GREAT OAKS INDUSTRIAL PARCEL 1
JSP19-35

GREAT OAKS INDUSTRIAL PARCEL 1, JSP 19-35

Public hearing at the request of Hillside Investments for Preliminary Site Plan, Special Land Use Permit, Wetland Permit, Woodland Permit and Storm Water Management Plan approval for a new 98,650 square foot speculative building for research & development, manufacturing or warehouse uses. The subject property is approximately 20 acres and is located in Section 9, north of Twelve Mile Road and west of West Park Drive. The southern portion of the site is zoned I-1, Light Industrial District and the northern portion is zoned I-2, General Industrial District.

Required Action

Approve or deny the Preliminary Site Plan, Special Land Use Permit, Wetland Permit, Woodland Permit and Storm Water Management plan.

REVIEW	RESULT	DATE	COMMENTS
Planning	Approval recommended	6-12-20	• **Special Land Use permit approval required** • **Variance for building height in I-1 District** (*Applicant will correct in FSP – not requested*); • **Variance for parking setback in the I-2 District** (*Applicant will correct in FSP – not requested*); • **Request to landbank parking spaces in excess of the required minimum** *(Supported by staff);* • Items to be addressed by the applicant prior to Electronic Stamping Set approval
Engineering	Approval recommended	6-5-20	• Items to be addressed by the applicant prior to Final Site Plan approval
Landscaping	Approval recommended	5-13-20	• **Waiver for 16 consecutive parking spaces without a landscape island** (*Applicant will correct in FSP – not requested*); • **Waiver for lack of greenbelt berm** (*Applicant will correct in FSP – not requested);* • **Waiver for lack of access drive perimeter trees along the west side of the driveway** (*Applicant will correct in FSP – not requested);* • Items to be addressed by the applicant prior to Final Site Plan approval
Wetlands	Approval recommended	6-10-20	• **Non-minor Wetland Permit required** • **Wetland buffer authorization** • Items to be addressed by the applicant prior to Final Site Plan approval
Woodlands	**Approval Not recommended**	6-10-20	• **Developer to comply with Woodland Protection Ordinance for all trees determined to meet regulated status** *(Applicant will correct on FSP as*

			indicated in response letter) • **Woodland permit required**
Traffic	Approval recommended	6-5-20	• Items to be addressed by the applicant prior to Final Site Plan approval
Traffic Impact Statement	Approval recommended	3-2-20	• **Addendum to the TIS Report should address changes anticipated for 12 Mile Road** *(Provided by applicant)*
Façade	Approval recommended	6-10-20	• **Section 9 waiver for underage of Brick**
Fire	Approval with conditions	5-12-20	• Items to be addressed by the applicant prior to Final Site Plan approval

MOTION SHEET

Approval – Special Land Use Permit

In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **approve** the Special Land Use permit based on the following findings:

a. The applicant states possible uses could include research & development, manufacturing, or warehouse, which are special land uses in the I-1 Light Industrial district when they abut a residential district.
b. If a manufacturing or warehouse tenant is to occupy the site, a noise analysis subject to the standards of Section 5.14.10.B. shall be submitted to the Community Development Department for evaluation prior to occupancy. Research and development tenants shall submit a noise impact statement to the Community Development Department for evaluation prior to occupancy.
c. Relative to other feasible uses of the site:
    1. The proposed use will not cause any detrimental impact on existing thoroughfares *(Traffic impacts will be similar to other uses that could be developed by-right in the I-1 District. A right turn taper is proposed);*
    2. The proposed use will not cause any detrimental impact on the capabilities of public services and facilities *(because there is adequate capacity in the public services and this area is planned for Industrial use.);*
    3. The proposed use is compatible with the natural features and characteristics of the land *(because the proposed building will mostly be constructed on an area formerly used as a golf range, the impacts on existing regulated woodlands or wetlands are minimized.);*
    4. The proposed use is compatible with adjacent uses of land *(because the existing adjacent uses are also industrial and the residentially zoned properties to the south have been vacant for several years.);*
    5. The proposed use is consistent with the goals, objectives and recommendations of the City's Master Plan for Land Use (*It complies with the goal that recommends supporting growth of new businesses in the city*);
    6. The proposed use will promote the use of land in a socially and economically desirable manner (*Future tenants will be able to expand operations and offer employment to a greater number of people*.);
    7. The proposed use is (1) listed among the provision of uses requiring special land use review as set forth in the various zoning districts of this Ordinance, and (2) is in harmony with the purposes and conforms to the applicable site design regulations of the zoning district in which it is located. *(Both statements are true when considering the applicant has agreed to make changes to bring several deviations into conformance as described in their response letter.)*
    8. *(additional comments here if any)*

(This motion is made because the plan is otherwise in compliance with Article 3.1.5, Article 4, Article 5 and Article 6 of the Zoning Ordinance and all other applicable provisions of the Ordinance.)

-AND-

Approval – Preliminary Site Plan

In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **approve** the Preliminary Site Plan based on and subject to the following:

a. A section 9 waiver is requested for **the underage of brick** (30% minimum required, 29% on South, 19% on West, 22% on East and 24% on North façade proposed)

because the combination of other masonry materials proposed will bring the percentage to approximately 30%, which is hereby granted;

b. The findings of compliance with Ordinance standards in the staff and consultant review letters and the conditions and the items listed in those letters being addressed on the Final Site Plan; and

c. (additional conditions here if any)

(This motion is made because the plan is otherwise in compliance with Article 3, Article 4, and Article 5 of the Zoning Ordinance and all other applicable provisions of the Ordinance.)

-AND-

Approval – Wetland Permit

In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **approve** the Wetland Permit based on and subject to the following:

a. The findings of compliance with Ordinance standards in the staff and consultant review letters, and the conditions and items listed in those letters being addressed on the Final Site Plan; and

b. *(additional conditions here if any)*

(This motion is made because the plan is otherwise in compliance with Chapter 12, Article V of the Code of Ordinances and all other applicable provisions of the Ordinance.)

-AND-

Approval – Woodland Permit

In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **approve** the Woodland Permit based on and subject to the following:

a. The regulated tree count shall be updated to reflect all trees determined to be subject to regulation under the Woodland Protection Ordinance by the City's environmental consultant as indicated in the applicant's response letter;

b. The findings of compliance with Ordinance standards in the staff and consultant review letters, and the conditions and items listed in those letters being addressed on the Final Site Plan; and

c. *(additional conditions here if any)*

(This motion is made because the plan is otherwise in compliance with Chapter 37 of the Code of Ordinances and all other applicable provisions of the Ordinance.)

– AND –

Approval – Stormwater Management Plan

In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **approve** the Stormwater Management Plan based on and subject to the following:

a. The findings of compliance with Ordinance standards in the staff and consultant review letters, and the conditions and items listed in those letters being addressed on the Final Site Plan; and

b. *(additional conditions here if any)*

(This motion is made because the plan is otherwise in compliance with Chapter 11 of the Code of Ordinances and all other applicable provisions of the Ordinance.)

– OR –

Denial – Special Land Use Permit
In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **deny** the Special Land Use permit for the following reasons... (*because it is not in compliance with the Ordinance.)*

Denial – Preliminary Site Plan

In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **deny** the Preliminary Site Plan...*(because the plan is not in compliance with Article 3, Article 4, and Article 5 of the Zoning Ordinance and all other applicable provisions of the Ordinance.)*

-AND-

Denial– Wetland Permit
In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **deny** the Wetland Permit... *(because the plan is not in compliance with Chapter 12, Article V of the Code of Ordinances and all other applicable provisions of the Ordinance.)*

-AND-

Denial– Woodland Permit
In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **deny** the Woodland Permit... *(because the plan is not in compliance with Chapter 37 of the Code of Ordinances and all other applicable provisions of the Ordinance.)*

-AND-

Denial – Stormwater Management Plan

In the matter of Great Lakes Industrial Parcel 1 JSP19-35, motion to **deny** the Stormwater Management Plan...*(because the plan is not in compliance with Chapter 11 of the Code of Ordinances and all other applicable provisions of the Ordinance.)*

MAPS

Location

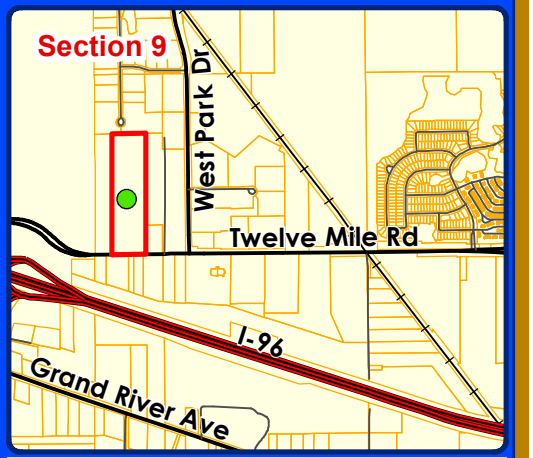
Zoning

Future Land Use

Natural Features

JSP 19-35 GREAT OAKS INDUSTRIAL PARK 1

LOCATION



LEGEND

Subject Property

City of Novi
Dept. of Community Development
City Hall / Civic Center
45175 W Ten Mile Rd
Novi, MI 48375
cityofnovi.org

Map Author: Lindsay Bell
Date: 6/4/20
Project: GREAT OAKS IND. PARK 1
Version #: 1

Feet
0 100 200 400 600

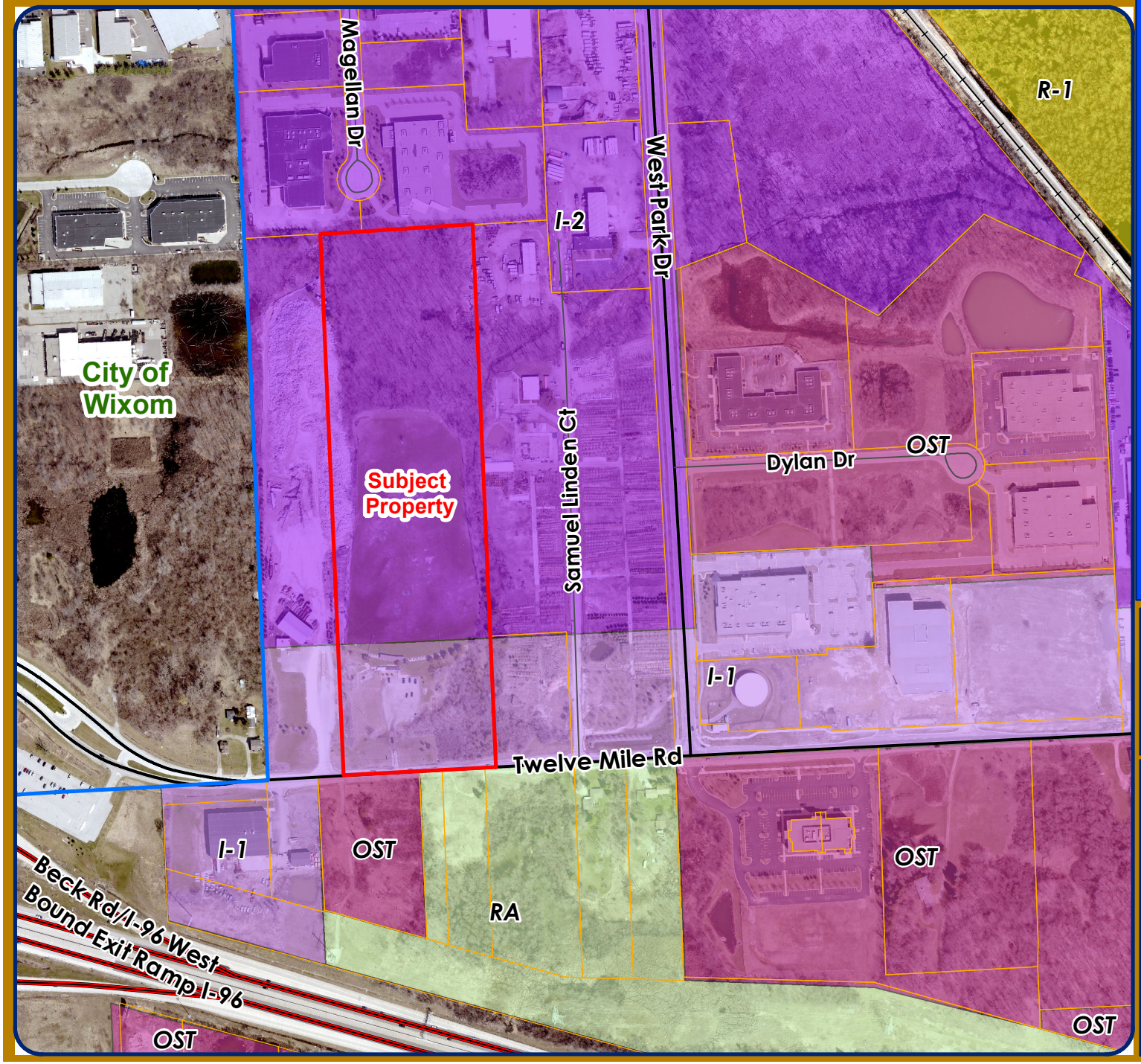
1 inch = 464 feet

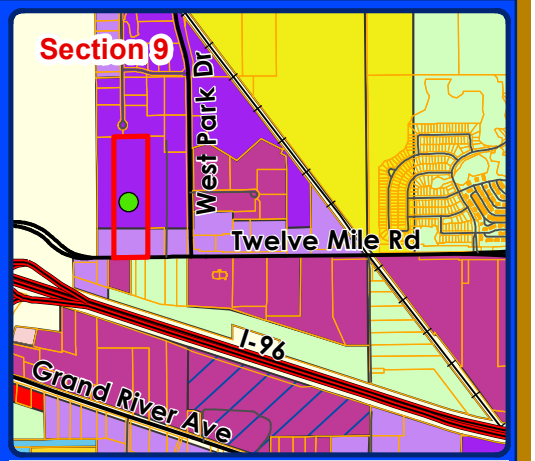
MAP INTERPRETATION NOTICE

Map information depicted is not intended to replace or substitute for any official or primary source. This map was intended to meet National Map Accuracy Standards and use the most recent, accurate sources available to the people of the City of Novi. Boundary measurements and area calculations are approximate and should not be construed as survey measurements performed by a licensed Michigan Surveyor as defined in Michigan Public Act 132 of 1970 as amended. Please contact the City GIS Manager to confirm source and accuracy information related to this map.

JSP 19-35 GREAT OAKS INDUSTRIAL PARK 1

NATURAL FEATURES





LEGEND

- R-A: Residential Acreage
- R-1: One-Family Residential District
- RM-1: Low-Density Multiple Family
- B-3: General Business District
- EXO: OST District with EXO Overlay
- FS: Freeway Service District
- I-1: Light Industrial District
- I-2: General Industrial District
- OS-1: Office Service District
- OST: Office Service Technology
- Subject Property

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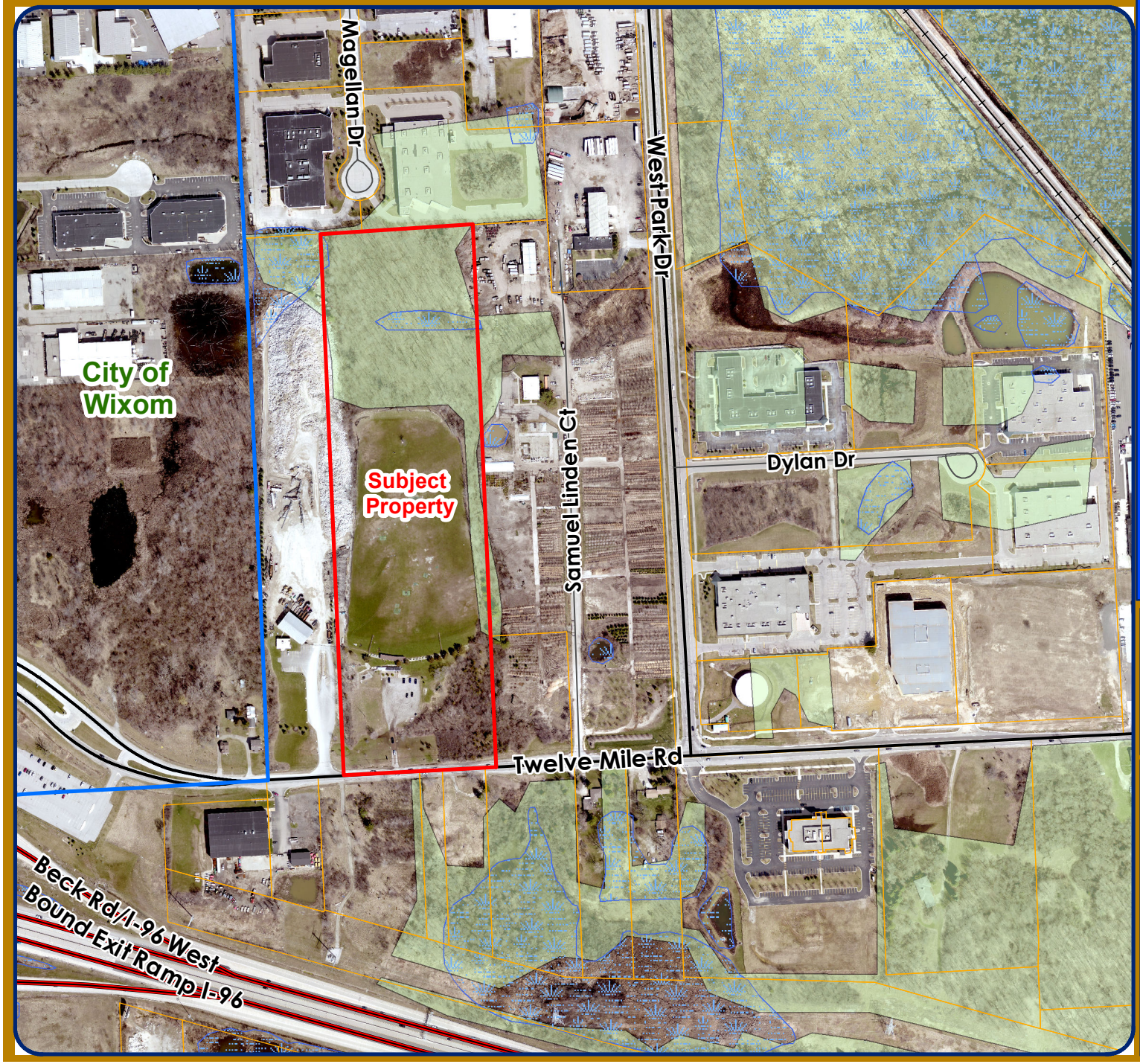

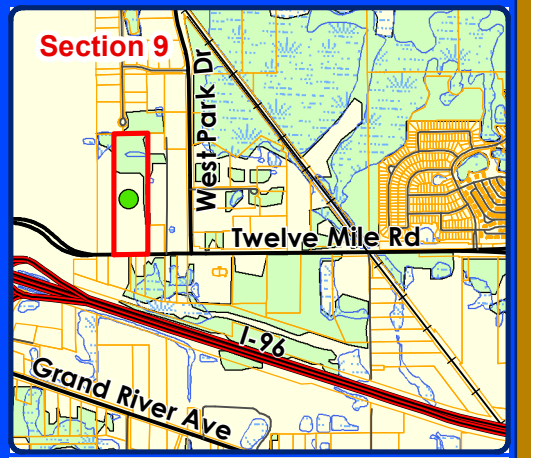

LEGEND

- WETLANDS
- WOODLANDS
- Subject Property

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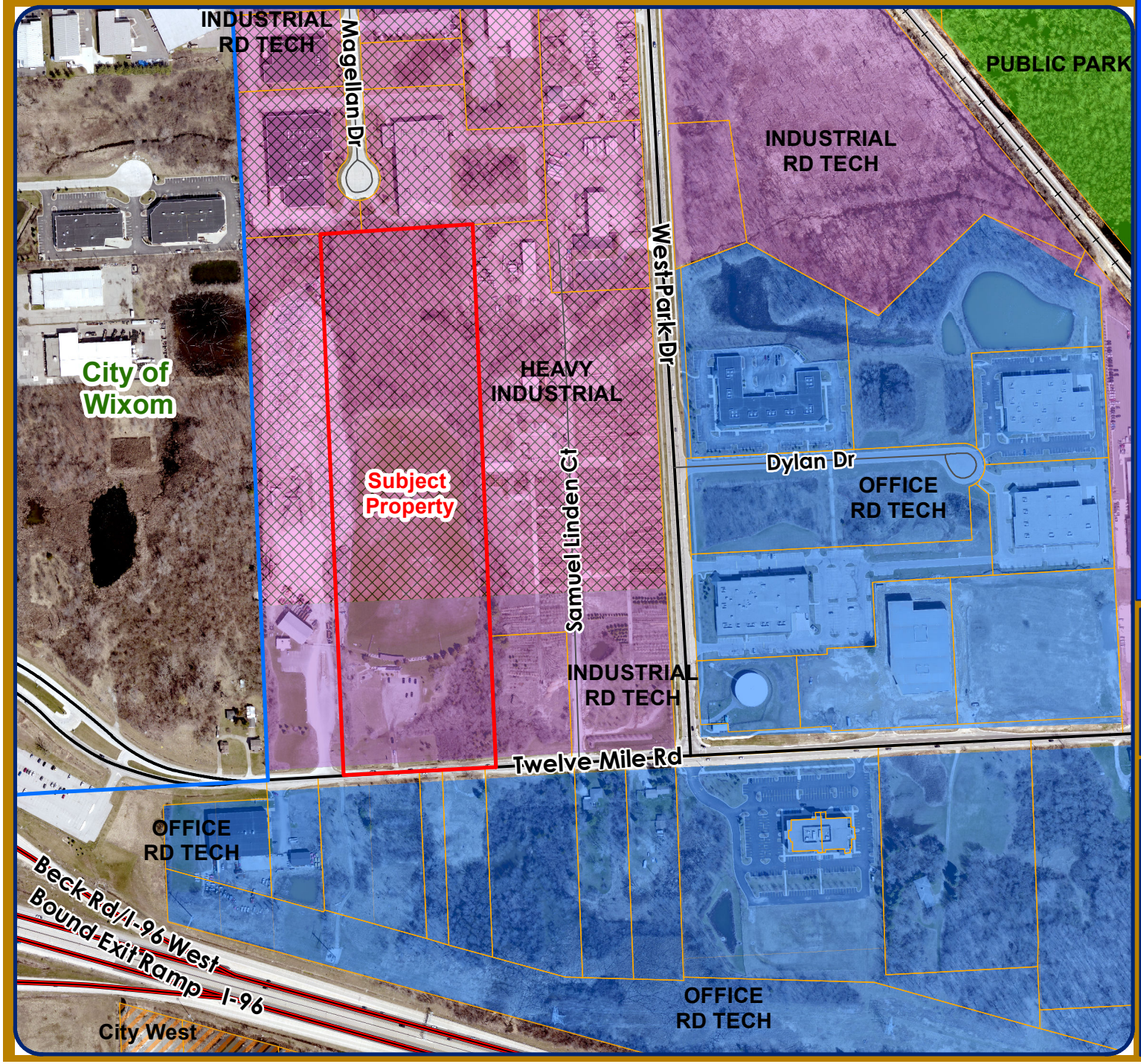
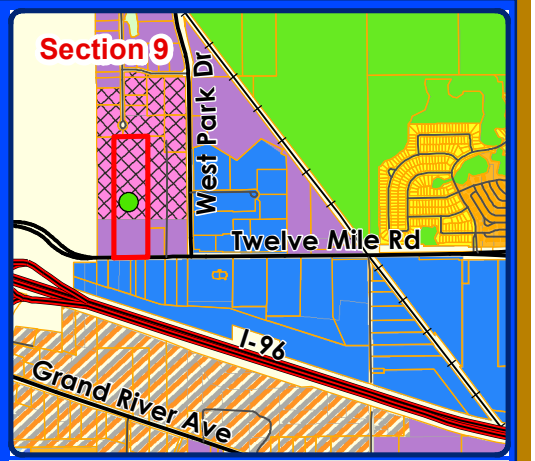
JSP 19-35 GREAT OAKS INDUSTRIAL PARK 1

FUTURE LAND USE





LEGEND

- Single Family
- Multiple Family
- Community Office
- Office Research Development Technology
- Industrial Research Development Technology
- Heavy Industrial
- City West
- Public Park
- Private Park
- Subject Property

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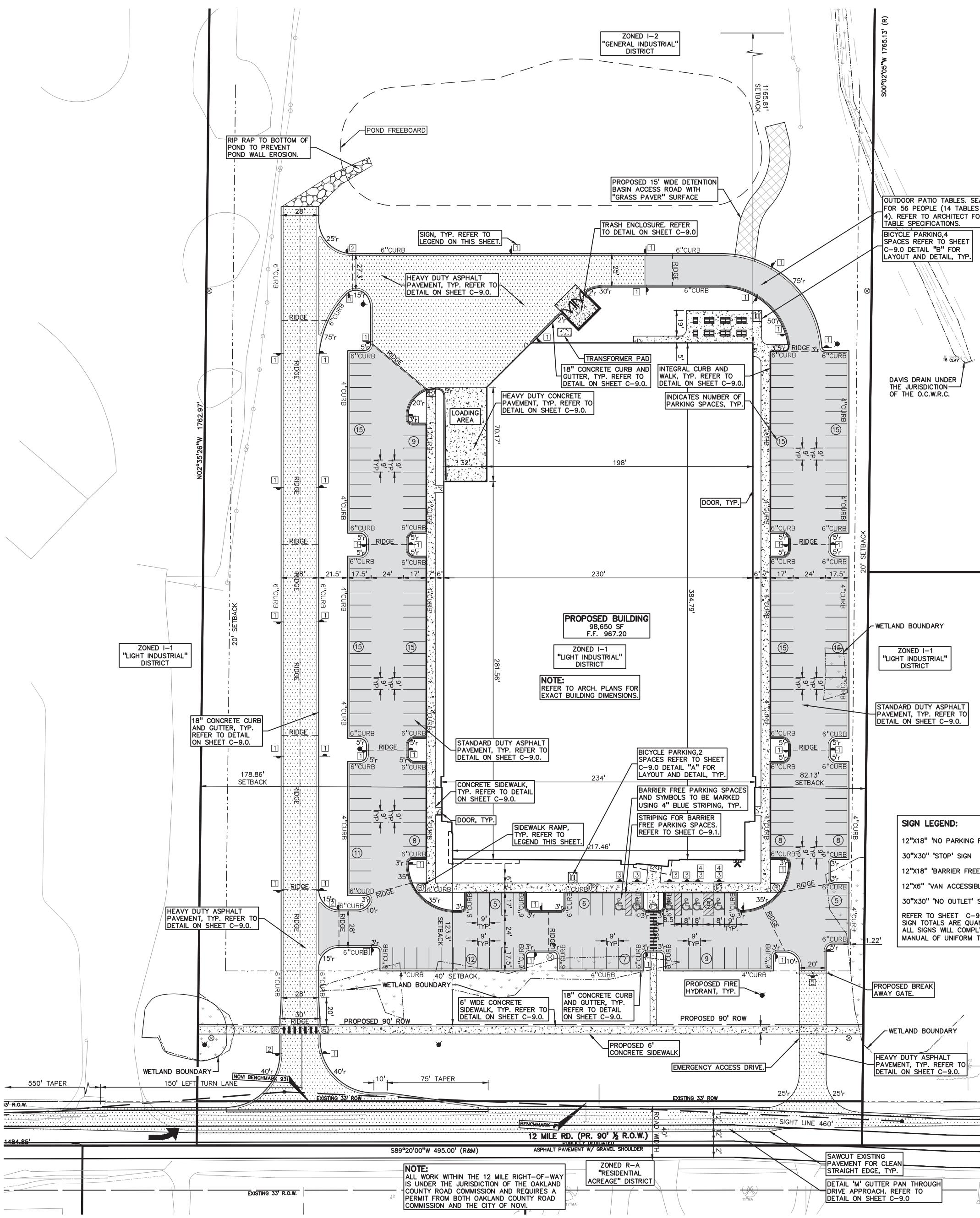
MAP INTERPRETATION NOTICE

SITE PLAN

(Full plan set available for viewing at the Community Development Department.)

GREAT OAKS LANDSCAPE PLAN

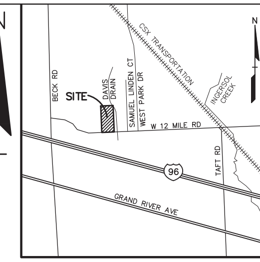
Hillside Investments | Novi, MI | June 2020



GRAPHIC SCALE

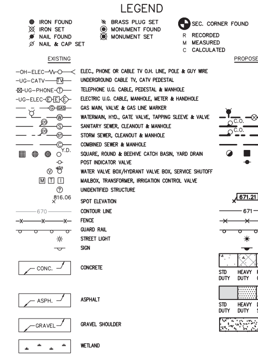
−40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.



LOCATION MAP – NOT TO SCALE

LEGEND



SIGN LEGEND:

'NO PARKING FIRE LANE' SIGN	1
'STOP' SIGN	2
'BARRIER FREE PARKING' SIGN	3
'VAN ACCESSIBLE' SIGN	4
'NO OUTLET' SIGN	5

REFER TO SHEET C–9.1 FOR SIGN DETAILS

SIDEWALK RAMP LEGEND:

SIDEWALK RAMP 'TYPE R'	Ⓡ
SIDEWALK RAMP 'TYPE F'	Ⓕ
SIDEWALK RAMP 'TYPE P'	Ⓟ

REFER TO LATEST M.D.O.T. R–28 STANDARD RAMP AND DETECTABLE WARNING DETAILS ON SHEET C–9.1.

NOTES:

1) DIRECT CONSUMER RETAIL IS PROHIBITED.

2) LONG TERM DELIVERY TRUCK PARKING IS PROHIBITED.

3) USE OF BUILDING MUST COMPLY WITH SECTION 5.14 PERTAINING TO LIGHTING, NOISE, VIBRATION AND ODOR.

GENERAL NOTES:

THESE NOTES APPLY TO ALL CONSTRUCTION ACTIVITIES ON THIS PROJECT.

1. ALL DIMENSIONS SHOWN ARE TO BACK OF CURB, FACE OF SIDEWALK, OUTSIDE FACE OF BUILDING, PROPERTY LINE, CENTER OF MANHOLE/CATCH BASIN OR CENTERLINE OF PIPE UNLESS OTHERWISE NOTED.
2. REFER TO SHEET C–9.0 FOR ON–SITE PAVING DETAILS.
3. 'NO PARKING–FIRE LANE' SIGNS SHALL BE POSTED ALONG ALL FIRE LANES AT 100 FOOT INTERVALS OR AS DIRECTED BY THE FIRE OFFICIAL.
4. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CITY OF NOVI CURRENT STANDARDS AND REGULATIONS.
5. THE CONTRACTOR SHALL NOTIFY THE CITY ENGINEER AND/OR THE AUTHORITY HAVING JURISDICTION 3 BUSINESS DAYS PRIOR TO THE BEGINNING OF CONSTRUCTION.
6. ANY WORK WITHIN THE STREET OR HIGHWAY RIGHTS–OF–WAY SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF THE AGENCIES HAVING JURISDICTION AND SHALL NOT BEGIN UNTIL ALL NECESSARY PERMITS HAVE BEEN ISSUED FOR THE WORK.
7. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO ADJUST THE TOP OF ALL EXISTING AND PROPOSED STRUCTURES (MANHOLES, CATCH BASINS, INLETS, GATE WELLS ETC.) WITHIN GRADED AND /OR PAVED AREAS TO FINAL GRADE SHOWN ON THE PLANS. ALL SUCH ADJUSTMENTS SHALL BE INCIDENTAL TO THE JOB AND WILL NOT BE PAID FOR SEPARATELY.

SITE DATA TABLE:

SITE AREA: = 20.04 ACRES (873,159 SF) GROSS
= 8.18 ACRES (356,409 SF) NET

ZONING: I–1, LIGHT INDUSTRIAL

EXISTING ZONING TO THE SOUTH: R–A, RESIDENTIAL ACREAGE
SPECIAL LAND USE PERMIT REQUESTED
FUTURE LAND USE MAP INDICATES "OFFICE RESEARCH DEVELOPMENT TECHNOLOGY".

EXISTING USE: GOLF DRIVING RANGE
PROPOSED USE: RESEARCH AND DEVELOPMENT

BUILDING INFORMATION:
BUILDING AREA:
1ST FLOOR SHOP= 70,610 SF
1ST FLOOR OFFICE= 14,020 SF
2ND FLOOR OFFICE= 14,020 SF
TOTAL= 98,650 SF
MAXIMUM ALLOWABLE BUILDING HEIGHT = 40 FEET
PROPOSED BUILDING HEIGHT = 30'–8" FT (2 STORIES)

BUILDING FOOTPRINT AREA = 84,630 SF

BUILDING LOT COVERAGE = 23.7%

SETBACK REQUIREMENTS:	REQUIRED	PROPOSED
BUILDING		
FRONT SETBACK (SOUTH):	40'	123.30'
SIDE SETBACK (EAST):	20'	82.13'
SIDE SETBACK (WEST):	20'	178.86'
REAR SETBACK (NORTH):	20'	1165.81'
PARKING		
FRONT SETBACK (SOUTH):	40'	40'
SIDE SETBACK (WEST):	20'	20'
REAR SETBACK (NORTH):	20'	216'

PARKING CALCULATIONS:
INDUSTRIAL/ RESEARCH AND OFFICE = 1 SPACE PER 700 S.F. USABLE FLOOR AREA

TOTAL PARKING REQUIRED
= (98,650 X 0.8 X 1 SPACE) / 700 SF = 113 SPACES

TOTAL PROPOSED PARKING SPACES
= 198 SPACES INC. 6 B.F. SPACES

BICYCLE PARKING REQUIRED: 5% OF REQUESTED VEHICLE PARKING
= 5% X 113 SPACES = 6 SPACES
BICYCLE PARKING PROVIDED = 6 SPACES

SITE SOILS INFORMATION:
ACCORDING TO THE USDA NATURAL RESOURCES CONSERVATION SERVICE WEB SITE SOIL SURVEY FOR OAKLAND COUNTY, THE SITE CONSISTS OF THE FOLLOWING SOIL TYPES:

10B MARLETTE SANDY LOAM, 1 TO 6 PERCENT SLOPES
11B CAPAC SANDY LOAM, 0 TO 4 PERCENT SLOPES

NAME OF NEAREST WATERCOURSE: DAVIS DRAIN

DISTANCE TO NEAREST WATERCOURSE IN FEET: 75'±

SIGN LEGEND:

12"X18" 'NO PARKING FIRE LANE' SIGN	(LR7–22)	1	27 EA.
30"X30" 'STOP' SIGN		2	1 EA.
12"X18" 'BARRIER FREE PARKING' SIGN	(R7–8)	3	6 EA.
12"X6" 'VAN ACCESSIBLE' SIGN	(R7–8P)	4	2 EA.
30"X30" 'NO OUTLET' SIGN		5	1 EA.

REFER TO SHEET C–9.1 FOR SIGN DETAILS.
SIGN TOTALS ARE QUANTITIES NEEDED FOR THE NEW DEVELOPMENT.
ALL SIGNS WILL COMPLY WITH THE LATEST EDITION OF THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MMUTCD)

CITY OF NOVI FIRE DEPARTMENT NOTES:

1. ALL WEATHER ACCESS ROADS CAPABLE OF SUPPORTING 35 TONS ARE TO BE PROVIDED FOR FIRE APPARATUS PRIOR TO CONSTRUCTION ABOVE THE FOUNDATION.
2. ALL WATER MAINS AND FIRE HYDRANTS ARE TO BE INSTALLED AND BE IN SERVICE PRIOR TO CONSTRUCTION ABOVE THE FOUNDATION.
3. THE BUILDING ADDRESS IS TO BE POSTED FACING THE STREET THROUGHOUT THE CONSTRUCTION. THE ADDRESS IS TO BE AT LEAST 3 INCHES HIGH ON CONTRASTING BACKGROUND.

LEGAL DESCRIPTION:

(BY NOWAK & FRAUS)

LAND SITUATED IN THE CITY OF NOVI, COUNTY OF OAKLAND, STATE OF MICHIGAN DESCRIBED AS FOLLOWS:

PART OF THE SOUTHWEST 1/4 OF SECTION 9, TOWN 1 NORTH, RANGE 8 EAST, BEGINNING AT POINT DISTANT SOUTH 89 DEGREES 20 MINUTES 00 SECONDS WEST, 584.15 FEET FROM THE SOUTH 1/4 CORNER; THENCE NORTH 00 DEGREES 02 MINUTES 05 SECONDS EAST, 1762.97 FEET; THENCE NORTH 89 DEGREES 04 MINUTES 55 SECONDS EAST, 495 FEET; THENCE SOUTH 00 DEGREES 02 MINUTES 05 SECONDS WEST, 1765.13 FEET TO BEGINNING.

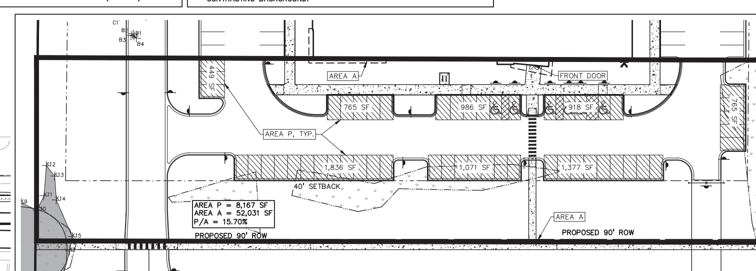
BENCHMARKS

(GPS DERIVED – NAVD88)
BM #1
RR SPIKE S. FACE ELEVATION
ELEV. – 964.26

NOVI BENCHMARK 931
(DERIVED – NAVD83)
BENCH TIE SET IN SOUTH FACE OF POWER POLE LOCATED 70 FEET WEST OFDRIVE #40844 12 MILE ROAD AND 30 FEET NORTH OF CENTERLINE OF 12 MILE ROAD.
ELEV. – 966.29

FLOODPLAIN NOTE:

BY GRAPHICAL PLOTTING, SITE IS WITHIN ZONE 'X', AREA DETERMINED TO BE OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN PER FLOOD INSURANCE RATE MAP NUMBER 26125C0607F, DATED SEPTEMBER 29, 2006.



FRONT YARD PARKING CALCULATION
SCALE: 1" = 40'-0"

NOT FOR CONSTRUCTION

No.	BY	CHK	DESCRIPTION	DATE
1.	BA	JS	PRELIMINARY SITE PLAN SUBMITTAL	1/31/20

REVISIONS

CAUTION!!
THE LOCATIONS AND ELEVATIONS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THIS DRAWING ARE ONLY APPROXIMATE. NO GUARANTEE IS EITHER EXPRESSED OR IMPLIED AS TO THE COMPLETENESS OR ACCURACY THEREOF. THE CONTRACTOR SHALL BE EXCLUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT UTILITY LOCATIONS AND ELEVATIONS PRIOR TO THE START OF CONSTRUCTION.

CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE DESIGN PROFESSIONAL.

3 FULL WORKING DAYS BEFORE YOU DIG CALL 811
Know what's below Call before you dig
MISS DIG System, Inc.
1-800-482-7171 (TOLL FREE) www.missdig.org

PEA, Inc.
2430 Rochester Ct., Ste. 100
Troy, MI 48083-1872
t: 248.689.9090
f: 248.689.1044
www.peainc.com

HILLSIDE INVESTMENTS
39475 13 MILE ROAD., SUITE 203
NOVI, MI 48377

PRELIMINARY SITE PLAN
GREAT OAKS
46844 WEST 12 MILE ROAD
NOVI, OAKLAND COUNTY, MICHIGAN

DES. JS | DN. JKS | SUR. – | P.M. JPB

ORIGINAL ISSUE DATE: AUGUST 16, 2019

PEA JOB NO. 2019-230

SCALE: 1" = 40'

DRAWING NUMBER:
C-3.0

GRAPHIC SCALE

−40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

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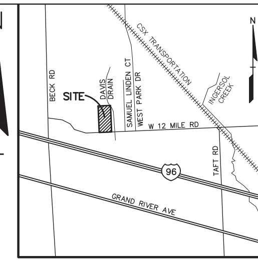
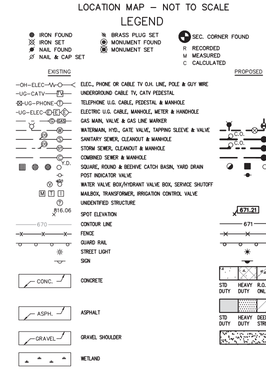
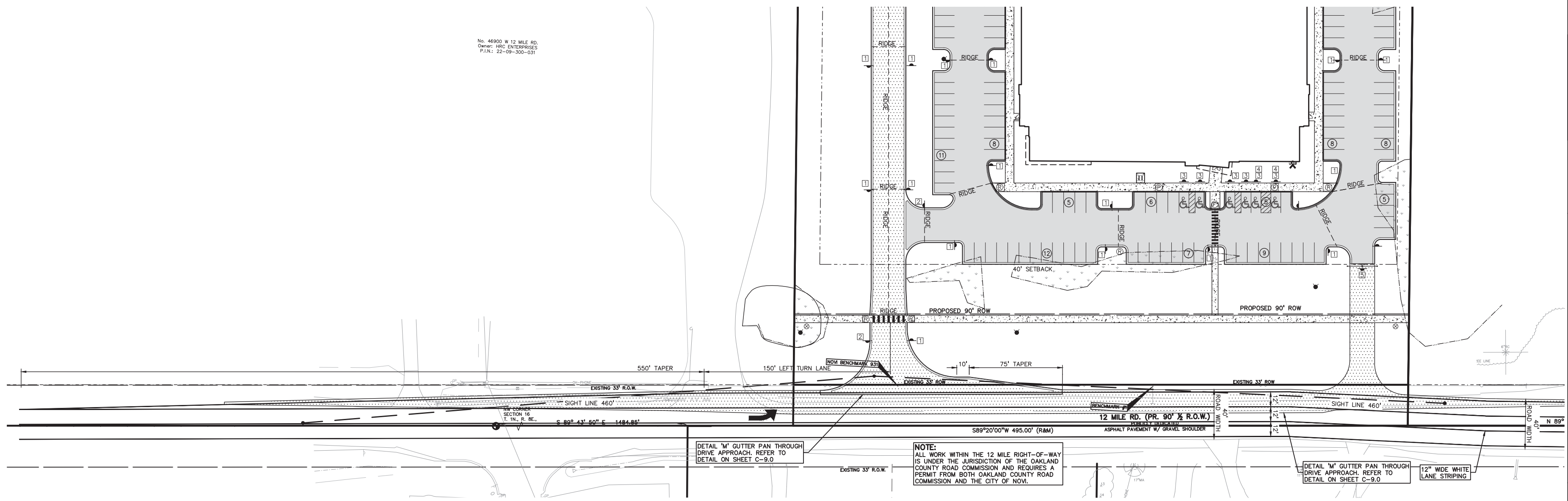


LOCATION MAP – NOT TO SCALE





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HILLSIDE INVESTMENTS
39475 13 MILE ROAD., SUITE 203
NOVI, MI 48377

RIGHT OF WAY IMPROVEMENT PLAN
GREAT OAKS
46844 WEST 12 MILE ROAD
NOVI, OAKLAND COUNTY, MICHIGAN

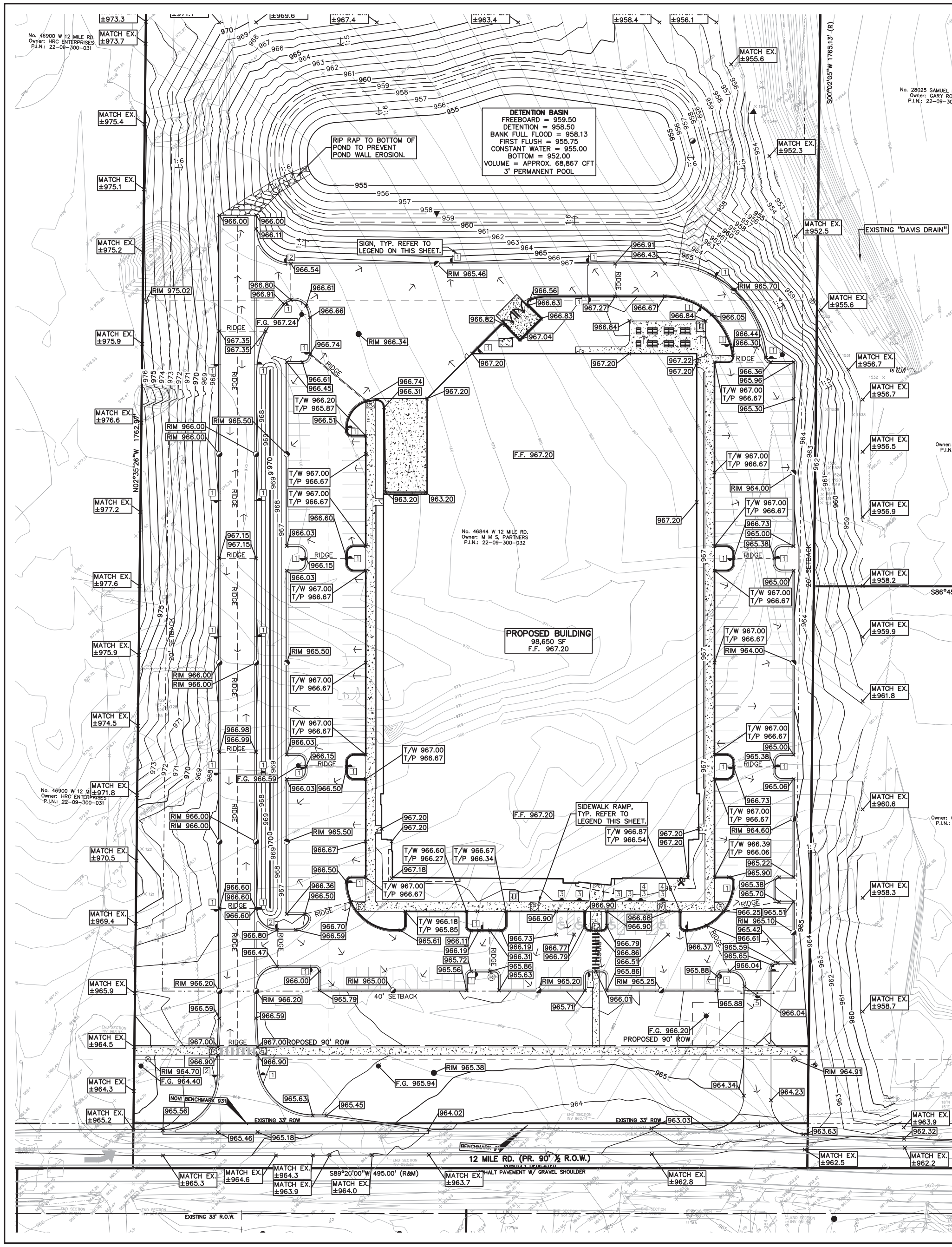
DES. JS | DN. JKS | SUR. – | P.M. JPB

ORIGINAL ISSUE DATE:
AUGUST 16, 2019

PEA JOB NO. 2019-230

SCALE: 1" = 40'

DRAWING NUMBER:
C-3.1



GRAPHIC SCALE

-40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

GENERAL GRADING AND EARTHWORK NOTES:

THESE NOTES APPLY TO ALL CONSTRUCTION ACTIVITIES ON THIS PROJECT

1. CONTRACTOR TO FIELD VERIFY ALL EXISTING TREES AND BRUSH AND REMOVE ALL THAT ARE NECESSARY TO GRADE SITE.
2. THE STAGING OF CONSTRUCTION ACTIVITIES SHALL OCCUR ONLY WITHIN THE SITE BOUNDARIES. ANY CONSTRUCTION ACTIVITIES OUTSIDE OF THE SITE BOUNDARIES SHALL BE AT THE SOLE RESPONSIBILITY AND RISK OF THE CONTRACTOR.
3. ALL SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL MEET THE REQUIREMENTS OF THE CITY OF NOVI. AN EROSION CONTROL PERMIT MUST BE SECURED FROM THE CITY PRIOR TO CONSTRUCTION.
4. ALL EARTHWORK AND GRADING OPERATIONS SHALL BE PERFORMED IN ACCORDANCE WITH THE SOILS INVESTIGATION AND REPORT PREPARED BY PEA, INC. DATED SEPTEMBER 28, 2018.
5. SEE ADDITIONAL GRADING AND EARTHWORK NOTES ON DETAIL SHEET C-10.1
6. REFER TO CONSTRUCTION PLANS FOR ALL SOIL EROSION AND SEDIMENTATION CONTROL MEASURES AND NOTES.
7. ALL SLOPES EXCEEDING 1:6 MUST BE STABILIZED BY SODDING OR BY PLACING A MULCH BLANKET PEGGED IN PLACE OVER SEED.
8. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED OR SODDED IN ACCORDANCE WITH THE LANDSCAPE PLANS. PROVIDE A MINIMUM OF 3" OF TOPSOIL IN THESE AREAS UNLESS OTHERWISE NOTED.
9. THE CONTRACTOR SHALL NOTE EXISTING UNDERGROUND UTILITIES WITHIN AND ADJACENT TO THE SITE. BACKFILL FOR EXISTING UTILITY TRENCHES SHALL BE EXAMINED CRITICALLY. ANY TRENCHES FOUND TO HAVE SOFT, UNSTABLE OR UNSUITABLE BACKFILL MATERIAL, IN THE OPINION OF THE GEOTECHNICAL ENGINEER, THAT ARE TO BE WITHIN THE ZONE OF INFLUENCE OF PROPOSED BUILDINGS OR PAVEMENT SHALL BE COMPLETELY EXCAVATED AND BACKFILLED WITH SUITABLE MATERIAL.

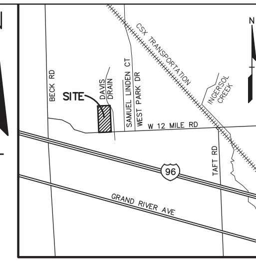
SYMBOLS: GRADING

PROPOSED SPOT GRADE ELEVATION. ALL GRADES INDICATED ARE TOP OF PAVEMENT UNLESS OTHERWISE NOTED. ADD 900 TO ALL 4-DIGIT ELEVATIONS TO OBTAIN ACTUAL ELEVATION — 94.50

PROPOSED CONTOUR LINE — 995

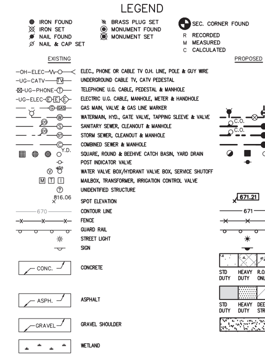
EARTHWORK BALANCING NOTE:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPORTING OR EXPORTING ALL MATERIALS AS REQUIRED TO PROPERLY GRADE THIS PROJECT TO THE FINISHED ELEVATIONS SHOWN ON THE APPROVED PLANS. THE CONTRACTOR SHALL MAKE THEIR OWN DETERMINATION OF CUT AND FILL QUANTITIES AND ALLOW FOR REMOVAL OF EXCESS OR IMPORTATION OF ADDITIONAL MATERIAL AT NO ADDITIONAL COST TO THE OWNER.



LOCATION MAP – NOT TO SCALE

LEGEND



LEGAL DESCRIPTION:

(BY NOWAK & FRAUS)

LAND SITUATED IN THE CITY OF NOVI, COUNTY OF OAKLAND, STATE OF MICHIGAN DESCRIBED AS FOLLOWS:

PART OF THE SOUTHWEST 1/4 OF SECTION 9, TOWN 1 NORTH, RANGE 8 EAST, BEGINNING AT POINT DISTANT SOUTH 89 DEGREES 20 MINUTES 00 SECONDS WEST, 584.15 FEET FROM THE SOUTH 1/4 CORNER; THENCE NORTH 00 DEGREES 02 MINUTES 05 SECONDS EAST, 1762.97 FEET; THENCE NORTH 89 DEGREES 04 MINUTES 55 SECONDS EAST, 495 FEET; THENCE SOUTH 00 DEGREES 02 MINUTES 05 SECONDS WEST, 1765.13 FEET TO BEGINNING.

BENCHMARKS

(GPS DERIVED – NAVD88)
BM #1
RR SPIKE S. FACE ELEVATION
ELEV. – 964.26

NOVI BENCHMARK 931
(DERIVED – NAVD83)
BENCH TIE SET IN SOUTH FACE OF POWER POLE LOCATED 70 FEET WEST OFDRIVE #40844 12 MILE ROAD AND 30 FEET NORTH OF CENTERLINE OF 12 MILE ROAD.
ELEV. – 966.29

FLOODPLAIN NOTE:

BY GRAPHICAL PLOTTING, SITE IS WITHIN ZONE 'X', AREA DETERMINED TO BE OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN PER FLOOD INSURANCE RATE MAP NUMBER 26125C0607F, DATED SEPTEMBER 29, 2006.

SIGN LEGEND:

'NO PARKING FIRE LANE' SIGN	1
'STOP' SIGN	2
'BARRIER FREE PARKING' SIGN	3
'VAN ACCESSIBLE' SIGN	4
'NO OUTLET' SIGN	5
'TRUCK ACCESS' SIGN	6

REFER TO SHEET C-9.1 FOR SIGN DETAILS

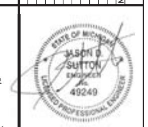
SIDEWALK RAMP LEGEND:

SIDEWALK RAMP 'TYPE R'	R
SIDEWALK RAMP 'TYPE F'	F
SIDEWALK RAMP 'TYPE P'	P

REFER TO LATEST M.D.O.T. R-28 STANDARD RAMP AND DETECTABLE WARNING DETAILS ON SHEET C-9.1.

REVISIONS

No.	BY	CHK	DESCRIPTION	DATE
1.	BA	JS	PRELIMINARY SITE PLAN SUBMITTAL	1/31/20



CAUTION!!
THE LOCATIONS AND ELEVATIONS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THIS DRAWING ARE ONLY APPROXIMATE. NO GUARANTEE IS EITHER EXPRESSED OR IMPLIED AS TO THE COMPLETENESS OR ACCURACY THEREOF. THE CONTRACTOR SHALL BE EXCLUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT UTILITY LOCATIONS AND ELEVATIONS PRIOR TO THE START OF CONSTRUCTION.

CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE DESIGN PROFESSIONAL.

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DES.	JS	DN.	JKS	SUR.	–	P.M.	JPB

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ORIGINAL ISSUE DATE:
AUGUST 16, 2019

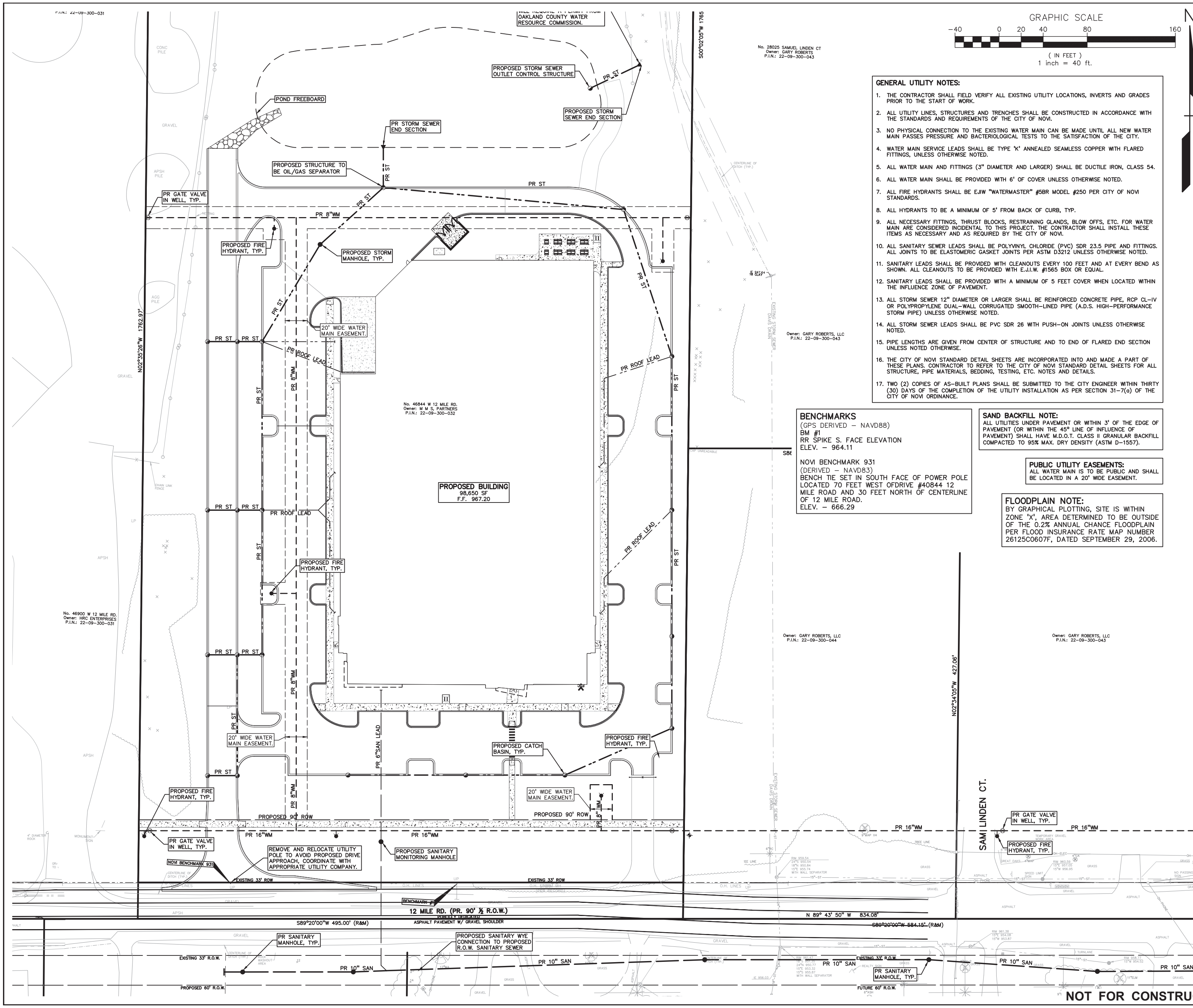
PEA JOB NO. 2019-230

SCALE: 1" = 40'

DRAWING NUMBER:
C-4.0

NOT FOR CONSTRUCTION

XREF: S:PROJECTS\2019\2019230\DWG\19230-TOPOBASE.DWG
XREF: S:PROJECTS\2019\2019230\DWG\SITE PLANS\X-BASE-19230.DWG
XREF: S:PROJECTS\2019\2019230\DWG\SITE PLANS\X-TBLK-19230.DWG



GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

GENERAL UTILITY NOTES:

1. THE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING UTILITY LOCATIONS, INVERTS AND GRADES PRIOR TO THE START OF WORK.
2. ALL UTILITY LINES, STRUCTURES AND TRENCHES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE STANDARDS AND REQUIREMENTS OF THE CITY OF NOVI.
3. NO PHYSICAL CONNECTION TO THE EXISTING WATER MAIN CAN BE MADE UNTIL ALL NEW WATER MAIN PASSES PRESSURE AND BACTERIOLOGICAL TESTS TO THE SATISFACTION OF THE CITY.
4. WATER MAIN SERVICE LEADS SHALL BE TYPE 'K' ANNEALED SEAMLESS COPPER WITH FLARED FITTINGS, UNLESS OTHERWISE NOTED.
5. ALL WATER MAIN AND FITTINGS (3" DIAMETER AND LARGER) SHALL BE DUCTILE IRON, CLASS 54.
6. ALL WATER MAIN SHALL BE PROVIDED WITH 6' OF COVER UNLESS OTHERWISE NOTED.
7. ALL FIRE HYDRANTS SHALL BE EJIW "WATERMASTER" #5BR MODEL #250 PER CITY OF NOVI STANDARDS.
8. ALL HYDRANTS TO BE A MINIMUM OF 5' FROM BACK OF CURB, TYP.
9. ALL NECESSARY FITTINGS, THRUST BLOCKS, RESTRAINING GLANDS, BLOW OFFS, ETC. FOR WATER MAIN ARE CONSIDERED INCIDENTAL TO THIS PROJECT. THE CONTRACTOR SHALL INSTALL THESE ITEMS AS NECESSARY AND AS REQUIRED BY THE CITY OF NOVI.
10. ALL SANITARY SEWER LEADS SHALL BE POLYVINYL CHLORIDE (PVC) SDR 23.5 PIPE AND FITTINGS. ALL JOINTS TO BE ELASTOMERIC GASKET JOINTS PER ASTM D3212 UNLESS OTHERWISE NOTED.
11. SANITARY LEADS SHALL BE PROVIDED WITH CLEANOUTS EVERY 100 FEET AND AT EVERY BEND AS SHOWN. ALL CLEANOUTS TO BE PROVIDED WITH E.J.I.W. #1565 BOX OR EQUAL.
12. SANITARY LEADS SHALL BE PROVIDED WITH A MINIMUM OF 5 FEET COVER WHEN LOCATED WITHIN THE INFLUENCE ZONE OF PAVEMENT.
13. ALL STORM SEWER 12" DIAMETER OR LARGER SHALL BE REINFORCED CONCRETE PIPE, RCP CL–IV OR POLYPROPYLENE DUAL–WALL CORRUGATED SMOOTH–LINED PIPE (A.D.S. HIGH–PERFORMANCE STORM PIPE) UNLESS OTHERWISE NOTED.
14. ALL STORM SEWER LEADS SHALL BE PVC SDR 26 WITH PUSH–ON JOINTS UNLESS OTHERWISE NOTED.
15. PIPE LENGTHS ARE GIVEN FROM CENTER OF STRUCTURE AND TO END OF FLARED END SECTION UNLESS NOTED OTHERWISE.
16. THE CITY OF NOVI STANDARD DETAIL SHEETS ARE INCORPORATED INTO AND MADE A PART OF THESE PLANS. CONTRACTOR TO REFER TO THE CITY OF NOVI STANDARD DETAIL SHEETS FOR ALL STRUCTURE, PIPE MATERIALS, BEDDING, TESTING, ETC. NOTES AND DETAILS.
17. TWO (2) COPIES OF AS–BUILT PLANS SHALL BE SUBMITTED TO THE CITY ENGINEER WITHIN THIRTY (30) DAYS OF THE COMPLETION OF THE UTILITY INSTALLATION AS PER SECTION 31–7(a) OF THE CITY OF NOVI ORDINANCE.

BENCHMARKS

(GPS DERIVED – NAVD88)
BM #1
RR SPIKE S. FACE ELEVATION
ELEV. – 964.11

NOVI BENCHMARK 931
(DERIVED – NAVD83)
BENCH TIE SET IN SOUTH FACE OF POWER POLE LOCATED 70 FEET WEST OFDRIVE #40844 12 MILE ROAD AND 30 FEET NORTH OF CENTERLINE OF 12 MILE ROAD.
ELEV. – 666.29

SAND BACKFILL NOTE:

ALL UTILITIES UNDER PAVEMENT OR WITHIN 3' OF THE EDGE OF PAVEMENT (OR WITHIN THE 45° LINE OF INFLUENCE OF PAVEMENT) SHALL HAVE M.D.O.T. CLASS II GRANULAR BACKFILL COMPACTED TO 95% MAX. DRY DENSITY (ASTM D–1557).

PUBLIC UTILITY EASEMENTS:

ALL WATER MAIN IS TO BE PUBLIC AND SHALL BE LOCATED IN A 20' WIDE EASEMENT.

FLOODPLAIN NOTE:

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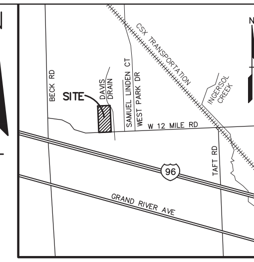

LOCATION MAP – NOT TO SCALE

LEGEND

IRON FOUND · IRON SET · NAIL FOUND · NAIL & CAP SET · BRASS PLUG SET · MONUMENT FOUND · MONUMENT SET · SEC. CORNER FOUND
R RECORDED · M MEASURED · C CALCULATED

EXISTING / PROPOSED:
ELEC, PHONE OR CABLE TV O.H. LINE, POLE & GUY WIRE
UNDERGROUND CABLE TV, CATV PEDESTAL
TELEPHONE U.G. CABLE, PEDESTAL & MANHOLE
ELECTRIC U.G. CABLE, MANHOLE, METER & HANDHOLE
GAS MAIN, VALVE & GAS LINE MARKER
WATERMAIN, HYD., GATE VALVE, TAPPING SLEEVE & VALVE
SANITARY SEWER, CLEANOUT & MANHOLE
STORM SEWER, CLEANOUT & MANHOLE
COMBINED SEWER & MANHOLE
SQUARE, ROUND & BEEHIVE CATCH BASIN, YARD DRAIN
POST INDICATOR VALVE
WATER VALVE BOX/HYDRANT VALVE BOX, SERVICE SHUTOFF
MAILBOX, TRANSFORMER, IRRIGATION CONTROL VALVE
UNIDENTIFIED STRUCTURE
SPOT ELEVATION
CONTOUR LINE
FENCE
GUARD RAIL
STREET LIGHT
SIGN
CONCRETE (STD DUTY, HEAVY DUTY, R.O.W. ONLY)
ASPHALT (STD DUTY, HEAVY DUTY, DEEP STRENGTH)
GRAVEL SHOULDER
WETLAND

LEGAL DESCRIPTION:

(BY NOWAK & FRAUS)

LAND SITUATED IN THE CITY OF NOVI, COUNTY OF OAKLAND, STATE OF MICHIGAN DESCRIBED AS FOLLOWS:

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NOT FOR CONSTRUCTION

REVISIONS

No.	BY	CHK	DESCRIPTION	DATE
1.	BA	JS	PRELIMINARY SITE PLAN SUBMITTAL	1/31/20

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PRELIMINARY UTILITY PLAN
GREAT OAKS
46844 WEST 12 MILE ROAD
NOVI, OAKLAND COUNTY, MICHIGAN

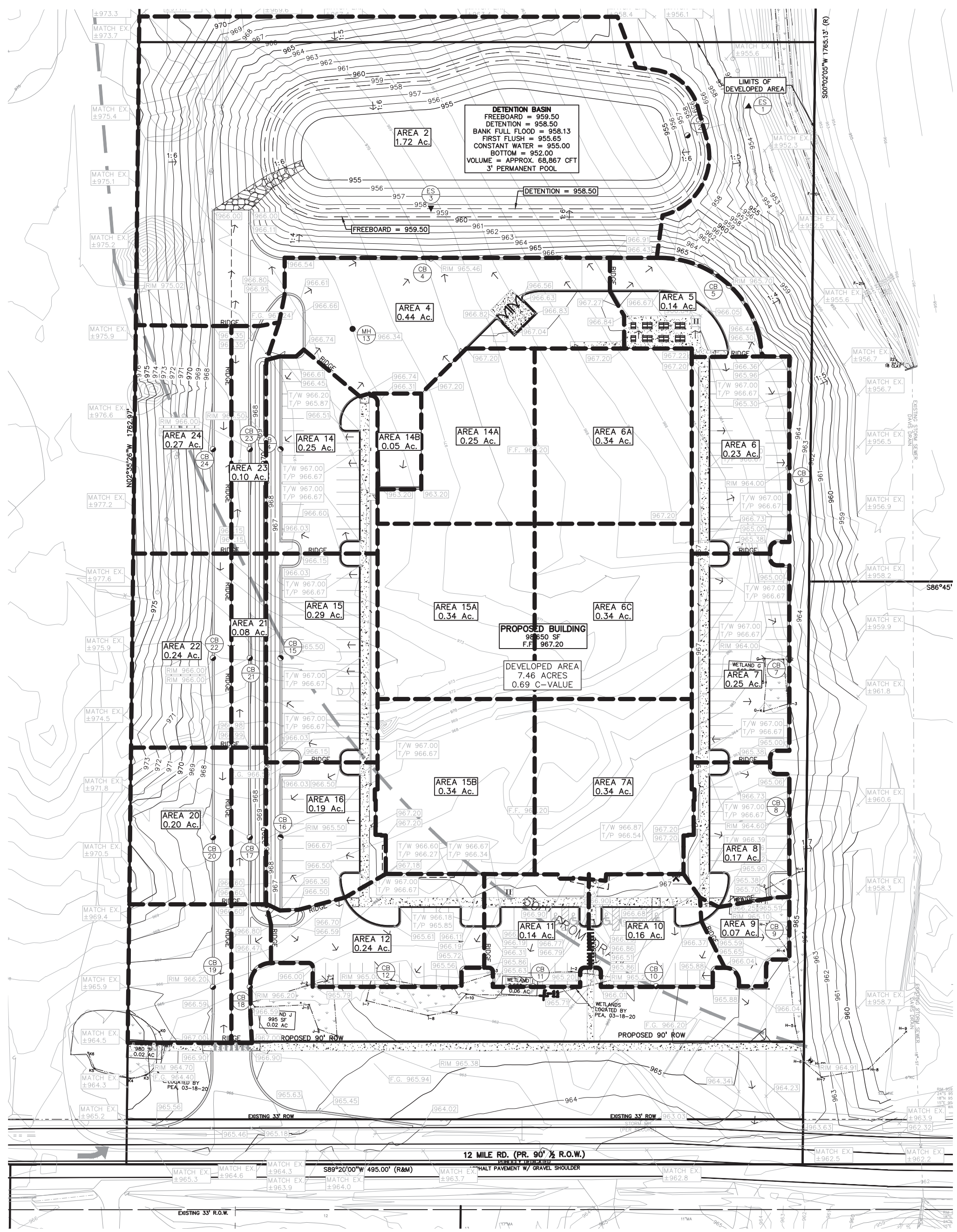
DES.	JS	DN.	JKS	SUR.	–	P.M.	JPB

ORIGINAL ISSUE DATE:
AUGUST 16, 2019

PEA JOB NO. 2019-230

SCALE: 1" = 40'

DRAWING NUMBER:
C-6.0



GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

Project:	Great Oaks		
Location:	Novi, MI		
Date:	6/2/2020		
Project No:	2019-230		

100 YEAR STORM DETENTION DESIGN (CITY OF NOVI DESIGN METHOD)

Contributing Area (A):	7.46	AC.
Allowable Discharge (Qa)	1.119	(=0.15 * acre) CFS
Coefficient of Runoff (Cr):	0.69	

Calculation of Required Discharge/Acre

Qo = ((Qa)/(A)(Cr):	0.22
T = -25 + ((10312.5/Qo))0.5:	192.80

Storage Volume Required:

Vs = (16500(T)/(T+25)) - 40Qo(T):	12929.54	
Vt = (Vs)(A)(Cr):	66,553.51	CU. FT.

OC/2 Restrictor Sizing:

Storage Elevation =	958.5	
Outlet Elevation =	955.00	
Hmax=	3.5	ft.
First Flush Outlet Restriction:		
First Flush Volume = 1815 A * C =	9,342.53	cf
Zff =	955.75	
Retain a minimum 24 hours:		
Qavg (24 hours)=	0.108	cfs
Havg (0.667*Zff-Zout) =	0.50	ft.
A = (Qavg/((0.62*(32.2*2*Havg)^0.5) =	0.0307	sf
BF Hole Dia. Provided =	2.5	in.
BF Hole Area Provided =	0.0341	sf
Qact ff =	0.120	cfs
Actual Holding Time = (Vff/Qact * 3600)	21.64	hrs.
Bank Full Outlet Restriction:		
Bank Full Volume = 5160 A * C =	26,560.58	cf
Zbf =	958.13	
Release Between 24 and 40 Hours:		
Qavg (24 hours)=	0.307	cfs
Qadjusted = (Qbfavg-Qff) =	0.188	cfs
Havg (0.667*Zbf-Zff) =	1.59	ft.
A = (Qavg/((0.62*(32.2*2*Havg)^0.5) =	0.0490	sf
BF Hole Dia. Provided =	2.5	in.
BF Hole Area Provided =	0.0341	sf
Qact bf =	0.214	cfs
Actual Holding Time = (Vbf/Qact * 3600)	34.54	hrs.
100 Year Outlet Restriction:		
Qallow =	1.119	cfs
Qff =	0.120	cfs
Qbf =	0.214	cfs
Qadjusted = (Qallow-Qbf) =	0.786	cfs
A = (Qadjusted/((0.62*(32.2*2*Hmax)^0.5) =	0.0844	sf
100 Year Hole Dia. Provided =	4.25	in.
100 Year Hole Area Provided =	0.0985	sf
Qactual (total) =	1.13	cfs </= 1.12

SEDIMENTATION BASIN

1-yr Storage Elevation: 955.65

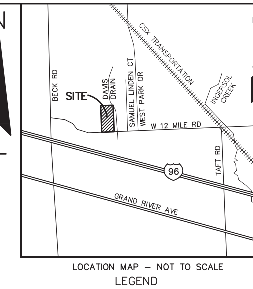
Elev. (ft)	Area (sf)	Vol. (cf)	Total Vol. (cf)
955.00	13,009	0	0
955.75	17,628	11,445	11,445

DETENTION BASIN

Elev. (ft)	Area (sf)	Vol. (cf)	Total Vol. (cf)
955.65	15,360	0	0
956.0	16,670	5,604	5,604
957.0	20,566	18,584	24,188
958.0	24,686	22,595	46,782
958.5	26,830	12,875	59,658

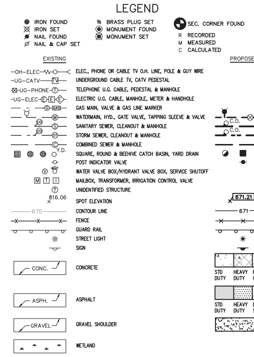
Total Stormwater Storage Provided

Storage Vol. Provided for Sediment Basin:	11,445 cf
Storage Vol. Provided for Detention Basin:	59,658 cf
Total Stormwater Storage Provided:	71,103 cf



LOCATION MAP – NOT TO SCALE

LEGEND



LEGAL DESCRIPTION:

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No.	BY	CHK	DESCRIPTION	DATE
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REVISIONS

JASON D. SUTTON ENGINEER 49249

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STORM WATER MANAGEMENT PLAN
GREAT OAKS
46844 WEST 12 MILE ROAD
NOVI, OAKLAND COUNTY, MICHIGAN

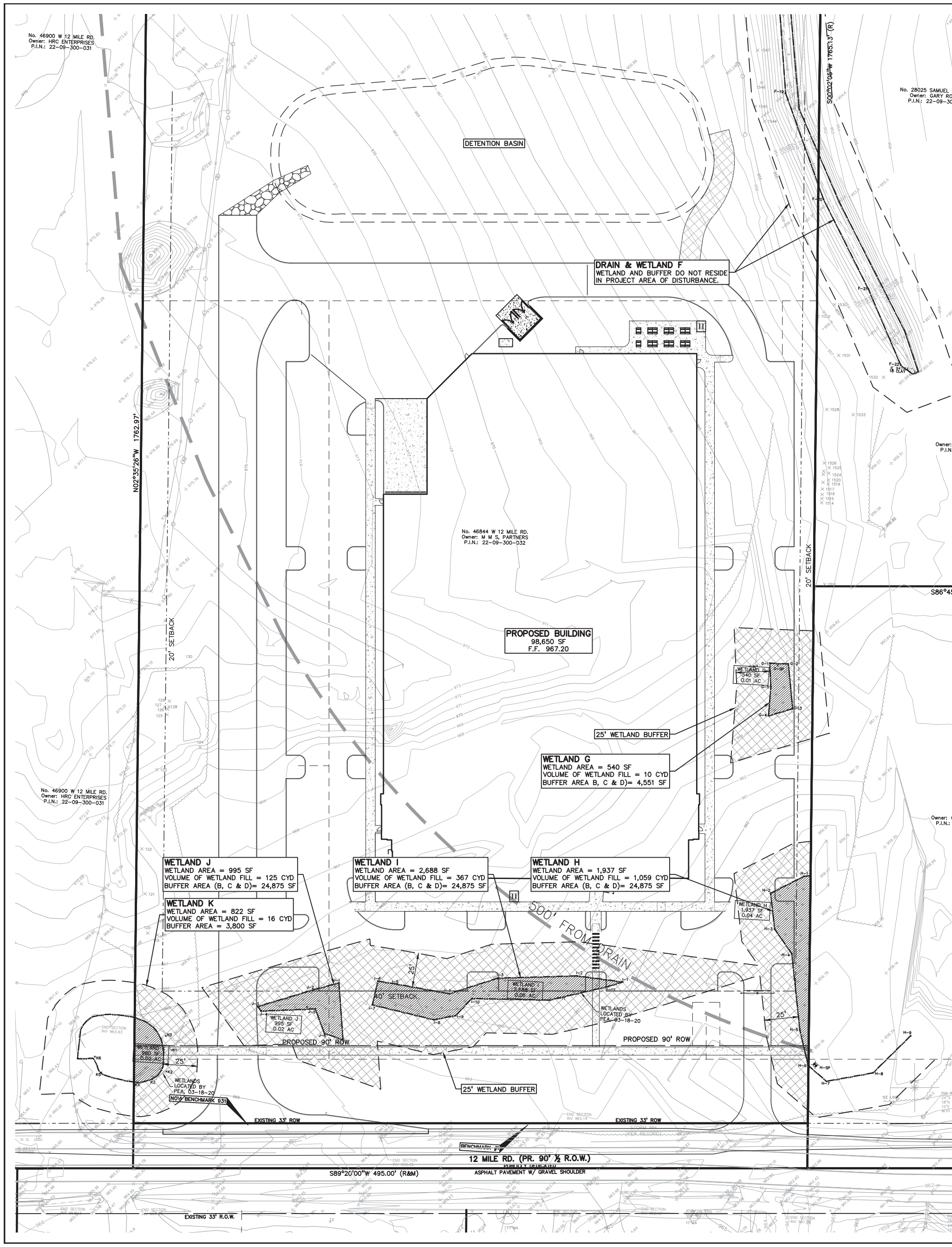
DES. JS | DN. JKS | SUR. – | P.M. JPB

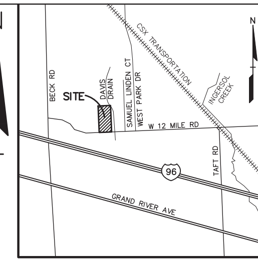
ORIGINAL ISSUE DATE: AUGUST 16, 2019

PEA JOB NO. 2019-230

SCALE: 1" = 40'

DRAWING NUMBER: C-7.0





LOCATION MAP – NOT TO SCALE

LEGEND

EXISTING		PROPOSED
OH–ELEC	ELEC., PHONE OR CABLE TV O.H. LINE, POLE & GUY WIRE	
UG–CATV	UNDERGROUND CABLE TV, CATV PEDESTAL	
UG–PHONE	TELEPHONE U.G. CABLE, PEDESTAL & MANHOLE	
UG–ELEC	ELECTRIC U.G. CABLE, MANHOLE, METER & HANDHOLE	
	GAS MAIN, VALVE & GAS LINE MARKER	
	WATERMAIN, HYD., GATE VALVE, TAPPING SLEEVE & VALVE	
	SANITARY SEWER, CLEANOUT & MANHOLE	
	STORM SEWER, CLEANOUT & MANHOLE	
	COMBINED SEWER & MANHOLE	
	SQUARE, ROUND & BEEHIVE CATCH BASIN, YARD DRAIN	
	POST INDICATOR VALVE	
	WATER VALVE BOX/HYDRANT VALVE BOX, SERVICE SHUTOFF	
	MAILBOX, TRANSFORMER, IRRIGATION CONTROL VALVE	
	UNIDENTIFIED STRUCTURE	
816.06	SPOT ELEVATION	671.21
670	CONTOUR LINE	671
	FENCE	
	GUARD RAIL	
	STREET LIGHT	
	SIGN	
CONC.	CONCRETE	STD DUTY / HEAVY DUTY / R.O.W. ONLY
ASPH.	ASPHALT	STD DUTY / HEAVY DUTY / DEEP STRENGTH
GRAVEL	GRAVEL SHOULDER	
	WETLAND	

IRON FOUND · IRON SET · NAIL FOUND · NAIL & CAP SET · BRASS PLUG SET · MONUMENT FOUND · MONUMENT SET · SEC. CORNER FOUND · R RECORDED · M MEASURED · C CALCULATED

LEGAL DESCRIPTION:

(BY NOWAK & FRAUS)

LAND SITUATED IN THE CITY OF NOVI, COUNTY OF OAKLAND, STATE OF MICHIGAN DESCRIBED AS FOLLOWS:

PART OF THE SOUTHWEST 1/4 OF SECTION 9, TOWN 1 NORTH, RANGE 8 EAST, BEGINNING AT POINT DISTANT SOUTH 89 DEGREES 20 MINUTES 00 SECONDS WEST, 584.15 FEET FROM THE SOUTH 1/4 CORNER; THENCE NORTH 00 DEGREES 02 MINUTES 05 SECONDS EAST, 1762.97 FEET; THENCE NORTH 89 DEGREES 04 MINUTES 55 SECONDS EAST, 495 FEET; THENCE SOUTH 00 DEGREES 02 MINUTES 05 SECONDS WEST, 1765.13 FEET TO BEGINNING.

BENCHMARKS

(GPS DERIVED – NAVD88)
BM #1
RR SPIKE S. FACE ELEVATION
ELEV. – 964.26

NOVI BENCHMARK 931
(DERIVED – NAVD83)
BENCH TIE SET IN SOUTH FACE OF POWER POLE LOCATED 70 FEET WEST OFDRIVE #40844 12 MILE ROAD AND 30 FEET NORTH OF CENTERLINE OF 12 MILE ROAD.
ELEV. – 966.29

FLOODPLAIN NOTE:

BY GRAPHICAL PLOTTING, SITE IS WITHIN ZONE 'X', AREA DETERMINED TO BE OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOODPLAIN PER FLOOD INSURANCE RATE MAP NUMBER 26125C0607F, DATED SEPTEMBER 29, 2006.

LEGEND

(WITHIN PROJECT AREA DISTURBANCE)

AREA OF WETLAND

AREA OF WETLAND BUFFER

NOT FOR CONSTRUCTION

XREF: S:PROJECTS\2019\2019230\DWG\19230–TOPOBASE.DWG
XREF: S:PROJECTS\2019\2019230\DWG\SITE PLANS\X–BASE–19230.DWG
XREF: S:PROJECTS\2019\2019230\DWG\SITE PLANS\X–TBLK–19230.DWG

REVISIONS

No.	BY	CHK	DESCRIPTION	DATE
1.	BA	JS	PRELIMINARY SITE PLAN SUBMITTAL	1/21/20

JASON D. SUTTON ENGINEER No. 49249 — STATE OF MICHIGAN LICENSED PROFESSIONAL ENGINEER

CAUTION!! THE LOCATIONS AND ELEVATIONS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THIS DRAWING ARE ONLY APPROXIMATE. NO GUARANTEE IS EITHER EXPRESSED OR IMPLIED AS TO THE COMPLETENESS OR ACCURACY THEREOF. THE CONTRACTOR SHALL BE EXCLUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT UTILITY LOCATIONS AND ELEVATIONS PRIOR TO THE START OF CONSTRUCTION.

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WETLAND IMPACT PLAN
GREAT OAKS
46844 WEST 12 MILE ROAD
NOVI, OAKLAND COUNTY, MICHIGAN

DES. JS | DN. JKS | SUR. – | P.M. JPB

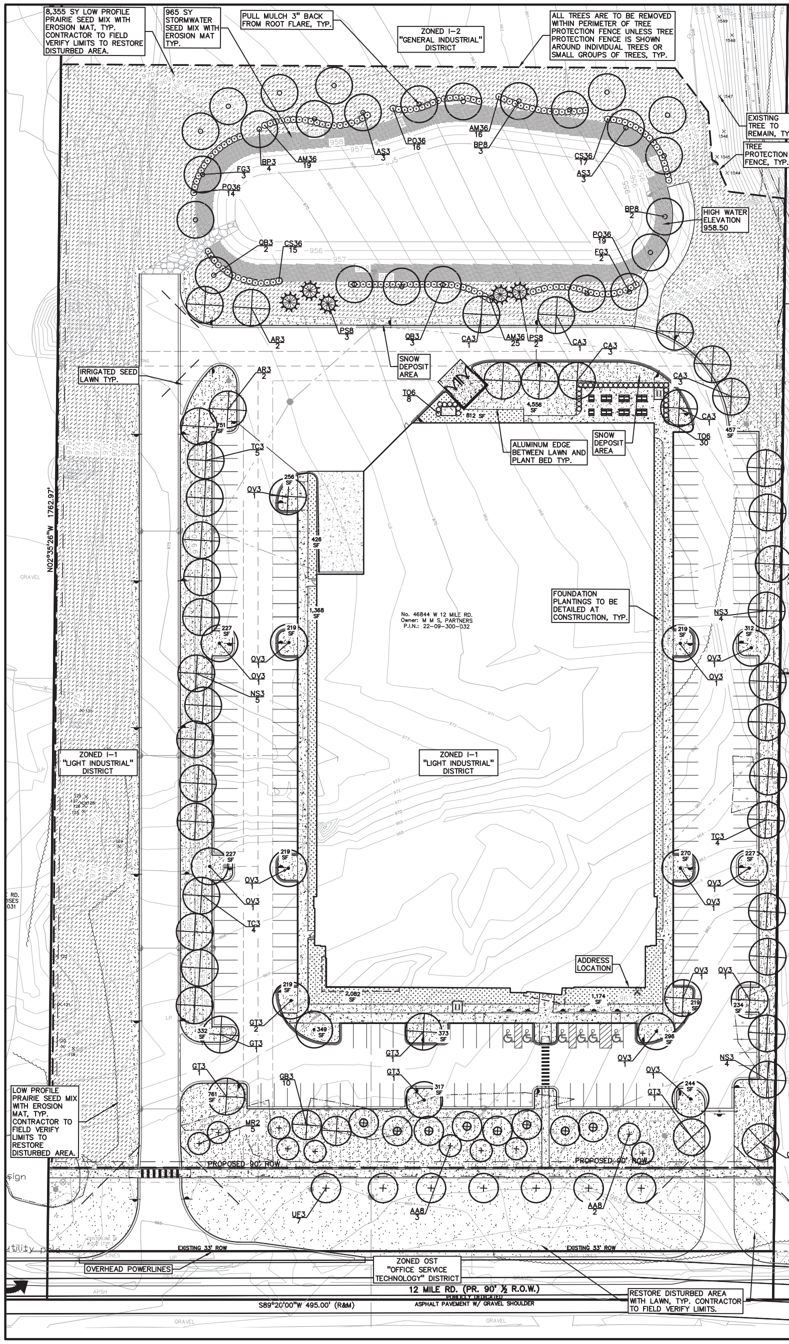
C:\Users\Jstebelton\Desktop\WORK FROM HOME DAILY\19230 GREAT OAKS\SITE PLANS\(C-10.0)WETLND-19230.dwg

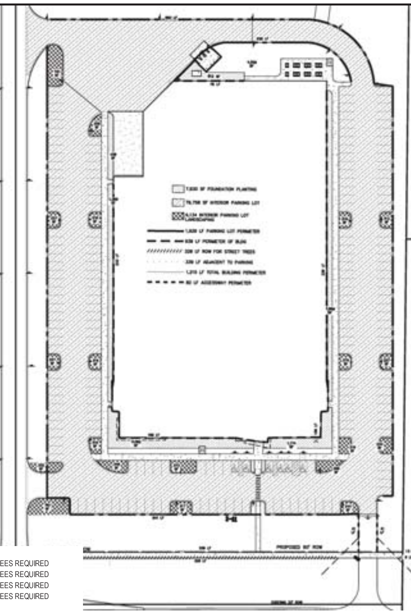
ORIGINAL ISSUE DATE: AUGUST 16, 2019

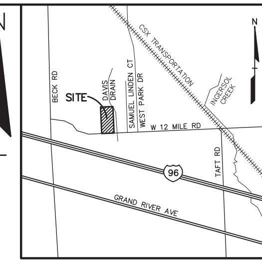
PEA JOB NO. 2019-230

SCALE: 1" = 40'

DRAWING NUMBER: C-4.0







LOCATION MAP – NOT TO SCALE

GRAPHIC SCALE

–40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

TREE REPLACEMENT CALCULATIONS

REQUIRED:	1 REPLACEMENT: 8"<11" =	9	9 REPLACEMENT TREES REQUIRED
	2 REPLACEMENT: 12"<19" =	8	16 REPLACEMENT TREES REQUIRED
	3 REPLACEMENT: 20"<29" =	1	3 REPLACEMENT TREES REQUIRED
	4 REPLACEMENT: <30" =	0	0 REPLACEMENT TREES REQUIRED
	TOTAL REGULATED TREES REMOVED =	18	
	TOTAL REQUIRED REPLACEMENT TREES=	28	

PROVIDED: 25 **(89.3%)** 3" CAL. DECIDUOUS TREES & **5 (10.7%)** 8' EVERGREENS AT 1.5:1 RATIO, SEE SHEET L-1.0

SEE SHEET T-1.1 FOR EXISTING TREE LIST. SEE SHEET L-1.0 FOR REPLACEMENT TREES.

No more than 25% of one genus and 15% of one species

LESS THAN 200 TREES

TREE PLANT LIST

QTY	SYM	COMMON NAME	SCIENTIFIC NAME	SIZE	SPEC	COMMENT	REPLACE TREE	GENUS %	SPECIES %
4	AR3	Red Maple	*Acer rubrum*	3" Cal.	B&B	Native	NO	5%	3%
9	CA3	American Hornbeam	*Carpinus caroliniana*	3" Cal.	B&B	Native	NO	8%	8%
10	GB3	Ginkgo	*Ginkgo biloba- male only*	3" Cal.	B&B	Native	NO	9%	9%
8	GT3	Skyline Honeylocust	*Gleditsia triacanthos*	3" Cal.	B&B	Native	NO	7%	7%
13	NS3	Tupelo	*Nyssa sylvatica*	3" Cal.	B&B	Native	NO	11%	11%
13	OV3	Hophornbeam	*Ostrya virginiana*	3" Cal.	B&B	Native	NO	11%	11%
13	TC3	American Basswood	*Tilia americana*	3" Cal.	B&B	Native	NO	11%	11%
7	UF3	Frontier Elm	*Ulmus 'Frontier'*	3" Cal.	B&B	Native	NO	6%	6%
77	TOTAL DECIDUOUS SITE TREES								

SUBCANOPY TREE PLANT LIST

QTY	SYM	COMMON NAME	SCIENTIFIC NAME	SIZE	SPEC	COMMENT	REPLACE TREE	GENUS %	SPECIES %
5	AA8	Downy Serviceberry	*Amelanchier arborea*	8-10' Ht.	B&B	Native	NO	4%	4%
5	MR2	Royal Raindrops Crab Apple	*Malus x 'JFS-KW5'*	2" Cal.	B&B	Non-Native	NO	4%	4%
10	TOTAL SUBCANOPY TREES								

REPLACEMENT TREE PLANT LIST

QTY	SYM	COMMON NAME	SCIENTIFIC NAME	SIZE	SPEC	COMMENT	REPLACE TREE	GENUS %	SPECIES %
6	AS3	Sugar Maple	*Acer saccharum 'Green Mountain'*	3" Cal.	B&B	Native	YES	9%	5%
9	BP8	River Birch	*Betula nigra*	8-10' Ht.	B&B	Native	YES	8%	8%
5	FG3	American Beech	*Fagus grandifolia*	3" Cal.	B&B	Native	YES	4%	4%
5	QB3	Swamp White Oak	*Quercus bicolor*	3" Cal.	B&B	Native	YES	4%	4%
25	TOTAL REPLACEMENT DECIDUOUS TREES								

EVERGREEN REPLACEMENT PLANT LIST: LESS THAN 200 TREES

QTY	SYM	COMMON NAME	SCIENTIFIC NAME	SIZE	SPEC	COMMENT	REPLACE TREE	GENUS %	SPECIES %
5	PS8	White Pine	*Pinus strobus*	8' Ht.	B&B	Native	YES	4%	4%
5	TOTAL EVERGREEN TREES								
117	TOTAL TREES								

SHRUB PLANT LIST:

QTY	SYM	COMMON NAME	SCIENTIFIC NAME	SIZE	SPEC	COMMENT
35	AM36	Black Chokecherry	*Aronia melanocarpa*	36" Ht.	Cont.	Native
32	CS36	Red Twig Dogwood	*Cornus sericea*	36" Ht.	Cont.	Native
49	PO36	Diablo Ninebark	*Physocarpus opulifolius 'Monlo'*	36" Ht.	Cont.	Native
38	TO6	Mission Arborvitae	*Thuja occidentalis 'Techny'*	6' Ht.	Cont.	Native
154	TOTAL SHRUBS					

PRELIMINARY LANDSCAPE CALCULATION:
PER CITY OF NOVI ZONING ORDINANCE (AMENDED 6.22.17) – ZONED I-1 DISTRICT GREAT OAKS, NOVI: 2019-230

INTERIOR PARKING LOT LANDSCAPE
REQUIRED:
A. SF OF PAVED AREA UNDER 50,000 SF = 50,000 SF x 5% = 2,500 SF
B. SF OF ADDITIONAL PAVED AREA OVER 50,000 SF= 29,758 SF X 0.5% = 149 SF
A+B=C 2,500 + 149 = 2,649 SF OF ISLANDS REQUIRED
E. C/200 2,649/ 200 = 13 CANOPY TREES REQUIRED

PROVIDED: 6,134 SF OF INTERIOR LANDSCAPE ISLAND AREA
13, 3" CAL. DEC. TREES

VEHICULAR PERIMETER PARKING LOT
REQUIRED: 1 TREE PER 35 LF OF PAVED VEHICULAR PERIMETER
1,929 LF OF PARKING LOT / 35 LF = 55 TREES REQUIRED

PROPOSED: 47 – 3" CAL DEC TREES + 8 LARGE DECIDUOUS TREES ALSO COUNTING AS ROW TREES

ACCESS WAY PERIMETER

REQUIRED: 1 TREE PER 35 LF OF PAVED VEHICULAR PERIMETER
82 LF OF PARKING LOT / 35 LF = 2 TREES

PROPOSED: 2 – LARGE DECIDUOUS TREES

RIGHT OF WAY INDUSTRIAL ADJACENT TO PARKING

REQUIRED: 1 LARGE DEC OR EVG / 40 LF OF FRONTAGE
1 SUB CANOPY DEC / 35 LF OF FRONTAGE
1 CANOPY DEC TREE / 45 LF BETWEEN SIDEWALK & CURB
339 LF/40 = 8 LARGE DEC OR EVG. REQUIRED
339 LF/35 = 10 SUB CANOPY REQUIRED
328 LF/45 = 7 CANOPY TREES BETWEEN WALK/CURB

PROVIDED: 8 LARGE DECIDUOUS TREES ALSO COUNTING AS PERIMETER PARKING LOT TREES, 10 SUB CANOPY TREES AND 7 CANOPY TREES BETWEEN WALK AND CURB

FOUNDATION PLANTINGS
REQUIRED: LF OF BUILDING PERIMETER x 8 = REQ. SF BLDG. FDN. PLANTINGS
BLDG PERIMETER = 939 LF X 8 = 7,512 SF

PROPOSED: 7,830 SF FDN. PLANTINGS

DETENTION BASIN LANDSCAPE

REQUIRED: 70–75% AREA NATIVE SHRUBS PLANTED ABOVE THE HIGH WATER ELEVATION. BOTTOM OF BASIN PLANTED IN NATIVE GRASSES/ GROUNDCOVER.
PROVIDED: 70–75% AREA NATIVE SHRUBS AND NATIVE SEED MIXES

KEY

=INTERIOR PARKING LOT TREES
= VEHICULAR PERIMETER PARKING LOT
= ACCESSWAY PERIMETER TREES
= ROW ADJACENT TO PARKING TREES COUNTING AS VEHICULAR PERIMETER PARKING LOT TREES
= ROW ADJACENT TO PARKING TREES
= REPLACEMENT TREES
= BASIN SHRUBS
= FOUNDATION PLANTINGS - TO BE DETAILED DURING CONSTRUCTION DWGS. TO BE IRRIGATED
= NATIVE DETENTION BASIN SHRUBS - TO BE DETAILED DURING CONSTRUCTION DWGS.
= STORMWATER SEED MIX & STAKED EROSION MAT BY: CARDNO NATIVE PLANT NURSERY PHONE: 574 . 586 . 2412
= IRRIGATED SEED LAWN
= EXISTING TREES TO REMAIN WITH TREE PROTECTION FENCE

*NOTE: PLANT MATERIAL SHALL BE PLANTED A MINIMUM OF 4' OFF OF PROPERTY LINES

NOTES PER CITY OF NOVI:

PLANT MATERIAL SHALL NOT BE PLANTED WITHIN 4' OF PROPERTY LINE.

NO TREES SHALL BE PLANTED CLOSER THAN 15' FROM OVERHEAD UTILITY, 10' FROM FIRE HYDRANT, CATCH BASIN OR MANHOLE, 5' FROM UNDERGROUND UTILITIES AND 3' OFF BACK OF CURB.

NO TREE TO BE LOCATED IN FRONT OF ANY SIGN OR BLOCK BUILDING ADDRESS. FIELD ADJUST TREES AS NECESSARY.

ALL TRANSFORMER AND UTILITY BOXES TO BE SCREENED PER NOVI CITY DETAIL AND IN THE CASE ADDITIONAL BOXES ARE ADDED TO THE SITE AFTER PLAN APPROVAL. SEE LANDSCAPE DETAIL SHT. L-1.1

EXISTING DISEASED TREES WILL BE REMOVED AND IN-FILLED WITH NEW PLANTINGS PER CITY'S APPROVAL AND DIRECTION.

SITE SOILS INFORMATION:
ACCORDING TO THE USDA NATURAL RESOURCES CONSERVATION SERVICE WEB SITE SOIL SURVEY FOR OAKLAND COUNTY, THE SITE CONSISTS OF THE FOLLOWING SOIL TYPES:

10B MARLETTE SANDY LOAM, 1 TO 6 PERCENT SLOPES
11B CAPAC SANDY LOAM, 0 TO 4 PERCENT SLOPES

REVISIONS

No.	BY	CHK	DESCRIPTION	DATE
1.	BA	JS	PRELIMINARY SITE PLAN SUBMITTAL	1/29/20

STATE OF MICHIGAN — LYNN A. WHIPPLE — LANDSCAPE ARCHITECT

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CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE DESIGN PROFESSIONAL.

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NOVI, MI 48377

LANDSCAPE PLAN
GREAT OAKS
46844 WEST 12 MILE ROAD
NOVI, OAKLAND COUNTY, MICHIGAN

DES. LW | DN. LW | SUR. – | P.M. JPB

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ORIGINAL ISSUE DATE: AUGUST 16, 2019

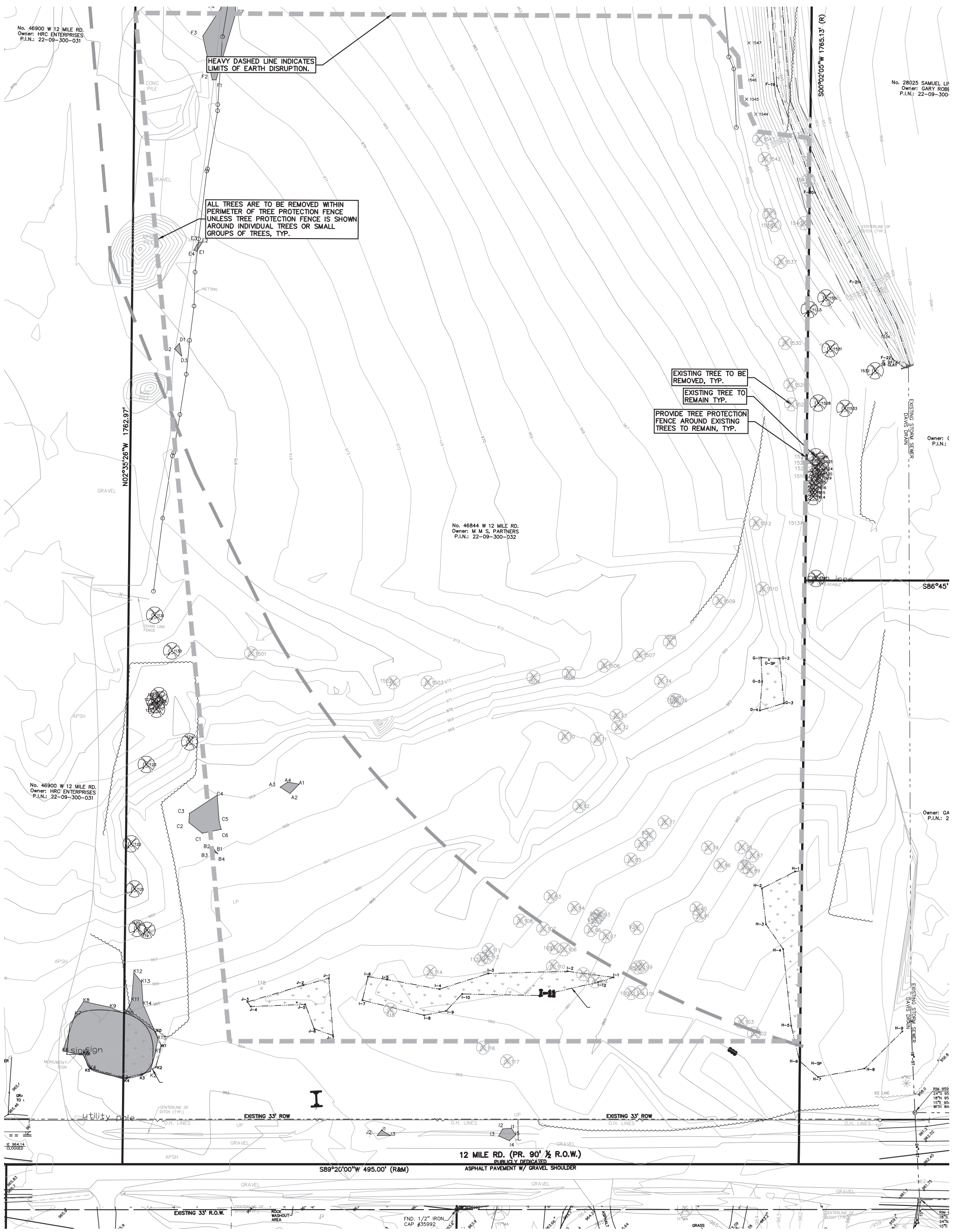
PEA JOB NO. 2019-230

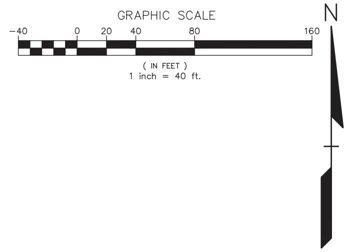
SCALE: 1" = 40'

DRAWING NUMBER: L-1.0

NOT FOR CONSTRUCTION

XREF: S:\PROJECTS\2019\2019230\DWG\19230-TOPOBASE.DWG
XREF: S:\PROJECTS\2019\2019230\DWG\SITE PLANS\X-BASE-19230.DWG
XREF: S:\PROJECTS\2019\2019230\DWG\SITE PLANS\X-TBLK-19230.DWG





KEY

= EXISTING TREES TO REMAIN

= EXISTING TREES TO BE REMOVED

= LIMITS OF DISRUPTION/TREE PROTECTION FENCE

TREE PROTECTION WILL BE ERECTED PRIOR TO START OF CONSTRUCTION ACTIVITIES AND SHALL REMAIN IN PLACE UNTIL CONSTRUCTION IS COMPLETE

NO PERSON MAY CONDUCT ANY ACTIVITY WITHIN THE DRIP LINE OF ANY TREE DESIGNATED TO REMAIN; INCLUDING, BUT NOT LIMITED TO PLACING SOLVENTS, BUILDING MATERIAL, CONSTRUCTION EQUIPMENT OR SOIL DEPOSITS WITHIN DRIP LINES

GRADE CHANGES MAY NOT OCCUR WITHIN THE DRIP LINE OF PROTECTED TREES

DURING CONSTRUCTION, NO PERSON SHALL ATTACH ANY DEVICE OR WIRE TO ANY REMAINING TREE

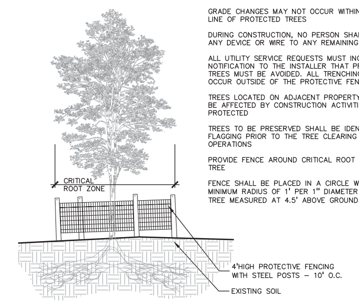
ALL UTILITY SERVICE REQUESTS MUST INCLUDE NOTIFICATION TO THE INSTALLER THAT PROTECTED TREES MUST BE AVOIDED. ALL TRENCHING SHALL OCCUR OUTSIDE OF THE PROTECTIVE FENCING

TREES LOCATED ON ADJACENT PROPERTY THAT MAY BE AFFECTED BY CONSTRUCTION ACTIVITIES MUST BE PROTECTED

TREES TO BE PRESERVED SHALL BE IDENTIFIED WITH FLAGGING PRIOR TO THE TREE CLEARING OPERATIONS

PROVIDE FENCE AROUND CRITICAL ROOT ZONE OF TREE

FENCE SHALL BE PLACED IN A CIRCLE WITH A MINIMUM RADIUS OF 1' PER 1" DIAMETER OF THE TREE MEASURED AT 4.5' ABOVE GROUND



1 TREE PROTECTION DETAIL

SCALE: 1" = 3'–0"

TREE REPLACEMENT CALCULATIONS

REQUIRED: 1 REPLACEMENT: 8"<11" =	**9**		9 REPLACEMENT TREES REQUIRED
2 REPLACEMENT: 12"<19" =	**8**		16 REPLACEMENT TREES REQUIRED
3 REPLACEMENT: 20"<29" =	**1**		3 REPLACEMENT TREES REQUIRED
4 REPLACEMENT: <30" =	**0**		0 REPLACEMENT TREES REQUIRED
TOTAL REGULATED TREES REMOVED =		**18**	
TOTAL REQUIRED REPLACEMENT TREES=		**28**	

PROVIDED: 25 **(89.3%)** 3" CAL. DECIDUOUS TREES & **5 (10.7%)** 8' EVERGREENS AT 1.5:1 RATIO, SEE SHEET L-1.0

SEE SHEET T-1.1 FOR EXISTING TREE LIST. SEE SHEET L-1.0 FOR REPLACEMENT TREES.

NOT FOR CONSTRUCTION

XREF: S:\PROJECTS\2019\2019230\DWG\19230-TOPOBASE.DWG
XREF: S:\PROJECTS\2019\2019230\DWG\SITE PLANS\X-BASE-19230.DWG
XREF: S:\PROJECTS\2019\2019230\DWG\SITE PLANS\X-TBLK-19230.DWG

No.	BY	CHK	DESCRIPTION	DATE
1.	BA	JS	PRELIMINARY SITE PLAN SUBMITTAL	1/31/20

REVISIONS

STATE OF MICHIGAN LYNN A. WHIPPLE ARCHITECT REGISTERED LANDSCAPE ARCHITECT

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TREE PRESERVATION PLAN
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NOVI, OAKLAND COUNTY, MICHIGAN

DES. LW | DN. LW | SUR. – | P.M. JPB

S:\PROJECTS\2019\2019-230 GREAT OAKS – JPB\DWG\LANDSCAPE\SITE PLANS\(T-1.0)TREE PRESERVATION PLAN-19230.dwg

ORIGINAL ISSUE DATE: AUGUST 16, 2019

PEA JOB NO. 2019-230

SCALE: 1" = 40'

DRAWING NUMBER:
T-1.0

TAG#	DBH	COMMON NAME	LATIN NAME	CON	COMMENT	Regulated	Type	Other Dia.	SAVE / REMOVE	REPLACEMENTS REQ'D
1	13	Red Oak	Quercus rubra	Fair	Competition	Y			SAVE	-
2	12	Basswood	Tilia americana	Good		Y			SAVE	-
3	17	Red Oak	Quercus rubra	Fair	Competition, seam at trunk	Y			SAVE	-
4	25	Red Oak	Quercus rubra	Good		Y			SAVE	-
5	15	Red Oak	Quercus rubra	Good		Y			SAVE	-
6	16	Red Oak	Quercus rubra	Good		Y			SAVE	-
7	18	Red Oak	Quercus rubra	Good		Y			SAVE	-
8	10	Red Oak	Quercus rubra	Good		Y			SAVE	-
9	11	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
10	16	Red Oak	Quercus rubra	Good		Y			SAVE	-
11	11	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
12	18	Bitternut Hickory	Carya cordiformis	Good	(Some vines)	Y			SAVE	-
13	8	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
14	18	Black Walnut	Juglans nigra	Good	(Some vines)	Y			SAVE	-
15	9	Sugar Maple	Acer saccharum	Fair	Competition	Y	Twin	2	SAVE	-
16	13	Bitternut Hickory	Carya cordiformis	Fair	Competition, vines (presumed 13" dbh - poison ivy)	Y			SAVE	-
17	12	Bitternut Hickory	Carya cordiformis	Fair	Competition, vines (presumed 12" dbh - poison ivy)	Y			SAVE	-
18	13	Sugar Maple	Acer saccharum	Fair	Competition, vines (presumed 13" dbh - poison ivy)	Y			SAVE	-
19	9	Sugar Maple	Acer saccharum	Fair	Competition	Y	Twin	2	SAVE	-
20	9	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
21	20	Eastern Cottonwood	Populus deltoides	Fair	Leaning, former twin dead	Y			SAVE	-
22	12	Eastern Cottonwood	Populus deltoides	Poor	Vines, leaning	Y			SAVE	-
23	17	Eastern Cottonwood	Populus deltoides	Good		Y			SAVE	-
24	16	Bitternut Hickory	Carya cordiformis	Fair	Competition, vines (presumed 16" dbh - poison ivy)	Y			SAVE	-
25	10	American Elm	Ulmus americana	Fair	Competition, vines (presumed 10" dbh - poison ivy)	Y			SAVE	-
26	12	Eastern Cottonwood	Populus deltoides	Fair	Competition, vines	Y			SAVE	-
27	13	Bitternut Hickory	Carya cordiformis	Fair	Competition, vines	Y			SAVE	-
28	26	Eastern Cottonwood	Populus deltoides	Good		Y			SAVE	-
29	11	Bitternut Hickory	Carya cordiformis	Fair	Vines	Y			SAVE	-
30	8	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
31	9	Sugar Maple	Acer saccharum	Poor	Mechanical damage, dieback	Y			SAVE	-
32	11	Bitternut Hickory	Carya cordiformis	Fair	Vines	Y			SAVE	-
33	10	Bitternut Hickory	Carya cordiformis	Fair	Competition, vines	Y			SAVE	-
34	12	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
35	18	Red Maple	Acer rubrum	Fair	Vines	Y			SAVE	-
36	17	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
37	20	Red Oak	Quercus rubra	Good		Y			SAVE	-
38	13	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
39	16	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
40	17	Basswood	Tilia americana	Fair	Competition	Y			SAVE	-
41	15	Basswood	Tilia americana	Fair	Competition	Y			SAVE	-
42	10	Bitternut Hickory	Carya cordiformis	Fair	Competition	Y			SAVE	-
43	9	Red Oak	Quercus rubra	Fair	Competition	Y			SAVE	-
44	10	Basswood	Tilia americana	Fair	Competition	Y			SAVE	-
45	12	Red Oak	Quercus rubra	Fair	Competition	Y			SAVE	-
46	16	Basswood	Tilia americana	Fair	Competition, vines	Y			SAVE	-
47	24	Red Oak	Quercus rubra	Good		Y			SAVE	-
48	10	Basswood	Tilia americana	Poor	Suppression	Y			SAVE	-
49	23	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
50	8	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
51	21	Black Walnut	Juglans nigra	Good		Y			SAVE	-
52	18	Red Oak	Quercus rubra	Good		Y			SAVE	-
53	12	Red Oak	Quercus rubra	Good		Y			SAVE	-
54	13	Red Oak	Quercus rubra	Fair	Competition, minor rot, lost limbs	Y	Twin	12	SAVE	-
55	16	Red Oak	Quercus rubra	Fair	Competition	Y			SAVE	-
56	9	Basswood	Tilia americana	Fair	Competition	Y			SAVE	-
57	8	Bitternut Hickory	Carya cordiformis	Fair	Competition	Y			SAVE	-
58	8	Basswood	Tilia americana	Good		Y			SAVE	-
59	10	Bitternut Hickory	Carya cordiformis	Fair	Competition	Y			SAVE	-
60	8	Basswood	Tilia americana	Fair	Competition	Y			SAVE	-
61	9	Bitternut Hickory	Carya cordiformis	Fair	Competition	Y			SAVE	-
62	10	Red Oak	Quercus rubra	Fair	Competition	Y			SAVE	-
63	18	Red Oak	Quercus rubra	Good		Y			SAVE	-
64	13	Red Oak	Quercus rubra	Fair	Competition	Y			SAVE	-
65	11	Red Oak	Quercus rubra	Fair	Competition	Y			SAVE	-
66	14	Basswood	Tilia americana	Good		Y	Multiple	13,6	SAVE	-
67	13	Red Oak	Quercus rubra	Good		Y			SAVE	-
68	9	Bitternut Hickory	Carya cordiformis	Fair	Vines	Y			SAVE	-
69	10	Black Walnut	Juglans nigra	Good		Y			SAVE	-
~~70~~	~~19~~	~~Siberian Elm~~	~~Ulmus pumila~~	~~Good~~	~~Some insects~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~71~~	~~19~~	~~Siberian Elm~~	~~Ulmus pumila~~	~~Good~~	~~Some insects~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~72~~	~~8~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Competition, epicormic branching, seam~~	~~N~~	~~Twin~~	~~6~~	~~REMOVE-EXEMPT~~	-
~~73~~	~~8~~	~~Boxelder~~	~~Acer negundo~~	~~Fair~~	~~Competition~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~74~~	~~17~~	~~Apple spp.~~	~~Malus spp.~~	~~Good~~		~~N~~	~~Twin~~	~~9~~	~~REMOVE-EXEMPT~~	-
~~75~~	~~8~~	~~Apple spp.~~	~~Malus spp.~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~76~~	~~8~~	~~Apple spp.~~	~~Malus spp.~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~77~~	~~8~~	~~Bitternut Hickory~~	~~Carya cordiformis~~	~~Poor~~	~~Competition, vines, dieback~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~78~~	~~10~~	~~Bitternut Hickory~~	~~Carya cordiformis~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~79~~	~~9~~	~~American Elm~~	~~Ulmus americana~~	~~Poor~~	~~Competition, vines, trunk rot~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~80~~	~~8~~	~~American Elm~~	~~Ulmus americana~~	~~Poor~~	~~Suppression~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~81~~	~~11~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Suppression, leaning, vines~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~82~~	~~13~~	~~Boxelder~~	~~Acer negundo~~	~~Good~~		~~N~~	~~Multiple~~	~~10,4~~	~~REMOVE-EXEMPT~~	-
~~83~~	~~9~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Competition, vines, leaning~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~84~~	~~8~~	~~Boxelder~~	~~Acer negundo~~	~~Fair~~	~~Vines~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~85~~	~~8~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Poor~~	~~Vines, dieback~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~86~~	~~8~~	~~American Elm~~	~~Ulmus americana~~	~~Poor~~	~~Competition, vines, dieback~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~87~~	~~12~~	~~Eastern Cottonwood~~	~~Populus deltoides~~	~~Fair~~	~~Vines~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~88~~	~~8~~	~~Green Ash~~	~~Fraxinus pennsylvanica~~	~~Poor~~	~~Insect, dieback~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~89~~	~~11~~	~~American Elm~~	~~Ulmus americana~~	~~Fair~~	~~Competition~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~90~~	~~10~~	~~Green Ash~~	~~Fraxinus pennsylvanica~~	~~Poor~~	~~Insect~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~91~~	~~9~~	~~Green Ash~~	~~Fraxinus pennsylvanica~~	~~Poor~~	~~Insect~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~92~~	~~10~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Leaning, dieback~~	~~N~~	~~Multiple~~	~~3,3~~	~~REMOVE-EXEMPT~~	-
~~93~~	~~11~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Competition, vines, leaning~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~94~~	~~19~~	~~Eastern Cottonwood~~	~~Populus deltoides~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~95~~	~~8~~	~~American Elm~~	~~Ulmus americana~~	~~Fair~~	~~Competition~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~96~~	~~9~~	~~Boxelder~~	~~Acer negundo~~	~~Fair~~	~~Competition~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~97~~	~~10~~	~~Boxelder~~	~~Acer negundo~~	~~Fair~~	~~Dieback, vines~~	~~N~~	~~Twin~~	~~8~~	~~REMOVE-EXEMPT~~	-
~~98~~	~~9~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Competition, vines, leaning~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~99~~	~~10~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Competition, leaning, dieback~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~100~~	~~10~~	~~American Elm~~	~~Ulmus americana~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~101~~	~~10~~	~~Green Ash~~	~~Fraxinus pennsylvanica~~	~~Poor~~	~~Insect, diebak~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~102~~	~~9~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Poor~~	~~Leaning, vines, dieback~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~103~~	~~12~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Poor~~	~~Competition, dieback, vines~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~104~~	~~10~~	~~Green Ash~~	~~Fraxinus pennsylvanica~~	~~Poor~~	~~Insect, vines, dieback~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~105~~	~~8~~	~~American Elm~~	~~Ulmus americana~~	~~Fair~~	~~Competition~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~106~~	~~9~~	~~American Elm~~	~~Ulmus americana~~	~~Poor~~	~~Suppression, vines~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~107~~	~~9~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Competition, dieback~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~108~~	~~10~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Competition, vines, leaning~~	~~N~~	~~Twin~~	~~2~~	~~REMOVE-EXEMPT~~	-
~~109~~	~~10~~	~~Boxelder~~	~~Acer negundo~~	~~Fair~~	~~Vines, trunk rot~~	~~N~~	~~Twin~~	~~10~~	~~REMOVE-EXEMPT~~	-
~~110~~	~~15~~	~~Willow spp.~~	~~Salix spp.~~	~~Good~~		~~N~~	~~Twin~~	~~13~~	~~REMOVE-EXEMPT~~	-
~~111~~	~~9~~	~~Boxelder~~	~~Acer negundo~~	~~Poor~~	~~Competition, leaning, vines~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~112~~	~~13~~	~~American Elm~~	~~Ulmus americana~~	~~Fair~~	~~Competition, vines, minor rot~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~113~~	~~9~~	~~Boxelder~~	~~Acer negundo~~	~~Fair~~	~~Competition, vines~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~114~~	~~9~~	~~Willow spp.~~	~~Salix spp.~~	~~Good~~		~~N~~	~~Multiple~~	~~8,6,5~~	~~REMOVE-EXEMPT~~	-
~~115~~	~~10~~	~~Red Maple~~	~~Acer rubrum~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~116~~	~~9~~	~~Eastern Red-Cedar~~	~~Juniperus virginiana~~	~~Poor~~	~~Dieback, girdled by buckthorn~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~117~~	~~9~~	~~Eastern Red-Cedar~~	~~Juniperus virginiana~~	~~Fair~~	~~Lost leader~~	~~N~~			~~REMOVE-EXEMPT~~	-
~~118~~	~~16~~	~~Sugar Maple~~	~~Acer saccharum~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
119	11	Boxelder	Acer negundo	Fair	Competition, leaning, vines	N	Twin	10	SAVE	-
120	11	Catalpa	Catalpa speciosa	Good		N			SAVE	-
121	8	Boxelder	Acer negundo	Fair	Competition	N			SAVE	-
122	17	Eastern Cottonwood	Populus deltoides	Good		N	Twin	16	SAVE	-
123	19	Eastern Cottonwood	Populus deltoides	Good		N	Multiple	18,14	SAVE	-
124	15	Eastern Cottonwood	Populus deltoides	Good		N			SAVE	-
125	9	Eastern Cottonwood	Populus deltoides	Fair	Competition	N	Twin	6	SAVE	-
126	16	Eastern Cottonwood	Populus deltoides	Fair	Competition	N			SAVE	-
127	10	Eastern Cottonwood	Populus deltoides	Fair	Competition	N			SAVE	-
128	13	Eastern Cottonwood	Populus deltoides	Fair	Competition, trunk seam	N			SAVE	-
129	12	Eastern Cottonwood	Populus deltoides	Fair	Competition	N	Twin	11	SAVE	-
130	11	Boxelder	Acer negundo	Poor	Growing into fence	N	Twin	9	SAVE	-

TAG#	DBH	COMMON NAME	LATIN NAME	CON	COMMENT	Regulated	Type	Other Dia.	SAVE / REMOVE	REPLACEMENTS REQ'D
131	8	Northern White-Cedar	Thuja occidentalis	Fair	Competition, vines	N			SAVE	-
132	17	Eastern Cottonwood	Populus deltoides	Fair	Mechanical damage, trunk burried by concrete	N			SAVE	-
133	14	Eastern Cottonwood	Populus deltoides	Fair	Trunk burried 5' by concrete and dirt	N			SAVE	-
134	17	Eastern Cottonwood	Populus deltoides	Fair	Mechanical damage, vines, burried	N			SAVE	-
135	14	Eastern Cottonwood	Populus deltoides	Poor	Mechanical damage, burried, vines	N			SAVE	-
136	8	Eastern Cottonwood	Populus deltoides	Fair	Mechanical damage, burried	N			SAVE	-
137	9	Eastern Cottonwood	Populus deltoides	Good		N			SAVE	-
138	13	Bitternut Hickory	Carya cordiformis	Poor	Competition, vines	N			SAVE	-
223	11	Sugar Maple	Acer saccharum	Fair	Leaning, dieback	Y			SAVE	-
224	23	Red Oak	Quercus rubra	Fair	Mechanical damage, minor trunk hollow, minor dieback	Y			SAVE	-
225	12	Bitternut Hickory	Carya cordiformis	Fair	Competition, minor trunk damage	Y			SAVE	-
226	13	Black Maple	Acer nigrum	Poor	Dead leader, vines, tunk cankers	Y			SAVE	-
227	10	Shagbark Hickory	Carya ovata	Fair	Competition	Y			SAVE	-
~~1501~~	~~13~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Fair~~	~~Minor Dirback~~	~~N~~	~~Twin~~	~~5~~	~~REMOVE-EXEMPT~~	-
~~1502~~	~~12~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~1503~~	~~12~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~1504~~	~~12~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~1505~~	~~11~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Good~~		~~N~~	~~Twin~~	~~8~~	~~REMOVE-EXEMPT~~	-
~~1506~~	~~13~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~1507~~	~~14~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~1508~~	~~16~~	~~Northern White-Cedar~~	~~Thuja occidentalis~~	~~Good~~		~~N~~			~~REMOVE-EXEMPT~~	-
~~1509~~	~~9~~	~~Boxelder~~	~~Acer negundo~~	~~Fair~~	~~Vines~~	~~Y~~			~~REMOVE-REPLACE~~	1 Tree
~~1510~~	~~11~~	~~Boxelder~~	~~Acer negundo~~	~~Fair~~	~~Competition, vines~~	~~Y~~			~~REMOVE-REPLACE~~	1 Tree
1511	12	White Pine	Pinus strobus	Fair	Competition, vines	Y			SAVE	-
~~1512~~	~~12~~	~~Boxelder~~	~~Acer negundo~~	~~Good~~		~~Y~~			~~REMOVE-REPLACE~~	2 Trees
~~1513~~	~~9~~	~~Green Ash~~	~~Fraxinus pennsylvanica~~	~~Poor~~	~~Insect, vines, dieback~~	~~Y~~			~~REMOVE-REPLACE~~	1 Tree
1514	17	White Pine	Pinus strobus	Poor	17" twin is dead, 12" vines with competition	Y	Twin	12	SAVE	-
1515	8	White Pine	Pinus strobus	Poor	Twin dead, vines, competition	Y	Twin	6	SAVE	-
1516	9	White Pine	Pinus strobus	Poor	Suppression, dieback	Y			SAVE	-
1517	16	White Pine	Pinus strobus	Poor	16" twin dead, 6" Suppression, vines	Y	Twin	6	SAVE	-
~~1518~~	~~10~~	~~White Pine~~	~~Pinus strobus~~	~~Poor~~	~~Competition, vines, dieback~~	~~Y~~	~~Twin~~	~~9~~	~~REMOVE-REPLACE~~	1 Tree
1519	15	White Pine	Pinus strobus	Fair	Competition, vines	Y			SAVE	-
1520	8	White Pine	Pinus strobus	Poor	Suppression, vines	Y			SAVE	-
~~1521~~	~~10~~	~~White Pine~~	~~Pinus strobus~~	~~Poor~~	~~Competition, vines~~	~~Y~~			~~REMOVE-REPLACE~~	1 Tree
~~1522~~	~~8~~	~~White Pine~~	~~Pinus strobus~~	~~Poor~~	~~Competition, vines~~	~~Y~~			~~REMOVE-REPLACE~~	1 Tree
~~1523~~	~~16~~	~~White Pine~~	~~Pinus strobus~~	~~Fair~~	~~Competition, vines~~	~~Y~~			~~REMOVE-REPLACE~~	2 Trees
1524	15	White Pine	Pinus strobus	Poor	Competition, vines, dieback	Y	Twin	10	SAVE	-
1525	11	White Pine	Pinus strobus	Poor	Suppression, lost leader, vines	Y	Twin	10	SAVE	-
1526	13	White Pine	Pinus strobus	Poor	Competition, vines	Y	Twin	12	SAVE	-
~~1527~~	~~12~~	~~White Pine~~	~~Pinus strobus~~	~~Fair~~	~~Competition, vines~~	~~Y~~			~~REMOVE-REPLACE~~	2 Trees
1528	8	American Elm	Ulmus americana	Good		Y			SAVE	-
~~1529~~	~~13~~	~~White Pine~~	~~Pinus strobus~~	~~Fair~~	~~Vines~~	~~Y~~			~~REMOVE-REPLACE~~	2 Trees
~~1530~~	~~11~~	~~White Pine~~	~~Pinus strobus~~	~~Poor~~	~~Competition, lost leader~~	~~Y~~			~~REMOVE-REPLACE~~	1 Tree
1531	9	Silver Maple	Acer saccharinum	Good		Y			SAVE	-
1532	18	White Oak	Quercus alba	Fair	Vines, trunk burried by debirs	Y			SAVE	-
1533	10	White Mulberry	Morus alba	Fair	Dieback, rot	Y	Twin	7	SAVE	-
1534	16	Sugar Maple	Acer saccharum	Good		Y	Twin	6	SAVE	-
1535	10	Northern White-Cedar	Thuja occidentalis	Poor	Competition, vines	Y			SAVE	-
1536	9	White Mulberry	Morus alba	Fair	Dieback, rot	Y	Twin	7	SAVE	-
~~1537~~	~~13~~	~~Black Locust~~	~~Robinia pseudoacacia~~	~~Good~~		~~Y~~			~~REMOVE-REPLACE~~	2 Trees
~~1538~~	~~10~~	~~Eastern Cottonwood~~	~~Populus deltoides~~	~~Good~~		~~Y~~			~~REMOVE-REPLACE~~	1 Tree
~~1539~~	~~16~~	~~Eastern Cottonwood~~	~~Populus deltoides~~	~~Good~~		~~Y~~			~~REMOVE-REPLACE~~	2 Trees
~~1540~~	~~13~~	~~Silver Maple~~	~~Acer saccharinum~~	~~Fair~~	~~Vines~~	~~Y~~			~~REMOVE-REPLACE~~	2 Trees
~~1541~~	~~22~~	~~Willow spp.~~	~~Salix spp.~~	~~Good~~		~~Y~~			~~REMOVE-REPLACE~~	3 Trees
~~1542~~	~~17~~	~~Eastern Cottonwood~~	~~Populus deltoides~~	~~Good~~		~~Y~~			~~REMOVE-REPLACE~~	2 Trees
~~1543~~	~~9~~	~~Black Locust~~	~~Robinia pseudoacacia~~	~~Good~~		~~Y~~	~~Twin~~	~~5~~	~~REMOVE-REPLACE~~	1 Tree
1544	14	Eastern Cottonwood	Populus deltoides	Fair	Competition	Y			SAVE	-
1545	23	Eastern Cottonwood	Populus deltoides	Fair	Vines (estimated DBH due to poison ivy)	Y			SAVE	-
1546	8	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1547	9	Black Cherry	Prunus serotina	Poor	Competition, vines	Y			SAVE	-
1548	16	Willow spp.	Salix spp.	Fair	Vines	Y	Multiple	14,14,12,12	SAVE	-
1549	11	Boxelder	Acer negundo	Fair	Competition, dieback	Y	Twin	10	SAVE	-
1550	22	Eastern Cottonwood	Populus deltoides	Good		Y	Twin	15	SAVE	-
1551	20	Boxelder	Acer negundo	Poor	Dieback, vines	Y			SAVE	-
1552	10	American Elm	Ulmus americana	Fair	Competition, vines	Y			SAVE	-
1553	12	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1554	18	Eastern Cottonwood	Populus deltoides	Good		Y			SAVE	-
1555	22	Eastern Cottonwood	Populus deltoides	Good		Y			SAVE	-
1556	16	Eastern Cottonwood	Populus deltoides	Fair	Vines	Y			SAVE	-
1557	15	Eastern Cottonwood	Populus deltoides	Fair	Vines	Y			SAVE	-
1558	10	Eastern Cottonwood	Populus deltoides	Fair	Competition	Y			SAVE	-
1559	11	Eastern Cottonwood	Populus deltoides	Fair	Vines	Y			SAVE	-
1560	9	Eastern Cottonwood	Populus deltoides	Fair	Competition, vines	Y			SAVE	-
1561	9	American Elm	Ulmus americana	Poor	Competition, vines	Y			SAVE	-
1562	11	American Elm	Ulmus americana	Fair	Competition, vines	Y			SAVE	-
1563	8	American Elm	Ulmus americana	Fair	Vines	Y			SAVE	-
1564	10	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1565	9	Black Walnut	Juglans nigra	Fair	Vines	Y			SAVE	-
1566	9	Black Walnut	Juglans nigra	Fair	Competition, vines	Y			SAVE	-
1567	8	American Elm	Ulmus americana	Fair	Competition	Y			SAVE	-
1568	12	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1569	9	Black Walnut	Juglans nigra	Poor	Competition, vines	Y			SAVE	-
1570	9	Black Walnut	Juglans nigra	Fair	Competition, girdling roots	Y			SAVE	-
1571	8	Black Walnut	Juglans nigra	Fair	Vines	Y			SAVE	-
1572	9	Bitternut Hickory	Carya cordiformis	Poor	Competition, vines	Y			SAVE	-
1573	11	Black Cherry	Prunus serotina	Good		Y			SAVE	-
1574	13	Black Cherry	Prunus serotina	Fair	Competition, vines	Y			SAVE	-
1575	8	American Elm	Ulmus americana	Fair	Competition, vines	Y			SAVE	-
1576	8	American Elm	Ulmus americana	Poor	Vines, dieback	Y			SAVE	-
1577	13	Black Cherry	Prunus serotina	Poor	Vines, dieback	Y	Twin	7	SAVE	-
1578	12	Black Walnut	Juglans nigra	Good		Y	Twin	5	SAVE	-
1579	8	Black Cherry	Prunus serotina	Poor	Dieback	Y			SAVE	-
1580	23	Silver Maple	Acer saccharinum	Good		Y			SAVE	-
1581	14	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1582	16	Eastern Cottonwood	Populus deltoides	Poor	Vines	Y			SAVE	-
1583	13	Eastern Cottonwood	Populus deltoides	Good		Y			SAVE	-
1584	8	Black Cherry	Prunus serotina	Poor	Competition, vines, leaning	Y			SAVE	-
1585	10	Eastern Cottonwood	Populus deltoides	Fair	Competition, leaning	Y			SAVE	-
1586	11	Eastern Cottonwood	Populus deltoides	Good		Y			SAVE	-
1587	10	Eastern Cottonwood	Populus deltoides	Fair	Competition, leaning	Y			SAVE	-
1588	8	Eastern Cottonwood	Populus deltoides	Poor	Competition, vines	Y			SAVE	-
1589	12	Eastern Cottonwood	Populus deltoides	Good		Y			SAVE	-
1590	10	Black Walnut	Juglans nigra	Fair	Competition, vines	Y			SAVE	-
1591	12	Black Cherry	Prunus serotina	Poor	Competition, vines, rot	Y			SAVE	-
1592	24	Willow spp.	Salix spp.	Fair	Vines, rot	Y	Twin	24	SAVE	-
1593	16	Boxelder	Acer negundo	Poor	Competition, vines, rot	Y	Multiple	8,7	SAVE	-
1594	12	Boxelder	Acer negundo	Poor	Leaning, vines, epicormic branching	Y			SAVE	-
1595	13	Eastern Cottonwood	Populus deltoides	Fair	Competition, dieback	Y	Twin	12	SAVE	-
1596	8	Eastern Cottonwood	Populus deltoides	Poor	Competition, vines	Y			SAVE	-
1597	11	Eastern Cottonwood	Populus deltoides	Poor	Competition, vines	Y			SAVE	-
1598	12	Eastern Cottonwood	Populus deltoides	Poor	Competition, dieback	Y			SAVE	-
1599	8	American Elm	Ulmus americana	Poor	Competition, vines	Y			SAVE	-
1600	16	Black Walnut	Juglans nigra	Fair	Competition, vines	Y			SAVE	-
1601	9	Slippery Elm	Ulmus rubra	Fair	Competition, vines	Y			SAVE	-
1602	11	American Elm	Ulmus americana	Fair	Competition	Y			SAVE	-
1603	8	Black Walnut	Juglans nigra	Fair	Competition	Y			SAVE	-
1604	9	Slippery Elm	Ulmus rubra	Fair	Competition	Y			SAVE	-
1605	16	Red Oak	Quercus rubra	Fair	Competition	Y			SAVE	-
1606	15	Basswood	Tilia americana	Good		Y	Multiple	12,9,9	SAVE	-
1607	9	Slippery Elm	Ulmus rubra	Good		Y			SAVE	-
1608	11	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1609	10	Swamp White Oak	Quercus bicolor	Good		Y			SAVE	-
1610	8	Silver Maple	Acer saccharinum	Fair	Competition	Y			SAVE	-
1611	10	American Elm	Ulmus americana	Poor	Vines, crown dieback	Y			SAVE	-
1612	8	Black Cherry	Prunus serotina	Good		Y			SAVE	-
1613	10	American Elm	Ulmus americana	Poor	Competition, vines	Y			SAVE	-
1614	8	Black Cherry	Prunus serotina	Fair	Vines	Y			SAVE	-
1615	16	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1616	10	Sugar Maple	Acer saccharum	Good		Y			SAVE	-

TAG#	DBH	COMMON NAME	LATIN NAME	CON	COMMENT	Regulated	Type	Other Dia.	SAVE / REMOVE	REPLACEMENTS REQ'D
1617	18	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1618	25	Basswood	Tilia americana	Good		Y	Twin	12	SAVE	-
1619	14	Sugar Maple	Acer saccharum	Poor	Competition, epicormic branching	Y			SAVE	-
1620	8	Bitternut Hickory	Carya cordiformis	Fair	Competition	Y			SAVE	-
1621	14	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1622	9	Basswood	Tilia americana	Fair	Competition	Y	Twin	7	SAVE	-
1623	21	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1624	17	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1625	11	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
1626	11	Black Cherry	Prunus serotina	Poor	Vines, crown dieback	Y	Twin	3	SAVE	-
1627	8	American Elm	Ulmus americana	Fair	Competition	Y			SAVE	-
1628	8	Slippery Elm	Ulmus rubra	Poor	Suppression, dieback	Y			SAVE	-
1629	20	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1630	13	Basswood	Tilia americana	Good		Y			SAVE	-
1631	11	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
1632	18	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1633	15	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1634	9	American Elm	Ulmus americana	Poor	Suppression	Y			SAVE	-
1635	23	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1636	16	Red Oak	Quercus rubra	Fair	Competition	Y			SAVE	-
1637	25	Red Oak	Quercus rubra	Good		Y			SAVE	-
1638	8	Bitternut Hickory	Carya cordiformis	Poor	Competition, vines	Y			SAVE	-
1639	8	Basswood	Tilia americana	Good		Y			SAVE	-
1640	10	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1641	18	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1642	13	Black Cherry	Prunus serotina	Good		Y			SAVE	-
1643	8	Black Maple	Acer nigrum	Fair	Competition	Y			SAVE	-
1644	8	American Elm	Ulmus americana	Good		Y			SAVE	-
1645	12	Black Walnut	Juglans nigra	Fair	Leaning, roots unstable and lifting out of ground	Y			SAVE	-
1646	17	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1647	8	American Elm	Ulmus americana	Fair	Competition	Y			SAVE	-
1648	10	American Elm	Ulmus americana	Poor	Competition, dieback, vines (Hybrid elm species)	Y			SAVE	-
1649	10	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1650	8	Red Maple	Acer rubrum	Good		Y			SAVE	-
1651	16	Tulip Tree	Liriodendron tulipifera	Good		Y			SAVE	-
1652	15	American Beech	Fagus grandifolia	Good		Y			SAVE	-
1653	13	Bitternut Hickory	Carya cordiformis	Good		Y	Twin	11	SAVE	-
1654	8	Eastern Cottonwood	Populus deltoides	Poor	Suppression, vines	Y			SAVE	-
1655	12	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
1656	12	Black Walnut	Juglans nigra	Fair	Competition	Y			SAVE	-
1657	8	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1658	8	Basswood	Tilia americana	Good		Y			SAVE	-
1659	13	Basswood	Tilia americana	Good		Y	Twin	5	SAVE	-
1660	15	Black Cherry	Prunus serotina	Fair	Competition, dieback	Y	Twin	12	SAVE	-
1661	8	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
1662	13	Basswood	Tilia americana	Good		Y			SAVE	-
1663	9	Basswood	Tilia americana	Fair	Competition	Y			SAVE	-
1664	14	Basswood	Tilia americana	Good		Y			SAVE	-
1665	10	Basswood	Tilia americana	Fair	Competition, leaning	Y			SAVE	-
1666	9	Basswood	Tilia americana	Fair	Competition	Y			SAVE	-
1667	22	Red Oak	Quercus rubra	Good		Y			SAVE	-
1668	19	Swamp White Oak	Quercus bicolor	Fair	Competition, epicormic branching, minor dieback	Y			SAVE	-
1669	15	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1670	9	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1671	21	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1672	10	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
1673	8	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1674	9	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
1675	9	American Elm	Ulmus americana	Fair	Competition, vines, leaning	Y			SAVE	-
1676	10	Sugar Maple	Acer saccharum	Fair	Competition, vines	Y			SAVE	-
1677	8	Bitternut Hickory	Carya cordiformis	Fair	Competition	Y	Twin	7	SAVE	-
1678	11	Black Cherry	Prunus serotina	Poor	Competition, vines	Y			SAVE	-
1679	8	Black Walnut	Juglans nigra	Fair	Competition	Y			SAVE	-
1680	18	Black Cherry	Prunus serotina	Poor	Dieback	Y			SAVE	-
1681	16	Sugar Maple	Acer saccharum	Poor	Competition, dieback	Y			SAVE	-
1682	12	Basswood	Tilia americana	Fair	Competition, leaning	Y			SAVE	-
1683	8	Sugar Maple	Acer saccharum	Fair	Competition, seam	Y	Twin	7	SAVE	-
1684	16	American Beech	Fagus grandifolia	Good		Y			SAVE	-
1685	12	American Beech	Fagus grandifolia	Good		Y			SAVE	-
1686	20	American Beech	Fagus grandifolia	Good		Y			SAVE	-
1687	16	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
1688	8	Black Cherry	Prunus serotina	Good		Y			SAVE	-
1689	17	Black Cherry	Prunus serotina	Fair	Minor dieback	Y			SAVE	-
1690	11	Black Cherry	Prunus serotina	Poor	Dieback, seam	Y			SAVE	-
1691	13	Black Cherry	Prunus serotina	Good		Y			SAVE	-
1692	9	Black Walnut	Juglans nigra	Poor	Competition, vines	Y			SAVE	-
1693	24	Red Oak	Quercus rubra	Good		Y			SAVE	-
1694	14	Red Oak	Quercus rubra	Good		Y			SAVE	-
1695	21	Basswood	Tilia americana	Fair	Competition, seam, minor rot	Y			SAVE	-
1696	10	Slippery Elm	Ulmus rubra	Poor	Suppression	Y			SAVE	-
1697	12	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
1698	17	Basswood	Tilia americana	Good		Y	Multiple	15,13,14,13,6	SAVE	-
1699	8	Sugar Maple	Acer saccharum	Good		Y	Twin	6	SAVE	-
1700	9	Black Cherry	Prunus serotina	Good		Y			SAVE	-
1701	12	American Beech	Fagus grandifolia	Good		Y			SAVE	-
1702	18	White Pine	Pinus strobus	Good		Y			SAVE	-
1703	10	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
1704	16	Sugar Maple	Acer saccharum	Fair	Seam, weak crotch	Y			SAVE	-
1705	9	Black Cherry	Prunus serotina	Fair	Dieback	Y	Twin	7	SAVE	-
1706	8	Black Cherry	Prunus serotina	Poor	Dieback, rot	Y			SAVE	-
1707	9	Sugar Maple	Acer saccharum	Good		Y	Twin	8	SAVE	-
1708	11	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1709	9	Black Cherry	Prunus serotina	Fair	Competition	Y			SAVE	-
1710	14	Black Walnut	Juglans nigra	Fair	Competition, dieback	Y			SAVE	-
1711	9	American Elm	Ulmus americana	Fair	Vines	Y			SAVE	-
1712	8	Bitternut Hickory	Carya cordiformis	Fair	Competition	Y			SAVE	-
1713	13	Black Cherry	Prunus serotina	Fair	Competition, dieback	Y			SAVE	-
1714	20	Basswood	Tilia americana	Good		Y			SAVE	-
1715	15	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
1716	12	Black Cherry	Prunus serotina	Fair	Competition	Y			SAVE	-
1717	10	Black Cherry	Prunus serotina	Fair	Competition	Y			SAVE	-
1718	16	Black Cherry	Prunus serotina	Good		Y			SAVE	-
1719	10	Bitternut Hickory	Carya cordiformis	Fair	Competition	Y			SAVE	-
1720	22	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1721	10	Black Cherry	Prunus serotina	Poor	Competition, trunk hollow, rot	Y			SAVE	-
1722	9	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
1723	8	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
1724	10	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1725	22	Red Oak	Quercus rubra	Good		Y			SAVE	-
1726					(Tag does not exist)				SAVE	-
1727					(Tag does not exist)				SAVE	-
1728	8	American Elm	Prunus serotina	Good	(American Elm hybrid)	Y			SAVE	-
1729	10	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1730	9	Black Cherry	Prunus serotina	Fair	Competition, dieback	Y			SAVE	-
1731	12	Black Cherry	Prunus serotina	Good		Y	Twin	11	SAVE	-
1732	12	Black Cherry	Prunus serotina	Good		Y			SAVE	-
1733	24	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
1734	8	Sugar Maple	Acer saccharum	Fair	Competition	Y			SAVE	-
1735	13	Black Cherry	Prunus serotina	Poor	Rot, dieback	Y			SAVE	-
1736	9	American Elm	Ulmus americana	Fair	Competition, truck rot (American Elm Hybrid)	Y			SAVE	-
1737	17	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1738	10	Black Cherry	Prunus serotina	Fair	Competition	Y			SAVE	-
1739	17	Bitternut Hickory	Carya cordiformis	Good		Y			SAVE	-
1740	8	American Elm	Ulmus americana	Poor	Suppression, epicormic branching, leaning	Y			SAVE	-
1741	13	Basswood	Tilia americana	Fair	Competition	Y	Twin	4	SAVE	-
1742	19	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1743	18	Black Walnut	Juglans nigra	Good		Y			SAVE	-
1744	18	Basswood	Tilia americana	Good		Y			SAVE	-
1745	11	Sugar Maple	Acer saccharum	Good		Y			SAVE	-
1746	12	Black Walnut	Juglans nigra	Good		Y	twin	11	SAVE	-

NOT FOR CONSTRUCTION

XREF: S:PROJECTS\2019\2019230\DWG\19230-TOPOBASE.DWG
XREF: S:PROJECTS\2019\2019230\DWG\SITE PLANS\X-BASE-19230.DWG
XREF: S:PROJECTS\2019\2019230\DWG\SITE PLANS\X-TBLK-19230.DWG

REVISIONS

No.	BY	CHK	DESCRIPTION	DATE
1.	BA	JS	PRELIMINARY SITE PLAN SUBMITTAL	1/31/20

STATE OF MICHIGAN
LYNN A. WHIPPLE
ARCHITECT
LANDSCAPE ARCHITECT

CAUTION!!
THE LOCATIONS AND ELEVATIONS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THIS DRAWING ARE ONLY APPROXIMATE. NO GUARANTEE IS EITHER EXPRESSED OR IMPLIED AS TO THE COMPLETENESS OR ACCURACY THEREOF. THE CONTRACTOR SHALL BE EXCLUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT UTILITY LOCATIONS AND ELEVATIONS PRIOR TO THE START OF CONSTRUCTION.

CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE DESIGN PROFESSIONAL.

3 FULL WORKING DAYS BEFORE YOU DIG CALL 811
Know what's below Call before you dig
MISS DIG System, Inc.
1-800-482-7171 (TOLL FREE) www.missdig.org

PEA, Inc.
2430 Rochester Ct., Ste. 100
Troy, MI 48083-1872
t: 248.689.9090
f: 248.689.1044
www.peainc.com

HILLSIDE INVESTMENTS
39475 13 MILE ROAD., SUITE 203
NOVI, MI 48377

TREE PRESERVATION LIST
GREAT OAKS
46844 WEST 12 MILE ROAD
NOVI, OAKLAND COUNTY, MICHIGAN

DES. LW | DN. LW | SUR. – | P.M. JPB

S:\PROJECTS\2019\2019-230 GREAT OAKS – JPB\DWG\LANDSCAPE\SITE PLANS\(T-1.0)TREE PRESERVATION PLAN-19230.dwg

ORIGINAL ISSUE DATE:
AUGUST 16, 2019

PEA JOB NO. 2019-230

SCALE: 1" = 40'

DRAWING NUMBER:
T-1.1

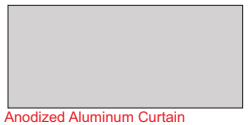
6-18-20

Field Brick

Stone Veneer

Polymer Composite Siding

Low “E” Tinted Glazing



Anodized Aluminum Curtain Wall & Sunshade Systems

Aluminum Composite Panel (ACM)

Vertical Metal Siding & Metal Coping

C-Brick Masonry

Split-Face CMU

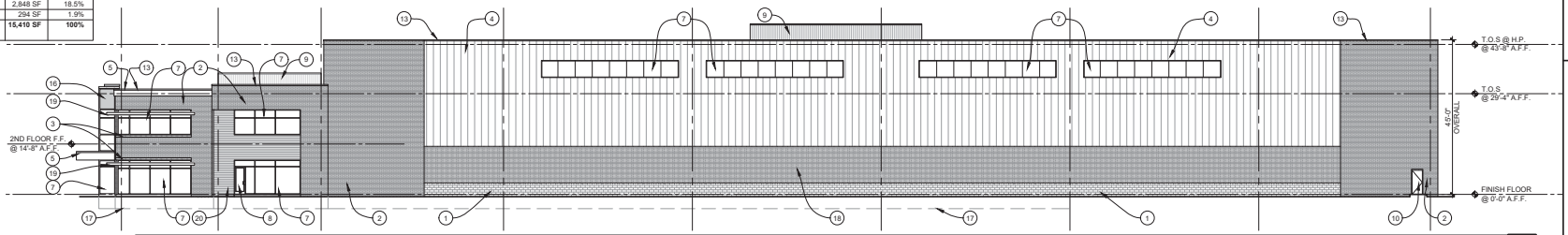
Proposed Material Board for:

HILLSIDE INVESTMENTS

FAUDIE ARCHITECTURE

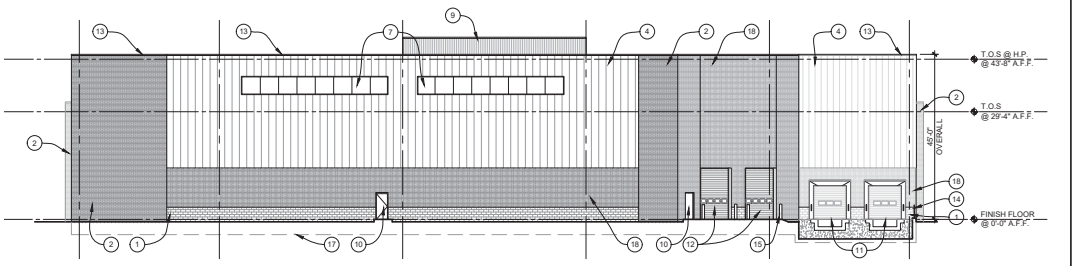
Design to Inspire

BUILDING FACADE MATERIAL BREAKDOWN		
FACADE MATERAL	AREA	REGION
BRICK	3,431 SF	22.3%
ACM	75 SF	0.5%
METAL PANELS/FLUSH METAL	7,694 SF	49.9%
SPLIT-FACE CMU	1,068 SF	6.9%
C-BRICK	2,848 SF	18.5%
POLYMER SIDING	294 SF	1.9%
TOTAL (EXCLUDES VISION GLASS & OPENINGS)	**15,410 SF**	**100%**



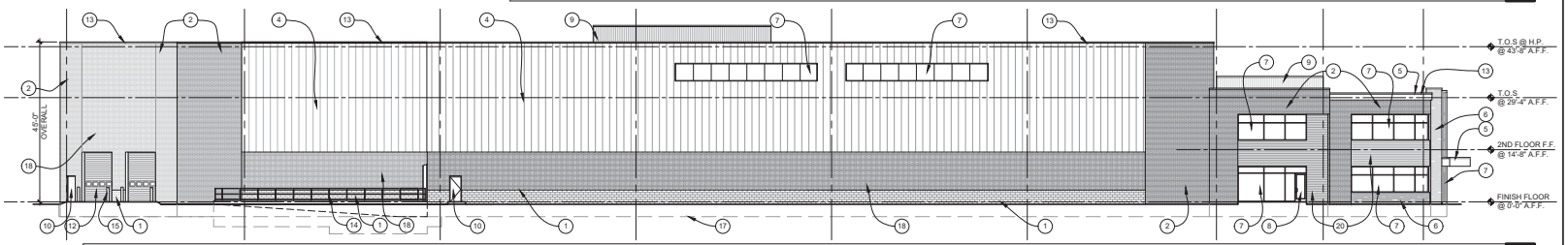
PROPOSED EAST ELEVATION 4
SCALE: 1/16"=1'-0"

BUILDING FACADE MATERIAL BREAKDOWN		
FACADE MATERAL	AREA	REGION
BRICK	2,310 SF	23.6%
METAL PANELS/FLUSH METAL	4,746 SF	48.4%
SPLIT-FACE CMU	541 SF	5.5%
C-BRICK	2,207 SF	22.5%
TOTAL (EXCLUDES VISION GLASS & OPENINGS)	**9,804 SF**	**100%**



PROPOSED NORTH ELEVATION 3
SCALE: 1/16"=1'-0"

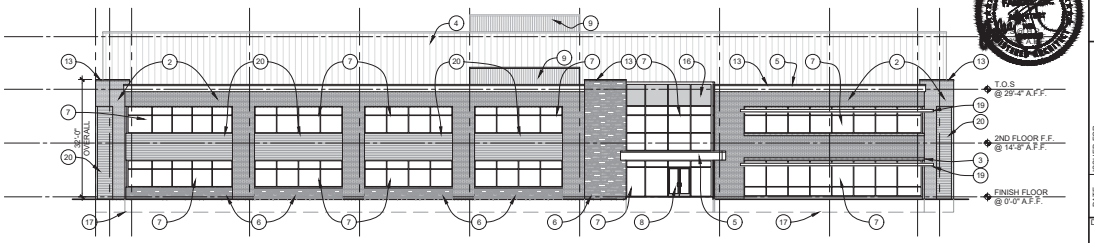
BUILDING FACADE MATERIAL BREAKDOWN		
FACADE MATERAL	AREA	REGION
BRICK	2,898 SF	18.6%
STONE VENEER	174 SF	1.1%
ACM	58 SF	0.4%
METAL PANELS/FLUSH METAL	7,642 SF	49.3%
SPLIT-FACE CMU	956 SF	6.1%
C-BRICK	3,364 SF	21.6%
POLYMER SIDING	456 SF	2.9%
TOTAL (EXCLUDES VISION GLASS & OPENINGS)	**15,548 SF**	**100%**



PROPOSED WEST ELEVATION 2
SCALE: 1/16"=1'-0"

EXTERIOR MATERIAL SCHEDULE	
1	SPLITFACE CMU
2	BRICK - FIELD COLOR COLOR: TBD
3	BRICK ACCENT - SOLDIER COURSE COLOR: TBD
4	INSULATED FLUSH VERTICAL METAL PANEL SIDING (FLAT PROFILE)
5	ALUMINUM COMPOSITE METAL PANEL SYSTEM (ACM)
6	STONE VENEER
7	1" TINTED LOW 'E' INSUL. GLAZING IN CLEAR ANOD. ALUM. THERMAL BREAK FRAMES.
8	CLEAR ANOD. ALUM. ENTRY DOOR W/ TEMPERED GLASS
9	FLUSH METAL PANEL SIDING (RTU SCREENING)
10	FIBERGLASS DOOR AND FRAME
11	9'x10' SECTIONAL INSULATED OVERHEAD TRUCK DOCK DOOR (MANUAL CHAIN OPERATED) w/ DOCK LEVELER, & SHELTER/SEAL
12	12'x14' SECTIONAL INSULATED OVERHEAD GRADE DOOR w/ MOTOR OPERATED OPENER
13	PREFINISHED METAL COPING
14	1½" dia. PAINTED STEEL PIPE GUARDRAIL
15	6" DIA. CONC. FILLER STEEL GUARD POST
16	1" LOW 'E' INSUL. GRAY TINTED SPANDREL GLAZING IN CLEAR ANOD. ALUM. THERMAL BREAK FRAMES.
17	CONC. TRENCH FOOTING BELOW
18	16"x4" C-BRICK MASONRY
19	ALUMINUM SUNSHADE SYSTEM (30" WIDE SHADE)
20	POLYMER COMPOSITE SIDING

BUILDING FACADE MATERIAL BREAKDOWN		
FACADE MATERAL	AREA	REGION
BRICK	2,219 SF	28.7%
STONE VENEER	682 SF	8.9%
ACM	438 SF	5.7%
METAL PANELS/FLUSH METAL	3,289 SF	42.7%
SPANDREL	129 SF	1.7%
POLYMER SIDING	949 SF	12.3%
TOTAL (EXCLUDES VISION GLASS & OPENINGS)	**7,706 SF**	**100%**



PROPOSED SOUTH ELEVATION 1
SCALE: 1/16"=1'-0"

FAUDIE ARCHITECTURE
Design Group
26261 Evergreen Rd., Suite #123
Southfield, Michigan 48076
www.faudiearchitecture.com

HILLSIDE 90K SPEC BUILDING

PROJECT NAME:
12 MILE RD
NOVI, MI

DATE:	ISSUED FOR:
3-26-20	PRELIM SITE PLAN RESUBMITTAL
5-1-20	PRELIM SITE PLAN RESUBMITTAL

DRAWING DATE:
6-1-20

PROJECT NUMBER:
19051

SHEET NUMBER:
PE-4

PLANNING REVIEW

PLAN REVIEW CENTER REPORT

June 12, 2020

Planning Review

Great Oaks Industrial Park 1, Spec Building

JSP 19-35

PETITIONER

Hillside Investments

REVIEW TYPE

Revised Preliminary Site Plan

PROPERTY CHARACTERISTICS

Section	9	
Site Location	North of Twelve Mile, West of West Park Road; 22-09-300-032	
Site School District	Novi Community School District	
Site Zoning	I-1: Light Industrial District, I-2: General Industrial District	
Adjoining Zoning	North	I-2: General Industrial District
	East	I-1: Light Industrial District, I-2: General Industrial District
	West	I-1: Light Industrial District, I-2: General Industrial District
	South	OST: Office Service Technology and RA: Residential Acreage
Current Site Use	Golf Driving Range	
Adjoining Uses	North	Light Industrial/Corporate park
	East	Landscaping Company
	West	Concrete plant
	South	Vacant
Site Size	20.04 acres	
Plan Date	January 31, 2020 (not updated)	

PROJECT SUMMARY

The applicant is proposing a new 98,650 square foot Research/Development/Office building on an approximately 20 acre parcel previously used as a golf driving range. Associated parking areas and a stormwater detention basin are also proposed. The parcel is on the north side of Twelve Mile Road, west of West Park Drive. The proposed speculative building does not have an identified tenant at this time. The site is zoned I-1: Light Industrial and I-2: General Industrial District. The future land use map indicates Industrial, Research, Development and Technology for the southern portion of the property, and Heavy Industrial for the northern 2/3 of the property.

RECOMMENDATION

Approval of the ***Preliminary Site Plan is recommended with the condition that the applicant agrees to correct the waivers and variances identified in this in other review letters***. ***Alternatively the applicant should request formal approval of any waivers and variances that cannot be corrected.*** The plan mostly conforms to the requirements of the Zoning Ordinance, with deviations identified below. All reviews except Woodlands recommend approval. Planning Commission approval of the Special Land Use Permit, Preliminary Site Plan, Wetland Permit, Woodland Permit, and Stormwater Management Plan is required.

ORDINANCE REQUIREMENTS

This project was reviewed for conformance with the Zoning Ordinance with respect to Article 3 (Zoning Districts), Article 4 (Use Standards), Article 5 (Site Standards), and any other applicable provisions of the Zoning Ordinance**. Please see the attached chart for information pertaining to ordinance requirements.** Items in **bold** below must be addressed and incorporated as part of the Final Site Plan submittal:

1. Special Land Use Permit: Section 6.2.C of the Zoning Ordinance outlines specific factors the Planning Commission shall consider in the review of the Special Land Use Permit request:

   i. Whether, relative to other feasible uses of the site, the proposed use will cause any detrimental impact on existing thoroughfares in terms of overall volumes, capacity, safety, vehicular turning patterns, intersections, view obstructions, line of sight, ingress and egress, acceleration/deceleration lanes, off-street parking, off-street loading/unloading, travel times and thoroughfare level of service. **Traffic impacts have been evaluated by the City's consultant. See the Traffic review letter for detailed comments. The Road Commission for Oakland County is developing plans for improvements to Twelve Mile Road.**

   ii. Whether, relative to other feasible uses of the site, the proposed use will cause any detrimental impact on the capabilities of public services and facilities, including water service, sanitary sewer service, storm water disposal and police and fire protection to service existing and planned uses in the area**. The plans show the applicant will extend the necessary water main and sanitary sewer facilities to serve the development at their expense.**

   iii. Whether, relative to other feasible uses of the site, the proposed use is compatible with the natural features and characteristics of the land, including existing woodlands, wetlands, watercourses and wildlife habitats. **There are several small wetlands identified that will be impacted, but the amount of area impacted does not require mitigation under the City's Ordinance. As this is a redevelopment of a site previously used as a driving range, there are minimal trees in the area currently proposed for development.**

   iv. Whether, relative to other feasible uses of the site, the proposed use is compatible with adjacent uses of land in terms of location, size, character, and impact on adjacent property or the surrounding neighborhood. **The existing adjacent uses are also industrial and/or planned for Office, Research and Technology uses.**

   v. Whether, relative to other feasible uses of the site, the proposed use is consistent with the goals, objectives and recommendations of the City's Master Plan for Land Use. **It complies with the goal that recommends supporting growth of new businesses. The Future Land Use map indicates Industrial, Research, Development and Technology for this area, which is the use proposed.**

   vi. Whether, relative to other feasible uses of the site, the proposed use will promote the use of land in a socially and economically desirable manner. **The redevelopment of the site will improve the tax base and provide employment. As the building does not have an identified tenant, specific details of the proposed us are not available.**

   vii. Whether, relative to other feasible uses of the site, the proposed use is (1) listed among the provision of uses requiring special land use review as set forth in the various zoning districts of this Ordinance, and (2) is in harmony with the purposes and conforms to the applicable site design regulations of the zoning district in which it is located**. Research and Development facilities are allowed as a Special land use in the I-1 zoning district when adjacent to residential districts. The applicant is seeking deviations from required conditions.**

2. Land Use: **As a tenant has not been identified for this facility, the applicant shall note that any future user of the building is subject to the standards and definition of "Research and Development" as provided in the Zoning Ordinance.**

3. Context Plan: Staff would like to understand the overall layout planned for the "Great Oaks Industrial Park" in order to identify any possible conflicts in access points, parcel lines, utilities, etc. The project appears to be a stand-alone, self-sufficient building, but future development of the remainder of the parcel to the north as well as the relationship of the parcels to the east would be helpful to consider this project in the larger context.

4. Zoning District Boundaries: The zoning district lines must be shown on the plan to determine where the split between the I-1 and the I-2 Districts lies. Several of the development standards are different between the two districts, including maximum building height, building setbacks and parking setbacks. **The portions of the site in the I-1 District must conform to its requirements, and the portion of the site in the I-2 District is expected to conform with its requirements. Therefore the zoning district boundary must be shown on the plan. It appears that the building height exceeds the 40 foot maximum in the I-1 District, and that approximately 17 parking spaces on the east side of the site in the I-2 District are within the 20 foot parking setback. The applicant shall either revise the plan to meet these ordinance requirements, or seek a variance from the Zoning Board of Appeals.**

5. Twelve Mile Improvements: The Road Commission for Oakland County (RCOC) has been exploring options to improve Twelve Mile Road in the vicinity of the subject project. A final design for a 4-lane boulevard plan has recently been released that shows a break in the boulevard, with a "loon" (turning bump-out) on both the north and south side, near the subject property. The applicant has modified the layout and site configuration to avoid conflicts with the proposed road improvements**.**

6. Accessory Structures (Sec 4.19.2.I): A transformer is now shown in the rear yard near the dumpster. Location meets the 20 foot setback requirement and screening is required.

7. Parking Calculations (Sec. 5.2.12.E.): The ordinance requirements for industrial or research establishments with accessory offices is one space for each 700 sf of Useable Floor Area. Using this formula, the Zoning Ordinance requires 113 parking spaces for this project. The applicant proposes to provide 198 parking spaces, or 75% more than required. **Staff encourages the applicant to reduce or land bank excess parking spaces in order to reduce the impervious coverage on the site.**

8. Bicycle Parking Accessibility (Sec. 5.16): The ordinance states bicycle parking spaces must be accessible via a 6-foot wide clear path from the street. Although the sidewalk along the south and west sides of the building are 7 feet wide, the path would be reduced to 5 feet clear when vehicles are present in the adjacent 17 foot length parking spaces. **These sidewalks shall be widened to 8 feet wide to account for the 2-foot vehicle overhang. Alternatively, the parking spaces could be lengthened to 19 feet with a 6-inch curb. The sidewalk leading from the 12 Mile ROW should also be widened to 6 feet.**

9. Project and Street Naming Committee: The name of the development, "Great Oaks Industrial Park," requires approval by the Project and Street Naming Committee. **The application has now been received.**

10. Plan Review Chart: There are additional minor clarifications requested in the Plan Review Chart. Please refer to the chart for additional details.

11. Other Reviews:

a. Engineering Review: Additional comments to be addressed with the Final Site Plan. Engineering recommends approval.
b. Landscape Review: Landscape recommends approval with comments to be addressed in Final Site Plan Submittal. Refer to review letter and chart for more comments.
c. Wetlands Review: Impacts to Wetlands have been provided in the latest submittal. Wetlands recommend approval, with additional comments to be addressed in the Final Site Plan submittal.
d. Woodlands Review: **ECT does not recommend approval for Woodlands at this time.** Refer to review letter for more details.
e. Traffic Review: Traffic review recommends approval of the revised Preliminary Site Plan, with additional comments to be addressed with Final Site Plan.
f. Traffic Impact Study: The TIS was reviewed and AECOM recommends approval, with comments to be addressed in an update to be provided to the city.
g. Facade Review: The proposed design will require a Section 9 waiver for not meeting the requirements of the façade ordinance. Façade consultant recommends approval of the waiver. See letter for additional details.
h. Fire Review: Fire recommends conditional approval. Additional comments to be addressed with Final Site Plan.

NEXT STEP: PLANNING COMMISSION MEETING

This Site Plan is scheduled to go before Planning Commission for public hearing on **June 24, 2020 at 7:00 p.m.** Please provide via email the following **by noon on June 18, 2020,** if you wish to keep this schedule:

1. Site Plan submittal in PDF format (maximum of 10MB). **NO CHANGES MADE. (This has been received)**
2. A response letter addressing ALL the comments from ALL the review letters and a request for waivers/variances as you see fit.
3. A color rendering of the Site Plan (Optional to be used for Planning Commission presentation).
4. A sample board of building materials as required by our Façade Consultant.

FINAL SITE PLAN SUBMITTAL

After receiving Planning Commission's approval of the Preliminary Site Plan, please follow the Final Site Plan Checklist and submit for approval:

1. Six copies of Final Site Plan sets (24" x 36", folded) addressing all comments from Preliminary review,
2. Response letter addressing ALL comments from ALL the review letters and **refer to sheet numbers where the change is reflected.**
3. Final Site Plan Application

ELECTRONIC STAMPING SET SUBMITTAL AND RESPONSE LETTER

After receiving Final Site Plan approval, plans addressing the comments in all of the staff and consultant review letters should be submitted electronically for informal review and approval prior to printing Stamping Sets**.** A letter from either the applicant or the applicant's representative addressing comments in this and other review letters and associated charts is to be submitted with the electronic stamping set. This letter should address all comments in ALL letters and ALL charts and **refer to sheet numbers where the change is reflected.**

STAMPING SET APPROVAL

Stamping sets will be required for this project. After having received all of the review letters from City staff the applicant should make the appropriate changes on the plans and submit **10 size 24" x 36" copies with original signature and original seals on the cover sheet (subsequent pages may use electronic seal with signature),** to the Community Development Department for final Stamping Set approval.

If required, drafts for all legal documents with a legal transmittal are to be submitted along with stamping sets.

SIGNAGE

Exterior Signage is not regulated by the Planning Division or Planning Commission. Sign permit applications that relate to construction of a new building or an addition to an existing building may submitted, reviewed, and approved as part of a site plan application. Proposed signs shall be shown on the preliminary site plan. Alternatively, an applicant may choose to submit a sign application to the Building Official for administrative review. Following preliminary site plan approval, any application to amend a sign permit or for a new or additional sign shall be submitted to the Building Official. Please contact the Ordinance Division 248.735.5678 for information regarding sign permits.

PRE-CONSTRUCTION MEETING

A Pre-Construction meeting is required for this project. Prior to the start of any work on the site, Pre-Construction (Pre-Con) meetings must be held with the applicant's contractor and the City's consulting engineer. Pre-Con meetings are generally held after Stamping Sets have been issued and prior to the start of any work on the site. There are a variety of requirements, fees and permits that must be issued before a Pre-Con can be scheduled, so it is recommended you contact Sarah Marchioni [248.347.0430 or smarchioni@cityofnovi.org] in the Community Development Department once you receive Final Site Plan approval. Any questions regarding the Pre-Con should be directed to Sarah.

CHAPTER 26.5

Chapter 26.5 of the City of Novi Code of Ordinances generally requires all projects be completed within two years of the issuance of any starting permit. Please contact Sarah Marchioni at 248-347-0430 for additional information on starting permits. The applicant should review and be aware of the requirements of Chapter 26.5 before starting construction.

If the applicant has any questions concerning the above review or the process in general, do not hesitate to contact me at 248.347.0484 or lbell@cityofnovi.org.

Lindsay Bell

Lindsay Bell, *AICP* – Senior Planner

PLANNING REVIEW CHART

Review Date: June 12, 2020
Review Type: Revised Preliminary Site Plan
Project Name: Great Oaks Industrial Park 1, JSP19-35
Location: North of Twelve Mile Rd, West of West Park Dr (22-09-300-032)
Plan Date: January 31, 2020 (not updated)
Prepared by: Lindsay Bell, Planner
E-mail: lbell@cityofnovi.org **Phone:** 248.347.0484

Bold	To be addressed with the next submittal
Underline	To be addressed with final site plan submittal
Bold and Underline	Requires Planning Commission and/or City Council Approval
Italics	To be noted

Item	Required Code	Proposed	Meets Code	Comments
Zoning and Use Requirements				
Master Plan *(adopted July 26, 2017)*	Industrial Research Development and Technology/ Heavy Industrial	Research & Development	Yes	98,650 sf proposed: 70,610 shop + 28,040 sf office
Area Study	N/A		NA	
Zoning *(Effective January 8, 2015)*	I-1: Light Industrial District and I-2: General Industrial	No Change	Yes	
Uses Permitted (Sec 3.1.18.C)	R&D treated as Special Land Use when adjacent to residential, otherwise as Principle Permitted Use	R&D, RA zoning to the south (although planned for office, R&D, Tech)	Yes	**Special Land Use permit required due to adjacent residential district to the south (see Planning Letter for discussion of SLU considerations)**
Non-Residential Open Storage *(Sec3.14.1.B.iv)*	Permitted as Special Land Use when conducted in conjunction with and accessory to otherwise permitted use in I-1	Not proposed	NA	
Height, bulk, density and area limitations *(Sec 3.1.18)*				
Frontage on a Public Street. *(Sec. 5.12)*	Frontage on a Public Street is required	Frontage on Twelve Mile Road	Yes	
Access to Major Thoroughfare *(Sec. 5.13)*	Vehicular access shall be provided only to an existing or planned major thoroughfare or freeway service drive *OR* access driveway on other street type is not across street from existing or planned single-family uses	Driveway onto Twelve Mile – Arterial/Major Thoroughfare	Yes	

Item	Required Code	Proposed	Meets Code	Comments
Minimum Zoning Lot Size for each Unit in Ac *(Sec 3.6.2.D)*	Except where otherwise provided in this Ordinance, the minimum lot area and width, and the maximum percent of lot coverage shall be determined on the basis of off-street parking, loading, greenbelt screening, yard setback or usable open space	20.04 acres gross; 8.18 acres net	Yes	*Is a lot split planned?*
Minimum Zoning Lot Size for each Unit: Width in Feet			NA	
Open Space Area	----	----	----	----
Maximum % of Lot Area Covered (By All Buildings)	*(Sec 3.6.2.D)*	23.7%	Yes	
Building Height *(Sec. 3.1.18.D)*	40 ft. (I-1 max height) 60 ft. (I-2 max height)	45 ft	**No**	**Max. Building height exceeded for I-1 district portion of building; This would require approval of a variance by ZBA**
Building Setbacks *(Sec 3.1.18.D) I-1 District/ I-2 District*				
Front (south)	40 ft. / 100 ft	118 ft.	Yes	
Rear (north)	20 ft. / 50 ft	210 ft.	Yes	
Side (east)	20 ft. / 50 ft	82.13 ft.	Yes	
Side (west)	20 ft. / 50 ft	91.5 ft.	Yes	
Parking Setback *(Sec 3.1.18.D)& Refer to applicable notes in Sec 3.6.2*				
Front (south)	40 ft. (See 3.6.2.E)	40 ft.	Yes	**The "20' setback" label on the east side of the site is not shown correctly; while the side yard parking setback is 10' for the I-1 District, it is 20' in the I-2 District so the parking spaces within the 20 foot setback north of the district line are not in compliance (variance required for approx. 17 spaces)**
Rear (north)	20 ft. / 50 ft.	> 200 ft.	Yes	
Side (east)	10 ft. /20 ft in I-2	12-17 ft.	**No**	
Side (west)	10 ft. /20 ft in I-2	20 ft.	Yes	
Note To District Standards *(Sec 3.6.2)*				
Exterior Side Yard Abutting a Street *(Sec 3.6.2.C)*	All exterior side yards abutting a street shall be provided with a setback equal to front yard.		NA	
Off-Street Parking in Front Yard *(Sec 3.6.2.E)*	Off-street parking is allowed in front yard if: - the site is a minimum 2 acre site, - does not extend into the minimum required front yard	Parking proposed in front yard -Meets (8+ acres) -Provided – 40 ft proposed	Yes	

Item	Required Code	Proposed	Meets Code	Comments
	setback of the district, - cannot occupy more than 50% of the area between min. front yard setback & bldg. setback, - must be screened by brick wall or landscaped berm 2.5 ft tall - lighting compatible with surrounding neighborhood	-15.70% per calculation provided -No berm or wall shown **-TBD**	**No**	**Front yard parking must be screened as required – see Landscape Review** Submit lighting plan with Final Site Plan
Off-Street Parking in Side and Rear Yards *(Sec 3.6.2.F)*	Off-street parking is allowed in side and rear yards if the site does not abut residential. If it does, additional conditions apply: i. shall not occupy more than 50% of side yard area abutting residential ii. parking setback no less than 100 ft from res district	Side yards not adjacent to residential	NA	
Setback from Residential District - Building *(Sec 3.6.2.H)*	I-1 and I-2 districts, five (5) feet of horizontal setback for each foot of building height, or one-hundred (100) feet, whichever is greater. (unless separated by a thoroughfare or RR ROW)	> 150 feet from residential district; (30' building x 5 ft = 150 feet min required)	Yes	
Wetland/ Watercourse Setback *(Sec 3.6.2.M)*	A setback of 25 ft. from wetlands and from high watermark course shall be maintained	Wetland impacts shown on updated plans	Yes	**See ECT letter for more detailed comments**
Additional Height *(Sec 3.6.2.O)*	Additional heights for selected buildings is allowed based on conditions listed in Sec 3.6.2.O	Does not apply as adj. to residential	NA	
Parking setback screening *(Sec 3.6.2.P)*	Required parking setback area shall be landscaped per Sec 5.5.3.		**No**	**See Landscaping comments**
Modification of parking setback requirements *(Sec 3.6.2.Q)*	The Planning Commission may modify parking setback requirements based on conditions listed in Sec 3.6.2.Q		NA	
Parking and Loading Requirements				

Item	Required Code	Proposed	Meets Code	Comments
Number of Parking Spaces Industrial or research Establishments & related offices *(Sec.5.2.12.E)*	One space for each 700 sf usable floor area OR 5 spaces plus 1 for each 1.5 employees on largest shift (whichever is greater) 98,650 sf proposed, 80% usable: 78,920/700 = 113 Required Parking: 113 Spaces	Total Parking Proposed = 198 spaces Spec building – employee count unknown	Yes	74% more spaces than required – **consider reducing or land banking excess parking to reduce impervious coverage**
Parking Space Dimensions and Maneuvering Lanes *(Sec. 5.3.2)*	- 90° Parking: 9 ft. x 19 ft. - 24 ft. two way drives - 9 ft. x 17 ft. parking spaces allowed along 7 ft. wide interior sidewalks as long as detail indicates a 4" curb at these locations and along landscaping	24 ft. drives min proposed 9 ft. x 17 ft. spaces proposed as well as 9 X19 ft spaces	Yes	
Parking stall located adjacent to a parking lot entrance(public or private) *(Sec. 5.3.13)*	Shall not be located closer than twenty-five (25) feet from the street right-of-way (ROW) line, street easement or sidewalk, whichever is closer	Minimum distance is maintained	Yes	
End Islands *(Sec. 5.3.12)*	- End Islands with landscaping and raised curbs are required at the end of all parking bays that abut traffic circulation aisles. - The end islands shall generally be at least 8 feet wide, have an outside radius of 15 feet, and be constructed 3' shorter than the adjacent parking stall as illustrated in the Zoning Ordinance	Some end islands abutting traffic circulation aisles may not be 3' shorter than adjacent parking stall	Yes	**NOTE: Interior parking islands can be the same length as the adjacent spaces, while end islands abutting traffic circulation aisles must be 3' shorter**
Barrier Free Spaces *Barrier Free Code*	For 198 spaces, 6 barrier free required	6 barrier free shown	Yes	
Barrier Free Space Dimensions *Barrier Free Code*	- 8' wide with an 8' wide access aisle for van accessible spaces - 8' wide with a 5' wide access aisle for regular accessible spaces	2 van accessible shown 4 regular BF shown	Yes	
Barrier Free Signs *Barrier Free Code*	One sign for each accessible parking space.	Shown	Yes	

Item	Required Code	Proposed	Meets Code	Comments
Minimum number of Bicycle Parking *(Sec. 5.16.1)*	5% of required auto spaces, min 2 spaces 113 required auto = 6 spaces	6 proposed	Yes	
Bicycle Parking General requirements *(Sec. 5.16)*	- Located along principal building entrance approach, clearly visible - No farther than 120 ft. from the entrance being served - When 4 or more spaces are required for a building with multiple entrances, the spaces shall be provided in multiple locations - Spaces to be paved and the bike rack shall be inverted "U" design min. of 36" tall - Shall be accessible via 6 ft. paved access from street	Two locations noted: near front entrance; one behind building Rack Design shown Both bike parking via 7' sidewalk, but 2' car overhang will leave 5'clear	Yes Yes Yes **No**	**Widen sidewalk to bike parking to 8' to leave 6' clear path when cars are present; 6 ft sidewalk from ROW required**
Bicycle Parking Lot layout *(Sec 5.16.6)*	Parking space width: 6 ft. One tier width: 10 ft. Two tier width: 16 ft. Maneuvering lane width: 4 ft. Parking space depth: 2 ft. single, 2 ½ ft. double	Layout shown	Yes	
Loading Spaces (*Sec. 5.4.3)*	Loading area in the rear yard, unless abutting residential or interior side yard if adjacent to I, EXPO or EXO district	Truck well in rear (north) yard	Yes	
Accessory Structures				
Dumpster *(Sec 4.19.2.F)*	- Located in rear yard - Attached to the building or no closer than 10 ft. from building if not attached - Not located in parking setback - If no setback, then it cannot be any closer than 10 ft, from property line. - Away from Barrier free Spaces	Dumpster enclosure in rear yard outside of parking setback, away from BF spaces	Yes	

Item	Required Code	Proposed	Meets Code	Comments
Dumpster Enclosure *(Sec. 21-145. (c)*	- Screened from public view - A wall or fence 1 ft. higher than height of refuse bin - And no less than 5 ft. on three sides - Posts or bumpers to protect the screening - Hard surface pad - Screening Materials: Masonry, wood or evergreen shrubbery	Details included in plans – Sheet C-9.0	Yes	**See façade review**
Roof top equipment and wall mounted utility equipment (*Sec. 4.19.2.E.ii)*	All roof top equipment must be screened and all wall mounted utility equipment must be enclosed and integrated into the design and color of the building	RTUs with screening shown	Yes	
Roof top appurtenances screening	Roof top appurtenances shall be screened in accordance with applicable facade regulations, and shall not be visible from any street, road or adjacent property.	RTUs with screening shown	Yes	
Transformer/ Generator	Provide location of any proposed transformers/ generators etc.	Transformer pad shown in rear yard	Yes	
I-1 District Required Conditions *(Sec 3.14)*				
Outdoor Storage of above ground storage tanks *(Sec. 3.14.1.B.ii)*	Outdoor placement of above-ground storage tanks of not more than 600 capacity per tank and accessory to an otherwise permitted use. Additional conditions apply.	Not Proposed	NA	
Outdoor Storage of recreational equipment *(Sec. 3.14.1.B.iii)*		Not Proposed	NA	
Other *(Sec 3.14.2)*	Unless otherwise provided, dealing directly with consumer at retail, is prohibited.	Noted sheet C-3.0	Yes	
Adjacent to Freeway ROW *(Sec 3.14.4)*	Where a permitted use abuts a freeway right-of way, special conditions listed in section 3.14.4 apply	Not adjacent to freeway ROW	NA	
Planning Commission findings for permitted uses *(Sec 3.14.3)*				

Item	Required Code	Proposed	Meets Code	Comments
Protecting current and future residential uses from adverse impact *Sec 3.14.3.A*	The scale, size, building design, façade materials, landscaping and activity of the use is such that current and future residential uses will be protected from adverse impacts.	No homes currently adjacent, however residential zoning to the south	Yes?	
Long term truck parking *Sec 3.14.3.B*	No long term delivery truck parking on site	Noted sheet C-3.0	Yes	
Performance standards *Sec 3.14.3.C*	The lighting, noise, vibration, odor and other possible impacts are in compliance with standards and intent of the article and performance standards of Section 5.14	Noted sheet C-3.0	Yes	
Storage and/use of material *Sec 3.14.3.D*	The storage and/or use of any volatile, flammable or other materials shall be fully identified in application and shall comply with any city ordinances regarding toxic or hazardous materials.	Note on plan	Yes	
Hazardous material checklist *Sec 3.14.3.E*	Compliance with City's hazardous materials checklist	Checklist provided	Yes	
Sidewalks and Pathways				
ARTICLE XI. OFF-ROAD NON-MOTORIZED FACILITIES *Sec. 11-256. Requirement. (c)* & Sub. Ord. Sec. 4.05,	- In the case of new streets and roadways to be constructed as part of the project, a sidewalk shall be provided on both sides of the proposed street or roadway. - Sidewalks along arterials and collectors shall be 6 feet or 8 feet wide as designated by the "Bicycle and Pedestrian Plan," but not along industrial service streets per Subdivision Ordinance. - Whereas sidewalks along local streets and private roadways shall be five (5) feet wide.	NA 6' Sidewalk shown along 12 Mile NA	Yes	
Pedestrian Connectivity	- Whether the traffic circulation features within the site and parking areas are designed to assure	Sidewalks proposed on S, W and E sides of building and from	Yes	**Widen sidewalk from ROW onto site to 6' and note dimension on the plan**

Item	Required Code	Proposed	Meets Code	Comments
	safety and convenience of both vehicular and pedestrian traffic both within the site and in relation to access streets - Building exits must be connected to sidewalk system or parking lot.	sidewalk in ROW into the site		
Lighting and Photometric Plan (Sec. 5.7)				
Intent *(Sec. 5.7.1)*	Establish appropriate minimum levels, prevent unnecessary glare, reduce spillover onto adjacent properties & reduce unnecessary transmission of light into the night sky	Provided	Yes	
Lighting Plan *(Sec. 5.7.A.i)*	Site plan showing location of all existing & proposed buildings, landscaping, streets, drives, parking areas & exterior lighting fixtures	Provided	Yes	
Building Lighting *(Sec. 5.7.2.A.iii)*	Relevant building elevation drawings showing all fixtures, the portions of the walls to be illuminated, illuminance levels of walls and the aiming points of any remote fixtures.	Not provided	**No**	**Provide illuminance levels of exterior walls as required**
Lighting Plan *(Sec.5.7.2.A.ii)*	Specifications for all proposed & existing lighting fixtures	Provided	Yes	
	Photometric data	Provided	Yes	
	Fixture height	20-25 ft	Yes	
	Mounting & design	Provided	Yes	
	Glare control devices *(Also see Sec. 5.7.3.D)*	Provided	Yes	
	Type & color rendition of lamps	Provided	Yes	
	Hours of operation	Not provided	**No**	**Provide lighting hours of operation**
Maximum Height *(Sec. 5.7.3.A)*	Height not to exceed maximum height of zoning district (40 ft.) (or 25 ft. where adjacent to residential districts or uses)	20-25 ft.	Yes	
Standard Notes *(Sec. 5.7.3.B)*	- Electrical service to light fixtures shall be placed underground - Flashing light shall not be permitted - Only necessary lighting for security purposes & limited operations shall be permitted after a site's hours	Provided	Yes	

Item	Required Code	Proposed	Meets Code	Comments
	of operation			
Security Lighting *(Sec. 5.7.3.H)* Lighting for security purposes shall be directed only onto the area to be secured.	- All fixtures shall be located, shielded, and aimed at the areas to be secured. - Fixtures mounted on the building and designed to illuminate the facade are preferred.	Not provided	**No?**	**Provide details of security lighting proposed**
Average Light Levels *(Sec.5.7.3.E)*	Average light level of the surface being lit to the lowest light of the surface being lit shall not exceed 4:1	3.8:1 shown	Yes	
Type of Lamps *(Sec. 5.7.3.F)*	Use of true color rendering lamps such as metal halide is preferred over high & low pressure sodium lamps	LED	Yes	
Min. Illumination *(Sec. 5.7.3.k)*	Parking areas: 0.2 min	1.0 fc	Yes	
	Loading/unloading areas: 0.4 min	3.1 fc	Yes	
	Walkways: 0.2 min	1.4 fc	Yes	
	Building entrances, frequent use: 1.0 min	5.5 fc	Yes	
	Building entrances, infrequent use: 0.2 min	2.9 fc	Yes	
Max. Illumination adjacent to Non-Residential *(Sec. 5.7.3.K)*	When site abuts a non-residential district, maximum illumination at the property line shall not exceed 1 foot candle	1.0 fc	Yes	
Cut off Angles *(Sec. 5.7.3.L)*	When adjacent to residential districts - All cut off angles of fixtures must be 90° - maximum illumination at the property line shall not exceed 0.5 foot candle	0.0 fc	Yes	
Other Requirements				
Design and Construction Standards Manual	Land description, Sidwell number (metes and bounds for acreage parcel, lot number(s), Liber, and page for subdivisions).	Provided	Yes	

Item	Required Code	Proposed	Meets Code	Comments
General layout and dimension of proposed physical improvements	Location of all existing and proposed buildings, proposed building heights, building layouts, (floor area in square feet), location of proposed parking and parking layout, streets and drives, and indicate square footage of pavement area (indicate public or private).	Provided	Yes	
Economic Impact Information	- Total cost of the proposed building & site improvements - Number of anticipated jobs created (during construction & after building is occupied, if known).		**No**	**Provide requested information for Planning Commission's consideration**
Development and Street Names	Development and street names must be approved by the Street Naming Committee before Preliminary Site Plan approval	Name approval for Industrial Park required	**No**	Contact Madeleine Kopko at 248-347-0475 to schedule a meeting with the Committee
Development/ Business Sign	Signage if proposed requires a permit. Can be considered during site plan review process or independently.	None shown	NA	For sign permit information contact Maureen Underhill 248-735-5602.

NOTES:

1. This table is a working summary chart and not intended to substitute for any Ordinance or City of Novi requirements or standards.
2. The section of the applicable ordinance or standard is indicated in parenthesis. Please refer to those sections in Article 3, 4, and 5 of the zoning ordinance for further details.
3. Please include a written response to any points requiring clarification or for any corresponding site plan modifications to the City of Novi Planning Department with future submittals.

ENGINEERING REVIEW

PLAN REVIEW CENTER REPORT

June 5, 2020

Engineering Review

Great Oaks Industrial Park 1
JSP19-0035

Applicant
Hillside Investments

Review Type
Revised Preliminary Site Plan

Property Characteristics

- Site Location: North of Twelve Mile Road, West of West Park Drive
- Site Size: 20.04 acres
- Plan Date: 01/31/2020
- Design Engineer: PEA, Inc.

Project Summary

- Construction of an approximately 98,650 square-foot industrial office building and associated parking. Site access would be provided via Twelve Mile Road.
- Water service would be provided by a 16-inch extension from the existing 24-inch water main along the west side of West Park Drive. Seven (7) hydrants are also proposed. No water service or fire protection leads are shown at this time.
- Sanitary sewer service would be provided by a 6-inch lead to the subject property from a 10-inch sewer main extension along the south side of Twelve Mile Road from the existing 10-inch sanitary sewer stub across from West Park Drive.
- Storm water would be collected by a single storm sewer collection system and discharged to an on-site detention basin.

Recommendation

Approval of the Preliminary Site Plan and Preliminary Storm Water Management Plan is recommended, with comments to be addressed at the time of Final Site Plan submittal.

Comments:
The Preliminary Site Plan does meet the general requirements of Chapter 11 of the Code of Ordinances, the Storm Water Management Ordinance and the Engineering Design Manual. The following should be addressed prior to submittal of the Final Site Plan:

General

1. The City benchmark shall be corrected from 666.29 to 966.29. Additionally, the 0.15' conversion is unnecessary, since the site datum appears to be NAVD88, which is the City's benchmark datum as well. Make this correction on all applicable sheets.
2. Provide a minimum of **two** ties to established section or quarter section corners.
3. All work within the right-of-way will require a permit from RCOC and the City of Novi.
4. Provide a traffic control plan for the proposed road work activity.
5. Provide a construction materials table on the Utility Plan listing the quantity and material type for each utility (water, sanitary and storm) being proposed.
6. Provide a utility crossing table indicating that at least 18-inch vertical clearance will be provided, or that additional bedding measures will be utilized at points of conflict where adequate clearance cannot be maintained.
7. Provide a note stating if dewatering is anticipated or encountered during construction a dewatering plan must be submitted to the Engineering Division for review.
8. Generally, all proposed trees shall remain outside utility easements. Where proposed trees are required within a utility easement, the trees shall maintain a minimum 5-foot horizontal separation distance from any existing or proposed utility.
9. Show the locations of all light poles on the utility plan and indicate the typical foundation depth for the pole to verify that no conflicts with utilities will occur. Light poles in a utility easement will require a License Agreement.

Water Main

10. Show the domestic water service and fire lead to the building on the utility plan.
11. A tapping sleeve, valve and well is required at the connection to the existing water main.
12. Provide a profile for all proposed water main 8-inch and larger.
13. All water main, on-site and off-site, should be located within a 20-foot wide water main easement or public right-of-way. Any off-site legal documents must be approved by the City prior to approval of the Stamping Set.
14. Three (3) sealed sets of revised utility plans along with the MDEGLE permit application (06/12 rev.) for water main construction and the Streamlined

Water Main Permit Checklist should be submitted to the Engineering Division for review when no further design changes are anticipated. An electronic plan can be sent to Kate Richardson at krichardson@cityofnovi.org for review prior to printing hard copies. Utility plan sets shall include only the cover sheet, any applicable utility sheets and the standard detail sheets.

Sanitary Sewer

15. Provide a sanitary sewer basis of design for the development on the utility plan sheet.
16. Extend the sanitary sewer on the south side of Twelve Mile to the western boundary of the site's property line.
17. Illustrate all pipes intersecting with manholes on the sanitary profiles.
18. All sanitary sewer main, on-site and off-site, should be located within a 20-foot wide water main easement or public right-of-way. Any off-site legal documents must be approved by the City prior to approval of the Stamping Set.
19. Three (3) sealed sets of revised utility plans along with the MDEGLE permit application (01/18 rev.) for sanitary sewer construction and the Streamlined Sanitary Sewer Permit Certification Checklist should be submitted to the Engineering Division for review, assuming no further design changes are anticipated. Utility plan sets shall include only the cover sheet, any applicable utility sheets and the standard detail sheets.

Storm Sewer

20. Provide a four-foot deep sump in the last storm structure prior to discharge to the storm water basin.
21. Illustrate all pipes intersecting storm structures on the storm profiles.
22. Provide a schedule listing the casting type and other relevant information for each proposed storm structure on the utility plan. Round castings shall be provided on all catch basins except curb inlet structures.
23. Label all roof conductors and provide material and sizing information.

Storm Water Management Plan

24. The Storm Water Management Plan for this development shall be designed in accordance with the Storm Water Ordinance and Chapter 5 of the new Engineering Design Manual.
25. Consider revising the detention basin grades to eliminate the need for riprap on the north side of the proposed road. When this road is extended the riprap will be removed and the pond may need to be regraded.
26. A 4-foot wide safety shelf is required one-foot below the permanent water surface elevation within the basin.
27. Show the drainage pattern that the basin outlet flow follows. If the volume and/or rate of discharge increases to any off-site property then an off-site drainage easement will be required.

28. Provide a 5-foot wide stone bridge/access route allowing direct access to the standpipe from the bank of the basin during high-water conditions (i.e. stone 6-inches above high water elevation). Provide a detail and/or note as necessary.
29. Provide a soil boring in the vicinity of the storm water basin to determine soil conditions and to establish the high water elevation of the groundwater table.
30. Provide supporting calculations for the runoff coefficient determination.

Paving & Grading

31. The widening of Twelve Mile Road is in the planning stage and any additional impacts to the site plan design will be communicated with the applicant. No revisions are anticipated at this time.
    a. Depending on the final road design, the amount of right-of-way required may decrease from the currently proposed 90-foot half-width right-of-way and vary in width across the property's frontage.
2. Site grading shall be limited to 1V:4H (25-percent), excluding landscaping berms. Numerous areas appear to exceed this standard.
32. The minimum emergency access easement width shall be 25 feet. Dimension this information on the plans.
33. Provide a detail of the permanent "break-away" gate that is in accordance with Figure VIII-K in Section 11-194 of the Code of Ordinance.
34. Provide the dimension of the internal sidewalk that connects to the Twelve Mile Road sidewalk.
35. The internal sidewalks that connect bicycle parking to adjacent facilities should have a minimum 6-foot wide clear path. The 2-foot vehicle overhang cannot encroach into this space. At a minimum, the western and southern sidewalks around the building should be widened to 8 feet wide.
36. Provide a minimum of 6 spot elevations where the sidewalk crosses the emergency access drive (one at each corner and two in the center of the driveway on each side of the pathway). Spot elevations shall be provided to demonstrate a level landing adjacent to each side of the pathway crossing.
37. Provide a note on the plan stating that the emergency access gate is to be installed and closed prior to the issuance of Temporary Certificate of Occupancy.
38. The barrier-free ramps shall comply with current MDOT specifications for ADA Sidewalk Ramps. Provide the latest version of the MDOT standard detail for detectable surfaces.
    a. Label specific ramp locations on the plans where the detectable warning surface is to be installed.
    b. Specify the product proposed and provide a detail for the detectable warning surface for barrier free ramps. The product shall be the concrete-embedded detectable warning plates, or equal, and shall be approved by the Engineering Division. Stamped concrete will not be acceptable.

39. All off-site grading will require a temporary construction easement from the neighboring property owners and the easement should be approved by the City before the Stamping Set is approved.
40. The end islands shall conform to the City standard island design, or variations of the standard design, while still conforming to the standards as outlined in Section 2506 of Appendix A of the Zoning ordinance (i.e. 2' minor radius, 15' major radius, minimum 8' wide, 3' shorter than adjacent 19' stall).
41. Provide the standard MDOT detail 'M' approach at the Twelve Mile Road driveway.
42. Either remove the paving details on sheet C-9.0 or update them to match the City's Standard Paving Details.

Soil Erosion and Sediment Control

43. SESC permit is required. A full review has not been completed at this time. The review checklist detailing all SESC requirements is attached to this letter. Please address the comments below and submit a SESC permit application under separate cover. The application can be found on the City's website at http://cityofnovi.org/Reference/Forms-and-Permits.aspx.

Off-Site Easements

44. All off-site utility easements anticipated must be executed **prior to final approval of the plans**. At the time of Final Site Plan submittal, drafts of the easements and a recent title search should be submitted to the Community Development Department as soon as possible for review, and shall be approved by the Engineering Division and the City Attorney prior to executing the easements.
45. Approval from the neighboring property owners for the work associated with the off-site water main and sanitary sewer shall be forwarded to the Engineering Division **prior to Final Site Plan approval**.

The following must be submitted with the Final Site Plan:

46. A letter from either the applicant or the applicant's engineer must be submitted with the Final Site Plan highlighting the changes made to the plans addressing each of the comments listed above and indicating the revised sheets involved. **Additionally, a statement must be provided stating that all changes to the plan have been discussed in the applicant's response letter.**
47. An itemized construction cost estimate must be submitted to the Community Development Department for the determination of plan review and construction inspection fees. This estimate should only include the civil site work and not any costs associated with construction of the building or any demolition work. ***The estimate must be itemized*** for each utility (water, sanitary, storm sewer), on-site paving (square yardage), right-of-way paving (including proposed right-of-way), grading, and the storm water basin (basin construction, control structure, pre-treatment structure and restoration).

The following must be submitted at the time of Stamping Set submittal:

48. A draft copy of the Storm Drainage Facility Maintenance Easement Agreement (SDFMEA), as outlined in the Storm Water Management Ordinance, must be submitted to the Community Development Department. Once the agreement is approved by the City's Legal Counsel, this agreement will then be sent to City Council for approval/acceptance. The SDFMEA will then be recorded at the office of the Oakland County Register of Deeds. This document is available on our website.

49. A draft copy of the 20-foot wide easement for the water main to be constructed on the site must be submitted to the Community Development Department.

50. A draft copy of the 20-foot wide easement for the sanitary sewer to be constructed on the site must be submitted to the Community Development Department.

51. A draft copy of the 25-foot wide emergency access easement site must be submitted to the Community Development Department.

52. A draft copy of the warranty deed for the additional proposed right-of-way along Twelve Mile Road must be submitted for review and acceptance by the City.

53. Executed copies of any required off-site legal documents must be submitted to the Community Development Department.

    a. This includes the additional right-of-way, sanitary sewer easements, water main easement or drainage easements necessary to complete the site work.

The following must be addressed prior to construction:

54. A pre-construction meeting shall be required prior to the commencement of any site work. Please contact Sarah Marchioni in the Community Development Department to setup a meeting (248-347-0430).

55. A City of Novi Grading Permit will be required prior to any grading on the site. This permit will be issued at the pre-construction meeting (no application fee).

56. An NPDES permit must be obtained from the MDEGLE since the site is over 5 acres in size. The MDEGLE requires an approved plan to be submitted with the Notice of Coverage.

57. A Soil Erosion Control Permit must be obtained from the City of Novi. Contact Sarah Marchioni in the Community Development Department (248-347-0430) for forms and information.

58. A permit for work within the right-of-way of Twelve Mile Road must be obtained from the City of Novi. The application is available from the City Engineering Division and should be filed at the time of Final Site Plan

submittal. Please contact the Engineering Division at 248-347-0454 for further information.

59. A permit for work within the right-of-way of Twelve Mile Road must be obtained from the Road Commission for Oakland County (RCOC). Please contact the RCOC (248-858-4835) directly with any questions. The applicant must forward a copy of this permit to the City. Provide a note on the plans indicating that all work within the road right-of-way will be constructed in accordance with RCOC standards.

60. A permit for water main construction must be obtained from the MDEGLE. This permit application must be submitted through the Engineering Division at the City of Novi.

61. A permit for sanitary sewer construction must be obtained from the MDEGLE. This permit application must be submitted through the Engineering Division at the City of Novi.

62. Construction Inspection Fees will be determined once the construction cost estimate is submitted and must be paid prior to the pre-construction meeting.

63. A storm water performance guarantee, equal to 1.2 times the amount required to complete storm water management and facilities (as specified in the Storm Water Management Ordinance) must be posted with Community Development.

64. A street sign financial guarantee in an amount to be determined ($400 per traffic control sign proposed) must be posted with Community Development.

To the extent this review letter addresses items and requirements that require the approval of/or a permit from an agency or entity other than the City, this review shall not be considered an indication or statement that such approvals or permits will be issued.

Please contact Kate Richardson at (248) 347-0586 with any questions.

Kate R.

Kate Richardson, EIT
Plan Review Engineer

cc: Lindsay Bell, Community Development
Ben Croy, PE; Engineering
Victor Boron, Engineering

LANDSCAPE REVIEW

PLAN REVIEW CENTER REPORT

May 13, 2020

Revised Preliminary Site Plan - Landscaping

Great Oaks Industrial Building

Review Type
Revised Preliminary Landscape Review

Job #
JSP19-0035

Property Characteristics

- Site Location: 46844 West Twelve Mile Road
- Site Acreage: 8.18 ac.
- Site Zoning: I-1/I-2: Proposed I-1
- Adjacent Zoning: North: I-2; East, West: I-1, I-2; South: OST, R-A
- Plan Date: 8/19/2019

Ordinance Considerations

This project was reviewed for conformance with Chapter 37: Woodland Protection, Zoning Article 5.5 Landscape Standards, the Landscape Design Manual and any other applicable provisions of the Zoning Ordinance. Items in **bold** below must be addressed and incorporated as part of the Final Site Plan submittal (except the item related to the Landscape Waiver). Please follow guidelines of the Zoning Ordinance and Landscape Design Guidelines. This review is a summary and is not intended to substitute for any Ordinance.

Recommendation

This project is **recommended for approval for Preliminary Site Plan,** provided the landscape waiver is granted or the layout is modified to remove the need for it. The other revisions noted can be addressed on the Final Site Plans.

LANDSCAPE WAIVERS REQUIRED BY PROPOSED LAYOUT:

- Landscape waiver for 16 consecutive parking spaces without a landscape island with a tree, in the southern most bay. *Not supported by staff.*
- Lack of the required greenbelt berm. *Not supported by staff.*
- Lack of access drive perimeter trees along the west side of the new drive. *Not supported by staff.*

Please revise the layout, grading and/or landscape plan to remove these waiver requests or list them on Sheet L-1.0.

Ordinance Considerations

Existing and proposed overhead and underground utilities, including hydrants. (LDM 2.e.(4))

1. Provided
2. Please be sure that trees are properly distanced from the overhead wires if they are to remain, or use sub-canopy trees if necessary.

Existing Trees (Sec 37 Woodland Protection, Preliminary Site Plan checklist #17 and LDM 2.3 (2))

1. Provided
2. Woodland replacement calculations and trees are also provided.

Adjacent to Residential - Buffer (Zoning Sec. 5.5.3.B.ii and iii)

The project is not adjacent to residentially-zoned property

Adjacent to Public Rights-of-Way – Berm/Wall, Buffer and Street Trees (Zoning Sec. 5.5.3.B.ii, iii)

1. Most of the required trees are provided. 4 additional trees are required (1 canopy and 3 subcanopy trees) and should be provided on Final Site Plans.
2. **Please add the required 3 foot minimum height undulating berm along the Twelve Mile Road greenbelt.**
3. The street trees may need to be changed to subcanopy trees due to overhead wires at a rate of 1.5 subcanopy trees per canopy tree required. See the landscape chart for more details.

Parking Lot Landscaping (Zoning Sec. 5.5.3.C.)

1. All required parking lot interior and perimeter trees are provided.
2. **The access drive along the west side needs to have deciduous canopy trees provided along its west side at a rate of 1/35 lf. Since the drive and parking lot are within 22 feet of each other, the parking lot perimeter trees along the drive can also count toward the requirement for that side of the road.**

Building foundation Landscaping (Zoning Sec 5.5.3.D)

1. Based on the building perimeter, 7512sf of landscape area is required and 7830sf will be provided.
2. Please provide detailed foundation planting plans with Final Site Plans.

Plant List (LDM 2.h. and t.), Section 37-8

1. Provided
2. 11 of 14 species used (*79%*) are native to Michigan.
3. The proposed tree diversity meets the standards of the Landscape Design Manual Section 4.
4. Please use bur oak or some other native species on the Woodland Replacement Chart in the Woodlands Protection ordinance as a substitute for River Birch, which is not on the chart.

Planting Notations and Details (LDM)

Provided

Storm Basin Landscape (Zoning Sec 5.5.3.E.iv and LDM 3)

1. Please identify all areas of the site with *Phragmites australis*.
2. If there is any on the site, please provide plans for its complete removal per the MDEGLE.
3. If there isn't any please note that on the plans.

Irrigation (LDM 1.a.(1)(e) and 2.s)

1. The proposed landscaping must be provided with sufficient water to become established and survive over the long term.
2. Please provide an irrigation plan or note how this will be accomplished if an irrigation plan is not provided on Final Site Plans. An actual irrigation plan could be provided in the electronic stamping set if desired.

If the applicant has any questions concerning the above review or the process in general, do not hesitate to contact me at 248.735.5621 or rmeader@cityofnovi.org.

Rick Meader – Landscape Architect

LANDSCAPE REVIEW SUMMARY CHART – PRELIMINARY SITE PLAN REVIEW

Review Date: May 13, 2020
Project Name: JSP19 – 0035: Great Oaks Building
Plan Date: January 31, 2020
Prepared by: Rick Meader, Landscape Architect E-mail: rmeader@cityofnovi.org; Phone: (248) 735-5621

Items in **Bold** need to be addressed by the applicant before approval of the Preliminary Site Plan. Underlined items need to be addressed for Final Site Plan.

LANDSCAPE WAIVERS REQUIRED BY PROPOSED LAYOUT:

- Landscape waiver for 16 consecutive parking spaces without a landscaped island in the southern most bay. *Not supported by staff.*
- Lack of the required greenbelt berm. *Not supported by staff.*
- Lack of access drive perimeter trees along the west side of the new drive. *Not supported by staff.*

Please revise the layout, grading and/or landscape plans to remove these waiver requests or list them on Sheet L-1.0.

Item	Required	Proposed	Meets Code	Comments
Landscape Plan Requirements (LDM (2)				
Landscape Plan *(Zoning Sec 5.5.2, LDM 2.e.)*	▪ New commercial or residential developments ▪ Addition to existing building greater than 25% increase in overall footage or 400 SF whichever is less. ▪ 1"=20' minimum with proper North. Variations from this scale can be approved by LA ▪ Consistent with plans throughout set	Scale 1"=40'	Yes	Please use a smaller scale (1"=20' or 1"=30') for the detailed foundation planting designs when they are provided.
Project Information *(LDM 2.d.)*	Name and Address	Location map	Yes	
Owner/Developer Contact Information *(LDM 2.a.)*	Name, address and telephone number of the owner and developer or association	Yes	Yes	
Landscape Architect contact information *(LDM 2.b.)*	Name, Address and telephone number of RLA/PLA/LLA who created the plan	Firm name, LA seal	Yes	
Sealed by LA. *(LDM 2.g.)*	Requires original signature	Seal provided	Yes	Live signature required on stamping sets

Item	Required	Proposed	Meets Code	Comments
Miss Dig Note (800) 482-7171 *(LDM.3.a.(8))*	Show on all plan sheets	Yes	Yes	
Zoning *(LDM 2.f.)*	Include all adjacent zoning	Parcel: I-1/I-2 Proposed: I-1 North: I-2 East, West: I-1, I-2 South: 12 Mile Rd, OST, RA	Yes	
Survey information *(LDM 2.c.)*	▪ Legal description or boundary line survey ▪ Existing topography	Sheets C-1.0-C-1.2	Yes	
Existing plant material Existing woodlands or wetlands *(LDM 2.e.(2))*	▪ Show location type and size. Label to be saved or removed. ▪ Plan shall state if none exists.	▪ Tree survey, removals, calculations are provided. ▪ Sheets T-1.0-T-1.2	Yes	
Soil types *(LDM.2.r.)*	▪ As determined by Soils survey of Oakland county ▪ Show types, boundaries	▪ Types are listed on Sheet C-3.0 and L-1. ▪ No boundaries are provided.	No	Please show soil boundaries on C-1.0 or L-1.0
Existing and proposed improvements *(LDM 2.e.(4))*	Existing and proposed buildings, easements, parking spaces, vehicular use areas, and R.O.W	Yes	Yes	
Existing and proposed utilities *(LDM 2.e.(4))*	▪ Overhead and underground utilities, including hydrants ▪ Light posts	▪ Existing and proposed utilities shown on Landscape Plan. ▪ No light posts are shown.	▪ Yes ▪ No	Please add all proposed light posts to plan and resolve any tree/pole conflicts.
Proposed grading. 2' contour minimum *(LDM 2.e.(1))*	Provide proposed contours at 2' interval	▪ Proposed contours and spot elevations on Sheet C-4 ▪ No greenbelt berm is proposed.	▪ Yes ▪ No	**1. Please add the required greenbelt berm.** 2. No berm is required along new access drive on west **– lower it to improve growing conditions for perimeter trees planted there.**
Snow deposit *(LDM.2.q.)*	Show snow deposit areas on plan	Yes	Yes	
LANDSCAPING REQUIREMENTS				
Parking Area Landscape Requirements LDM 1.c. & Calculations (LDM 2.o.)				
General requirements *(LDM 1.c)*	▪ Clear sight distance within parking islands ▪ No evergreen trees	Yes	Yes	

Item	Required	Proposed	Meets Code	Comments
Name, type and number of ground cover (LDM 1.c.(5))	As proposed on planting islands	Seed is indicated on islands.	Yes	
General *(Zoning Sec 5.5.3.C.ii)*				
Parking lot Islands *(a, b. i)*	▪ A minimum of 200 SF to qualify ▪ A minimum of 200sf unpaved area per tree planted in an island ▪ 6" curbs ▪ Islands minimum width 10' BOC to BOC	Islands are sufficiently large.	Yes	
Curbs and Parking stall reduction *(c)*	Parking stall can be reduced to 17' and the curb to 4" adjacent to a sidewalk of minimum 7 ft.	Spaces along outer edge are 17 ft with 4" curbs	Yes	
Contiguous space limit *(i)*	Maximum of 15 contiguous spaces	▪ 15 is maximum bay length ▪ Interior island on southernmost bay with walk does not have sufficient green space or a tree but bays on either side of it total 16 spaces.	▪ Yes ▪ No	**Either shorten one of the bays on either side of the path in the southernmost parking bay so there is just a total of 15 spaces on either side of the pathway, or add area and a tree to the island with the pathway to bring that area into compliance and avoid needing a landscape waiver.**
Plantings around Fire Hydrant *(d)*	No plantings with matured height greater than 12' within 10 ft. of fire hydrants	No trees are located closer than 10' from hydrants or other utility structures.	Yes	Please adjust the hydrant island on the west side of the west parking lot to allow a tree to be located inside that island, not at the perimeter.
Landscaped area *(g)*	Areas not dedicated to parking use or driveways exceeding 100 sq. ft. shall be landscaped	Yes	Yes	
Clear Zones (LDM 2.3.(5))	25 ft corner clearance required. Refer to Zoning Section 5.5.9	City of Novi clear vision zone is provided at 12 Mile Road entry.	No	**1.** Please indicate clear vision zone per RCOC regulations for 12 Mile Road entry. (Their rules are shown at the end of this chart). **2.** If RCOC does not

Item	Required	Proposed	Meets Code	Comments
				allow some or all of the Haggerty Road street trees, the disallowed trees do not need to be planted, but documentation of that ruling must be provided.
Category 1: For OS-1, OS-2, OSC, OST, B-1, B-2, B-3, NCC, EXPO, FS, TC, TC-1, RC, Special Land Use or non-residential use in any R district *(Zoning Sec 5.5.3.C.iii)*				
A = Total square footage of vehicular use areas up to 50,000sf x 7.5%	• A = x sf * 7.5 % = A sf • 50,000 * 7.5% = 3750 sf	NA	Yes	
B = Total square footage of additional paved vehicular use areas (not including A or B) over 50,000 SF) x 1 %	• B = x sf * 1% = B sf • (xxx – 50000) * 1% = xx sf	NA		
Category 2: For: I-1 and I-2 (Zoning Sec 5.5.3.C.iii)				
A. = Total square footage of vehicular use area up to 50,000 sf x 5%	A = x sf * 5% = A sf A = 50000 * 5% = 2500 sf			
B = Total square footage of additional paved vehicular use areas over 50,000 SF x 0.5%	B = x sf * 0.5% = B SF B = 29,758 * 0.5% = 149 sf			
All Categories				
C = A+B Total square footage of landscaped islands	2500 + 149 = 2649 SF	6134 sf	Yes	
D = C/200 Number of canopy trees required	▪ xx/200 = xx trees ▪ 2648/200 = 13 trees	13 trees	Yes	Please move the parking lot tree at the southeast corner of the building 10 feet or so to the west to widen the angle of view to the building address.
Parking Lot Perimeter Trees	▪ 1 Canopy tree per 35 lf ▪ 1929lf/35 = 55 trees	47 trees plus 8 double-counted canopy trees in greenbelt	No	
Access way perimeter	▪ 1 canopy tree per 35 lf on each side of road, less widths of access drives.	• 2 trees for east entry from Twelve Mile Road • No trees provided	• Yes • No	1. Please add calculations and deciduous canopy trees along the west

Item	Required	Proposed	Meets Code	Comments
	East entry drive ▪ 82lf/35 = 2 trees Access Drive: • 605/35 = 17 trees (only required along west side as the east side's requirement is met by the parking lot perimeter trees.	for west side of access drive		side of the access drive at 1 tree per 35 lf. 2. Due to the 22 feet separation between the parking lot and access drive, the parking lot perimeter trees can also count toward the trees required for the east side of the drive. 3. **A landscape waiver would be required to not provide the trees along the west side.** *It would not be supported by staff.*
Parking land banked	NA	No		As there is such a large excess number of parking spaces provided versus required, please consider land-banking some spaces.
Berms, Walls and ROW Planting Requirements				
Berms				
▪ All berms shall have a maximum slope of 33%. Gradual slopes are encouraged. Show 1ft. contours ▪ Berm should be located on lot line except in conflict with utilities. ▪ Berms should be constructed with 6" of top soil.				
Residential Adjacent to Non-residential (Sec 5.5.3.A) & (LDM 1.a)				
Berm requirements *(Zoning Sec 5.5.A)*	No berm is required as it does not abut residential	None	Yes	
Planting requirements *(LDM 1.a.)*	LDM Novi Street Tree List	NA		
Adjacent to Public Rights-of-Way (Sec 5.5.B) and (LDM 1.b)				
Berm requirements *(Zoning Sec 5.5.3.A.(5))*	An undulating berm a minimum of 3 feet high with a 3 foot wide crest is required in the 12 Mile Road greenbelt	None	No	**Please provide the required berm. A landscape waiver would be required to not provide it.** *That request would not be supported by staff.*
Cross-Section of Berms (LDM 2.j)				
Slope, height and width	▪ Label contour lines ▪ Maximum 33% ▪ Min. 3 feet flat horizontal area	No		Please provide berm cross section.

Item	Required	Proposed	Meets Code	Comments
	▪ Minimum 3 feet high ▪ Constructed of loam with 6' top layer of topsoil.			
Type of Ground Cover		NA		
Setbacks from Utilities	Overhead utility lines and 15 ft. setback from edge of utility or 20 ft. setback from closest pole	Overhead lines are indicated along 12 Mile Road		If the overhead lines are to remain as shown, please move the trees away from them and/or use sub-canopy trees.
Walls (LDM 2.k & Zoning Sec 5.5.3.vi)				
Material, height and type of construction footing	Freestanding walls should have brick or stone exterior with masonry or concrete interior	No walls are proposed		
Walls greater than 3 ½ ft. should be designed and sealed by an Engineer		NA		
ROW Landscape Screening Requirements*(Sec 5.5.3.B. ii)*				
Greenbelt width (2)(3) (5)	Parking: 20 ft. No Pkg: 25 ft	40 ft between parking and future 90' ROW	Yes	
Min. berm crest width	12 Mile Road: 3 ft Interior Drive: None req.	12 Mile Road: None Interior Drive: 1 ft	No	**Please provide the required undulating berm facing 12 Mile Road within the greenbelt.**
Min. berm height (9)	12 Mile Road: 3 ft Interior Drive: None req.	12 Mile Road: None Interior Drive: 3 ft	No	**See above**
3' wall	(4)(7)	No		
Canopy deciduous or large evergreen trees Notes (1) (10)	12 Mile Road: ▪ Adj to Parking: 1 tree per 40 lf ▪ (405-20)/40 = 10 trees West of access drive: • 1 tree per 60 ft • 60/60 = 1 tree Interior Drive: None req.	10 deciduous canopy trees between the drives	Yes	1. Please revise the calculation. 2. Please add calculations and the required tree for the west side of the new access road.
Sub-canopy deciduous trees Notes (2)(10)	12 Mile Road: ▪ Adj to Parking: 1 tree per 35 lf ▪ (405-20)/35 = 11 trees West of access drive:	10 subcanopy trees between the drives	No	1. Please revise the calculations 2. Please add calculations and the required tree for the west side of the new

Item	Required	Proposed	Meets Code	Comments
	• 1 tree per 40 ft • 60/40 = 2 trees Interior Drive: None req.			access road.
Canopy deciduous trees in area between sidewalk and curb *(Novi Street Tree List)*	12 Mile Road: ▪ Parking & No Parking: 1 tree per 45 lf ▪ (495-28-20)/45 = 10 trees Interior Drive: None req. (but access way perimeter trees are required – see below)	7 canopy trees	TBD	1. Please deduct the width of the RCOC clear vision from frontage for basis of calculation. 2. It would be helpful to include the proposed plans for widening 12 Mile on the plans, including utility lines if they are available to be sure where the street trees can be located. As it is, it looks like the trees are just 5 feet away from an overhead utility line. 3. Subcanopy trees may need to be provided at a rate of 1.5 subcanopy trees per required canopy tree if the trees will be within 15 feet of overhead lines.
Non-Residential Zoning Sec 5.5.3.E.iii & LDM 1.d (2) Refer to Planting in ROW, building foundation landscape, parking lot landscaping and LDM				
Screening of outdoor storage, loading/unloading *(Zoning Sec. 3.14, 3.15, 4.55, 4.56, 5.5)*		Loading zone to be screened by building and foundation landscaping	TBD	Please use upright evergreens in foundation area adjacent to loading docks when foundation plantings are proposed.
Transformers/Utility boxes *(LDM 1.e from 1 through 5)*	▪ A minimum of 2ft. separation between box and the plants ▪ Ground cover below 4" is allowed up to pad. ▪ No plant materials within 8 ft. from the doors	It appears that there may be a transformer at the north end of the building that is properly screened	TBD	When transformer locations are finalized, screening shrubs per standard detail are required.
Building Foundation Landscape Requirements (Sec 5.5.3.D)				
Interior site landscaping SF	▪ Equals to entire perimeter of the	7830 SF	TBD	**1.** Shaded areas indicate that

Item	Required	Proposed	Meets Code	Comments
	building, less with of man doors and vehicular doors, x 8 with a minimum width of 4 ft. ▪ A= 939 lf x 8ft = 7512 SF			sufficient area is provided. **2.** Please provide detailed planting plans for foundation planting with final site plans. **3.** Foundation plantings are to be included in cost estimate.
Zoning Sec 5.5.3.D.ii. All items from (b) to (e)	If visible from public street a minimum of 60% of the exterior building perimeter should be covered in green space	It appears that 95% of the building frontages facing 12 Mile Road will be landscaped.	Yes	
Detention/Retention Basin Requirements (Sec. 5.5.3.E.iv)				
Planting requirements *(Sec. 5.5.3.E.iv)*	▪ Clusters of large native shrubs shall cover 70-75% of the basin rim area ▪ 10" to 14" tall grass along sides of basin ▪ Refer to wetland for basin mix	The proposed shrubs provide the required coverage.	Yes	Please cluster shrubs along the high water line.
Phragmites Control (Sec 5.5.6.C)	▪ Any and all populations of Phragmites australis on site shall be included on tree survey. ▪ Treat populations per MDEQ guidelines and requirements to eradicate the weed from the site.	None indicated	TBD	1. Please survey the site for any populations of Phragmites australis and submit plans for its removal. 2. If none is found, please indicate that on the survey.
LANDSCAPING NOTES, DETAILS AND GENERAL REQUIREMENTS				
Landscape Notes – Utilize City of Novi Standard Notes				
Installation date *(LDM 2.l. & Zoning Sec 5.5.5.B)*	Provide intended date	Between Mar 15 and Nov 15.	Yes	
Maintenance & Statement of intent *(LDM 2.m & Zoning Sec 5.5.6)*	▪ Include statement of intent to install and guarantee all materials for 2 years. ▪ Include a minimum one cultivation in June, July and August for the 2-year warranty period.	Yes	Yes	
Plant source *(LDM 2.n & LDM*	Shall be northern nursery grown, No.1 grade.	Yes	Yes	

Item	Required	Proposed	Meets Code	Comments
3.a.(2))				
Irrigation plan *(LDM 2.s.)*	A fully automatic irrigation system or a method of providing sufficient water for plant establishment and survival is required on Final Site Plans.	No		**1.** Please add irrigation plan or information as to how plants will be watered sufficiently for establishment and long- term survival. **2.** If xeriscaping is used, please provide information about plantings included.
Other information *(LDM 2.u)*	Required by Planning Commission	NA		
Establishment period *(Zoning Sec 5.5.6.B)*	**2 yr. Guarantee**	Yes	Yes	
Approval of substitutions. *(Zoning Sec 5.5.5.E)*	City must approve any substitutions in writing prior to installation.	Yes	Yes	
Plant List (LDM 2.h., 4) – Include all cost estimates				
Quantities and sizes	Refer to LDM suggested plant list	Yes	Yes	
Root type		Yes	Yes	
Botanical and common names		▪ 11 of 14 (79%) of species used are native to MI ▪ Tree diversity is satisfactory per LDM Sect 4.	Yes	1. When foundation plantings are added, please keep the mix of native species used to at least 50%. **2.** Please substitute a native species such as bur oak for the River Birch woodland replacement trees, which is not on the woodland replacement chart.
Type and amount of lawn		Seed	Yes	
Cost estimate *(LDM 2.t)*	For all new plantings, mulch and sod as listed on the plan	Yes	Yes	
Planting Details/Info (LDM 2.i) – Utilize City of Novi Standard Details				
Canopy Deciduous Tree	Refer to LDM for detail drawings	Yes	Yes	
Evergreen Tree		Yes	Yes	
Multi-stem Tree		Yes	Yes	
Shrub		Yes	Yes	
Perennial/		Yes	Yes	

Item	Required	Proposed	Meets Code	Comments
Ground Cover				
Tree stakes and guys. (Wood stakes, fabric guys)		Yes	Yes	
Tree protection fencing	Located at Critical Root Zone (1' outside of dripline)	Yes	Yes	
Other Plant Material Requirements (LDM 3)				
General Conditions *(LDM 3.a)*	Plant materials shall not be planted within 4 ft. of property line	Yes – a note indicates this and all plantings are away from the property line.	Yes	
Plant Materials & Existing Plant Material *(LDM 3.b)*	Clearly show trees to be removed and trees to be saved.	Yes	Yes	
Landscape tree credit *(LDM3.b.(d))*	▪ Substitutions to landscape standards for preserved canopy trees outside woodlands/ wetlands should be approved by LA. ▪ Refer to Landscape tree Credit Chart in LDM	No		
Plant Sizes for ROW, Woodland replacement and others *(LDM 3.c)*	2.5" canopy trees 6' evergreen trees	On plant list		
Plant size credit *(LDM3.c.(2))*	NA	No		
Prohibited Plants *(LDM 3.d)*	No plants on City Invasive Species List	None are proposed	TBD	
Recommended trees for planting under overhead utilities *(LDM 3.e)*	Label the distance from the overhead utilities	Overhead lines are shown along southern property line.	Yes	See notes above regarding overhead line along 12 Mile Road.
Collected or Transplanted trees *(LDM 3.f)*		None		
Nonliving Durable Material: Mulch *(LDM 4)*	▪ Trees shall be mulched to 3"depth and shrubs, groundcovers to 2" depth ▪ Specify natural color, finely shredded hardwood bark mulch. Include in cost	Yes	Yes	

Item	Required	Proposed	Meets Code	Comments
	estimate.			

NOTES:

1. This table is a working summary chart and not intended to substitute for any Ordinance or City of Novi requirements or standards.
2. The section of the applicable ordinance or standard is indicated in parenthesis. For the landscape requirements, please see the Zoning Ordinance landscape section 5.5 and the Landscape Design Manual for the appropriate items under the applicable zoning classification.
3. Please include a written response to any points requiring clarification or for any corresponding site plan modifications to the City of Novi Planning Department with future submittals.

FIGURE 6-1

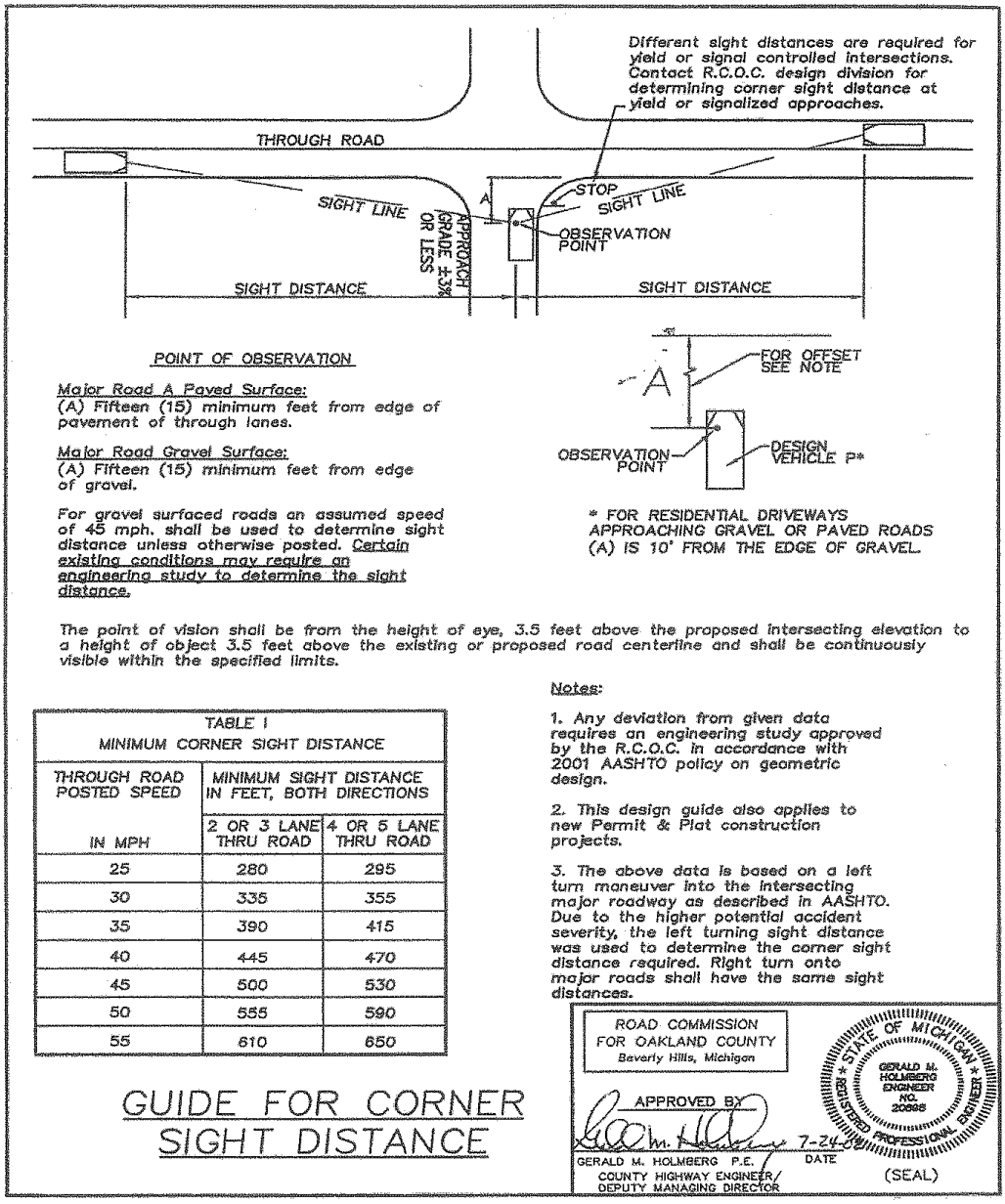


TABLE I
MINIMUM CORNER SIGHT DISTANCE

THROUGH ROAD POSTED SPEED IN MPH	MINIMUM SIGHT DISTANCE IN FEET, BOTH DIRECTIONS	
	2 OR 3 LANE THRU ROAD	4 OR 5 LANE THRU ROAD
25	280	295
30	335	355
35	390	415
40	445	470
45	500	530
50	555	590
55	610	650

Notes:

1. Any deviation from given data requires an engineering study approved by the R.C.O.C. in accordance with 2001 AASHTO policy on geometric design.

2. This design guide also applies to new Permit & Plat construction projects.

3. The above data is based on a left turn maneuver into the intersecting major roadway as described in AASHTO. Due to the higher potential accident severity, the left turning sight distance was used to determine the corner sight distance required. Right turn onto major roads shall have the same sight distances.

ROAD COMMISSION FOR OAKLAND COUNTY
Beverly Hills, Michigan

APPROVED BY

GERALD M. HOLMBERG P.E.
COUNTY HIGHWAY ENGINEER/ DEPUTY MANAGING DIRECTOR

7-24-08
DATE

STATE OF MICHIGAN
GERALD M. HOLMBERG ENGINEER NO. 20688
REGISTERED PROFESSIONAL ENGINEER
(SEAL)

GUIDE FOR CORNER SIGHT DISTANCE

WETLAND REVIEW

ECT Environmental Consulting & Technology, Inc.

ECT Project No. 200154-0200

June 10, 2020

Ms. Barbara McBeth, AICP
City Planner
Community Development Department
City of Novi
45175 W. Ten Mile Road
Novi, Michigan 48375

Re: Great Oaks Industrial Park 1 (JSP19-35)
Wetland Review of the Revised Preliminary Site Plan (PSP20-0039)

Dear Ms. McBeth:

Environmental Consulting & Technology, Inc. (ECT) has reviewed the Revised Preliminary Site Plan (PSP20-0039) for the proposed Great Oaks Industrial Park 1 project prepared by PEA, Inc. dated January 31, 2020 (Plan). The Plan date does not appear to be updated from the Preliminary Site Plan submittal. The Plan was reviewed for conformance with the City of Novi Wetland and Watercourse Protection Ordinance and the natural features setback provisions in the Zoning Ordinance.

ECT currently recommends approval of the Preliminary Site Plan (PSP20-0039) for Wetlands contingent on the applicant addressing the items noted in the *Wetland Comments* Section of this letter prior to receiving Wetland approval of the Final Site Plan.

Item	Required/Not Required/Not Applicable
Wetland Permit (specify Non-Minor or Minor)	Required (Non-Minor)
Wetland Mitigation	Not Likely Required (To Be Determined)
Wetland Buffer Authorization	Required
EGLE Permit	Likely (To Be Determined)
Wetland Conservation Easement	Not Required

The proposed project is located north of Twelve Mile Road and west of West Park Drive in Section 9. The proposed project includes a portion of Parcel 50-22-09-300-032 and the project site is listed as 20.04 acres (gross). It appears as if proposed grading for the project extends onto the parcels to the east and to the west. Novi Crushed Concrete is located to the west and Great Oaks Landscape Associates, Inc. is located to the east. The current use of the subject property is a driving range facility (Novi Oaks Golf and Sport Center).

The project continues to include the construction of a 98,650 square-foot light industrial building, associated parking and utilities, and a stormwater detention area in the northern portion of the proposed site. The proposed limits of disturbance do not appear to extend any further north than the existing open area associated with the current golf driving range facility.

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The City of Novi's Regulated Wetland & Woodland Map indicates areas of City-Regulated Wetland in the northern section of the subject property (see Figure 1). This area of wetland appears to be located outside of the proposed limits of disturbance for the project. It should be noted that the Plan (including the *Wetland Impact Plan*; Sheet C-4.0) includes several wetlands (Wetlands A, C, D, E, F, I, J, and K) within or directly adjacent to the proposed limits of disturbance area. The Davis Drain is adjacent to the subject property to the east. It can be noted that Wetlands A, B, C, D, and E are all located on the north section of the property; north of the proposed limits of disturbance.

Wetland Evaluation

ECT's in-office review of available materials included the City of Novi Regulated Wetland/Watercourse and Regulated Woodlands maps (see Figure 1, attached), USGS topographic quadrangle map, NRCS soils map, USFWS National Wetland Inventory map, and historical aerial photographs. ECT has not completed an on-site wetland verification. Wetland delineations and verifications should be conducted during the growing season (May 1 through October 15). The wetland boundaries currently indicated on the Plan can be used for initial planning purposes.

The Wetland Delineation Report prepared by PEA, Inc. dated March 19, 2020 indicates the following regarding the existing wetland areas:

- Wetland A (6,400 SF/0.15-acre), forested/scrub-shrub;
- Wetland B (2,863 SF/0.06-acre), forested/scrub-shrub;
- Wetland C (4,673/0.11-acre), scrub-shrub/emergent;
- Wetland D (2,265 SF/0.05-acre), forested/scrub-shrub;
- Wetland E (4,239 SF/0.10-acre), forested;
- Wetland F (7,373 SF/0.17-acre), forested/scrub-shrub;
- Wetland G (540 SF/0.01-acre), emergent/scrub-shrub;
- Wetland H (1,937 SF/0.04-acre), scrub-shrub/forested; and
- Wetland I/J (3,683 SF/0.08-acre), emergent/scrub-shrub.

Wetland Impact Review

The *Wetland Impact Plan*; Sheet C-4.0 indicates the proposed wetland impact areas and impact volumes to the existing wetlands. The proposed development as shown requires the filling of some areas of existing wetland and 25-foot wetland setback.

The following table summarizes the proposed wetland impacts as listed on the *Wetland Impact Plan*:

Table 1. *Proposed Wetland Impacts*

Wetland	***City Reg?***	***MDEQ Reg?***	***Wetland Area (On-Site)***	***Impact Area***		***Impact Volume***
			Acre	***Square Feet***	***Acre***	***Cubic Yards***
A	**Yes, City Regulated /Essential**	**Likely**	0.15	N/A	N/A	N/A
B	**Yes, City Regulated /Essential**	**Likely**	0.06	N/A	N/A	N/A
C	**Yes, City Regulated /Essential**	**Not Likely**	0.11	N/A	N/A	N/A
D	**Yes, City Regulated /Essential**	**Likely**	0.05	N/A	N/A	N/A
E	**Yes, City Regulated /Essential**	**Likely**	0.10	N/A	N/A	N/A
F	**Yes, City Regulated /Essential**	**Likely**	0.17	N/A	N/A	N/A
G	**Yes, City Regulated /Essential**	**Likely**	0.01	540	0.01	10
H	**Yes, City Regulated /Essential**	**Likely**	0.04	1,937	0.04	1,059
I	**Yes, City Regulated /Essential**	**Likely**	0.06	2,688	0.06	367
J	**Yes, City Regulated /Essential**	**Likely**	0.02	995	0.02	125
K	**Yes, City Regulated /Essential**	**Likely**	0.02	822	0.02	16
TOTAL	**--**	**--**	**0.79**	**6,982**	**0.16**	**1,577**

With regard to the 25-foot wetland setbacks, the Plan appears to propose encroachment into several of the wetland setback areas for the purpose of building and parking area construction. The following table summarizes the proposed wetland setback impacts as listed on the Plan:

Table 2. *Proposed 25-Foot Wetland Buffer Impacts*

Wetland Buffer	***Existing Wetland Buffer Area***		***Permanent Buffer Impact Area***		***Temporary Buffer Impact Area***		***Purpose of Impact***
	Square Feet	***Acre***	***Square Feet***	***Acre***	***Square Feet***	***Acre***	
A	Not Provided	Not Provided	N/A	N/A	N/A	N/A	N/A
B	Not Provided	Not Provided	N/A	N/A	N/A	N/A	N/A
C	Not Provided	Not Provided	N/A	N/A	N/A	N/A	N/A
D	Not Provided	Not Provided	N/A	N/A	N/A	N/A	N/A
E	Not Provided	Not Provided	N/A	N/A	N/A	N/A	N/A
F	Not Provided	Not Provided	N/A	N/A	N/A	N/A	N/A
G	4,551	0.10	4,551	0.10	N/A	N/A	Parking area construction
H/I/J	24,875	0.57	24,875	0.57	N/A	N/A	Parking area construction
K	3,800	0.09	3,800	0.09	N/A	N/A	Site Grading
TOTAL	**--**	**--**	**33,226**	**0.76**	**N/A**	**N/A**	**--**

Wetland Mitigation Review

In general, it can be noted that in those cases where an activity results in the impact to wetland areas of 0.25-acre or greater that are deemed essential under City of Novi Ordinance subsection 12-174(b) mitigation shall be required. The applicant shall submit a mitigation plan which provides for the establishment of replacement wetlands at a ratio of 1:1 through 2:1 times the area of the natural wetland impaired or destroyed, if impacts meet or exceed the 0.25-acre threshold (emergent and scrub-shrub wetlands are generally mitigated at a 1.5-to-1 ratio, forested wetlands are mitigated for at a 2.0-to-1 ratio, and open water areas are mitigated for at a 1.0-to-1 ratio). The Michigan Department of Environment, Great Lakes, and Energy's (EGLE) threshold for the requirement of wetland mitigation is 0.3-acre of wetland impacts.

The current Plan proposes a total wetland impact of 6,982 square feet (0.16-acre). As such, wetland mitigation is not required by the City of Novi Wetland Ordinance.

Regulatory Status - EGLE

Based on a review of the applicant's wetland delineation report, the on-site wetland areas are considered to be essential/regulated by the City of Novi as they appear to meet the essentiality criteria listed in the City's Wetland Ordinance (namely stormwater storage and wildlife habitat).

EGLEgenerally regulates wetlands that are within 500 feet of an inland lake, pond, or stream, or within 1,000 feet of a Great Lake, Lake St. Clair, the St. Clair River, or the Detroit River. Isolated wetlands five (5) acres in size or greater are also regulated. EGLE may also exert regulatory control over isolated wetlands less than five acres in size "…if the department determines that protection of the area is essential to the

preservation of the natural resources of the state from pollution, impairment, or destruction and the department has notified the owner".

Wetlands A, B, D, E, G, and H appear likely to be regulated by EGLE as they appear to be within 500 feet of a stream/drain. Of these, the Plan currently proposes impacts to Wetland G and Wetland H. It is the applicant's responsibility to contact EGLE in order to confirm the regulatory authority with respect to the on-site wetland areas.

Regulatory Status – City of Novi

The City of Novi Wetland and Watercourse Protection Ordinance (City of Novi Code of Ordinances, Part II, Chapter 12, Article V.; Division 2.) describes the regulatory criteria for wetlands and review standards for wetland permit applications. The City of Novi regulates wetlands that are: (1) contiguous to a lake, pond, river or stream, as defined in Administrative Rule 281.921; (2) two (2) acres in size or greater; or (3) less than two (2) acres in size but deemed essential to the preservation of the natural resources of the city under the criteria set forth in subsection 12-174(b). Wetlands deemed regulated by the City of Novi require the approval of a use permit for any proposed impacts to the wetland.

As noted above, based on a review of the applicant's wetland delineation report, the on-site wetland areas are considered to be essential/regulated by the City of Novi as they appear to meet the essentiality criteria listed in the City's Wetland Ordinance (namely stormwater storage and wildlife habitat).

Any proposed use of the wetlands will require a City of Novi *Wetland Use Permit* as well as an *Authorization to Encroach the 25-Foot Natural Features Setback* for any proposed impacts to the 25-foot wetland buffers. The applicant is urged to minimize impacts to on-site wetlands and wetland setbacks to the greatest extent practicable. The City regulates wetland buffers/setbacks. Article 24, Schedule of Regulations, of the Zoning Ordinance states that:

> "*There shall be maintained in all districts a wetland and watercourse setback, as provided herein, unless and to the extent, it is determined to be in the public interest not to maintain such a setback. The intent of this provision is to require a minimum setback from wetlands and watercourses*".

City of Novi Wetland Ordinance Requirements

The City of Novi Wetland and Watercourse Protection Ordinance (City of Novi Code of Ordinances, Part II, Chapter 12, and Article V) describes the regulatory criteria for wetlands and review standards for wetland permit applications.

As stated in the Ordinance, it is the policy of the city to prevent a further net loss of those wetlands that are: (1) contiguous to a lake, pond, river or stream, as defined in Administrative Rule 281.921; (2) two (2) acres in size or greater; or (3) less than two (2) acres in size, but deemed essential to the preservation of the natural resources of the city under the criteria set forth in subsection 12-174(b).

The wetland essentiality criteria as described in the Wetland and Watercourse Protection Ordinance are included below. Wetlands deemed essential by the City of Novi require the approval of a use permit for any proposed impacts to the wetland:

> *All noncontiguous wetland areas of less than two (2) acres which appear on the wetlands inventory map, or which are otherwise identified during a field inspection by the city, shall be analyzed for the purpose of determining whether such*

areas are essential to the preservation of the natural resources of the city….In making the determination, the city shall find that one (1) or more of the following exist at the particular site:

(1) The site supports state or federal endangered or threatened plants, fish or wildlife appearing on a list specified in Section 36505 of the Natural Resources Environmental Protection Act (Act 451 of 1994) [previously section 6 of the endangered species act of 1974, Act No. 203 of the Public Acts of 1974, being section 229.226 of the Michigan Compiled Laws].
(2) The site represents what is identified as a locally rare or unique ecosystem.
(3) The site supports plants or animals of an identified local importance.
(4) The site provides groundwater recharge documented by a public agency.
(5) The site provides flood and storm control by the hydrologic absorption and storage capacity of the wetland.
(6) The site provides wildlife habitat by providing breeding, nesting or feeding grounds or cover for forms of wildlife, waterfowl, including migratory waterfowl, and rare, threatened or endangered wildlife species.
(7) The site provides protection of subsurface water resources and provision of valuable watersheds and recharging groundwater supplies.
(8) The site provides pollution treatment by serving as a biological and chemical oxidation basin.
(9) The site provides erosion control by serving as a sedimentation area and filtering basin, absorbing silt and organic matter.
(10) The site provides sources of nutrients in water food cycles and nursery grounds and sanctuaries for fish.

After determining that a wetland less than two (2) acres in size is essential to the preservation of the natural resources of the city, the wetland use permit application shall be reviewed according to the standards in subsection 12-174(a).

Wetland and Watercourse Comments

The following are repeat comments from our Wetland Review of the Preliminary Site Plan (PSP20-0013) letter dated February 27, 2020. The current status of each comment follows in ***bold italics***. ECT recommends that the Applicant address the items noted below in subsequent site plan submittals:

1. If they have not already done so, the applicant should have a wetland delineation conducted by a qualified wetland consultant. A wetland boundary determination report shall be provided to the City when available.

   This comment has been satisfactorily addressed. A copy of the Wetland Delineation Report prepared by PEA, Inc. dated March 19, 2020 has been provided.

2. ECT encourages the Applicant to minimize impacts to on-site wetlands, wetland setbacks, and watercourses to the greatest extent practicable.

   This comment still applies. The current Plan proposes 0.16-acre of wetland impact and 0.76-acre of permanent impact to the on-site 25-foot wetland setbacks.

3. It should be noted that neither the existing wetland areas nor the proposed area of impact (square foot or acres) to these wetlands, have been quantified/indicated on the Plan. It can also be noted that the existing wetlands and the proposed project limits of disturbance boundary are not both clearly shown

on the same Plan sheet. ECT requests that the applicant clarify which on-site wetlands will be impacted by the proposed project.

This comment has been satisfactorily addressed. The required information has been shown on the Wetland Impact Plan (Sheet C-4.0).

4. The applicant shall indicate the following information on subsequent site plans:

    a. Area (square feet or acres) of all existing, on-site wetland areas;
    b. The area (square feet or acres) and volume (cubic yards) of all proposed wetland impacts;
    c. Area (square feet or acres) of all existing, on-site 25-foot wetland buffer areas;
    d. Area (square feet or acres) of all wetland buffer impacts (both permanent and temporary);
    e. The proposed impacts to wetlands and 25-foot wetland setbacks shall be indicated on the Plan on the same sheet at the proposed site plan, not just on the existing conditions/demo plan.

    This comment has been satisfactorily addressed. The required information has been shown on the Wetland Impact Plan (Sheet C-4.0).

5. It appears as though a City of Novi *Wetland Use Permit* and possibly an EGLE Wetland Permit and a would be required for any proposed impacts to on-site wetlands. A City of Novi *Authorization to Encroach the 25-Foot Natural Features Setback* would be required for any proposed impacts to on-site 25-foot wetland buffers.

    This comment still applies.

6. It should be noted that it is the Applicant's responsibility to confirm the need for a Permit from EGLE for any proposed wetland impacts. Final determination as to the regulatory status of any on-site wetlands (if applicable) shall be made by EGLE. The Applicant should provide a copy of EGLE Wetland Use Permit application to the City (and our office) for review and a copy of the approved permit upon issuance. A City of Novi Wetland Permit cannot be issued prior to receiving this information.

    This comment still applies.

7. The Plan should address how any temporary impacts to wetland buffers shall be restored, if applicable. Specifically, the Plan should indicate what seed mix will be used to restore the areas of temporary wetland buffer impact. This shall be incorporated into the Landscape Plans.

    This comment is no longer applicable. All proposed impacts to the on-site wetlands and 25-foot wetland setbacks appear to be permanent and will not require restoration/re-seeding.

Wetland Conclusion

The project site appears to contain wetlands that are regulated by the City of Novi, and potentially by EGLE. Any proposed impacts to on-site wetlands will require a City of Novi *Wetland and Watercourse Use Permit*, and an *Authorization to Encroach the 25-Foot Natural Features Setback* for any proposed impacts to the 25-foot wetland buffers. The project may require a Wetland Use Permit from EGLE. Any correspondence with EGLE pertaining to a permit application for this proposed project should be shared with the Community

Development Department. A City of Novi Wetland Permit cannot be issued prior to receiving this information.

Recommendation

ECT currently recommends approval of the Preliminary Site Plan (PSP20-0013) for Wetlands contingent on the applicant addressing the items noted in the *Wetland Comments* Section of this letter prior to receiving Wetland approval of the Final Site Plan.

If you have any questions regarding the contents of this letter, please contact us.

Respectfully submitted,
ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.

Pete Hill, P.E.
Senior Associate Engineer

cc: Lindsay Bell, City of Novi Planner
Madeleine Kopko, City of Novi Planning Assistant
Rick Meader, City of Novi Landscape Architect

Attachments: Figure 1 – City of Novi Regulated Wetland and Woodland Map

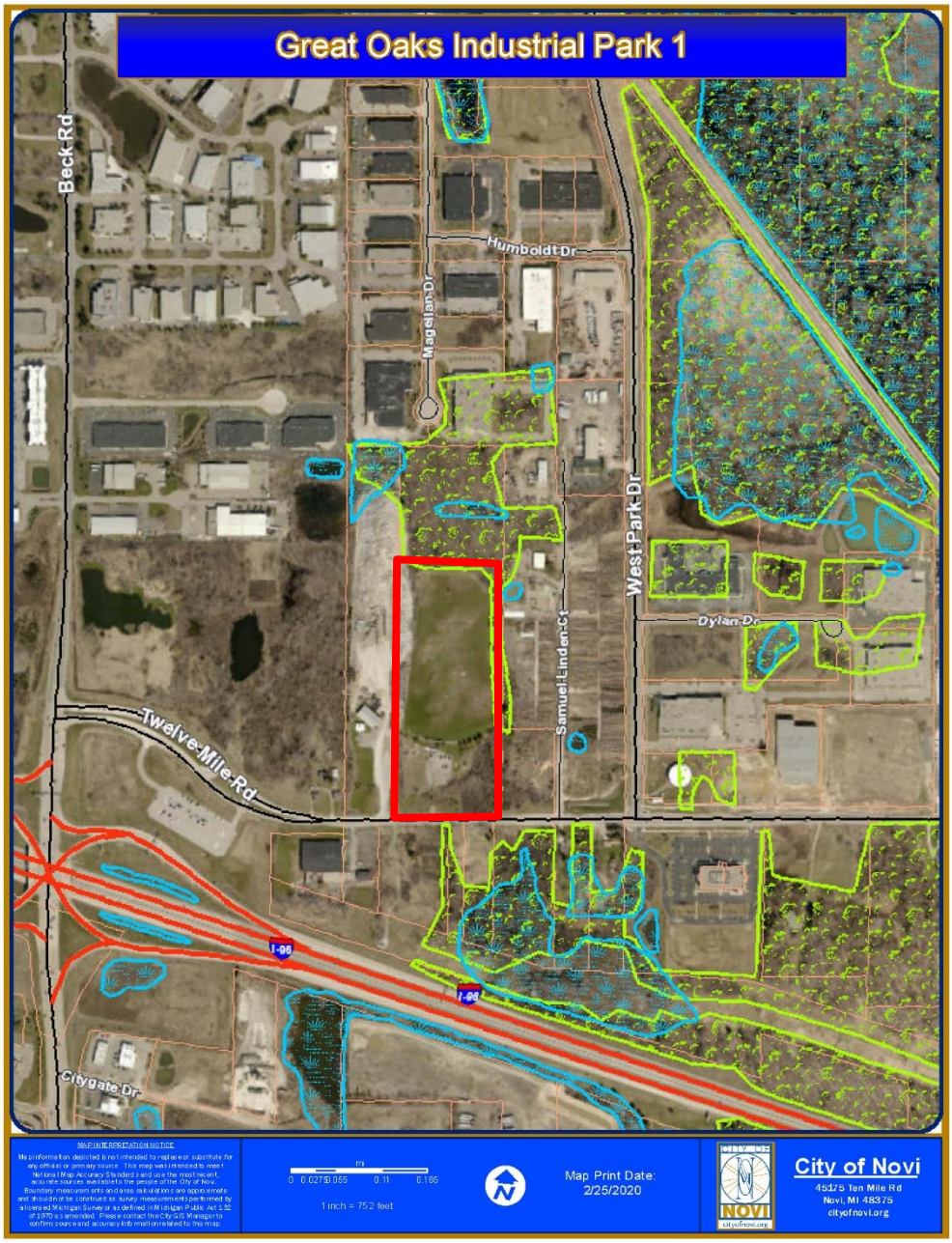

Figure 1. City of Novi Regulated Wetland & Woodland Map (approximate project area is shown in red). Regulated Woodland areas are shown in green and Regulated Wetland areas are shown in blue.

WOODLAND REVIEW

ECT Environmental Consulting & Technology, Inc.

ECT Project No. 200154-0300

June 10, 2020

Ms. Barbara McBeth, AICP
City Planner
Community Development Department
City of Novi
45175 W. Ten Mile Road
Novi, Michigan 48375

Re: Great Oaks Industrial Park 1 (JSP19-0035)
Woodland Review of the Revised Preliminary Site Plan (PSP20-0039)

Dear Ms. McBeth:

Environmental Consulting & Technology, Inc. (ECT) has reviewed the Revised Preliminary Site Plan (PSP20-0039) for the proposed Great Oaks Industrial Park 1 project prepared by PEA, Inc. dated January 31, 2020 (Plan). The Plan date does not appear to be updated from the Preliminary Site Plan submittal. The Plan was reviewed for conformance with the City of Novi Woodland Protection Ordinance Chapter 37.

ECT currently does not recommend approval of the Revised Preliminary Plan (PSP20-0039) for Woodlands. The Applicant shall address the items noted in the *Woodland Comments* Section of this letter prior to receiving Woodland approval of the Preliminary Site Plan.

The following woodland related items are required for this project:

Item	Required/Not Required/Not Applicable
Woodland Permit	Required
Woodland Fence	Required
Woodland Conservation Easement	Required

The proposed project is located north of Twelve Mile Road and west of West Park Drive in Section 9. The proposed project includes a portion of Parcel 50-22-09-300-032 and the project site is listed as 20.04 acres (gross). Novi Crushed Concrete is located to the west and Great Oaks Landscape Associates, Inc. is located to the east. The current use of the subject property is a driving range facility (Novi Oaks Golf and Sport Center).

The project continues to include the construction of a 98,650 square-foot light industrial building, associated parking and utilities, and a stormwater detention area in the northern portion of the proposed development site. The proposed limits of disturbance do not appear to extend any further north than the existing open area associated with the current golf driving range facility. The City of Novi's Regulated Wetland & Woodland Map indicates areas of City-Regulated Woodland in the northern section, and along the eastern section, of the subject property (see Figure 1). The majority of this area of woodland appears to be located outside of the proposed limits of disturbance for the project as a large portion of the subject site has been cleared or previously disturbed.

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It should be noted that the purpose of the City of Novi Woodland Protection Ordinance (Chapter 37) is to:

- *Provide for the protection, preservation, replacement, proper maintenance and use of trees and woodlands located in the city in order to minimize disturbance to them and to prevent damage from erosion and siltation, a loss of wildlife and vegetation, and/or from the destruction of the natural habitat. In this regard, it is the intent of this chapter to protect the integrity of woodland areas as a whole, in recognition that woodlands serve as part of an ecosystem, and to place priority on the preservation of woodlands, trees, similar woody vegetation, and related natural resources over development when there are no location alternatives;*
- *Protect the woodlands, including trees and other forms of vegetation, of the city for their economic support of local property values when allowed to remain uncleared and/or unharvested and for their natural beauty, wilderness character of geological, ecological, or historical significance; and*
- *Provide for the paramount public concern for these natural resources in the interest of health, safety and general welfare of the residents of the city.*

City of Novi Woodland Review Standards & Woodland Permit Requirements

Based on Section 37-29 (*Application Review Standards*) of the City of Novi Woodland Ordinance, the following standards shall govern the grant or denial of an application for a use permit required by this article:

> *No application shall be denied solely on the basis that some trees are growing on the property under consideration. However, the protection and conservation of irreplaceable natural resources from pollution, impairment, or destruction is of paramount concern. Therefore, the preservation of woodlands, trees, similar woody vegetation, and related natural resources shall have priority over development when there are location alternatives.*

In addition,

> *"The removal or relocation of trees shall be limited to those instances when necessary for the location of a structure or site improvements and when no feasible and prudent alternative location for the structure or improvements can be had without causing undue hardship".*

A Woodland Permit from the City of Novi would be required for proposed impacts to any trees 8-inch diameter-at-breast-height (DBH) or greater and located within an area designated as City Regulated Woodland, or any tree 36-inches DBH regardless of location on the site. Such trees shall be relocated or replaced by the permit grantee. All deciduous replacement trees shall be two and one-half (2 ½) inches caliper or greater and count at a 1-to-1 replacement ratio and all coniferous replacement trees shall be six (6) feet in height (minimum) and count at a 1.5-to-1 replacement ratio. All Woodland Replacement trees shall be species that are listed on the City's Woodland Tree Replacement Chart (attached). It should be noted that the City's Woodland Ordinance does not include any exemptions for "poor" or "very poor" tree conditions. There is a definition of a "dead" tree, and this assessment is to be made during the growing season. Per the City's Woodland Ordinance:

Dead tree means a tree having no more than zero (0) to fifteen (15) percent of the canopy with leaves. This determination shall be made during the regular growing season.

In addition, there are no exemptions within the Woodland Ordinance for any individual tree species being exempt from replacement.

Woodland Evaluation

ECT's in-office review of available materials included the City of Novi Regulated Wetland/Watercourse and Regulated Woodlands maps (see Figure 1, attached), USGS topographic quadrangle map, NRCS soils map, USFWS National Wetland Inventory map, and historical aerial photographs. It should be noted that a large portion of the proposed project's limits of disturbance contains previously disturbed areas that do not contain existing trees. In terms of habitat quality and diversity of tree species, the overall subject site contains trees in fair condition. In terms of a scenic asset, wildlife habitat, wind block, noise buffer or other environmental asset, the forested areas located on the subject site appear to be considered to be of fair quality.

The current Plan includes a *Tree Preservation Plan* (Sheet T-1.0) that indicates the locations of the surveyed trees as well as which existing trees are proposed for removal. The Plan also includes a *Tree Preservation List* (Sheet T-1.1) that provides tree tag number, species, diameter, condition of the surveyed trees on the site, save/remove status, regulatory status, and the number of Woodland Replacement Credits required for each tree proposed for removal. In general, the on-site trees consist of eastern cottonwood (*Populus deltoides*), black walnut (*Juglans nigra*), bitternut hickory (*Carya cordiformis*), sugar maple (*Acer saccharum*), American elm (*Ulmus americana*), Siberian elm (*Ulmus pumila*), white pine (*Pinus strobus*), boxelder (*Acer negundo*), basswood (*Tilia americana*), red oak (*Quercus rubra*), green ash (*Fraxinus pennsylvanica*), silver maple (*Acer saccharinum*), black cherry (*Prunus serotina*), and several other species.

As noted above, the northern section (and a section along the eastern side of the site) is mapped as Regulated Woodland on the City of Novi's Regulated Woodland Map. There are a number of trees to be removed for the proposed development. While some of these trees indicated for removal fall outside of the City of Novi's mapped Woodland Boundaries, the City's Woodland Ordinance contains the following:

> *Where uncertainty exists with respect to the boundaries of designated woodland areas shown on the regulated woodland map, the following rules shall apply:*
>
> - *Distances not specifically indicated on the map shall be determined by the scale on the map;*
> - *Where physical or natural features existing on the ground are at variance with those shown on the regulated woodland map, or in other circumstances where uncertainty exists, the community development director or his or her designee shall interpret the woodland area boundaries;*
> - *On any parcel containing any degree of regulated woodland, the applicant shall provide site plan documentation showing the locations, species, size and condition of all trees of eight-inch caliper or larger. Existing site understory trees, shrubs and ground cover conditions must be documented on the site plan or woodland use permit application plan in the form of a brief narrative. The woodland conditions narrative should include information regarding plant species, general quantities and condition of the woodland vegetation*

In our review of the Preliminary Site Plan, ECT noted that it is our opinion that all of the surveyed trees on the Plan within the project's proposed limits of disturbance should be considered as Regulated Woodland area. As such, there are physical and natural features existing on the site that are at variance with those shown on the regulated woodland map. The eight (8) northern white cedar trees (Trees #1501 to #1508) along the existing golf tee box area were previously planted and should therefore be exempted from replacement.

The Woodland Ordinance also defines Woodland Areas as:

> *All lands (including all trees, shrubs and ground cover thereon regardless of size) which are subject to this chapter under section 37-4 as designated on the regulated woodland map and/or on an approved site plan. Woodlands areas are identified by such factors as: soil quality, habitat quality, tree species and diversity, health and vigor of tree stand, understory species and quality, presence of wildlife, and other factors such as the value of the woodland area as a scenic asset, wind block, noise buffer, healthy environment, and the value of historic or specimen trees.*

The proposed Plan includes the removal of City-regulated trees as indicated below.

Proposed Woodland Impacts and Woodland Replacements

Based on a review of the *Tree Replacement Calculations* on the *Tree Preservation Plan* (Sheet T-1.0), a total of eighteen (18) City-Regulated trees are proposed for removal requiring twenty-eight (28) Woodland Replacement Credits.

As noted above, the Plan includes the removal of trees located within existing wooded areas on the subject site that are not currently designated as City-Regulated Woodland. Based on a review of the *Tree Preservation List* (Sheet T-1.1), the Plan includes the removal of fifty-seven (57) trees that are not located within an area currently designated as City-Regulated Woodland. As noted above, eight (8) of these trees are northern white cedar trees that were previously planted along the existing golf tee areas. These 8 trees should be exempt from replacement. Based on diameter, these additional forty-nine (49) trees would require a total of fifty-nine (59) Woodland Replacement Credits if they were located within an area mapped as City-Regulated Woodland. **The applicant should review and revise the woodland removal and replacement information provided on the Plan**.

The following tree removals by diameter are currently indicated on the Plan:

- Stems to be Removed 8" to 11": 9 x 1 replacement (Requiring 9 Replacements)
- Stems to be Removed 11" to 20": 8 x 2 replacements (Requiring 16 Replacements)
- Stems to be Removed 20" to 30": 1 x 3 replacements (Requiring 3 Replacements)
- Stems to be Removed 30"+: 0 x 4 replacements (Requiring 0 Replacements)
- Total Stems Removed: 18

Total Woodland Replacement Credits Required: 28 Replacements

The Plan notes that the following Woodland Replacement tree material is proposed:

- 25 – 2.5-inch deciduous trees (25 Woodland Replacement Credits @ 1:1 replacement ratio);
- 5 – evergreen trees (3.3 Woodland Replacement Credits @ 1.5:1 replacement ratio);
- 30 Woodland Replacement Trees (**28.3** Woodland Replacement Credits)

These Woodland Replacement Trees are proposed around the stormwater detention basin in the northern section of the site. The *Landscape Plan* (Sheet L-1.0) indicates the proposed locations and species of the Woodland Replacement Trees.

The following Woodland Replacement Trees are proposed in the Replacement Plant lists:

- 6 – sugar maple (*Acer saccharum*), 5 Credits;
- 9 – river birch (*Betula nigra*), 7 Credits;
- 5 – American beech (*Fagus grandifolia*), 7 Credits;
- 5 – swamp white oak (*Quercus bicolor*), 6 Credits:
- Subtotal 25 credits (deciduous tree planting)

- 5 – white pine (*Pinus strobus*), 3.3 Credits (1.5-to-1);
- Subtotal 3.3 (evergreen tree planting)

It should be noted that river birch (*Betula nigra*) is not a species that is approved for use as Woodland Replacement Credit on the City's *Woodland Tree Replacement Chart*. If the applicant would like to continue to plant birch trees, the following species are acceptable as Woodland Replacement Trees:

- yellow birch (*Betula alleghaniensis*);
- paper birch (*Betula papyrifera*).

Woodland Review Comments

The following are repeat comments from our *Woodland Review of the Preliminary Site Plan (PSP20-0013)* letter dated February 27, 2020. The current status of each comment is listed in ***bold italics***. Please consider the following comments when preparing subsequent site plan submittals:

1. ECT encourages the Applicant to minimize impacts to on-site woodlands to the greatest extent practicable and attempt to incorporate natural features into the site plan.

   This comment still applies.

2. The Plan includes the removal of trees that are not located within areas currently designated as City-Regulated Woodland. It is ECT's opinion that additional on-site trees should be considered Regulated and require Woodland Replacement Credits for their removal.

   Based on a review of the *Tree Preservation List* (Sheet T-1.1), the Plan includes the removal of fifty-seven (57) trees that are not located within an area currently designated as City-Regulated Woodland. As noted above, eight (8) of these trees are northern white cedar trees that were previously planted along the existing golf tee areas. These 8 trees should be exempt from replacement. Based on diameter, these additional forty-nine (49) trees would require a total of fifty-nine (59) Woodland Replacement Credits if they were located within an area mapped as City-Regulated Woodland. The applicant should review and revise the woodland removal and replacement information provided on the Plan.

   This comment still applies and has not been addressed on the Plan.

3. The currently proposed Woodland Replacement Trees are proposed around the stormwater detention basin in the northern section of the site. The *Landscape Plan* (Sheet L-1.0) indicates the proposed locations and species of the Woodland Replacement Trees. It should be noted that the *Landscape Plan*

appear to show only 22 of the 25 proposed deciduous Woodland Replacement trees. This shall be reviewed and revised as necessary on subsequent site plan submittals.

This comment has been satisfactorily addressed.

4. It should be noted that river birch (*Betula nigra*) is not a species that is approved for use as Woodland Replacement Credit on the City's *Woodland Tree Replacement Chart*. Please make a substitution to an approved tree from the City's list. If the applicant would like to continue to plant birch trees, the following species are acceptable as Woodland Replacement Trees:

    a. yellow birch (*Betula alleghaniensis*);
    b. paper birch (*Betula papyrifera*).

    This comment has not been addressed.

5. A Woodland Permit from the City of Novi would be required for proposed impacts to any trees 8-inch diameter-at-breast-height (DBH) or greater and located within an area designated as City Regulated Woodland, or any tree 36-inches DBH regardless of location on the site. Such trees shall be relocated or replaced by the permit grantee. All deciduous replacement trees shall be two and one-half (2 ½) inches caliper or greater and count at a 1 tree-to-1 Woodland Replacement credit ratio and all coniferous replacement trees shall be six (6) feet in height (minimum) and count at a 1.5 tree-to-1 Woodland Replacement credit ratio. All Woodland Replacement trees shall be species that are listed on the City's Woodland Tree Replacement Chart (attached).

    This comment still applies.

6. A Woodland Replacement Performance financial guarantee for the planting of on-site replacement trees will be required. This financial guarantee will be based on the number of on-site woodland replacement trees (credits) being provided at a per tree value of $400. Based on the current Plan, this Woodland Replacement Performance Guarantee would be **$11,200** (28 Woodland Replacement Credits Required x $400/Credit). As noted above, it is ECT's opinion that all of the areas containing surveyed trees on the Plan, including within the project's proposed limits of disturbance, should be considered as Regulated Woodland area. This would add a total of 49 additional trees to be removed requiring 59 Woodland Replacement Credits.

    This comment still applies. As such, the Woodland Replacement Performance Guarantee would be $23,600 (as opposed to $11,200).

7. Based on a successful inspection of the installed on-site Woodland Replacement trees, the Woodland Replacement financial guarantee will be returned to the Applicant. A Woodland Maintenance financial guarantee in the amount of twenty-five percent (25%) of the original Woodland Replacement financial guarantee will then be provided by the applicant. This Woodland Maintenance financial guarantee will be kept for a period of 2-years after the successful inspection of the on-site woodland replacement tree installation.

    This comment still applies.

8. The Applicant will be required to pay the City of Novi Tree Fund at a value of $400/credit for any Woodland Replacement Tree Credits that cannot be placed on-site.

   This comment still applies.

9. The Applicant shall provide preservation/conservation easements as directed by the City of Novi Community Development Department for any areas of woodland replacement trees to be installed in a currently non-regulated woodland area. The applicant shall demonstrate that the all proposed woodland replacement trees will be guaranteed to be preserved as planted with a conservation easement or landscape easement to be granted to the City. This language shall be submitted to the City Attorney for review. The executed easement must be returned to the City Attorney within 60 days of the issuance of the City of Novi Woodland permit. These easement areas shall be indicated on the Plan.

   This comment still applies.

Recommendation

ECT currently does not recommend approval of the Revised Preliminary Plan (PSP20-0039) for Woodlands. The Applicant shall address the items noted in the *Woodland Comments* Section of this letter prior to receiving Woodland approval of the Preliminary Site Plan.

If you have any questions regarding the contents of this letter, please contact us.

Respectfully submitted,
ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC.

Pete Hill, P.E.
Senior Associate Engineer

cc: Lindsay Bell, City of Novi Planner
Madeleine Kopko, City of Novi Planning Assistant
Rick Meader, City of Novi Landscape Architect

Attachments: Figure 1 – City of Novi Regulated Wetland and Woodland Map
Woodland Tree Replacement Chart

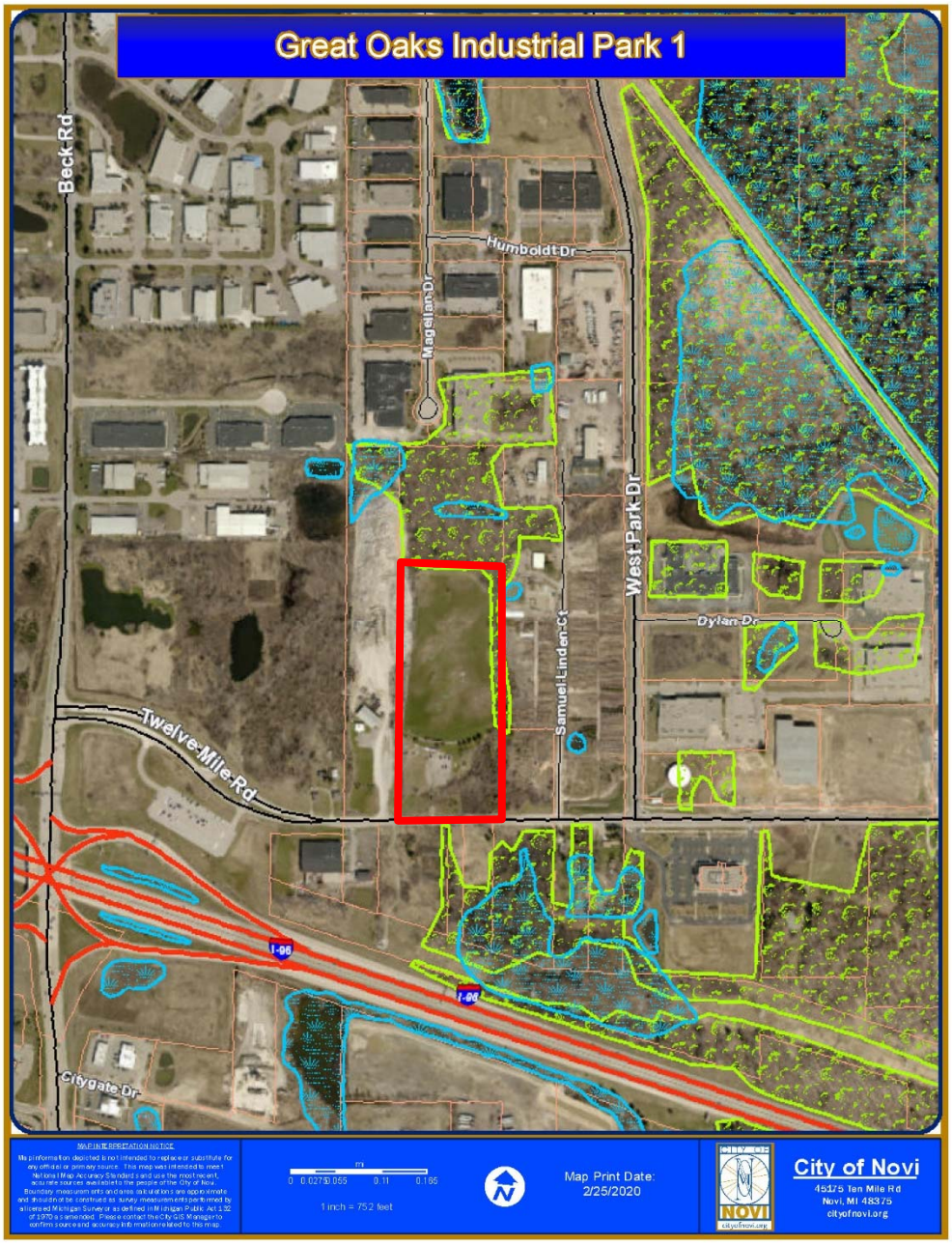


Figure 1. City of Novi Regulated Wetland & Woodland Map (approximate project area is shown in red). Regulated Woodland areas are shown in green and Regulated Wetland areas are shown in blue.

Woodland Tree Replacement Chart

(from Chapter 37 Woodlands Prote``ction) - Revised 5/7/2018
(All canopy trees to be 2.5" cal or larger, evergreens as listed)

Common Name	Botanical Name
Black Maple	Acer nigrum
Striped Maple	Acer pennsylvanicum
Red Maple	Acer rubrum
Sugar Maple	Acer saccharum
Mountain Maple	Acer spicatum
Ohio Buckeye	Aesculus glabra
Downy Serviceberry	Amelanchier arborea
Smooth Shadbush	Amelanchier laevis
Yellow Birch	Betula alleghaniensis
Paper Birch	Betula papyrifera
American Hornbeam	Carpinus caroliniana
Bitternut Hickory	Carya cordiformis
Pignut Hickory	Carya glabra
Shagbark Hickory	Carya ovata
Northern Hackberry	Celtis occidentalis
Eastern Redbud	Cercis canadensis
Pagoda Dogwood	Cornus alternifolia
Flowering Dogwood	Cornus florida
American Beech	Fagus grandifolia
Thornless Honeylocust	Gleditsia triacanthos inermis
Kentucky Coffeetree	Gymnocladus diocus
Walnut	Juglans nigra or Juglans cinerea
Eastern Larch	Larix laricina
Tuliptree	Liriodendron tulipfera
Tupelo	Nyssa sylvatica
American Hophornbeam	Ostrya virginiana
White Spruce_(1.5:1 ratio) (6' ht.)	Picea glauca
Black Spruce_(1.5:1 ratio) (6' ht.)	Picea mariana
Red Pine_(1.5:1 ration) (6' ht.)	Pinus resinosa
White Pine_(1.5:1 ratio) (6' ht.)	Pinus strobus
American Sycamore	Platanus occidentalis
Black Cherry	Prunus serotina
White Oak	Quercus alba
Swamp White Oak	Quercus bicolor
Scarlet Oak	Quercus coccinea
Shingle Oak	Quercus imbricaria
Burr Oak	Quercus macrocarpa
Chinkapin Oak	Quercus muehlenbergii
Red Oak	Quercus rubra
Black Oak	Quercus velutina
American Basswood	Tilia americana

TRAFFIC REVIEW

AECOM
27777 Franklin Road
Southfield
MI, 48034
USA
aecom.com

Project name:
JSP19-35 Great Oaks Revised Preliminary Site Plan Traffic Review

To:
Barbara McBeth, AICP
City of Novi
45175 10 Mile Road
Novi, Michigan 48375

From:
AECOM

Date:
June 5, 2020

CC:
Lindsay Bell, Madeleine Kopko, Kate Richardson, Victor Boron

Memo

Subject: JSP19-35 Great Oaks Revised Preliminary Site Plan Traffic Review

The preliminary site plan was reviewed to the level of detail provided and AECOM recommends **approval** for the applicant to move forward with the condition that the comments provided below are adequately addressed to the satisfaction of the City.

GENERAL COMMENTS

1. The applicant, Hillside Investments, is proposing a 98,650 SFT Research and Development facility on the north side of 12 Mile Road between Beck Road and West Park Drive.
2. 12 Mile Road is under the jurisdiction of Oakland County.
3. The parcel is currently zoned I-1 (Light Industrial) and no zoning changes are proposed.
4. There are no traffic related waivers/variances required at this time.

TRAFFIC IMPACTS

1. AECOM performed an initial trip generation based on the ITE Trip Generation Manual, 10th Edition, as follows.

   ITE Code: 760 – Research and Development Center
   Development-specific Quantity: 98,650 square feet
   Zoning Change: N/A

Trip Generation Summary				
	Estimated Trips	**Estimated Peak-Direction Trips**	**City of Novi Threshold**	**Above Threshold?**
AM Peak-Hour Trips	41	31	100	No
PM Peak-Hour Trips	48	41	100	No
Daily (One-Directional) Trips	1214	N/A	750	Yes

2. The number of trips exceeds the City's threshold of more than 750 trips per day or 100 trips per either the AM or PM peak hour. AECOM recommends performing the following traffic impact study in accordance with the City's requirements.

Trip Impact Study Recommendation	
Type of Study:	**Justification**
TIS	The daily trips projected for the development exceed the City threshold for conducting a TIS. The applicant has submitted a TIS, which was reviewed in a separate letter.

EXTERNAL SITE ACCESS AND OPERATIONS

The following comments relate to the external interface between the proposed development and the surrounding roadway(s).

1. The applicant is proposing one (1) driveway on 12 Mile Road. An emergency access drive is also proposed to the west.
    a. The proposed radii is in compliance with Figure IX.1 of the City's Code of Ordinances.
    b. The applicant has indicated the width of the main driveway to be 30' which is consistent with Figure IX.1.
2. A right turn taper is proposed for 12 Mile Road. The applicant should refer to Figure IX.11 of the City's Code of Ordinances for the standard tangent and taper lengths.
3. The applicant should submit proposed 12 Mile Road revisions to the Road Commission for Oakland County for their review and approval.
4. The applicant has included sight distance measurements for the driveway proposed on 12 Mile Road that is in compliance with Figure VIII-E of the City's Code of Ordinances.
5. The applicant should dimension driveway spacing along 12 Mile Road to ensure compliance with Section 11.216.d of the City's Code of Ordinances which requires 150' between near approach curb to near approach curb between driveways on the same side of the street.
6. There is not existing sidewalk along 12 Mile Road. The applicant is proposing including sidewalk along the length of the property to be consistent with the non-motorized master plan.
    a. The applicant has indicated the sidewalk is to be 6' in width.
    b. The applicant has indicated proposed sidewalk ramps at the driveway and have included the latest Michigan Department of Transportation (MDOT) ramp details.

INTERNAL SITE OPERATIONS

The following comments relate to the on-site design and traffic flow operations.

1. General Traffic Flow
    a. The applicant has indicated a loading zone of 2,245.44 SF, which meets the requirements for a loading zone as put forth in Section 5.4.2 of the Zoning Ordinance. The applicant should include truck turning movements to ensure the loading zone is accessible by trucks expected to utlize this area.
    b. The applicant has indicated aisle widths throughout the site, which meet the minimum requirement of 24'.
    c. The applicant has included dimensions for the radii of the proposed end islands throughout the site but should provide widths as well to ensure compliance with City requirements as stated in Section 5.3.12 of the Zoning Ordinance.
        i. Note that all end islands adjacent to a travel way shall be constructed three (3) feet shorter than the adjacent parking space.

ii. The islands that are internal to parking bays (that is, have parking on parallel sides and provided to separate 15 space parking bays) are not required to be 3' shorter than the adjacent parking space and may be the same length.

d. The applicant has indicated one trash receptacle location on the north side of the parking lot.
   i. The applicant could provide trash collection vehicle turning movements to ensure access.

2. Parking Facilities
   a. The applicant is proposing 198 parking spaces. The applicant should refer to Section 5.2.12 of the City's Zoning Ordinance as well as the Planning Review Letter for parking quantity requirements.
   b. The applicant has ensured that there are no more than 15 parking spaces adjacent to each other without an island.
   c. The applicant has indicated 17' long parking spaces, measured to front of curb.
      i. The applicant has provided curb heights throughout the site that are generally in compliance with the City's requirements.
         1. A curb is required at all parking spaces. **The accessible parking spaces are currently proposed with no curb, with ramps to either side of the barrier free parking spaces. The applicant should modify the plans to include a curb at these spaces**
         2. The integral curb and sidewalk detail on sheet C-9.0 indicates 6" height but the plans show 4" with a 17' long parking space abutting a 7' wide sidewalk.
      ii. The applicant has proposed six (6) accessible spaces, with two (2) designated as van accessible.
         1. Six (6) barrier free spaces are required for 198 total spaces with one (1) of the available spaces being van accessible. The applicant has indicated sufficient accessible parking spaces.
   d. Six (6) bicycle parking spaces are required per Section 5.16.1 of the City's Zoning Ordinance and the applicant is proposing six (6) spaces.
      i. The applicant has indicated the location, detail, and layout of the bicycle parking racks.
         1. The applicant has indicated the height of the rack in the detail, which complies with the 36" minimum height.
         2. The applicant should modify the quantity of bicycle parking racks required from three (3) to four (4), to be consistent with the layouts provided. The provided layouts indicate two (2) racks per location. Alternatively, the applicant could revise the number of spaces per location to be consistent with 3 bicycle parking racks with four (4) spaces at one location and two (2) at the other.
      ii. A 6' clear path from the bicycle parking areas to adjacent facilities, sidewalk or roadway, is required. The applicant is currently proposing a 5' clear path, when the 2' vehicle overhang is removed from the 7' sidewalk proposed. **The applicant should widen the sidewalks that connect the bicycle parking to the adjacent facilities in order to be in compliance.**
      iii. Refer to Section 5.16 of the City's Zoning Ordinance for more information regarding the City requirements.

3. Sidewalk Requirements
   a. The applicant has indicated where sidewalks are proposed on the site along with dimensions.
      i. The applicant has included a sidewalk connection to the facilities from the street and should dimension the width.
      ii. Sidewalks throughout the site meet the required minimum of 5' wide.
   b. The applicant has labeled sidewalk ramps on the plans and have included the latest Michigan Department of Transportation (MDOT) detail.

SIGNING AND STRIPING

1. All on-site signing and pavement markings shall be in compliance with the Michigan Manual on Uniform Traffic Control Devices (MMUTCD). The following is a discussion of the proposed signing and striping.

   a. The applicant has provided a signing table that includes quantities and proposed sizes, but does not have MMUTCD codes for all proposed signs. The codes for the stop and no outlet signs should be added.
   b. The applicant should include signing for the emergency access drive as required in Figure VIII-K of the City's Code of Ordinances.
2. The applicant has provided the following notes and details related to the proposed signing.
   a. Single signs with nominal dimensions of 12" x 18" or smaller in size shall be mounted on a galvanized 2 lb. U-channel post. Multiple signs and/or signs with nominal dimension greater than 12" x 18" shall be mounted on a galvanized 3 lb. or greater U-channel post as dictated by the weight of the proposed signs.
   b. The applicant should indicate a bottom height of 7' from final grade for all signs installed.
   c. The applicant should indicate that all signing shall be placed 2' from the face of the curb or edge of the nearest sidewalk to the near edge of the sign.
   d. Traffic control signs shall use the FHWA Standard Alphabet series.
   e. Traffic control signs shall have High Intensity Prismatic (HIP) sheeting to meet FHWA retroreflectivity requirements.
3. The applicant should include parking space striping notes to indicate that:
   a. The standard parking spaces shall be striped with four (4) inch white stripes.
   b. The accessible parking space and associated aisle should be striped with four (4) inch blue stripes.
   c. Where a standard space is adjacent to an accessible space, abutting blue and white stripes shall be installed.
4. The applicant has provided a detail for the proposed international symbol for accessibility pavement markings that may be placed in the accessible parking space. The symbol shall be white or white with a blue background and white border with rounded corners.
5. The applicant has provided a crosswalk pavement marking detail.

Should the City or applicant have questions regarding this review, they should contact AECOM for further clarification.

Sincerely,

AECOM

Patricia Thompson, EIT
Traffic Engineer

Paula K. Johnson, PE
Senior Transportation Engineer

TRAFFIC IMPACT STUDY REVIEW

AECOM
27777 Franklin Road
Southfield
MI, 48034
USA
aecom.com

Project name:
JSP19-35 Great Oaks Industrial Park 1 Traffic Impact Study Review Letter
From:
AECOM

Date:
March 2, 2020

To:
Barbara McBeth, AICP
City of Novi
45175 10 Mile Road
Novi, Michigan 48375

CC:
Sri Komaragiri, Lindsay Bell, Kate Richardson, Madeleine Kopko, Kale Richardson

Memo

Subject: JSP19-35 Great Oaks Industrial Park 1 Traffic Impact Study Review Letter

The traffic impact study (TIS) for the Great Oaks Industrial Park 1 development was reviewed to the level of detail provided and AECOM recommends **approval** of the TIS; however, the applicant should review the comments provided below and provide an addendum to the City.

GENERAL COMMENTS

1. The memo will provide comments on a section-by-section basis following the format of the submitted report.

PROJECT OVERVIEW

1. The project is proposed on the north side of 12 Mile Road, between Beck Road and West Park Drive.
2. The development is proposed as a 98,650 SFT research and development facility.
3. The TIS examines the traffic conditions on 12 Mile Road and at the intersections of 12 Mile Road with Beck Road and West Park Drive.
4. RCOC is planning to implement a boulevard design on this stretch of roadway.

EXISTING CONDITIONS

1. The study intersections are 12 Mile Road with the following roads/driveways: Beck Road, West Park Drive, and the Site Driveway.
2. The preparer utilized AM and PM weekday traffic counts provided by RCOC. These counts were conducted on Tuesday, June 4, 2019.
3. Of the three roadways examined, Beck Road, classified as a minor arterial, has the most traffic with 23,300 vehicles as the AADT. West Park Drive has the least at 13,000 vehicles per day.
4. All three intersections are T-intersections with 12 Mile Road being the thru street at West Park Drive and the Site Driveway and Beck Road being the thru street at its intersection with 12 Mile Road.
5. The preparer included the I-96 & Beck Road interchange in the Synchro models developed for simulation purposes. 2016 traffic volumes were balanced to match the 2019 traffic count data from RCOC.
6. The preparer produced a SimTraffic model utilized MDOT's *Electronic Traffic Control Device Guidelines* to run the simulations.
7. NB Beck Road experiences a land drop approximately 300 feet north of the intersection with Beck Road, reducing the utilization of the outside through lane.

8. The existing conditions at 12 Mile and West Park Drive have all southbound approaches operating at LOS F nduring the PM peak, with delay of up to 3 minutes. At 12 Mile and Beck, the WB left turn movement has an LOS of F during the PM peak, with 98.2 seconds delay.
    a. In both cases, the volume to capacity ratio exceeds 1. Queues do not dissipate and remain through the PM peak period.

BACKGROUND CONDITIONS

1. The following background developments were considered for this TIS:
    a. Novi Corporate Campus
    b. Dixon Meadows Residential
    c. Fountain View Medical Office
    d. A123
    e. Amson-Nasser Office and R&D
2. The buildout year used for this study is 2021.
3. A ambient background growth rate of 0.5% per year was used for this study.
    a. This value is consistent with MDOT's approach for growth for projects in Southeast Michigan.
4. PM Peak LOS remain consistent with existing conditions, with increases in delay but no additional LOS F approaches. In the AM peak period, the SB left turn from West Park Drive experiences LOS F with a delay of 97.2 seconds.
    a. As with the PM peak periods, these queues do not dissipate until the peak period has ended.
5. The applicant did not examine mitigation methods for the area due to a feasibility study undertaken by RCOC to determine if widening 12 Mile Road is feasible.

SITE TRIP GENERATION

1. The total trips expected from the development is 1,214 trips, with a maximum of 48 additional trips during the PM peak and 41 additional trips during the AM peak.
2. The preparer used the assumption that employee passenger car trips would navigate to and from the site from the Beck Road and I-96 interchange. 60% of the total trips were assumed to travel to or from the site via Beck Road south of 12 Mile Road.

AUXILIARY LANE ANALYSIS

1. The preparer has indicated that a left turn lane is warranted at the site driveway due to expected driveway volumes and volume on 12 Mile Road.
2. The preparer has indicated that a right turn taper is warranted at the site driveway.
3. The preparer should re-examine whether a right turn taper or a right turn lane will be warranted when 12 Mile Road becomes a boulevard and the driveway becomes right-in/right-out only due to the median.

FUTURE TRAFFIC OPERATIONS

1. The preparer indicates that there is a small increase in delay for several approaches with the addition of the site traffic, however it is not significant and does not change the LOS for any approach.
2. Left turns out of the site driveway ate predicted to be LOS F with a delay of 50 seconds or more during both AM and PM peak periods.
3. During PM peak periods, the site driveway will likely be blocked by the WB vehicle queue on 12 Mile Road frequently.

FUTURE IMPROVEMENTS

1. The preparer has indicated that minor signal timing adjustments at the 12 Mile and Beck Road intersection could reduce the queueing on WB 12 Mile Road to keep the queue from blocking the site driveway.

2. The preparer does not acknowledge the adaptive nature of the signals that exist according to the SCATS program.
    a. However, the impacts of including SCATS would only reduce the expected delay and improve LOS.

CONCLUSIONS

1. The Great Oaks facility would not change the LOS of any of the approaches or intersections in the surrounding area. However, the site driveway is expected to operate at LOS F for left turns during both peak periods.
    a. Southbound Park Drive at 12 Mile currently operates at LOS F during the PM peak.
    b. Westbound 12 Mile at Beck currently operates at LOS F during the PM peak.
2. Both a left turn lane and a right turn taper are warranted at the site driveway.
    a. The removal of left turns with proposed upgrades to 12 Mile Road should be examined in an addendum to determine if a right turn taper or lane will be warranted when the improvements are complete.

Should the City or applicant have questions regarding this review, they should contact AECOM for further clarification.

Sincerely,

AECOM

Josh A. Bocks, AICP, MBA
Senior Transportation Planner/Project Manager

Patricia A. Thompson, EIT
Traffic Engineer

FAÇADE REVIEW

DRN & ASSOCIATES, ARCHITECTS, PC
Phone: (248) 880-6523
E-Mail: dnecci@drnarchitects.com
Web: drnarchitects.com
50850 Applebrooke Dr., Northville, MI 48167

June 10, 2020

Status: Approved, Section 9 Waiver recommended for underage of Brick

City of Novi Planning Department
45175 W. 10 Mile Rd.
Novi, MI 48375-3024

Attn: Ms. Barb McBeth – Director of Community Development

Re: FACADE ORDINANCE Preliminary Site Plan
Great Oaks Industrial Park 1, JSP19-35 (Revised)
Façade Region: 1, Zoning District: I-1

Dear Ms. McBeth:
The following is the Facade Review for the above referenced project based on the revised drawings prepared by Faudie Architects dated 6/1/20. The revision consists primarily of increasing the height of the shop area of the building from 29'-4" to 43'-8". The revised and previous percentages of materials for each façade are shown on the table below (revised/previous). The maximum percentages allowed by the Ordinance Section 5.15 are shown in the right-hand column. Materials in non-compliance with the Façade Chart are highlighted in bold. The sample board required by Section 5.15.4.D was not provided at the time of this review.

Façade Region 1	South (Front)	West	East	North	Ordinance Maximum (Minimum)
Brick	**29%**/49%	**19%/16%**	**22%/21%**	**24%/18%**	100% (30% Min.)
Stone	9%/14%	1%/2%	0%/0%	0%/0%	50%
Split Faced CMU	0%/0%	6%/9%	7%/8%	6%/8%	10%
Flat Metal Panels & ACM	48%/13%	49%/42%	50%/45%	48%/50%	50%
Spandrel Glass	2%/3%	0%/3%	0%/0%	0%/0%	50%
Polymer Siding	12%/21%	3%/3%	2%/3%	0%/0%	25%
C-Brick	0%	22%/25%	19%/23%	22%/24%	25%

Recommendation – As shown above the minimum percentage of Brick (30%) is not provided on all facades. In this case the combined percentages of masonry materials (Brick, Stone and Split faced CMU) is approximately 30% on these facades. This proposed combination of materials will enhance the overall design and will have an overall aesthetic value equal to or greater than 30% Brick. Therefore, it is our recommendation that the design is consistent with the intent and purpose of the Façade Ordinance and that a Section 9 Waiver be granted for the underage of Brick on all facades.

A material sample board showing carefully coordinated colors should be provided as required by Section 5.15.4.D of the Ordinance.

Notes to the Applicant:

1. It should be noted that all roof top equipment must be screened from view from all vantage points both on-site and off-site using materials in compliance with the Façade Ordinance.

2. Inspections – The Façade Ordinance requires inspection(s) for all projects. Materials displayed on the approved sample board (in this case the adjacent existing material) will be compared to materials to be installed. It is the applicant's responsibility to request the inspection of each façade material at the appropriate time. Inspections may be requested using the Novi Building Department's Online Inspection Portal with the following link. Please click on "Click here to Request an Inspection" under "Contractors", then click "Façade".

http://www.cityofnovi.org/Services/CommDev/OnlineInspectionPortal.asp.

If you have any questions regarding this review, please do not hesitate to call.

Sincerely,
DRN & Architects PC

Douglas R. Necci, AIA

FIRE REVIEW

Novi Public Safety Administration
45125 Ten Mile Road
Novi, Michigan 48375
248.348.7100
248.347.0590 fax

cityofnovi.org

May 12, 2020

TO: Barbara McBeth- City Planner
Lindsay Bell-Plan Review Center
Madeleine Kopko-Planning Assistant

RE: Great Oaks Twelve Mile

PSP# 20-0039
PSP# 20-0013
PSP# 20-0006

Project Description:
Build a 98,650 S.Q.F.T. 2 story structure off of Twelve Mile west of Samuel Linden Ct.

Comments:

- **All** fire hydrants **MUST** be installed and operational prior to any combustible material is brought on site. **IFC 2015 3312.1**
- The ability to serve at least two thousand (2,000) gallons per minute in single-family detached residential; three thousand (3,000) gallons per school areas; and at least four thousand (4,000) gallons per minute in office, industrial and shopping centers is essential. **(D.C.S. Sec.11-68(a))**
- Hydrants shall be spaced approximately three hundred (300) feet apart on line in commercial, industrial, and multiple-residential areas. In cases where the buildings within developments are fully fire suppressed, hydrants shall be no more than five hundred (500) feet apart. The spacing of hydrants around commercial and/or industrial developments shall be considered as individual cases where special circumstances exist upon consultation with the fire chief. **(D.C.S. Sec. 11-68 (f)(1)c)**
- **Corrected 5/14/2020 KSP-**Fire Hydrant lead that is greater than 25' **MUST** be at least an 8" main. South east corner of structure has a 6" fire hydrant lead. **City of Novi Ordinance 11-68(c)(1)(c)**
- **Corrected 2/12/20 KSP-**Proximity to hydrant: In any building or structure required to be equipped with a fire department connection, the connection shall be located within one hundred (100) feet of a fire hydrant. **(Fire Prevention Ord. Sec. 15-17*)***
- **Corrected 2/12/2020 KSP-**An unobstructed outside turning radius of 50 feet minimum and an inside turning radius of 30 feet maximum are to be provided at intersections of private or public roadways and cul-de-sacs. ***(*IFC 2015 503.2.4*)***

- Emergency access drive turning to the west doesn't meet city standards. Fire apparatus access drives to and from buildings through parking lots shall have a minimum fifty (50) feet outside and thirty (30) feet turning radius and designed to support a minimum of thirty-five (35) tons. **(D.C.S. Sec 11-239(b)(5))**
- The tree on the Landscape Plan #L-1 will be blocking visual site for the address and FDC strobe when the tree matures.
- A hazardous chemical survey is required to be submitted to the Planning & Community Development Department for distribution to the Fire Department at the time any Preliminary Site Plan is submitted for review and approval. Definitions of chemical types can be obtained from the Fire Department at (248) 735-5674.
- **Corrected 5/14/20 KSP-**MUST provide a secondary access drive (emergency access) to the site. Drive MUST be at least 20' wide.
- The fire lead and domestic lead for the structure **MUST** be put on the plans for review.
- Fire Hydrant lead that is greater than 25' **MUST** be at least an 8" main. North east corner of structure has a fire hydrant lead > 25' with no labeling of size. **City of Novi Ordinance 11-68(c)(1)(c)**
- The two fire hydrants on the 16" main that is off of Twelve Mile Rd need to be turned 180 degrees to service the main road and not the property.

Recommendation:
APPROVED WITH CONDITIONS

Sincerely,

Kevin S. Pierce-Fire Marshal
City of Novi – Fire Dept.

cc: file

APPLICANT RESPONSE LETTER

Civil Engineers | Land Surveyors | Landscape Architects
experienced. responsive. passion for quality.
Corporate Office: 2430 Rochester Court • Suite 100 • Troy, MI 48083
t: 248.689.9090 • f: 248.689.1044 • www.peainc.com

June 18, 2020
PEA Project No: 2019-230
City of Novi Project No: JSP19-35

Lindsay Bell, AICP | Senior Planner
City of Novi Community Development Department
45175 West 10 Mile Road
Novi, Michigan, 48375

Re: Great Oaks Industrial Park No: 1
Novi, Michigan

Dear Ms. Bell:

In response to the Revised Preliminary Site Plan review letters received from various City Departments, we offer the following responses to those comments that require change or clarification:

Planning Review (June 12, 2020)

Special Land Uses:

- A tenant has not been identified for this property yet, although the applicant has submitted numerous proposals to several different types of companies that have shown interest in this site. Anticipated uses for this site are research & development, light industrial, manufacturing, and warehousing. It is anticipated that any of these uses will have a component of professional office use along with them.

Planning Chart:

- **(Building Height)** The proposed building height will be reduced to meet the requirements of the zoning district; therefore, **a variance will not be required**.
- **(Parking Setback)** The proposed parking located in the required parking setback will be shifted to meeting the dimensional requirement, **therefore a variance will not be required**.
- **(Number of Parking Spaces)** The proposed parking spaces will be reduced to very near the ordinance required amount and the excess will be land banked.
- **(Bicycle Parking General Requirements)** The width of the sidewalk to the bike parking will be increased to 8'.
- **(Pedestrian Connectivity)** The width of the sidewalk to the ROW will be 6' wide and will be noted on the plan.
- **(Building Lighting)** Lighting levels will be provided for the exterior walls.
- **(Lighting Plan)** The lighting hours of operation will be added to the plans.
- **(Security Lighting)** The details of the security lighting will be added to the plans.
- **(Economic Impact Information)** Total cost and site improvements is $12-$15M, depending on the final interior buildout cost. The project is anticipated to create 125 jobs during construction and 100-200 permanent jobs once the building is completed.
- **(Development and Street Names)** A Project and Street Naming Committee Application has been filed.

Engineering Review (June 5, 2020):

- All the items noted in the review letter will be addressed prior to the submittal of the final site plan.

Landscaping Review (May 13, 2020):

Landscaping Report:

Landscape Waivers

- The site landscape plan layout will be revised prior to final site plan submittal to eliminate the need for the landscape waiver for 16 consecutive parking spaces without a landscape island with a tree. NO WAIVER REQUESTED
- The required landscape berm along 12 Mile Road will be added to the plan prior to final site plan submittal. NO WAIVER REQUESTED
- Perimeter trees will be added along the west side of the access drive will be added prior to final site plan submittal. NO WAIVER REQUESTED

Landscaping Chart:

- **(Soil Types)** Soil boundaries will be added to the plan prior to final site plan submittal.
- **(Existing and Proposed Utilities)** Proposed light post will be added to the plan prior to final site plan submittal.
- **(Contiguous Space Limit)** An adjustment will be made to have a maximum of 15 parking spaces on either side of the pathway.
- **(Plantings Around Fire Hydrant)** The hydrant island along the west side of the west parking area will be adjusted prior to final site plan submittal to allow for a tree to be located within the island.
- **(Clear Zones)** The requested “clear vision” zones per RCOC requirements for the 12 Mile Road entry will be added to the plans prior to final site plan submittal.
- **(Number of Canopy Trees Required)** The parking lot tree at the southeast corner of the building will be moved 10 feet prior to final site plan submittal.
- **(Access Way Perimeter)** Calculations and deciduous canopy trees along the west will be added.
- **(Berm Requirements)** Required berm will be provided
- **(Slope, Height, and Width)** Cross section will be provided
- **(Setbacks from Utilities)** The existing overhead lines are proposed to remain, we will relocation the trees and our use canopy trees.
- **(Canopy Deciduous | Large Evergreen Trees)** The calculations for the trees along the west side of the access drive will be added to the plans prior to final site plan submittal.
- **(Building Foundation Landscape Requirements)** Details for the foundation plants will be added to the plans prior to final site plan submittal.
- **(Detention Basin Requirements)** The plans will be revised prior to final site plan submittal to cluster scrubs along the high-water line. Phragmites will be surveyed prior to submittal.
- **(Irrigation Plan)** Irrigation plan will be added to the plan set prior to final site plan submittal.
- **(Plant List)** The plans will provide for a mix of native species for the foundation plantings.
- **(Plant List)** The bur oak will be substituted for the river birch.

ECT Wetland Review (June 10, 2020):

Comments will be addressed prior to the submittal of the final site plan.

ECT Woodland Review (June 10, 2020):

Regarding the tree removal proposed outside of the City's Regulated Woodland, the developer is willing to provide woodland replacements for the trees being removed. The other comments noted in the review letter will addressed prior to the submittal of the final site plan.

Traffic Review (June 5, 2020):

External Site Access and Operations

1. a. No comment necessary.
   b. No comment necessary.
2. Comment noted.
3. We will submit plans to RCOC for review.
4. No comment necessary.
5. The driveway spacing dimension will be added to the plans prior to the submittal of the final site plans.
6. a. No comment necessary.
   b. No comment necessary.

Internal Site Operations

1. a. Comment noted. The requested truck turning movements will be added to the plans prior to the final site plan submittal.
   b. No comment necessary.
   c. No comment necessary.
   d. No comment necessary.
2. a. No comment necessary.
   b. No comment necessary.
   c. Noted comments will be added and/or revised prior to final site plan submittal.
   d. Noted comments will be added and/or revised prior to final site plan submittal.
3. a. No comment necessary.

Signing and Striping

1. No comment necessary.
   a. The MMUTCD codes will be added to the plan prior to final site plan submittal.
   b. The requested emergency access drive signage will be added to the plans prior to final site plan submittal.
2. The requested information will be added to the plans prior to final site plan submittal.
3. The requested information will be added to the plans prior to final site plan submittal.
4. No comment necessary
5. No comment necessary.

Façade Review:

No additional comments. A "Section 9 Waiver" is requested for this project.

Fire Department Review (August 12, 2019):

All Fire Department comments will be addressed on the final site plan submittal.

If there are any further questions, please contact this office.

Sincerely,

PEA, Inc.

James P. Butler, PE
President

TRAFFIC IMPACT STUDY

BERGMANN
ARCHITECTS ENGINEERS PLANNERS

MEMO

To: Mr. David Hardin
Hillside Investment

From: Steven J. Russo, PE
Transportation Engineer

Date: May 8, 2020

Re: Great Oaks – City of Novi, MI
Traffic Impact Study (TIS)

INTRODUCTION

This memorandum presents the results of the Traffic Impact Study (TIS) for the proposed Great Oaks Research & Development (R&D) facility in the City of Novi, Oakland County, Michigan. The subject site is located on the north side of 12 Mile Road approximately 1,000 feet west of W Park Drive and is currently occupied by the Novi Oaks Golf & Sport Center. The project will include construction of a 98,650 square feet (SF) R&D facility. Existing access for the site is provided via a single driveway to 12 Mile Road which will be relocated approximately 100 feet west of the existing driveway location. Additionally, a secondary emergency only access drive will be provided to 12 Mile Road.

The study section of 12 Mile Road is under the jurisdiction of the Road Commission for Oakland County (RCOC) and a TIS is required for permitting of site access. Additionally, in accordance with Chapter 5 of the City of Novi *Site Plan and Development Manual*, a TIS is required for site plan approval.

The purpose of this TIS is to evaluate traffic operations on the adjacent roadways with and without the proposed project and to determine if any improvements or modifications are necessary to facilitate site generated traffic. In particular, access operations to 12 Mile Road were analyzed to determine appropriate lane configurations as well as traffic control to safely and efficiently process site traffic. Specifically, the intersections of 12 Mile Road with Beck Road and W. Park Drive were evaluated for this TIS.

This TIS has been prepared in accordance with the methodologies and practices published by the Institute of Transportation Engineers (ITE). The zoning ordinances, guidelines, and standards of the City of Novi and RCOC were referenced as applicable. Additionally, Bergmann solicited input regarding the scope of work from the City of Novi and RCOC to gather understanding of what was required with respect to this TIS, which the City (via their traffic consultant AECOM) provided. This memorandum is intended for use by the City and RCOC to guide decisions related to development project approvals, access permitting, and identifying future roadway improvements.

EXISTING CONDITIONS

This site is currently occupied by the Novi Oaks Golf & Sport Center and the proposed redevelopment project is subject to review by the City of Novi. Vehicle transportation for the facility will be provided via 12 Mile Road, Beck Road, and W. Park Drive. Regional transportation is provided via I-96, which has an interchange with Beck Road approximately 750 feet south of 12 Mile Road. The study intersections are identified below and further details on the study network are summarized in **Table 1**.

Table 1: Roadway Summary

Roadway Data	12 Mile Road	Beck Road	W. Park Drive
Functional Class	Principal Arterial	Minor Arterial	Minor Arterial
Direction	E-W	N-S	N-S
Speed Limit (mph)	45	40	45
Jurisdiction	RCOC	City	City
Cross Section	2-Lane	2-Lane	3-Lane
AADT	17,000	23,300	13,000
AM Peak Hour Volume	1,432	2,332	1,129
PM Peak Hour Volume	1,721	2,018	1,298

The intersection of 12 Mile Road & Beck Road is a traffic signal-controlled T-intersection with lagging protected only left-turn phasing for the SB approach and right turn overlap phasing for the NB approach. The intersection operates on the RCOC Sydney Coordinated Adaptive Traffic System (SCATS) adaptive traffic signal system with vehicle actuation provided for all approaches and movements via video detection. No pedestrian facilities are provided at the intersection.

The intersection of 12 Mile Road & W. Park Drive is traffic signal controlled with lagging permissive-protected left-turn phasing for the EB and WB approaches. The intersection operates on the RCOC SCATS adaptive traffic signal system with vehicle and pedestrian actuation provided for all approaches and movements. Marked crosswalks are also provided for all legs connecting sidewalks in all four quadrants of the intersection.

Existing weekday AM (7:00 to 9:00) and PM (4:00 to 6:00) turning movement counts for the study intersections were provided by RCOC. These counts were collected at the study intersections on Tuesday, June 4, 2019 during typical traffic conditions while schools were in session and avoiding adverse weather conditions. The weekday AM and PM peak hours of existing road traffic were identified at each of the individual study intersections. Specific traffic generators were identified as sink / source locations between each intersection, and thru traffic volumes were balanced upward across the network. In general, the existing peak hours were determined to occur between 7:30 to 8:30 AM and 4:30 to 5:30 PM. The existing peak hour traffic volumes are shown on the attached **Figure 1**.

The study intersections were modeled using Synchro traffic analysis software based on the existing intersection geometry and peak hour traffic volumes. Peak hour factors were modeled by intersection approach. Existing AM and PM peak hour vehicle delays and Levels of Service (LOS) were calculated based on the methodologies of the *Highway Capacity Manual, 6th Edition* (*HCM6*).

Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions and/or volume exceeding capacity. Simulations of the study network were also observed using SimTraffic, in order to identify potential issues related to vehicle queuing, traffic flow between intersections, and the overall study network. Given the close proximity and interaction with the 12 Mile Road & Beck Road intersection, the I-96 & Beck Road Single Point Urban Interchange (SPUI) was included in the Synchro models for simulation purposes only. Traffic volumes for the interchange were obtained from a previous TIS completed in 2016 and the volumes through the interchange were balanced upward to 2019 levels based on the traffic count data provided by RCOC.

The SimTraffic model was calibrated based on the actual and simulated number of entering vehicles in accordance with the Michigan Department of Transportation (MDOT) *Electronic Traffic Control Device Guidelines*. To complete this process, five simulations of each peak period were performed and the average of the volumes for each turning movement was reported in the SimTraffic vehicles exited report. These volumes were then compared to actual traffic volumes collected at each intersection and considered validated when the field counts, and model results were within the greater of ±10 percent or ±20 vehicles.

At the intersection of 12 Mile Road & Beck Road, a far-side lane drop for NB Beck Road occurs approximately 300 feet north of the intersection. The reduction in the number of through lanes immediately after a signalized intersection does not provide adequate distance for vehicles to merge downstream of the intersection, reducing the lane utilization of the outside through lane. In order to accurately reflect this in the models, the mandatory and positioning distance at the lane drop location north of the intersection were adjusted along with their corresponding driver adjustment factors in SimTraffic.

Table 2: Existing Traffic Conditions

Intersection	AM Peak Hour Approach				PM Peak Hour Approach			
1. 12 Mile Rd and Park Drive	EB	25.1 C	13.8 B	29.7 C	13.9 B	EB	16.1 B	20.5 C	13.8 B	10.5 B
	WB	20.2 C	18.5 B	20.1 C	20.5 C	WB	22.5 C	10.4 B	25.1 C	15.5 B
Signalized	NB	28.2 C	35.0 C	24.4 C		NB	40.2 D	51.9 D	29.0 C	
	SB	45.0 D	54.2 D	30.3 C		SB	163.9 F	183.8 F	142.8 F	
	Overall		**30.2**	**LOS**	**C**	**Overall**		**74.0**	**LOS**	**E**
2. 12 Mile Rd and Beck Rd	WB	42.3 D	42.9 D		36.4 D	WB	90.8 F	98.2 F		28.6 C
	NB	41.5 D		40.9 D	42.3 D	NB	41.6 D		43.1 D	38.7 D
Signalized	SB	16.4 B	31.1 C	14.8 B		SB	25.6 C	32.3 C	25.1 C	
	Overall		**33.4**	**LOS**	**C**	**Overall**		**53.3**	**LOS**	**D**

The results of the existing conditions analysis, as summarized in **Table 2**, indicate that the signalized study intersections currently operate at an acceptable level with an overall LOS D or better during both peak hours, with the exception of the 12 Mile Road & W. Park Drive intersection which operates at an overall LOS E during the PM peak hour. Additionally, the following approaches and movements currently operate at a LOS E or F during the peak hours:

- The WB left-turn movement at the signalized intersection of 12 Mile Road & Beck Road which currently operates at a LOS F during the PM peak hour with a volume to capacity (v/c) ratio greater than 1.0.

- The SB approach at the signalized intersection of 12 Mile Road & W. Park Drive / Keystone Medical Center Drive which operates at a LOS F during the PM peak hour with a v/c ratio greater than 1.0.

Review of network simulations indicates generally acceptable traffic operations during the AM peak hour. During the PM peak hour, long vehicle queues are observed for the approaches and movements indicated above to operate at a LOS F. These queues do not dissipate and are present throughout the duration of the peak hour.

BACKGROUND CONDITIONS

Traffic impact studies typically include an evaluation of traffic operations in the future as they would be without the proposed development. This "background" condition serves to identify any mitigation that may be required regardless of the project, and as a baseline for comparison of future buildout conditions. This scenario is comprised of existing traffic conditions plus ambient traffic growth plus traffic from approved developments in the study area that have yet to be constructed. At the time of this study the following background developments were identified by the City of Novi for inclusion in this study:

- Novi Corporate Campus
- Dixon Meadows Residential
- Fountain View Medical Office
- A123
- Amson-Nasser Office and R&D

The vehicle trips that would be generated by the background developments were assigned to the study intersections based on the respective traffic study completed for each development. Where a traffic study was not completed for the development, the number of vehicle trips was forecast based on data published by ITE in *Trip Generation, 10th Edition* and assigned to the study road network based on existing traffic patterns. It is important to note that based on the location and access points of the background developments, not all site-generated background trips will travel through the study intersections.

In addition to background developments, an ambient growth factor is applied to existing traffic volumes to account for future projects in the study area and population increases, as well as growth in regular traffic volumes due to development projects outside the study area. In order to determine the applicable traffic growth rate for the existing traffic volumes to the 2021 buildout year, historical traffic volume data at the intersection of 12 Mile Road & W. Park Drive was reviewed. The results of this analysis indicate that traffic volumes at the intersection increased at an annual rate of approximately 0.35% per year from 2012 – 2018. Therefore, an ambient background growth rate of 0.5% per year was utilized for this study. MDOT has consistently applied this growth rate for other projects in Southeast Michigan and across the State, and this rate was therefore applied to the 2019 traffic volumes for a period of two years. The resulting background peak hour traffic volumes are summarized on the attached **Figure 2**.

Lastly, RCOC has a planned roadway project to reconstruct the study section of 12 Mile Road to a median divided four-lane boulevard with indirect left turns accommodated via median crossovers. Therefore, these improvements were also incorporated in the background conditions analysis.

The boulevard configuration of 12 Mile Road was modeled in Synchro according to the guidelines set forth by MDOT in the *Electronic Traffic Control Device Guidelines*. Traffic signal timings were modeled per traffic signal timing permits provided by MDOT. As part of these improvements, the crossovers along 12 Mile Road east and west of Park Drive along with the intersection of WB 12 Mile Road & Park Drive were assumed to be signalized. For these signalized intersections, current HCM6 methodology does not support the intersection configurations and non-NEMA phasing. Therefore, HCM results for the signalized study intersections were reported based on HCM 2000 calculations. This methodology has been discussed previously with MDOT and determined acceptable for TIS purposes.

Background AM and PM peak hour vehicle delays and LOS were calculated based on the methodologies of the *HCM6 and HCM 2000* and are shown in **Table 3**. These calculations indicate all study intersection approaches and movements will operate acceptably at a LOS D or better during the AM peak hour. During the PM peak hour, the signalized study intersection of 12 Mile Road & Beck Road will operate at an overall LOS E with the WB left-turn movement continuing to operate at a LOS F with a v/c ratio greater than 1.0.

Table 3: Background Traffic Conditions

Intersection	AM Peak Hour Approach	↰	↑	↱	PM Peak Hour Approach	↰	↑	↱
1. WB 12 Mile Rd & W. Park Drive Signalized	WB 6.6 A		16.0 B	1.1 A	WB 28.1 C		43.6 D	1.1 A
	SB 30.4 C			30.4 C	SB 46.4 D			46.4 D
	Overall	**18.3**	**LOS**	**B**	**Overall**	**35.5**	**LOS**	**D**
2. 12 Mile Rd & Beck Rd Signalized	WB 41.8 D	42.4 D		35.7 D	WB 144.8 F	158.7 F		29.0 C
	NB 41.7 D		39.0 D	44.6 D	NB 41.5 D		42.9 D	39.3 D
	SB 18.3 B	34.4 C	16.3 B		SB 26.4 C	32.8 C	25.8 C	
	Overall	**34.3**	**LOS**	**C**	**Overall**	**74.2**	**LOS**	**E**
3. EB 12 Mile Rd & Keystone Medical Center Dr STOP Unsignalized	EB Free				EB Free			
	NB 18.1 C			18.1 C	NB 13.2 B			13.2 B
4. WB 12 Mile Rd & EB to WB XO E. of Park Drive Signalized	WB 3.7 A		3.7 A		WB 6.5 A		6.5 A	
	NB 49.6 D	49.6 D			NB 51.2 D	51.2 D		
	Overall	**19.4**	**LOS**	**B**	**Overall**	**14.5**	**LOS**	**B**
5. EB 12 Mile Rd & WB to EB XO W. of Park Drive Signalized	EB 19.8 B		19.8 B		EB 17.1 B		17.1 B	
	SB 25.2 C	25.2 C			SB 48.5 D	48.5 D		
	Overall	**21.6**	**LOS**	**C**	**Overall**	**31.4**	**LOS**	**C**

Review of network simulations shows long vehicle queues for the WB left turn movement at the intersection of 12 Mile Road & Beck Road during the PM peak hour. This queue does not dissipate and is present throughout the duration of the peak period. Additionally, a long vehicle queue is observed for the SB right-turn movement from Park Drive to WB 12 Mile Road during the PM peak hour.

FUTURE IMPROVEMENT

In order to improve traffic operations to a LOS D or better for all intersection approaches and movements in the background condition, mitigation measures were investigated. First, signal timing adjustments were investigated at the intersections of 12 Mile Road with Beck Road and W. Park Drive. However, it was determined that signal timing adjustments at these intersections alone would not address the operational deficiencies previously identified. Subsequently, geometric improvements were investigated.

At the intersection of 12 Mile Road & Beck Road, RCOC should consider the construction of a SB left-turn lane within the existing concrete median area and convert the existing SB left-turn lane into a through lane. This will help to increase capacity at the intersection, particularly during the PM peak hour, allowing additional green time to be given to the WB approach.

At the intersection of WB 12 Mile Road & W. Park Drive, RCOC should consider constructing dual right turn lanes on the SB Park Drive approach as part of the planned roadway improvement project to increase capacity and shorten vehicle queues. With these improvements, all study intersection approaches and movements would operate acceptably at a LOS D or better as summarized in **Table *4***. Additionally, review of network simulations indicate acceptable traffic operations and significant vehicle queues are not observed. As these improvements are not currently planned, the future conditions analysis does not assume they are in place.

Table 4: Background Traffic Conditions with Improvements

Intersection	AM Peak Hour Approach					PM Peak Hour Approach				
1. WB 12 Mile Rd & W. Park Drive Signalized	WB	4.2 A		9.6 A	1.1 A	WB	9.9 A		15.0 B	1.1 A
	SB	26.5 C			26.5 C	SB	30.0 C			30.0 C
	Overall		**15.2**	**LOS**	**B**	**Overall**		**18.1**	**LOS**	**B**
2. 12 Mile Rd & Beck Rd Signalized	WB	46.4 D	47.5 D		36.2 D	WB	37.7 D	39.6 D		21.4 C
	NB	37.9 D		35.9 D	40.1 D	NB	44.3 D		46.0 D	41.5 D
	SB	9.8 A	37.7 D	6.3 A		SB	19.8 B	39.7 D	18.2 B	
	Overall		**30.1**	**LOS**	**C**	**Overall**		**35.0**	**LOS**	**C**

SITE TRIP GENERATION

The number of AM and PM peak hour vehicle trips that would be generated by the proposed development were forecast based on the rates and equations published by ITE in *Trip Generation, 10th Edition*. The site trip generation forecast for the proposed facility expansion is shown in **Table 5**.

Table 5: Site Trip Generation

Land Use	ITE Code	Amount	Units	Average Daily	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Research and Development Center	760	98,650	SF	1,214	31	10	41	7	41	48

The vehicle trips that would be generated by the proposed expansion were assigned to the study road network based on existing traffic patterns and ITE methodologies. These methods indicate that new site trips will enter the network in the direction of current traffic patterns and return to their direction of origin. Existing traffic patterns are assumed to accurately reflect the relationship between residential areas and employment centers in this region, as well as traffic flows specific to this site. Specifically, employee passenger car vehicle trips during the weekday AM and PM peaks are assumed to travel with a pattern that is gravitated towards entering the site in the morning the Beck Road & I-96 interchange and leaving in the afternoon towards the Beck Road & I-96 interchange. Given this, traffic volumes on the study road network indicate the directional distributions for site-generated traffic summarized in **Table 6**.

Table 6: Site Trip Distribution

To/From	Via	AM	PM
South	Beck Road	60%	60%
North	Beck Road	10%	10%
North	W. Park Drive	17%	11%
East	12 Mile Road	13%	19%
		100%	100%

The site-generated vehicle trips were assigned to the study road network based on this trip distribution pattern as shown on the attached **Figure 3**. The site-generated trips were added to the background traffic volumes to calculate the future peak hour traffic volumes shown on the attached **Figure 4**.

AUXILIARY LANE ANALYSIS

In order to determine the configuration of the proposed site driveway with 12 Mile Road, warrants for right turn lanes were evaluated in accordance with the RCOC *Permit Specifications and Guidelines*. Evaluation of the forecast site traffic volume assignments versus 24-hour volumes on 12 Mile Road indicate that a right turn taper only is warranted at the site driveway. The applicable warrant evaluation is attached.

FUTURE TRAFFIC OPERATIONS

Future peak hour vehicle delays and LOS with the proposed development were calculated based on the planned lane configurations and traffic control, the proposed site access plan, and future traffic volumes. The results of the future conditions analysis are summarized in **Table 7.**

Table 7: Future Traffic Conditions

Intersection	AM Peak Hour Approach					PM Peak Hour Approach				
1. WB 12 Mile Rd & W. Park Drive Signalized	WB	6.8 A		16.5 B	1.1 A	WB	27.8 C		43.3 D	1.1 A
	SB	30.1 C			30.1 C	SB	47.3 D			47.3 D
	Overall		**18.3**	**LOS**	**B**	**Overall**		**35.7**	**LOS**	**D**
2. 12 Mile Rd & Beck Rd Signalized	WB	41.6 D	42.3 D		35.5 D	WB	154.9 F	170.1 F		29.1 C
	NB	41.9 D		38.8 D	45.2 D	NB	41.5 D		42.9 D	39.4 D
	SB	18.6 B	35.0 C	16.6 B		SB	26.4 C	32.9 C	25.8 C	
	Overall		**34.5**	**LOS**	**C**	**Overall**		**78.4**	**LOS**	**E**
3. EB 12 Mile Rd & Keystone Medical Center Dr STOP Unsignalized	EB	Free				EB	Free			
	NB	18.2 C			18.2 C	NB	13.3 B			13.3 B
4. WB 12 Mile Rd & EB to WB XO E. of Park Drive Signalized	WB	3.7 A		3.7 A		WB	6.6 A		6.6 A	
	NB	49.7 D	49.7 D			NB	51.4 D	51.4 D		
	Overall		**19.5**	**LOS**	**B**	**Overall**		**14.8**	**LOS**	**B**
5. EB 12 Mile Rd & WB to EB XO W. of Park Drive Signalized	EB	19.7 B		19.7 B		EB	17.3 B		17.3 B	
	SB	25.3 C	25.3 C			SB	47.7 D	47.8 D		
	Overall		**21.5**	**LOS**	**C**	**Overall**		**31.0**	**LOS**	**C**
6. WB 12 Mile Rd & EB to WB XO W. of Park Drive STOP Unsignalized	WB	Free				WB	Free			
	NB	10.5 B			10.5 B	NB	14.8 B			14.8 B
7. EB 12 Mile Rd & WB to EB XO E. of Beck Road STOP Unsignalized	EB	Free				EB	Free			
	SB	14.0 B			14.0 B	SB	10.7 B			10.7 B
8. WB 12 Mile Rd & Site Drive STOP Unsignalized	WB	Free				WB	Free			
	SB	10.2 B			10.2 B	SB	15.6 C			15.6 C

The results of this analysis indicate that all study intersection approaches and movements would continue to operate in a manner similar to background conditions. Comparison of background and future vehicle

delays indicate little appreciable difference (less than four seconds per vehicle overall) in traffic operations at the signalized study intersections. ***Therefore, this project would have no discernable impact on the adjacent road network.***

Future traffic operations were also evaluated at the proposed site driveway to 12 Mile Road. The results of this analysis indicate all approaches and movements would operate acceptably at a LOS C or better during both peak periods. Review of network simulations indicate future traffic operations which are similar to background conditions with long vehicle queues continued to be observed for the WB approach at the intersection of 12 Mile Road & Beck Road during the PM peak hour. This queue does not dissipate and is present throughout the duration of the peak hour.

At the proposed site driveway to 12 Mile Road, network simulations indicate acceptable traffic operations during the AM peak hour with vehicles able to enter and exit the site with minimal delays. During the PM peak hour, the WB vehicle queue from the intersection of 12 Mile Road & Beck Road frequently extends back past the proposed site driveway blocking driveway movements.

FUTURE IMPROVEMENTS

In order to mitigate traffic operations in the future condition at the intersection of 12 Mile Road & Beck Road during the PM peak hour, signal cycle length and timing changes were investigated. The results of this analysis indicate that minor signal timing adjustments at the intersection would provide improved overall operations from LOS E to an acceptable LOS D as summarized in **Table 8**.

Table 8: Future Traffic Conditions with Improvements

Intersection	AM Peak Hour Approach					PM Peak Hour Approach				
2. 12 Mile Rd and Beck Rd	WB	41.6 D	42.3 D		35.5 D	WB	59.7 E	64.1 F		23.6 C
	NB	41.9 D		38.8 D	45.2 D	NB	42.8 D		44.2 D	40.4 D
Signalized	SB	18.6 B	35.0 C	16.0 B		SB	47.9 D	38.1 D	48.7 D	
	Overall		**34.5**	**LOS**	**C**	**Overall**		**50.4**	**LOS**	**D**

Review of network simulations with the optimized signal timings continues to indicate long vehicle queues for several approaches and movements at the intersection during the PM peak hour; however, traffic operations for the proposed site driveway to 12 Mile Road would be acceptable as WB vehicle queues from the signalized intersection of 12 Mile Road & Beck Road would no longer block the proposed site driveway.

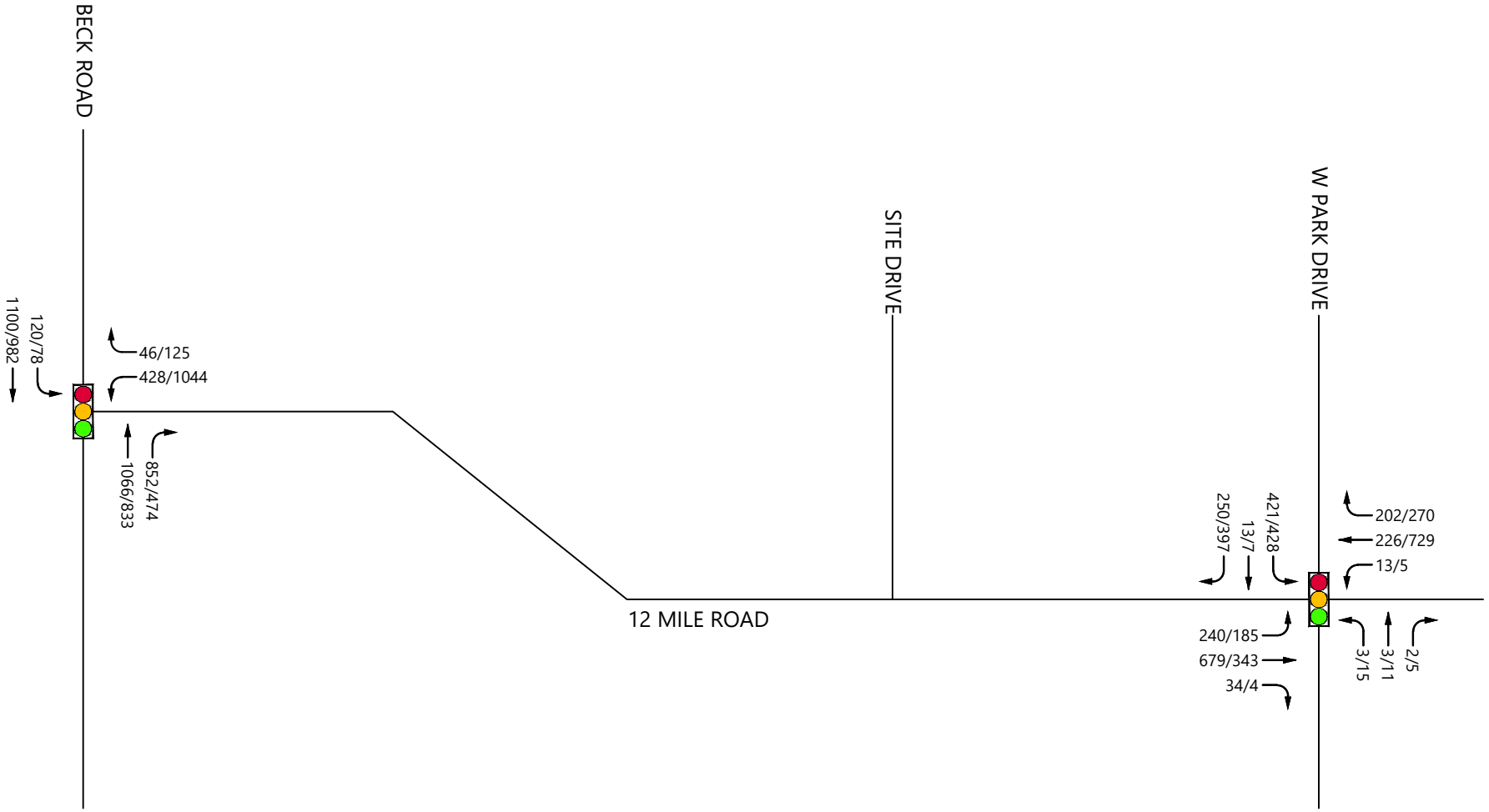
CONCLUSIONS

Based on the information outlined herein regarding the proposed development and resulting traffic operations, there would be no discernable impact to traffic operations on the adjacent road network. With minor signal timing optimization at the study intersections, the site driveway to 12 Mile Road will also operate acceptably. This conclusion is based on the following key items:

- The signalized study intersection of 12 Mile Road & W. Park Drive currently operates at an overall LOS E during the PM peak hour. Additionally, several study intersection approaches and movements currently operate at a LOS E or F.
- Additional traffic volumes from background developments and ambient traffic growth will result in degraded operations at the intersection of 12 Mile Road & Beck Road.
- Future planned roadway improvements to reconstruct the study section of 12 Mile Road to a median divided four-lane boulevard with indirect left turns will help to improve intersection operations at the intersection of 12 Mile Road & W. Park Drive; however, RCOC should consider constructing dual right turn lanes on the SB Park Drive approach as part of the planned roadway improvements.
- Future vehicle delays indicate little appreciable difference (less than four seconds per vehicle overall) in traffic operations at the signalized study intersections relative to background conditions.
- All approaches and movements at the STOP controlled site driveway approach to 12 Mile Road will operate at a LOS C or better during the peak hours.
- A right-turn taper only is warranted at the proposed site driveway.

The referenced traffic data, calculations, and analysis results are attached. Please direct any questions regarding this memorandum to Bergmann.

Attached: Figures 1 – 4
Existing Traffic Volume Data
Synchro and SimTraffic Results
Right Turn Lane Warrant



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AM/PM PEAK HOUR VOLUME

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Figure 1
Existing 2019 Traffic Volumes

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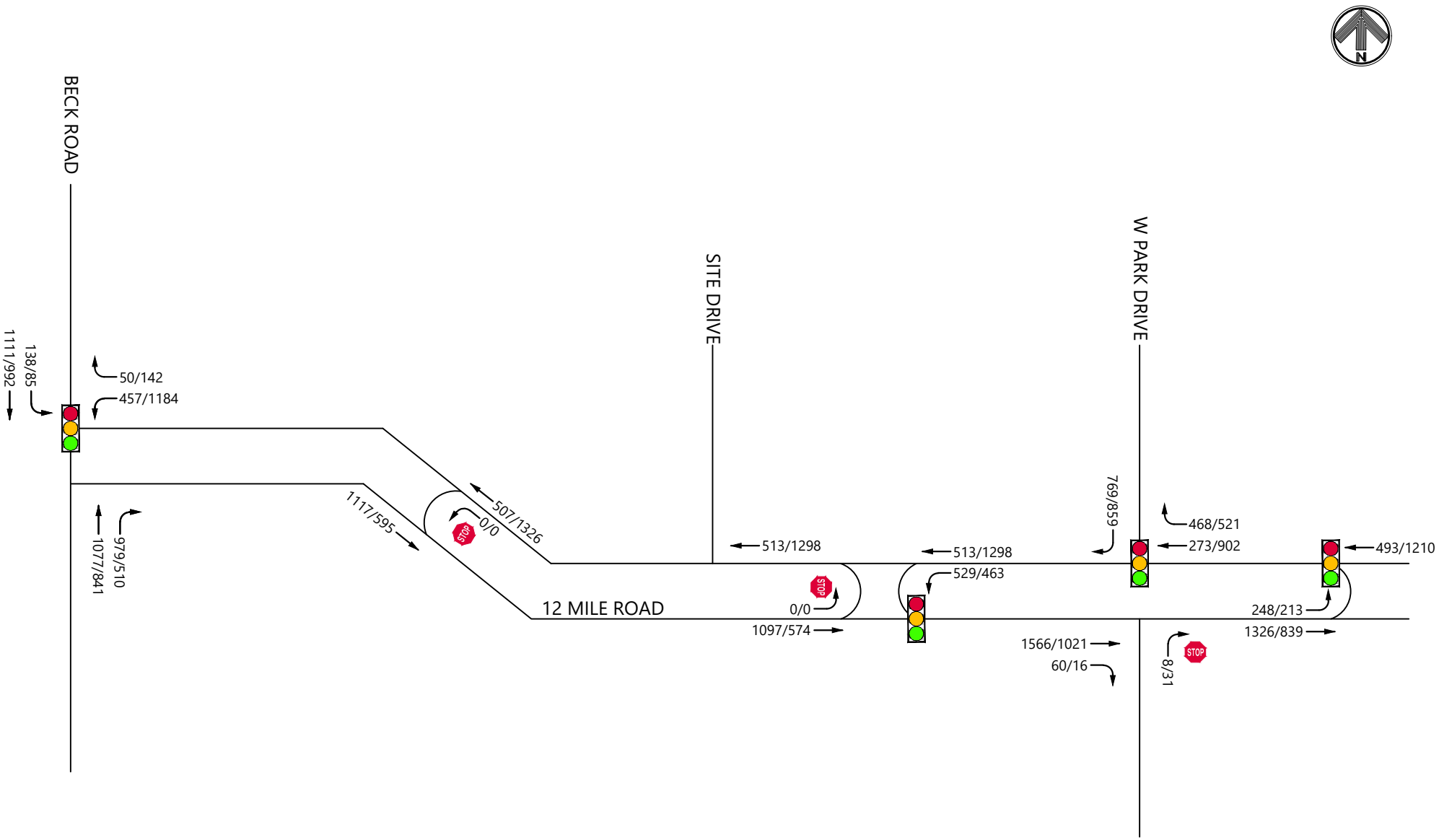

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Figure 2
Background 2021 Traffic Volumes

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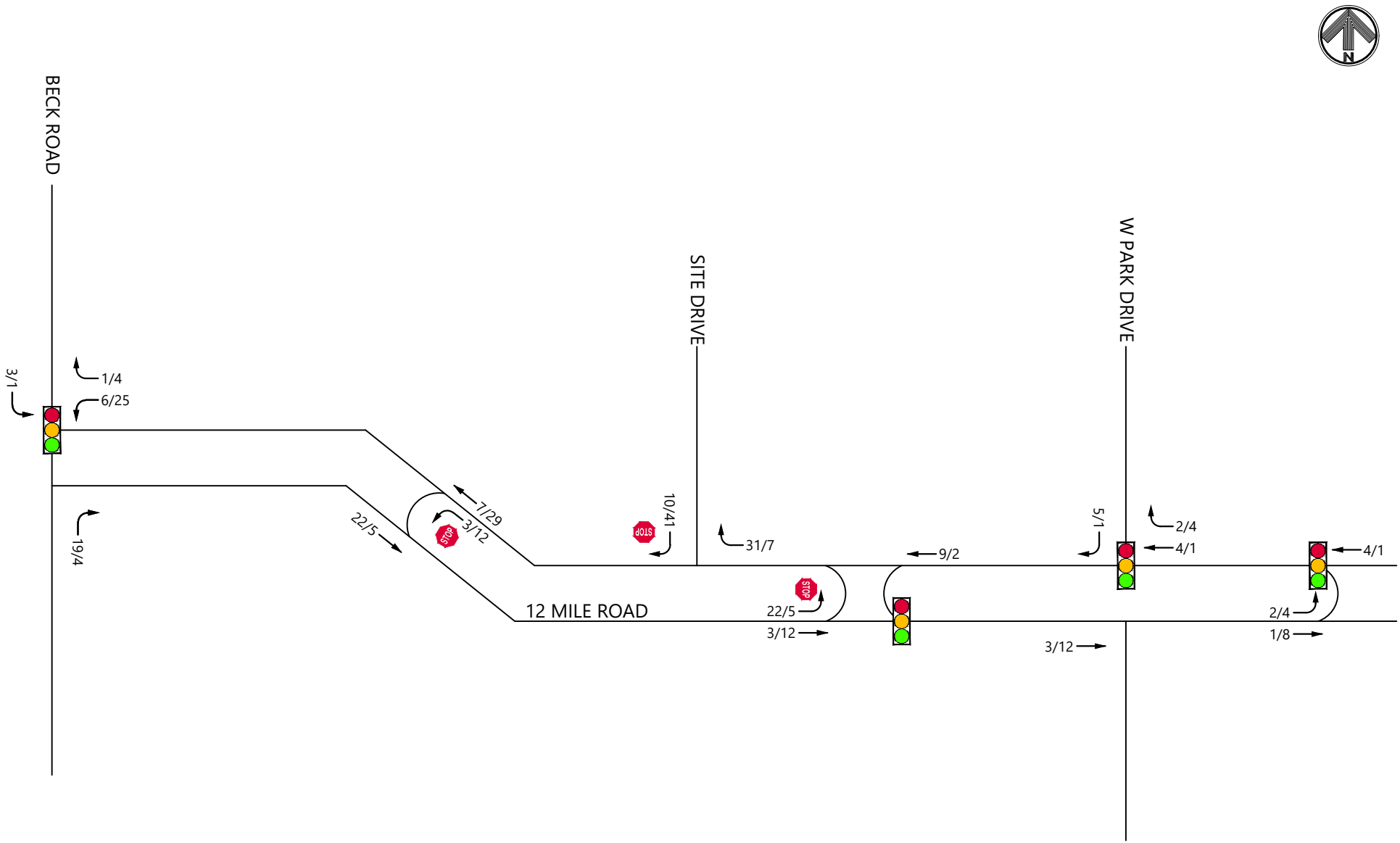

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AM/PM PEAK HOUR VOLUME

Great Oaks R&D Facility
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Figure 3
Site-Generated Traffic Volumes

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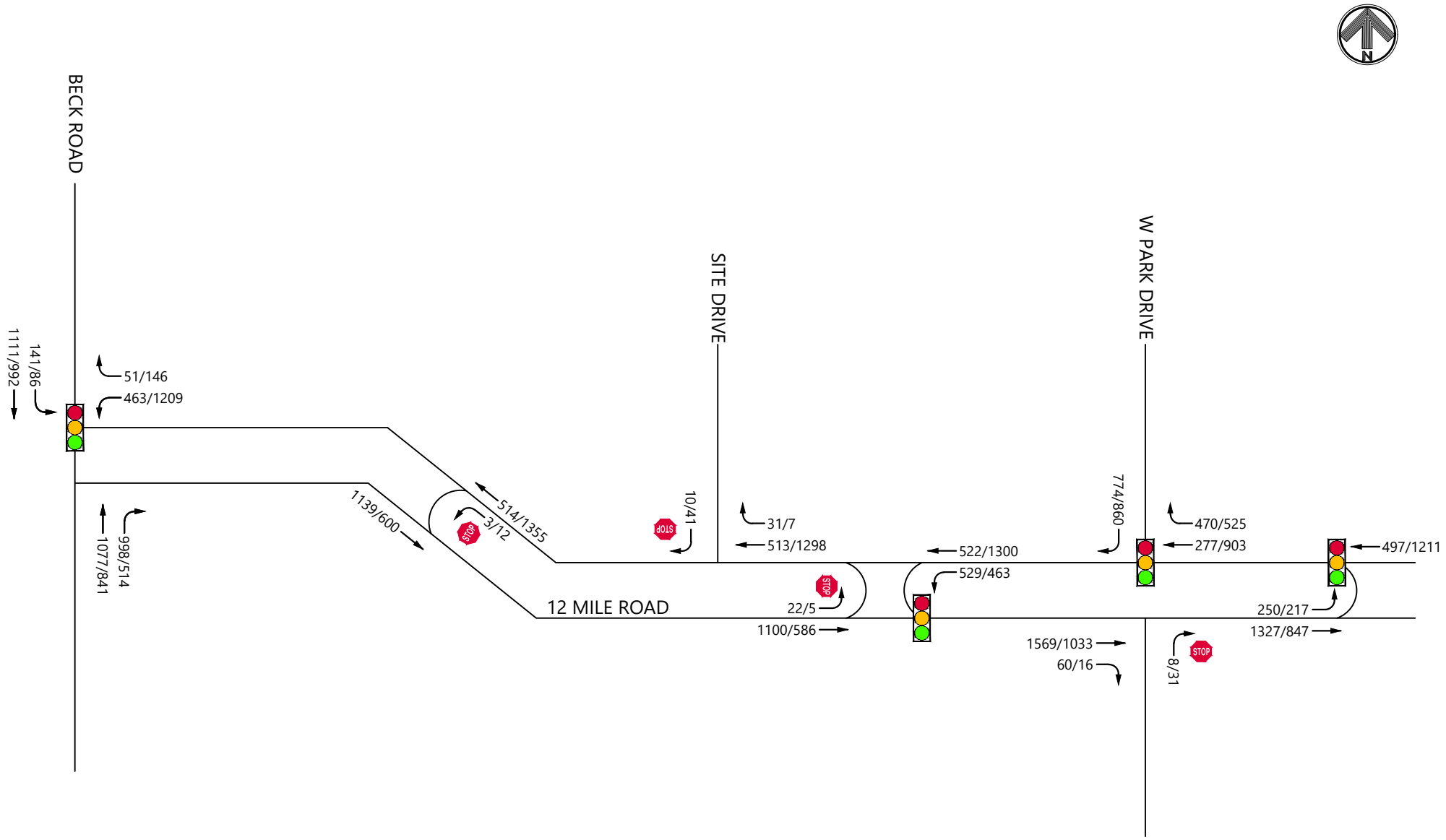

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AM/PM PEAK HOUR VOLUME

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Figure 4
Future Traffic Volumes

PAGE NO.	SCALE	DATE	
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Study Name Beck Rd & 12 Mile Rd AM
Start Date 06/04/2019
Start Time 6:00 AM
Site Code 1241-6483-00/0100/0006

Type Road
Classification Totals

	Beck Road				Twelve Mile Road				Beck Road			
	Southbound				Westbound				Northbound			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
6:00 AM	0	130	9	0	1	0	29	0	47	111	0	0
6:15 AM	0	172	16	0	3	0	28	0	64	154	0	0
6:30 AM	0	174	16	0	4	0	76	0	118	194	0	0
6:45 AM	0	253	20	0	7	0	73	0	144	267	0	0
7:00 AM	0	287	26	0	11	0	81	0	167	218	0	0
7:15 AM	0	282	20	0	6	0	100	0	202	212	0	0
7:30 AM	0	295	25	0	16	0	103	0	195	247	0	0
7:45 AM	0	262	35	0	7	0	112	0	212	313	0	0
8:00 AM	0	294	18	0	10	0	123	0	197	268	0	0
8:15 AM	0	249	42	0	13	0	90	0	248	238	0	1
8:30 AM	0	287	24	0	15	0	118	0	196	204	0	0
8:45 AM	0	240	36	0	19	0	89	0	196	230	0	0

Study Name Beck Rd & 12 Mile Rd PM
Start Date 06/04/2019
Start Time 4:00 PM
Site Code 1241-6483-00/0100/0006

Type Road
Classification Totals

	Beck Road				Twelve Mile Road				Beck Road			
	Southbound				Westbound				Northbound			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
4:00 PM	0	263	12	0	32	0	207	0	104	209	0	0
4:15 PM	0	251	20	0	40	0	243	0	118	212	0	0
4:30 PM	0	238	19	0	28	0	276	0	111	224	0	0
4:45 PM	0	246	21	0	28	0	240	0	129	194	0	0
5:00 PM	0	247	18	0	29	0	285	0	116	203	0	1
5:15 PM	0	240	22	0	28	0	245	0	115	229	0	0
5:30 PM	0	265	28	0	35	0	226	0	107	220	0	0
5:45 PM	0	212	17	0	30	0	226	0	106	218	0	0
6:00 PM	0	182	18	0	30	0	227	0	102	201	0	0
6:15 PM	0	202	26	0	47	0	158	0	99	234	0	0
6:30 PM	0	157	19	0	38	0	137	0	97	254	0	0
6:45 PM	0	139	25	0	23	0	113	0	95	227	0	0

Study Name W Park Dr & 12 Mile Rd AM
Start Date 06/04/2019
Start Time 6:00 AM
Site Code 1241-6483-00/0100/0006

Type Road
Classification Totals

	W Park Dr				Twelve Mile Rd				Parking Lot Drwy				Twelve Mile Rd			
	Southbound				Westbound				Northbound				Eastbound			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
6:00 AM	21	0	20	0	8	8	0	0	0	0	0	0	1	38	12	0
6:15 AM	19	1	33	0	11	11	1	0	0	0	0	0	0	49	16	0
6:30 AM	59	1	63	0	27	19	3	0	0	0	0	0	5	60	41	0
6:45 AM	45	2	71	0	31	38	2	0	0	0	0	0	6	76	59	0
7:00 AM	55	1	69	0	16	34	0	0	0	0	0	0	2	128	54	0
7:15 AM	64	1	102	0	37	42	2	0	1	0	1	0	7	152	58	0
7:30 AM	69	1	99	0	38	45	2	0	0	0	1	0	8	147	57	0
7:45 AM	71	4	97	0	68	54	0	0	0	0	1	0	9	160	71	0
8:00 AM	71	1	91	0	53	67	5	0	0	2	0	0	6	132	58	0
8:15 AM	49	5	117	0	46	43	4	0	0	1	0	0	7	203	62	0
8:30 AM	59	3	116	0	35	62	4	0	2	0	0	0	12	184	49	0
8:45 AM	47	0	102	0	38	59	3	0	0	1	0	0	6	182	44	0

Study Name W Park Dr & 12 Mile Rd PM
Start Date 06/04/2019
Start Time 4:00 PM
Site Code 1241-6483-00/0100/0006

Type Road
Classification Totals

	W Park Dr				Twelve Mile Rd				Parking Lot Drwy				Twelve Mile Rd			
	Southbound				Westbound				Northbound				Eastbound			
Start Time	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn	Right	Thru	Left	U-Turn
4:00 PM	79	1	79	0	67	165	2	0	0	0	1	0	4	94	29	0
4:15 PM	79	1	74	0	53	187	3	0	3	3	4	0	3	89	50	0
4:30 PM	94	0	85	0	72	190	1	0	2	2	5	0	1	76	38	0
4:45 PM	73	3	112	0	61	181	1	0	0	3	3	0	1	93	47	0
5:00 PM	132	3	112	0	72	172	1	0	2	3	5	0	1	82	61	0
5:15 PM	98	1	119	0	65	186	2	0	1	3	2	0	1	92	39	0
5:30 PM	68	0	79	0	66	174	1	0	1	1	2	0	0	99	49	0
5:45 PM	61	0	61	0	84	184	3	0	1	0	4	0	1	87	44	0
6:00 PM	55	0	48	0	91	176	0	0	1	2	4	0	0	76	36	0
6:15 PM	27	0	57	0	90	180	1	0	0	0	0	0	2	83	36	0
6:30 PM	40	0	54	0	97	122	0	0	0	0	1	0	0	70	32	0
6:45 PM	36	1	64	0	56	97	0	0	0	1	0	0	0	79	42	0

Level of Service Criteria for Signalized Intersections

Control Delay (s/veh)	LOS by Volume-to-Capacity Ratio	
	≤ 1.0	> 1.0
≤10	A	F
>10-20	B	F
>20-35	C	F
>35-55	D	F
>55-80	E	F
>80	F	F

LOS A describes operations with a control delay of 10 s/veh or less and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable or the cycle length is very short. If LOS A is the result of favorable progression, most vehicles arrive during the green indication and travel through the intersection without stopping.

LOS B describes operations with control delay between 10 and 20 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.

LOS C describes operations with control delay between 20 and 35 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when progression is favorable or the cycle length is moderate. individual cycle failures (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.

LOS D describes operations with control delay between 35 and 55 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.

LOS E describes operations with control delay between 55 and 80 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.

LOS F describes operations with control delay exceeding 80 s/veh or a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.

A lane group can incur a delay less than 80 s/veh when the volume-to-capacity ratio exceeds 1.0. This condition typically occurs when the cycle length is short, the signal progression is favorable, or both. As a result, both the delay and volume-to-capacity ratio are considered when lane group LOS is established. A ratio of 1.0 or more indicates cycle capacity is fully utilized and represents failure from a capacity perspective (just as delay in excess of 80 s/veh represents failure from a delay perspective).

Source: Highway Capacity Manual, 6th Edition. Transportation Research Board, National Research Council.

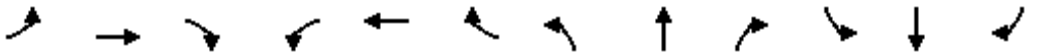
Level of Service Criteria for Two-Way-Stop-Controlled Intersections

Control Delay (s/veh)	LOS by Volume-to-Capacity Ratio	
	≤ 1.0	> 1.0
≤10	A	F
>10-15	B	F
>15-25	C	F
>25-35	D	F
>35-50	E	F
>50	F	F

LOS for TWSC intersection is determined by the computed or measured control delay. For motor vehicles, LOS is determined for each minor-street movement (or shared movement), as well as the major-street left turns. LOS is not defined for the intersection as a whole or for major-street approaches for three primary reasons: (a) major street through vehicles are assumed to experience zero delay; (b) the disproportionate number of major-street through vehicles at a typical TWSC intersection skews the weighted average of all movements, resulting in very low overall average delay for all vehicles; and (c) the resulting low delay can mask LOS deficiencies of minor movements. LOS F is assigned to a movement if its volume-to-capacity ratio exceeds 1.0, regardless of the control delay.

The LOS criteria for TWSC intersections differ somewhat from the criteria used for signalized intersections, primarily because user perceptions differ among transportation facility types. The expectation is that a signalized intersection is designed to carry higher traffic volumes and will present greater delay than an unsignalized intersection. Unsignalized intersections are also associated with more uncertainty for users, as delays are less predictable than they are at signals.

Source: Highway Capacity Manual, 6th Edition. Transportation Research Board, National Research Council.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	240	679	34	13	226	202	3	3	2	421	13	250
Future Volume (veh/h)	240	679	34	13	226	202	3	3	2	421	13	250
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	273	772	39	15	257	230	4	4	3	443	14	263
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.67	0.67	0.67	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	563	949	804	246	834	707	254	316	237	495	26	484
Arrive On Green	0.10	0.48	0.48	0.04	0.42	0.42	0.30	0.30	0.30	0.30	0.30	0.30
Sat Flow, veh/h	1875	1969	1668	1875	1969	1668	1102	1044	783	1409	85	1596
Grp Volume(v), veh/h	273	772	39	15	257	230	4	0	7	443	0	277
Grp Sat Flow(s),veh/h/ln	1875	1969	1668	1875	1969	1668	1102	0	1828	1409	0	1681
Q Serve(g_s), s	7.8	33.4	1.2	0.4	8.7	9.2	0.3	0.0	0.3	30.0	0.0	13.7
Cycle Q Clear(g_c), s	7.8	33.4	1.2	0.4	8.7	9.2	14.1	0.0	0.3	30.3	0.0	13.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.43	1.00		0.95
Lane Grp Cap(c), veh/h	563	949	804	246	834	707	254	0	554	495	0	509
V/C Ratio(X)	0.49	0.81	0.05	0.06	0.31	0.33	0.02	0.00	0.01	0.89	0.00	0.54
Avail Cap(c_a), veh/h	568	949	804	361	834	707	254	0	554	495	0	509
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.1	22.1	13.7	18.4	19.1	19.3	34.9	0.0	24.4	35.7	0.0	29.1
Incr Delay (d2), s/veh	0.6	7.6	0.1	0.1	1.0	1.2	0.0	0.0	0.0	18.6	0.0	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	15.7	0.5	0.2	3.9	3.6	0.1	0.0	0.1	12.8	0.0	5.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.8	29.7	13.9	18.5	20.1	20.5	35.0	0.0	24.4	54.2	0.0	30.3
LnGrp LOS	B	C	B	B	C	C	C	A	C	D	A	C
Approach Vol, veh/h		1084			502			11			720	
Approach Delay, s/veh		25.1			20.2			28.2			45.0	
Approach LOS		C			C			C			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	15.7	48.3		36.0	9.9	54.1		36.0				
Change Period (Y+Rc), s	* 5.9	* 5.9		* 5.7	* 5.9	* 5.9		* 5.7				
Max Green Setting (Gmax), s	* 10	* 42		* 30	* 10	* 42		* 30				
Max Q Clear Time (g_c+I1), s	9.8	11.2		32.3	2.4	35.4		16.1				
Green Ext Time (p_c), s	0.0	2.1		0.0	0.0	2.8		0.0				

Intersection Summary		
HCM 6th Ctrl Delay		30.2
HCM 6th LOS		C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

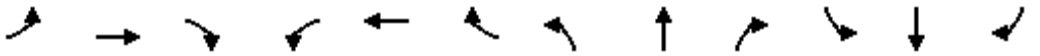
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	428	46	1066	852	120	1100
Future Volume (veh/h)	428	46	1066	852	120	1100
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	481	52	1171	936	126	1158
Peak Hour Factor	0.89	0.89	0.91	0.91	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	596	273	1582	1242	454	1418
Arrive On Green	0.16	0.16	0.14	0.14	0.24	0.72
Sat Flow, veh/h	3638	1668	3839	2937	1875	1969
Grp Volume(v), veh/h	481	52	1171	936	126	1158
Grp Sat Flow(s),veh/h/ln	1819	1668	1870	1468	1875	1969
Q Serve(g_s), s	12.7	2.7	30.0	30.7	5.5	40.0
Cycle Q Clear(g_c), s	12.7	2.7	30.0	30.7	5.5	40.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	596	273	1582	1242	454	1418
V/C Ratio(X)	0.81	0.19	0.74	0.75	0.28	0.82
Avail Cap(c_a), veh/h	1088	499	1739	1365	454	1418
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.3	36.1	37.8	38.0	30.8	9.5
Incr Delay (d2), s/veh	2.6	0.3	3.2	4.3	0.3	5.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	1.1	15.6	12.7	2.4	14.6
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	42.9	36.4	40.9	42.3	31.1	14.8
LnGrp LOS	D	D	D	D	C	B
Approach Vol, veh/h	533		2107			1284
Approach Delay, s/veh	42.3		41.5			16.4
Approach LOS	D		D			B

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	29.7	47.8		22.5		77.5
Change Period (Y+Rc), s	* 5.5	* 5.5		* 6.1		* 5.5
Max Green Setting (Gmax), s	* 6.5	* 47		* 30		* 59
Max Q Clear Time (g_c+I1), s	7.5	32.7		14.7		42.0
Green Ext Time (p_c), s	0.0	9.6		1.6		8.8

Intersection Summary	
HCM 6th Ctrl Delay	33.4
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	185	343	4	5	729	270	15	11	5	428	7	397
Future Volume (veh/h)	185	343	4	5	729	270	15	11	5	428	7	397
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	201	373	4	5	767	284	19	14	6	510	8	473
Peak Hour Factor	0.92	0.92	0.92	0.95	0.95	0.95	0.78	0.78	0.78	0.84	0.84	0.84
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	313	1067	904	584	1005	851	72	318	136	399	7	400
Arrive On Green	0.07	0.54	0.54	0.04	0.51	0.51	0.24	0.24	0.24	0.24	0.24	0.24
Sat Flow, veh/h	1875	1969	1668	1875	1969	1668	914	1308	560	1392	28	1645
Grp Volume(v), veh/h	201	373	4	5	767	284	19	0	20	510	0	481
Grp Sat Flow(s),veh/h/ln	1875	1969	1668	1875	1969	1668	914	0	1868	1392	0	1673
Q Serve(g_s), s	5.0	10.7	0.1	0.1	31.3	10.0	0.0	0.0	0.8	23.5	0.0	24.3
Cycle Q Clear(g_c), s	5.0	10.7	0.1	0.1	31.3	10.0	24.3	0.0	0.8	24.3	0.0	24.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.30	1.00		0.98
Lane Grp Cap(c), veh/h	313	1067	904	584	1005	851	72	0	454	399	0	406
V/C Ratio(X)	0.64	0.35	0.00	0.01	0.76	0.33	0.26	0.00	0.04	1.28	0.00	1.18
Avail Cap(c_a), veh/h	368	1067	904	699	1005	851	72	0	454	399	0	406
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.6	12.9	10.5	10.4	19.6	14.5	50.0	0.0	29.0	40.4	0.0	37.9
Incr Delay (d2), s/veh	2.9	0.9	0.0	0.0	5.5	1.1	1.9	0.0	0.0	143.4	0.0	105.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	4.5	0.0	0.0	14.1	3.7	0.5	0.0	0.4	25.5	0.0	21.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.5	13.8	10.5	10.4	25.1	15.5	51.9	0.0	29.0	183.8	0.0	142.8
LnGrp LOS	C	B	B	B	C	B	D	A	C	F	A	F
Approach Vol, veh/h		578			1056			39			991	
Approach Delay, s/veh		16.1			22.5			40.2			163.9	
Approach LOS		B			C			D			F	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	13.1	56.9		30.0	9.9	60.1		30.0				
Change Period (Y+Rc), s	* 5.9	* 5.9		* 5.7	* 5.9	* 5.9		* 5.7				
Max Green Setting (Gmax), s	* 10	* 48		* 24	* 10	* 48		* 24				
Max Q Clear Time (g_c+I1), s	7.0	33.3		26.3	2.1	12.7		26.3				
Green Ext Time (p_c), s	0.2	5.2		0.0	0.0	2.2		0.0				

Intersection Summary		
HCM 6th Ctrl Delay		74.0
HCM 6th LOS		E

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1044	125	833	474	78	982
Future Volume (veh/h)	1044	125	833	474	78	982
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	1123	134	877	499	82	1034
Peak Hour Factor	0.93	0.93	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	1015	466	1244	977	408	1191
Arrive On Green	0.28	0.28	0.11	0.11	0.22	0.61
Sat Flow, veh/h	3638	1668	3839	2937	1875	1969
Grp Volume(v), veh/h	1123	134	877	499	82	1034
Grp Sat Flow(s),veh/h/ln	1819	1668	1870	1468	1875	1969
Q Serve(g_s), s	27.9	6.3	22.6	16.0	3.6	43.7
Cycle Q Clear(g_c), s	27.9	6.3	22.6	16.0	3.6	43.7
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	1015	466	1244	977	408	1191
V/C Ratio(X)	1.11	0.29	0.70	0.51	0.20	0.87
Avail Cap(c_a), veh/h	1015	466	1814	1424	408	1191
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.0	28.3	39.8	36.8	32.0	16.4
Incr Delay (d2), s/veh	62.1	0.3	3.4	1.9	0.2	8.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.3	2.4	11.8	6.5	1.6	19.5
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	98.2	28.6	43.1	38.7	32.3	25.1
LnGrp LOS	F	C	D	D	C	C
Approach Vol, veh/h	1257		1376			1116
Approach Delay, s/veh	90.8		41.6			25.6
Approach LOS	F		D			C

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	27.2	38.8		34.0		66.0
Change Period (Y+Rc), s	* 5.5	* 5.5		* 6.1		* 5.5
Max Green Setting (Gmax), s	* 6.5	* 49		* 28		* 61
Max Q Clear Time (g_c+I1), s	5.6	24.6		29.9		45.7
Green Ext Time (p_c), s	0.0	8.6		0.0		6.9

Intersection Summary	
HCM 6th Ctrl Delay	53.3
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

1: Keystone Medical Center Drive/Park Drive & Twelve Mile Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Exited	236	668	32	12	232	200	1	2	3	425	12	241
Hourly Exit Rate	236	668	32	12	232	200	1	2	3	425	12	241
Input Volume	240	681	34	13	226	202	3	3	2	421	13	250
% of Volume	98	98	95	94	103	99	31	62	133	101	91	96

1: Keystone Medical Center Drive/Park Drive & Twelve Mile Road Performance by movement

Movement	All
Vehicles Exited	2064
Hourly Exit Rate	2064
Input Volume	2089
% of Volume	99

2: Beck Road & Twelve Mile Road Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Vehicles Exited	425	44	1065	834	110	1089	3567
Hourly Exit Rate	425	44	1065	834	110	1089	3567
Input Volume	428	46	1066	852	120	1100	3612
% of Volume	99	96	100	98	92	99	99

13: WB I-96 On-Ramp Performance by movement

Movement	WBT	NWL	All
Vehicles Exited	231	218	449
Hourly Exit Rate	231	218	449
Input Volume	237	228	465
% of Volume	98	96	97

19: WB I-96 Off-Ramp Performance by movement

Movement	WBL	WBT	All
Vehicles Exited	484	704	1188
Hourly Exit Rate	484	704	1188
Input Volume	499	716	1214
% of Volume	97	98	98

21: EB I-96 Off-Ramp Performance by movement

Movement	EBL	EBT	All
Vehicles Exited	544	397	941
Hourly Exit Rate	544	397	941
Input Volume	552	394	946
% of Volume	99	101	100

7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-Ramp Perfor

Movement	NBL	NBT	SBL	SBT	NEL	SWL	All
Vehicles Exited	218	635	608	675	551	489	3176
Hourly Exit Rate	218	635	608	675	551	489	3176
Input Volume	228	650	600	691	552	499	3220
% of Volume	96	98	101	98	100	98	99

7002: Beck Road & WB I-96 Off-Ramp Performance by movement

Movement	WBR	NBT	SBT	All
Vehicles Exited	705	1196	1283	3184
Hourly Exit Rate	705	1196	1283	3184
Input Volume	716	1212	1291	3218
% of Volume	98	99	99	99

7003: Beck Road & EB I-96 Off-Ramp Performance by movement

Movement	EBR	NBT	SBT	All
Vehicles Exited	395	853	1162	2410
Hourly Exit Rate	395	853	1162	2410
Input Volume	394	878	1191	2462
% of Volume	100	97	98	98

7004: Beck Road & WB I-96 On-Ramp Performance by movement

Movement	NBT	SBT	SBR	All
Vehicles Exited	1901	1294	232	3427
Hourly Exit Rate	1901	1294	232	3427
Input Volume	1925	1301	237	3463
% of Volume	99	99	98	99

8001: Beck Road Performance by movement

Movement	NBT	SBT	All
Vehicles Exited	1110	1198	2308
Hourly Exit Rate	1110	1198	2308
Input Volume	1112	1220	2332
% of Volume	100	98	99

8002: Twelve Mile Road Performance by movement

Movement	EBT	WBT	All
Vehicles Exited	957	467	1424
Hourly Exit Rate	957	467	1424
Input Volume	984	474	1457
% of Volume	97	99	98

9001: Dummy Node A & Twelve Mile Road Performance by movement

Movement	EBT	EBR	WBT	WBR	All
Vehicles Exited	932	16	472	5	1425
Hourly Exit Rate	932	16	472	5	1425
Input Volume	954	19	478	5	1456
% of Volume	98	84	99	95	98

Total Network Performance

Vehicles Exited	5389
Hourly Exit Rate	5389
Input Volume	37385
% of Volume	14

Intersection: 1: Keystone Medical Center Drive/Park Drive & Twelve Mile Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	L	TR	L	TR
Maximum Queue (ft)	272	456	125	106	216	126	19	24	389	236
Average Queue (ft)	103	271	20	13	97	46	1	2	230	60
95th Queue (ft)	222	410	81	57	177	87	8	14	355	130
Link Distance (ft)		1279			1233			221		1221
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	125		25	125		125	75		400	
Storage Blk Time (%)	3	45	1		4	0		0	1	
Queuing Penalty (veh)	21	123	10		10	0		0	2	

Intersection: 2: Beck Road & Twelve Mile Road

Movement	WB	WB	WB	NB	NB	NB	NB	SB	SB	B6	B6
Directions Served	L	L	R	T	T	R	R	L	T	T	T
Maximum Queue (ft)	232	204	90	310	258	241	198	222	272	30	155
Average Queue (ft)	127	118	24	265	148	104	65	109	215	2	46
95th Queue (ft)	199	182	64	326	239	178	135	201	309	20	148
Link Distance (ft)	788	788	788	224	224	224	224	190	190	94	94
Upstream Blk Time (%)				35	1	0	0	5	12	0	6
Queuing Penalty (veh)				170	5	1	0	27	75	0	36
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 13: WB I-96 On-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 19: WB I-96 Off-Ramp

Movement	WB	WB	WB
Directions Served	L	T	T
Maximum Queue (ft)	19	150	114
Average Queue (ft)	1	15	6
95th Queue (ft)	13	92	60
Link Distance (ft)	655	655	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			150
Storage Blk Time (%)		2	0
Queuing Penalty (veh)		6	0

Intersection: 21: EB I-96 Off-Ramp

Movement	EB	EB	EB
Directions Served	L	L	T
Maximum Queue (ft)	34	45	24
Average Queue (ft)	1	4	1
95th Queue (ft)	24	43	17
Link Distance (ft)		456	456
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	200		
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Intersection: 25: Bend

Movement	EB	EB
Directions Served		T
Maximum Queue (ft)	130	257
Average Queue (ft)	22	74
95th Queue (ft)	82	201
Link Distance (ft)	547	547
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 27: Bend

Movement	WB	WB
Directions Served	T	
Maximum Queue (ft)	36	16
Average Queue (ft)	1	1
95th Queue (ft)	8	8
Link Distance (ft)	138	138
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-R

Movement	NB	NB	NB	SB	SB	SB	SB	NE	NE	SW	SW
Directions Served	L	T	T	L	L	T	T	L	L	L	L
Maximum Queue (ft)	186	195	196	179	201	183	197	322	342	245	297
Average Queue (ft)	98	136	139	120	158	131	150	174	214	136	160
95th Queue (ft)	173	210	201	177	206	190	206	304	353	217	247
Link Distance (ft)	126	126	126	105	105	105	105	318	318	235	235
Upstream Blk Time (%)	6	15	14	14	31	16	20	2	4	0	1
Queuing Penalty (veh)	18	43	42	46	100	52	64	6	12	1	3
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 7002: Beck Road & WB I-96 Off-Ramp

Movement	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	T	T	T
Maximum Queue (ft)	320	264	125	133	67	113	70	78
Average Queue (ft)	154	143	55	63	6	22	5	11
95th Queue (ft)	306	244	121	123	41	77	31	47
Link Distance (ft)	219	219	105	105	167	167	167	167
Upstream Blk Time (%)	12	2	1	2		0		
Queuing Penalty (veh)	44	9	8	15		0		
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 7003: Beck Road & EB I-96 Off-Ramp

Movement	EB	NB	NB	NB	SB	SB
Directions Served	R	T	T	T	T	T
Maximum Queue (ft)	325	75	143	111	90	99
Average Queue (ft)	145	2	14	10	40	42
95th Queue (ft)	267	20	66	50	85	89
Link Distance (ft)	283		392	392	126	126
Upstream Blk Time (%)	2				0	
Queuing Penalty (veh)	8				0	
Storage Bay Dist (ft)		150				
Storage Blk Time (%)			0			
Queuing Penalty (veh)			0			

Intersection: 7004: Beck Road & WB I-96 On-Ramp

Movement	NB	NB	NB	SB
Directions Served	T	T	T	R
Maximum Queue (ft)	251	189	25	8
Average Queue (ft)	105	30	1	0
95th Queue (ft)	270	137	18	5
Link Distance (ft)	167	167		
Upstream Blk Time (%)	12	0		
Queuing Penalty (veh)	114	4		
Storage Bay Dist (ft)			1	100
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8001: Beck Road

Movement	B6	B6	SB	SB
Directions Served	T		T	T
Maximum Queue (ft)	330	244	74	358
Average Queue (ft)	143	40	9	55
95th Queue (ft)	384	175	63	304
Link Distance (ft)	190	190		588
Upstream Blk Time (%)	6	1		2
Queuing Penalty (veh)	34	3		0
Storage Bay Dist (ft)			100	
Storage Blk Time (%)				3
Queuing Penalty (veh)				21

Intersection: 8002: Twelve Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9001: Dummy Node A & Twelve Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 1136

1: Keystone Medical Center Drive/Park Drive & Twelve Mile Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vehicles Exited	180	329	4	5	744	267	15	9	6	424	7	392
Hourly Exit Rate	180	329	4	5	744	267	15	9	6	424	7	392
Input Volume	185	345	4	5	729	270	15	11	5	428	7	397
% of Volume	97	95	100	100	102	99	98	82	114	99	97	99

1: Keystone Medical Center Drive/Park Drive & Twelve Mile Road Performance by movement

Movement	All
Vehicles Exited	2382
Hourly Exit Rate	2382
Input Volume	2402
% of Volume	99

2: Beck Road & Twelve Mile Road Performance by movement

Movement	WBL	WBT	WBR	NBT	NBR	SBL	SBT	All
Vehicles Exited	1001	1	120	856	456	79	1001	3514
Hourly Exit Rate	1001	1	120	856	456	79	1001	3514
Input Volume	1044	1	125	848	474	78	982	3553
% of Volume	96	133	96	101	96	101	102	99

13: WB I-96 On-Ramp Performance by movement

Movement	WBT	NWL	NWT	All
Vehicles Exited	571	341	0	912
Hourly Exit Rate	571	341	0	912
Input Volume	595	344	2	940
% of Volume	96	99	0	97

19: WB I-96 Off-Ramp Performance by movement

Movement	WBL	WBT	All
Vehicles Exited	340	311	651
Hourly Exit Rate	340	311	651
Input Volume	343	318	661
% of Volume	99	98	98

21: EB I-96 Off-Ramp Performance by movement

Movement	EBL	EBT	All
Vehicles Exited	142	285	427
Hourly Exit Rate	142	285	427
Input Volume	135	284	418
% of Volume	105	100	102

7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-Ramp Perfor

Movement	NBL	NBT	SBL	SBT	NEL	SWL	All
Vehicles Exited	340	846	677	756	142	339	3100
Hourly Exit Rate	340	846	677	756	142	339	3100
Input Volume	344	855	672	760	135	343	3109
% of Volume	99	99	101	100	105	99	100

7002: Beck Road & WB I-96 Off-Ramp Performance by movement

Movement	WBR	NBT	SBT	All
Vehicles Exited	310	992	1430	2732
Hourly Exit Rate	310	992	1430	2732
Input Volume	318	993	1431	2742
% of Volume	97	100	100	100

7003: Beck Road & EB I-96 Off-Ramp Performance by movement

Movement	EBR	NBT	SBT	All
Vehicles Exited	283	1185	1105	2573
Hourly Exit Rate	283	1185	1105	2573
Input Volume	284	1198	1112	2594
% of Volume	100	99	99	99

7004: Beck Road & WB I-96 On-Ramp Performance by movement

Movement	NBT	SBT	SBR	All
Vehicles Exited	1302	1449	572	3323
Hourly Exit Rate	1302	1449	572	3323
Input Volume	1311	1450	595	3356
% of Volume	99	100	96	99

8001: Beck Road Performance by movement

Movement	NBT	SBT	All
Vehicles Exited	964	1074	2038
Hourly Exit Rate	964	1074	2038
Input Volume	958	1060	2018
% of Volume	101	101	101

8002: Twelve Mile Road Performance by movement

Movement	EBT	WBT	All
Vehicles Exited	538	1167	1705
Hourly Exit Rate	538	1167	1705
Input Volume	556	1170	1725
% of Volume	97	100	99

9001: Dummy Node A & Twelve Mile Road Performance by movement

Movement	EBT	EBR	WBT	SBR	All
Vehicles Exited	514	20	1153	25	1712
Hourly Exit Rate	514	20	1153	25	1712
Input Volume	533	20	1149	28	1730
% of Volume	96	101	100	90	99

Total Network Performance

Vehicles Exited	5248
Hourly Exit Rate	5248
Input Volume	36493
% of Volume	14

Intersection: 1: Keystone Medical Center Drive/Park Drive & Twelve Mile Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	R	L	T	R	L	TR	L	TR
Maximum Queue (ft)	190	248	121	106	871	275	60	34	525	1145
Average Queue (ft)	91	140	6	5	418	172	14	7	459	724
95th Queue (ft)	162	230	46	41	733	355	42	26	631	1515
Link Distance (ft)		1279			1233			221		1221
Upstream Blk Time (%)										23
Queuing Penalty (veh)										0
Storage Bay Dist (ft)	125		25	125		125	75		500	
Storage Blk Time (%)	3	36	0		37	0	0		39	0
Queuing Penalty (veh)	11	67	1		101	2	0		160	1

Intersection: 2: Beck Road & Twelve Mile Road

Movement	WB	WB	WB	B10	B10	NB	NB	NB	NB	SB	SB	B6
Directions Served	L	L	R	T	T	T	T	R	R	L	T	T
Maximum Queue (ft)	854	847	157	180	173	308	264	127	80	145	287	167
Average Queue (ft)	676	689	72	80	82	236	122	60	37	63	247	90
95th Queue (ft)	1002	994	135	237	239	330	232	104	70	120	308	195
Link Distance (ft)	788	788	788	135	135	224	224	224	224	190	190	94
Upstream Blk Time (%)	39	38		27	28	27	2			0	24	16
Queuing Penalty (veh)	150	148		157	160	89	7			0	130	84
Storage Bay Dist (ft)												
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 13: WB I-96 On-Ramp

Movement	NW
Directions Served	L
Maximum Queue (ft)	4
Average Queue (ft)	0
95th Queue (ft)	3
Link Distance (ft)	527
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 19: WB I-96 Off-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 21: EB I-96 Off-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 25: Bend

Movement	EB	EB
Directions Served		T
Maximum Queue (ft)	133	243
Average Queue (ft)	34	103
95th Queue (ft)	99	228
Link Distance (ft)	547	547
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 27: Bend

Movement	WB	WB
Directions Served	T	
Maximum Queue (ft)	171	136
Average Queue (ft)	45	13
95th Queue (ft)	171	80
Link Distance (ft)	138	138
Upstream Blk Time (%)	1	0
Queuing Penalty (veh)	7	1
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-R

Movement	NB	NB	NB	SB	SB	SB	SB	NE	NE	SW	SW
Directions Served	L	T	T	L	L	T	T	L	L	L	L
Maximum Queue (ft)	190	213	194	189	198	194	188	70	102	167	181
Average Queue (ft)	156	168	154	148	169	130	142	27	47	84	112
95th Queue (ft)	218	219	207	201	204	191	201	61	91	148	170
Link Distance (ft)	126	126	126	105	105	105	105	318	318	235	235
Upstream Blk Time (%)	27	25	17	35	48	12	15				
Queuing Penalty (veh)	109	99	70	124	172	42	55				
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 7002: Beck Road & WB I-96 Off-Ramp

Movement	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	T	T	T
Maximum Queue (ft)	143	109	78	48	115	159	59	79
Average Queue (ft)	57	45	7	6	19	42	5	9
95th Queue (ft)	105	90	37	27	77	117	30	44
Link Distance (ft)	219	219	105	105	167	167	167	167
Upstream Blk Time (%)			0		0	0		
Queuing Penalty (veh)			0		1	1		
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 7003: Beck Road & EB I-96 Off-Ramp

Movement	EB	NB	NB	NB	SB	SB
Directions Served	R	T	T	T	T	T
Maximum Queue (ft)	224	176	220	146	53	61
Average Queue (ft)	100	37	50	19	14	15
95th Queue (ft)	180	127	163	87	41	43
Link Distance (ft)	283		392	392	126	126
Upstream Blk Time (%)	0		0			
Queuing Penalty (veh)	0		0			
Storage Bay Dist (ft)		150				
Storage Blk Time (%)		2	0			
Queuing Penalty (veh)		9	2			

Intersection: 7004: Beck Road & WB I-96 On-Ramp

Movement	NB	NB	SB	SB	SB
Directions Served	T	T	T	T	R
Maximum Queue (ft)	208	161	8	20	26
Average Queue (ft)	51	8	0	1	1
95th Queue (ft)	164	65	6	10	13
Link Distance (ft)	167	167		224	
Upstream Blk Time (%)	3	0			
Queuing Penalty (veh)	17	0			
Storage Bay Dist (ft)			1		100
Storage Blk Time (%)		0			
Queuing Penalty (veh)		0			

Intersection: 8001: Beck Road

Movement	B6	B6	SB	SB
Directions Served	T		T	T
Maximum Queue (ft)	319	254	100	510
Average Queue (ft)	89	22	10	119
95th Queue (ft)	309	133	67	412
Link Distance (ft)	190	190		588
Upstream Blk Time (%)	4	0		1
Queuing Penalty (veh)	19	2		0
Storage Bay Dist (ft)			100	
Storage Blk Time (%)				10
Queuing Penalty (veh)				52

Intersection: 8002: Twelve Mile Road

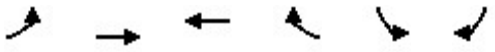
Movement	WB	WB
Directions Served	T	T
Maximum Queue (ft)	323	118
Average Queue (ft)	114	48
95th Queue (ft)	434	158
Link Distance (ft)	412	
Upstream Blk Time (%)	8	
Queuing Penalty (veh)	96	
Storage Bay Dist (ft)		1
Storage Blk Time (%)	1	0
Queuing Penalty (veh)	7	2

Intersection: 9001: Dummy Node A & Twelve Mile Road

Movement	WB	SB
Directions Served	TR	R
Maximum Queue (ft)	567	100
Average Queue (ft)	84	35
95th Queue (ft)	454	96
Link Distance (ft)	1279	271
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 2155



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑	↱		↱
Traffic Volume (vph)	0	0	273	468	0	769
Future Volume (vph)	0	0	273	468	0	769
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)			6.0	6.0		6.0
Lane Util. Factor			0.95	1.00		1.00
Frt			1.00	0.85		0.86
Flt Protected			1.00	1.00		1.00
Satd. Flow (prot)			3725	1667		1696
Flt Permitted			1.00	1.00		1.00
Satd. Flow (perm)			3725	1667		1696
Peak-hour factor, PHF	0.92	0.92	0.89	0.89	0.95	0.95
Adj. Flow (vph)	0	0	307	526	0	809
RTOR Reduction (vph)	0	0	0	0	0	145
Lane Group Flow (vph)	0	0	307	526	0	664
Turn Type			NA	custom		Prot
Protected Phases			2	4		4
Permitted Phases				2		4
Actuated Green, G (s)			40.9	88.0		47.1
Effective Green, g (s)			40.9	88.0		47.1
Actuated g/C Ratio			0.41	0.88		0.47
Clearance Time (s)			6.0	6.0		6.0
Vehicle Extension (s)			3.0	3.0		3.0
Lane Grp Cap (vph)			1523	1667		798
v/s Ratio Prot			0.08	c0.15		c0.39
v/s Ratio Perm				0.17		
v/c Ratio			0.20	0.32		0.83
Uniform Delay, d1			19.0	1.0		23.0
Progression Factor			0.83	1.00		1.00
Incremental Delay, d2			0.3	0.1		7.4
Delay (s)			16.1	1.1		30.4
Level of Service			B	A		C
Approach Delay (s)		0.0	6.6		30.4	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	457	50	1077	979	138	1111
Future Volume (veh/h)	457	50	1077	979	138	1111
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	513	56	1184	1076	145	1169
Peak Hour Factor	0.89	0.89	0.91	0.91	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	630	289	1669	1310	393	1399
Arrive On Green	0.17	0.17	0.15	0.15	0.21	0.71
Sat Flow, veh/h	3638	1668	3839	2937	1875	1969
Grp Volume(v), veh/h	513	56	1184	1076	145	1169
Grp Sat Flow(s),veh/h/ln	1819	1668	1870	1468	1875	1969
Q Serve(g_s), s	13.6	2.9	30.1	35.5	6.6	42.3
Cycle Q Clear(g_c), s	13.6	2.9	30.1	35.5	6.6	42.3
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	630	289	1669	1310	393	1399
V/C Ratio(X)	0.81	0.19	0.71	0.82	0.37	0.84
Avail Cap(c_a), veh/h	1088	499	1739	1365	393	1399
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.8	35.4	36.5	38.8	33.9	10.3
Incr Delay (d2), s/veh	2.6	0.3	2.6	5.9	0.6	6.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	1.2	15.5	14.9	3.0	15.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	42.4	35.7	39.0	44.6	34.4	16.3
LnGrp LOS	D	D	D	D	C	B
Approach Vol, veh/h	569		2260			1314
Approach Delay, s/veh	41.8		41.7			18.3
Approach LOS	D		D			B

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	26.5	50.1		23.4		76.6
Change Period (Y+Rc), s	* 5.5	* 5.5		* 6.1		* 5.5
Max Green Setting (Gmax), s	* 6.5	* 47		* 30		* 59
Max Q Clear Time (g_c+I1), s	8.6	37.5		15.6		44.3
Green Ext Time (p_c), s	0.0	7.1		1.7		8.1

Intersection Summary	
HCM 6th Ctrl Delay	34.3
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1566	60	0	0	0	8
Future Vol, veh/h	1566	60	0	0	0	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	50	-	-	-	0
Veh in Median Storage, #	0	-	-	16983	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	88	88	92	92	67	67
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1780	68	0	0	0	12

Major/Minor	Major1			Minor1	
Conflicting Flow All	0	0		-	890
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	-		-	6.94
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	-		-	3.32
Pot Cap-1 Maneuver	-	-		0	286
Stage 1	-	-		0	-
Stage 2	-	-		0	-
Platoon blocked, %	-	-			
Mov Cap-1 Maneuver	-	-		-	286
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

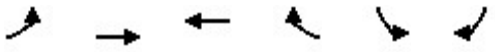
Approach	EB	NB
HCM Control Delay, s	0	18.1
HCM LOS		C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	286	-	-
HCM Lane V/C Ratio	0.042	-	-
HCM Control Delay (s)	18.1	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	0.1	-	-

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↰	
Traffic Volume (vph)	0	0	0	493	248	0
Future Volume (vph)	0	0	0	493	248	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.0	6.0	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.88	0.88	0.85	0.85
Adj. Flow (vph)	0	0	0	560	292	0
RTOR Reduction (vph)	0	0	0	0	143	0
Lane Group Flow (vph)	0	0	0	560	149	0
Turn Type				NA	Prot	
Protected Phases				2	4	
Permitted Phases						
Actuated Green, G (s)				74.6	13.4	
Effective Green, g (s)				74.6	13.4	
Actuated g/C Ratio				0.75	0.13	
Clearance Time (s)				6.0	6.0	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				3993	249	
v/s Ratio Prot				c0.10	c0.08	
v/s Ratio Perm						
v/c Ratio				0.14	0.60	
Uniform Delay, d1				3.6	40.8	
Progression Factor				1.00	1.15	
Incremental Delay, d2				0.1	2.9	
Delay (s)				3.7	49.6	
Level of Service				A	D	
Approach Delay (s)	0.0			3.7	49.6	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	19.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.21		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

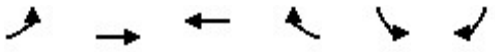
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	1097	0	0	529	0
Future Volume (vph)	0	1097	0	0	529	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			6.0	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3725			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3725			1863	
Peak-hour factor, PHF	0.88	0.88	0.92	0.92	0.89	0.89
Adj. Flow (vph)	0	1247	0	0	594	0
RTOR Reduction (vph)	0	0	0	0	16	0
Lane Group Flow (vph)	0	1247	0	0	578	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		51.9			36.1	
Effective Green, g (s)		51.9			36.1	
Actuated g/C Ratio		0.52			0.36	
Clearance Time (s)		6.0			6.0	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		1933			672	
v/s Ratio Prot		c0.33			c0.31	
v/s Ratio Perm						
v/c Ratio		0.65			0.86	
Uniform Delay, d1		17.4			29.6	
Progression Factor		1.06			0.58	
Incremental Delay, d2		1.4			8.1	
Delay (s)		19.8			25.2	
Level of Service		B			C	
Approach Delay (s)		19.8	0.0		25.2	
Approach LOS		B	A		C	

Intersection Summary			
HCM 2000 Control Delay	21.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑	↱		↱
Traffic Volume (vph)	0	0	902	521	0	859
Future Volume (vph)	0	0	902	521	0	859
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)			6.0	6.0		6.0
Lane Util. Factor			0.95	1.00		1.00
Frt			1.00	0.85		0.86
Flt Protected			1.00	1.00		1.00
Satd. Flow (prot)			3725	1667		1696
Flt Permitted			1.00	1.00		1.00
Satd. Flow (perm)			3725	1667		1696
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.84	0.84
Adj. Flow (vph)	0	0	949	548	0	1023
RTOR Reduction (vph)	0	0	0	0	0	4
Lane Group Flow (vph)	0	0	949	548	0	1019
Turn Type			NA	custom		Prot
Protected Phases			2	4		4
Permitted Phases				2		4
Actuated Green, G (s)			27.6	88.0		60.4
Effective Green, g (s)			27.6	88.0		60.4
Actuated g/C Ratio			0.28	0.88		0.60
Clearance Time (s)			6.0	6.0		6.0
Vehicle Extension (s)			3.0	3.0		3.0
Lane Grp Cap (vph)			1028	1667		1024
v/s Ratio Prot			c0.25	0.20		c0.60
v/s Ratio Perm				0.13		
v/c Ratio			0.92	0.33		1.00
Uniform Delay, d1			35.2	1.0		19.7
Progression Factor			0.84	1.00		1.00
Incremental Delay, d2			14.2	0.1		26.8
Delay (s)			43.6	1.1		46.4
Level of Service			D	A		D
Approach Delay (s)		0.0	28.1		46.4	
Approach LOS		A	C		D	

Intersection Summary			
HCM 2000 Control Delay	35.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1184	142	841	510	85	992
Future Volume (veh/h)	1184	142	841	510	85	992
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	1273	153	885	537	89	1044
Peak Hour Factor	0.93	0.93	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	1015	466	1261	990	399	1191
Arrive On Green	0.28	0.28	0.11	0.11	0.21	0.61
Sat Flow, veh/h	3638	1668	3839	2937	1875	1969
Grp Volume(v), veh/h	1273	153	885	537	89	1044
Grp Sat Flow(s),veh/h/ln	1819	1668	1870	1468	1875	1969
Q Serve(g_s), s	27.9	7.3	22.8	17.3	3.9	44.6
Cycle Q Clear(g_c), s	27.9	7.3	22.8	17.3	3.9	44.6
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	1015	466	1261	990	399	1191
V/C Ratio(X)	1.25	0.33	0.70	0.54	0.22	0.88
Avail Cap(c_a), veh/h	1015	466	1814	1424	399	1191
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.0	28.6	39.6	37.1	32.5	16.6
Incr Delay (d2), s/veh	122.6	0.4	3.3	2.1	0.3	9.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	28.9	2.8	11.9	7.0	1.8	20.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	158.7	29.0	42.9	39.3	32.8	25.8
LnGrp LOS	F	C	D	D	C	C
Approach Vol, veh/h	1426		1422			1133
Approach Delay, s/veh	144.8		41.5			26.4
Approach LOS	F		D			C

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	26.8	39.2		34.0		66.0
Change Period (Y+Rc), s	* 5.5	* 5.5		* 6.1		* 5.5
Max Green Setting (Gmax), s	* 6.5	* 49		* 28		* 61
Max Q Clear Time (g_c+I1), s	5.9	24.8		29.9		46.6
Green Ext Time (p_c), s	0.0	8.9		0.0		6.7

Intersection Summary	
HCM 6th Ctrl Delay	74.2
HCM 6th LOS	E

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1021	16	0	0	0	31
Future Vol, veh/h	1021	16	0	0	0	31
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	50	-	-	-	0
Veh in Median Storage, #	0	-	-	16983	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	92	92	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1098	17	0	0	0	40

Major/Minor	Major1			Minor1	
Conflicting Flow All	0	0		-	549
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	-		-	6.94
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	-		-	3.32
Pot Cap-1 Maneuver	-	-		0	480
Stage 1	-	-		0	-
Stage 2	-	-		0	-
Platoon blocked, %	-	-			
Mov Cap-1 Maneuver	-	-		-	480
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

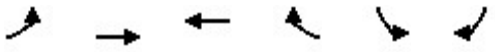
Approach	EB	NB
HCM Control Delay, s	0	13.2
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	480	-	-
HCM Lane V/C Ratio	0.083	-	-
HCM Control Delay (s)	13.2	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.3	-	-

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↰	
Traffic Volume (vph)	0	0	0	1210	213	0
Future Volume (vph)	0	0	0	1210	213	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.0	6.0	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.76	0.76
Adj. Flow (vph)	0	0	0	1274	280	0
RTOR Reduction (vph)	0	0	0	0	31	0
Lane Group Flow (vph)	0	0	0	1274	249	0
Turn Type				NA	Prot	
Protected Phases				2	4	
Permitted Phases						
Actuated Green, G (s)				69.2	18.8	
Effective Green, g (s)				69.2	18.8	
Actuated g/C Ratio				0.69	0.19	
Clearance Time (s)				6.0	6.0	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				3704	350	
v/s Ratio Prot				c0.24	c0.13	
v/s Ratio Perm						
v/c Ratio				0.34	0.71	
Uniform Delay, d1				6.2	38.1	
Progression Factor				1.00	1.18	
Incremental Delay, d2				0.3	6.4	
Delay (s)				6.5	51.2	
Level of Service				A	D	
Approach Delay (s)	0.0			6.5	51.2	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	14.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	574	0	0	463	0
Future Volume (vph)	0	574	0	0	463	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			6.0	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3725			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3725			1863	
Peak-hour factor, PHF	0.93	0.93	0.92	0.92	0.90	0.90
Adj. Flow (vph)	0	617	0	0	514	0
RTOR Reduction (vph)	0	0	0	0	79	0
Lane Group Flow (vph)	0	617	0	0	435	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		58.2			29.8	
Effective Green, g (s)		58.2			29.8	
Actuated g/C Ratio		0.58			0.30	
Clearance Time (s)		6.0			6.0	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		2167			555	
v/s Ratio Prot		c0.17			c0.23	
v/s Ratio Perm						
v/c Ratio		0.28			0.78	
Uniform Delay, d1		10.5			32.1	
Progression Factor		1.60			1.45	
Incremental Delay, d2		0.3			1.9	
Delay (s)		17.1			48.5	
Level of Service		B			D	
Approach Delay (s)		17.1	0.0		48.5	
Approach LOS		B	A		D	

Intersection Summary			
HCM 2000 Control Delay	31.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 1: WB 12 Mile Road & Park Drive

Movement	WB	WB	WB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	164	139	72	361
Average Queue (ft)	73	50	18	167
95th Queue (ft)	140	117	51	309
Link Distance (ft)	439	439	439	726
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Beck Road & 12 Mile Road

Movement	WB	WB	WB	NB	NB	NB	NB	SB	SB	B10	B10
Directions Served	L	L	R	T	T	R	R	L	T	T	T
Maximum Queue (ft)	215	226	64	299	275	148	153	284	279	131	162
Average Queue (ft)	119	109	19	270	151	75	82	177	229	24	65
95th Queue (ft)	191	187	53	320	247	117	126	299	326	105	170
Link Distance (ft)	731	731	731	223	223	223	223	192	192	94	94
Upstream Blk Time (%)				35	2			31	17	9	7
Queuing Penalty (veh)				180	9			192	105	57	46
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 3: Keystone Medical Center Drive & EB 12 Mile Road

Movement	NB
Directions Served	R
Maximum Queue (ft)	28
Average Queue (ft)	6
95th Queue (ft)	23
Link Distance (ft)	247
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: EB to WB XO. E. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	104	68	128	87
Average Queue (ft)	36	16	43	68
95th Queue (ft)	78	49	100	78
Link Distance (ft)	536	536		23
Upstream Blk Time (%)				67
Queuing Penalty (veh)				166
Storage Bay Dist (ft)			450	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: EB 12 Mile Road & WB to EB XO. W. of Park Drive

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	124	126	78
Average Queue (ft)	99	107	59
95th Queue (ft)	140	141	67
Link Distance (ft)	56	56	10
Upstream Blk Time (%)	24	26	60
Queuing Penalty (veh)	132	145	315
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: EB to WB XO W. of Park Drive & WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 7: EB 12 Mile Road & WB to EB XO. E. of Beck Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 13: WB I-96 On-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 19: WB I-96 Off-Ramp

Movement	WB	WB	WB
Directions Served	L	T	T
Maximum Queue (ft)	12	34	12
Average Queue (ft)	0	2	1
95th Queue (ft)	6	27	14
Link Distance (ft)	655	655	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			150
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 21: EB I-96 Off-Ramp

Movement	EB	EB	EB
Directions Served	L	L	T
Maximum Queue (ft)	60	130	33
Average Queue (ft)	6	20	2
95th Queue (ft)	51	96	21
Link Distance (ft)		456	456
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	200		
Storage Blk Time (%)		0	
Queuing Penalty (veh)		1	

Intersection: 25: Bend

Movement	EB	EB
Directions Served		T
Maximum Queue (ft)	90	216
Average Queue (ft)	22	71
95th Queue (ft)	74	182
Link Distance (ft)	547	547
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 27: Bend

Movement	WB	WB
Directions Served	T	
Maximum Queue (ft)	37	15
Average Queue (ft)	1	1
95th Queue (ft)	16	8
Link Distance (ft)	138	138
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 104: EB 12 Mile Road & EB to WB XO. E. of Park Drive

Movement	EB
Directions Served	L
Maximum Queue (ft)	231
Average Queue (ft)	112
95th Queue (ft)	208
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	225
Storage Blk Time (%)	0
Queuing Penalty (veh)	3

Intersection: 105: WB to EB XO. W. of Park Drive & WB 12 Mile Road

Movement	WB
Directions Served	L
Maximum Queue (ft)	433
Average Queue (ft)	205
95th Queue (ft)	357
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	450
Storage Blk Time (%)	0
Queuing Penalty (veh)	1

Intersection: 106: EB 12 Mile Road & EB to WB XO W. of Park Drive

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	138	155
Average Queue (ft)	32	46
95th Queue (ft)	98	118
Link Distance (ft)	580	580
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 107: WB to EB XO. E. of Beck Road & WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-R

Movement	NB	NB	NB	SB	SB	SB	SB	NE	NE	SW	SW
Directions Served	L	T	T	L	L	T	T	L	L	L	L
Maximum Queue (ft)	179	191	194	180	195	193	192	338	445	242	317
Average Queue (ft)	98	131	155	123	157	136	150	227	294	153	179
95th Queue (ft)	174	201	211	177	204	196	202	363	480	244	287
Link Distance (ft)	126	126	126	105	105	105	105	318	318	235	235
Upstream Blk Time (%)	6	13	19	16	30	18	21	1	19	0	4
Queuing Penalty (veh)	19	39	58	53	99	60	69	4	56	1	9
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 7002: Beck Road & WB I-96 Off-Ramp

Movement	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	T	T	T
Maximum Queue (ft)	280	294	140	132	54	97	65	90
Average Queue (ft)	143	170	64	78	4	19	8	13
95th Queue (ft)	260	289	125	132	26	65	38	54
Link Distance (ft)	219	219	105	105	167	167	167	167
Upstream Blk Time (%)	5	5	2	4				
Queuing Penalty (veh)	19	22	11	27				
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 7003: Beck Road & EB I-96 Off-Ramp

Movement	EB	NB	NB	NB	SB	SB
Directions Served	R	T	T	T	T	T
Maximum Queue (ft)	339	24	100	125	102	95
Average Queue (ft)	164	1	9	20	50	49
95th Queue (ft)	304	17	50	76	97	92
Link Distance (ft)	283		392	392	126	126
Upstream Blk Time (%)	3				0	0
Queuing Penalty (veh)	15				1	0
Storage Bay Dist (ft)		150				
Storage Blk Time (%)			0			
Queuing Penalty (veh)			0			

Intersection: 7004: Beck Road & WB I-96 On-Ramp

Movement	NB	NB	NB	SB
Directions Served	T	T	T	R
Maximum Queue (ft)	247	214	35	9
Average Queue (ft)	111	52	1	0
95th Queue (ft)	270	185	19	6
Link Distance (ft)	167	167		
Upstream Blk Time (%)	10	1		
Queuing Penalty (veh)	102	8		
Storage Bay Dist (ft)			1	100
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 8001: Beck Road

Movement	B10	B10	SB	SB
Directions Served	T		T	T
Maximum Queue (ft)	334	284	98	270
Average Queue (ft)	162	51	16	54
95th Queue (ft)	411	208	80	249
Link Distance (ft)	192	192		588
Upstream Blk Time (%)	8	1		0
Queuing Penalty (veh)	43	6		0
Storage Bay Dist (ft)			100	
Storage Blk Time (%)			1	3
Queuing Penalty (veh)			8	19

Intersection: 8002: EB 12 Mile Road & 12 Mile Road/WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9001: Dummy Node A & EB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9002: WB 12 Mile Road & Dummy Node B

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 2094

Intersection: 1: WB 12 Mile Road & Park Drive

Movement	WB	WB	WB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	472	479	72	700
Average Queue (ft)	286	284	26	383
95th Queue (ft)	492	490	61	700
Link Distance (ft)	439	439	439	726
Upstream Blk Time (%)	10	8		8
Queuing Penalty (veh)	45	39		0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Beck Road & 12 Mile Road

Movement	WB	WB	WB	NB	NB	NB	NB	SB	SB	B10
Directions Served	L	L	R	T	T	R	R	L	T	T
Maximum Queue (ft)	823	815	184	298	245	106	107	144	293	166
Average Queue (ft)	775	773	73	243	133	55	54	60	252	85
95th Queue (ft)	877	868	153	327	235	90	90	117	304	185
Link Distance (ft)	731	731	731	223	223	223	223	192	192	94
Upstream Blk Time (%)	74	72		30	2			0	23	12
Queuing Penalty (veh)	329	320		100	7			0	125	64
Storage Bay Dist (ft)										
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 3: Keystone Medical Center Drive & EB 12 Mile Road

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	105	29	49
Average Queue (ft)	5	1	17
95th Queue (ft)	58	21	38
Link Distance (ft)	558	558	247
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: EB to WB XO. E. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	302	297	261	85
Average Queue (ft)	89	81	64	67
95th Queue (ft)	232	235	186	80
Link Distance (ft)	536	536		23
Upstream Blk Time (%)	0	0	0	71
Queuing Penalty (veh)	0	0	0	151
Storage Bay Dist (ft)			450	
Storage Blk Time (%)		1	0	
Queuing Penalty (veh)		2	0	

Intersection: 5: EB 12 Mile Road & WB to EB XO. W. of Park Drive

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	117	117	72
Average Queue (ft)	56	67	59
95th Queue (ft)	117	125	66
Link Distance (ft)	56	56	10
Upstream Blk Time (%)	7	10	62
Queuing Penalty (veh)	20	28	289
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: EB to WB XO W. of Park Drive & WB 12 Mile Road

Movement	WB	WB
Directions Served	T	T
Maximum Queue (ft)	137	154
Average Queue (ft)	54	57
95th Queue (ft)	153	161
Link Distance (ft)	56	56
Upstream Blk Time (%)	39	41
Queuing Penalty (veh)	250	260
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 7: EB 12 Mile Road & WB to EB XO. E. of Beck Road

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 13: WB I-96 On-Ramp

Movement	NW
Directions Served	L
Maximum Queue (ft)	15
Average Queue (ft)	1
95th Queue (ft)	6
Link Distance (ft)	527
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 19: WB I-96 Off-Ramp

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: EB I-96 Off-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 25: Bend

Movement	EB	EB
Directions Served		T
Maximum Queue (ft)	134	321
Average Queue (ft)	34	118
95th Queue (ft)	102	253
Link Distance (ft)	547	547
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 27: Bend

Movement	WB	WB
Directions Served	T	
Maximum Queue (ft)	199	151
Average Queue (ft)	46	11
95th Queue (ft)	167	73
Link Distance (ft)	138	138
Upstream Blk Time (%)	1	0
Queuing Penalty (veh)	7	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 104: EB 12 Mile Road & EB to WB XO. E. of Park Drive

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	272	178	143
Average Queue (ft)	96	16	10
95th Queue (ft)	220	149	108
Link Distance (ft)		439	439
Upstream Blk Time (%)		2	0
Queuing Penalty (veh)		10	0
Storage Bay Dist (ft)	225		
Storage Blk Time (%)	4		
Queuing Penalty (veh)	17		

Intersection: 105: WB to EB XO. W. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB
Directions Served	L	T	T
Maximum Queue (ft)	524	548	561
Average Queue (ft)	287	166	170
95th Queue (ft)	469	537	543
Link Distance (ft)		547	547
Upstream Blk Time (%)		1	1
Queuing Penalty (veh)		6	9
Storage Bay Dist (ft)	450		
Storage Blk Time (%)	0	10	
Queuing Penalty (veh)	1	45	

Intersection: 106: EB 12 Mile Road & EB to WB XO W. of Park Drive

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	37	46
Average Queue (ft)	3	4
95th Queue (ft)	20	24
Link Distance (ft)	580	580
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 107: WB to EB XO. E. of Beck Road & WB 12 Mile Road

Movement	WB	WB
Directions Served	T	T
Maximum Queue (ft)	716	714
Average Queue (ft)	483	492
95th Queue (ft)	951	954
Link Distance (ft)	611	611
Upstream Blk Time (%)	56	56
Queuing Penalty (veh)	365	366
Storage Bay Dist (ft)		
Storage Blk Time (%)	68	
Queuing Penalty (veh)	0	

Intersection: 7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-R

Movement	NB	NB	NB	SB	SB	SB	SB	NE	NE	SW	SW
Directions Served	L	T	T	L	L	T	T	L	L	L	L
Maximum Queue (ft)	208	191	198	193	206	180	190	84	117	166	182
Average Queue (ft)	165	161	164	163	177	127	141	24	48	86	112
95th Queue (ft)	227	221	217	211	205	186	201	63	96	147	166
Link Distance (ft)	126	126	126	105	105	105	105	318	318	235	235
Upstream Blk Time (%)	41	24	23	53	64	12	16				0
Queuing Penalty (veh)	170	100	93	204	248	45	60				0
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 7002: Beck Road & WB I-96 Off-Ramp

Movement	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	T	T	T
Maximum Queue (ft)	176	124	83	96	164	202	52	70
Average Queue (ft)	66	52	11	10	57	84	3	8
95th Queue (ft)	131	94	56	47	155	186	23	39
Link Distance (ft)	219	219	105	105	167	167	167	167
Upstream Blk Time (%)	1		0	0	0	3		
Queuing Penalty (veh)	1		1	0	2	11		
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 7003: Beck Road & EB I-96 Off-Ramp

Movement	EB	NB	NB	NB	SB	SB
Directions Served	R	T	T	T	T	T
Maximum Queue (ft)	212	184	321	302	53	53
Average Queue (ft)	97	67	99	80	10	14
95th Queue (ft)	172	189	317	274	37	43
Link Distance (ft)	283		392	392	126	126
Upstream Blk Time (%)			5	2		
Queuing Penalty (veh)			0	0		
Storage Bay Dist (ft)		150				
Storage Blk Time (%)		11	1			
Queuing Penalty (veh)		44	3			

Intersection: 7004: Beck Road & WB I-96 On-Ramp

Movement	NB	NB	SB	SB	SB
Directions Served	T	T	T	T	R
Maximum Queue (ft)	229	105	16	13	5
Average Queue (ft)	58	5	1	0	0
95th Queue (ft)	179	46	12	9	4
Link Distance (ft)	167	167			
Upstream Blk Time (%)	4	0			
Queuing Penalty (veh)	27	0			
Storage Bay Dist (ft)			1	1	100
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 8001: Beck Road

Movement	NB	B10	B10	SB	SB
Directions Served	T	T		T	T
Maximum Queue (ft)	8	328	262	75	374
Average Queue (ft)	0	101	28	12	77
95th Queue (ft)	6	328	148	72	316
Link Distance (ft)	94	192	192		588
Upstream Blk Time (%)		5	0		0
Queuing Penalty (veh)		23	2		0
Storage Bay Dist (ft)				100	
Storage Blk Time (%)					6
Queuing Penalty (veh)					33

Intersection: 8002: EB 12 Mile Road & 12 Mile Road/WB 12 Mile Road

Movement	WB	WB
Directions Served	T	T
Maximum Queue (ft)	251	253
Average Queue (ft)	189	187
95th Queue (ft)	313	310
Link Distance (ft)	160	160
Upstream Blk Time (%)	71	66
Queuing Penalty (veh)	474	440
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9001: Dummy Node A & EB 12 Mile Road

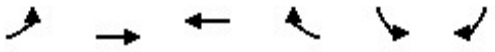
Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9002: WB 12 Mile Road & Dummy Node B

Movement	WB	WB	SB
Directions Served	T	TR	R
Maximum Queue (ft)	502	515	239
Average Queue (ft)	250	252	102
95th Queue (ft)	633	635	252
Link Distance (ft)	422	422	238
Upstream Blk Time (%)	42	43	19
Queuing Penalty (veh)	266	270	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 5373



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	273	468	0	769
Future Volume (vph)	0	0	273	468	0	769
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)			6.0	6.0		6.0
Lane Util. Factor			0.95	1.00		0.88
Frt			1.00	0.85		0.85
Flt Protected			1.00	1.00		1.00
Satd. Flow (prot)			3725	1667		2933
Flt Permitted			1.00	1.00		1.00
Satd. Flow (perm)			3725	1667		2933
Peak-hour factor, PHF	0.92	0.92	0.89	0.89	0.95	0.95
Adj. Flow (vph)	0	0	307	526	0	809
RTOR Reduction (vph)	0	0	0	0	0	319
Lane Group Flow (vph)	0	0	307	526	0	490
Turn Type			NA	custom		Prot
Protected Phases			2	4		4
Permitted Phases				2		4
Actuated Green, G (s)			53.9	88.0		34.1
Effective Green, g (s)			53.9	88.0		34.1
Actuated g/C Ratio			0.54	0.88		0.34
Clearance Time (s)			6.0	6.0		6.0
Vehicle Extension (s)			3.0	3.0		3.0
Lane Grp Cap (vph)			2007	1667		1000
v/s Ratio Prot			0.08	c0.11		c0.17
v/s Ratio Perm				0.21		
v/c Ratio			0.15	0.32		0.49
Uniform Delay, d1			11.6	1.0		26.1
Progression Factor			0.81	1.00		1.00
Incremental Delay, d2			0.2	0.1		0.4
Delay (s)			9.6	1.1		26.5
Level of Service			A	A		C
Approach Delay (s)		0.0	4.2		26.5	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	15.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

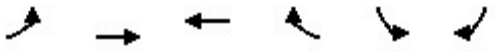
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	457	50	1077	979	138	1111
Future Volume (veh/h)	457	50	1077	979	138	1111
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	513	56	1184	1076	145	1169
Peak Hour Factor	0.89	0.89	0.91	0.91	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	608	279	1816	1426	331	2682
Arrive On Green	0.17	0.17	0.16	0.16	0.18	0.72
Sat Flow, veh/h	3638	1668	3839	2937	1875	3839
Grp Volume(v), veh/h	513	56	1184	1076	145	1169
Grp Sat Flow(s),veh/h/ln	1819	1668	1870	1468	1875	1870
Q Serve(g_s), s	13.7	2.9	29.7	35.0	6.9	12.9
Cycle Q Clear(g_c), s	13.7	2.9	29.7	35.0	6.9	12.9
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	608	279	1816	1426	331	2682
V/C Ratio(X)	0.84	0.20	0.65	0.75	0.44	0.44
Avail Cap(c_a), veh/h	760	349	2001	1571	331	2682
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.4	35.9	34.1	36.3	36.7	5.8
Incr Delay (d2), s/veh	7.1	0.4	1.8	3.8	0.9	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	1.2	15.2	14.4	3.2	4.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	47.5	36.2	35.9	40.1	37.7	6.3
LnGrp LOS	D	D	D	D	D	A
Approach Vol, veh/h	569		2260			1314
Approach Delay, s/veh	46.4		37.9			9.8
Approach LOS	D		D			A

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	23.2	54.0		22.8		77.2
Change Period (Y+Rc), s	* 5.5	* 5.5		* 6.1		* 5.5
Max Green Setting (Gmax), s	* 8.5	* 54		* 21		* 68
Max Q Clear Time (g_c+I1), s	8.9	37.0		15.7		14.9
Green Ext Time (p_c), s	0.0	11.5		1.0		10.8

Intersection Summary	
HCM 6th Ctrl Delay	30.1
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	902	521	0	859
Future Volume (vph)	0	0	902	521	0	859
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)			6.0	6.0		6.0
Lane Util. Factor			0.95	1.00		0.88
Frt			1.00	0.85		0.85
Flt Protected			1.00	1.00		1.00
Satd. Flow (prot)			3725	1667		2933
Flt Permitted			1.00	1.00		1.00
Satd. Flow (perm)			3725	1667		2933
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.84	0.84
Adj. Flow (vph)	0	0	949	548	0	1023
RTOR Reduction (vph)	0	0	0	0	0	51
Lane Group Flow (vph)	0	0	949	548	0	972
Turn Type			NA	custom		Prot
Protected Phases			2	4		4
Permitted Phases				2		4
Actuated Green, G (s)			46.9	88.0		41.1
Effective Green, g (s)			46.9	88.0		41.1
Actuated g/C Ratio			0.47	0.88		0.41
Clearance Time (s)			6.0	6.0		6.0
Vehicle Extension (s)			3.0	3.0		3.0
Lane Grp Cap (vph)			1747	1667		1205
v/s Ratio Prot			c0.25	0.14		c0.33
v/s Ratio Perm				0.19		
v/c Ratio			0.54	0.33		0.81
Uniform Delay, d1			18.9	1.0		26.0
Progression Factor			0.73	1.00		1.00
Incremental Delay, d2			1.2	0.1		4.1
Delay (s)			15.0	1.1		30.0
Level of Service			B	A		C
Approach Delay (s)		0.0	9.9		30.0	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1184	142	841	510	85	992
Future Volume (veh/h)	1184	142	841	510	85	992
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	1273	153	885	537	89	1044
Peak Hour Factor	0.93	0.93	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	1378	632	1163	913	261	1890
Arrive On Green	0.38	0.38	0.10	0.10	0.14	0.51
Sat Flow, veh/h	3638	1668	3839	2937	1875	3839
Grp Volume(v), veh/h	1273	153	885	537	89	1044
Grp Sat Flow(s),veh/h/ln	1819	1668	1870	1468	1875	1870
Q Serve(g_s), s	33.4	6.3	23.0	17.5	4.3	19.2
Cycle Q Clear(g_c), s	33.4	6.3	23.0	17.5	4.3	19.2
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	1378	632	1163	913	261	1890
V/C Ratio(X)	0.92	0.24	0.76	0.59	0.34	0.55
Avail Cap(c_a), veh/h	1451	666	1365	1072	261	1890
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.7	21.2	41.3	38.8	38.9	17.0
Incr Delay (d2), s/veh	9.9	0.2	4.7	2.8	0.8	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.3	2.3	12.2	7.2	2.0	7.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	39.6	21.4	46.0	41.5	39.7	18.2
LnGrp LOS	D	C	D	D	D	B
Approach Vol, veh/h	1426		1422			1133
Approach Delay, s/veh	37.7		44.3			19.8
Approach LOS	D		D			B

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	19.4	36.6		44.0		56.0
Change Period (Y+Rc), s	* 5.5	* 5.5		* 6.1		* 5.5
Max Green Setting (Gmax), s	* 6.5	* 37		* 40		* 49
Max Q Clear Time (g_c+I1), s	6.3	25.0		35.4		21.2
Green Ext Time (p_c), s	0.0	6.1		2.4		8.0

Intersection Summary	
HCM 6th Ctrl Delay	35.0
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection: 1: WB 12 Mile Road & Park Drive

Movement	WB	WB	WB	SB	SB
Directions Served	T	T	R	R	R
Maximum Queue (ft)	143	100	66	214	194
Average Queue (ft)	54	26	18	92	58
95th Queue (ft)	115	73	50	165	129
Link Distance (ft)	440	440	440	721	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					150
Storage Blk Time (%)				1	0
Queuing Penalty (veh)				6	0

Intersection: 2: Beck Road & 12 Mile Road

Movement	WB	WB	WB	NB	NB	NB	NB	SB	SB	SB	B10	B10
Directions Served	L	L	R	T	T	R	R	L	T	T	T	T
Maximum Queue (ft)	211	198	92	312	256	139	146	248	248	188	30	31
Average Queue (ft)	125	111	23	271	145	81	90	134	142	77	3	1
95th Queue (ft)	197	181	64	324	239	122	134	236	229	166	26	16
Link Distance (ft)	731	731	731	223	223	223	223	192	192	192	94	94
Upstream Blk Time (%)				36	1			8	2	0	0	
Queuing Penalty (veh)				188	7			32	7	0	0	
Storage Bay Dist (ft)												
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 2: Beck Road & 12 Mile Road

Movement	B10
Directions Served	T
Maximum Queue (ft)	19
Average Queue (ft)	1
95th Queue (ft)	13
Link Distance (ft)	94
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 3: Keystone Medical Center Drive & EB 12 Mile Road

Movement	NB
Directions Served	R
Maximum Queue (ft)	27
Average Queue (ft)	5
95th Queue (ft)	21
Link Distance (ft)	247
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: EB to WB XO. E. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	96	82	107	75
Average Queue (ft)	32	11	38	67
95th Queue (ft)	75	45	86	76
Link Distance (ft)	536	536		23
Upstream Blk Time (%)				66
Queuing Penalty (veh)				165
Storage Bay Dist (ft)			450	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: EB 12 Mile Road & WB to EB XO. W. of Park Drive

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	121	128	74
Average Queue (ft)	95	103	58
95th Queue (ft)	144	143	65
Link Distance (ft)	56	56	10
Upstream Blk Time (%)	21	26	58
Queuing Penalty (veh)	117	143	307
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: EB to WB XO W. of Park Drive & WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 7: EB 12 Mile Road & WB to EB XO. E. of Beck Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 13: WB I-96 On-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 19: WB I-96 Off-Ramp

Movement	WB	WB
Directions Served	T	T
Maximum Queue (ft)	58	53
Average Queue (ft)	6	3
95th Queue (ft)	43	32
Link Distance (ft)	655	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)	0	0
Queuing Penalty (veh)	0	0

Intersection: 21: EB I-96 Off-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 25: Bend

Movement	EB	EB
Directions Served		T
Maximum Queue (ft)	101	243
Average Queue (ft)	18	68
95th Queue (ft)	68	183
Link Distance (ft)	547	547
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 27: Bend

Movement	WB	WB
Directions Served	T	
Maximum Queue (ft)	34	40
Average Queue (ft)	1	1
95th Queue (ft)	13	17
Link Distance (ft)	138	138
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 104: EB 12 Mile Road & EB to WB XO. E. of Park Drive

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	228	91	47
Average Queue (ft)	104	4	2
95th Queue (ft)	195	55	34
Link Distance (ft)		439	439
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	225		
Storage Blk Time (%)	0	0	
Queuing Penalty (veh)	1	0	

Intersection: 105: WB to EB XO. W. of Park Drive & WB 12 Mile Road

Movement	WB	WB
Directions Served	L	T
Maximum Queue (ft)	416	53
Average Queue (ft)	216	2
95th Queue (ft)	347	38
Link Distance (ft)	536	536
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 106: EB 12 Mile Road & EB to WB XO W. of Park Drive

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	124	142
Average Queue (ft)	23	35
95th Queue (ft)	78	102
Link Distance (ft)	580	580
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 107: WB to EB XO. E. of Beck Road & WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-R

Movement	NB	NB	NB	SB	SB	SB	SB	NE	NE	SW	SW
Directions Served	L	T	T	L	L	T	T	L	L	L	L
Maximum Queue (ft)	186	206	203	179	192	185	194	302	339	228	266
Average Queue (ft)	107	155	170	113	157	141	153	140	193	121	146
95th Queue (ft)	184	216	218	166	205	198	203	239	292	193	214
Link Distance (ft)	126	126	126	105	105	105	105	318	318	235	235
Upstream Blk Time (%)	7	27	37	13	31	24	22	0	1	0	0
Queuing Penalty (veh)	20	85	117	42	101	81	73	0	2	0	1
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 7002: Beck Road & WB I-96 Off-Ramp

Movement	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	T	T	T
Maximum Queue (ft)	301	321	113	109	61	106	94	107
Average Queue (ft)	173	174	31	50	3	21	12	18
95th Queue (ft)	313	280	86	104	28	71	54	69
Link Distance (ft)	219	219	105	105	167	167	167	167
Upstream Blk Time (%)	11	4	1	1		0		
Queuing Penalty (veh)	43	18	6	7		0		
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 7003: Beck Road & EB I-96 Off-Ramp

Movement	EB	NB	NB	NB	SB	SB
Directions Served	R	T	T	T	T	T
Maximum Queue (ft)	306	148	242	277	74	73
Average Queue (ft)	141	16	54	70	24	26
95th Queue (ft)	247	100	214	223	60	58
Link Distance (ft)	283		392	392	126	126
Upstream Blk Time (%)	0		1	0		
Queuing Penalty (veh)	2		0	0		
Storage Bay Dist (ft)		150				
Storage Blk Time (%)		0	5			
Queuing Penalty (veh)		0	15			

Intersection: 7004: Beck Road & WB I-96 On-Ramp

Movement	NB	NB	NB
Directions Served	T	T	T
Maximum Queue (ft)	248	213	25
Average Queue (ft)	118	48	1
95th Queue (ft)	276	179	18
Link Distance (ft)	167	167	
Upstream Blk Time (%)	12	1	
Queuing Penalty (veh)	129	6	
Storage Bay Dist (ft)			1
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 8001: Beck Road

Movement	B10	B10
Directions Served	T	
Maximum Queue (ft)	324	276
Average Queue (ft)	160	54
95th Queue (ft)	401	215
Link Distance (ft)	192	192
Upstream Blk Time (%)	6	1
Queuing Penalty (veh)	35	4
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8002: EB 12 Mile Road & 12 Mile Road/WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9001: Dummy Node A & EB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9002: WB 12 Mile Road & Dummy Node B

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 1761

Intersection: 1: WB 12 Mile Road & Park Drive

Movement	WB	WB	WB	SB	SB
Directions Served	T	T	R	R	R
Maximum Queue (ft)	316	295	72	297	259
Average Queue (ft)	159	151	27	152	128
95th Queue (ft)	264	246	58	254	229
Link Distance (ft)	440	440	440	721	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					200
Storage Blk Time (%)				3	1
Queuing Penalty (veh)				11	4

Intersection: 2: Beck Road & 12 Mile Road

Movement	WB	WB	WB	NB	NB	NB	NB	SB	SB	SB	B10	B10
Directions Served	L	L	R	T	T	R	R	L	T	T	T	T
Maximum Queue (ft)	521	522	137	306	263	119	108	191	272	234	122	72
Average Queue (ft)	314	323	50	275	153	65	62	91	206	146	14	4
95th Queue (ft)	482	492	109	320	248	102	97	185	290	220	66	33
Link Distance (ft)	731	731	731	223	223	223	223		192	192	94	94
Upstream Blk Time (%)				56	3			0	9	1	1	0
Queuing Penalty (veh)				187	10			0	49	6	3	0
Storage Bay Dist (ft)								200				
Storage Blk Time (%)								0	9			
Queuing Penalty (veh)								1	8			

Intersection: 3: Keystone Medical Center Drive & EB 12 Mile Road

Movement	NB
Directions Served	R
Maximum Queue (ft)	46
Average Queue (ft)	15
95th Queue (ft)	38
Link Distance (ft)	247
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: EB to WB XO. E. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	177	180	182	80
Average Queue (ft)	74	56	55	66
95th Queue (ft)	144	125	120	79
Link Distance (ft)	536	536		23
Upstream Blk Time (%)				71
Queuing Penalty (veh)				152
Storage Bay Dist (ft)			450	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: EB 12 Mile Road & WB to EB XO. W. of Park Drive

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	117	119	67
Average Queue (ft)	52	58	58
95th Queue (ft)	114	120	64
Link Distance (ft)	56	56	10
Upstream Blk Time (%)	8	10	60
Queuing Penalty (veh)	22	29	280
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: EB to WB XO W. of Park Drive & WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 7: EB 12 Mile Road & WB to EB XO. E. of Beck Road

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 13: WB I-96 On-Ramp

Movement	NW
Directions Served	L
Maximum Queue (ft)	51
Average Queue (ft)	6
95th Queue (ft)	31
Link Distance (ft)	527
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 19: WB I-96 Off-Ramp

Movement	WB	WB
Directions Served	T	T
Maximum Queue (ft)	125	109
Average Queue (ft)	17	9
95th Queue (ft)	125	88
Link Distance (ft)	655	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)	3	0
Queuing Penalty (veh)	5	0

Intersection: 21: EB I-96 Off-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 25: Bend

Movement	EB	EB
Directions Served		T
Maximum Queue (ft)	219	257
Average Queue (ft)	38	110
95th Queue (ft)	124	242
Link Distance (ft)	547	547
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 27: Bend

Movement	WB	WB
Directions Served	T	
Maximum Queue (ft)	217	178
Average Queue (ft)	75	23
95th Queue (ft)	228	114
Link Distance (ft)	138	138
Upstream Blk Time (%)	4	0
Queuing Penalty (veh)	20	1
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 104: EB 12 Mile Road & EB to WB XO. E. of Park Drive

Movement	EB	EB
Directions Served	L	T
Maximum Queue (ft)	207	46
Average Queue (ft)	86	2
95th Queue (ft)	174	33
Link Distance (ft)		439
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	225	
Storage Blk Time (%)	0	0
Queuing Penalty (veh)	2	0

Intersection: 105: WB to EB XO. W. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB
Directions Served	L	T	T
Maximum Queue (ft)	451	114	110
Average Queue (ft)	251	11	8
95th Queue (ft)	412	140	113
Link Distance (ft)	536	536	536
Upstream Blk Time (%)	0	0	0
Queuing Penalty (veh)	0	2	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 106: EB 12 Mile Road & EB to WB XO W. of Park Drive

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	49	54
Average Queue (ft)	4	5
95th Queue (ft)	23	28
Link Distance (ft)	580	580
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 107: WB to EB XO. E. of Beck Road & WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-

Movement	NB	NB	NB	SB	SB	SB	SB	NE	NE	SW	SW
Directions Served	L	T	T	L	L	T	T	L	L	L	L
Maximum Queue (ft)	200	210	204	185	190	187	194	100	115	182	209
Average Queue (ft)	154	175	170	141	167	139	152	35	48	98	123
95th Queue (ft)	218	221	219	199	205	198	202	81	94	161	182
Link Distance (ft)	126	126	126	105	105	105	105	318	318	235	235
Upstream Blk Time (%)	23	40	29	30	44	16	18			0	0
Queuing Penalty (veh)	95	164	117	117	171	61	70			0	0
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 7002: Beck Road & WB I-96 Off-Ramp

Movement	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	T	T	T
Maximum Queue (ft)	252	165	127	98	91	118	82	93
Average Queue (ft)	117	65	35	19	15	35	8	15
95th Queue (ft)	281	153	116	69	65	99	42	59
Link Distance (ft)	219	219	105	105	167	167	167	167
Upstream Blk Time (%)	13	0	1	0	0	0		
Queuing Penalty (veh)	21	0	7	0	0	0		
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 7003: Beck Road & EB I-96 Off-Ramp

Movement	EB	NB	NB	NB	SB	SB
Directions Served	R	T	T	T	T	T
Maximum Queue (ft)	192	190	330	312	79	71
Average Queue (ft)	97	55	104	80	29	30
95th Queue (ft)	177	177	316	258	64	64
Link Distance (ft)	283		392	392	126	126
Upstream Blk Time (%)			4	2		
Queuing Penalty (veh)			0	0		
Storage Bay Dist (ft)		150				
Storage Blk Time (%)		1	10			
Queuing Penalty (veh)		3	39			

Intersection: 7004: Beck Road & WB I-96 On-Ramp

Movement	NB	NB	SB
Directions Served	T	T	R
Maximum Queue (ft)	253	156	15
Average Queue (ft)	134	14	1
95th Queue (ft)	286	87	8
Link Distance (ft)	167	167	
Upstream Blk Time (%)	23	0	
Queuing Penalty (veh)	153	0	
Storage Bay Dist (ft)			100
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Intersection: 8001: Beck Road

Movement	B10	B10	SB
Directions Served	T		T
Maximum Queue (ft)	340	258	24
Average Queue (ft)	128	30	1
95th Queue (ft)	372	156	13
Link Distance (ft)	192	192	588
Upstream Blk Time (%)	4	0	
Queuing Penalty (veh)	20	2	
Storage Bay Dist (ft)			
Storage Blk Time (%)			0
Queuing Penalty (veh)			0

Intersection: 8002: EB 12 Mile Road & 12 Mile Road/WB 12 Mile Road

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9001: Dummy Node A & EB 12 Mile Road

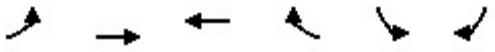
Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 9002: WB 12 Mile Road & Dummy Node B

Movement	SB
Directions Served	R
Maximum Queue (ft)	68
Average Queue (ft)	20
95th Queue (ft)	52
Link Distance (ft)	238
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Network Summary

Network wide Queuing Penalty: 1837



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑	↱		↱
Traffic Volume (vph)	0	0	277	470	0	774
Future Volume (vph)	0	0	277	470	0	774
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)			6.0	6.0		6.0
Lane Util. Factor			0.95	1.00		1.00
Frt			1.00	0.85		0.86
Flt Protected			1.00	1.00		1.00
Satd. Flow (prot)			3725	1667		1696
Flt Permitted			1.00	1.00		1.00
Satd. Flow (perm)			3725	1667		1696
Peak-hour factor, PHF	0.92	0.92	0.89	0.89	0.95	0.95
Adj. Flow (vph)	0	0	311	528	0	815
RTOR Reduction (vph)	0	0	0	0	0	141
Lane Group Flow (vph)	0	0	311	528	0	674
Turn Type			NA	custom		Prot
Protected Phases			2	4		4
Permitted Phases				2		4
Actuated Green, G (s)			40.3	88.0		47.7
Effective Green, g (s)			40.3	88.0		47.7
Actuated g/C Ratio			0.40	0.88		0.48
Clearance Time (s)			6.0	6.0		6.0
Vehicle Extension (s)			3.0	3.0		3.0
Lane Grp Cap (vph)			1501	1667		808
v/s Ratio Prot			0.08	c0.15		c0.40
v/s Ratio Perm				0.17		
v/c Ratio			0.21	0.32		0.83
Uniform Delay, d1			19.4	1.0		22.7
Progression Factor			0.83	1.00		1.00
Incremental Delay, d2			0.3	0.1		7.4
Delay (s)			16.5	1.1		30.1
Level of Service			B	A		C
Approach Delay (s)		0.0	6.8		30.1	
Approach LOS		A	A		C	

Intersection Summary			
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	463	51	1077	998	141	1111
Future Volume (veh/h)	463	51	1077	998	141	1111
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	520	57	1184	1097	148	1169
Peak Hour Factor	0.89	0.89	0.91	0.91	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	637	292	1679	1318	384	1395
Arrive On Green	0.18	0.18	0.15	0.15	0.20	0.71
Sat Flow, veh/h	3638	1668	3839	2937	1875	1969
Grp Volume(v), veh/h	520	57	1184	1097	148	1169
Grp Sat Flow(s),veh/h/ln	1819	1668	1870	1468	1875	1969
Q Serve(g_s), s	13.8	2.9	30.1	36.3	6.8	42.6
Cycle Q Clear(g_c), s	13.8	2.9	30.1	36.3	6.8	42.6
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	637	292	1679	1318	384	1395
V/C Ratio(X)	0.82	0.19	0.71	0.83	0.39	0.84
Avail Cap(c_a), veh/h	1088	499	1739	1365	384	1395
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.7	35.2	36.3	38.9	34.3	10.4
Incr Delay (d2), s/veh	2.6	0.3	2.5	6.3	0.6	6.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	1.2	15.5	15.3	3.1	16.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	42.3	35.5	38.8	45.2	35.0	16.6
LnGrp LOS	D	D	D	D	C	B
Approach Vol, veh/h	577		2281			1317
Approach Delay, s/veh	41.6		41.9			18.6
Approach LOS	D		D			B

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	26.0	50.4		23.6		76.4
Change Period (Y+Rc), s	* 5.5	* 5.5		* 6.1		* 5.5
Max Green Setting (Gmax), s	* 6.5	* 47		* 30		* 59
Max Q Clear Time (g_c+I1), s	8.8	38.3		15.8		44.6
Green Ext Time (p_c), s	0.0	6.6		1.8		8.0

Intersection Summary	
HCM 6th Ctrl Delay	34.5
HCM 6th LOS	C

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱				↱
Traffic Vol, veh/h	1569	60	0	0	0	8
Future Vol, veh/h	1569	60	0	0	0	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	50	-	-	-	0
Veh in Median Storage, #	0	-	-	16983	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	88	88	92	92	67	67
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1783	68	0	0	0	12

Major/Minor	Major1			Minor1	
Conflicting Flow All	0	0		-	892
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	-		-	6.94
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	-		-	3.32
Pot Cap-1 Maneuver	-	-		0	285
Stage 1	-	-		0	-
Stage 2	-	-		0	-
Platoon blocked, %	-	-			
Mov Cap-1 Maneuver	-	-		-	285
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

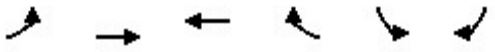
Approach	EB	NB
HCM Control Delay, s	0	18.2
HCM LOS		C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	285	-	-
HCM Lane V/C Ratio	0.042	-	-
HCM Control Delay (s)	18.2	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	0.1	-	-

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	497	250	0
Future Volume (vph)	0	0	0	497	250	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.0	6.0	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.88	0.88	0.85	0.85
Adj. Flow (vph)	0	0	0	565	294	0
RTOR Reduction (vph)	0	0	0	0	141	0
Lane Group Flow (vph)	0	0	0	565	153	0
Turn Type				NA	Prot	
Protected Phases				2	4	
Permitted Phases						
Actuated Green, G (s)				74.4	13.6	
Effective Green, g (s)				74.4	13.6	
Actuated g/C Ratio				0.74	0.14	
Clearance Time (s)				6.0	6.0	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				3982	253	
v/s Ratio Prot				c0.11	c0.08	
v/s Ratio Perm						
v/c Ratio				0.14	0.61	
Uniform Delay, d1				3.7	40.7	
Progression Factor				1.00	1.15	
Incremental Delay, d2				0.1	3.1	
Delay (s)				3.7	49.7	
Level of Service				A	D	
Approach Delay (s)	0.0			3.7	49.7	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.21		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	1100	0	0	529	0
Future Volume (vph)	0	1100	0	0	529	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			6.0	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3725			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3725			1863	
Peak-hour factor, PHF	0.88	0.88	0.92	0.92	0.89	0.89
Adj. Flow (vph)	0	1250	0	0	594	0
RTOR Reduction (vph)	0	0	0	0	16	0
Lane Group Flow (vph)	0	1250	0	0	578	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		51.9			36.1	
Effective Green, g (s)		51.9			36.1	
Actuated g/C Ratio		0.52			0.36	
Clearance Time (s)		6.0			6.0	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		1933			672	
v/s Ratio Prot		c0.34			c0.31	
v/s Ratio Perm						
v/c Ratio		0.65			0.86	
Uniform Delay, d1		17.4			29.6	
Progression Factor		1.05			0.58	
Incremental Delay, d2		1.4			8.0	
Delay (s)		19.7			25.3	
Level of Service		B			C	
Approach Delay (s)		19.7	0.0		25.3	
Approach LOS		B	A		C	

Intersection Summary			
HCM 2000 Control Delay	21.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑	↰	
Traffic Vol, veh/h	0	0	0	522	22	0
Future Vol, veh/h	0	0	0	522	22	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	89	89	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	587	24	0

Major/Minor	Major2		Minor1	
Conflicting Flow All	-	-	294	-
Stage 1	-	-	0	-
Stage 2	-	-	294	-
Critical Hdwy	-	-	6.84	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.84	-
Follow-up Hdwy	-	-	3.52	-
Pot Cap-1 Maneuver	0	-	673	0
Stage 1	0	-	-	0
Stage 2	0	-	730	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	673	-
Mov Cap-2 Maneuver	-	-	673	-
Stage 1	-	-	-	-
Stage 2	-	-	730	-

Approach	WB	NB
HCM Control Delay, s	0	10.5
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	673	-
HCM Lane V/C Ratio	0.036	-
HCM Control Delay (s)	10.5	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0.1	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↰	
Traffic Vol, veh/h	0	1139	0	0	3	0
Future Vol, veh/h	0	1139	0	0	3	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	16983	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	88	88	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	1294	0	0	3	0

Major/Minor	Major1		Minor2	
Conflicting Flow All	-	0	647	-
Stage 1	-	-	0	-
Stage 2	-	-	647	-
Critical Hdwy	-	-	6.84	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.84	-
Follow-up Hdwy	-	-	3.52	-
Pot Cap-1 Maneuver	0	-	404	0
Stage 1	0	-	-	0
Stage 2	0	-	483	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	404	-
Mov Cap-2 Maneuver	-	-	404	-
Stage 1	-	-	-	-
Stage 2	-	-	483	-

Approach	EB	SB
HCM Control Delay, s	0	14
HCM LOS		B

Minor Lane/Major Mvmt	EBT	SBLn1
Capacity (veh/h)	-	404
HCM Lane V/C Ratio	-	0.008
HCM Control Delay (s)	-	14
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0

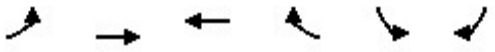
Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑	↱		↱
Traffic Vol, veh/h	0	0	513	31	0	10
Future Vol, veh/h	0	0	513	31	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	10	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	89	89	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	576	35	0	11

Major/Minor	Major2		Minor2	
Conflicting Flow All	-	0	-	288
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	-	3.32
Pot Cap-1 Maneuver	-	-	0	709
Stage 1	-	-	0	-
Stage 2	-	-	0	-
Platoon blocked, %	-	-		
Mov Cap-1 Maneuver	-	-	-	709
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	WB	SB
HCM Control Delay, s	0	10.2
HCM LOS		B

Minor Lane/Major Mvmt	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	709
HCM Lane V/C Ratio	-	-	0.015
HCM Control Delay (s)	-	-	10.2
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑	↱		↱
Traffic Volume (vph)	0	0	903	525	0	860
Future Volume (vph)	0	0	903	525	0	860
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)			6.0	6.0		6.0
Lane Util. Factor			0.95	1.00		1.00
Frt			1.00	0.85		0.86
Flt Protected			1.00	1.00		1.00
Satd. Flow (prot)			3725	1667		1696
Flt Permitted			1.00	1.00		1.00
Satd. Flow (perm)			3725	1667		1696
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.84	0.84
Adj. Flow (vph)	0	0	951	553	0	1024
RTOR Reduction (vph)	0	0	0	0	0	4
Lane Group Flow (vph)	0	0	951	553	0	1020
Turn Type			NA	custom		Prot
Protected Phases			2	4		4
Permitted Phases				2		4
Actuated Green, G (s)			27.7	88.0		60.3
Effective Green, g (s)			27.7	88.0		60.3
Actuated g/C Ratio			0.28	0.88		0.60
Clearance Time (s)			6.0	6.0		6.0
Vehicle Extension (s)			3.0	3.0		3.0
Lane Grp Cap (vph)			1031	1667		1022
v/s Ratio Prot			c0.26	0.20		c0.60
v/s Ratio Perm				0.13		
v/c Ratio			0.92	0.33		1.00
Uniform Delay, d1			35.1	1.0		19.8
Progression Factor			0.83	1.00		1.00
Incremental Delay, d2			14.1	0.1		27.5
Delay (s)			43.3	1.1		47.3
Level of Service			D	A		D
Approach Delay (s)		0.0	27.8		47.3	
Approach LOS		A	C		D	

Intersection Summary			
HCM 2000 Control Delay	35.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1209	146	841	514	86	992
Future Volume (veh/h)	1209	146	841	514	86	992
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	1300	157	885	541	91	1044
Peak Hour Factor	0.93	0.93	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	1015	466	1262	991	399	1191
Arrive On Green	0.28	0.28	0.11	0.11	0.21	0.61
Sat Flow, veh/h	3638	1668	3839	2937	1875	1969
Grp Volume(v), veh/h	1300	157	885	541	91	1044
Grp Sat Flow(s),veh/h/ln	1819	1668	1870	1468	1875	1969
Q Serve(g_s), s	27.9	7.5	22.8	17.4	4.0	44.6
Cycle Q Clear(g_c), s	27.9	7.5	22.8	17.4	4.0	44.6
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	1015	466	1262	991	399	1191
V/C Ratio(X)	1.28	0.34	0.70	0.55	0.23	0.88
Avail Cap(c_a), veh/h	1015	466	1814	1424	399	1191
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.0	28.7	39.6	37.2	32.6	16.6
Incr Delay (d2), s/veh	134.0	0.4	3.3	2.2	0.3	9.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	30.5	2.9	11.9	7.1	1.8	20.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	170.1	29.1	42.9	39.4	32.9	25.8
LnGrp LOS	F	C	D	D	C	C
Approach Vol, veh/h	1457		1426			1135
Approach Delay, s/veh	154.9		41.5			26.4
Approach LOS	F		D			C

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	26.8	39.2		34.0		66.0
Change Period (Y+Rc), s	* 5.5	* 5.5		* 6.1		* 5.5
Max Green Setting (Gmax), s	* 6.5	* 49		* 28		* 61
Max Q Clear Time (g_c+I1), s	6.0	24.8		29.9		46.6
Green Ext Time (p_c), s	0.0	8.9		0.0		6.7

Intersection Summary	
HCM 6th Ctrl Delay	78.4
HCM 6th LOS	E

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1033	16	0	0	0	31
Future Vol, veh/h	1033	16	0	0	0	31
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	50	-	-	-	0
Veh in Median Storage, #	0	-	-	16983	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	92	92	78	78
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1111	17	0	0	0	40

Major/Minor	Major1			Minor1	
Conflicting Flow All	0	0		-	556
Stage 1	-	-		-	-
Stage 2	-	-		-	-
Critical Hdwy	-	-		-	6.94
Critical Hdwy Stg 1	-	-		-	-
Critical Hdwy Stg 2	-	-		-	-
Follow-up Hdwy	-	-		-	3.32
Pot Cap-1 Maneuver	-	-		0	475
Stage 1	-	-		0	-
Stage 2	-	-		0	-
Platoon blocked, %	-	-			
Mov Cap-1 Maneuver	-	-		-	475
Mov Cap-2 Maneuver	-	-		-	-
Stage 1	-	-		-	-
Stage 2	-	-		-	-

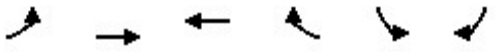
Approach	EB	NB
HCM Control Delay, s	0	13.3
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	475	-	-
HCM Lane V/C Ratio	0.084	-	-
HCM Control Delay (s)	13.3	-	-
HCM Lane LOS	B	-	-
HCM 95th %tile Q(veh)	0.3	-	-

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑↑	↰	
Traffic Volume (vph)	0	0	0	1211	217	0
Future Volume (vph)	0	0	0	1211	217	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)				6.0	6.0	
Lane Util. Factor				0.91	1.00	
Frt				1.00	1.00	
Flt Protected				1.00	0.95	
Satd. Flow (prot)				5353	1863	
Flt Permitted				1.00	0.95	
Satd. Flow (perm)				5353	1863	
Peak-hour factor, PHF	0.92	0.92	0.95	0.95	0.76	0.76
Adj. Flow (vph)	0	0	0	1275	286	0
RTOR Reduction (vph)	0	0	0	0	31	0
Lane Group Flow (vph)	0	0	0	1275	255	0
Turn Type				NA	Prot	
Protected Phases				2	4	
Permitted Phases						
Actuated Green, G (s)				68.9	19.1	
Effective Green, g (s)				68.9	19.1	
Actuated g/C Ratio				0.69	0.19	
Clearance Time (s)				6.0	6.0	
Vehicle Extension (s)				3.0	3.0	
Lane Grp Cap (vph)				3688	355	
v/s Ratio Prot				c0.24	c0.14	
v/s Ratio Perm						
v/c Ratio				0.35	0.72	
Uniform Delay, d1				6.3	37.9	
Progression Factor				1.00	1.18	
Incremental Delay, d2				0.3	6.5	
Delay (s)				6.6	51.4	
Level of Service				A	D	
Approach Delay (s)	0.0			6.6	51.4	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	586	0	0	463	0
Future Volume (vph)	0	586	0	0	463	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)		6.0			6.0	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3725			1863	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3725			1863	
Peak-hour factor, PHF	0.93	0.93	0.92	0.92	0.90	0.90
Adj. Flow (vph)	0	630	0	0	514	0
RTOR Reduction (vph)	0	0	0	0	75	0
Lane Group Flow (vph)	0	630	0	0	439	0
Turn Type		NA			Prot	
Protected Phases		2			4	
Permitted Phases						
Actuated Green, G (s)		57.9			30.1	
Effective Green, g (s)		57.9			30.1	
Actuated g/C Ratio		0.58			0.30	
Clearance Time (s)		6.0			6.0	
Vehicle Extension (s)		3.0			3.0	
Lane Grp Cap (vph)		2156			560	
v/s Ratio Prot		c0.17			c0.24	
v/s Ratio Perm						
v/c Ratio		0.29			0.78	
Uniform Delay, d1		10.7			32.0	
Progression Factor		1.59			1.44	
Incremental Delay, d2		0.3			1.8	
Delay (s)		17.3			47.8	
Level of Service		B			D	
Approach Delay (s)		17.3	0.0		47.8	
Approach LOS		B	A		D	

Intersection Summary			
HCM 2000 Control Delay	31.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations				↑↑	↰	
Traffic Vol, veh/h	0	0	0	1300	5	0
Future Vol, veh/h	0	0	0	1300	5	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	93	93	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	0	1398	5	0

Major/Minor	Major2		Minor1	
Conflicting Flow All	-	-	699	-
Stage 1	-	-	0	-
Stage 2	-	-	699	-
Critical Hdwy	-	-	6.84	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.84	-
Follow-up Hdwy	-	-	3.52	-
Pot Cap-1 Maneuver	0	-	374	0
Stage 1	0	-	-	0
Stage 2	0	-	454	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	374	-
Mov Cap-2 Maneuver	-	-	374	-
Stage 1	-	-	-	-
Stage 2	-	-	454	-

Approach	WB	NB
HCM Control Delay, s	0	14.8
HCM LOS		B

Minor Lane/Major Mvmt	NBLn1	WBT
Capacity (veh/h)	374	-
HCM Lane V/C Ratio	0.015	-
HCM Control Delay (s)	14.8	-
HCM Lane LOS	B	-
HCM 95th %tile Q(veh)	0	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↰	
Traffic Vol, veh/h	0	600	0	0	12	0
Future Vol, veh/h	0	600	0	0	12	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	16983	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	93	93	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	645	0	0	13	0

Major/Minor	Major1		Minor2	
Conflicting Flow All	-	0	323	-
Stage 1	-	-	0	-
Stage 2	-	-	323	-
Critical Hdwy	-	-	6.84	-
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	5.84	-
Follow-up Hdwy	-	-	3.52	-
Pot Cap-1 Maneuver	0	-	646	0
Stage 1	0	-	-	0
Stage 2	0	-	706	0
Platoon blocked, %		-		
Mov Cap-1 Maneuver	-	-	646	-
Mov Cap-2 Maneuver	-	-	646	-
Stage 1	-	-	-	-
Stage 2	-	-	706	-

Approach	EB	SB
HCM Control Delay, s	0	10.7
HCM LOS		B

Minor Lane/Major Mvmt	EBT	SBLn1
Capacity (veh/h)	-	646
HCM Lane V/C Ratio	-	0.02
HCM Control Delay (s)	-	10.7
HCM Lane LOS	-	B
HCM 95th %tile Q(veh)	-	0.1

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations			↑↑	↱		↱
Traffic Vol, veh/h	0	0	1298	7	0	41
Future Vol, veh/h	0	0	1298	7	0	41
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	10	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	93	93	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	1396	8	0	45

Major/Minor	Major2		Minor2	
Conflicting Flow All	-	0	-	698
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Critical Hdwy	-	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-
Follow-up Hdwy	-	-	-	3.32
Pot Cap-1 Maneuver	-	-	0	383
Stage 1	-	-	0	-
Stage 2	-	-	0	-
Platoon blocked, %	-	-		
Mov Cap-1 Maneuver	-	-	-	383
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	WB	SB
HCM Control Delay, s	0	15.6
HCM LOS		C

Minor Lane/Major Mvmt	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	383
HCM Lane V/C Ratio	-	-	0.116
HCM Control Delay (s)	-	-	15.6
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	0.4

Intersection: 1: WB 12 Mile Road & Park Drive

Movement	WB	WB	WB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	166	149	70	433
Average Queue (ft)	71	62	20	181
95th Queue (ft)	138	123	53	338
Link Distance (ft)	439	439	439	726
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Beck Road & 12 Mile Road

Movement	WB	WB	WB	NB	NB	NB	NB	SB	SB	B10	B10
Directions Served	L	L	R	T	T	R	R	L	T	T	T
Maximum Queue (ft)	210	201	67	310	286	147	154	281	286	132	165
Average Queue (ft)	118	107	17	274	156	77	86	193	230	34	79
95th Queue (ft)	187	172	47	320	258	118	127	314	330	123	190
Link Distance (ft)	731	731	731	223	223	223	223	192	192	94	94
Upstream Blk Time (%)				41	2		0	43	18	13	12
Queuing Penalty (veh)				216	12		0	266	116	77	77
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 3: Keystone Medical Center Drive & EB 12 Mile Road

Movement	NB
Directions Served	R
Maximum Queue (ft)	23
Average Queue (ft)	6
95th Queue (ft)	22
Link Distance (ft)	247
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: EB to WB XO. E. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	100	61	95	82
Average Queue (ft)	30	15	40	68
95th Queue (ft)	72	47	84	77
Link Distance (ft)	536	536		23
Upstream Blk Time (%)				69
Queuing Penalty (veh)				172
Storage Bay Dist (ft)			450	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: EB 12 Mile Road & WB to EB XO. W. of Park Drive

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	130	138	67
Average Queue (ft)	100	108	58
95th Queue (ft)	143	142	64
Link Distance (ft)	56	56	10
Upstream Blk Time (%)	23	28	59
Queuing Penalty (veh)	130	153	311
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: EB to WB XO W. of Park Drive & WB 12 Mile Road

Movement	NB
Directions Served	L
Maximum Queue (ft)	40
Average Queue (ft)	15
95th Queue (ft)	41
Link Distance (ft)	12
Upstream Blk Time (%)	2
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: EB 12 Mile Road & WB to EB XO. E. of Beck Road

Movement	SB
Directions Served	L
Maximum Queue (ft)	25
Average Queue (ft)	2
95th Queue (ft)	13
Link Distance (ft)	31
Upstream Blk Time (%)	0
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: WB 12 Mile Road & Site Drive

Movement	WB	SB
Directions Served	R	R
Maximum Queue (ft)	14	22
Average Queue (ft)	0	7
95th Queue (ft)	10	24
Link Distance (ft)		224
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	10	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	0	

Intersection: 13: WB I-96 On-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 19: WB I-96 Off-Ramp

Movement	WB	WB	WB	WB	B26
Directions Served	L	L	T	T	T
Maximum Queue (ft)	47	78	298	166	54
Average Queue (ft)	6	9	49	31	5
95th Queue (ft)	61	78	278	177	67
Link Distance (ft)		655	655		254
Upstream Blk Time (%)			1		1
Queuing Penalty (veh)			0		0
Storage Bay Dist (ft)	150			150	
Storage Blk Time (%)	0	1	9	1	
Queuing Penalty (veh)	1	2	35	6	

Intersection: 21: EB I-96 Off-Ramp

Movement	EB	EB
Directions Served	L	L
Maximum Queue (ft)	39	134
Average Queue (ft)	1	21
95th Queue (ft)	28	96
Link Distance (ft)		456
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	200	
Storage Blk Time (%)	0	0
Queuing Penalty (veh)	0	1

Intersection: 25: Bend

Movement	EB	EB
Directions Served		T
Maximum Queue (ft)	98	273
Average Queue (ft)	26	84
95th Queue (ft)	82	214
Link Distance (ft)	547	547
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 27: Bend

Movement	WB	WB
Directions Served	T	
Maximum Queue (ft)	26	9
Average Queue (ft)	1	0
95th Queue (ft)	11	6
Link Distance (ft)	138	138
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 104: EB 12 Mile Road & EB to WB XO. E. of Park Drive

Movement	EB	EB
Directions Served	L	T
Maximum Queue (ft)	232	38
Average Queue (ft)	113	1
95th Queue (ft)	204	27
Link Distance (ft)		439
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	225	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	3	

Intersection: 105: WB to EB XO. W. of Park Drive & WB 12 Mile Road

Movement	WB	WB
Directions Served	L	T
Maximum Queue (ft)	468	120
Average Queue (ft)	216	8
95th Queue (ft)	388	119
Link Distance (ft)		547
Upstream Blk Time (%)		0
Queuing Penalty (veh)		1
Storage Bay Dist (ft)	450	
Storage Blk Time (%)	1	
Queuing Penalty (veh)	3	

Intersection: 106: EB 12 Mile Road & EB to WB XO W. of Park Drive

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	113	121
Average Queue (ft)	28	42
95th Queue (ft)	91	106
Link Distance (ft)	580	580
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 107: WB to EB XO. E. of Beck Road & WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-R

Movement	NB	NB	NB	SB	SB	SB	SB	NE	NE	SW	SW
Directions Served	L	T	T	L	L	T	T	L	L	L	L
Maximum Queue (ft)	192	202	204	180	189	188	194	373	448	249	304
Average Queue (ft)	106	143	160	124	159	134	153	236	315	157	182
95th Queue (ft)	184	210	217	182	209	191	205	374	489	265	295
Link Distance (ft)	126	126	126	105	105	105	105	318	318	235	235
Upstream Blk Time (%)	7	18	25	18	32	17	22	3	23	3	6
Queuing Penalty (veh)	23	58	79	60	107	57	73	9	69	9	16
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 7002: Beck Road & WB I-96 Off-Ramp

Movement	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	T	T	T
Maximum Queue (ft)	344	328	142	141	79	105	58	68
Average Queue (ft)	182	194	73	88	8	25	5	12
95th Queue (ft)	340	343	141	137	47	81	30	47
Link Distance (ft)	219	219	105	105	167	167	167	167
Upstream Blk Time (%)	19	12	2	5				
Queuing Penalty (veh)	73	48	15	31				
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 7003: Beck Road & EB I-96 Off-Ramp

Movement	EB	NB	NB	NB	SB	SB
Directions Served	R	T	T	T	T	T
Maximum Queue (ft)	326	88	153	155	102	94
Average Queue (ft)	143	6	20	35	45	48
95th Queue (ft)	258	44	89	116	92	96
Link Distance (ft)	283		392	392	126	126
Upstream Blk Time (%)	1				0	
Queuing Penalty (veh)	4				1	
Storage Bay Dist (ft)		150				
Storage Blk Time (%)			1			
Queuing Penalty (veh)			2			

Intersection: 7004: Beck Road & WB I-96 On-Ramp

Movement	NB	NB	NB
Directions Served	T	T	T
Maximum Queue (ft)	253	214	49
Average Queue (ft)	131	60	2
95th Queue (ft)	294	197	31
Link Distance (ft)	167	167	
Upstream Blk Time (%)	13	1	
Queuing Penalty (veh)	141	8	
Storage Bay Dist (ft)			1
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Intersection: 8001: Beck Road

Movement	B10	B10	SB	SB
Directions Served	T		T	T
Maximum Queue (ft)	335	297	100	568
Average Queue (ft)	190	62	22	114
95th Queue (ft)	436	232	96	396
Link Distance (ft)	192	192		588
Upstream Blk Time (%)	9	2		1
Queuing Penalty (veh)	50	9		0
Storage Bay Dist (ft)			100	
Storage Blk Time (%)			3	7
Queuing Penalty (veh)			21	43

Intersection: 8002: EB 12 Mile Road & 12 Mile Road/WB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9001: Dummy Node A & EB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9002: WB 12 Mile Road & Dummy Node B

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 2590

Intersection: 1: WB 12 Mile Road & Park Drive

Movement	WB	WB	WB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	526	520	155	765
Average Queue (ft)	351	354	31	490
95th Queue (ft)	582	576	97	841
Link Distance (ft)	439	439	439	726
Upstream Blk Time (%)	29	30		16
Queuing Penalty (veh)	135	137		0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Beck Road & 12 Mile Road

Movement	WB	WB	WB	NB	NB	NB	NB	SB	SB	B10
Directions Served	L	L	R	T	T	R	R	L	T	T
Maximum Queue (ft)	826	817	246	289	257	110	92	170	279	164
Average Queue (ft)	772	771	78	242	124	55	54	70	238	80
95th Queue (ft)	911	899	191	328	225	92	88	137	316	184
Link Distance (ft)	731	731	731	223	223	223	223	192	192	94
Upstream Blk Time (%)	77	77		29	2			0	22	12
Queuing Penalty (veh)	349	347		100	6			1	121	67
Storage Bay Dist (ft)										
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 3: Keystone Medical Center Drive & EB 12 Mile Road

Movement	EB	EB	NB
Directions Served	T	T	R
Maximum Queue (ft)	407	361	103
Average Queue (ft)	66	28	24
95th Queue (ft)	349	198	72
Link Distance (ft)	558	558	247
Upstream Blk Time (%)	5	0	
Queuing Penalty (veh)	28	0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 4: EB to WB XO. E. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	517	493	467	80
Average Queue (ft)	166	153	121	65
95th Queue (ft)	411	406	349	76
Link Distance (ft)	536	536		23
Upstream Blk Time (%)	3	4	0	77
Queuing Penalty (veh)	0	0	0	165
Storage Bay Dist (ft)			450	
Storage Blk Time (%)		6	1	
Queuing Penalty (veh)		22	3	

Intersection: 5: EB 12 Mile Road & WB to EB XO. W. of Park Drive

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	120	117	76
Average Queue (ft)	60	68	58
95th Queue (ft)	124	125	69
Link Distance (ft)	56	56	10
Upstream Blk Time (%)	12	11	62
Queuing Penalty (veh)	35	32	289
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: EB to WB XO W. of Park Drive & WB 12 Mile Road

Movement	WB	WB	NB
Directions Served	T	T	L
Maximum Queue (ft)	154	152	48
Average Queue (ft)	68	69	11
95th Queue (ft)	171	172	37
Link Distance (ft)	56	56	12
Upstream Blk Time (%)	51	51	26
Queuing Penalty (veh)	323	329	1
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 7: EB 12 Mile Road & WB to EB XO. E. of Beck Road

Movement	SB
Directions Served	L
Maximum Queue (ft)	31
Average Queue (ft)	10
95th Queue (ft)	33
Link Distance (ft)	31
Upstream Blk Time (%)	1
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: WB 12 Mile Road & Site Drive

Movement	WB	WB	WB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	374	372	68	216
Average Queue (ft)	209	210	9	115
95th Queue (ft)	478	478	51	256
Link Distance (ft)	278	278		209
Upstream Blk Time (%)	53	53		38
Queuing Penalty (veh)	338	344		0
Storage Bay Dist (ft)			10	
Storage Blk Time (%)		24		
Queuing Penalty (veh)		2		

Intersection: 13: WB I-96 On-Ramp

Movement	NW
Directions Served	L
Maximum Queue (ft)	28
Average Queue (ft)	1
95th Queue (ft)	11
Link Distance (ft)	527
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 19: WB I-96 Off-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 21: EB I-96 Off-Ramp

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 25: Bend

Movement	EB	EB
Directions Served		T
Maximum Queue (ft)	115	281
Average Queue (ft)	32	103
95th Queue (ft)	91	226
Link Distance (ft)	547	547
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 27: Bend

Movement	WB	WB
Directions Served	T	
Maximum Queue (ft)	212	180
Average Queue (ft)	45	13
95th Queue (ft)	168	80
Link Distance (ft)	138	138
Upstream Blk Time (%)	1	0
Queuing Penalty (veh)	7	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 104: EB 12 Mile Road & EB to WB XO. E. of Park Drive

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	343	433	376
Average Queue (ft)	163	93	22
95th Queue (ft)	342	378	162
Link Distance (ft)		439	439
Upstream Blk Time (%)		14	0
Queuing Penalty (veh)		74	0
Storage Bay Dist (ft)	225		
Storage Blk Time (%)	22	1	
Queuing Penalty (veh)	91	3	

Intersection: 105: WB to EB XO. W. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB
Directions Served	L	T	T
Maximum Queue (ft)	524	577	581
Average Queue (ft)	311	261	251
95th Queue (ft)	537	689	669
Link Distance (ft)		547	547
Upstream Blk Time (%)		4	1
Queuing Penalty (veh)		37	11
Storage Bay Dist (ft)	450		
Storage Blk Time (%)	3	16	
Queuing Penalty (veh)	20	73	

Intersection: 106: EB 12 Mile Road & EB to WB XO W. of Park Drive

Movement	EB	EB	EB
Directions Served	L	T	T
Maximum Queue (ft)	12	153	147
Average Queue (ft)	1	12	14
95th Queue (ft)	8	85	83
Link Distance (ft)		580	580
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	275		
Storage Blk Time (%)		0	
Queuing Penalty (veh)		0	

Intersection: 107: WB to EB XO. E. of Beck Road & WB 12 Mile Road

Movement	WB	WB	WB
Directions Served	L	T	T
Maximum Queue (ft)	224	721	720
Average Queue (ft)	58	540	543
95th Queue (ft)	220	964	963
Link Distance (ft)		611	611
Upstream Blk Time (%)		65	67
Queuing Penalty (veh)		444	456
Storage Bay Dist (ft)	150		
Storage Blk Time (%)		74	
Queuing Penalty (veh)		9	

Intersection: 7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-R

Movement	NB	NB	NB	SB	SB	SB	SB	NE	NE	SW	SW
Directions Served	L	T	T	L	L	T	T	L	L	L	L
Maximum Queue (ft)	218	195	202	193	202	180	187	88	113	167	179
Average Queue (ft)	172	158	167	162	176	131	145	25	43	93	117
95th Queue (ft)	225	221	213	211	204	187	198	62	89	154	171
Link Distance (ft)	126	126	126	105	105	105	105	318	318	235	235
Upstream Blk Time (%)	51	22	24	54	67	13	17				
Queuing Penalty (veh)	209	91	97	213	261	50	66				
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 7002: Beck Road & WB I-96 Off-Ramp

Movement	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	T	T	T
Maximum Queue (ft)	142	111	60	72	183	214	65	86
Average Queue (ft)	60	49	5	8	66	91	5	9
95th Queue (ft)	113	92	30	38	193	223	32	43
Link Distance (ft)	219	219	105	105	167	167	167	167
Upstream Blk Time (%)	0		0	0	7	12		
Queuing Penalty (veh)	0		0	0	29	48		
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 7003: Beck Road & EB I-96 Off-Ramp

Movement	EB	NB	NB	NB	SB	SB
Directions Served	R	T	T	T	T	T
Maximum Queue (ft)	207	199	376	321	56	53
Average Queue (ft)	97	97	124	86	12	12
95th Queue (ft)	172	230	360	290	39	38
Link Distance (ft)	283		392	392	126	126
Upstream Blk Time (%)			4	2		
Queuing Penalty (veh)			0	0		
Storage Bay Dist (ft)		150				
Storage Blk Time (%)		17	0			
Queuing Penalty (veh)		72	2			

Intersection: 7004: Beck Road & WB I-96 On-Ramp

Movement	NB	NB	SB	SB	SB	SB
Directions Served	T	T	T	T	T	T
Maximum Queue (ft)	192	76	35	62	71	68
Average Queue (ft)	46	4	10	17	14	4
95th Queue (ft)	145	43	55	96	123	62
Link Distance (ft)	167	167			223	223
Upstream Blk Time (%)	2	0			1	0
Queuing Penalty (veh)	14	0			7	0
Storage Bay Dist (ft)			1	1		
Storage Blk Time (%)			0	0		
Queuing Penalty (veh)			0	1		

Intersection: 8001: Beck Road

Movement	B10	B10	SB	SB
Directions Served	T		T	T
Maximum Queue (ft)	324	234	100	398
Average Queue (ft)	96	32	9	67
95th Queue (ft)	318	154	61	259
Link Distance (ft)	192	192		588
Upstream Blk Time (%)	4	0		0
Queuing Penalty (veh)	19	2		0
Storage Bay Dist (ft)			100	
Storage Blk Time (%)				6
Queuing Penalty (veh)				31

Intersection: 8002: EB 12 Mile Road & 12 Mile Road/WB 12 Mile Road

Movement	WB	WB
Directions Served	T	T
Maximum Queue (ft)	246	240
Average Queue (ft)	199	198
95th Queue (ft)	305	300
Link Distance (ft)	160	160
Upstream Blk Time (%)	76	72
Queuing Penalty (veh)	514	491
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9001: Dummy Node A & EB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 9002: WB 12 Mile Road & Dummy Node B

Movement	WB	WB	SB
Directions Served	T	TR	R
Maximum Queue (ft)	198	196	252
Average Queue (ft)	112	113	136
95th Queue (ft)	239	240	299
Link Distance (ft)	89	89	238
Upstream Blk Time (%)	60	63	33
Queuing Penalty (veh)	403	419	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 7439

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1209	146	841	514	86	992
Future Volume (veh/h)	1209	146	841	514	86	992
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1969	1969	1969	1969	1969	1969
Adj Flow Rate, veh/h	1300	157	885	541	91	1044
Peak Hour Factor	0.93	0.93	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	1270	582	1215	954	291	1053
Arrive On Green	0.35	0.35	0.11	0.11	0.16	0.54
Sat Flow, veh/h	3638	1668	3839	2937	1875	1969
Grp Volume(v), veh/h	1300	157	885	541	91	1044
Grp Sat Flow(s),veh/h/ln	1819	1668	1870	1468	1875	1969
Q Serve(g_s), s	34.9	6.8	22.9	17.5	4.3	52.5
Cycle Q Clear(g_c), s	34.9	6.8	22.9	17.5	4.3	52.5
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	1270	582	1215	954	291	1053
V/C Ratio(X)	1.02	0.27	0.73	0.57	0.31	0.99
Avail Cap(c_a), veh/h	1270	582	1552	1219	291	1053
HCM Platoon Ratio	1.00	1.00	0.33	0.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.5	23.4	40.4	38.0	37.5	23.0
Incr Delay (d2), s/veh	31.5	0.2	3.9	2.4	0.6	25.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	19.7	2.6	12.0	7.2	2.0	28.8
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	64.1	23.6	44.2	40.4	38.1	48.7
LnGrp LOS	F	C	D	D	D	D
Approach Vol, veh/h	1457		1426			1135
Approach Delay, s/veh	59.7		42.8			47.9
Approach LOS	E		D			D

Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	21.0	38.0		41.0		59.0
Change Period (Y+Rc), s	* 5.5	* 5.5		* 6.1		* 5.5
Max Green Setting (Gmax), s	* 6.5	* 42		* 35		* 54
Max Q Clear Time (g_c+I1), s	6.3	24.9		36.9		54.5
Green Ext Time (p_c), s	0.0	7.6		0.0		0.0

Intersection Summary	
HCM 6th Ctrl Delay	50.4
HCM 6th LOS	D

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection: 1: WB 12 Mile Road & Park Drive

Movement	WB	WB	WB	SB
Directions Served	T	T	R	R
Maximum Queue (ft)	293	305	76	756
Average Queue (ft)	179	185	32	571
95th Queue (ft)	278	286	63	897
Link Distance (ft)	439	439	439	726
Upstream Blk Time (%)				31
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Beck Road & 12 Mile Road

Movement	WB	WB	WB	NB	NB	NB	NB	SB	SB	B10
Directions Served	L	L	R	T	T	R	R	L	T	T
Maximum Queue (ft)	815	823	154	299	268	103	107	172	291	168
Average Queue (ft)	633	640	72	259	146	62	58	69	262	125
95th Queue (ft)	946	946	141	325	243	94	94	136	293	199
Link Distance (ft)	731	731	731	223	223	223	223	192	192	94
Upstream Blk Time (%)	31	32		43	3			0	39	31
Queuing Penalty (veh)	137	144		145	9			2	208	166
Storage Bay Dist (ft)										
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 3: Keystone Medical Center Drive & EB 12 Mile Road

Movement	NB
Directions Served	R
Maximum Queue (ft)	49
Average Queue (ft)	17
95th Queue (ft)	41
Link Distance (ft)	247
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 4: EB to WB XO. E. of Park Drive & WB 12 Mile Road

Movement	WB	WB	WB	NB
Directions Served	T	T	T	L
Maximum Queue (ft)	177	171	166	87
Average Queue (ft)	76	58	55	68
95th Queue (ft)	146	128	125	80
Link Distance (ft)	536	536		23
Upstream Blk Time (%)				72
Queuing Penalty (veh)				156
Storage Bay Dist (ft)			450	
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 5: EB 12 Mile Road & WB to EB XO. W. of Park Drive

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	117	117	62
Average Queue (ft)	51	62	58
95th Queue (ft)	107	113	62
Link Distance (ft)	56	56	10
Upstream Blk Time (%)	7	8	60
Queuing Penalty (veh)	19	23	279
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 6: EB to WB XO W. of Park Drive & WB 12 Mile Road

Movement	NB
Directions Served	L
Maximum Queue (ft)	30
Average Queue (ft)	4
95th Queue (ft)	20
Link Distance (ft)	12
Upstream Blk Time (%)	1
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 7: EB 12 Mile Road & WB to EB XO. E. of Beck Road

Movement	SB
Directions Served	L
Maximum Queue (ft)	31
Average Queue (ft)	10
95th Queue (ft)	33
Link Distance (ft)	31
Upstream Blk Time (%)	1
Queuing Penalty (veh)	0
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: WB 12 Mile Road & Site Drive

Movement	SB
Directions Served	R
Maximum Queue (ft)	54
Average Queue (ft)	19
95th Queue (ft)	41
Link Distance (ft)	222
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 13: WB I-96 On-Ramp

Movement	NW
Directions Served	L
Maximum Queue (ft)	39
Average Queue (ft)	2
95th Queue (ft)	16
Link Distance (ft)	527
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 19: WB I-96 Off-Ramp

Movement	WB
Directions Served	T
Maximum Queue (ft)	12
Average Queue (ft)	1
95th Queue (ft)	10
Link Distance (ft)	655
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 21: EB I-96 Off-Ramp

Movement	
Directions Served	
Maximum Queue (ft)	
Average Queue (ft)	
95th Queue (ft)	
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 25: Bend

Movement	EB	EB
Directions Served		T
Maximum Queue (ft)	221	305
Average Queue (ft)	34	108
95th Queue (ft)	116	237
Link Distance (ft)	547	547
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 27: Bend

Movement	WB	WB
Directions Served	T	
Maximum Queue (ft)	214	179
Average Queue (ft)	73	25
95th Queue (ft)	216	120
Link Distance (ft)	138	138
Upstream Blk Time (%)	3	0
Queuing Penalty (veh)	16	1
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 104: EB 12 Mile Road & EB to WB XO. E. of Park Drive

Movement	EB	EB
Directions Served	L	T
Maximum Queue (ft)	208	37
Average Queue (ft)	85	1
95th Queue (ft)	168	27
Link Distance (ft)		439
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	225	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	1	

Intersection: 105: WB to EB XO. W. of Park Drive & WB 12 Mile Road

Movement	WB
Directions Served	L
Maximum Queue (ft)	363
Average Queue (ft)	234
95th Queue (ft)	334
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	450
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 106: EB 12 Mile Road & EB to WB XO W. of Park Drive

Movement	EB	EB
Directions Served	T	T
Maximum Queue (ft)	38	45
Average Queue (ft)	2	4
95th Queue (ft)	16	23
Link Distance (ft)	580	580
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 107: WB to EB XO. E. of Beck Road & WB 12 Mile Road

Movement	WB	WB	WB
Directions Served	L	T	T
Maximum Queue (ft)	45	355	361
Average Queue (ft)	5	61	73
95th Queue (ft)	57	275	299
Link Distance (ft)		611	611
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	150		
Storage Blk Time (%)		8	
Queuing Penalty (veh)		1	

Intersection: 7001: EB I-96 Off-Ramp/WB I-96 Off-Ramp & Beck Road & EB I-96 On-Ramp/WB I-96 On-R

Movement	NB	NB	NB	SB	SB	SB	SB	NE	NE	SW	SW
Directions Served	L	T	T	L	L	T	T	L	L	L	L
Maximum Queue (ft)	206	204	199	198	214	201	196	84	105	190	208
Average Queue (ft)	171	153	160	169	178	146	161	27	49	91	116
95th Queue (ft)	227	231	222	211	206	199	204	66	90	161	183
Link Distance (ft)	126	126	126	105	105	105	105	318	318	235	235
Upstream Blk Time (%)	55	23	24	62	72	16	21			0	0
Queuing Penalty (veh)	227	92	97	240	280	61	80			0	0
Storage Bay Dist (ft)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 7002: Beck Road & WB I-96 Off-Ramp

Movement	WB	WB	NB	NB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	T	T	T
Maximum Queue (ft)	204	179	108	72	207	229	89	103
Average Queue (ft)	79	65	14	11	94	115	9	19
95th Queue (ft)	188	142	68	48	228	256	46	69
Link Distance (ft)	219	219	105	105	167	167	167	167
Upstream Blk Time (%)	3	0	0	0	11	17		
Queuing Penalty (veh)	5	0	2	0	44	66		
Storage Bay Dist (ft)								
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 7003: Beck Road & EB I-96 Off-Ramp

Movement	EB	NB	NB	NB	SB	SB
Directions Served	R	T	T	T	T	T
Maximum Queue (ft)	176	200	422	409	57	54
Average Queue (ft)	97	115	188	152	12	13
95th Queue (ft)	160	256	481	432	40	40
Link Distance (ft)	283		392	392	126	126
Upstream Blk Time (%)			18	7		
Queuing Penalty (veh)			0	0		
Storage Bay Dist (ft)		150				
Storage Blk Time (%)		29	2			
Queuing Penalty (veh)		118	8			

Intersection: 7004: Beck Road & WB I-96 On-Ramp

Movement	NB	NB	SB	SB	SB	SB	SB
Directions Served	T	T	T	T	T	T	R
Maximum Queue (ft)	226	130	61	116	212	114	10
Average Queue (ft)	84	11	11	22	19	7	0
95th Queue (ft)	225	77	58	106	136	75	7
Link Distance (ft)	167	167			223	223	
Upstream Blk Time (%)	9	0			1	0	
Queuing Penalty (veh)	61	1			7	1	
Storage Bay Dist (ft)			1	1			100
Storage Blk Time (%)		0	0	1			
Queuing Penalty (veh)		0	0	2			

Intersection: 8001: Beck Road

Movement	B10	B10	SB	SB
Directions Served	T		T	T
Maximum Queue (ft)	333	266	124	614
Average Queue (ft)	129	35	32	303
95th Queue (ft)	369	169	121	727
Link Distance (ft)	192	192		588
Upstream Blk Time (%)	5	1		15
Queuing Penalty (veh)	24	3		0
Storage Bay Dist (ft)			100	
Storage Blk Time (%)				26
Queuing Penalty (veh)				137

Intersection: 8002: EB 12 Mile Road & 12 Mile Road/WB 12 Mile Road

Movement	WB	WB
Directions Served	T	T
Maximum Queue (ft)	228	220
Average Queue (ft)	79	85
95th Queue (ft)	244	246
Link Distance (ft)	160	160
Upstream Blk Time (%)	17	18
Queuing Penalty (veh)	111	117
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 9001: Dummy Node A & EB 12 Mile Road

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

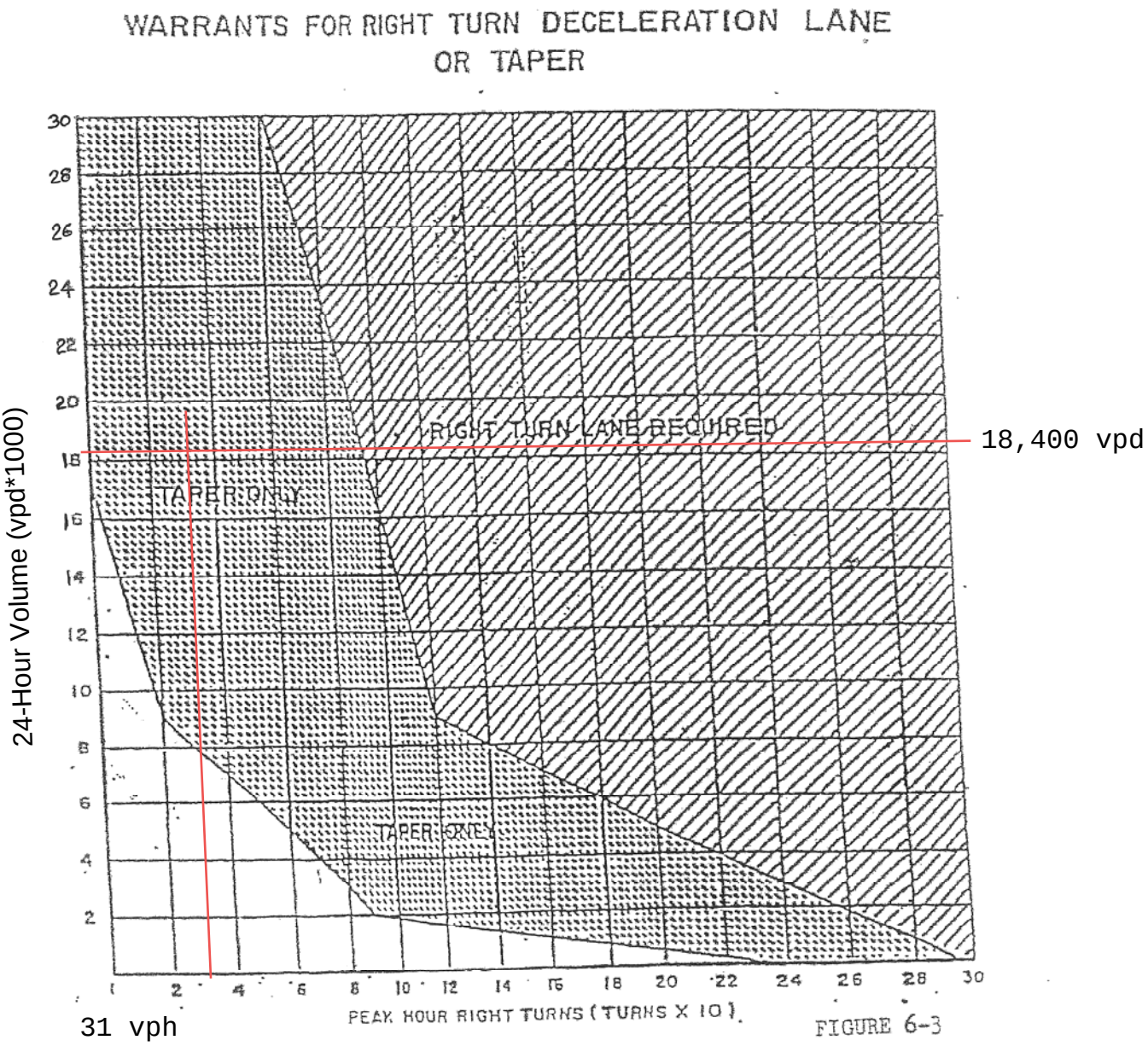
Intersection: 9002: WB 12 Mile Road & Dummy Node B

Movement	WB	SB
Directions Served	TR	R
Maximum Queue (ft)	7	65
Average Queue (ft)	0	20
95th Queue (ft)	5	50
Link Distance (ft)	89	238
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 3093

FIGURE 6-3


WARRANTS FOR RIGHT TURN DECELERATION LANE OR TAPER
24-Hour Volume (vpd*1000)
RIGHT TURN LANE REQUIRED
TAPER ONLY
TAPER ONLY
18,400 vpd
31 vph
PEAK HOUR RIGHT TURNS (TURNS X 10)
FIGURE 6-3