost. These criteria were presented to the public in an Evaluation Matrix, shown in **Exhibit 4-08**. Evaluation of the four Practical Alternatives is not intended to drive to select a Preferred Alternative, rather to demonstrate the potential benefits of each alternative.



MDOT Michigan Department of Transportation  
**EXHIBIT 4-05**  
**OLD M-14 DETOUR ROUTE | CS: 82101, JN: 106621**





**EXHIBIT 4-06** HINES DRIVE DETOUR ROUTES | CS: 82101, JN: 106621

Evaluation Criteria	Practical Alternative		
	2A	2B	2C
<b>Land Use and Zoning</b>	<p>No impact to existing and future land use.</p> <p>Minor impact to park property.</p> <p>1.30 acres encroachment (grading and permanent ROW): New pedestrian route and grading, Old M-14 widening, and Middle Rouge River Bridge reconstruction.</p>	<p>Diminished existing parkland use. No impact to future land use.</p> <p>Minor impact to park property. Substantial impact to Rouge River NMDCP "Grow Zone" (Section 4(f)-eligible property).</p> <p>2.6 acre encroachment (grading and permanent ROW): New pedestrian routes and grading, Old M-14 widening, and Middle Rouge River Bridge reconstruction.</p> <p>*0.80 acre - Plymouth Road and Old M-14 realignment through "Grow Zones"</p>	<p>3</p> <p>No impact to existing and future land use.</p> <p>Minor impact to park property.</p> <p>1.0 acres encroachment (grading and permanent ROW): New pedestrian route and grading, Old M-14 widening, and Middle Rouge River Bridge reconstruction.</p> <p>*0.90 acre - New pedestrian routes and grading</p>
<b>Parklands and Special Lands</b>	<p>Potential adverse effect to NRHP-eligible Hines Drive Bridge due to reconstruction of original structure and re-grading to raise structure three feet. Potential to adversely affect Edward N. Hines Parkway if determined NRHP-eligible.</p> <p>Minor impact to existing wetlands and streams. Project plans and ROW acquisition occur in wetlands.</p> <p>Minor impact to 100 year floodplain at the Middle Rouge River crossing.</p> <p>Field surveys required to verify presence of protected species in project vicinity.</p> <p>No visual/aesthetic impacts.</p>	<p>Potential adverse effect to NRHP-eligible Hines Drive Bridge due to reconstruction and relocation of original structure, and re-grading to raise structure seven feet. Potential to adversely affect Edward N. Hines Parkway if determined NRHP-eligible.</p> <p>Moderate impact to existing wetlands and streams. Project plans and ROW acquisition occur in wetlands.</p> <p>Minor impact to 100 year floodplain at the Middle Rouge River crossing.</p> <p>Field surveys required to verify presence of protected species in project vicinity.</p> <p>Moderate visual/aesthetic impacts.</p>	<p>Adverse effect to NRHP-eligible Hines Drive Bridge due to its demolition. Potential to adversely affect Edward N. Hines Parkway if determined NRHP-eligible, due to new signalized intersection at Old M-14 and Edward N. Hines Drive.</p> <p>Minor impact to existing wetlands and streams. Project plans and ROW acquisition occur in wetlands.</p> <p>Minor impact to 100 year floodplain at the Middle Rouge River crossing.</p> <p>Field surveys required to verify presence of protected species in project vicinity.</p> <p>Substantial visual/aesthetic impacts.</p>
<b>Architectural History</b>			
<b>Wetlands and Streams</b>			
<b>Floodplain</b>			
<b>Endangered Species</b>			
<b>Visual/Aesthetic Resources</b>			



Evaluation Criteria	Practical Alternative		
	2A	2B	2C
<b>Impact to Intersections</b>	<p>Reconstruct 2 Signals Driveways on Old M-14 from Plymouth Road to Market Street could be affected</p> <p>Could increase safety by adding left turn lanes on north and south approach of Newburgh Road. Adds right turn lane on north side of the Newburgh Road/Old M-14 intersection. Skewed intersection at Plymouth Road and Old M-14 is not desirable.</p> <p>Net increase of 1000 square yards from existing.</p>	<p>Reconstruct 2 Signals Driveways on Plymouth Road from Globe Street to Old M-14 could be affected</p> <p>Could increase safety by adding left turn lanes on north and south approach of Newburgh Road. Adds right turn lane on north side of the Newburgh Road/Old M-14 intersection. Additional signal heads may be required if obstructed by proposed Hines Drive bridge.</p> <p>Net increase of 4100 sqyd from existing.</p>	<p>Reconstruct 2 signals, add 1 Signal Driveways on Old M-14 from Plymouth Road to Market Street could be affected</p> <p>Increases conflict points with the additional signal at the Old M-14/Hines intersection. Could increase safety by adding left turn lanes on north and south approach of Newburgh Road. Adds right turn lane on north side of the Newburgh Road/Old M-14 intersection.</p> <p>Net increase of 2400 sqyd from existing.</p>
<b>Intersection Safety</b>			
<b>Pavement Footprint</b>			
<b>Impact to Structures</b>	<p>Reconstruct Hines Drive Bridge and Middle Rouge River Bridge</p> <p>Potential 0.30 acres ROW required from parcels: 121-99-0023-000, 126-99-0014-000, 126-99-0013-000, 115-99-0001-000, 126-99-0008-000, 126-01-0733-000</p> <p>Non-motorized paths will be provided along Old M-14. Crossing Plymouth Rd. at the Old M-14/Plymouth intersection likely not provided.</p>	<p>Reconstruct Hines Drive Bridge and Middle Rouge River Bridge</p> <p>Potential 0.9 acres ROW required from parcels: 121-99-0023-000, 126-99-0014-000, 126-99-0013-000, 115-99-0001-000, 126-99-0008-000, 126-01-0733-000</p> <p>Non-motorized paths will be provided along Old M-14. Crossing Plymouth at the Old M-14/Plymouth intersection will be improved. The non-motorized path along Hines Drive will be required to cross the added signal.</p>	<p>Reconstruct Middle Rouge River Bridge, eliminate Hines Drive Bridge</p> <p>Potential 0.2 acres ROW required from parcels: 121-99-0023-000, 126-99-0014-000, 126-99-0013-000, 120-99-0011-000, 120-99-0008-000, 126-01-0733-000</p> <p>Non-motorized paths will be provided along Old M-14. Crossing Plymouth at the Old M-14/Plymouth intersection will be improved. The non-motorized path along Hines Drive will be required to cross the added signal.</p>
<b>Non-Motorized Connectivity</b>			
<b>Construction Cost (Excluding ROW)</b>	<p>\$10.1 Million - HMA \$10.2 Million - Concrete</p>	<p>\$11.4 Million - HMA \$11.5 Million - Concrete</p>	<p>\$9.2 Million - HMA \$9.3 Million - Concrete</p>
<b>Infrastructure Maintenance</b>	2 Bridges, 450 ft of retaining wall, 2 signals	2 Bridges, 450 ft of retaining wall, 2 signals	1 Bridge, 2450 ft of retaining wall, 3 signals
<b>Properties within Construction Limits</b>	Possible Construction Impacts include 3 Residents and 12 Businesses	Possible Construction Impacts include 3 Residents and 16 Businesses, access to Globe Street and Market Street	Possible Construction Impacts include 3 Residents and 12 Businesses
<b>Consistency with Local Plans</b>	Consistent with local plans	Consistent with local plans	Consistent with local plans
<b>Route Continuity</b>	No change to the existing route	No change to the existing Old M-14 route. Plymouth Road will "T" into Old M-14, however the route will remain the same.	No change to the existing Old M-14 route. Hines Drive route will change with the addition of a signal.
<b>Change to Traffic Pattern</b>	No change to the existing traffic pattern	Westbound Plymouth from Old M-14 will require a right-turn at the signal	Hines Drive will have an additional access point on Old M-14
<b>User Delay</b>	Reduces user delay 7.8 hours compared to the future "No Build" condition. Old M-14 maintains existing grades. Hines Drive will be raised 3 feet, creating need for earth fill.	Reduces user delay 10.4 hours compared to the future "No Build" condition. Old M-14 maintains existing grades. Hines Drive will be raised 3 feet, creating need for earth fill.	Reduces user delay 21.3 hours compared to the future "No Build" condition. Possible configuration includes Old M-14 to be raised 7 feet requiring earth fill and Hines Drive to be lowered 11 feet to provide an at grade signalized intersection.
<b>Constructability</b>			



EVALUATION CRITERIA - ROADWAY | CS: 82101, JN: 106621

EXHIBIT 4-08

## 5.0 SUMMARY

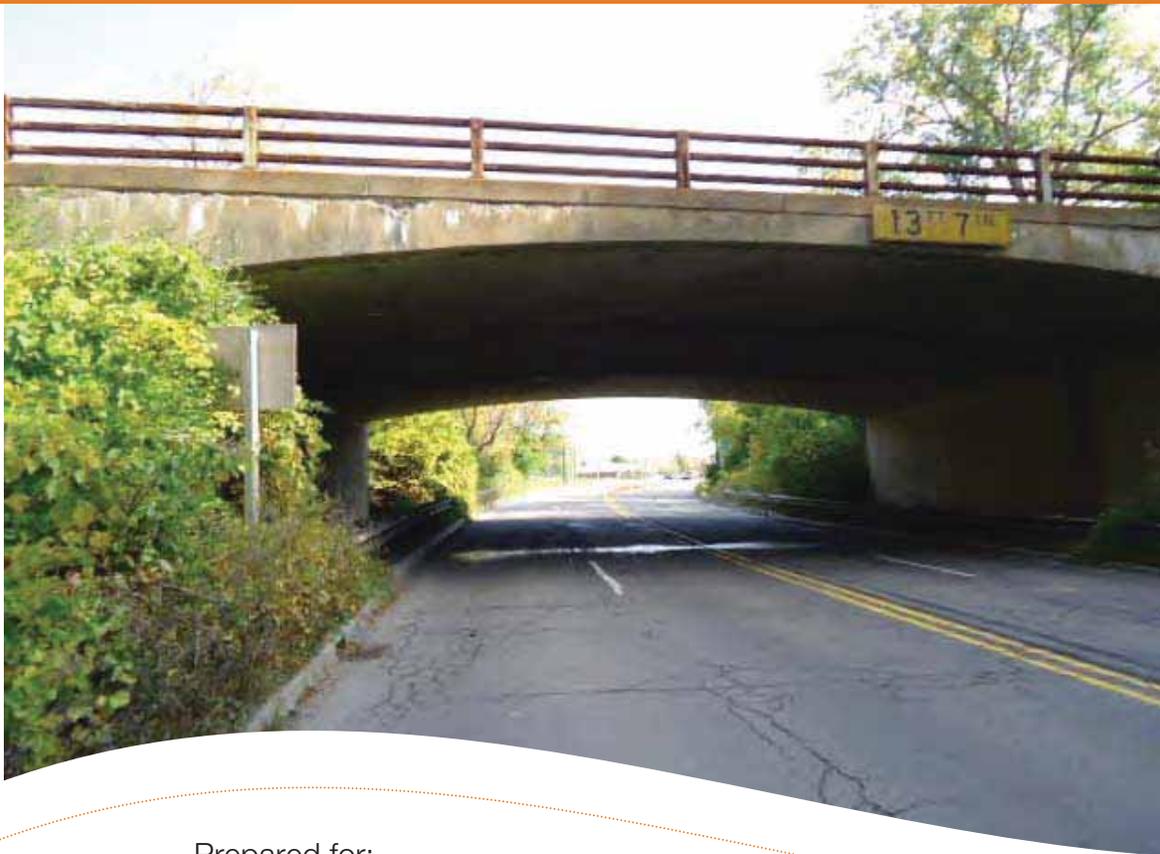
The information provided in this report is intended to provide documentation of the possible alternatives to improve the study area. It is not the intent of this study to provide environmental clearance or to choose a Preferred Alternative. Each alternative was developed and evaluated independently of each other with the benefits and impacts being documented and provided in this report for use in the future for the selection of a Preferred Alternative.

## Appendix A:

### Illustrative Alternatives Assessment Report

# Illustrative Alternatives Assessment Report Old M-14, Newburgh Road to Market Street CS 82101 – JN 106621

February 7, 2012



Prepared for:



34000 Plymouth Road  
Livonia, MI 48150  
[www.ohm-advisors.com](http://www.ohm-advisors.com)



## REPORT OVERVIEW

OHM has been directed by the Michigan Department of Transportation (MDOT) to perform a Feasibility Study focused on Old M-14 (Ann Arbor Road) from Newburgh Road to Market Street, including the bridge over the Middle Rouge River, the Edward N. Hines Drive Bridge over Old M-14 and the intersection with Plymouth Road. The deteriorating physical condition of the roadway and bridges, as well as safety and geometric considerations, is driving the need for this study.

This report is a presentation of the illustrative alternatives that have been chosen from the initial concepts presented at the first Steering Committee Meeting held on Tuesday, November 29, 2011. The initial concepts were condensed to illustrative alternatives based on the study goals and key strategies identified in the meeting. They were further refined based on comments and concerns of the steering committee members.

## INITIAL CONCEPT DEVELOPMENT

OHM developed initial concepts to present a variety of potential improvements for the project area. These initial concepts ranged from a simple rehabilitation of Old M-14 (Ann Arbor Road) to a full reconstruction and reconfiguration of the route. The concepts were labeled and the consultant team organized them from the least to the greatest impacts based on rudimentary assessments.

## STEERING COMMITTEE

A study Steering Committee (SC) was assembled under MDOT's direction with the goal of guiding the development of the Feasibility Study. Steering Committee members are listed below.

### Steering Committee Members

MDOT		Wayne County	City of Livonia	OHM	PB
Gorette Yung	Sue Datta	Ken Kucel	Todd Zilincik	Pat Wingate	Steve Ott
Jeff Horne	Marilyn Hansen	Chuck Nnaji	Mark Taormina	Jesse Morgan	
Adam Penzenstadler	Najim Salman	Noel Mullett		Steve Dearing	
Mike Budai	John Bugg			Jim Marcinkowski	
Kay Adefeso	Erik Carlson			Craig Dashner	
Julie Edwards	David Dortman				

The first SC meeting was held on November 29, 2011 at the MDOT Taylor Transportation Service Center. At the meeting, the study team presented the initial concepts and an overview of the study area's existing conditions. These included the physical condition of the road and bridges, current operational issues and environmental features. The study goals and key strategies were also presented and discussed. These goals and strategies were developed to provide the basis to prioritize what the SC considered most important to least important for the study area. Additional SC meetings are anticipated, with one scheduled for early February and a possible third meeting to be held in March.

## GOALS, DESIRES AND EXPECTATIONS

Study Goals	Key Strategies
Provide a functionally safe and efficient facility	<ul style="list-style-type: none"> <li>▼ Upgrade physical infrastructure</li> <li>▼ Improve operations</li> <li>▼ Improve safety</li> </ul>
Improve mobility and economic opportunities	<ul style="list-style-type: none"> <li>▼ Enhance multi-modal connectivity</li> </ul>
Limit environmental/cultural resource impacts	<ul style="list-style-type: none"> <li>▼ Minimize or mitigate impacts</li> </ul>
Define the character of the corridor	<ul style="list-style-type: none"> <li>▼ Incorporate complete streets principles</li> <li>▼ Explore gateway opportunities</li> <li>▼ Explore aesthetics opportunities</li> </ul>

## INITIAL CONCEPTS

The initial concepts presented at the first SC Meeting are depicted on **Pages 5-13** and described below:

- ▼ **Concept 1A** – Mill and Overlay – Maintain existing lane configuration and alignment.
- ▼ **Concept 1B** – Mill and Overlay – Widen to five 12-ft lanes on the existing alignment.
- ▼ **Concept 2A** – Reconstruct Old M-14 – Re-align and widen to five 12-ft lanes.
- ▼ **Concept 2B** – Reconstruct Old M-14 on the existing alignment and re-align Plymouth Road to “T” into Old M-14.
- ▼ **Concept 2C** – Reconstruct and re-align Old M-14 to “T” into Plymouth Road.
- ▼ **Concept 3** – Reconstruct Old M-14 with a signalized intersection at Old M-14 and Hines Drive.
- ▼ **Concept 4** – Reconstruct Old M-14 with roundabout intersections at Hines Drive and at Plymouth Road.
- ▼ **Concept 5** – Reconstruct Old M-14 with a five legged roundabout, consisting of Old M-14, Hines Drive and Plymouth Road.
- ▼ **Concept 6** – Remove Old M-14 from Newburgh Road to Plymouth Road, provide a grade separation of Hines Drive over Newburgh Road, and construct roundabouts at the Newburgh Road/ Plymouth Road and Newburgh Road/Old M-14 intersections.
- ▼ **Concept 7** – Remove Old M-14 from Newburgh Road to Plymouth Road and remove Hines Drive from Jughandle Road to Globe Street.
- ▼ **Concept 8** – Reconstruct Old M-14 and Plymouth Road as one-way roads from Newburgh Road to Market Street and provide a grade separation at Hines Drive over Newburgh Road.

Input provided by the SC on the goals, key strategies and initial concepts was used to develop an initial benefits/impacts matrix shown on **Pages 14-15**. The benefits/impacts table provides information on each initial concept and their potential impacts to the corridor. The benefits and impacts are preliminary and will be further refined once the final alternative(s) are chosen.



**Concept 1A:** Mill and Overlay - Maintain Existing Lane Configuration and Alignment  
**Concept 1B:** Mill and Overlay - Widen to Five - 12 ft Lanes on Existing Alignment





Concept 2A: Reconstruct Old M-14 - Re-Align and Widen to Five - 12 ft Lanes





Concept 2B: Reconstruct Old M-14 on Existing Alignment - Realign Plymouth Road to "T" into Old M-14





CONCEPT 2C: Reconstruct and Realign Old M-14 to "T" into Plymouth Road





Concept 3: Reconstruct Old M-14 with Signalized Intersection at Old M-14 and Hines Dr





Concept 4: Reconstruct Old M-14 with RAB Intersection at Hines Dr and at Plymouth Rd





Concept 5: Reconstruct Old M-14 with Five Point RAB Combining Old M-14, Hines Dr and Plymouth Rd





**Concept 6:** Remove Old M-14 from Newburgh Rd to Plymouth Rd - Grade Separate Hines Dr from Newburgh Rd. Construct RAB at Plymouth Rd and Old M-14





Concept 7: Remove Old M-14 from Newburgh Rd to Plymouth Rd. Remove Hines Dr from Jughandle Rd to Globe St.





**Concept 8:** Reconstruct Old M-14 and Plymouth Road as One Way from Newburgh Rd to Market St. Grade Separate Hines Dr over Newburgh Rd.



# Old M-14 Feasibility Study

JN 106621, CS 82101

## Benefits and Impacts Analysis of Initial Concepts



#	Benefits	Impacts
1A	<ul style="list-style-type: none"> <li>Minimal to no impact to Wayne County Park</li> <li>Will utilize service life remaining in the Rouge and Hines bridges</li> <li>Driver habits remain the same</li> <li>Geometric configuration remains the same</li> </ul>	<ul style="list-style-type: none"> <li>Horizontal Sight Offset (HSO) will not be brought up to standard</li> <li>Requires separate pedestrian bridge</li> <li>Pavement life will be reduced due to condition of existing roadway</li> </ul>
1B	<ul style="list-style-type: none"> <li>Minimal to no impact to Wayne County Park</li> <li>Driver habits remain the same</li> <li>Provides lane continuity through the Old M-14 corridor</li> <li>Geometric configuration remains the same</li> </ul>	<ul style="list-style-type: none"> <li>HSO will not be brought up to standard</li> <li>Requires separate pedestrian bridge over Rouge River</li> <li>Potential Section 106 impacts</li> <li>Pavement life will be reduced due to condition of existing roadway</li> </ul>
2A	<ul style="list-style-type: none"> <li>Provides improved pedestrian access on Old M-14 corridor</li> <li>Improves intersection geometrics of Plymouth Rd and Old M-14</li> <li>Alignment changes improves HSO</li> <li>Improves visibility of traffic signal at Plymouth Road and Old M-14 intersection</li> <li>Driver habits remain the same</li> </ul>	<ul style="list-style-type: none"> <li>Impacts Hines Park "Grow Zones"</li> <li>Potential Section 106 Impacts</li> <li>Potential Section 4(f)/6(f) Impacts</li> </ul>
2B	<ul style="list-style-type: none"> <li>Provides lane continuity through the Old M-14 corridor</li> <li>Improves visibility of traffic signal at Plymouth Road and Old M-14 intersection</li> <li>Improves intersection geometrics at Plymouth Road and Old M-14</li> <li>Replaces "Y" intersection with a traditional intersection</li> </ul>	<ul style="list-style-type: none"> <li>Impacts Hines Park "Grow Zone"</li> <li>Potential Section 106 impacts</li> <li>Potential Section 4(f)/6(f) Impacts</li> <li>Impacts access to businesses on Plymouth Road</li> <li>Requires permanent ROW purchase</li> </ul>
2C	<ul style="list-style-type: none"> <li>Improves visibility of traffic signal at Plymouth Road and Old M-14 intersection</li> <li>Improves intersection geometrics at Plymouth Road and Old M-14</li> <li>Potential to reduce Old M-14 laneage under Hines Drive Bridge</li> </ul>	<ul style="list-style-type: none"> <li>Impacts "Grow Zone"</li> <li>Potential Section 106 impacts</li> <li>Potential Section 4(f)/6(f) Impacts</li> <li>Interrupts Old M-14 Continuity</li> <li>Requires permanent ROW purchase</li> </ul>
3	<ul style="list-style-type: none"> <li>Removes one bridge from the MDOT system</li> <li>Provides additional access to Hines Park</li> <li>May reduce congestion at Newburgh and Hines Intersection</li> </ul>	<ul style="list-style-type: none"> <li>Will require complex signal timing</li> <li>Requires moderate to extensive grading</li> <li>Potential Section 106 impacts</li> </ul>
4	<ul style="list-style-type: none"> <li>Eliminates one bridge from the MDOT system</li> <li>Eliminates one signalized intersection</li> <li>Provides additional access to Hines Park</li> <li>May reduce congestion at Newburgh intersections</li> <li>Provides two continuous flow intersections</li> <li>Provides Context Sensitive opportunity for Hines Park and City of Livonia</li> </ul>	<ul style="list-style-type: none"> <li>Impacts "Grow Zone"</li> <li>Requires moderate grading</li> <li>Impacts access to businesses on Plymouth Road</li> <li>Potential Section 106 impacts</li> <li>Potential Section 4(f)/6(f) Impacts</li> </ul>

## Benefits and Impacts Analysis of Initial Concepts -Continued

#	Benefits	Impacts
5	<ul style="list-style-type: none"> <li>▪ Eliminates one bridge from the MDOT system</li> <li>▪ Eliminates one signalized intersection</li> <li>▪ Provides additional access to Hines Park</li> <li>▪ May reduce congestion at Newburgh intersections</li> <li>▪ Provides a continuous flow intersections</li> <li>▪ Provides gateway opportunity for Hines Park</li> <li>▪ MOT can utilize existing Old M-14</li> <li>▪ Increases route connectivity</li> </ul>	<ul style="list-style-type: none"> <li>▪ Impact "Grow Zone"</li> <li>▪ Requires extensive grading</li> <li>▪ Potential for secondary impacts of Middle Rouge Bridge</li> <li>▪ Impacts access to businesses on Plymouth Road</li> <li>▪ Potential Section 106 impacts</li> <li>▪ Potential Section 4(f)/6(f) Impacts</li> <li>▪ Requires additional intersection reconstruct at Newburgh Road and Old M-14</li> </ul>
6	<ul style="list-style-type: none"> <li>▪ Potential to eliminate two bridges from the MDOT system</li> <li>▪ Removes segment of Old M-14 corridor</li> <li>▪ Eliminates two intersections</li> <li>▪ Replaces two signalized intersections with continuous flow intersections</li> <li>▪ Provides additional opportunity for park and river access</li> <li>▪ Eliminates closely spaced signalized intersections on Newburgh</li> <li>▪ Grade separation of Hines Drive and Newburgh Road intersection increases park continuity</li> </ul>	<ul style="list-style-type: none"> <li>▪ Extensive grading required</li> <li>▪ Potential for residential relocation</li> <li>▪ Possible permanent ROW required</li> <li>▪ Potential Section 106 impacts</li> <li>▪ Potential Section 4(f)/6(f) Impacts</li> <li>▪ Increases traffic on Newburgh Road</li> <li>▪ Creates break in Old M-14 continuity</li> </ul>
7	<ul style="list-style-type: none"> <li>▪ Potential to eliminate two bridges from the MDOT system</li> <li>▪ Provides better traffic flow through corridor</li> <li>▪ Removes segments of Hines Drive and Old M-14</li> <li>▪ Provides additional opportunity for park and river access</li> <li>▪ Eliminates three intersections</li> <li>▪ Replaces three signalized intersections with continuous flow intersections</li> </ul>	<ul style="list-style-type: none"> <li>▪ Extensive grading required</li> <li>▪ Potential for residential relocation</li> <li>▪ May require permanent ROW</li> <li>▪ Potential Section 106 impacts</li> <li>▪ Increases traffic on Newburgh Road</li> <li>▪ Creates break in the Hines Drive and Old M-14 continuity</li> </ul>
8	<ul style="list-style-type: none"> <li>▪ Two existing bridges can be maintained and rehabilitated</li> <li>▪ Utilizes service life of existing bridges</li> <li>▪ Can utilize existing Old M-14 footprint for pedestrian route</li> </ul>	<ul style="list-style-type: none"> <li>▪ Requires three bridges to be maintained</li> <li>▪ Impacts access to businesses on Plymouth Road</li> <li>▪ Will require extensive grading</li> <li>▪ Potential for residential relocation</li> <li>▪ Possible permanent ROW required</li> <li>▪ Possible Section 106 impacts</li> <li>▪ Potential Section 4(f) Impacts</li> </ul>

## ILLUSTRATIVE ALTERNATIVES

The initial concepts were evaluated based on the goals, key strategies, benefits/impacts and SC input. The following initial concepts were eliminated for a variety of reasons, as described below:

- ▼ **Concept 1A** – Eliminated based on pavement design life and MDOT C&T direction supporting a pavement reconstruct.
- ▼ **Concept 1B** – Eliminated based on pavement design life and MDOT C&T direction supporting a pavement reconstruct.
- ▼ **Concept 4** – Eliminated based on potential impacts to Hines Park due to the size of the intersection footprint. This concept also incorporated two closely spaced roundabouts which is an intersection configuration that would be unique and unexpected for users within this and the surrounding traffic corridors.
- ▼ **Concept 5** – Eliminated due to the roundabout size and realignment of Old M-14 impacts to City of Livonia property and Hines Park. The proposed realignment of Old M-14 also impacts the currently undisturbed natural features of the Middle Rouge River. Finally, the geometric configuration and the intersection treatment, a roundabout with 5 entry and exit points, will alter how users are accustomed to traversing the study area.
- ▼ **Concept 7** – Eliminated due the impact to City of Livonia park/recreational property and Hines Park as well as potential development on Plymouth Road. The realignment of Jughandle Road, Hines Drive and the footprint required for the roundabouts has a greater impact to these facilities than the other concepts. The roundabout intersection treatments result in three new roundabouts on Plymouth Road which changes the nature expectations for users of this county road.

After the initial concepts were evaluated, six illustrative alternatives were chosen by the SC and further evaluated. The purpose of this evaluation was to provide additional details on each alternative, including geometric configurations, operations of each alternative and impact of the study area for each alternative. The illustrative alternatives are depicted on **Pages 18-25**

Intersections for each alternative were designed with a minimum Level-of-Service (LOS) of C. The LOS is based on guidance from AASHTO's 2004 Geometric Design of Highways and Streets, Exhibit 2-32. Alternatives 6 and 8 include sub-alternatives depicting signalized intersections in place of roundabouts. The illustrative alternatives and sub-alternatives are described below:

- ▼ **Illustrative Alternative 2A – Reconstruct Old M-14, re-align and widen to five 12-ft lanes**  
Alternative 2A will provide LOS B at the Plymouth Road/Old M-14 intersection and would re-align Old M-14.
- ▼ **Illustrative Alternative 2B – Reconstruct Old M-14, re-align Plymouth Road to “T” into Old M-14**  
Alternative 2B will provide LOS B at the Plymouth Road/Old M-14 intersection and would re-align Plymouth Road to “T” into Old M-14.
- ▼ **Illustrative Alternative 2C – Reconstruct Old M-14, re-align to “T” into Plymouth Road**  
Alternative 2C will provide LOS B at the Plymouth Road/Old M-14 intersection and would re-align Old M-14 to “T” into Plymouth Road.
- ▼ **Illustrative Alternative 3 – Reconstruct Old M-14 with signalized intersection at Hines Drive and Plymouth Road**  
Alternative 3 will provide LOS B at both the Old M-14/Hines Drive and Old M-14/Plymouth Road intersections and would replace the Hines Bridge over Old M-14 with a signalized at-grade intersection.

▼ **Illustrative Sub-Alternative 6 (Single RAB) – Remove Old M-14 from Newburgh Road to Plymouth Road**

Alternative 6 (Single RAB) will provide LOS B at the Newburgh Road/Plymouth Road and Newburgh Road/Old M-14 Intersections. Hines Drive will be grade separated over Newburgh Road. The Middle Rouge River Bridge could be eliminated as well as the Hines Bridge with the removal of Old M-14 from Newburgh Road to Plymouth Road.

▼ **Illustrative Sub-Alternative 6 (Signals) – Remove Old M-14 from Newburgh Road to Plymouth Road**

Alternative 6 (Signals) will provide LOS C at the Newburgh Road/Plymouth Road, Newburgh Road/Hines Drive, and Newburgh Road/Old M-14 Intersections and also at the Jughandle Road/Plymouth Road Intersection. The Middle Rouge River Bridge could be eliminated as well as the Hines Bridge, with the removal of Old M-14 from Newburgh Road to Plymouth Road.

▼ **Illustrative Alternative 8 (Single RAB) – Reconstruct Old M-14 and Plymouth Road as one-way roads from Newburgh Road to Market Street.**

Alternative 8 (Single RAB) will provide a LOS B at the Newburgh Road/Plymouth Road, Newburgh Road/Hines Drive, and Newburgh Road/Old M-14 intersections. Hines Drive will be grade separated over Newburgh Road.

▼ **Illustrative Sub-Alternative 8 (Signals) – Reconstruct Old M-14 and Plymouth Road as one-way roads from Newburgh Road to Market Street.**

Alternative 8 (Signals) will provide a LOS C at the Newburgh Road/Plymouth Road, Newburgh Road/Hines Drive, and Newburgh Road/Old M-14 Intersections and also at the Jughandle Road/Plymouth Road intersection.



Illustrative Alternative 2A: Reconstruct Old M-14 - Re-Align and Widen to Five - 12 ft Lanes





Illustrative Alternative 2B: Reconstruct Old M-14 on Existing Alignment - Realign Plymouth Road to "T" into Old M-14





Illustrative Alternative 2C: Reconstruct and Realign Old M-14 to "T" into Plymouth Road





Illustrative Alternative 3: Reconstruct Old M-14 with Signalized Intersection at Old M-14 and Hines Dr





**Illustrative Alternative 6 (Roundabout):** Remove Old M-14 from Newburgh Road to Plymouth Road.  
Grade Separate Hines Road over Newburgh Road





Illustrative Sub-Alternative 6 (Signalized): Remove Old M-14 from Newburgh Road to Plymouth Road  
Grade Separate Hines Road over Newburgh Road





**Illustrative Alternative 8 (Roundabout):** Reconstruct Old M-14 and Plymouth Road as One Way from Newburgh Road to Market Street.  
Grade separate Hines Road over Newburgh Road





**Illustrative Sub-Alternative 8 (Signalized):** Reconstruct Old M-14 and Plymouth Road as One Way from Newburgh Road to Market Street.  
Grade separate Hines Road over Newburgh Road





## FINAL ALTERNATIVE(S) AND STUDY COMPLETION

Following the second SC meeting, the study team will further refine the geometrics based on a more in-depth assessment of operations, environmental coordination and specific impacts of each of the final alternative(s). Included in the assessment will be continued coordination with Wayne County and the City of Livonia to determine the extent of potential involvement with Section 4(f) resources, and properties eligible for the National Register of Historic Places under Section 106 of the National Historic Preservation Act. This will be particularly focused on the section of land bordered by Newburgh Road, Plymouth Road and Old M-14. The final alternative(s) will be chosen based on direction from the SC at the second SC meeting. The results of the detailed assessment may result in further coordination with MDOT and the SC.

A public meeting will be held to review alternatives with business owners and the general public to provide information about the operations and impacts and to receive valuable feedback on the final alternative(s).

The Final Feasibility Study Report will be submitted to MDOT. The report will present the final alternative(s) for use by MDOT to prioritize and program repairs needed to upgrade this corridor.

## Appendix B:

Old M-14 Feasibility Study –  
Reduction of Final Practical Alternatives Memo

# Memorandum



**Date:** March 28, 2012  
**To:** Mike Bellini  
**CC:** Jeff Horne, Gorette Yung, Jesse Morgan  
**From:** Patrick Wingate  
**Re:** Old M-14 Feasibility Study – Reduction to Final Practical Alternatives

Mr. Bellini,

MDOT recently held a public meeting to present five alternatives for public comment.

**Alternative 2A:** Reconstruct Old M-14 (Ann Arbor Road) with only minor geometric changes

**Alternative 2B:** Reconstruct Old M-14 (Ann Arbor Road) and “T” Plymouth Road into Old M-14

**Alternative 2C:** Reconstruct Old M-14 (Ann Arbor Road) and “T” Ann Arbor Road into Plymouth Road

**Alternative 3:** Reconstruct Old M-14 (Ann Arbor Road) and create a at-grade, signalized intersection at Old M-14 and Hines Drive

**Alternative 6:** Remove the Old M-14 (Ann Arbor Road) roadway segment from Newburgh Road to Plymouth Road, grade-separate Hines Drive over Newburgh Road

## Overall Feedback Summary

OHM provided a feedback form for the public to make comments on the information that was provided to them. We received comment cards from four residences. All preferred Alternative 2A and preferred the traffic patterns to remain the same. Of the four responses, one liked Alternative 2C and one resident liked the idea of roundabouts. Also three of the respondents preferred not to include roundabouts in the study area, with two commenting that they believe roundabouts are not safe. OHM has also received feedback from Steering Committee Members. The MDOT Geometrics Unit preferred Alternative 2A and was concerned with safety issues that arise from three lane roundabouts shown on Alternative 6 and from increased conflict points of Alternative 3 with the additional traffic signal. The Geometrics unit also had concern with the close spacing of the Hines Drive over Old M-14 and the proposed signal placement, which could be difficult for motorists to locate, depicted in Alternative 2B. Other Steering Committee Members have stated that Alternative 2B and 2C were very similar and of the two, Alternative 2B was preferred. This alternative would allow the highest volume of traffic to be more of a “through” movement rather

than a “turning” movement depicted in Alternative 2C. There was also concern from some Steering Committee Members that Alternative 3 would have a bigger impact on the flood plains, wetlands and park due to the grade change required.

#### Specific Alternative Recommendations

Based on the feedback from the Steering Committee, the Public and the OHM team investigations (summarized on the Evaluation Criteria Matrix), OHM recommends eliminating Alternative 6 from further study and retain Alternative 2A, Alternative 2B, Alternative 2C and Alternative 3. While there have been both advantages and disadvantages suggested for each of the four remaining alternatives, there still is a high benefit and low impact identified to date for each of these alternatives.

Alternative 2A was selected because it is the closest to the existing condition, yet with a rebuilt roadway and bridges, still meets many of the goals developed earlier in this study. Alternative 2B was chosen because it provides a more standardized geometric intersection and still best accommodates the higher volume movements in the corridor. It is also accepted by the Plymouth Road Development Authority and residents. Alternative 2C was chosen because its impacts are similar to Alternative 2B and it was accepted by the MDOT Lansing Geometrics Unit and the public. Alternative 3 was selected for further study because it retains the existing alignment, removes a bridge from the MDOT network, significantly increase sight distance, and reduces the required footprint of the Newburgh Road/ Old M-14 intersection. Alternative 6 was eliminated due to the large footprint and significant impacts to parkland the adjacent properties and with a now-minimal benefit that focused on a possible Wayne County Parks enhancement.

#### Study completion

The initial objective stated by MDOT for this Feasibility Study was to drive to final alternatives that are the most practical and not necessarily a single preferred alternative. The OHM team believes that these four alternatives (2A, 2B, 2C, and 3) have the highest potential benefit, however one or more alternatives could still fall out if determined to have a “fatal flaw” prior to the final reports.

OHM will begin final analysis of the four alternatives selected and prepare a Feasibility Report and the Scoping Document to be provided as a final deliverable.

If you have any questions or concerns, please contact me at (734) 522-6711.

Regards,



Patrick G. Wingate, P.E.  
Project Manager

## Appendix C:

### Old M-14 Preliminary Pavement Recommendation Memo



# OFFICE MEMORANDUM

**DATE:** July 13, 2011

**TO:** Jeff Horne  
Transportation Engineer, Taylor TSC

**FROM:** Lex Kinter  
Metro Region C&T – Area Soils Engineer

**SUBJECT:** CS 82101 – JN 106621  
Old M-14 from Newburgh Road to Market Street  
Preliminary Pavement Recommendation

## Proposed Work Description

**Reconstruction:** It is recommended that the pavement within the project limits be reconstructed based on the severe distresses and deterioration of the pavement section as discussed below in the Pavement Condition Survey section below.

## Proposed Pavement Section

The recommended pavement sections have been designed in accordance with the 1993 AASHTO Pavement Design Methodology. As this project does not require a formal Life Cycle Cost Analysis (LCCA), the below recommendation may prove to be the final, but may need adjustment due to considerations such as utility conflicts, hydraulics of the adjacent river and staging. It is recommended that the alternative yielding the highest cost be used for scoping purposes.

Using the PPMS let date of October 10, 2014, the estimated 20-year Equivalent Single Axle Loads (ESALs) are 2.6 million for flexible pavement and 4.4 million for rigid pavement. A Traffic Analysis Request (TAR) must be submitted to the Project Planning Section for an official ESAL forecast.

### ***Alternative #1: Reconstruct with Hot Mix Asphalt Pavement***

THICKNESS (IN.)	ITEM	REMARKS
1.5	HMA, 5E3, High Stress	Top Course, 165 lbs/syd, PG 70-22P (AWI=260)
2.0	HMA, 4E3, High Stress	Leveling Course, 220 lbs/syd, PG 70-22P
3.0	HMA, 3E3	Base Course, 330 lbs/syd, PG 58-22
16.0	Open-Graded Drainage Course	
--	Geotextile Separator	
8.0	Sand Subbase	MDOT CI II Granular Material
6.0	Open-Graded Underdrain System	

**Alternative #2: Reconstruct with Jointed Plain Concrete Pavement**

THICKNESS (IN.)	ITEM	REMARKS
9	High Performance Non-Reinforced Concrete Pavement	Grade P1 Modified
16	Open Graded Drainage Course	
	Geotextile Separator	
6	Open Graded Underdrain System	

It is recommended that, for the HMA pavement section, lanes and shoulders be paved in echelon to reduce the total number of longitudinal construction joints.

**Pavement History**

YEAR	PROJECT ID	WORK DESCRIPTION	PAVEMENT SECTION	REMARKS
1924	81-15 C8	20-foot, two lane road construction, with 4-foot unpaved shoulders	9-in Concrete Pavement placed on subgrade. This is believed to be plain concrete.	The limits of this project was from POB to POE. Open ditch drainage systems. Believed to be parabolic.
1928	J-18-B-3	Road widened to 40-feet with 8-foot unpaved shoulders	Matched adjacent.	The limits of this project was from POB to POE.
1967	013	Road widened to 60-feet; paved shoulders with curb and gutter	8-in reinforced concrete Pavement placed on subgrade with a 2.2-inch bituminous overlay	Limits from Ann Arbor Road/Plymouth Road split to the POE
1974	07547	Road widened to total lane width of 60-feet	8-in reinforced concrete Pavement placed on subgrade with a 2.2-inch bituminous overlay	Limits from POB to Ann Arbor Road/Plymouth Road split. Curb and gutter included
1993	33556	1.5 inch Mill and Resurface	--	The limits of this project was from POB to POE.
2001	49401	Reconstruct	7.5 inch HMA on 6.3 inch aggregate base. Approach to river was 3.5 inch HMA on 9.5 in reinforced concrete on 6.3 inch aggregate base.	Limits from the POB to the Rouge River

It should be noted that the table above only includes projects with information available for review and considered applicable for this recommendation. The table may not represent every project or maintenance activity completed within the subject limits.

**Existing Pavement Condition**

***Pavement Condition Survey/Description:***

A field investigation was performed on June 14, 2011 (pictures available on request). The pavement from the POB to the Rouge River bridge showed slight distress of the longitudinal construction joint and some oxidation. There was some low severity map type cracks (unsealed) measuring approximately 1/8 inch.

The pavement from the Rouge River to the POE showed severely distressed areas with both longitudinal and transverse reflective cracking, in addition to areas with likely settlement. Using the latest Concrete Pavement Condition Survey Manual (1991) metrics as a guide, the

underlying concrete pavement is believed to have many underlying Severity Level 1 distresses. The cracks in these limits were unsealed at the time of inspection.

**Pavement Management Data:**

Pavement Measure	Definition	Year	EB	
<b>Distress Index (DI)</b>	DI $\geq$ 50 indicates pavement is in need of rehabilitation or reconstruction.	2007	58.611	
		2008	No Data	
		2009	No Data	
		2010	No Data	
<b>Remaining Service Life (RSL)</b>	RSL = the number of years to reach a DI of 50.	2007	2.7	
		2008	0	
		2009	0	
		2010	6.7	
<b>International Roughness Index (IRI)</b>	IRI $\leq$ 75 inches/mile is acceptable for new pavements (design speed > 50 mph). IRI $\leq$ 125 inches/mile is acceptable for new pavements (design speeds 30-50 mph). IRI > 254 inches/mile generally represents a damaged pavement.	2007	226	
		2008	No Data	
		2009	No Data	
		2010	282	

**Field Sample and Test Data**

**Mainline Pavement Cores:**

A total of 5 pavement cores and soil probes were performed in the area under JN 55664 (TH's 71, 79, 80, 86 and 102). The pavement cores generally reveal the composite pavement with average thicknesses of 5.2 inches HMA over 9.4 inches concrete over 7.5 inches of moderately compact, fine to coarse, moist sand.

		Mainline Old M-14
<b>HMA (inches)</b>	Avg.	5.2
	Min.	2.6
	Max.	9.2
<b>Concrete (inches)</b>	Avg.	9.4
	Min.	9.0
	Max.	10.6
<b>Sand Subbase (inches)</b>	Avg.	10.3
	Min.	7.6
	Max.	15

**Mechanical Analysis (Sand Samples):**

One sand sample (TH102 Sample#10) was obtained under JN55664. The sample was collected from a depth of 1-foot to 3-foot below the top of pavement. Mechanical analysis results indicate that this sand subbase material did not meet MDOT CL IIA requirements.

**Subgrade Classification and Groundwater Information:**

Several (approx 60%) of the test holes revealed sand to depth (TH's 102, 71, and 79). The sand varied from compact to moderately compact, fine to medium with trace gravel. The remaining test holes (TH's 80 and 86) revealed moderately compact fine to very fine sand over firm to high firm silty clay. Test hole 102 revealed saturated conditions at depths of 1.25

feet. Depending on the selected profile and work, subgrade correction and other treatments may be necessary.

***Dynamic Cone Penetrometer (DCP):***

DCP was conducted at one location within the project limits (TH 102). The California Bearing Ratio (CBR) value estimated is approximately 10 from 0-6 inches below grade, 20 from 6-20 inches below grade and 60 from 20-36 inches below grade.

The United States Army Corp of Engineers (USACE) DCP test procedure defines Good as CBR>10%, Marginal as CBR 5-10%, Poor as CBR 3-5%, and Very Poor CBR <3%.

**Field Sample and Test Data**

---

Existing pavement condition photos and raw field sample and test data are on file and available for further review upon request. Should you have any questions or concerns about this recommendation, or should you need additional information, please contact me by email at [kintera@michigan.gov](mailto:kintera@michigan.gov) or by telephone at (248) 483-5167.

METRO REGION MATERIALS AND TECHNOLOGY OFFICE

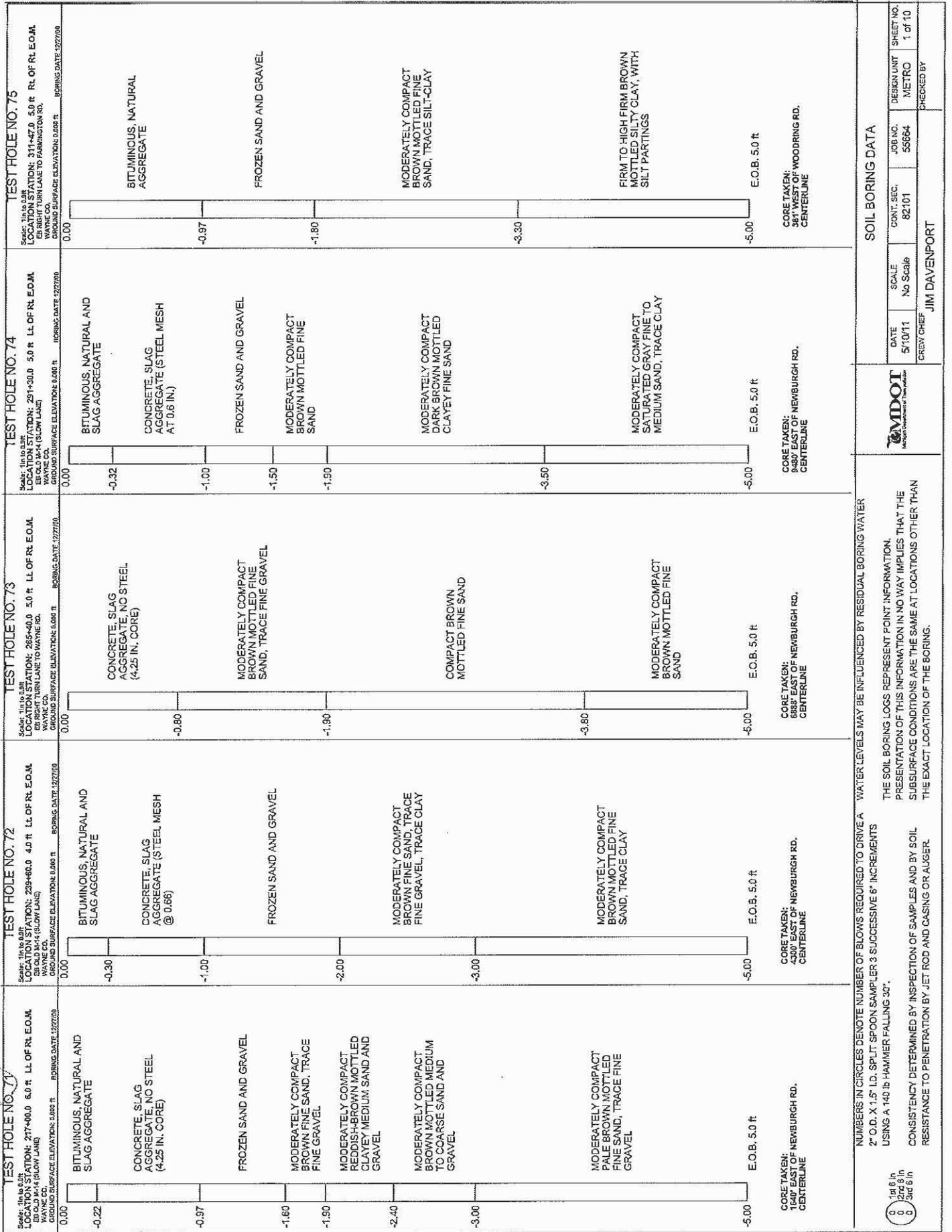


---

Alexis (Lex) Kinter, PE, PMP

Attachments: Soil Boring Log Sheets

cc: ProjectWise File



NUMBERS IN CIRCLES DENOTE NUMBER OF BLOWS REQUIRED TO DRIVE A 2" O.D. X 1.5" I.D. SPLIT SPOON SAMPLER 3 SUCCESSIVE 6" INCREMENTS USING A 140 LB HAMMER FALLING 30".

WATER LEVELS MAY BE INFLUENCED BY RESIDUAL BORING WATER

THE SOIL BORING LOGS REPRESENT POINT INFORMATION. PRESENTATION OF THIS INFORMATION IN NO WAY IMPLIES THAT THE SUBSURFACE CONDITIONS ARE THE SAME AT LOCATIONS OTHER THAN THE EXACT LOCATION OF THE BORING.

CONSISTENCY DETERMINED BY INSPECTION OF SAMPLES AND BY SOIL RESISTANCE TO PENETRATION BY JET ROD AND CASING OR AUGER.

SOIL BORING DATA

DATE	SCALE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO.
5/10/11	No Scale	82101	55664	METRO	1 of 10
CREW CHIEF JIM DAVENPORT					
CHECKED BY					



Scale: 1 in to 10 ft  
 LOCATION STATION: 311+47.0 5.0 ft RL OF RL E.O.M.  
 (SLOW LANE TO FARMINGTON RD.)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 0.66 ft. BORING DATE: 12/27/09

Scale: 1 in to 10 ft  
 LOCATION STATION: 291+30.0 5.0 ft LL OF RL E.O.M.  
 (SLOW LANE)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 0.00 ft. BORING DATE: 12/27/09

Scale: 1 in to 10 ft  
 LOCATION STATION: 285+40.0 5.0 ft LL OF RL E.O.M.  
 (SLOW LANE TO WAYNE RD.)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 0.00 ft. BORING DATE: 12/27/09

Scale: 1 in to 10 ft  
 LOCATION STATION: 228+60.0 4.0 ft LL OF RL E.O.M.  
 (SLOW LANE)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 0.00 ft. BORING DATE: 12/27/09

Scale: 1 in to 10 ft  
 LOCATION STATION: 277+00.0 6.0 ft LL OF RL E.O.M.  
 (SLOW LANE)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 0.00 ft. BORING DATE: 12/27/09

BITUMINOUS, NATURAL AGGREGATE

BITUMINOUS, NATURAL AND SLAG AGGREGATE

CONCRETE, SLAG AGGREGATE, NO STEEL (4.25 IN. CORE)

BITUMINOUS, NATURAL AND SLAG AGGREGATE

BITUMINOUS, NATURAL AND SLAG AGGREGATE

FROZEN SAND AND GRAVEL

FROZEN SAND AND GRAVEL

MODERATELY COMPACT BROWN MOTTLED FINE SAND, TRACE FINE GRAVEL

FROZEN SAND AND GRAVEL

FROZEN SAND AND GRAVEL

MODERATELY COMPACT BROWN MOTTLED FINE SAND, TRACE SILT-CLAY

MODERATELY COMPACT BROWN MOTTLED CLAYEY FINE SAND

COMPACT BROWN MOTTLED FINE SAND

MODERATELY COMPACT BROWN FINE SAND, TRACE FINE GRAVEL, TRACE CLAY

MODERATELY COMPACT REDDISH-BROWN MOTTLED CLAYEY MEDIUM SAND AND GRAVEL

FIRM TO HIGH FIRM BROWN MOTTLED SILTY CLAY, WITH SILT PARTINGS

MODERATELY COMPACT SATURATED GRAY FINE TO MEDIUM SAND, TRACE CLAY

MODERATELY COMPACT BROWN MOTTLED FINE SAND

MODERATELY COMPACT BROWN MOTTLED FINE SAND, TRACE CLAY

MODERATELY COMPACT PALE BROWN MOTTLED FINE SAND, TRACE FINE GRAVEL

E.O.B. 5.0 ft

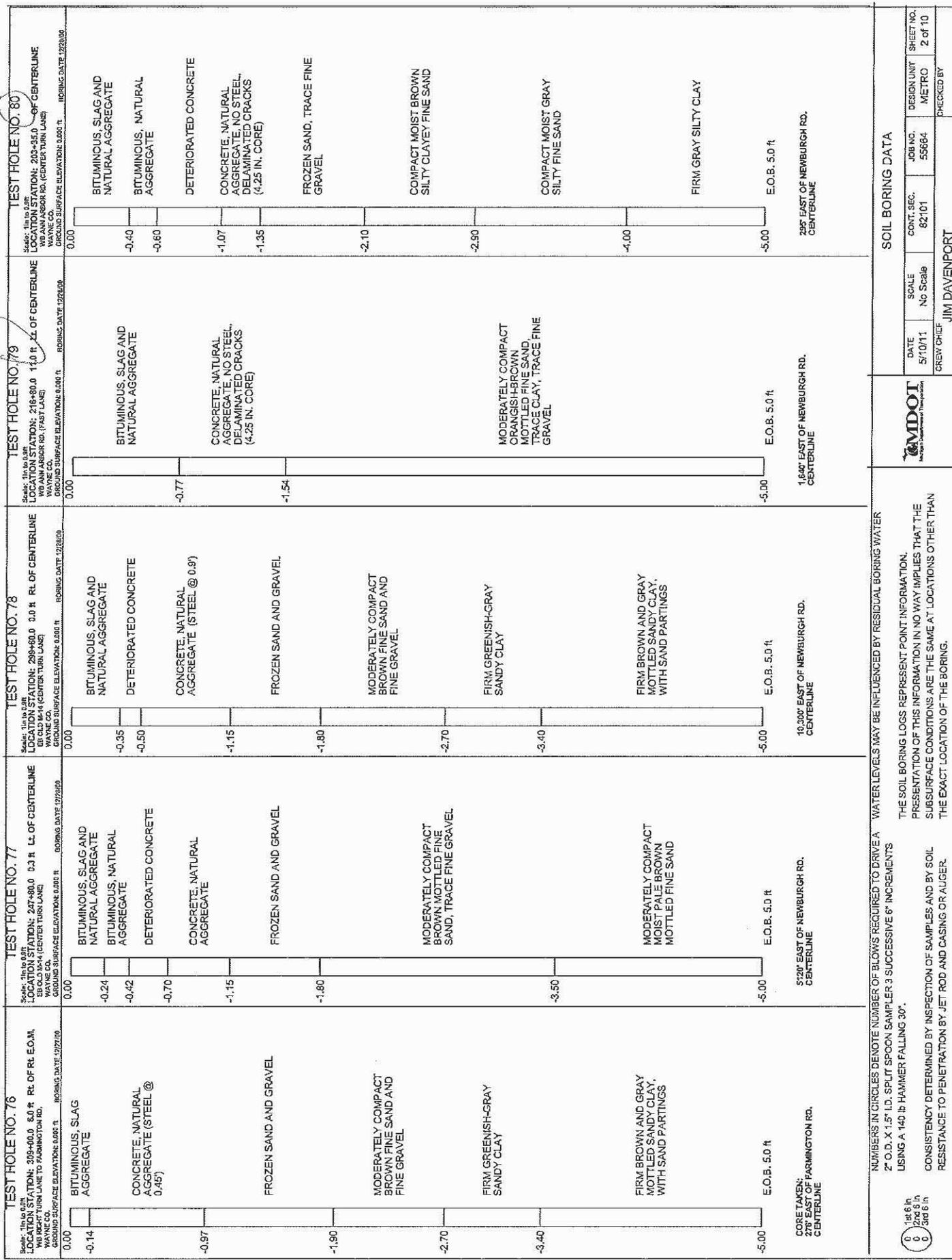
CORE TAKEN: 3411 WEST OF WOODRING RD. CENTERLINE

CORE TAKEN: 9489 EAST OF NEWBURGH RD. CENTERLINE

CORE TAKEN: 6888 EAST OF NEWBURGH RD. CENTERLINE

CORE TAKEN: 4300 EAST OF NEWBURGH RD. CENTERLINE

CORE TAKEN: 1647 EAST OF NEWBURGH RD. CENTERLINE



SOIL BORING DATA	
DATE	5/10/11
SCALE	No Scale
CONT. SEC.	82/101
JOB NO.	55664
DESIGN UNIT	METRO
SHEET NO.	2 of 10
CHECKED BY	JIM DAVENPORT

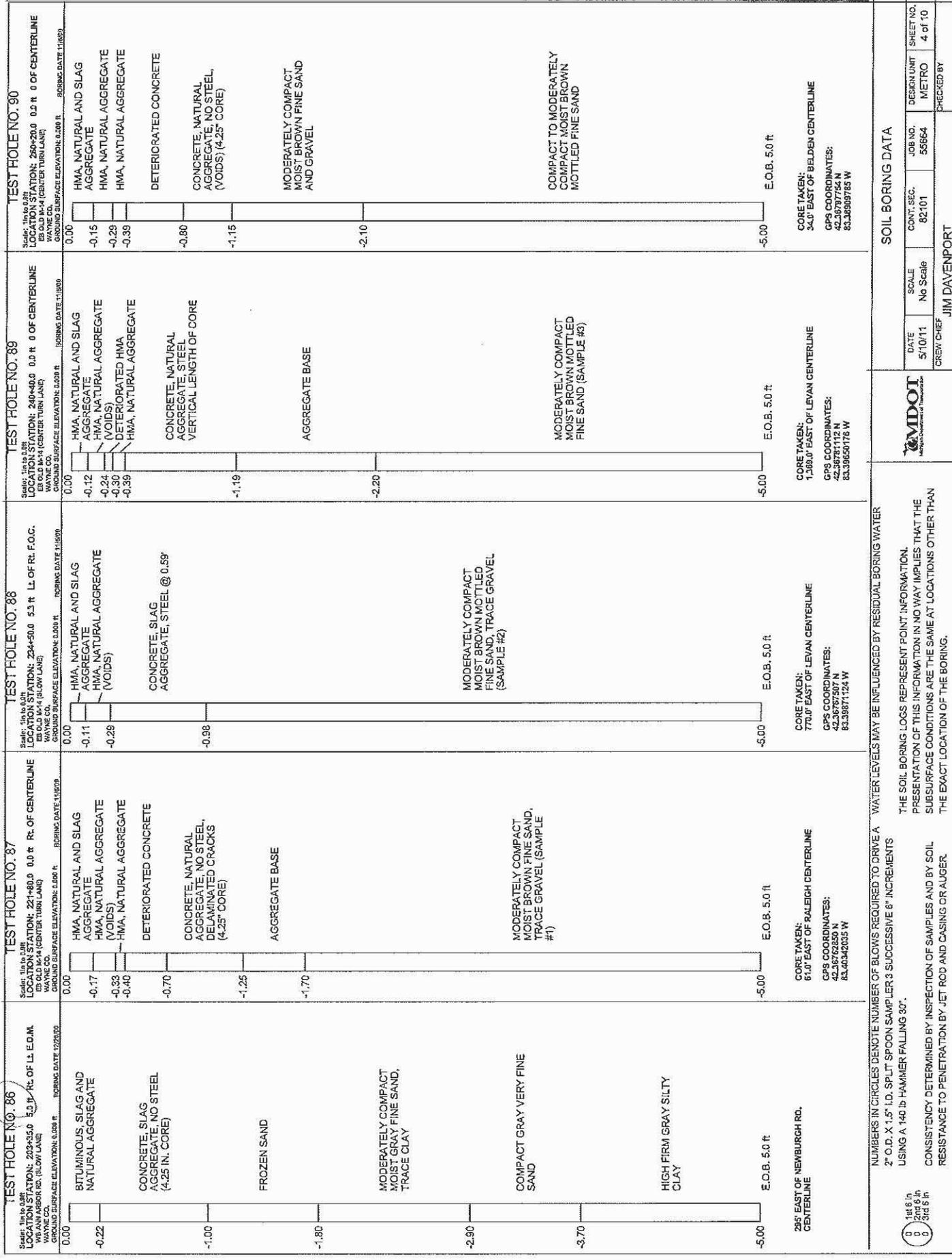
NUMBERS IN CIRCLES DENOTE NUMBER OF BLOWS REQUIRED TO DRIVE A 2" O.D. X 1.5" I.D. SPLIT SPOON SAMPLER 3 SUCCESSIVE 6" INCREMENTS USING A 140 lb HAMMER FALLING 30".

CONSISTENCY DETERMINED BY INSPECTION OF SAMPLES AND BY SOIL RESISTANCE TO PENETRATION BY JET ROD AND CASING OR AUGER.

THE SOIL BORING LOGS REPRESENT POINT INFORMATION. PRESENTATION OF THIS INFORMATION IN NO WAY IMPLIES THAT THE SUBSURFACE CONDITIONS ARE THE SAME AT LOCATIONS OTHER THAN THE EXACT LOCATION OF THE BORING.

WATER LEVELS MAY BE INFLUENCED BY RESIDUAL BORING WATER

1st 6 in  
2nd 6 in  
3rd 6 in



**TEST HOLE NO. 86**  
 Scale: 1/4" = 1.00 ft  
 LOCATION: 203+35.0 5.0 ft Rt. of L.S. E.D.M.  
 WB ANN ARBOR RD. (SLOW LANE)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 0.000 ft BORING DATE: 12/23/09

**TEST HOLE NO. 87**  
 Scale: 1/4" = 1.00 ft  
 LOCATION: 221+80.0 0.0 ft Rt. of CENTERLINE  
 EB OLD M-14 (CENTER TURN LANE)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 5.000 ft BORING DATE: 11/05/09

**TEST HOLE NO. 88**  
 Scale: 1/4" = 1.00 ft  
 LOCATION: 234+50.0 5.3 ft L. of R.L. F.O.C.  
 EB OLD M-14 (SLOW LANE)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 0.000 ft BORING DATE: 11/05/09

**TEST HOLE NO. 89**  
 Scale: 1/4" = 1.00 ft  
 LOCATION: 240+40.0 0.0 ft 0.0 OF CENTERLINE  
 EB OLD M-14 (CENTER TURN LANE)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 0.000 ft BORING DATE: 11/05/09

**TEST HOLE NO. 90**  
 Scale: 1/4" = 1.00 ft  
 LOCATION: 250+25.0 0.2 ft 0 OF CENTERLINE  
 EB OLD M-14 (CENTER TURN LANE)  
 WAYNE CO.  
 GROUND SURFACE ELEVATION: 0.000 ft BORING DATE: 11/05/09

1st 6 in  
 2nd 6 in  
 3rd 6 in

**SOIL BORING DATA**  
 DATE: 5/10/11  
 SCALE: No Scale  
 JOB NO.: 55864  
 DESIGN UNIT: METRO  
 SHEET NO.: 4 of 10  
 CHECKED BY: JIM DAVENPORT

**MDOT**  
 Michigan Department of Transportation

THE SOIL BORING LOSS REPRESENT POINT INFORMATION.  
 PRESENTATION OF THIS INFORMATION IN NO WAY IMPLIES THAT THE  
 SUBSURFACE CONDITIONS ARE THE SAME AT LOCATIONS OTHER THAN  
 THE EXACT LOCATION OF THE BORING.

NUMBERS IN CIRCLES DENOTE NUMBER OF BLOWS REQUIRED TO DRIVE A  
 2" O.D. X 1.5" I.D. SPLIT-SPoon SAMPLER 3 SUCCESSIVE 6" INCREMENTS  
 USING A 140 lb HAMMER FALLING 30".

WATER LEVELS MAY BE INFLUENCED BY RESIDUAL BORING WATER



Appendix D:

Old M-14 Hydraulic Report

**HYDRAULIC REPORT**

**PREPARED BY:** Andrew Kilpatrick, P.E. & Steven Reschke, P.E.  
Northwest Consultants, Inc.  
44978 Ford Road, Suite A  
Canton, MI 48187  
(734) 454-7566

**REVIEWED BY:** Tong Luo, P.E.  
Northwest Consultants, Inc.

**APPROVED BY:** Jie Luo, P.E.  
Northwest Consultants, Inc.

**SUMMARY**

The project encompasses Ann Arbor Road between Newburgh Road and Market Street, the signalized intersection of Plymouth and Ann Arbor Roads, and the Hines Drive Bridge over Ann Arbor Road/Old M-14 in the Hines Parkway, in the City of Livonia in Wayne County. The project is to study, assess, and develop proposed improvements to Ann Arbor Road and at the bridge over the Middle Rouge River (B03 of 82101), as it needs replacement due its deteriorating condition. The expected project length is approximately 0.5 miles. This analysis found an improvement with the proposed conditions as compared with the existing conditions for the 1% chance (100-year) storm event.

**PROJECT DATA**

STRUCTURE NUMER : B03  
CONTROL SECTION : 82101  
JOB NUMBER : 106621  
STREAM : Middle Rouge River  
CITY : Livonia  
COUNTY : Wayne  
SECTION : 32  
TOWN AND RANGE : T01S/R09E  
DRAINAGE AREA : 62.1 sq. mi.  
DISCHARGE : 2-YEAR: 550 cfs  
10-YEAR: 1300 cfs  
50-YEAR: 2300 cfs  
100-YEAR: 2700 cfs  
500-YEAR: 4200 cfs

**METHOD OF ANALYSIS**

HEC-RAS River Analysis System Version 4.1.0 was used for analyzing this water crossing.

**SCOPE OF STUDY**

The existing bridge over the Middle Rouge River is a concrete arch design built in the 1920's. The existing bridge spans 70 ft (hydraulic width) and has a total width of 49 ft (hydraulic length). The approximate elevation at the highest point of the bridge arch is 657.6.

There are four different proposed construction alternatives for the design of the project. The following descriptions list the proposed changes at the crossing location for each alternative:

- **Alternative 2A: Reconstruct Old M-14 (Ann Arbor Road)**  
This alternative proposes a 74 ft wide (hydraulic length) bridge. The minimum proposed span length that would avoid causing harmful interference (raise in energy grade or water surface elevation) is 80 ft (hydraulic width) and have a low chord elevation of 652.21.
- **Alternative 2B: Reconstruct Old M-14 (Ann Arbor Road) and “T” Plymouth Road into Old M-14**  
This alternative proposes a 74 ft wide (hydraulic length) bridge. The minimum proposed span length that would avoid causing harmful interference (raise in energy grade or water surface elevation) is 80 ft (hydraulic width) and have a low chord elevation of 652.22.
- **Alternative 2C: Reconstruct Old M-14 (Ann Arbor Road) and “T” into Plymouth Road**  
This alternative proposes a 74 ft wide (hydraulic length) bridge. The minimum proposed span length that would avoid causing harmful interference (raise in energy grade or water surface elevation) is 85 ft (hydraulic width) and have a low chord elevation of 652.22.
- **Alternative 3: Reconstruct Old M-14 (Ann Arbor Road) adding a signalized intersection at Old M-14 and Hines Drive**  
This alternative proposes a 74 ft wide (hydraulic length) bridge. The minimum proposed span length that would avoid causing harmful interference (raise in energy grade or water surface elevation) is 85 ft (hydraulic width) and have a low chord elevation of 652.22.

The low chord elevation of the bridge for each alternative was based on MDOT Policy and Design Criteria as described in Section 6.3.2 of the MDOT Drainage Manual. This section states “Where practical, a minimum clearance of 2 feet between the water surface and low chord shall be provided during the design flood” (100-year storm). The low chord elevations shown are calculated at exactly 2 feet above the water surface elevation for a 100-year storm event. This is

intended to model the minimum requirements set forth by MDOT. Clearances may be increased during actual bridge design.

**GEOMETRY OF THE MODEL**

A hydraulic survey was performed by Northwest Consultants to obtain hydraulic cross-sections for HEC-RAS modeling. All horizontal and vertical controls were based on the approved control data from MDOT JN55664C’s control information. The survey is based on the Michigan State Coordinate System NAD 83 South Zone. The project unit is international feet. All elevations are based on the North American Datum of 1988 (NAVD88).

The survey crew used a Trimble 5603 Autolock Total Station for mapping and used the latest MDOT feature codes to conduct the hydraulic survey information. The hydraulic cross-sections were surveyed as shown in the project scope. All of the survey data was adjusted using Star-Net and Star\*Lev programs and downloaded to CAiCE software, prior to being added to HEC-RAS.

The proposed structure and road information were modeled based on proposed designs.

**MANNING’S ROUGHNESS COEFFICIENT**

Terrain type along each cross-section was determined from pictures (see Appendix E) and field visits. Manning’s n values were then determined based on Table 4-1 in the *MDOT Drainage Manual*.

It was determined that the main channel should be classified as a major stream which is relatively clean, winding, and with some stones, weeds and pools/shoals. A minor stream with these characteristics would have a normal Manning’s n value around 0.045. However, because this is a major stream, the n value was lowered to 0.035 because the banks offer less effective resistance. The meets the minimum n value for major streams with irregular and rough sections. The overbanks are heavily forested and a Manning’s n of 0.160 was decided upon with MDOT personnel in the field meeting on September 9, 2011. The overbank on the south side of the river, upstream from the crossing contains areas of aggregate and high grass. A Manning’s n of 0.050 was assigned for this area, assuming a worst-case scenario.

**EXPANSION AND CONTRACTION COEFFICIENTS**

The ranges for the expansion and contraction coefficients used in the modeling are summarized below:

<b>Cross-section</b>	<b>Expansion</b>	<b>Contraction</b>
Gradual Transition	0.3	0.1
Bridge Sections	0.5	0.3

**STARTING WATER SURFACE ELEVATION**

Known conditions were the flow for the 50 and 100 year storms and the upstream and downstream stream water surface slopes which were approximated as the normal depth slopes. A best-fit curve was used on the surveyed water surface elevations to determine the slope of this tributary to be 0.000045 ft/ft upstream of the crossing and 0.00045 ft/ft downstream from the crossing.

**FINDINGS**

The analysis performed indicates an improved condition with the proposed conditions for the 1% chance (100-year) storm event. The attached summary table (Appendix A) describes this improvement.

**APPENDICES**

<b>Appendix A</b>	Summary Tables	<b>A1-A4</b>
<b>Appendix B</b>	Location Map and Map of Cross Section Locations	<b>B1</b>
<b>Appendix C</b>	Stream Profiles	<b>C1-C5</b>
<b>Appendix D</b>	MDEQ Discharge Estimates	<b>D1-D2</b>
<b>Appendix E</b>	Photographs	<b>E1-E6</b>
<b>(Attached)</b>	Computer Input and Output (Folder)	

**Appendix A**  
**Summary Tables**

**Alternative 2A: Reconstruct Old M-14 (Ann Arbor Road)**

This alternative proposes a 74 ft wide (hydraulic length) bridge containing a 65 ft roadway section (back of curb to back of curb), a 7 ft sidewalk on the north, and bridge barrier railing. The bridge width limits would extend 18.4’ upstream and 6.6’ downstream from the existing bridge limits. The proposed roadway grade would be raised approximately 0.3 feet. The proposed bridge would span 80 feet (hydraulic width).

50-YEAR FLOOD FREQUENCY: EXISTING VS. PROPOSED CONDITION (2A)										
Sec No.	Velocity in Channel (fps)		Top Width (ft)		Energy Grade (ft)		Change in Energy (ft)	Computed WS Elev (ft)		Change in WS Elev (ft)
	Existing	Proposed	Existing	Proposed	Existing	Proposed		Existing	Proposed	
50	3.05	3.06	255.64	254.65	650.01	649.99	-0.02	649.90	649.87	-0.03
45	3.77	3.79	250.02	249.84	649.97	649.94	-0.03	649.80	649.77	-0.03
40	3.39	3.41	315.82	315.43	649.89	649.86	-0.03	649.74	649.71	-0.03
35	3.63	3.65	177.59	177.21	649.85	649.82	-0.03	649.66	649.63	-0.03
30	4.22	4.24	156.52	155.28	649.80	649.77	-0.03	649.54	649.51	-0.03
28	Bridge									
25	3.06	3.06	253.86	253.64	649.66	649.65	-0.01	649.52	649.51	-0.01
20	3.97	3.97	475.31	475.24	649.61	649.60	-0.01	649.38	649.37	-0.01
15	4.29	4.29	369.36	369.24	649.56	649.55	-0.01	649.33	649.32	-0.01
10	4.13	4.13	412.22	412.09	649.45	649.44	-0.01	649.24	649.23	-0.01
5	3.91	3.91	454.86	454.82	649.34	649.33	-0.01	649.18	649.17	-0.01

100-YEAR FLOOD FREQUENCY: EXISTING VS. PROPOSED CONDITION (2A)										
Sec No.	Velocity in Channel (fps)		Top Width (ft)		Energy Grade (ft)		Change in Energy (ft)	Computed WS Elev (ft)		Change in WS Elev (ft)
	Existing	Proposed	Existing	Proposed	Existing	Proposed		Existing	Proposed	
50	3.22	3.24	282.69	281.45	650.77	650.73	-0.04	650.64	650.61	-0.03
45	3.85	3.87	255.01	254.75	650.72	650.69	-0.03	650.56	650.52	-0.04
40	3.53	3.56	325.71	325.21	650.64	650.61	-0.03	650.49	650.45	-0.04
35	3.83	3.85	186.83	186.37	650.61	650.57	-0.04	650.41	650.37	-0.04
30	4.57	4.61	172.21	171.63	650.56	650.52	-0.04	650.25	650.21	-0.04
28	Bridge									
25	3.34	3.34	277.79	277.67	650.39	650.38	-0.01	650.22	650.21	-0.01
20	4.28	4.28	480.75	480.67	650.33	650.32	-0.01	650.07	650.06	-0.01
15	4.55	4.54	379.27	379.13	650.28	650.27	-0.01	650.03	650.02	-0.01
10	4.38	4.38	422.40	422.24	650.17	650.16	-0.01	649.93	649.92	-0.01
5	4.09	4.08	458.01	457.96	650.05	650.04	-0.01	649.88	649.87	-0.01

### Alternative 2B: Reconstruct Old M-14 (Ann Arbor Road) and “T” Plymouth Road into Old M-14

This alternative proposes a 74 ft wide (hydraulic length) bridge containing a 65 ft roadway section (back of curb to back of curb), a 7 ft sidewalk on the north, and bridge barrier railing. The bridge width limits would extend 15.2’ upstream and 9.8’ downstream from the existing bridge limits. The proposed roadway grade would be raised approximately 0.3 feet. The proposed bridge would span 80 feet (hydraulic width).

50-YEAR FLOOD FREQUENCY: EXISTING VS. PROPOSED CONDITION (2B)										
Sec No.	Velocity in Channel (fps)		Top Width (ft)		Energy Grade (ft)		Change in Energy (ft)	Computed WS Elev (ft)		Change in WS Elev (ft)
	Existing	Proposed	Existing	Proposed	Existing	Proposed		Existing	Proposed	
50	3.05	3.05	255.64	254.99	650.01	650.00	-0.01	649.90	649.88	-0.02
45	3.77	3.78	250.02	249.90	649.97	649.95	-0.02	649.80	649.78	-0.02
40	3.39	3.40	315.82	315.57	649.89	649.87	-0.02	649.74	649.72	-0.02
35	3.63	3.64	177.59	177.35	649.85	649.83	-0.02	649.66	649.65	-0.01
30	4.22	4.23	156.52	155.75	649.80	649.78	-0.02	649.54	649.52	-0.02
28	Bridge									
25	3.06	3.06	253.86	253.84	649.66	649.66	0.00	649.52	649.52	0.00
20	3.97	3.97	475.31	475.30	649.61	649.60	-0.01	649.38	649.38	0.00
15	4.29	4.29	369.36	369.35	649.56	649.56	0.00	649.33	649.33	0.00
10	4.13	4.13	412.22	412.21	649.45	649.45	0.00	649.24	649.24	0.00
5	3.91	3.91	454.86	454.86	649.34	649.34	0.00	649.18	649.18	0.00

100-YEAR FLOOD FREQUENCY: EXISTING VS. PROPOSED CONDITION (2B)										
Sec No.	Velocity in Channel (fps)		Top Width (ft)		Energy Grade (ft)		Change in Energy (ft)	Computed WS Elev (ft)		Change in WS Elev (ft)
	Existing	Proposed	Existing	Proposed	Existing	Proposed		Existing	Proposed	
50	3.22	3.23	282.69	281.81	650.77	650.74	-0.03	650.64	650.62	-0.02
45	3.85	3.87	255.01	254.83	650.72	650.70	-0.02	650.56	650.53	-0.03
40	3.53	3.55	325.71	325.36	650.64	650.62	-0.02	650.49	650.47	-0.02
35	3.83	3.84	186.83	186.50	650.61	650.58	-0.03	650.41	650.38	-0.03
30	4.57	4.59	172.21	171.82	650.56	650.53	-0.03	650.25	650.22	-0.03
28	Bridge									
25	3.34	3.34	277.79	277.78	650.39	650.39	0.00	650.22	650.22	0.00
20	4.28	4.28	480.75	480.74	650.33	650.33	0.00	650.07	650.07	0.00
15	4.55	4.54	379.27	379.25	650.28	650.28	0.00	650.03	650.03	0.00
10	4.38	4.38	422.40	422.38	650.17	650.17	0.00	649.93	649.93	0.00
5	4.09	4.09	458.01	458.00	650.05	650.05	0.00	649.88	649.88	0.00

### Alternative 2C: Reconstruct Old M-14 (Ann Arbor Road) and “T” into Plymouth Road

This alternative proposes a 74 ft wide (hydraulic length) bridge containing a 65 ft roadway section (back of curb to back of curb), a 7 ft sidewalk on the north, and bridge barrier railing. The bridge width limits would extend 10.6’ upstream and 14.4’ downstream from the existing bridge limits. The proposed roadway grade would be raised approximately 1 foot. The proposed bridge would span 85 feet (hydraulic width).

50-YEAR FLOOD FREQUENCY: EXISTING VS. PROPOSED CONDITION (2C)										
Sec No.	Velocity in Channel (fps)		Top Width (ft)		Energy Grade (ft)		Change in Energy (ft)	Computed WS Elev (ft)		Change in WS Elev (ft)
	Existing	Proposed	Existing	Proposed	Existing	Proposed		Existing	Proposed	
50	3.05	3.06	255.64	254.82	650.01	649.99	-0.02	649.90	649.88	-0.02
45	3.77	3.79	250.02	249.87	649.97	649.95	-0.02	649.80	649.78	-0.02
40	3.39	3.41	315.82	315.50	649.89	649.86	-0.03	649.74	649.71	-0.03
35	3.63	3.65	177.59	177.28	649.85	649.83	-0.02	649.66	649.64	-0.02
30	4.22	4.23	156.52	155.53	649.80	649.78	-0.02	649.54	649.51	-0.03
28	Bridge									
25	3.06	3.06	253.86	253.82	649.66	649.66	0.00	649.52	649.52	0.00
20	3.97	3.97	475.31	475.29	649.61	649.60	-0.01	649.38	649.38	0.00
15	4.29	4.29	369.36	369.34	649.56	649.56	0.00	649.33	649.33	0.00
10	4.13	4.13	412.22	412.20	649.45	649.45	0.00	649.24	649.23	-0.01
5	3.91	3.91	454.86	454.85	649.34	649.34	0.00	649.18	649.18	0.00

100-YEAR FLOOD FREQUENCY: EXISTING VS. PROPOSED CONDITION (2C)										
Sec No.	Velocity in Channel (fps)		Top Width (ft)		Energy Grade (ft)		Change in Energy (ft)	Computed WS Elev (ft)		Change in WS Elev (ft)
	Existing	Proposed	Existing	Proposed	Existing	Proposed		Existing	Proposed	
50	3.22	3.24	282.69	281.62	650.77	650.74	-0.03	650.64	650.61	-0.03
45	3.85	3.87	255.01	254.79	650.72	650.69	-0.03	650.56	650.53	-0.03
40	3.53	3.55	325.71	325.29	650.64	650.61	-0.03	650.49	650.46	-0.03
35	3.83	3.85	186.83	186.43	650.61	650.58	-0.03	650.41	650.38	-0.03
30	4.57	4.59	172.21	171.77	650.56	650.53	-0.03	650.25	650.22	-0.03
28	Bridge									
25	3.34	3.34	277.79	277.77	650.39	650.39	0.00	650.22	650.22	0.00
20	4.28	4.28	480.75	480.73	650.33	650.32	-0.01	650.07	650.07	0.00
15	4.55	4.54	379.27	379.24	650.28	650.28	0.00	650.03	650.03	0.00
10	4.38	4.38	422.40	422.37	650.17	650.17	0.00	649.93	649.93	0.00
5	4.09	4.09	458.01	458.00	650.05	650.05	0.00	649.88	649.88	0.00

**Alternative 3: Reconstruct Old M-14 (Ann Arbor Road) adding a signalized intersection at Old M-14 and Hines Drive**

This alternative proposes a 74 ft wide (hydraulic length) bridge containing a 65 ft roadway section (back of curb to back of curb), a 7 ft sidewalk on the north, and bridge barrier railing. The bridge width limits would extend 10.6’ upstream and 14.4’ downstream from the existing bridge limits. The proposed roadway grade would be raised approximately 4 feet. The proposed bridge would span 85 feet (hydraulic width).

50-YEAR FLOOD FREQUENCY: EXISTING VS. PROPOSED CONDITION (3)										
Sec No.	Velocity in Channel (fps)		Top Width (ft)		Energy Grade (ft)		Change in Energy (ft)	Computed WS Elev (ft)		Change in WS Elev (ft)
	Existing	Proposed	Existing	Proposed	Existing	Proposed		Existing	Proposed	
50	3.05	3.06	255.64	254.82	650.01	649.99	-0.02	649.90	649.88	-0.02
45	3.77	3.79	250.02	249.87	649.97	649.95	-0.02	649.80	649.78	-0.02
40	3.39	3.41	315.82	315.50	649.89	649.86	-0.03	649.74	649.71	-0.03
35	3.63	3.65	177.59	177.28	649.85	649.83	-0.02	649.66	649.64	-0.02
30	4.22	4.23	156.52	155.53	649.80	649.78	-0.02	649.54	649.51	-0.03
28	Bridge									
25	3.06	3.06	253.86	253.82	649.66	649.66	0.00	649.52	649.52	0.00
20	3.97	3.97	475.31	475.29	649.61	649.60	-0.01	649.38	649.38	0.00
15	4.29	4.29	369.36	369.34	649.56	649.56	0.00	649.33	649.33	0.00
10	4.13	4.13	412.22	412.20	649.45	649.45	0.00	649.24	649.23	-0.01
5	3.91	3.91	454.86	454.85	649.34	649.34	0.00	649.18	649.18	0.00

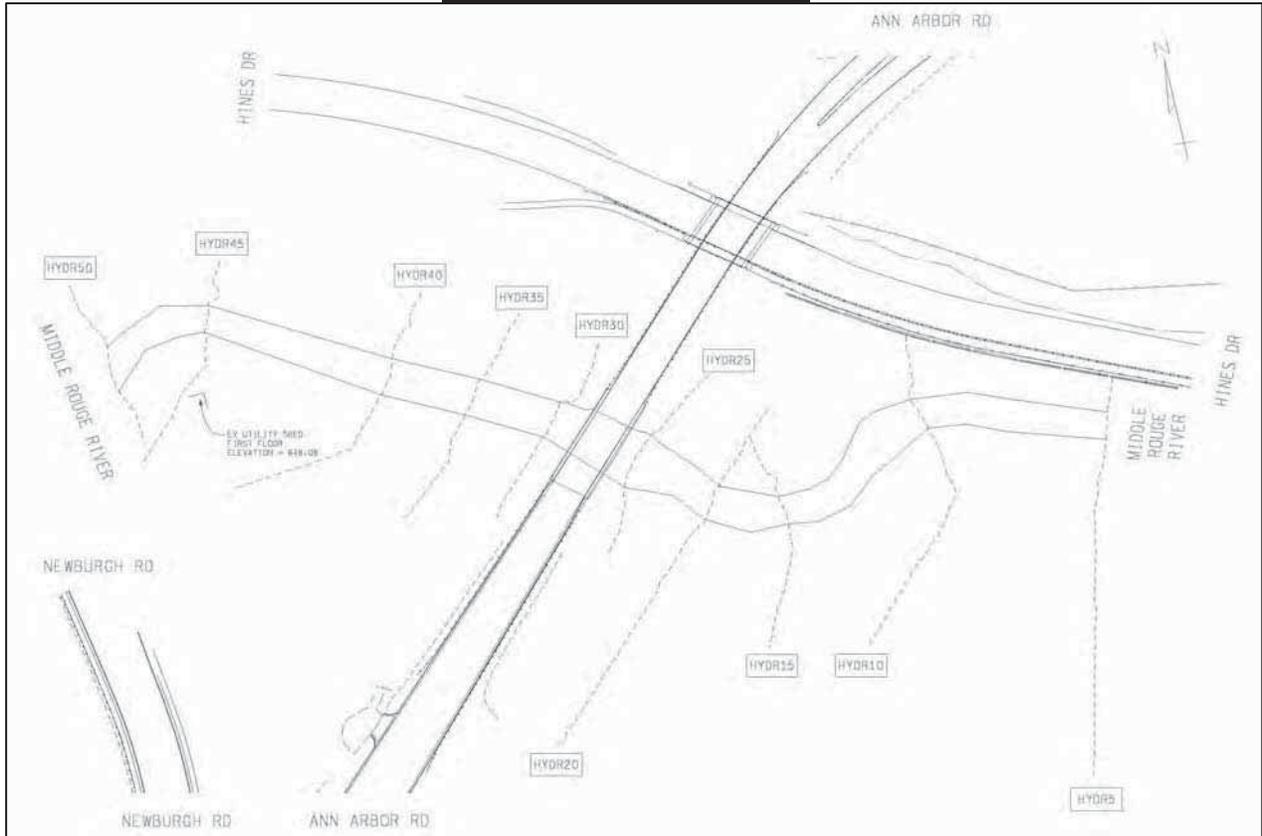
100-YEAR FLOOD FREQUENCY: EXISTING VS. PROPOSED CONDITION (3)										
Sec No.	Velocity in Channel (fps)		Top Width (ft)		Energy Grade (ft)		Change in Energy (ft)	Computed WS Elev (ft)		Change in WS Elev (ft)
	Existing	Proposed	Existing	Proposed	Existing	Proposed		Existing	Proposed	
50	3.22	3.24	282.69	281.62	650.77	650.74	-0.03	650.64	650.61	-0.03
45	3.85	3.87	255.01	254.79	650.72	650.69	-0.03	650.56	650.53	-0.03
40	3.53	3.55	325.71	325.29	650.64	650.61	-0.03	650.49	650.46	-0.03
35	3.83	3.85	186.83	186.43	650.61	650.58	-0.03	650.41	650.38	-0.03
30	4.57	4.59	172.21	171.77	650.56	650.53	-0.03	650.25	650.22	-0.03
28	Bridge									
25	3.34	3.34	277.79	277.77	650.39	650.39	0.00	650.22	650.22	0.00
20	4.28	4.28	480.75	480.73	650.33	650.32	-0.01	650.07	650.07	0.00
15	4.55	4.54	379.27	379.24	650.28	650.28	0.00	650.03	650.03	0.00
10	4.38	4.38	422.40	422.37	650.17	650.17	0.00	649.93	649.93	0.00
5	4.09	4.09	458.01	458.00	650.05	650.05	0.00	649.88	649.88	0.00

**Appendix B**  
**Location Map and Map of Cross Section Locations**

**Aerial Map**

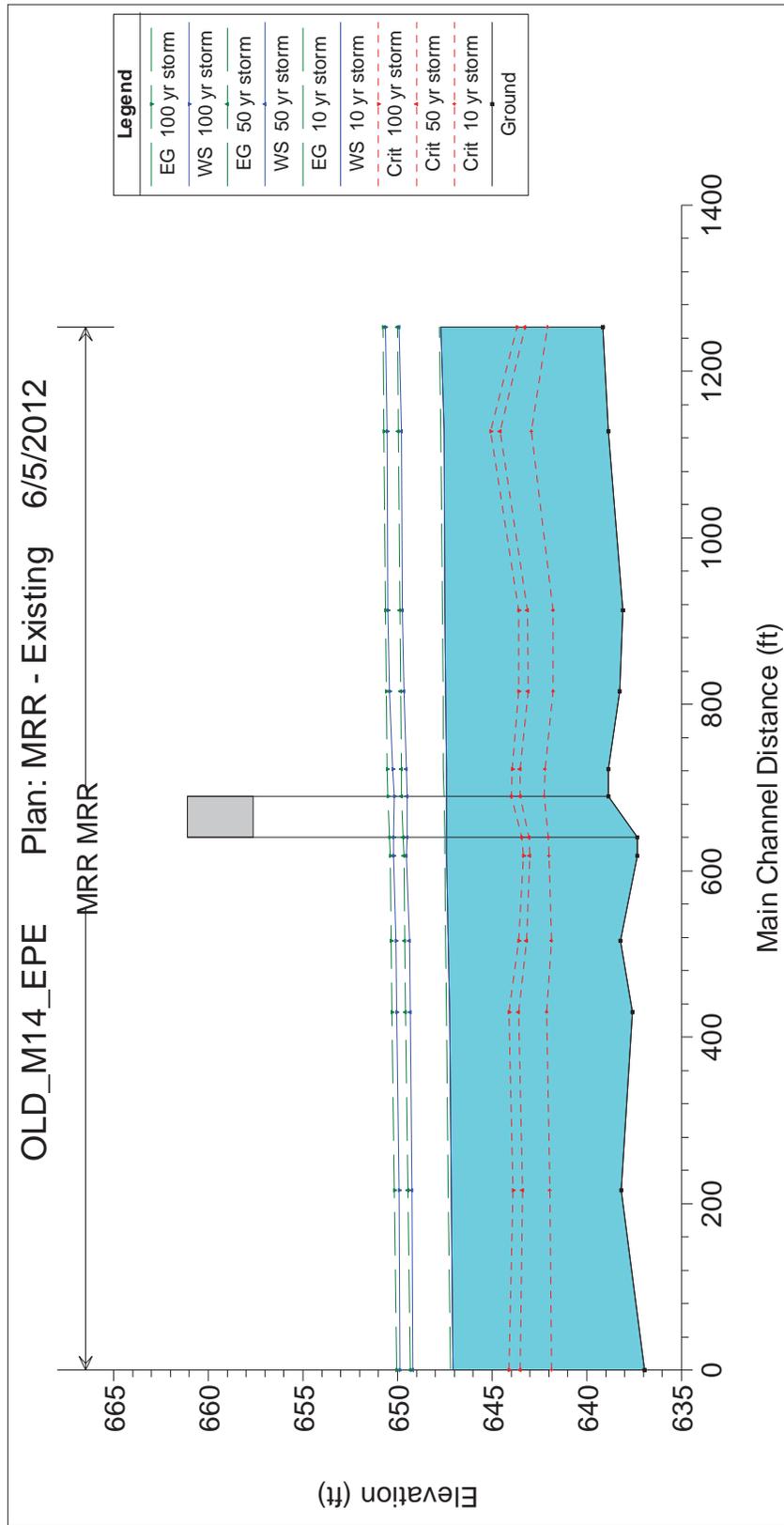


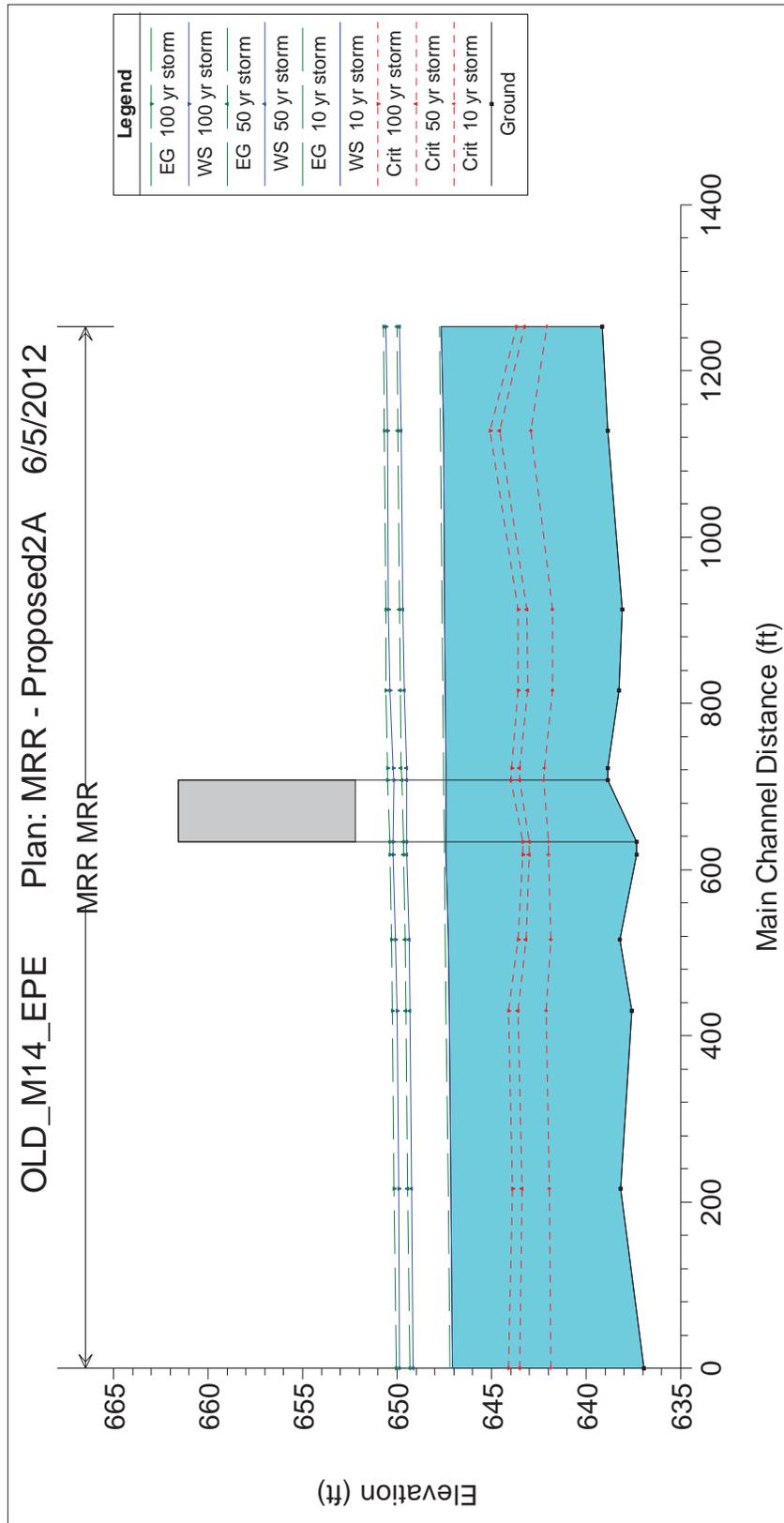
**Hydraulic Overview Map**

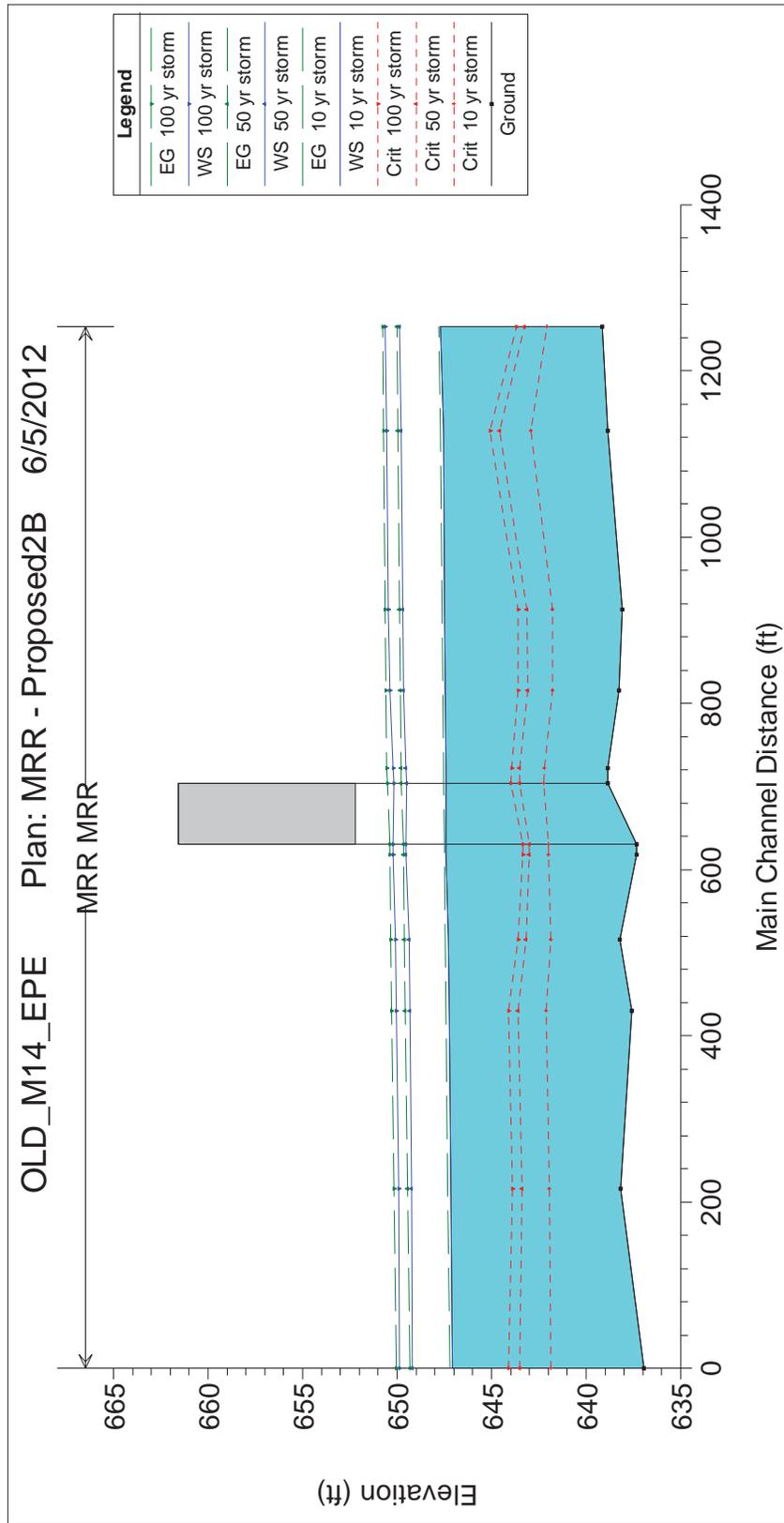


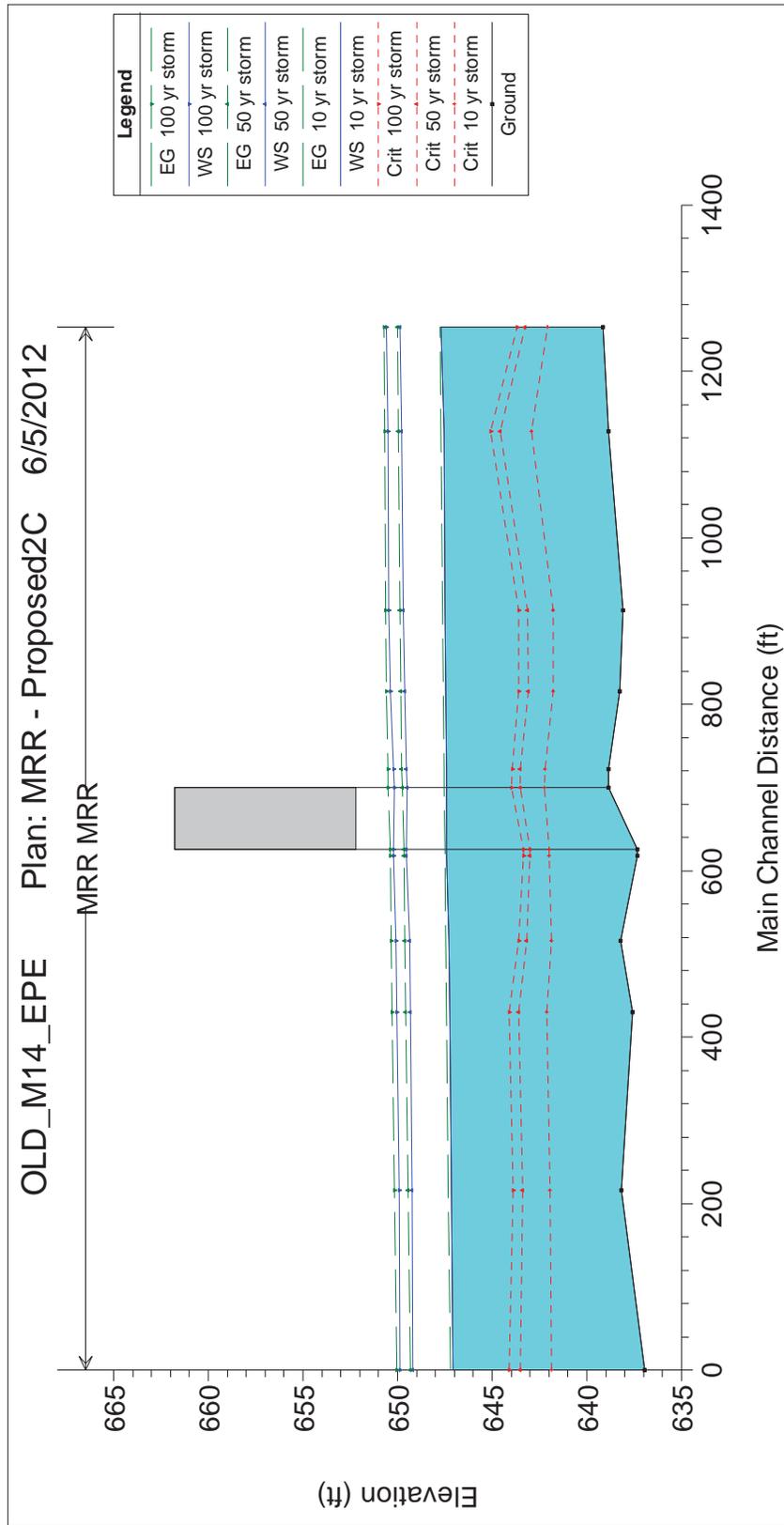
## **Appendix C**

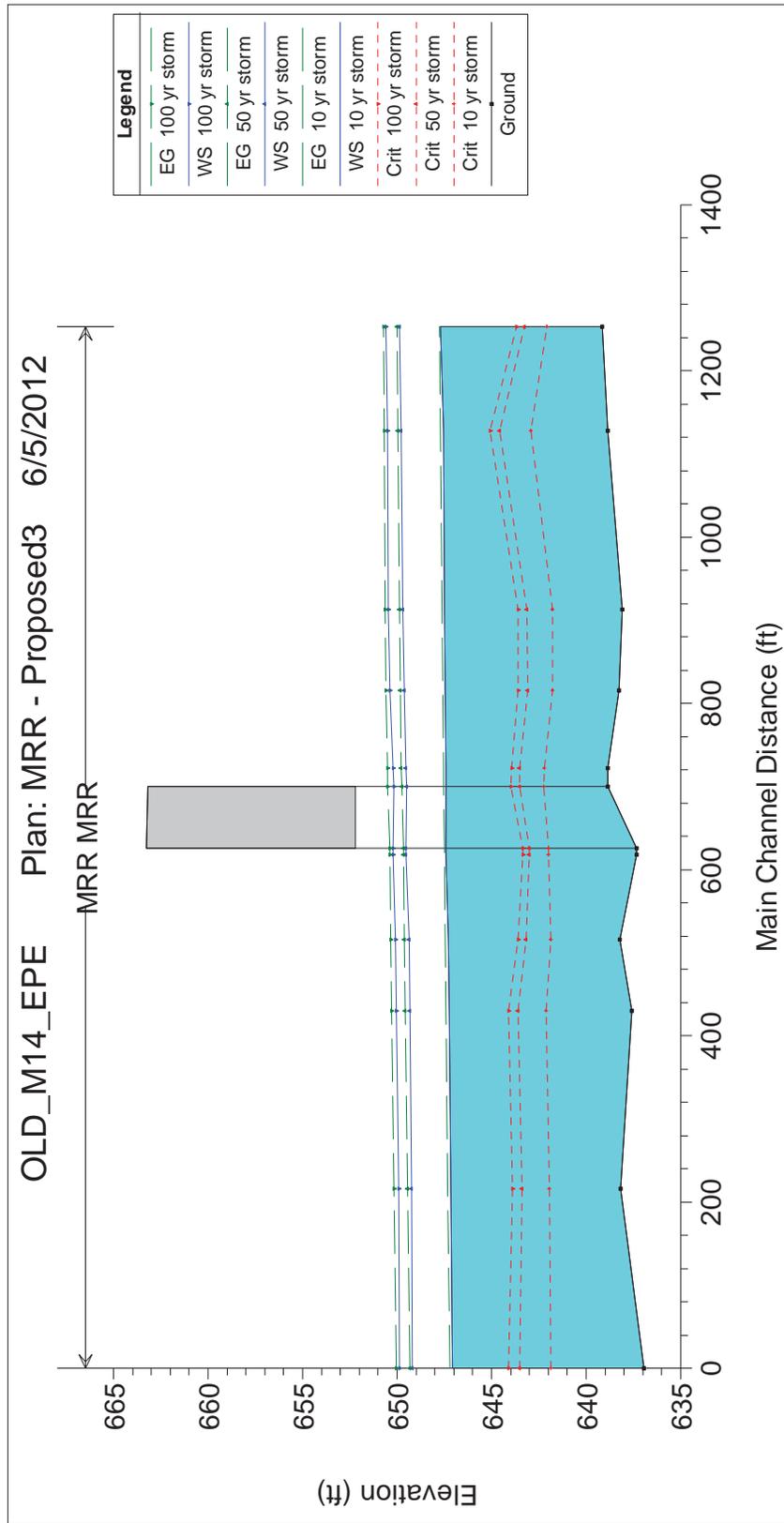
### **Stream Profiles**











**Appendix D**  
**MDEQ Discharge Estimates**

**Steven Reschke**

---

**From:** Andy Kilpatrick  
**Sent:** Monday, April 09, 2012 11:10 AM  
**To:** Steven Reschke  
**Subject:** FW: flood or low flow discharge request (ContentID - 168812)

Andrew Kilpatrick, P.E.  
Northwest Consultants, Inc.  
-----Original Message-----  
From: deq-wrd-qreq [<mailto:deq-wrd-qreq@michigan.gov>]  
Sent: Tuesday, October 18, 2011 9:49 AM  
To: Andy Kilpatrick  
Subject: RE: flood or low flow discharge request (ContentID - 168812)

This reply is being sent via email only.

We have estimated the flood frequency discharges requested in your email of September 30, 2011 (Process No. 20110340), as follows:

Middle River Rouge at Ann Arbor Road, Section 32, T1S, R9E, City of Livonia, Wayne County, has a drainage area of 62.1 square miles. The 50%, 10%, 2%, 1%, and 0.2% chance peak flows are estimated to be 550 cubic feet per second (cfs), 1300 cfs, 2300 cfs, 2700 cfs, and 4200 cfs, respectively. (Watershed Basin No. 31 Rouge).

Please include a copy of this letter with your application for permit and indicate whether or not the project is funded under Act 51. These estimates should be confirmed by our office if an application is not submitted within one year. If you have any questions concerning the discharge estimates, please contact Ms. Susan Greiner, Hydrologic Studies and Dam Safety Unit, at 517-241-1210 or by email to [GreinerS@michigan.gov](mailto:GreinerS@michigan.gov). Any questions concerning hydraulic and/or environmental permit issues should be directed to Mr. Jerry Fulcher, Water Resources Division, Transportation and Flood Hazard Management Unit, at 517-335-3172 or by email to [FulcherG@michigan.gov](mailto:FulcherG@michigan.gov).

-----Original Message-----  
From: Andrew Kilpatrick [<mailto:akilpatrick@nci-eng.com>]  
Sent: Friday, September 30, 2011 1:53 PM  
To: deq-wrd-qreq  
Subject: flood or low flow discharge request (ContentID - 168812)

Requestor: Andrew Kilpatrick  
Company: Northwest Consultants, Inc.  
Address: 44978 Ford Road, Suite A  
City: Canton, MI  
Zip: 48187  
Phone: 734-454-7566  
Date: 09/30/11  
F10percent: Yes  
F2percent: Yes

F1percent: Yes  
F0.2percent: Yes  
ContactAgency: None Selected  
ContactPerson:  
Watercourse: Middle Rouge River  
LocalName:  
CountyLocation: Wayne  
CityorTownship: Livonia  
Section: 32  
Town: 01S  
Range: 09E  
Location: Middle Rouge River at Ann Arbor Road crossing, approximately 550 ft downstream from Newburgh Road, in the NW 1/4 of Section 32.  
FFR1: MDOT Road Project  
  
Content-Length: 757567

## **Appendix E**

### **Photographs**



Dam Upstream of Structure – Looking West (Picture 01 – 10/20/11)



Channel Upstream of Structure – Looking Northwest (Picture 02 – 10/20/11)



Channel Upstream of Structure – Looking Southeast (Picture 03 – 10/20/11)



Upstream Face of Structure – Looking Southeast (Picture 04 – 10/20/11)



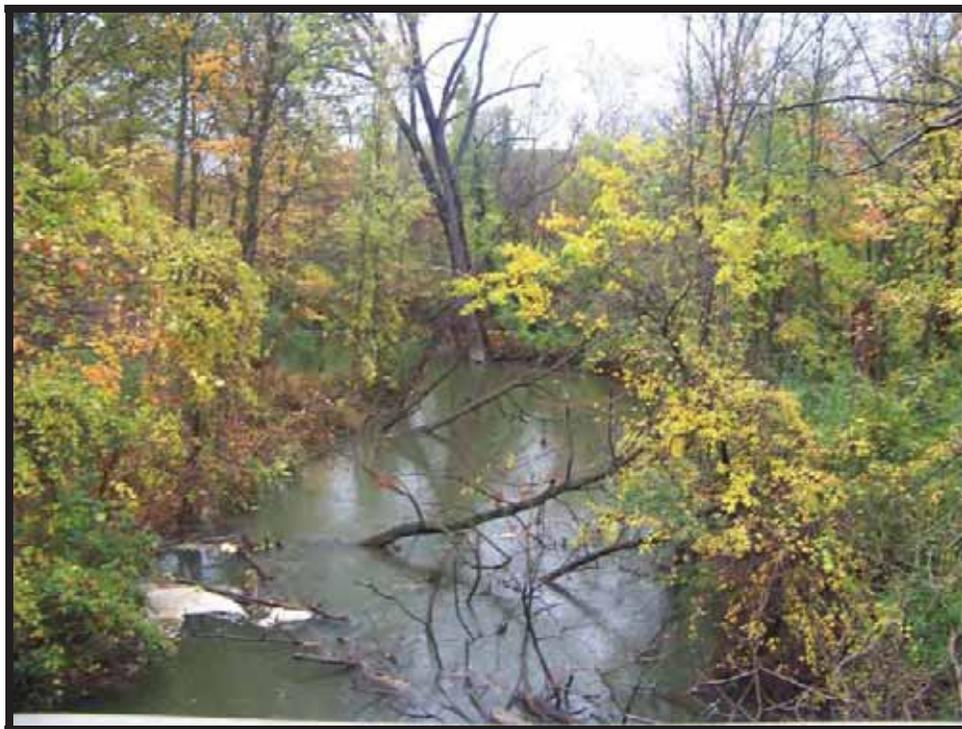
Upstream Channel from Structure – Looking Northwest (Picture 05 – 10/20/11)



Bridge Deck over Middle Rouge River – Looking Northeast (Picture 06 – 10/20/11)



Bridge Deck over Middle Rouge River – Looking Southwest (Picture 07 – 10/20/11)



Downstream Channel From Structure – Looking Southeast (Picture 08 – 10/20/11)



Downstream Face of Structure – Looking Northwest (Picture 09 – 10/20/11)



Channel Downstream of Structure – Looking Northwest (Picture 10 – 10/20/11)



Channel Downstream of Structure – Looking Southeast (Picture 11 – 10/20/11)

## Appendix E:

### Old M-14 Maintenance of Traffic Alternatives Analysis Memo

**To:** Jesse Morgan, OHM

**From:** Scott Shogan  
Tim Day

**Date:** April 20, 2012

**Subject:** Old M-14 (Ann Arbor Road)/Hines Drive Bridge Reconstruction  
Maintenance of Traffic Alternatives Analysis

The purpose of this memo is to present the analysis of Maintenance of Traffic (MOT) options for each of the reconstruction alternatives for the study area. The project generally includes reconstruction of Old M-14 (Ann Arbor Road) between Newburgh Road and Plymouth Road, and includes the replacement of the Hines Drive over Old M-14 bridge in order to facilitate a wider cross-section on Old M-14. This memo provides a summary of the geometric alternatives advanced for detailed analysis, key assumptions used to identify MOT options, and the evaluation of MOT components, along with recommended approach.

#### **Summary of Geometric Alternatives**

The proposed area of study is located along Old M-14 (Ann Arbor Road) between Newburgh Road and Plymouth Road in the City of Livonia, Wayne County, Michigan. Several initial geometric alternatives were developed and presented to MDOT and key project stakeholders for consideration. The following four geometric alternatives have been advanced for detailed evaluation, including the identification of MOT concepts included herein:

- Alternative 2A – Reconstruct Old M-14 and replace Hines Drive Bridge over Old M-14
- Alternative 2B – Reconstruct Old M-14, “T” Plymouth Road into Old M-14, and replace Hines Drive bridge over Old M-14
- Alternative 2C – Reconstruct Old M-14, “T” Old M-14 into Plymouth Road, and replace Hines Drive bridge over Old M-14
- Alternative 3 – Reconstruct Old M-14 and remove Hines Drive bridge creating an at grade signalized intersection of Old M-14 and Hines Drive

#### **Key Assumptions**

The maintaining traffic concepts presented in this memo were based on the following assumptions:

- The Old M-14 over the Rouge River bridge will be built on the same horizontal alignment. Given the existing width, the earth-filled arch-type structure, and without a change in horizontal alignment, it is only possible to maintain a maximum of one travel lane during the first stage of construction should part-width construction be desired.
- The Hines Drive over Old M-14 bridge will be built on the same horizontal alignment. Given the required increase in vertical grade (approximately 3-feet), and without a change in horizontal alignment, it is only possible to maintain a maximum of one travel lane plus pedestrian access during the first stage of construction should part-width construction be desired.

### MOT Alternatives Considered

Analysis of initial MOT alternatives yielded an understanding that the two key elements of the project - Hines Drive and Old M-14 - can be treated as independent maintaining traffic entities, and that options for maintaining traffic on each of those roadways can be done in any combination, with the exception of Alternatives 2C and 3. Due to the significant grade change needed on Hines Drive and Old M-14 in order to construct Alternative 2C and the need to remove the Hines Drive bridge for Alternative 3, it was determined that these alternatives can only be constructed by closing both Hines Drive and Old M-14.

The following presents the independent MOT options for reconstruction along Hines Drive and along Old M-14, including detour options for each.

#### Hines Drive over Old M-14

The following options have been identified to maintain traffic along Hines Drive for replacement of the Hines Drive over Old M-14 bridge:

- MOT Option A - Full Closure (applies to ALL alternatives): Option A includes full closure of Hines Drive from Newburgh Road to 1000' south of Hines Drive over Old M-14 bridge, with traffic detoured. Full closure would have the least construction duration but the greatest impact on motorists. In addition, a full closure would have a significant impact on recreational use, necessitating a long detour for pedestrians and bicyclists along Hines Drive and the recreational trail between Newburgh Road and Stark Road.
- MOT Option B – Part-Width Construction (applies only to Alternatives 2A and 2B): Part-width construction of the Hines Drive bridge. By using part-width construction, traffic could be maintained using three different schemes. Part-width construction is only feasible for Alternatives 2A and 2B as Alternatives 2C and 3 require full closure of Hines Drive for construction. Part-width construction would ease the impact on motorists but increase construction duration and cost. Additional cost for part-width construction of the Hines Drive bridge is estimated at \$140,000. In all options pedestrian traffic is proposed to be maintained to allow access to the recreational trail running parallel to Hines Drive.

- *MOT Option B-1:*

Stage 1 - Close Hines Drive to vehicles and maintain pedestrian traffic on existing sidewalk across the bridge. Construct half of Hines Drive bridge.

Stage 2 - Maintain two-way traffic on the completed half of the bridge and finish construction of Hines Drive bridge and approaches.

Option B-1 would have the least impact on construction duration and cost but the greatest impact on motorists using part-width construction. The impact to recreational/pedestrian use would be greatly reduced relative to full closure.

- *MOT Option B-2:*

Stage 1 - Maintain one lane in one direction of travel, in addition to pedestrian traffic using existing sidewalk portion of the bridge. The closed direction of travel would be detoured via the routes stated below.

Stage 2: Maintain one travel lane in each direction on the completed half of the bridge and finish construction of Hines Drive.

Option B-2 would reduce the impact to vehicle traffic relative to Option B-1, but would still result in the detour of one direction of travel. Cost and duration of construction would be marginally increased relative to Option B-1 due to the additional complexity of maintaining vehicle traffic through the construction area.

- *MOT Option B-3:*

Stage 1 - Maintain bi-directional travel on one travel lane using temporary traffic signals on either end of the construction site. Maintain pedestrian traffic on existing sidewalk portion of the bridge.

Stage 2: Maintain two-way traffic on the newly built half of Hines Drive bridge and complete construction of Hines Drive.

Option B-3 would have the least impact on vehicle traffic of the part-width closure options, but would result in additional cost, complexity, and potential safety concerns due to the need for temporary traffic signals for control of the alternating travel lane.

- Detour Options: Detours would be required for one or both directions of travel for Options A, B-1 and B-2. As Hines Drive itself is not a state route, it is not possible to detour Hines Drive entirely on state trunk lines. Therefore all detour routes for Hines Drive may require permits or rental fees from the local maintaining agency. The following two detour routes are suggested:

- Detour Option 1: Newburgh Road to I-96 Service Drive to Farmington Road to Joy Road (7 miles)
- Detour Option 2: Newburgh Road to Plymouth Road to Farmington Road to Joy Road (5.3 miles)

Although Option 1 is a longer route than Option 2, a portion of this detour would take place on state trunkline (the I-96 Service Drive) and may therefore reduce the need for local agency permits or rental fees as compared to Option 2. It should be noted I-96 in this area may be under construction at the same time. Due to the relatively low traffic volumes on Hines Drive, it is not anticipated that temporary improvements will be required to facilitate this detour. Given the unknowns at this time in terms of local agency fees or other requirements, it is recommended that both detour routes remain under consideration into the subsequent phases of this project.

Ann Arbor Trail was considered as a possible detour route. However, Ann Arbor Trail has a single lane in each direction, residential frontage, and poor capacity at major intersections for required turning movements. Although this detour would be shorter utilizing Ann Arbor Trail, 4.8 miles, it is not recommended.

The relative benefits and impacts of each of the Hines Drive MOT alternatives were considered and are evaluated in the Table 1.

**Table 1: Comparison of Hines Drive MOT Options**

	Option A	Option B-1	Option B-2	Option B-3
Construction Duration	●	◐	◑	◑
Motorist Impact	○	○	◐	◑
Non-Motorized Impact	○	●	●	●
Cost of Temporary Improvements	●	◐	◐	◑
Additional MOT Cost	●	◐	◐	◐
Constructability	●	◐	◐	◐
Safety	●	●	◐	◑
Business Impact	◐	◐	◐	◐
Impact to Residents	◐	◐	◐	◐
<b>OVERALL</b>	◐	◐	◐	◐
	○	◑	◑	●
	Least beneficial/greatest impact			Most beneficial/least impact

Old M-14 including Newburgh and Plymouth Intersections

The following options have been identified to maintain traffic during the reconstruction of Old M-14 between Newburgh and Plymouth Roads:

- MOT Option A – Full Closure (applies to ALL alternatives): Option A includes full closure of Old M-14 with traffic detoured. Full closure would have the least construction duration but the greatest impact on motorists. The intersections would be constructed part-width in advance of the closure, maintaining all traffic movements. There is no current pedestrian access along Old M-14 within the project limits, and therefore pedestrians would continue to utilize Newburgh and Plymouth Roads to traverse the project area.

Option A would have the most significant impact on vehicle traffic of the alternatives presented, but would result in greatly simplified construction operations, particularly of the Old M-14 over Middle Rouge bridge.

- MOT Option B: Part-Width Construction (applies only to Alternatives 2A and 2B): Option B includes construction of Old M-14 under various part-width traffic scenarios as stated below. This option is only feasible for Alternatives 2A and 2B as Alternatives 2C and 3 require full closure of Old M-14 for construction. These options include maintaining only one travel direction during stage 1, as it was found to be infeasible to alternate directions on a single lane due to lack of storage space for traffic queues. The intersections of Old M-14 with Newburgh and Plymouth Roads would be built part-width, maintaining all traffic movements throughout the construction.

- *MOT Option B-1:*

Stage 1 - Maintain one eastbound lane and reconstruct half of Old M-14. Westbound traffic would be detoured.

Stage 2 - Maintain one travel lane in each direction on the westbound reconstructed pavement and finish constructing Old M-14.

Option B-1 would reduce the impact to motorists of full closure, but greatly increase the complexity and cost of construction. For the reconstruction of the Old M-14 over Middle Rouge River bridge, part-width construction as compared to full closure is expected to add approximately \$480,000 to the construction cost of the project. In addition, the complexity of constructing this segment part-width may require the project be constructed over two seasons.

Under this option, westbound traffic would be detoured during Stage 1. Since detour options below would divert traffic to the north of the project area, westbound traffic would be required to make mostly left turns, which may result in capacity issues at certain intersection locations. See the discussion on detours for further information.

- *MOT Option B-2:*

Stage 1 - Maintain one westbound lane and reconstruct half of Old M-14. Westbound traffic would be detoured.

Stage 2 - Maintain one travel lane in each direction on the eastbound reconstructed pavement and finish constructing Old M-14.

Similar to Option B-1, Option B-2 would reduce the impact to motorists of full closure, but greatly increase the complexity and cost of construction. For the reconstruction of the Old M-14 over Middle Rouge River bridge, part-width construction as compared to full closure is expected to add approximately \$480,000 to the construction cost of the project. In addition, the complexity of constructing this segment part-width may require the project be constructed over two seasons.

Under this option, eastbound traffic would be detoured during Stage 1. Since detour options below would divert traffic to the north of the project area, eastbound traffic would be required to make mostly right turns, which may result in capacity issues at certain intersection locations. See the discussion on detours for further information.

- Detour Options: All MOT options for Old M-14 would require detour of at least one direction of traffic during one stage of construction. Given the location of surrounding state trunklines, a detour entirely on state trunklines may not be practical. Therefore, a variety of detour options were considered, some of which may require local agency permits or rental fees:

- *Detour Option 1 – All State Trunkline:* I-275 to I-96 to US-24 to Old M-14 (18 Miles). This detour option is the shortest option for utilizing only state trunklines, and would require the “intercepting” of traffic far in advance of the actual closure in order to properly detour traffic. Significant signage would be required to implement a detour of this length. At an average travel speed of 35 mph, this detour would take approximately 30 minutes to return to just beyond the point of closure, and is therefore very unlikely to be utilized by the majority of local traffic. The roadways and intersections along this detour are high-capacity and are not anticipated to need temporary improvements. It should be noted I-96 in this area may be under construction at the same time.
- *Detour Option 2 – Hybrid State/Local Roads:* Newburgh Road to I-96 Service Drives to Levan Road (3 miles). This option would utilize nearby local roadways, but would also leverage use of a portion of the I-96 service drives. The option also takes advantage of the relatively high-capacity intersection at Old M-14/Levan Road, and avoids the introduction of new turning traffic at Newburgh/Plymouth. At an average speed of 25 mph, this detour would take approximately 7 minutes. No temporary improvements are anticipated to be required in order to implement this detour.
- *Detour Option 3 – Local Roads:* Newburgh Road to Plymouth Road (0.6 miles). This option represents the shortest and most direct detour, and the

one most likely to be utilized by the majority of traffic. However, without significant diversion of traffic to other routes, this detour is likely to become extremely congested and strain signal operations. For the detour of westbound traffic (MOT Options A and B-1), the signal at the Newburgh and Plymouth intersection would need to be altered. The detour would significantly increase left turns from westbound Plymouth to southbound Newburgh. Therefore, the signal would need to be upgraded to a box span configuration and a split-phase added to allow protected left-turns. The southeast corner of the Newburgh and Plymouth intersection is a designated grow zone. If the signal is upgraded a Michigan Department of Environmental Quality (MDEQ) permit would be required.

The relative benefits and impacts of each of the Old M-14 MOT alternatives were considered and are evaluated in the Table 2. Comparative analysis of detour options are presented in Table 3.

### **Recommendations**

Based on the comparative evaluation of alternatives for each of the principle components of the project, the following are recommended options for MOT and detouring:

- Hines Drive over Old M-14: MOT Option B-1 – Part-Width (Peds only in Stage 1)

Option B-1 would include reconstruction of Hines Drive under part-width construction, maintaining pedestrian access during the first stage of construction. This will allow construction to proceed quickly, while not impeding recreational access along the park corridor. During the second stage, a portion of the bridge will be opened to two-way vehicular and pedestrian traffic for the duration of construction. This option balances speed and cost-effectiveness with the value of maintaining pedestrian access and avoiding a lengthy pedestrian detour. Both detour options are recommended to advance for further consideration during subsequent phases of study. Note that this recommendation only applies should Geometric Alternatives 2A or 2B be selected. Alternatives 2C and 3 will require full closure of this bridge during construction.

- Old M-14 (Newburgh to Plymouth): MOT Option A – Full Closure

While Option A would be the most disruptive to motorists, it would reduce cost and significantly accelerate the reconstruction of Old M-14, and most significantly the bridge over the Middle Rouge River. Part-width construction of this bridge would be costly and complex, with an estimated additional cost of \$480,000 to implement. In addition, part-width options may necessitate two seasons of construction in order to complete this work, thereby prolonging the impact of construction, and possibly requiring in lane closures over the winter.

- Old M-14 Detour: Option 2 – Hybrid Local/State Roads

While significantly longer than the local-only detour (Option 3), this option is reasonable in length, utilizes a portion of state roadways, and is not expected to require temporary improvements or signal modifications (beyond timing updates) to implement.

**Table 2: Comparison of Old M-14 MOT Options**

	Option A	Option B-1	Option B-2
Construction Duration			
Motorist Impact			
Non-Motorized Impact			
Additional MOT Cost			
Constructability			
Safety			
Business Impact			
Impact to Residents			
<b>OVERALL</b>			



**Table 3: Comparison of Old M-14 Detour Options**

	Option 1	Option 2	Option 3
Length			
Motorist Impact			
Cost of Temporary Improvements			
Cost of Signage			
Cost of Rental Fees/Permits			
Business Impact			
<b>OVERALL</b>			

