



## PLANNING COMMISSION MEETING

LOCATION: TOWNSHIP ANNEX, 7527 HIGHLAND ROAD, WHITE LAKE, MI 48383  
THURSDAY, APRIL 04, 2024 – 6:30 PM

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*White Lake Township | 7525 Highland Rd | White Lake, MI 48383 | Phone: (248) 698-3300 | [www.whitelaketwp.com](http://www.whitelaketwp.com)*

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### AGENDA

1. CALL TO ORDER
2. ROLL CALL
3. PLEDGE OF ALLEGIANCE
4. APPROVAL OF AGENDA
5. APPROVAL OF MINUTES
  - A. [March 7, 2024](#)
6. CALL TO THE PUBLIC (FOR ITEMS NOT ON THE AGENDA)
7. PUBLIC HEARING
  - A. [Gateway Crossing](#)  
[Property described as parcel numbers 12-20-426-003 \(6350 Highland Road\) and 12-20-402-003 \(6340 Highland Road\), located at the southwest corner of Bogie Lake Road and Highland Road, consisting of approximately 5.36 acres.](#)  
[Request: Preliminary site plan and special land use approvals](#)  
[Applicant: Najor Companies](#)
  - B. [2024 Master Plan](#)
  - C. [Zoning Ordinance amendments](#)
8. CONTINUING BUSINESS
9. NEW BUSINESS
10. LIAISON'S REPORT
11. DIRECTOR'S REPORT
12. OTHER BUSINESS
  - A. [New Hope White Lake PDA amendment](#)
  - B. [Walmart temporary use request](#)
13. COMMUNICATIONS
14. NEXT MEETING DATE: April 18, 2024
15. ADJOURNMENT

**Procedures for accommodations for persons with disabilities:** The Township will follow its normal procedures for individuals with disabilities needing accommodations for effective participation in this meeting. **Please contact the Township Clerk's office at (248) 698-3300 X-164 at least two days in advance of the meeting.** An attempt will be made to make reasonable accommodations.

**WHITE LAKE TOWNSHIP  
PLANNING COMMISSION  
MARCH 7, 2024**

**CALL TO ORDER**

Chairperson Seward called the meeting to order at 6:30 P.M.

**ROLL CALL**

**Present:**

Scott Ruggles, Township Board Liaison  
T. Joseph Seward, Chairperson  
Steve Anderson  
Debby Dehart  
Merrie Carlock, Vice Chairperson  
Mona Sevic

**Absent:**

Robert Seeley  
Pete Meagher  
Matt Slicker

**Others:**

Sean O'Neil, Community Development Director  
Hannah Kennedy-Galley, Recording Secretary

**APPROVAL OF AGENDA**

**MOTION by Commissioner Anderson, seconded by Commissioner Ruggles to approve the agenda as presented. The motion carried with a voice vote: (6 yes votes).**

**APPROVAL OF MINUTES**

A. February 1, 2024

**MOTION by Commissioner Sevic, seconded by Commissioner Anderson to approve the minutes of February 1, 2024 as presented. The motion carried with a voice vote: (6 yes votes).**

**CALL TO THE PUBLIC (FOR ITEMS NOT ON THE AGENDA)**

None.

**PUBLIC HEARING**

**A. 9101 Highland - Rezoning Request**

Location: Property described as 9101 Highland Road, identified as parcel number 12-23-227-003, located south of Highland Road, west of Sunnybeach Boulevard, consisting of approximately 5.02 acres.

Request: **Applicant requests to rezone the parcel from R1-C (Single Family Residential) to GB (General Business) or any other appropriate zoning district.**

Applicant: Affinity 10 Investments, LLC



Director O'Neil briefly went over the review in the packet. He clarified that the concept plan included in the packet would not lead to a decision on a site plan this evening. The applicant had not even started the site plan approval process. The recommendation from the staff was to move forward with the rezoning.

Erin McMachen, Stonefield Engineering, representing the applicant, was present. The proposed commercial development would be a mix of retail and restaurant uses.

Chairperson Seward opened the public hearing at 6:40 P.M.

Aaron Greenblatt, 9055 Huron Bluffs, voiced his concerns regarding ordinance requirements being met for the proposed rezoning request. A copy of his concerns was submitted into the record.

David Gian, 9315 Steep Hollow Drive, expressed his concerns regarding the lack Highland Road and Sunnybeach Blvd in the applicant's presented traffic study.

Diane Sha, 9669 Steep Hollow Drive, expressed her concerns regarding the traffic that the proposed commercial development would experience.

Barry Seviment, 8890 Twin Lakes Drive, expressed his concerns regarding the traffic that the proposed commercial development would experience.

Joe Jereckos, 852 Sunnybeach Boulevard, expressed his concerns regarding the traffic that regarding the traffic that the proposed commercial development would experience. He also expressed his concerns regarding lighting that a commercial development would bring. His written statement was submitted to Chairperson Seward.

John Bem, 298 Shotwell, stated that the church served as a buffer for the residential neighborhood from M-59. He spoke in opposition of the rezoning request.

Leonard Zito, 9121 Steep Hollow Drive, voiced his concerns about the rezoning request. He didn't think the Township needed more storefronts.

Beverly Clancy, 8780 Twin Lakes, spoke in opposition to the rezoning request. She had concerns with the potential of increased traffic.

Dan Gottschall, 891 Sunnybeach, spoke in opposition of the rezoning request. He urged the Planning Commission to consider how volatile the restaurant business was. He wanted to see something that would enhance his property, instead of bringing it down.

Eric, 953 Sunnybeach, proposed to keep the site residential and give the homeowners the ability to expand their property.

Chairperson Seward closed the public hearing at 7:01 P.M.

Ms. McMachen stated the she appreciated the comments heard tonight. Sunnybeach Boulevard sounded like a major concern, and said the traffic consultants were revising the traffic study to include Sunnybeach. The existing church did not meet the driveway requirements, and the applicant would provide the safest driveway configuration as recommended by MDOT. The concept plan proposed a 6' fence along all of the property that abutted the site. In addition, there was a 20' buffer and there would be a dense green wall installed with evergreens.

Commissioner Carlock asked staff what zoning surrounded the site. Director O'Neil said it was a combination of Local Business, General Business, and Restricted Business, and Single-Family Residential south of the site.

Commissioner Anderson asked Ms. McMachen if the property had already been purchased. Ms. McMachen said the property was close to be closed on.

Commissioner Dehart asked staff if the developer needed to show a need for the development to the Township. Director O'Neil said no, the request needed to meet the requirements outlined in the zoning ordinance. The Master Plan designated the area for a commercial use, it would not be feasible to rezone the site to a Single-Family Residential zoning.

Commissioner Dehart asked if staff the project would need to obtain a variance for their driveway placement. Director O'Neil said yes, and MDOT would have the final say over the location of the driveway. The development would be required to have a cross access agreement to the daycare center to the west of the site.

**MOTION by Commissioner Anderson, seconded by Commissioner Ruggles, to recommend the Township Board approve the rezoning requested by Affinity 10 Investments, LLC for 9101 Highland Road, identified as 12-23-227-003, from R1-C Single Family Residential to General Business, subject to staff comments. The motion failed with a roll call vote: (2 yes votes).**

**(Sevic/yes, Ruggles/no, Anderson/no, Seward/yes, Dehart/no, Carlock/no).**

**MOTION by Commissioner Ruggles, seconded by Commissioner Carlock, to recommend the Township Board deny the rezoning requested by Affinity 10 Investments, LLC, for 9101 Highland, identified as 12-23-227-003. The motion carried with a roll call vote: (5 yes votes).**

**(Carlock/yes, Dehart/yes, Seward/no, Anderson/yes, Ruggles/yes, Sevic/yes).**

#### **CONTINUING BUSINESS**

A. Master Plan Final Review

The public hearing for Master Plan was scheduled for April 4. Comments for the document were still able to be received.

#### **NEW BUSINESS**

A. Discussion of draft zoning ordinance amendments

Many of the amendments were housekeeping items; these amendments were made due to feedback heard at the Planning Commission and Zoning Board of Appeals meeting. The public hearing for the amendments to the zoning ordinance was scheduled for April 4.

#### **OTHER BUSINESS**

A. Election of Officers

**MOTION by Commissioner Anderson, seconded by Commissioner Sevic, to maintain Joe Seward, Merrie Carlock, and Debby Dehart as Chairperson, Vice Chairperson, and Secretary, respectively. The motion carried with a voice vote: (6 yes votes).**

#### **LIAISON'S REPORT**

The February ZBA meeting was canceled, there was three cases on the agenda for March.

Bonds would be issued to fund Triangle Trail and Stanley Park Phase 1. The Township Board approved a renewal and restoration of the Parks and Recreation millage. The Six Lakes/Filling Station rezoning request was approved

by the Township Board, with the exception of the end result of the request to be rezoned to General Business. The Ginko Storage preliminary site plan was approved.

**DIRECTOR'S REPORT**

There would be potentially three public hearings at the April 4 meeting.

**NEXT MEETING DATE:** April 4, 2024

**ADJOURNMENT**

**MOTION by Commissioner Dehart, seconded by Commissioner Carlock, to adjourn at 7:42 P.M. The motion carried with a voice vote: (6 yes votes).**

**Director's Report**

Project Name: Gateway Crossing  
 Description: Preliminary site plan and special land use approvals  
 Date on Agenda this packet pertains to: April 4, 2024

- Public Hearing
- Special Land Use
- Initial Submittal
- Rezoning
- Revised Plans
- Other:
- Preliminary Approval
- Final Approval

Contact	Consultants & Departments	Approval	Denial	Approved w/Conditions	Other	Comments
Sean O'Neil	Planning Director	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
DLZ	Engineering Consultant	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	See letter dated 03/27/24.
Justin Quagliata	Staff Planner	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	See letter dated 03/28/24.
Jason Hanifen	WLT Fire Marshal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	See letter dated 03/26/24.

# WHITE LAKE TOWNSHIP PLANNING COMMISSION

## REPORT OF THE COMMUNITY DEVELOPMENT DEPARTMENT

**TO:** Planning Commission

**FROM:** Sean O'Neil, AICP, Community Development Director  
Justin Quagliata, Staff Planner

**DATE:** March 28, 2024

**RE:** Gateway Crossing  
Preliminary Site Plan and Special Land Uses – Review #4

Staff reviewed the revised site plan prepared by Boss Engineering (revision date January 12, 2024). The following comments from the first review dated January 23, 2023, second review dated September 26, 2023, and third review dated February 8, 2024 are listed below. Responses to those comments are provided in **(green)**.

Najor Companies (Brian Najor) has requested preliminary site plan and special land use (2) approval to construct a commercial/retail center on Parcel Number 12-20-426-003 and Parcel Number 12-20-402-003, located at the southwest corner Bogie Lake Road and Highland Road. **The two legal descriptions on Sheet 1 conflict with the combined legal description on Sheet 2 and the size of the parcels listed in the Site Data Table on Sheet 3. Revise for consistency. The lot width listed in the Site Data table is also inconsistent with the combined legal description on Sheet 2 and the dimension labeled on the drawing. Revise for consistency.** **(Comments addressed. Acreage is now consistent between plan sheets and the Site Data Table).** Currently the parcels are zoned GB (General Business). Combined the parcels comprising the subject site are approximately 5.836 acres in size (to be confirmed based on previous comments). **If the project proceeds to construction, an application to combine the parcels shall be submitted to the Assessing Department prior to issuance of a building permit.** **final site plan submission (comment remains as a notation).** The design engineer stated the Applicant acknowledges this requirement.

The Applicant is proposing to construct ~~two~~ **one** single-story buildings totaling ~~12,380~~ **8,573** **8,620** square feet in size. **(Total area of the building and each tenant space size listed on Sheet 3 are all inconsistent with the preliminary floor plan. Revise for consistency).** **(Comment addressed. The total area of the building and each tenant space size listed on Sheet 4 are now consistent with the floor plan).** ~~**The size of the retail and coffee shop building labeled on the drawing (8,320 square feet) is two square feet less than the size of the building listed in the Site Data table on Sheet 3 (8,322 square feet). Revise for consistency. (Comment addressed. The Site Data Table now shows the correct total area for the building and it matches what is shown on the site plan).**~~ Special land use approval is requested as ~~two~~ **one** drive-thru windows are **is** proposed; the easterly unit of the east building is identified as a coffee shop ~~and the westerly building is identified as a Culver's drive-thru restaurant.~~ Special land use approval is also requested to allow outdoor dining at the retail and coffee shop building ~~and Culver's.~~ **(The Culver's building is no longer being proposed on this site).**

**Based on the nature of the proposed project, the Applicant shall state whether the development would be a commercial condominium project or consist of another ownership arrangement.** **(Comment addressed. A note about the building having a single owner and leasable units as well as a west parcel for sale is now noted in the Site Data Table. However, it appears the proposed west parcel would share a driveway and drive aisle(s) with the east parcel; the appropriate easement agreements would need to be submitted for review and approval prior to scheduling a pre-construction meeting).**

### *Master Plan*

The Future Land Use Map from the Master Plan designates the subject site in the Planned Business category. All development in Planned Business is required to adhere to strict access management principles in order to minimize traffic conflict and maximize safety throughout the M-59 corridor. Connections to and segments of the Township community-wide pathway system are required as an integral part of all Planned Business development.

The Future Land Use Map from the draft 2024 Master Plan designates the subject site in the Commercial Corridor category, which is intended to provide regional goods and services (such as large box-stores and drive-thrus) to residents and non-residents.

**FUTURE LAND USE MAP**



*Zoning*

Both parcels comprising the subject site are located in the GB (General Business) zoning district, which requires a minimum of 200 feet of lot width and one acre of lot area. Both parcels meet the minimum standards for both lot area and lot width of the GB zoning district. Retail commercial uses are a permitted principal use in the GB zoning district. Beverage and restaurant establishments with drive-thru window service are a special land use in the GB zoning district.

**ZONING MAP**



### *Physical Features*

There appear to be EGLE (Michigan Department of Environment, Great Lakes, and Energy) regulated wetlands on the site. However, a wetland delineation was not provided. **A delineation prepared by a wetland specialist/ecologist must be provided by the Applicant at preliminary site plan.** (Comment outstanding. Provide a copy of a delineation report). (Comment addressed. A delineation report dated November 3, 2023 has been provided). EGLE has regulatory authority regarding the wetland boundary location(s) and jurisdictional status of wetlands on this site. **Prior to final site plan, wetland boundary verification shall be completed by EGLE. Note the proposed layout may require revision in response to the EGLE review. Based on the submitted plans, the Applicant proposes to grade within the Natural Features Setback. Grading activities should not occur in the Natural Features Setback as the intent is to, as much as possible, leave said area in its natural state. If grading is permitted to occur in the Natural Features Setback, the area must be restored to its natural, undisturbed state. A Natural Features Setback restoration plan is required and must be submitted at final site plan.** (Comments remain as notations. These requirements were acknowledged by the Applicant’s engineer in the response letter provided to the first and second review).

The following should be conditions of any approval:

- Prior to any construction or grading on the site, the Applicant shall install silt fencing at the upland edge of Natural Features Setbacks / limits of grading. The silt fencing shall be removed after construction once the area is stabilized and vegetation has been established.
- Wetland limits shall be clearly identified with permanent markers. The size, number, location, and language on the markers shall be subject to the approval of the Community Development Director.

### *Access*

The site fronts on Highland Road and Bogie Lake Road. Highland Road (state trunkline) along the subject site is a four-lane divided highway designated as a Principal Arterial on the Township Thoroughfare Plan. Development of the subject site requires the installation of an eight-foot-wide sidewalk along the Highland Road property frontage (shown on plans; **the existing paved shoulder shall be removed and converted to greenbelt.**) (Comment addressed. The existing paved shoulder along Highland Road will be removed and converted to greenbelt except for the area being used for the right-turn taper). Along the east side of the property the northern portion of Bogie Lake Road is a four-lane road (three lanes going north (two right-turn lanes to eastbound Highland Road, one northbound lane through Highland Road), and one lane going south). There is also an existing right-turn taper at the Bogie Lake Road driveway approach. Bogie Lake Road along the southern portion of the property is a two-lane road.



While the zoning ordinance requires site plans incorporate (where feasible and appropriate) cross-access with neighboring sites, the property to the west is owned by ITC. There is no opportunity for vehicle access through the ITC corridor, so constructing a frontage road to the west is not required.

The zoning ordinance requires a minimum six-foot-wide sidewalk placed one-foot from the inside edge of the right-of-way along the Bogie Lake Road property frontage. The plan shows eight-foot-wide sidewalk and boardwalk (195 linear feet of boardwalk) along Bogie Lake Road property frontage. **Direct pedestrian access from the frontage sidewalks to the buildings should be provided. (Comment addressed. Direct pedestrian access is now provided from the sidewalks along Highland Road and Bogie Lake Road). Note it appears the Applicant is proposing to construct offsite sidewalk to the west along Highland Road (whether or not the offsite sidewalk is in the road right-of-way shall be clarified on the plan). Easements would be required from the adjacent property owner to construct offsite sidewalk (if not in the right-of-way). (Comment addressed. Per the design engineer, the sidewalk is located in the right-of-way). The boardwalk details on Sheet 9 conflict with the boardwalk width shown on Sheet 3. Revise for consistency. (Comment addressed. The boardwalk width on Sheet 9 is now shown to be eight-foot-wide). Additionally, some of the sidewalk (boardwalk) along Bogie Lake Road is proposed outside of the right-of-way; the sidewalk (boardwalk) must be relocated inside the road right-of-way or an easement be provided. Right-of-way/easement widths for public walkways when not adjacent to or a part of street rights-of-way must be at least 15 feet and dedicated to the use of the public. Only a 10-foot-wide sidewalk easement is proposed. Revise accordingly. (Comment addressed. The sidewalk easement has been changed to be 15 feet as required instead of the 10 feet previously proposed). Furthermore, sidewalk shall be constructed to the south property line, or a variance is required from the Zoning Board of Appeals. (Comment addressed. A portion of the sidewalk is now proposed to the south property line (south side of the church driveway).**

DLZ reviewed the submitted traffic impact study (TIS) and stated the methodology is in line with standard practices and the findings are supported by the data provided. Additionally, DLZ was in agreement with the conclusions and recommended treatments.

The development would be accessed from a driveway on Highland Road and Bogie Lake Road. **Both driveways—The Highland Road driveway would require variances from the zoning ordinance access management standards.** As a preface to the following comments regarding access management, the Planning Commission should note the zoning ordinance states direct access drives should generally be minimized in number and maximized in separation. Reasonable access is not necessarily the same as direct access. The number of driveways permitted for a site shall be the minimum number necessary to provide safe and efficient access for regular traffic and emergency vehicles.

The minimum distance between a proposed driveway and the nearest intersection shall not be less than 455 feet when the speed limit is greater than or equal to 50 miles per hour (mph). Along the Highland Road frontage the speed limit is 55 mph. The proposed distance of the Highland Road driveway to the Bogie Lake Road intersection is 300 feet. **Therefore, a 155-foot variance is required from the Zoning Board of Appeals. (Comment outstanding; however, the Applicant intends to seek a variance from the Zoning Board of Appeals).** The minimum distance between a proposed driveway and the nearest intersection shall not be less than 350 feet when the speed limit is 45 miles per hour (mph). Along the Bogie Lake Road frontage, the speed limit is 45 mph. **As the driveway is not 350 feet from the intersection, a variance is required from the Zoning Board of Appeals. (Comment rescinded. See response to following comment). Note the dimension of the centerline of the Bogie Lake Road driveway to Highland Road on the site plan. (Comment addressed. A dimension (350.6 feet) has been added to the plan).**

### *Utilities*

The project would be served by both the municipal water and sanitary sewer systems. The Township Engineering Consultant will perform an analysis of stormwater, location and capacity of utilities, and grading to ensure compliance with all applicable ordinances as well as the Township Engineering Design Standards.

### **Staff Analysis – Preliminary Site Plan**

The development standards for the GB district require 50-foot front yard setbacks, 20-foot rear yard setbacks, and 15-foot side yard setbacks. **The proposed front (east) setback listed in the Site Data table on Sheet 3 is incorrect. Revise accordingly. (Comment addressed. The proposed east setback in the Site Data Table is now shown correctly). General Note 2 on Sheet 7 identifies the west setback as a front yard and not a side yard. Revise accordingly. (Comment addressed. The note has been revised).** The maximum building height allowed is 35 feet or two stories, whichever is less. Article 4, Section 17 of the zoning ordinance provides additional standards for drive-in or drive-thru window service, including a front yard setback of 60 feet (see Page 8 of this report regarding this requirement).

### *Building Architecture and Design*

Generally, exterior building materials should be comprised primarily of high quality, durable, low maintenance material, such as masonry, stone, brick, glass, or equivalent materials. Buildings should be completed on all sides with acceptable materials. ~~The proposed building materials for the Culver's are a mix of stone (veneer) and EFIS (exterior insulation finishing system). Canvas awnings are also proposed.~~ The proposed building materials for the multi-tenant building are a mix of brick (veneer), fiber cement siding, and ~~hardie~~ paneling. Metal canopies are also proposed.

While building materials will be reviewed in detail at final site plan, the Applicant should be aware of the Township’s architectural character requirements. EFIS, fiber cement siding, and hardie panel are not considered high-quality materials. **Seventy (70) percent of all elevations of both buildings should be covered with some combination of brick or stone or glass.** (Comment outstanding. The building is unattractive in appearance, and the fiber cement paneling and siding are substandard materials. All sides of the building will be visible from adjacent roads and must be comprised of high-quality materials. Also, a brown/tan/taupe color scheme should be utilized on the building as opposed to dark grey, light grey, and black). (Comment addressed. The building materials have been revised to include almost all brick veneer with a light, medium, and dark brown color scheme). **Furthermore, all buildings shall have windows at eye level covering at least 30 percent of the front facade (north and east elevations of the buildings). Calculations for window coverage on the front facades shall be provided on the elevations at final site plan.** (Comment remains as a notation. This requirement was acknowledged by the Applicant’s engineer in the response letter provided to the first review). While front facade window coverage calculations are not provided at this time, it appears the north elevation meets the 30% requirement. However, the east elevation does not meet the 30% requirement; if the east elevation is not updated to provide the required window coverage, a variance must be requested from the Zoning Board of Appeals. (Glass coverage calculations have been added to the preliminary elevations. The required window coverage is provided on the north elevation, but a variance is required on the east elevation as only 9.27% window coverage is proposed. The required variance has been added to the variance list on Sheet 4 of the plan set).

**A sample board of building materials to be displayed at the Planning Commission meeting and elevations in color are required by the zoning ordinance and must be submitted at final site plan. Additionally, the address (street number) locations shall be shown on the building. Six-inch-tall numbers visible from the street shall be required. The address locations are subject to approval of the Fire Marshal.** (Comments remain as notations. These requirements were acknowledged by the Applicant’s engineer in the response letter provided to the first review).

Outdoor patios are located on the site. **Details for the items to be located on the patios and details for the patios’ surfacing shall be provided at final site plan.** (Comment remains as a notation. This requirement was acknowledged by the Applicant’s engineer in the response letter provided to the first review). **An ornamental paving treatment should be required by the Planning Commission.** The treatment should be something either decorative or something to provide aesthetic quality to the patios. Potential options for ornamental paving treatments include, but are not limited to, CMU pavers; brick; stone; or stamped, stained, and sealed concrete. Accessory items such as railings, benches, trash receptacles, outdoor seating (such as tables and chairs), or sidewalk planters located in the vicinity of sidewalks and/or outdoor seating areas are required to be of commercial quality and complement the building design and style. **These details shall be provided at final site plan.** (Comment remains as a notation. This requirement was acknowledged by the Applicant’s engineer in the response letter provided to the first review).

### *Landscaping and Screening*

Landscaping must comply with the provisions of the zoning ordinance and should be designed to preserve existing significant natural features and to buffer service areas, parking lots, and dumpsters. A mix of evergreen and deciduous plants and trees are preferred, along with seasonal accent plantings. A landscape plan will be provided and reviewed in detail during final site plan if the preliminary site plan is approved. Following are initial comments relative to a landscape plan:

- **A snow storage plan was not provided. Information on method of snow storage shall be provided at final site plan. Winter maintenance of parking lot landscape islands (insufficient parking lot landscape islands for plant material – variance required from the Zoning Board of Appeals (add to list of variances to be requested on Sheet 4 or demonstrate the required amount of parking lot landscaping can be provided (this can be demonstrated without having a landscape architect prepare a landscape plan)) (Comment addressed at this level of review. Proposed areas for parking lot landscaping have been shown on Sheet 4. Note not all of the proposed areas identified will count as parking lot landscaping; this will be reviewed further when a landscape plan is submitted at final site plan)) shall be required where heavy applications of salt and de-icing products occur through the use of salt tarps which minimize soil absorption and ultimately reduce plant disorders. (Comments remain as notations. The response letter provided to the first review states a snow storage plan will be provided at final site plan along with a landscape plan).**

### *Trash Receptacle Screening*

The zoning ordinance requires dumpsters to be surrounded by a six-foot-tall wall on three sides and an obscuring wood gate on a steel frame on the fourth side, located on a six-inch concrete pad extending 10 feet in front of the gate, with six-inch concrete-filled steel bollards to protect the rear wall and gates. Furthermore, the zoning ordinance states dumpsters and trash storage enclosures shall be constructed of the same decorative masonry materials as the buildings to which they are accessory. Brickform concrete (simulated brick pattern) or stained, decorative CMU block are not permitted where the principal building contains masonry. Plain CMU block is also prohibited. A dumpster enclosure detail was provided on Sheet PP-1. **(The aforementioned sheet has been renumbered as PP-3 with the second submittal).** **(The aforementioned sheet has been renumbered as PP-4 with the third submittal).** **(The aforementioned sheet has been renumbered as PP-5 with the third submittal).**

**At the time of trash pick-up, the location of the dumpster enclosure could cause conflict with traffic entering and exiting the site. The dumpster enclosure location should be evaluated when considering circulation around the site. (Comment addressed. One dumpster enclosure has been eliminated and the other dumpster enclosure location has been revised to reduce conflict with traffic).**

*Parking*

**The parking calculations in the Site Data table on Sheet 3 are incorrect and shall be revised.** (Comment outstanding. When units or measurements determining number of required parking spaces result in fractional space, any fraction up to and including one-half shall be disregarded and fractions over one-half shall require one parking space). (Comment addressed. Required parking calculations have been updated. See following comments). ~~54 parking spaces are required for Culver's, not 46. 31 parking spaces are required for the coffee shop, not 19.~~ The fast food standard shall be applied to the coffee shop. (Comment outstanding. Revise accordingly). (Comment addressed. Required parking calculations have been updated. See following comments). ~~Retail tenant space #1 requires 13 12 parking spaces, not 11 13. Retail tenant spaces #2 and #3 each require nine parking spaces, not seven. Additionally, gross floor area is utilized for fast food and retail uses, not useable floor area. It is unacceptable to remove 15 percent of the floor area from the parking calculations.~~ (Comment addressed). ~~116 65-77 parking spaces and 8 stacking spaces are required to serve the development and 90 48-61 parking spaces and 16 stacking spaces are proposed; therefore, a 261716-parking space variance is required from the Zoning Board of Appeals.~~ (Revise parking variance note on Sheet 3 accordingly). (Comment addressed. The applicable note on Sheet 4 has been updated).

The Planning Commission should note per the proposed zoning ordinance amendment to the off-street parking requirements, a maximum of 77 parking spaces would be allowed on the site and a minimum of 58 parking spaces would be required. Therefore, with 61 parking spaces proposed, a parking space variance would not be required.

Staff recommends the Planning Commission require the six easterly parking spaces be removed. Traffic circulation at the northeast corner of the site will make these spaces dangerous and difficult to access; vehicles attempting to access these spaces could cause traffic conflicts with vehicles exiting the drive-thru and bypass lane. Additionally, staff suggests the three northwesterly parking spaces be removed. Traffic circulation at the northwest corner of the site will make these spaces dangerous and difficult to access; vehicles attempting to access these spaces could cause traffic conflicts with vehicle ingress/egress from/to the Highland Road driveway and vehicles entering the drive-thru. (Comment outstanding. The nine aforementioned parking spaces remain as previously proposed. A dimension (19 feet) has been added to the back side of the six parking spaces on the east side of the site; this has been noted as an attempt to demonstrate reduced interference from these parking spaces with the bypass lane. Staff continues to recommend revisions to this area of the site plan; see recommendation on Page 15).

Two-way drives are required to be a minimum of 24 feet in width. At the east end of the northerly drive aisle, the proposed width is 22.8 feet. Revise the site plan to increase the width to 24 feet; if not revised, a variance is required from the Zoning Board of Appeals. (Comment addressed. The aforementioned two-way drive aisle has been revised to be 24 feet in width).



The one-way drive (approximately 40 feet in length) north of the Bogie Lake Road driveway shall be removed. (Comment outstanding. See third comment in green in this paragraph). One-way drives are required to be a minimum of 20 feet in width, so the proposed width of 12 feet would require a variance from the Zoning Board of Appeals. (Comment addressed. The one-way drive aisle has been increased to 20 feet in width). However, removing this drive will improve vehicle circulation around the site. Funneling traffic north through said area would conflict with drive-thru and bypass lane traffic (maintaining the bypass lane is important for the efficient and safe function of the drive-thru). Also, vehicles attempting to enter the drive-thru from the Bogie Lake Road driveway would also have to traverse west across the drive aisle north of the building where pedestrians are accessing vehicles north of said drive aisle and vehicles on both sides of said drive aisle are entering/exiting the site from the west. Removing the aforementioned section of one-way drive aisle will also allow the landscape island in this area to be extended east to the east property line. (Staff concerns remain regarding the internal traffic circulation near the northeast corner of the site. Vehicles backing out of the easternmost parking spaces may have difficulties).

The zoning ordinance requires each individual parking space be delineated by dual stripes, two feet apart centered on the dividing lines and painted white. Revise the site plan and the typical parking space detail on Sheet 3. If the required striping is not provided, a variance is required from the Zoning Board of Appeals. (Comment addressed. The plans as well as the parking space detail on Sheet 3 (now Sheet 4) now show white dual striping).

All dimensions for drive widths and parking space depth shall be revised. The site plan measures drive widths to the face of curb; road measurement surface is taken between the edges of the gutter pan (drive width shall be provided between the edges of the gutter pan). (Comment partially addressed. There are still some drive aisles/maneuvering lanes with width measured to the curb, not the edge of the gutter pan. Revise accordingly). (Comment addressed. The measurements have been revised accordingly). Furthermore, gutter pan shall not be included in the measurement of parking space depth. Revise the site plan and the typical parking space detail on Sheet 3. (Comment partially addressed. Sheet 3 shows 18-foot-deep parking spaces in some areas of the site while other spaces are 17-feet in depth. Gutter pan is also being counted as width in parking spaces abutting such. Revise accordingly). (Comment addressed. The typical parking space detail now shows the space length to be 17-feet and matching what is proposed on the site plan, and the space measurements have been revised accordingly).

The typical parking space detail shows spaces 18 feet in length and the site plan shows the spaces 17 feet in length. Revise for consistency. (See previous comment. While the typical parking space detail shows parking spaces 17 feet in depth, the plan shows 18-foot-deep spaces in some areas). (Comment addressed. See previous comment).

While provided on the typical angled parking space detail, label the length and width dimensions of the angled parking on the site plan. (Comment rescinded. Angled parking is no longer proposed).

The sidewalk north of the southernmost parking spaces shall be increased to seven feet in width to be eligible for 17-foot-deep parking spaces abutting the aforementioned sidewalk. Otherwise, 18-foot-deep parking spaces shall be required. (Comment outstanding. Clarification is required. While in the response letter provided to the second review the Applicant’s engineer stated the sidewalk width has been increased to seven feet in width, on Sheet 4 there is a 6.5-foot dimension label appearing to indicate the width of said sidewalk). (Comment addressed. The dimension has been revised and now shows the full seven-foot width). Label the parking space depth and width, width of the sidewalk north of the spaces, and width of the sidewalk west of the spaces. (Comment partially addressed. Parking space depth and width have been added, but the sidewalk width west of the spaces is not labeled and the width of the sidewalk north of the spaces is unclear (see previous comment)). (Comment addressed. Additional sidewalk width dimensions have been added to the site plan). Additionally, staff recommends the 10 southernmost parking spaces be restricted to employee parking and designated/marked accordingly. (Comment partially addressed. The number of parking spaces south of the building has increased to 24. Staff continues to suggest the southernmost spaces (12) be restricted to employee parking and designated/marked accordingly. While in the response letter provided to the second review the Applicant’s engineer stated they acknowledge this recommendation, a note stating such could not be located by staff on Sheet 4). (Comment addressed. Site Plan Note 4 has been added to Sheet 4 of the plan set).

**For the proposed drive-thrus, eight vehicle stacking spaces inclusive of the vehicle at the window are required. The site plan shall show nine-foot-wide and 18-foot-long stacking spaces, and the parking calculations in the Site Data table on Sheet 3 shall be revised to show the required and proposed stacking spaces.** (Comment addressed. The Site Data Table now shows the correct number of required and proposed stacking spaces).

*Off-Street Loading Requirements*

The zoning ordinance requires ~~two~~ **one** loading spaces for a development of this size (~~one for each building~~). Such loading and unloading spaces must be an area 10 feet by 50 feet, with a 15-foot height clearance. **No loading spaces are proposed, so a variance is required from the Zoning Board of Appeals.** (Comment partially addressed. A loading space is now provided northeast of the proposed dumpster enclosure (label the length and width); however, staff agrees with DLZ regarding the location presenting conflict with traffic entering and exiting the site from Bogie Lake Road). (Comment addressed. The loading space north of the proposed dumpster is now shown outside of the drive aisle).

### Signs

The zoning ordinance requires the area, quantity, location, and dimensions of all signs to be provided with the preliminary site plan. The site plan shows the location of ~~two~~ **one** monument signs, each with a 10-foot setback from the Highland Road and Bogie Lake Road rights-of-way. **(The proposed sign area of the monument sign is 125 square feet, which exceeds the allowed sign area by 65 square feet and would require a variance from the Zoning Board of Appeals (a note on Sheet 4 incorrectly states the allowed sign area is 65 square feet when the allowed sign area is 60 square feet based on the proposed sign setback; revise accordingly). (Comment addressed. The monument sign has been revised with additional setback and reduced sign area to comply with the zoning ordinance). Freestanding signs on parcels containing a multi-tenant building in the GB zoning district are allowed six square feet of sign area for each one foot of setback, up to a maximum of 150 square feet in area (with a 25-foot setback)). (The Applicant will be requesting a variance for sign area (has been added to the list of variances to be requested on Sheet 4)). (Comment rescinded. See previous comment in green in this paragraph).** In instances where a parcel has frontage on two thoroughfares, a second freestanding sign may be permitted along the secondary thoroughfare. This provision is contingent upon the second sign being no more than 50 percent of the size permitted the first sign, a minimum 150 feet of separation exists between any freestanding signs on the site, and all other setback requirements are met. Sheet PP-1 shows a detail labeled “existing pylon sign.” There is no existing pylon sign on the site. **(The aforementioned sheet has been renumbered as PP-3 with the second submittal).** Furthermore, the zoning ordinance prohibits pylon signs. **Remove the aforementioned detail from the plan set. (Comment addressed. The aforementioned detail has been removed).** Any proposed freestanding sign must be of the monument type (which is indicated on Sheet 3 of the site plan). While monument sign details were not provided **(a detail is now provided on Sheet PP-3) (the aforementioned sheet has been renumbered as PP-4 with the third submittal) (the aforementioned sheet has been renumbered as PP-5 with the third submittal)**, staff can administratively review and approve signage. Any/all signage would be required to comply with the zoning ordinance.

~~The Culver’s building elevations show three wall signs (one on every façade except the south elevation). In instances where a parcel has frontage on two streets, an additional wall sign may be permitted on the building facing the secondary thoroughfare, which is no greater than five percent of the wall area on which the sign is placed. Where permitted, wall signs must be located flat against the building’s front façade or parallel to the front façade on a canopy. **The wall sign on the west elevation shall be removed, or a variance is required from the Zoning Board of Appeals.** Additionally, wall signs cannot extend above the roofline of a building. **Variances are required to install wall signs above the roofline of the building.** Staff does not support any variances for signage. **The building elevations should be revised to comply with the sign standards.** Note signage is not permitted on the awnings. **(These comments are no longer applicable as the Culver’s building is no longer being proposed on this site).**~~



~~The multi-tenant (four tenants) retail and coffee shop building elevations show wall signs on every facade, except the south elevation.~~ In the case of a building with two or more tenants, one wall sign is permitted per tenant. In instances where a parcel has frontage on two streets, an additional wall sign may be permitted on the building facing the secondary thoroughfare, which is no greater than five percent of the wall area on which the sign is placed. **The wall sign on the west elevation shall be removed, or a variance is required from the Zoning Board of Appeals.** (Comment outstanding). (The Applicant will be seeking a variance for this wall sign (has been added to the list of variances to be requested on Sheet 4)). (Comment rescinded. The wall sign on the west elevation has been removed). Additionally, wall signs cannot extend above the roofline of a building. **Variances are required to install wall signs above the roofline of the building.** (Comment outstanding). (The Applicant will be seeking a variance for the placement of walls signs (has been added to the list of variances to be requested on Sheet 4)). (Comment rescinded. The wall signs on the north elevation have been removed. The response letter provided to the third review stated until tenants are known sign placement is unknown, and sign permits will be sought as tenants are selected). Staff does not support any variances for signage. **The building elevations should be revised to comply with the sign standards.** (Comment remains as a notation). Note signage is not permitted on the canopies.

### *Outdoor Lighting*

Site lighting is required to comply with the zoning ordinance. Information on site lighting will be provided and reviewed in detail during final site plan. While the building elevations show wall-mounted lighting, outdoor lighting is reviewed and approved via a photometric plan and required attachments. **All luminaries shall be removed from existing sheets in the plan set.** (Comment outstanding. Note the type of wall-mounted sconce lighting (appears to be outward, unshielded lighting) shown on the preliminary elevations is not permitted in the Township and would require a variance from the Zoning Board of Appeals). (Comment rescinded. The sconce lighting has been removed from the plans. A photometric plan indicating light sources and styles will be provided at final site plan).

### **Staff Analysis – Special Land Use (Drive-thru)**

Special land uses for drive-thrus are evaluated using the general standards for all special land uses listed in Article 6, Section 10 of the zoning ordinance and the following specific standards for outdoor dining found in Article 4, Section 17 of the zoning ordinance:

*A. A front yard setback of at least sixty (60) feet shall be required.*

The coffee shop drive-thru tenant space is only 50 feet from the Bogie Lake Road right-of-way. However, the drive-thru window is over 60 feet from the Bogie Lake Road right-of-way. **The Applicant may request the Zoning Board of Appeals make an interpretation allowing the setback as proposed being conforming to the 60-foot front yard setback.** (Comment outstanding; however, the Applicant intends to seek an interpretation/variance from the Zoning Board of Appeals). ~~The Culver's building is conforming.~~

*B. Entrance and exit drives shall be at least one hundred (100) feet from any street intersection and two hundred (200) feet from any residential district.*

The Highland Road driveway is not 200 feet from the residential zoning district to the west. **Therefore, a variance is required from the Zoning Board of Appeals. (Comment outstanding; however, the Applicant intends to seek a variance from the Zoning Board of Appeals).** The Bogie Lake Road driveway is compliant.

*C. An outdoor lighting plan shall specify the type of fixtures to be used, light intensity, and method of shielding the fixtures so that light does not project onto adjoining properties or on any public or private street or right-of-way. Dropped fixtures shall not be allowed. The site plan shall include a photometric plan and catalog details for all proposed fixtures. Outdoor lights must meet the performance standards of Section 5.18.*

Site lighting is required to comply with the zoning ordinance. Information on site lighting will be provided and reviewed in detail during final site plan.

### **Staff Analysis – Special Land Use (Outdoor Dining)**

Special land uses for outdoor dining are evaluated using the general standards for all special land uses listed in Article 6, Section 10 of the zoning ordinance and the following specific standards for outdoor dining found in Article 4, Section 18 of the zoning ordinance:

*A. The Planning Commission shall determine that the use is designed and will be operated so as not to create a nuisance to property owners adjacent to or nearby the eating establishment. As such, the proposed use shall meet the following minimum criteria:*

*i. The establishment may operate only during the following hours:*

- *Monday thru Thursday: 8:00 a.m. – 12:00 midnight*
- *Friday: 8:00 a.m. – 2:00 a.m.*
- *Saturday: 10:00 a.m. – 2:00 a.m.*
- *Sunday: 10:00 a.m. – 10:00 p.m.*

~~Culver's and t~~The coffee shop would be required to adhere to said hours of operation. **(Revise Site Plan Note 3 on Sheet 3. The hours of operation pertain to the outdoor dining hours, not hours of operation for the coffee shop).** (Comment addressed. The note on Sheet 4 has been updated accordingly).

*ii. The use of exterior loudspeakers is prohibited where the site abuts a residential district or use. The noise level at the lot line shall not exceed 70 dB.*

~~Culver's and t~~The coffee shop would be required to adhere to said performance standard.

*iii. An outdoor lighting plan shall specify the type of fixtures to be used, light intensity, and method of shielding the fixtures so that light does not project onto adjoining properties or on any public or private street or right-of-way. Dropped fixtures shall not be allowed. The site plan shall include a photometric plan and catalog details for all proposed fixtures. Outdoor lights must meet the performance standards of Section 5.18.*

Site lighting is required to comply with the zoning ordinance. Information on site lighting will be provided and reviewed in detail during final site plan.

**B. Additional parking spaces must be provided according to the following:**

- i. *Outdoor dining areas for more than 30 people or which include either permanent or seasonal structures, such as awning, roofs, or canopies, may be required to provide additional parking according to the following:*
  - a. *If the outdoor seating is 25% of the indoor seating or less, no additional parking is necessary.*
  - b. *If the outdoor seating is 26%-50% of the indoor seating, the restaurant may be required to provide up to 125% of the parking required for the indoor space.*
  - c. *If the outdoor seating is over 50% of the indoor seating capacity, the restaurant may be required to provide up to 150% of the parking required for the indoor space.*

According to the site plan, a 656 square foot patio is proposed on the northeast corner of the Culver's building and a 253 **232** square foot patio is proposed on the northeast corner of the retail and coffee shop building. From an occupancy perspective, the Building Code states assembly without fixed seating – unconcentrated (tables and chairs) is F15 square feet per person. Maximum patio occupancy is subject to approval of the Building Official. The site plan shows seating for 16 patrons on the Culver's patio (four, four-top tables). Based on a restaurant dining room with 80 seats, the outdoor seating does not warrant additional parking. The site plan shows seating for eight patrons on the coffee shop patio (two, four-top tables). The submitted floor plan does not show the coffee shop seating capacity; however, the tenant space would be limited to 32 seats in order to not warrant additional parking to serve the outdoor seating. **(Per the design engineer, the outdoor seating is less than 25% of the indoor seating. Therefore, no additional parking is required).**

**Planning Commission Options / Recommendation**

The Planning Commission may recommend approval, approval with conditions, or denial of the preliminary site plan to the Township Board; action on the special land use is determined by the Planning Commission. ~~Staff recommends the plans be revised and resubmitted to address the items identified in this memorandum. An updated list of any requested variances shall also be provided.~~ **The majority of staff comments have been addressed. While there are variances required, the plan demonstrates land use feasibility. Concerns remain regarding the internal traffic circulation, especially near the northeast corner of the site. At a minimum the southerly three parking spaces of the easternmost six parking spaces should be removed; doing so would also allow the direct pedestrian access to the building from the frontage sidewalk along Bogie Lake Road to be shifted north. As proposed, the location of the pedestrian access is a safety concern as it crosses the bypass lane just north of the drive-thru window. Eliminating the three aforementioned parking spaces and shifting the pedestrian access north would provide separation from vehicles at the drive-thru window.**

The following plans were reviewed:

- Plans prepared by Boss Engineering dated January 5, 2023 (~~revision date-September 8, 2023~~ ~~January 12~~February 28, 2024). The utility, grading, and drainage plans for the site are subject to the approval of the Township Engineering Consultant and shall be completed in accordance with the Township Engineering Design Standards. **Note 2 on Sheet 1 shall be removed (the zoning ordinance requires plans be to scale).** (Comment addressed. The note has been removed).
- Preliminary floor plan and elevations prepared by Detroit Architectural Group dated ~~January 4~~~~September 6~~~~November 15,~~ 2023February 28, 2024. **These plans shall be sealed by the Registered Architect who prepared the plans.** (Comment addressed. The aforementioned plan sheets have been sealed).
- ~~Floor plan and exterior elevations prepared by AMAG dated May 15, 2020 (revision date May 28, 2020). These plans shall be sealed by the Registered Architect who prepared the plans. (Comment rescinded. This comment is no longer applicable as the west building is no longer being proposed).~~



INNOVATIVE IDEAS  
EXCEPTIONAL DESIGN  
UNMATCHED CLIENT SERVICE

March 27, 2024

Sean O' Neil  
Community Development Department  
Charter Township of White Lake  
7525 Highland Road  
White Lake, Michigan 48383

**RE: Gateway Crossing- Preliminary Site Plan Review – 4<sup>th</sup> Review**

Ref: DLZ No. 2345-7567-01

Design Professional: Boss Engineering

Dear Mr. O' Neil,

Our office has performed a Preliminary Site Plan review for the above-mentioned plan dated February 28, 2024. The plans were reviewed for feasibility based on general conformance with the Township Engineering Design Standards.

### **General Site Information**

This site is located at the southwest corner of M-59 and Bogie Lake Road. Total site acreage is approximately 5.36 acres.

### **Site Improvement Information:**

- Construction of a retail and coffee shop building (8,620 sq.ft.) with associated parking, including ADA parking.
- Site to be serviced by proposed water main and sanitary sewer.
- Storm water runoff is proposed to be routed via storm sewer to and detained underground located south of the proposed building.

The following items should be noted with respect to Planning Commission review:

Note that comments from our previous review dated February 13, 2024 are in *italics*. Responses to those comments are in **bold**. New comments are in standard font.



INNOVATIVE IDEAS  
EXCEPTIONAL DESIGN  
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WLT-Gateway Crossing  
Preliminary Site Plan Review.04  
March 27, 2024  
Page 2 of 3

- a) *Provide wetland delineation report. In addition, a wetland permit from EGLE will be required due to the construction of the boardwalk within the wetlands and wetland buffer and due to the proximity of site construction in general to the wetlands. Comment outstanding. Although a delineation has been provided, our office requests a copy of the wetland report. Comment addressed. A copy of the wetland report has now been provided. A wetland boundary verification shall be done by EGLE.*  
**Comment remains as a notation regarding EGLE wetland boundary verification and EGLE wetland permit requirement.**
- b) *We defer to the Township Fire Department regarding hydrant spacing/coverage.* **Comment remains.**
- c) *Show the location/continuation of the existing sanitary sewer to the south relative to the location of the proposed boardwalk. It appears that construction of the boardwalk may impact the existing sewer and that construction of the boardwalk may be in an existing sanitary sewer easement. Permission from the Township would be required for construction within the easement.* **Comment remains as a notation. The existing sanitary sewer is now shown. Per the design engineer response, the property owner acknowledges that permission from the Township will be required for work within the sanitary sewer easement.**
- d) *Provide fire truck turning plan to demonstrate adequate turning radii for fire trucks, please use a 40 foot long vehicle for the analysis. Comment addressed. A truck turning plan has been provided. We note that fire truck clearance will be tight in the area of the dumpster location. Per the current submittal, we now note that the fire truck clearance in the vicinity of the proposed dumpster location appears to be improved from the previous plan submittal.* **Comment remains as a notation.**
- e) *The proposed watermain stub to the west shall end with a blow off assembly or hydrant.* **Comment addressed. A GV&W as well as a temporary blowoff assembly have now been provided at the stub.**
- f) *The drive width near the northeastern portion of parking now shows a width less than the required 24'. Is the intent for the parking area in the NE corner to only be accessed from the south? (i.e. one way). In addition, the drive width near the SE area of the site has been reduced from 15' to 12'. Is one way circulation the intent? Current zoning standards for drives require one way circulation drives to be a minimum of 20' width and two way to be 24'. There are also circulation concerns relative to the 6 parking spaces near the NE corner of the site. We defer to the Township regarding these items.*  
**Comment addressed. The two way drive width near the northeastern parking area now shows a width of 24'. The one way drive width near the southeastern area of the site is now shown as 20' wide. Both drive widths now meet ordinance requirements. We continue to defer to the Township regarding the internal traffic circulation concerns near the northeastern corner of the site. We do note that dimension (19.0') was added to the back side of the six parking spaces on**



INNOVATIVE IDEAS  
EXCEPTIONAL DESIGN  
UNMATCHED CLIENT SERVICE

WLT-Gateway Crossing  
Preliminary Site Plan Review.04  
March 27, 2024  
Page 3 of 3

**the east side to demonstrate reduction in interference from these parking spaces with the drive thru lane.**

- g) *We note that OCWRC Sanitary Sewer Details have been included in the plan submittal but are unnecessary as the White Lake details are what apply to this site. Comment addressed. OCWRC sanitary sewer details have been removed from the plan set.*
- h) *Sheet 9-Basin Summary- Basin size provided (26,207 cu. ft.) should be 27,646 cu.ft. based on DHWL. Comment addressed. The basin size provided has now been revised to that based on the DHWL.*

### Recommendation

The plan now demonstrates feasibility from an engineering perspective. We defer to the Township regarding the remainder of comment f) above.

Please feel free to contact our office should you have any questions.

Sincerely,

DLZ Michigan

Michael Leuffgen, P.E.  
Department Manager

Victoria Loemker, P.E.  
Senior Engineer

Encl. None

Cc: Justin Quagliata, Community Development, *via email*  
Hannah Kennedy-Galley, Community Development, *via email*  
Aaron Potter, DPS Director, White Lake Township, *via email*  
Jason Hanifen, Fire Marshall, White Lake Township, *via email*

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INNOVATIVE IDEAS  
EXCEPTIONAL DESIGN  
UNMATCHED CLIENT SERVICE

January 19, 2023

Sean O'Neil, Director  
Community Development Department  
Charter Township of White Lake  
7525 Highland Road  
White Lake, Michigan 48383

**Re: Gateway Crossing Development  
TIS Memorandum Response**

Ref: DLZ File No. 2345-7567-01

Date of Memo: 1/3/23

Design Professional: Jacob Swanson, PE and  
Kyle Paulson; Fleis & VandenBrink

The applicant has submitted a Traffic Impact Study (TIS) for the Gateway Crossings Development located in the southwest quadrant of the Bogie Lake Road and Highland Road (M-59) intersection. The proposed development in the TIS includes 6,031 square feet of retail, 4,060 square feet of restaurant with a drive-through, and 2,289 square feet of coffee shop with a drive-through. The TIS utilized turning movement traffic counts at the Bogie Lake Road and Highland Road intersection, EB Highland Road (M-59) and WB-EB Crossover (west of Bogie Lake Road), WB Highland Road (M-59) & Nordic Drive / EB-WB Crossover (east of Bogie Lake Road), and the SB Bogie Lake Road and NB-SB Crossover (north of Highland Road (M-59)) on Thursday, November 3, 2022.

DLZ has reviewed the analysis; the methodology is in line with standard practices, and the findings are supported by the data provided. Based on data from the Shopping Plaza and Fast Food with Drive-Through sections of the 11<sup>th</sup> edition of the "ITE Trip Generation Manual", the additional daily trips are 2,835 trips per day. Additionally, 109 AM Peak Hour trips per day and 111 PM Peak Hour trips per day are anticipated to be added to the existing traffic volumes. Based on the White Lake Zoning Ordinance, the number of daily trips generated by the site is above the minimum threshold for requiring a Traffic Impact Study (750+ daily trips).

The TIS evaluated the existing traffic conditions at each intersection, the future background conditions (existing conditions with natural traffic volume growth) at each intersection and the future conditions at each intersection with the full proposed build-out of the site. The TIS data indicates that with traffic signal optimization, each intersection will operate in a similar manner to the future background condition. It also shows that no traffic movements will operate below a level of service (LOS) of "D", with the exception of the southbound right turn movement, which will continue to operate a LOS of "E".

The future traffic conditions were also evaluated at proposed site drives along both Bogie Lake Road and Highland Road (M-59). During both the AM and PM peak hours, the site drives operate with all turning movements at a LOS of "C" or greater.





INNOVATIVE IDEAS  
EXCEPTIONAL DESIGN  
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White Lake Plaza  
Traffic Impact Study Review  
Page 2 of 2

The TIS also evaluated the need for turn lanes or tapers at the proposed site driveways based on MDOT and Road Commission for Oakland County (RCOC). Based on the trip generation peak hour's traffic, it was determined that a right turn lane is warranted at the site driveway along Highland Road (M-59), but no treatment is required at the site driveway along Bogie Lake Road. However, while the TIS indicates a right turn taper is not warranted along Bogie There appears to be an existing right turn taper at the Bogie Lake Road site drive location, but the owner should evaluate the existing right turn taper to ensure it meets current RCOC dimensional requirements. RCOC and MDOT ROW permits will be required prior to construction.

As previously stated, we are in agreement with the conclusions and recommended treatments, with the exception of the right turn taper on Bogie Lake Road.

If you have any questions, please feel free to contact to me.

Respectfully,  
DLZ Michigan, Inc.

Leigh Merrill, P.E.  
Project Manager

Cc: Michael Leuffgen, P.E., DLZ *via email*  
Craig Burnside, Community Development *via e-mail*



**Fire Department  
Charter Township  
of White Lake**

Fire Department  
Charter Township  
of White Lake

**Fire Department  
Charter Township  
of White Lake**

**Fire Department  
Charter Township  
of White Lake**

## Site / Construction Plan Review

To: Sean O'Neil, Planning Department Director

Date: 03/26/2024

Project: Gateway Crossing

Job #: 22-029-1

Date on Plans: 02/28/2024

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The Fire Department has the following comments with regards to the 4<sup>th</sup> review of preliminary site plans for the project known as Gateway Crossing

The Fire Department has no further comments at this time.

Jason Hanifen  
Fire Marshal  
Charter Township of White Lake  
(248)698-3993  
[jhanifen@whitelaketwp.com](mailto:jhanifen@whitelaketwp.com)

Plans are reviewed using the International Fire Code (IFC), 2015 Edition and Referenced NFPA Standards.

**CHARTER TOWNSHIP OF WHITE LAKE**  
**SITE PLAN REVIEW APPLICATION**  
 Community Development Department, 7525 Highland  
 Road, White Lake, Michigan 48383  
 (248) 698-3300 x5

Item A.

**APPLICANT AND PROPERTY INFORMATION**

Applicant: Najor Companies, Brian Najor

Phone: 248-433-7000 / 248-703-8900 Email Address: brian@najorcompanies.com

Address: 600 N. Old Woodward, Suite 100 Birmingham, MI 48009  
(Street) (City) (State) (Zip)

Applicant's Legal Interest in Property: Owner

Property Owner: Same as above Phone: \_\_\_\_\_

Address: \_\_\_\_\_  
(Street) (City) (State) (Zip)

**PROJECT INFORMATION**

Project Name: Gateway Commons Parcel I.D. No.: 12-20-40-003, 12-20-426-003

Proposed Use: DRIVE-THROUGH RESTAURANT, RETAIL AND COFFEE SHOP WITH DRIVE-THROUGH Current Zoning: General Business

Existing Use: Vacant Parcel Size: 4.79 AC & 1.07 AC Floor Area / No. of Units: 4,060 AND 8,322 GSF

**TYPE OF DEVELOPMENT**

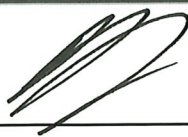
Subdivision     
  Site Condominium     
  Commercial  
 Multiple Family     
  Special Land Use     
  Industrial  
 Adult Entertainment

**SITE PLAN SUBMITTAL CHECKLIST**

PDF File <sup>TWO</sup> and ~~One~~ Paper Copy (sealed and no larger than 24x36)  
 Application Review Fees (to be calculated by the Community Development Department)

\* PLANS WILL NOT BE ACCEPTED UNLESS FOLDED \*

**REQUIRED SIGNATURES**

  
 \_\_\_\_\_  
 (Signature of Property Owner)

12/21/22  
 \_\_\_\_\_  
 (Date)

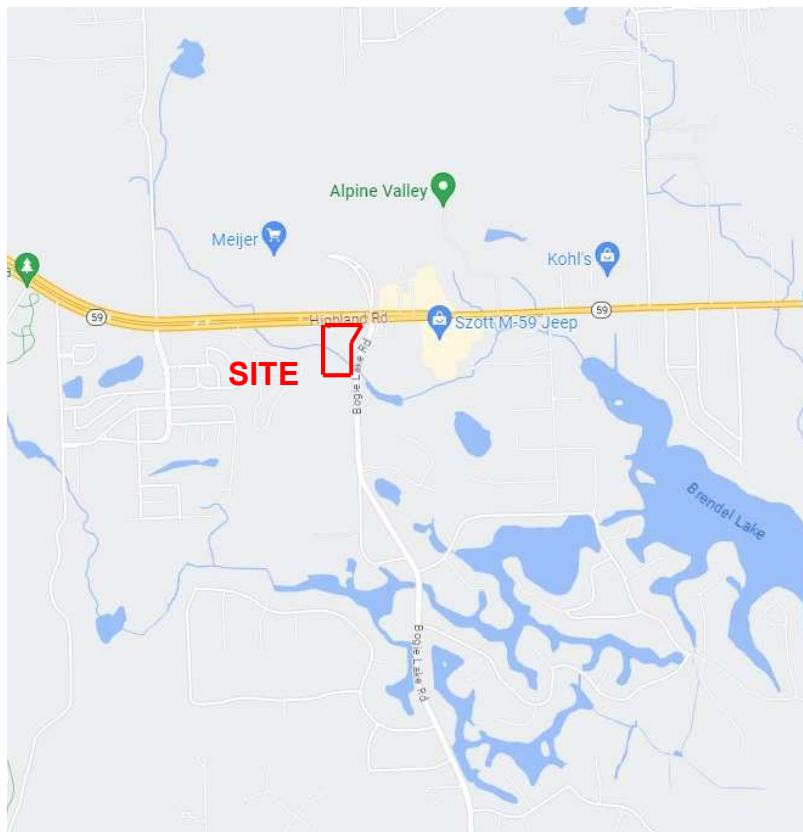
\_\_\_\_\_  
 (Signature of Applicant)

\_\_\_\_\_  
 (Date)

**SIGNATURES TO BE VERIFIED BY THE TOWNSHIP**

## WETLAND DELINEATION FOR:

## Gateway Crossing Highland Road and Bogie Lake Road White Lake Township, Oakland County, MI



### I. Summary

A wetland delineation was conducted at the property (parcel #'s 12-20-402-003 & 12-20-426-003) in White Lake, MI. The site location is shown in the map figure at left. The study area is on the west parcel (12-20-402-003). The study area was currently undeveloped but disturbed. There was evidence of previous development at the top of slope that defined the north/northwest borders of the wetland, a constructed driveway along the south, and a mowed field along the west / southwest border of the wetland. The purpose of the delineation was to determine existing conditions and establish development limits.

### Report Index:

- I. Summary
- II. Wetland Description
- III. Reference Maps
- IV. Representative Photos
- V. Drawing / Boundary Map (excerpt)
- VI. Data Sheets

As part of the work the following information was reviewed and is included in this report:

- National Wetland Inventory (NWI) Map 1
- USDA NRCS Soil Survey Map 2
- Aerial Maps / Photos

A site visit was conducted on June 3, 2022, and the wetland flagged. Further documentation was collected during a second site visit on November 3, 2023. Conditions were drier than normal during the initial visit and considered normal for the season during the second visit but there was no change to the wetland boundary.

The site investigation substantiated the Palustrine environment and also determined a likely Riverine condition that runs northwest to southeast through the western corner of the site, the entire area included in an area determined to be a wetland.

Owner: Gateway Crossing, LLC  
600 North Old Woodward, Suite 101  
Birmingham, MI 48009  
Contact: Brian Najor  
Email: brian@najorcompanies.com  
Phone: 248-433-7000

Prepared By:



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Contact: Patrick Cleary, PLA - Landscape Architect

November 3, 2023

The delineation was completed in accordance with the 1987 U.S. Army Corps of Engineers (USACOE) Wetland Delineation Manual, the Regional Supplement for the Midwest Region August 2010, and USACOE MI State Plan List 2018. Wetlands were determined by the soil, vegetation and hydrology criteria that have been established by the USACOE - and adopted by the Michigan Department of Environment, Great Lakes and Energy (EGLE).

There are larger Palustrine wetlands directly west of the study area as shown on the NWI map excerpt (Map 1) that most likely include more than 5- acres. This size of connected wetlands along with the potential Riverine environment indicates that this wetland would be regulated by EGLE. EGLE is the final arbiter for wetland determinations in the state (non-coastal) and it is recommended that they be consulted for an official determination if any wetland impact is contemplated.

The White Lake Township Zoning Ordinance contains provisions for natural features including wetlands. Section 3.11 (Q) states *"No building or structure shall be located closer than 25-feet to any regulated wetland, submerged land, watercourse, pond, stream, lake or like body of water. The setback shall be measured from the edge of the established wetland boundary as reviewed and approved by the Township."* This setback is shown and noted on the Wetland Boundary Map in Section V of this report. This setback should be taken into account with any development scenario.

## II. Wetland Descriptions

Two wetlands were flagged in the field. Wetland 'A' with three transects, A1 to A3 and Wetland 'B' with two transects, B1 and B2. Wetland 'A' is the primary depressional area that includes approximately 1.33 acres on site, and substantially more off-site. Wetland 'B' can be described as essentially a left over 'hole' from some previous construction activity with steep 3:1 or steeper sides, rounded shape (+-15-ft x 30-ft) and a flat bottom, in total measuring only approximately 375 sq ft. However, due to its configuration it does not appear to drain well and therefore exhibits wetland characteristics.

**Wetland 'A':** This wetland is a well-defined depression. Near the northwest corner of the site, it is at the bottom of a steep constructed fill slope located near the west property line and continues south and then east towards Bogie Lake Road. At the east side, bordering the road, and then along its south side it appears to be a more natural depression with flatter bank slopes (5-8%). The sampling points were taken at the first at the steep fill slope at the west side of the site (northeast area of the wetland), further east where there was a change in vegetation, and then along the south side of the wetland where it appeared as a more natural depression with shallower slopes and another change in vegetation.

### TRANSECT A1:

This transect was taken near the northern end of the site and wetland, near the west property line, along a steep (3:1) embankment probably fill embankment (See 'Wetland Boundary Map' for specific location.)

**Soils & Hydrology:** Upland soils were a 10YR 5/3 loamy sand to sand, possible fill, although the color was consistent with Oakland County NRCS description of 18B Fox Sandy Loam at depths greater than 9-inches. The upland sample was taken near the toe of the slope with a 10YR 4/1 loamy clay transition at 11-inches, consistent with the soil color and texture further downslope at the wetland edge. Due to the sandy texture the soil was quite dry. Down slope to the wetland edge soil saturation and standing water occurred before hydric soil indicators were prominent – a 10YR 4/1 silty/loamy clay. Approximately 8-10 further downslope it became a much more defined Houghton/Adrian Muck with 10YR 2/1 color and mucky texture. The boundary was confirmed where the hydrology & hydric soil characteristics agreed, meeting the 'F1' Loamy Mucky Mineral criteria, and consistent with the 6-2-22 site visit flagging.

Vegetation: The vegetation going up the slope was a mixture of invasives & lawn-type grasses. There was a quick transition from a near monoculture of Phragmites to a near monoculture of Goldenrod (*Solidago canadensis*) then more Autumn Olive (*Elaeagnus umbellata*) and Cottonwood (*Populus*) further up to the top of the slope along with an increasing density of lawn-type grasses (*Festuca* & *Poa*). At the wetland edge, at the transect, there was a large clump of Willow (*Salix alba*) along with smaller amounts of Green Ash (Saplings only), Red and Gray Dogwoods (*Cornus alba / sericea* & *racemosa*). Just above the wetland edge the general area was dominated by Phragmites for approximately 15-20-ft up slope.

#### TRANSECT A2:

This transect was taken further east through the toe of a less steep slope (10-15%+-) primarily where was a change in the vegetation mix. (See 'Wetland Boundary Map' for specific location.)

Soils & Hydrology: Upland soils were consistent with Transect A1-1 with a 10YR 5/3 color, sandy texture, and dry condition. At the wetland edge the same soil and hydrologic conditions continued with an approximately 6-8-inch layer of 10YR 4/1 silty/loamy clay between the 10YR 2/1 Muck and the 10YR 5/3 Loamy Sand above, again meeting the 'F1' hydric soil indicator.

Vegetation: The vegetation at this transect generally became more woody with more in the tree stratum dominated by Cottonwood of varying sizes, and Russian Olive. The herbaceous layer was still dominated by Phragmites at the wetland edge, then Goldenrod, and lawn-type grasses further up slope, but then Crown Vetch became much more prevalent near and the top of the slope.

#### TRANSECT A3:

This transect was taken along the south side of the wetland with more moderate boundary slopes (5-8%). Although dominated by invasives this boundary appeared to be more natural and less disturbed (See 'Wetland Boundary Map' for specific location.)

Soils & Hydrology: Upland soils were similar to the previous transects with a 10YR 5/2 color, sandy texture, and dry condition. At the wetland edge, however, it continued sandy but darker at 10YR 3/1 with soil saturation (approximately 10-15-ft further downslope soil was inundated). The 11-inches of 10YR 3/1 met the Dark Surface (S7) hydric soil indicator. Other hydrologic evidence included water-stained leaves and geomorphic position. Generally the entire wetland – saturation if not inundation was evident on aerial images going back 20-years or more.

Vegetation: The vegetation at this transect generally became more scrubby /woody with more in the tree stratum dominated by Boxelder (*Acer negundo*) along with the Cottonwood and Green Ash. Vines became dominant – Riverbank Grape (*Vitis riparia*) along with Blackberry (*Rubus occidentalis*). The herbaceous layer was still dominated by Phragmites at the wetland edge, but with scattered Sedges (*Carex lacustris*) then much more Buckthorn and Honeysuckle (*Lonicera japonica*) scattered Gray Dogwood, and several prominent clumps of Sumac (*Rhus typhina*) nearer the road.

**Wetland 'B'** Adjacent to Wetland Flags 'A13' & 'A14', separated by a ridge/mound there was a small (+-375 sq ft) 'hole', most likely left over from some previous construction. Highly disturbed, irregularly rounded in shape and with steep 3:1 plus side slopes. This area is the result of construction, and its 'borderline' wetland status may need further confirmation by EGLE.

TRANSECT B1: One transect was taken for this wetland including representative upland conditions data sheet and a sampling wetland data sheet near the middle of the flat bottom to document existing conditions.

Soils & Hydrology: Soils around the 'hole' and in it are the same 10YR 5/3 sandy soils as other upland areas on the site, including the flat bottom of this area. Except a hardpan was encountered at 8-inches precluding further determination of the soil conditions. Hydrologically, however, it was sparsely vegetated (B8), contained water-stained leaves (B9) and met the conditions of Geomorphic Position (D2). The encountered hardpan may be precluding adequate drainage.

Vegetation: The vegetation could be discounted as inside the hole it was dominated by volunteer invasives Buckthorn, Phragmites, Boxelder, but also Riverbank Grape and some Green Ash to meet the FAC neutral test criteria. Outside was more of the same but also with Sumac supporting the dry surrounding conditions.



### III. Reference Maps



22-029\_NWI Wetlands



March 3, 2022

#### Wetland Types

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory  
This page was produced by the NWI m

### MAP 1 – National Wetland Inventory (NWI) Map



Hydric Rating by Map Unit—Oakland County, Michigan  
(22-029\_Hydric Soils)




























MAP 2 – USDA NRCS Hydric Soils Map

## Hydric Rating by Map Unit

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
18B	Fox sandy loam, till plain, 2 to 6 percent slopes	4	11.3	39.6%
19	Sebewa loam, disintegration moraine, 0 to 2 percent slopes	94	2.7	9.4%
27	Houghton and Adrian mucks	100	6.3	22.2%
46A	Dixboro loamy fine sand, 0 to 3 percent slopes	7	3.2	11.2%
47C	Fox-Riddles sandy loams, 6 to 12 percent slopes	3	0.8	3.0%
50B	Udipsamments, undulating	0	3.7	12.9%
W	Water	0	0.5	1.7%
Totals for Area of Interest			28.4	100.0%

## MAP LEGEND

<b>Area of Interest (AOI)</b>	<b>Transportation</b>
 Area of Interest (AOI)	+++ Rails
<b>Soils</b>	 Interstate Highways
<b>Soil Rating Polygons</b>	 US Routes
 Hydric (100%)	 Major Roads
 Hydric (66 to 99%)	 Local Roads
 Hydric (33 to 65%)	<b>Background</b>
 Hydric (1 to 32%)	 Aerial Photography
 Not Hydric (0%)	
 Not rated or not available	
<b>Soil Rating Lines</b>	
 Hydric (100%)	
 Hydric (66 to 99%)	
 Hydric (33 to 65%)	
 Hydric (1 to 32%)	
 Not Hydric (0%)	
 Not rated or not available	
<b>Soil Rating Points</b>	
 Hydric (100%)	
 Hydric (66 to 99%)	
 Hydric (33 to 65%)	
 Hydric (1 to 32%)	
 Not Hydric (0%)	
 Not rated or not available	
<b>Water Features</b>	
 Streams and Canals	



**IV. Site Photos**



**PHOTO 1 – Near Northwest Corner, At Toe of Steep Slope – Looking West**



**PHOTO 2 – Southeast Side, Near Culvert Crossing – Looking North**





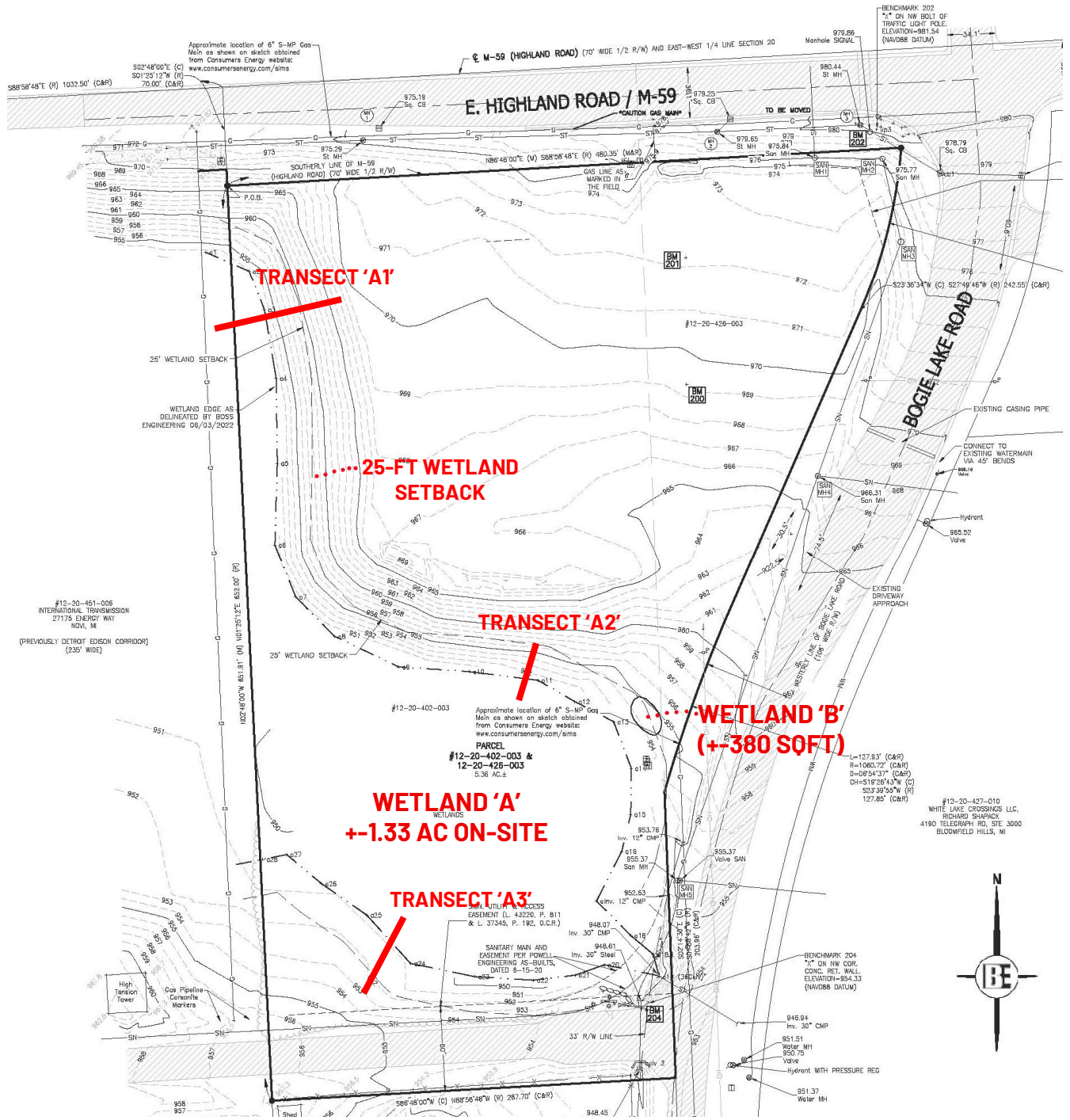
**PHOTO 3 – South Side – Looking North**



**PHOTO 4 – Southwest Corner – Looking North**



# V. WETLAND BOUNDARY MAP



# MEMO

VIA EMAIL [keith@najorcompanies.com](mailto:keith@najorcompanies.com)

**To:** Keith Maziasz  
Gateway Crossing, LLC

**From:** Jacob Swanson, PE  
Kyle Paulson  
Fleis & VandenBrink

**Date:** January 3, 2023

**Re:** Gateway Crossing Development  
White Lake Township, Michigan  
Traffic Impact Study

## 1 INTRODUCTION

This memorandum presents the results of the Traffic Impact Study (TIS) for the Gateway Crossing Development located in the southwest quadrant of the Highland Road (M-59) & Bogie Lake Road intersection, in White Lake Township, Michigan. The proposed development includes retail and restaurant land uses, including two (2) restaurants with drive-through services. Site access is proposed via one (1) right-in/right-out (RIRO) driveway on EB Highland Road (M-59) and one (1) full access driveway on Bogie Lake Road, as shown on the attached **Figure 1**. The study section of Highland Road (M-59) and Bogie Lake Road are under the jurisdiction of the Michigan Department of Transportation (MDOT) and the Road Commission for Oakland County (RCOC), respectively. The completion of a TIS has been required (in accordance with the MDOT Geometric Design Guidance Section 1.2.4) as part of the site plan approvals and driveway permitting process.

The scope of work for this study was developed based on the requirements and input provided by MDOT, Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practices, and information published by the Institute of Transportation Engineers (ITE). The study analyses were completed using Synchro/SimTraffic (Version 11). Sources of data for this study include F&V subconsultant Quality Counts, LLC (QC), MDOT, ITE, RCOC, and the Southeast Michigan Council of Governments (SEMCOG).

## 2 BACKGROUND

### 2.1 EXISTING ROAD NETWORK

Vehicle transportation for the study area is provided by Highland Road (M-59) and Bogie Lake Road. The lane uses and traffic control at the study intersections are shown on the attached **Figure 2** and the study roadways are further described below. For the purposes of this study, all minor streets, crossovers, and site driveways are assumed to have an operating speed of 25 miles per hour (mph), unless otherwise noted.

**Highland Road (M-59)** generally runs in the east and west directions, adjacent to the north side of the project site. The roadway is classified as an *Other Principal Arterial* and is under the jurisdiction of MDOT. The study section of Highland Road (M-59) has a posted speed limit of 55 mph and an Average Annual Daily Traffic (AADT) volume of approximately 40,000 vehicles per day (SEMCOG 2016). The roadway provides a four-lane, median divided cross-section, with two (2) lanes in each direction; left-turns are facilitated via exclusive left-turn lanes provided at the crossovers (U-turns) intersections.

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**Bogie Lake Road** generally runs in the north and south directions, adjacent to the east side of the project site. Bogie Lake Road begins/ends, to the north of Highland Road (M-59), at the Meijer parking lot. Left turn movements are prohibited at the signalized intersection with Highland Road (M-59); these movements are facilitated via the median crossovers (U-turns) intersections along Highland Road (M-59).

- **South of Highland Road (M-59):** The study section of Bogie Lake Road, south of M-59, has a posted speed limit of 45mph, is classified as a *Minor Arterial*, is under the jurisdiction of MDOT, and has an AADT volume of approximately 10,200 vehicles per day (SEMCOG 2021). Bogie Lake Road provides a two-lane cross-section, with one (1) lane in each direction. At the intersection with Highland Road (M-59), Bogie Lake Road widens to provide three (3) northbound lanes; one (1) exclusive through lane and dual (2) right-turn lanes.
- **North of Highland Road (M-59):** This study section of Bogie Lake Road has a posted speed limit of 25mph, is classified as a *Local Road*, and is under the jurisdiction of RCOC. Bogie Lake Road provides a four-lane, median divided cross-section, with two (2) lanes in each direction. At the intersection with Highland Road (M-59), Bogie Lake Road widens to provide three (3) southbound lanes; one (1) exclusive through lane and dual (2) right-turn lanes. Additionally, at the NB-to-SB crossover, north of Highland Road (M-59), northbound Bogie Lake Road widens to provide an exclusive left-turn lane.

**Nordic Drive** intersects WB Highland Road (M-59), serving as the 4<sup>th</sup>-leg of the EB-to-WB Crossover intersection. Southbound Nordic Drive provides right-turn egress-only onto WB Highland Road (M-59).

## 2.2 EXISTING TRAFFIC VOLUMES

F&V subconsultant QC collected existing Turning Movement Count (TMC) data at the following study intersections on Thursday, November 3, 2022, during the AM (7:00 AM-9:00 AM) and PM (4:00 PM-6:00 PM) peak periods:

- EB Highland Road (M-59) & WB-to-EB Crossover, West of Bogie Lake Road
- Highland Road (M-59) & Bogie Lake Road
- WB Highland Road (M-59) & Nordic Drive / EB-to-WB Crossover, East of Bogie Lake Road
- SB Bogie Lake Road & NB-to-SB X/O, North of Highland Road (M-59)

During collection of the turning movement counts, Peak Hour Factors (PHFs) and commercial truck percentages were recorded and used in the traffic analysis. The peak hours of the study intersections were utilized and the through volumes were carried through the roadway network and balanced upwards at the proposed site driveway. Therefore, the traffic volumes used in the analysis and shown on the attached traffic volume figures may not match the raw traffic volumes shown in the data collection. The weekday AM and PM peak hours for the adjacent roadway network were observed to generally occur between 7:15 AM to 8:15 AM and 4:30 PM to 5:30 PM, respectively. F&V collected an inventory of existing lane use and traffic controls, as shown on the attached **Figure 2**. Additionally, F&V obtained the current signal timing permits from RCOC for the signalized study intersection. The existing 2022 peak hour traffic volumes used in the analysis are shown on the attached **Figure 3**.

## 3 EXISTING CONDITIONS

Existing peak hour vehicle delays and Levels of Service (LOS) were calculated at the study intersections using Synchro/SimTraffic (Version 11) traffic analysis software. This analysis was based on the existing lane use and traffic control shown on the attached **Figure 2**, the existing peak hour traffic volumes shown on the attached **Figure 3**, and the methodologies presented in the *Highway Capacity Manual, 6<sup>th</sup> Edition* (HCM6). The signalized intersections within the study roadway network operate with non-NEMA phasing and clustered signals, which are not supported by HCM6; therefore, HCM2000 was determined to be more appropriate for use at these intersections. Descriptions of LOS "A" through "F" as defined in the HCM6, are attached. Typically, LOS D is considered acceptable, with LOS A representing minimal delay and LOS F indicating failing conditions. The existing conditions results are attached and summarized in **Table 1**.

The results of the existing conditions analysis indicates that all approaches and movements are currently operating acceptably, at LOS D or better during both peak periods, with the exception of the following:

### Highland Road (M-59) & Bogie Lake Road

- **During the AM peak hour:** The southbound right-turn movement is currently operating at LOS E.

- During the PM peak hour: The northbound through movement, the southbound through movement, and the southbound right-turn movement are currently operating at LOS E.

Although the Synchro LOS analysis indicates poor operations, a review of SimTraffic network simulations indicates generally acceptable operations during both the AM and PM peak hours. SimTraffic microsimulations indicate that all vehicle queues along the northbound and southbound approaches were observed to be processed through the intersection within each cycle length.

**WB Highland Road (M-59) & EB-to-WB Crossover / Nordic Drive**

- During the PM peak hour: The northbound (crossover) approach is currently operating at LOS E.

Review of SimTraffic microsimulations indicates generally acceptable operations at this signalized study intersection. Occasional periods of vehicle queues were present during the PM peak hour; however, the majority of queues were observed to be serviced each cycle, leaving minimal residual vehicle queueing. Additionally, vehicle queues were observed to dissipate and were not present throughout the PM peak hour.

SimTraffic network simulations indicate acceptable operations throughout the remainder of the study roadway network during both the AM and PM peak hours. All vehicles at the remaining signalized study intersections were observed to be serviced within each cycle length.

**Table 1: Existing Intersection Operations**

	Intersection	Control	Approach	Existing Conditions			
				AM Peak		PM Peak	
				Delay (s/veh)	LOS	Delay (s/veh)	LOS
10 & 11	EB Highland Road (M-59) & WB-to-EB X/O	Signalized	EBT	15.3	B	9.6	A
			SBL	0.4	A	0.3	A
			<b>Overall</b>	<b>13.6</b>	<b>B</b>	<b>8.3</b>	<b>A</b>
20 & 21	Highland Road (M-59) & Bogie Lake Road	Signalized	EBT	3.2	A	2.9	A
			EBR	3.0	A	2.0	A
			WBT	6.5	A	14.2	B
			WBR	3.7	A	2.1	A
			NBT	31.8	C	59.3	E
			NBR	33.7	C	51.8	D
			SBT	36.8	D	61.2	E
			SBR	59.6	E	66.4	E
<b>Overall</b>	<b>9.6</b>	<b>A</b>	<b>17.3</b>	<b>B</b>			
30 & 31	WB Highland Road (M-59) & EB-to-WB X/O / Nordic Drive	Signalized	WBT	9.5	A	11.2	B
			WBR	6.1	A	5.0	A
			NBTL	36.9	D	65.0	E
			SBR	26.4	C	42.2	D
<b>Overall</b>	<b>13.3</b>	<b>B</b>	<b>19.7</b>	<b>B</b>			
40 & 41	Bogie Lake Road & NB-to-SB X/O	Signalized	WBL	0.3	A	0.3	A
			SB	5.9	A	4.7	A
			<b>Overall</b>	<b>1.5</b>	<b>A</b>	<b>1.0</b>	<b>A</b>

**4 BACKGROUND CONDITIONS (2024 NO BUILD)**

Historical population and economic profile data was obtained for White Lake Township from SEMCOG in order to calculate a background growth rate to project the existing 2022 peak hour traffic volumes to the site buildout year of 2024. Population and employment projections from 2020 to 2045 were reviewed and show an average annual growth of 0.16% and 0.01%, respectively. Therefore, a conservative background growth rate of **0.5%** per year was applied to the existing peak hour traffic volumes to forecast the background 2024 traffic volume **without the proposed development**, as shown on the attached **Figure 4**.



In addition to the background traffic growth, it is important to account for traffic that will be generated by developments within the vicinity of the study area that are currently under construction or will be within the buildout year. At the time of this study, neither MDOT nor White Lake Township identified any planned background developments within the vicinity of the project site.

Background peak hour vehicles delays and LOS **without the proposed development** were calculated at the study intersections based on the existing lane use and traffic control shown on the attached **Figure 2**, the background peak hour traffic volumes shown on the attached **Figure 4**, and the methodologies presented in the HCM. The results of the background conditions analysis are attached and summarized in **Table 2**.

**Table 2: Background Intersection Operations**

Intersection	Control	Approach	Existing Conditions				Background Conditions				Difference			
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
10 & 11 EB Highland Rd. (M-59) & WB-to-EB X/O	Signal	EBT	15.3	B	9.6	A	15.6	B	9.7	A	0.3	-	0.1	-
		SBL	0.4	A	0.3	A	0.4	A	0.3	A	0.0	-	0.0	-
		<b>Overall</b>	<b>13.6</b>	<b>B</b>	<b>8.3</b>	<b>A</b>	<b>13.9</b>	<b>B</b>	<b>8.4</b>	<b>A</b>	<b>0.3</b>	-	<b>0.1</b>	-
20 & 21 Highland Road (M-59) & Bogie Lake Rd.	Signal	EBT	3.2	A	2.9	A	3.1	A	2.9	A	-0.1	-	0.0	-
		EBR	3.0	A	2.0	A	3.0	A	2.0	A	0.0	-	0.0	-
		WBT	6.5	A	14.2	B	6.6	A	14.4	B	0.1	-	0.2	-
		WBR	3.7	A	2.1	A	3.7	A	2.0	A	0.0	-	-0.1	-
		NBT	31.8	C	59.3	E	31.9	C	59.6	E	0.1	-	0.3	-
		NBR	33.7	C	51.8	D	33.8	C	52.2	D	0.1	-	0.4	-
		SBT	36.8	D	61.2	E	36.7	D	61.0	E	-0.1	-	-0.2	-
		SBR	59.6	E	66.4	E	60.4	E	66.1	E	0.8	-	-0.3	-
<b>Overall</b>	<b>9.6</b>	<b>A</b>	<b>17.3</b>	<b>B</b>	<b>9.8</b>	<b>A</b>	<b>17.5</b>	<b>B</b>	<b>0.2</b>	-	<b>0.2</b>	-		
30 & 31 WB Highland Rd. (M-59) & EB-to-WB X/O / Nordic Drive	Signal	WBT	9.5	A	11.2	B	9.6	A	11.4	B	0.1	-	0.2	-
		WBR	6.1	A	5.0	A	6.1	A	5.0	A	0.0	-	0.0	-
		NBTL	36.9	D	65.0	E	36.0	D	65.7	E	-0.9	-	0.7	-
		SBR	26.4	C	42.2	D	26.4	C	42.3	D	0.0	-	0.1	-
		<b>Overall</b>	<b>13.3</b>	<b>B</b>	<b>19.7</b>	<b>B</b>	<b>13.2</b>	<b>B</b>	<b>19.9</b>	<b>B</b>	<b>-0.1</b>	-	<b>0.2</b>	-
40 & 41 Bogie Lake Rd. & NB-to-SB X/O	Signal	WBL	0.3	A	0.3	A	0.3	A	0.3	A	0.0	-	0.0	-
		SB	5.9	A	4.7	A	5.9	A	4.7	A	0.0	-	0.0	-
		<b>Overall</b>	<b>1.5</b>	<b>A</b>	<b>1.0</b>	<b>A</b>	<b>1.5</b>	<b>A</b>	<b>0.9</b>	<b>A</b>	<b>0.0</b>	-	<b>-0.1</b>	-

\* Decreased delays are the result of improved progression and/or HCM weighting methodologies

The results of the background conditions analysis indicates that all approaches and movements at the study intersections are expected to continue operating acceptably, in a manner similar to the existing conditions analysis. Additionally, review of SimTraffic network simulations indicates acceptable operations throughout the study roadway network, similar to the observations made during existing conditions.

**5 SITE TRIP GENERATION**

The number of weekday peak hour (AM and PM) and daily vehicle trips generated by the proposed development were calculated using the rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation, 11<sup>th</sup> Edition*. The proposed development includes retail and restaurant land uses, including two (2) restaurants with drive-through service. Additionally, one (1) of the proposed drive-through restaurants is currently planned to be a Culver’s restaurant, which does not operate during the AM peak hours (7AM-9AM); therefore, the AM peak trip generation was excluded. Site access is proposed via one (1) right-in/right-out (RIRO) driveway on Highland Road (M-59) and one (1) full access driveway on Bogie Lake Road. The site trip generation forecast utilized for the proposed development is summarized in **Table 3**.

**Table 3: Site Trip Generation Summary**

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Strip Retail Plaza (<40k SF)	822	6,031	SF	484	8	6	14	27	27	54
Internal Capture					1	1	2	14	8	22
Pass-By		0% AM, 40% PM		97	0	0	0	6	6	12
New Trips				387	7	5	12	7	13	20
Fast Food with Drive-Through	934	4,060	SF	1,898	0	0	0	70	64	134
Internal Capture					0	0	0	5	8	13
Pass-By		0% AM, 55% PM		408	0	0	0	33	33	66
New Trips				1,490	0	0	0	32	23	55
Coffee Shop with Drive-Through	937	2,289	SF	1,221	100	97	197	45	44	89
Internal Capture					1	1	2	3	6	9
Pass-By		50% AM; 55% PM		263	49	49	98	22	22	44
New Trips				958	50	47	97	20	16	36
Total Trips				3,603	108	103	211	142	135	277
Total Internal Capture					2	2	4	22	22	44
Total Pass-By				768	49	49	98	61	61	122
Total New Trips				2,835	57	52	109	59	52	111

As is typical of commercial developments, a portion of the trips generated by the proposed development are from vehicles currently on the adjacent roadway that will pass the site on the way from an origin to their ultimate destination. Therefore, not all traffic at the site driveways is necessarily new traffic added to the street system. This percentage of the trips generated by the development are considered “pass-by” trips and do not add new traffic to the adjacent street system. The percentage of pass-by trips used in this analysis was determined based on the rates published by ITE in the *Trip Generation Manual, 11<sup>th</sup> Edition*. However, ITE does not provide pass-by data for either LUC 822: Strip Retail Plaza or LUC 937: Coffee Shop with Drive-Through; therefore, the pass-by data for LUC 821: Shopping Plaza and LUC 934: Fast Food with Drive-Through were utilized for this analysis, respectively.

Additionally, the table also presents internal trip capture estimates, which are the portion of trips generated by a mixed-used development that would begin and end within the development site, resulting in no additional trips added to the adjacent road network. The internal trip capture projections follow the Transportation Research Board’s (TRB) *Report 684: Enhancing Internal Trip Capture Estimation for Mixed-Use Development*. The internal trips estimation calculations spreadsheets are attached.

These pass-by trips and the internal trips were reduced from the total trips generated by the site, in order to calculate the total new trip generation that was distributed to the study roadway network.

**6 SITE TRIP DISTRIBUTION**

The vehicular trips that would be generated by the proposed development were assigned to the study roads based on the proposed site access plan and driveway configurations, the existing peak hour traffic patterns in the adjacent roadway network, and the methodologies published by ITE. The ITE trip distribution methodology assumes that new trips will enter the network and access the development, then leave the development and return to their direction of origin, whereas pass-by trips will enter and exit the development in their original direction of travel. The site trip distributions utilized in the analysis are summarized in **Table 6**.

The vehicular traffic volumes shown in **Table 3** were distributed to the study roadway network according to the distribution shown in **Table 4**. The site-generated trips shown on the attached **Figure 5** were added to the background peak hour traffic volumes shown on the attached **Figure 4**, in order to calculate the future peak hour traffic volumes, with the addition of the proposed development. Future peak hour traffic volumes are shown on the attached **Figure 6**.

**Table 4: Site Trip Distribution**

To/From	Via	New Trips		Pass-By	
		AM	PM	AM	PM
East	Highland Road (M-59)	34%	46%	47% (EB)	38% (EB)
West	Highland Road (M-59)	53%	39%	27% (WB)	41% (WB)
South	Bogie Lake Road	13%	15%	15% (SB)	9% (SB)
North	Bogie Lake Road	N/A	N/A	11% (NB)	12% (NB)
<b>Total</b>		<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Trip Volumes					
East	Highland Road (M-59)	36	51	46	46
West	Highland Road (M-59)	58	43	23	50
South	Bogie Lake Road	15	17	10	14
North	Bogie Lake Road	0	0	16	12
<b>Total</b>		<b>109</b>	<b>111</b>	<b>98</b>	<b>122</b>

**7 FUTURE CONDITIONS (2024 BUILDOUT)**

Future peak hour vehicle delays and LOS *with the proposed development* were calculated based on the proposed lane use and traffic controls shown on the attached **Figure 2**, future peak hour traffic volumes shown on the attached **Figure 6**, and the methodologies presented in the HCM. The results of the future conditions analysis are attached and summarized in **Table 5**.

**Table 5: Future Intersection Operations**

Intersection	Control	Approach	Background Conditions				Future Conditions				Difference			
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
10 & 11	Signal	EBT	15.6	B	9.7	A	16.1	B	9.9	A	0.5	-	0.2	-
		SBL	0.4	A	0.3	A	0.5	A	0.3	A	0.1	-	0.0	-
		<b>Overall</b>	<b>13.9</b>	<b>B</b>	<b>8.4</b>	<b>A</b>	<b>14.1</b>	<b>A</b>	<b>8.3</b>	<b>A</b>	<b>0.2</b>	<b>B→A</b>	<b>-0.1</b>	<b>-</b>
20 & 21	Signal	EBT	3.1	A	2.9	A	4.1	A	3.8	A	1.0	-	0.9	-
		EBR	3.0	A	2.0	A	2.5	A	1.7	A	-0.5	-	-0.3	-
		WBT	6.6	A	14.4	B	8.3	A	16.6	B	1.7	-	2.2	-
		WBR	3.7	A	2.0	A	3.3	A	3.0	A	-0.4	-	1.0	-
		NBT	31.9	C	59.6	E	31.9	C	59.6	E	0.0	-	0.0	-
		NBR	33.8	C	52.2	D	34.1	C	53.3	D	0.3	-	1.1	-
		SBT	36.7	D	61.0	E	36.4	D	61.2	E	-0.3	-	0.2	-
		SBR	60.4	E	66.1	E	60.7	E	66.0	E	0.3	-	-0.1	-
<b>Overall</b>	<b>9.8</b>	<b>A</b>	<b>17.5</b>	<b>B</b>	<b>11.0</b>	<b>B</b>	<b>19.2</b>	<b>B</b>	<b>1.2</b>	<b>A→B</b>	<b>1.7</b>	<b>-</b>		
30 & 31	Signal	WBT	9.6	A	11.4	B	9.7	A	11.6	B	0.1	-	0.2	-
		WBR	6.1	A	5.0	A	6.1	A	5.0	A	0.0	-	0.0	-
		NBTL	36.0	D	65.7	E	32.6	C	91.2	F	-3.4	D→C	25.5	E→F
		SBR	26.4	C	42.3	D	26.4	C	42.4	D	0.0	-	0.1	-
		<b>Overall</b>	<b>13.2</b>	<b>B</b>	<b>19.9</b>	<b>B</b>	<b>13.6</b>	<b>B</b>	<b>25.2</b>	<b>C</b>	<b>0.4</b>	<b>-</b>	<b>5.3</b>	<b>B→C</b>
40 & 41	Signal	WBL	0.3	A	0.3	A	0.3	A	0.3	A	0.0	-	0.0	-
		SB	5.9	A	4.7	A	5.9	A	4.7	A	0.0	-	0.0	-
		<b>Overall</b>	<b>1.5</b>	<b>A</b>	<b>0.9</b>	<b>A</b>	<b>1.5</b>	<b>A</b>	<b>0.9</b>	<b>A</b>	<b>0.0</b>	<b>-</b>	<b>0.0</b>	<b>-</b>

Intersection	Control	Approach	Background Conditions				Future Conditions				Difference				
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak		
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	
50	EB M-59 & W. Site Drive	Stop (Minor)	EB	N/A				Free				N/A			
			NBR	15.2	C	15.0	C								
60	Bogie Lake Rd. & E. Site Drive	Stop (Minor)	EB	N/A				14.0	B	13.8	B	N/A			
			NBL	8.9	A	8.2	A								
			SB	Free											

\* Decreased delays are the result of improved progression and/or HCM weighting methodologies

The results of the future conditions analysis indicates that all the study intersection approaches and movements will continue to operate acceptably, in a manner similar to the background conditions analysis, with the exception of the following:

**WB Highland Road (M-59) & EB-to-WB Crossover / Nordic Drive**

- During the PM peak hour: The northbound (crossover) approach is expected to operate at LOS F.

Although the Synchro LOS analysis indicates failing operations, a review of SimTraffic network simulations indicates generally acceptable operations. Occasional periods of long vehicle queues were present during the PM peak hour; however, the majority of queues were observed to be serviced each cycle, leaving minimal residual vehicle queueing. Additionally, any vehicle queues present were contained within the available left-turn storage area and were observed to dissipate within the PM peak hour.

SimTraffic network simulations indicate acceptable operations throughout the remainder of the study roadway network during both the AM and PM peak hours. All vehicles at the remaining signalized study intersections were observed to be serviced within each cycle length. Additionally, all approaches and movements at the proposed site driveways are expected to operate acceptably at LOS D or better during both peak periods; the stop-controlled egress traffic was observed to find adequate gaps within the through traffic.

**7.1 FUTURE CONDITIONS WITH IMPROVEMENTS**

Mitigation measures were investigated in order to improve the projected future traffic operations to LOS D or better for all approaches and movements during both peak periods. Signal timing adjustments, geometric improvements, and traffic control modifications were investigated at the study intersections. The results of the evaluation indicates that signal timing optimizations alone will adequately mitigate increases in delay due to the additional traffic generated by the proposed development.

**Table 6: Future Intersection Operations with Improvements**

Intersection	Control	Approach	Future Conditions				Future w/ IMPs				Difference				
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak		
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	
20 & 21	Highland Road (M-59) & Bogie Lake Rd.	Signal	EBT	4.1	A	3.8	A	11.5	B	9.5	A	7.4	A→B	5.7	-
			EBR	2.5	A	1.7	A	3.8	A	2.2	A	1.3	-	0.5	-
			WBT	8.3	A	16.6	B	14.7	B	23.5	C	6.4	A→B	6.9	B→C
			WBR	3.3	A	3.0	A	3.1	A	10.1	B	-0.2	-	7.1	A→B
			NBT	31.9	C	59.6	E	24.4	C	41.8	D	-7.5	-	-17.8	E→D
			NBR	34.1	C	53.3	D	26.1	C	41.1	D	-8.0	-	-12.2	-
			SBT	36.4	D	61.2	E	31.8	D	53.3	D	-4.6	-	-7.9	E→D
			SBR	60.7	E	66.0	E	52.9	D	58.2	E	-7.8	E→D	-7.8	-
		<b>Overall</b>	<b>11.0</b>	<b>B</b>	<b>19.2</b>	<b>B</b>	<b>15.6</b>	<b>B</b>	<b>24.1</b>	<b>C</b>	<b>4.6</b>	<b>-</b>	<b>4.9</b>	<b>B→C</b>	

Intersection	Control	Approach	Future Conditions				Future w/ IMPs				Difference							
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak					
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS				
30 & 31 WB Highland Rd. (M-59) & EB-to-WB X/O / Nordic Drive	Signal	WBT	9.7	A	11.6	B	No Change				28.5	C	No Change				16.9	B→C
		WBR	6.1	A	5.0	A					11.2	B					6.2	A→B
		NBTL	32.6	C	91.2	F					53.0	D					-38.2	F→D
		SBR	26.4	C	42.4	D					28.8	C					-13.6	D→C
		<b>Overall</b>	<b>13.6</b>	<b>B</b>	<b>25.2</b>	<b>C</b>					<b>32.1</b>	<b>C</b>					<b>6.9</b>	<b>-</b>

With the implementation of the recommended signal timing optimizations, all study intersection approaches and movements are expected to operate acceptably, at LOS D or better during both peak periods, with the exception of the following:

**Highland Road (M-59) & Bogie Lake Road**

- During the PM peak hour: The southbound right-turn movement is expected to continue operating at LOS E.

Although the Synchro LOS analysis still indicates poor operations, a review of SimTraffic network simulations indicates acceptable operations during the PM peak hour. SimTraffic microsimulations indicate that all southbound vehicle queues were observed to be processed through the intersection within each cycle length, leaving no residual vehicle queues.

With the implementation of the recommended mitigation measures, SimTraffic network simulations indicate acceptable operations throughout the remainder of the study roadway network and proposed site driveways during both peak periods.

**8 ACCESS MANAGEMENT**

**8.1 AUXILIARY TURN LANE EVALUATION**

Highland Road (M-59) and Bogie Lake Road are under the jurisdiction of MDOT and RCOC, respectively; therefore, the MDOT and RCOC warranting criteria were utilized in order to determine the need for auxiliary turn lanes at the proposed site driveways. Highland Road (M-59) is a four-lane, median-divided roadway; therefore, the left-turn warrants were not evaluated at the proposed W. Site Drive. The result of the analyses shown on the attached MDOT/RCOC warrant charts and are summarized in **Table 7**.

**Table 7: Turn Lane Warrant Analysis Summary**

Site Driveway Intersection	Right-Turn Treatment	Left-Turn Treatment
EB Highland Road (M-59) & W. Site Drive	<b>Right-Turn Lane</b>	<b>N/A</b>
Bogie Lake Road & E. Site Drive	<b>No Treatment</b>	<b>No Treatment</b>

The results of the auxiliary turn lane evaluation indicates that a full-width right-turn deceleration lane is recommended along eastbound Highland Road (M-59) at the proposed W. Site Drive.

**8.2 DRIVEWAY SPACING EVALUATION**

The MDOT Geometric Design Guidance (Section 1.2.2) was utilized to evaluate the location of the proposed site driveways in relation to nearby intersections, crossovers, and driveways within close proximity to the project site. The AASHTO intersection corner clearance criteria were evaluated for the 55-mph section of Highland Road (M-59) and the 45-mph section of Bogie Lake Road. The proposed development plans include two (2) proposed access points: one (1) right-in/right-out (RIRO) site driveway along EB Highland Road (M-59) and one (1) full access driveway along Bogie Lake Road. The distance of the proposed site driveways from nearby access points and the warranting criteria are summarized in **Table 8** and displayed in **Exhibit 1**.

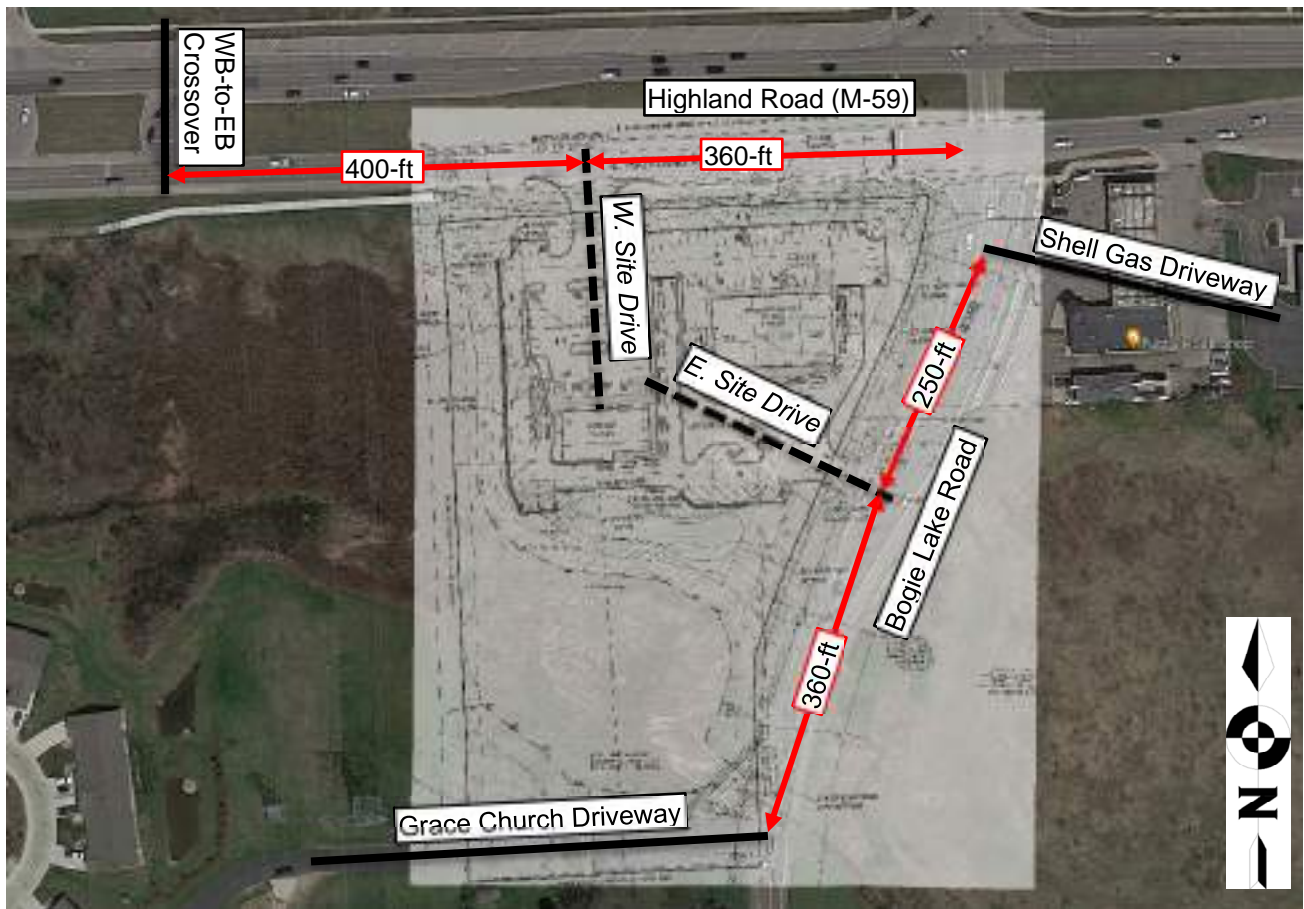


**Table 8: Desirable Corner Clearance Summary**

Adjacent Driveways & Intersections			Distance	Criteria	Meets
W. Site Drive	to	WB-to-EB Crossover	400 feet	150 feet	<b>YES</b>
W. Site Drive	to	Bogie Lake Road	360 feet	230 feet	<b>YES</b>
E. Site Drive	to	Shell Gas Station	250 feet	630 feet	<b>NO</b>
E. Site Drive	to	Grace Church	360 feet	350 feet	<b>YES</b>

The results of the analysis indicates that the proposed E. Site Drive is not expected to meet the desirable MDOT spacing criteria in relation to the nearby Shell Gas Station driveway on the opposite side of Bogie Lake Road. However, the proposed location of the E. Site Drive location currently meets the driveway spacing requirements from the Grace Church driveway; therefore, shifting the driveway location further south to increase the spacing from the Shell Drive would result in the driveway no longer meeting spacing requirements to the south.

**Exhibit 1: Proposed Driveway Spacing**



**9 SITE CIRCULATION AND QUEUEING**

**9.1 COFFEE SHOP DRIVE-THROUGH**

The projected drive-through vehicle queuing was reviewed to determine if the proposed on-site drive-through storage is adequate to accommodate the projected operations. Typical restaurants with drive-through have an average service rate of approximately 60 vehicles/hour; additionally, approximately 70% of customers will utilize a drive-through. Therefore, of the total of 100 vehicles generated by the coffee shop during the AM peak hour, it is estimated that approximately 70 vehicles per hour will use the drive-through facility, with the remaining 30 vehicles using walk-in service. The evaluation of the queue length included two criteria:

- 1) A queuing analysis was performed to determine if the projected demand of the proposed development exceeds the service rate and calculate the projected queuing. The projected demand (70 veh/hr) is greater than the service rate (60 veh/hr) of the site; therefore, a surplus of 10 vehicles is expected.
- 2) In addition, a Poisson Distribution was performed to determine the probability of random arrivals; the results indicate a maximum potential of five (5) vehicles arriving at any given time.

Therefore, providing queuing for a total drive-through queue of 15 vehicles is recommended. The proposed drive-through provides vehicle queuing storage, at 25-ft each vehicle, for four (4) vehicles from the order board to the pick-up window and 11 vehicles past the order boards, for a total drive-through queue of 15 vehicles (375 feet) within the allotted drive-through area without impacting the parking spaces or internal site circulation.

The proposed vehicle queuing storage for this project site can adequately accommodate the projected vehicle queue lengths for the proposed development. In the event that the vehicle demands exceed the drive-through capacity, the internal site circulation has adequate space to accommodate the additional vehicle storage lengths on-site without impacting the adjacent street operations on Highland Road (M-59). The projected vehicle queuing is summarized in **Table 9** and the expected queuing is shown in the attached site plan.

**Table 9: Coffee Shop Vehicle Queuing Analysis**

COFFEE SHOP DRIVE-THROUGH STACKING SPACE CALCULATOR	
Number of Arrivals	70
Time per Vehicle (s)	60
Service Rate (veh/hr)	60
Drive-Through Queue (veh)	10
Peak Arrival (veh)	5
Vehicle Length	25
<b>TOTAL QUEUE (ft)</b>	<b>375</b>

**Exhibit 2: Coffee Shop Vehicle Queuing**





**9.2 CULVERS DRIVE-THROUGH**

The peak trip generation for the proposed Culver’s restaurant is expected during the PM peak period; therefore, the projected drive-through vehicle queuing for the PM was reviewed to determine if the proposed on-site queue length for the drive-through is adequate to accommodate the projected operations.

Fast-food restaurants with drive-through windows typically service approximately 70% of customers via a drive-through, with the remaining patrons choosing to dine-in. Therefore, of the total of 70 vehicles generated by the fast-food restaurant during the PM peak hour, it is estimated that approximately 49 vehicles per hour will use the drive-through facility, with the remaining 21 vehicles using walk-in service.

Culver’s operates similar to a typical fast-food restaurant, wherein food is ordered at menu board and drivers pay for their orders at the window. Upon receipt of payment, drivers that order food (not drinks or frozen custard) are issued an order number and must pull ahead to wait for their food to be delivered to their vehicle in the queue past the pickup window. Therefore, the vehicle queue for Culver’s is calculated two ways: Before the Payment Window and After the Payment Window

**Before the Payment Window**

The estimated service rate for a typical fast-food restaurant (90 veh/hr) is greater than the projected arrival rate at the drive-through (49 veh/hr); therefore, the required queueing for the drive-through is based on the maximum potential for random arrivals.

A Poisson Distribution was performed to determine the probability of random arrivals; the results are attached and indicate a maximum potential of four (4) vehicles arriving simultaneously at any given time. The proposed site utilizes two (2) menu order boards and one (1) pick up window. The proposed drive-through provides vehicle queueing storage, at 25-ft each vehicle, for eight (8) vehicles from the order boards to the pick-up window and seven (7) vehicles past the order boards, for a total drive-through queue of 15 vehicles (375 feet) within the allotted drive-through area without impacting the parking spaces or internal site circulation.

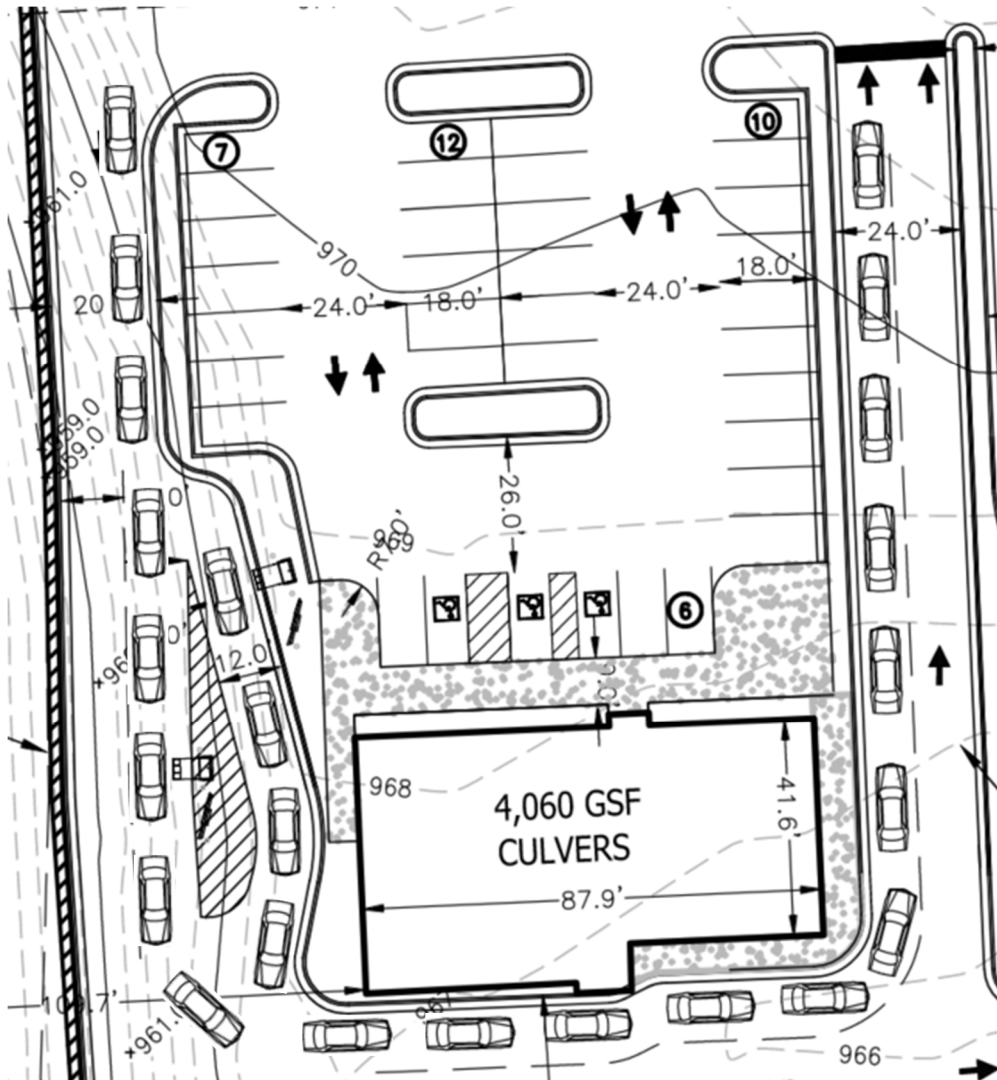
**After the Payment Window**

The estimated service rate is one (1) vehicle served food every 120 seconds (2 min) past the payment window. It was assumed that 80% of the vehicles in the drive-through will order food, then will enter the food queue lane past the payment window. The results of the analysis are summarized below and show a projected peak queue of nine (9) vehicles past the payment window.

**Table 10: Culver’s Vehicle Queuing Analysis**

<b>CULVER'S DRIVE-THROUGH STACKING SPACE CALCULATOR</b>	
<b>Before Payment Window</b>	
Number of Arrivals	49
Time per Vehicle (s)	40
Service Rate (veh/hr)	90
Order Board to Pick-up Window (veh)	8
Peak Arrival (veh)	4
Vehicle Length	25
<b>TOTAL QUEUE (ft)</b>	<b>300</b>
<b>After Payment Window</b>	
Number of Arrivals	39
Time per Vehicle (s)	120
Vehicle Queue Past Window (veh)	9
Vehicle Length	25
<b>TOTAL QUEUE (ft)</b>	<b>225</b>

**Exhibit 3: Fast-Food Restaurant Vehicle Queueing**



**10 CONCLUSIONS**

The conclusions of this TIS are as follows:

**10.1 EXISTING CONDITIONS (2022)**

The result of the existing conditions analysis indicates that all of the study intersections, approaches, and movements, are currently operating acceptably at LOS D or better during both peak periods, with the exception of the following:

**Highland Road (M-59) & Bogie Lake Road**

- During AM peak hour: The SB right-turn movement is currently operating at LOS E.
- During PM peak hour: The NB through, SB through, and SB right-turn movements are currently operating at LOS E.

Review of SimTraffic network simulations indicates generally acceptable operations throughout the study roadway network. All vehicle queues along the northbound/southbound approaches were observed to be serviced within each cycle length, leaving no residual queueing.

**WB Highland Road (M-59) & EB-to-WB Crossover / Nordic Drive**

- During PM peak hour: The NB (crossover) approach is currently operating at LOS E.

Although the Synchro LOS analysis indicates poor operations, a review of SimTraffic network simulations indicates generally acceptable operations. SimTraffic microsimulations indicate that occasional periods of vehicle queues were present during the PM peak hour; however, the majority observed to be serviced each cycle, leaving minimal residual vehicle queueing. Additionally, vehicle queues were observed to dissipate and were not present throughout the peak hour.

**10.2 BACKGROUND CONDITIONS (2024 No BUILD):**

- A conservative 0.5% annual background growth rate was utilized in order to project the existing 2022 peak hour traffic volumes to the buildout year of 2024. Additionally, no planned developments were identified within the vicinity of the project site.
- The results of the background conditions analysis indicates that all approaches and movements at the study intersections will continue to operate in a manner similar to existing conditions. Additionally, review of SimTraffic microsimulations indicates acceptable operations, with minimal vehicle queueing.

**10.3 FUTURE CONDITIONS (2024 BUILDOUT)**

The results of the future conditions analysis indicates that all of the study intersection approaches and movements will continue to operate in a manner similar to background conditions with the following additional delays:

**Highland Road (M-59) & EB-to-WB Crossover / Nordic Drive**

- During PM peak hour: The NB approach is expected to operate at LOS F.

Review of SimTraffic network simulations indicates generally acceptable operations, similar to those observations made during the background conditions analysis. Occasional periods of long vehicle queues were present; however, the majority of queues were observed to be serviced each cycle, leaving minimal residual vehicle queueing. Additionally, any vehicle queues present were contained within the available left-turn storage area and were observed to dissipate within the PM peak hour.

The proposed site driveways are expected to operate acceptably, at LOS D or better during both peak periods.

**10.4 FUTURE CONDITIONS WITH IMPROVEMENTS**

- Mitigation measures were reviewed at the study intersections in order to mitigate the impact that the site-generated traffic from the proposed development.
- Signal timing optimizations were reviewed during both peak periods and were determined to adequately mitigate increases in delay due to the additional traffic generated by the proposed development.

**10.5 ACCESS MANAGEMENT**

- The MDOT and RCOC auxiliary turn lane warranting criteria were reviewed at the proposed site driveways on Highland Road (M-59) and Bogie Lake Road, respectively. The results of the evaluation indicates the following:
  - A full-width right-turn deceleration lane is recommended at the proposed W. Site Drive on eastbound Highland Road (M-59).
  - No treatments are recommended at the proposed E. Site Drive on Bogie Lake Road.
- Review of the proposed driveway location and adjacent crossover intersections indicates that the proposed E. Site Drive does not meet the MDOT minimum desirable spacing criteria, in relation to the existing Shell Gas Station driveway. However, shifting the driveway further south to increase the spacing would result in insufficient spacing to the south (from existing Grace Church driveway).

**10.6 SITE CIRCULATION**

- The results of the drive-through queueing evaluation indicates that the proposed site plan can adequately accommodate the projected vehicle queueing generated by the fast-food restaurant and the coffee shop drive-through operations, without impacting the internal site circulation or the adjacent roadway network.

**11 RECOMMENDATIONS**

The recommendation of this TIS are as follows:

Recommended Improvements
<b>Highland Road (M-59) &amp; Bogie Lake Road</b>
<ul style="list-style-type: none"> <li>• Optimize the traffic signal timing during both peak periods</li> </ul>
<b>WB Highland Road (M-59) &amp; EB-to-WB Crossover / Nordic Drive</b>
<ul style="list-style-type: none"> <li>• Optimize the traffic signal timing during the PM peak hour</li> </ul>
<b>EB Highland Road (M-59) &amp; W. Site Drive</b>
<ul style="list-style-type: none"> <li>• Provide a full-width right-turn deceleration lane at the proposed E. Site Drive</li> </ul>

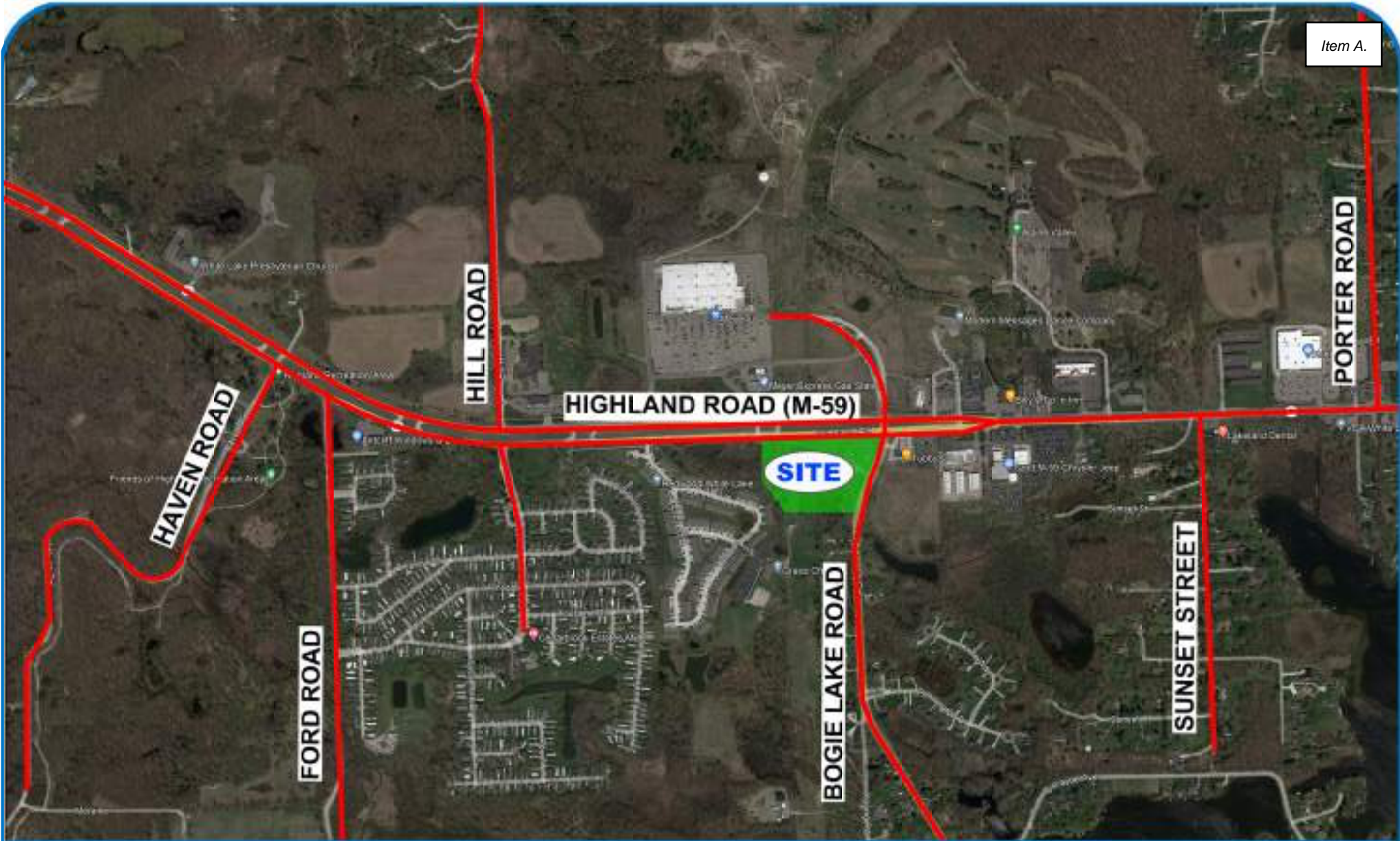
Any questions related to this memorandum, study, analysis, and results should be addressed to Fleis & VandenBrink.



I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Michigan.

- Attached:**
- Figures 1 – 6
  - Proposed Site Plan
  - Traffic Volume Data
  - Signal Timing Permits
  - Internal Capture Spreadsheet
  - Synchro / SimTraffic Results
  - Auxiliary Lane Warrant
  - Poisson Distribution





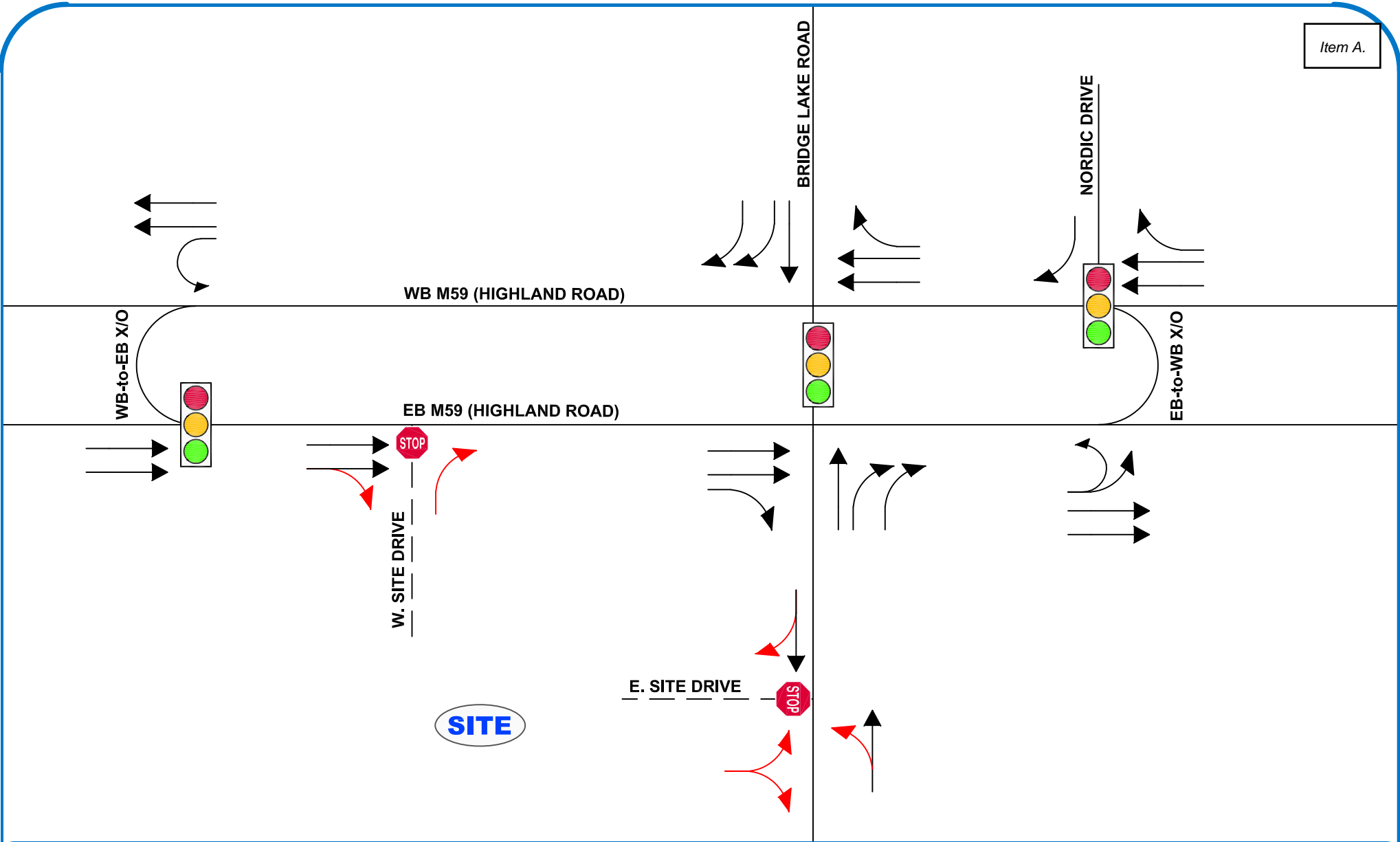
**FIGURE 1**  
**SITE LOCATION**

GATEWAY CROSSINGS TIS - WHITE LAKE CHARTER TOWNSHIP, MI

**LEGEND**

 SITE LOCATION



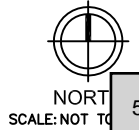


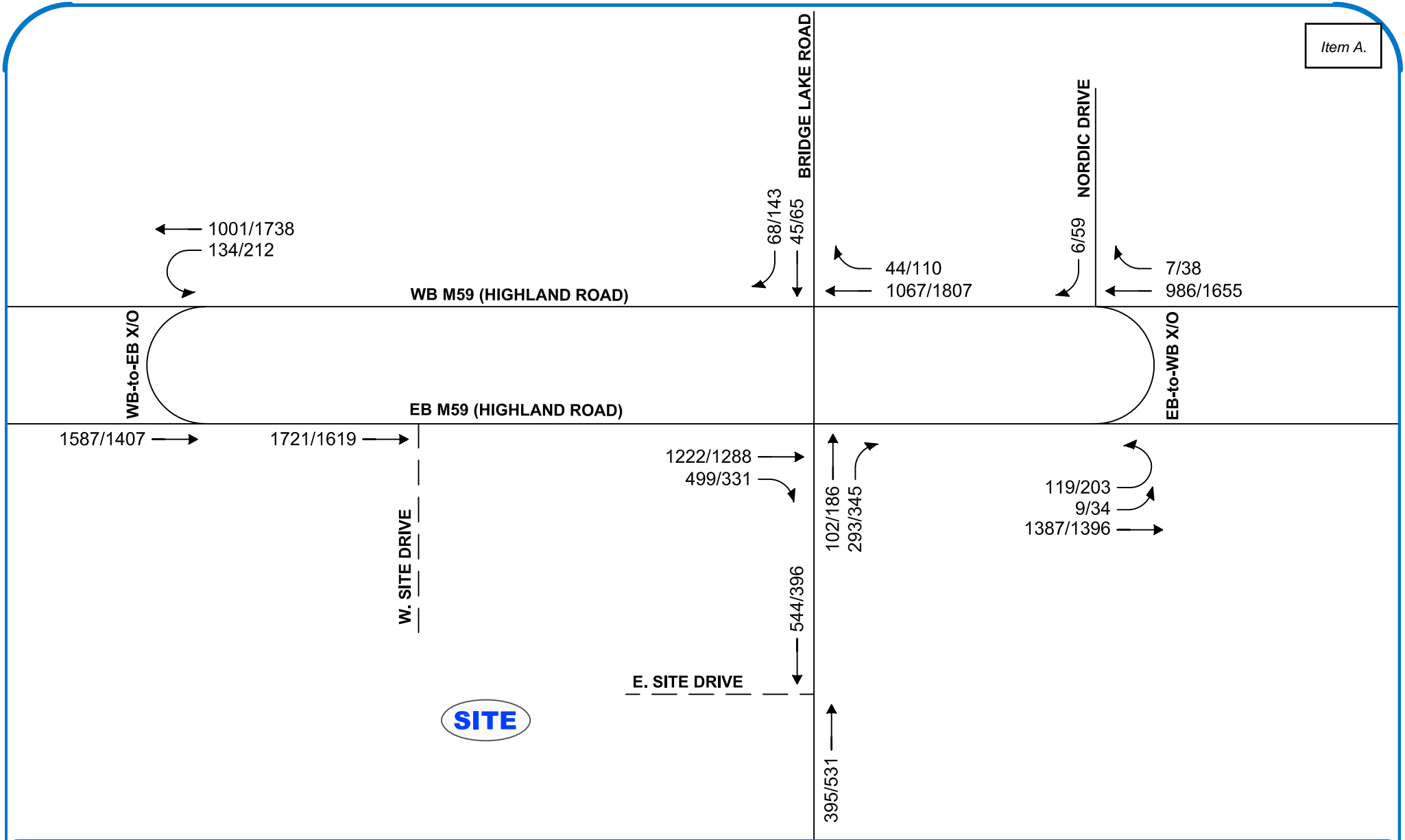
**FIGURE 2**  
**LANE USE AND TRAFFIC CONTROL**

GATEWAY CROSSINGS TIS - WHITE LAKE CHARTER TOWNSHIP, MI

**LEGEND**

- ROADS
- PROPOSED ROADS
- LANE USE
- PROPOSED LANE USE
- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- ROUNDABOUT INTERSECTION





### FIGURE 3

## EXISTING TRAFFIC VOLUMES

GATEWAY CROSSINGS TIS - WHITE LAKE CHARTER TOWNSHIP, MI

#### LEGEND

- ROADS
- - - PROPOSED ROADS
- ↑↓ TRAFFIC VOLUMES (AM/PM)





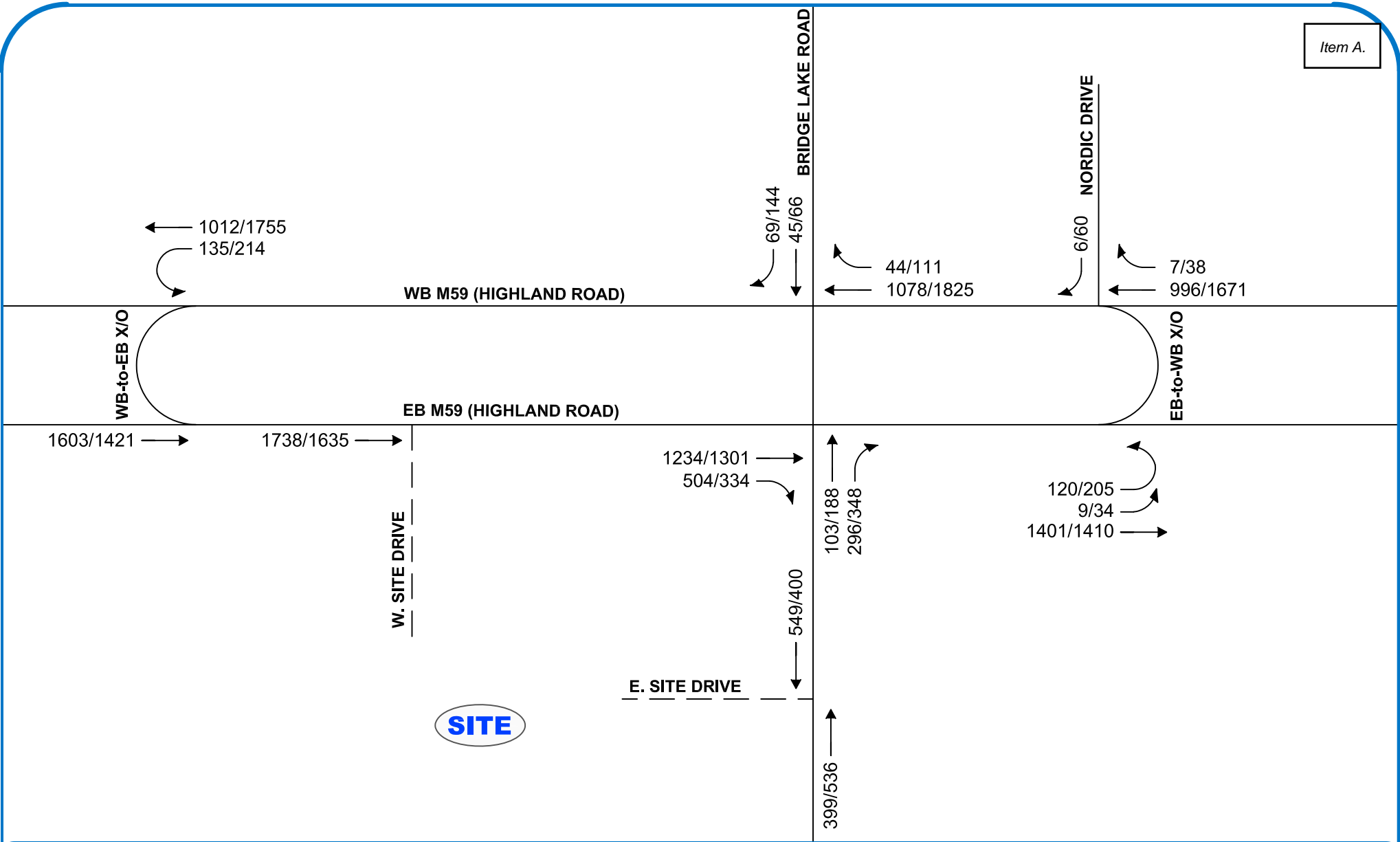


FIGURE 4

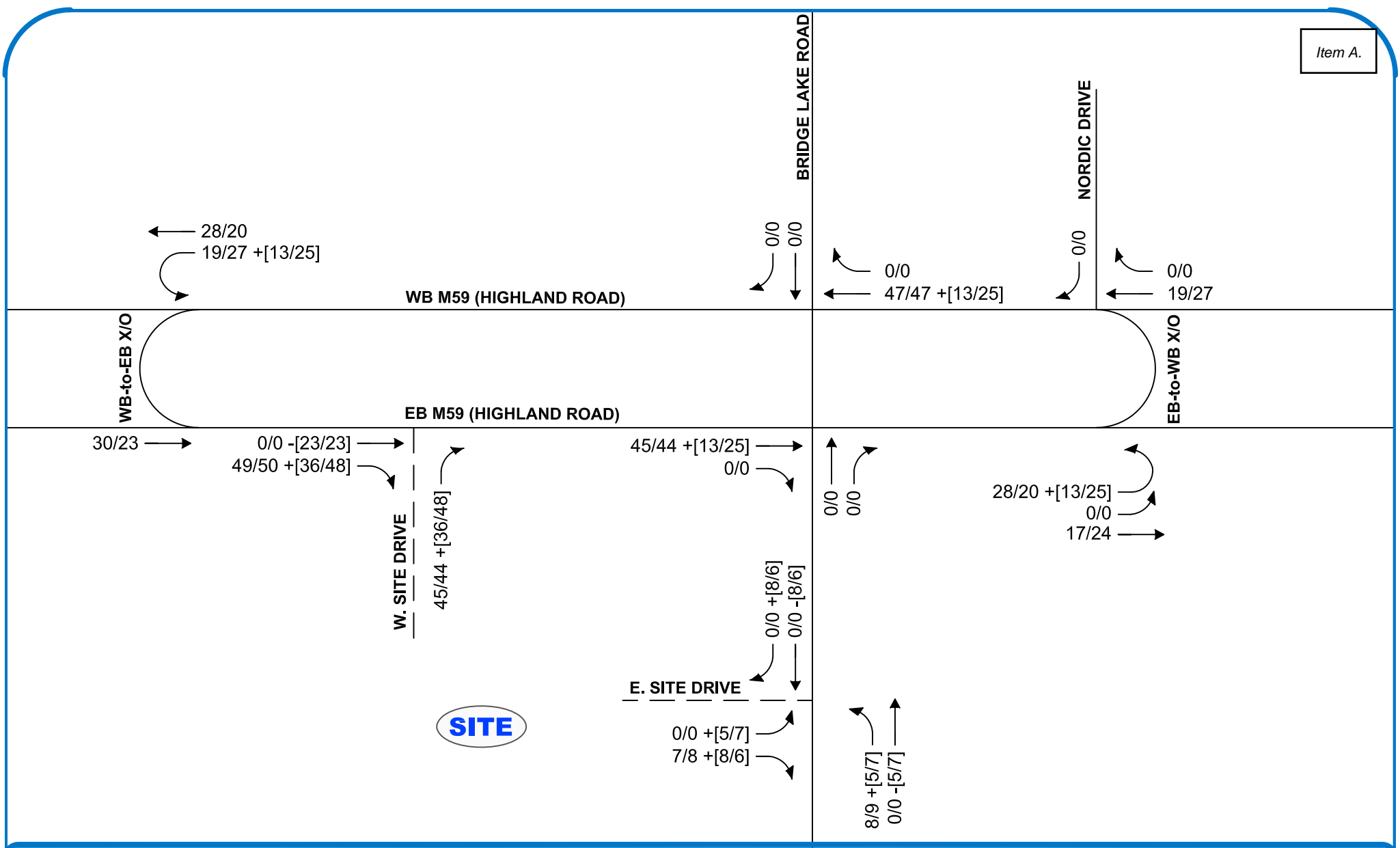
BACKGROUND TRAFFIC VOLUMES

GATEWAY CROSSINGS TIS - WHITE LAKE CHARTER TOWNSHIP, MI

LEGEND

- ROADS
- - - PROPOSED ROADS
- ↑↑↑↑ TRAFFIC VOLUMES (AM/PM)



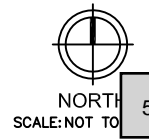


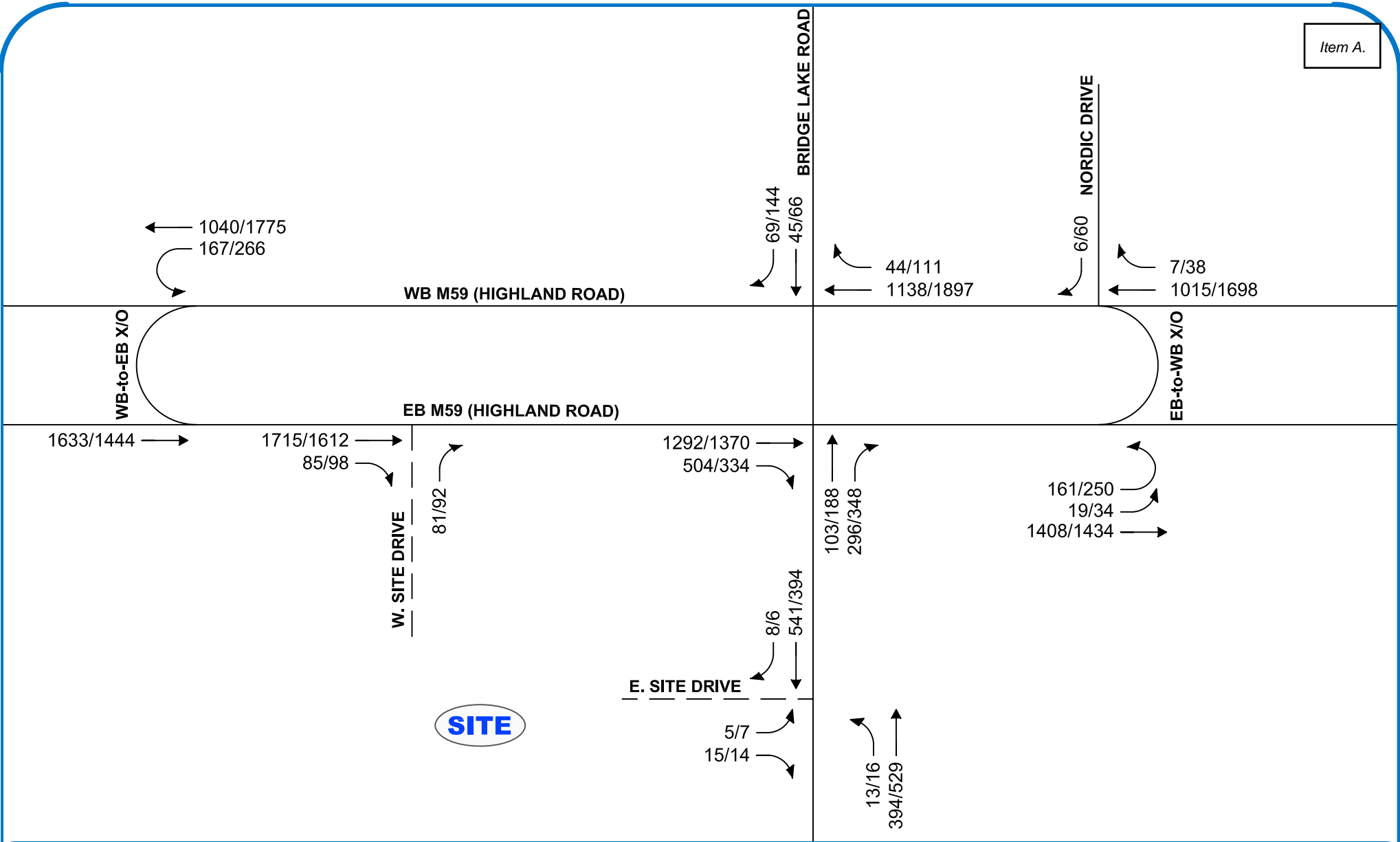
**FIGURE 5**  
**SITE-GENERATED TRAFFIC VOLUMES**

GATEWAY CROSSINGS TIS - WHITE LAKE CHARTER TOWNSHIP, MI

**LEGEND**

- ROADS
- - - PROPOSED ROADS
- ↑↓ TRAFFIC VOLUMES (AM/PM)





### FIGURE 6

## FUTURE TRAFFIC VOLUMES

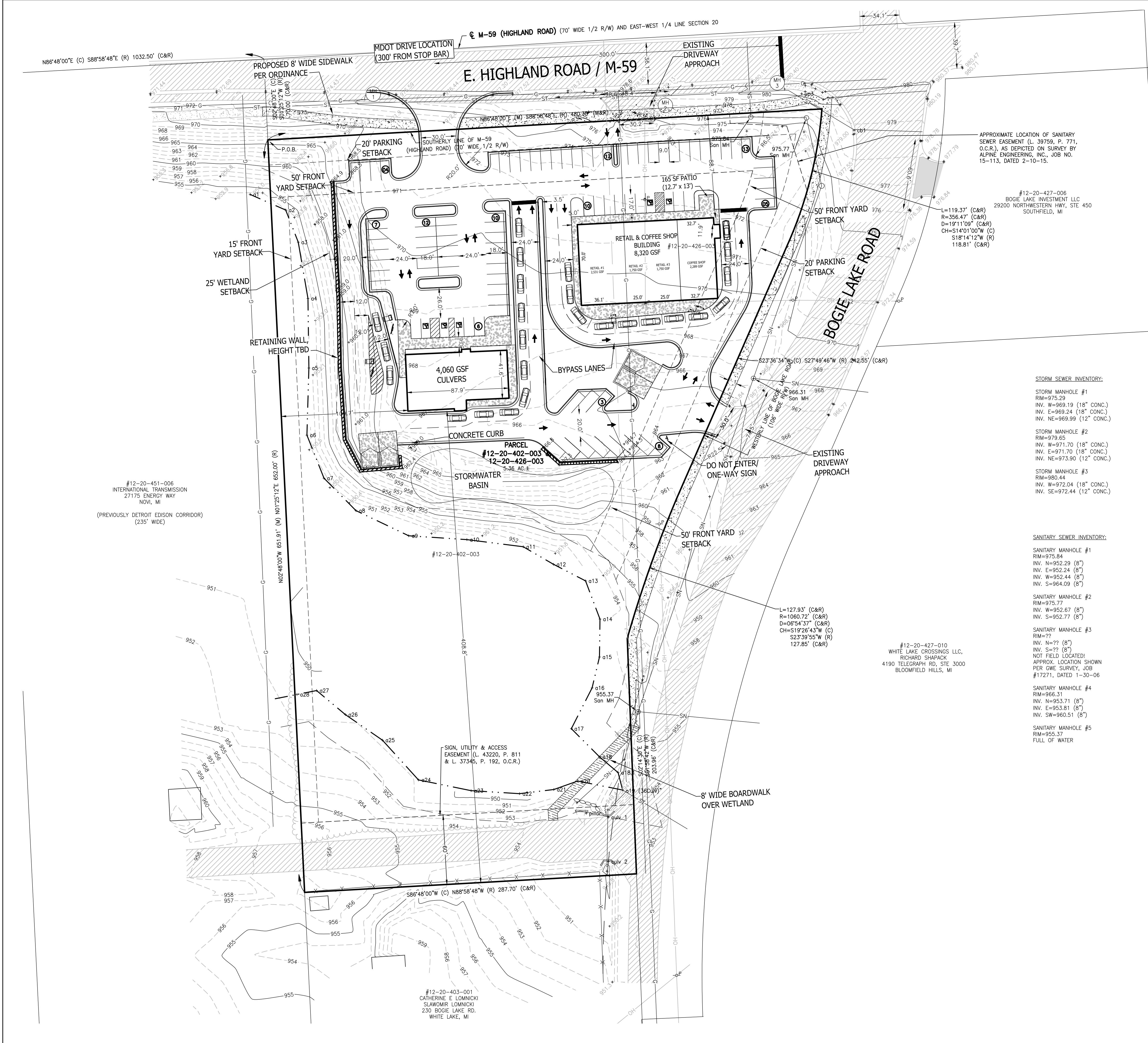
GATEWAY CROSSINGS TIS - WHITE LAKE CHARTER TOWNSHIP, MI

#### LEGEND

- ROADS
- - - PROPOSED ROADS
- ↑↓ TRAFFIC VOLUMES (AM/PM)



NORTH  
SCALE: NOT TO



**LEGEND**

PROPOSED (PR)	EXISTING (EX)	DESCRIPTION
FF	FF	CONTOUR
FG	FG	FINISHED FLOOR ELEVATION
T/A	T/A	TOP OF ASPHALT
T/W	T/W	TOP OF CURB / CONCRETE
F/L	F/L	TOP OF WALK
T/P	T/P	FLOW LINE
B/P	B/P	TOP OF PIPE
RM	RM	RIM ELEVATION
INV	INV	INVERT ELEVATION
MH	MH	MANHOLE STRUCTURE
IN	IN	INLET STRUCTURE
CB	CB	CATCHBASIN STRUCTURE
RY	RY	REAR YARD STRUCTURE
ES	ES	END-SECTION
OV	OV	GATEVALVE STRUCTURE
HY	HY	HYDRANT
UP	UP	UTILITY POLE
SN	SN	SANITARY SEWER
SL	SL	SANITARY LEAD
FM	FM	FORCE MAIN
PS	PS	PRESSURE SEWER
ST	ST	STORM SEWER
WM	WM	WATER MAIN
WL	WL	WATER LEAD
FO	FO	FIBER OPTIC
OH	OH	OVERHEAD WIRE
C	C	CABLE
E	E	ELECTRIC
G	G	GAS
T	T	TELEPHONE
X	X	FENCE
+	+	SILT FENCE
○	○	WETLAND BOUNDARY
□	□	LIMITS OF GRADING/CLEARING
○	○	MANHOLE
○	○	INLET / CATCHBASIN
○	○	FLARED END-SECTION
○	○	GATE VALVE
○	○	HYDRANT
○	○	UTILITY POLE
○	○	TO BE REMOVED
○	○	SANITARY SEWER LABEL
○	○	STORM SEWER LABEL
○	○	WATER MAIN LABEL
○	○	SOIL EROSION CONTROL MEASURE (P=PERMANENT, T=TEMPORARY)
○	○	CONCRETE
○	○	ASPHALT
○	○	MODIFIED CURB

**SITE DATA:**

WHITE LAKE TOWNSHIP  
 PARCEL # 4712-20-402-003  
 6350 HIGHLAND ROAD  
 WHITE LAKE, MI 48383  
 4.79 AC +/-

AND

PARCEL # 4712-20-426-003  
 6340 HIGHLAND ROAD  
 WHITE LAKE, MI 48383  
 1.07 AC +/-

ZONING: GENERAL BUSINESS

USE: DRIVE-THROUGH RESTAURANT (SPECIAL USE) AND RETAIL  
 BUILDING SQUARE FOOTAGE (FOOTPRINT): CULVERS 4,060 GSF AND RETAIL WITH DRIVE-THROUGH 8,322 GSF

MIN. LOT AREA REQUIRED FOR ZONING: 1 ACRE  
 MIN. LOT WIDTH: 200 FT  
 TOTAL EX. LOT WIDTH: 485.39  
 MAX. LOT COVERAGE: 40% BLDG, 85% IMPERVIOUS  
 PROPOSED LOT COVERAGE: 4.5% BLDG, APPROX 23% IMPERVIOUS (W/O BLDGS)

MIN. SETBACKS REQUIRED:  
 FRONT: 50-FT  
 REAR: 20-FT  
 SIDE: 15-FT

PROPOSED SETBACKS:  
 FRONT (NORTH): 88.7-FT  
 FRONT (EAST): 35.4-FT  
 SIDE (WEST): 103.2-FT  
 REAR (SOUTH): 408.7-FT

PARKING CALCULATION (GENERAL COMMERCIAL):  
 CULVERS RESTAURANT (FAST FOOD WITH DRIVE-THROUGH)  
 = 1.0 SPACE PER 75 GROSS FLOOR AREA  
 4,060 GSF \* 85% = 3,451 UFA / 75 SF = 46 SPACES  
 PLUS 8 STACKING SPACES

COFFEE SHOP W/ DRIVE-THROUGH  
 (ESTABLISHMENT FOR SALE AND CONSUMPTION ON THE PREMISES OF BEVERAGES, FOOD OR REFRESHMENTS)  
 = 1.0 SPACE PER 100 GROSS FLOOR AREA  
 2,531 GFA \* 85% = 1,945.65 / 100 = 19.46 SPACES ~ 19  
 PLUS 8 STACKING SPACES

RETAIL #1 = 1.0 SPACE PER 200 GFA  
 2,531 GFA \* 85% = 2,151 UFA / 200 = 10.75 SPACES ~ 11

RETAIL #2 = 1.0 SPACE PER 200 GFA  
 1,750 GFA \* 85% = 1,487.50 UFA / 200 = 7.44 SPACES ~ 7

RETAIL #3 = 1.0 SPACE PER 200 GFA  
 1,750 GFA \* 85% = 1,487.50 UFA / 200 = 7.44 SPACES ~ 7

SPACES REQUIRED: 90 SPACES  
**PROVIDED: 90 SPACES INCLUDING 4 ADA SPACES, PLUS 16 STACKING SPACES**

PROPOSED LINEAR FEET OF CONCRETE SIDEWALK: 1,025 LF  
 PROPOSED LINEAR FEET OF BOARDWALK: 111 LF

**BEBOSS**  
 Engineering  
 Planners Landscape Architects  
 3121 E. GRAND RIVER AVE.  
 HOWELL, MI. 48843  
 517.546.4836 FAX 517.548.1670

**GATEWAY CROSSING**

PROJECT: GATEWAY CROSSING, LLC  
 PREPARED FOR: 600 NORTH OLD WOODWARD, SUITE 101  
 BIRMINGHAM, MI 38209  
 248-433-7000

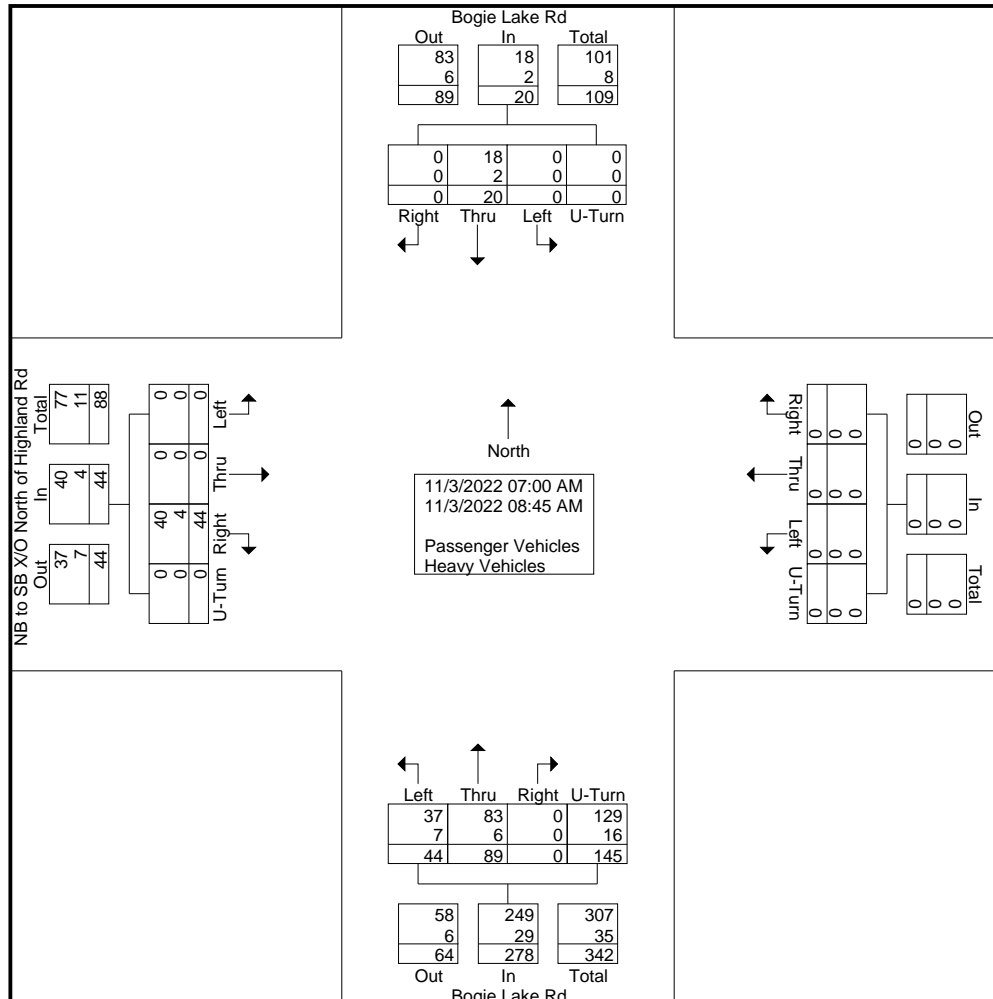
TITLE: DRAFT SITE PLAN

NO.	DATE	REVISION PER	BY

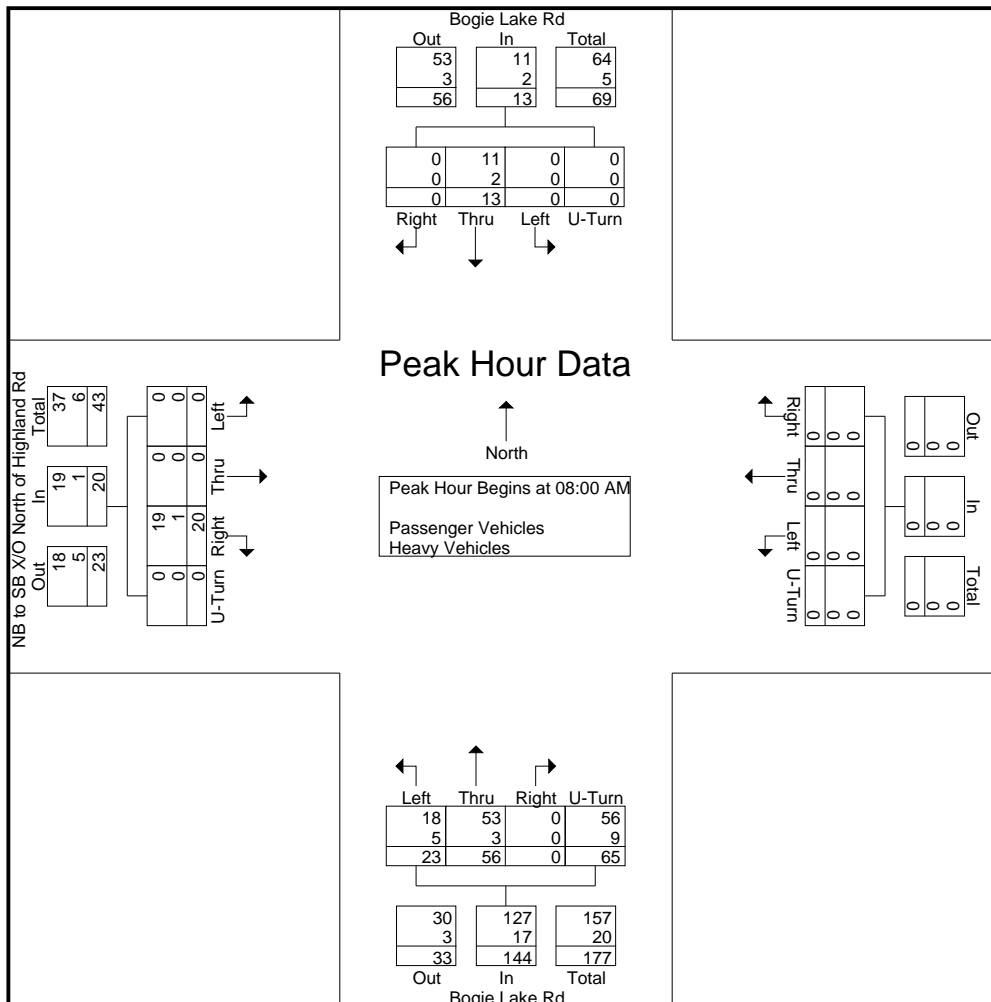
DESIGNED BY: JA  
 DRAWN BY: JA  
 CHECKED BY: BL  
 SCALE: 1" = 40'  
 JOB NO: 22-029-1  
 DATE: 11/04/22  
 SHEET NO. **2**

Groups Printed- Passenger Vehicles - Heavy Vehicles

Start Time	NB to SB X/O North of Highland Rd Eastbound					Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
07:00 AM	0	0	7	0	7	0	0	0	0	0	8	10	0	29	47	0	2	0	0	2	56
07:15 AM	0	0	3	0	3	0	0	0	0	0	6	7	0	23	36	0	2	0	0	2	41
07:30 AM	0	0	7	0	7	0	0	0	0	0	4	4	0	13	21	0	1	0	0	1	29
07:45 AM	0	0	7	0	7	0	0	0	0	0	3	12	0	15	30	0	2	0	0	2	39
<b>Total</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>0</b>	<b>24</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>21</b>	<b>33</b>	<b>0</b>	<b>80</b>	<b>134</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>165</b>
08:00 AM	0	0	7	0	7	0	0	0	0	0	5	9	0	13	27	0	3	0	0	3	37
08:15 AM	0	0	2	0	2	0	0	0	0	0	6	14	0	24	44	0	3	0	0	3	49
08:30 AM	0	0	7	0	7	0	0	0	0	0	7	16	0	12	35	0	3	0	0	3	45
08:45 AM	0	0	4	0	4	0	0	0	0	0	5	17	0	16	38	0	4	0	0	4	46
<b>Total</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>0</b>	<b>20</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>23</b>	<b>56</b>	<b>0</b>	<b>65</b>	<b>144</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>0</b>	<b>13</b>	<b>177</b>
Grand Total	0	0	44	0	44	0	0	0	0	0	44	89	0	145	278	0	20	0	0	20	342
Apprch %	0	0	100	0		0	0	0	0		15.8	32	0	52.2		0	100	0	0		
Total %	0	0	12.9	0	12.9	0	0	0	0	0	12.9	26	0	42.4	81.3	0	5.8	0	0	5.8	
Passenger Vehicles	0	0	40	0	40	0	0	0	0	0	37	83	0	129	249	0	18	0	0	18	307
% Passenger Vehicles	0	0	90.9	0	90.9	0	0	0	0	0	84.1	93.3	0	89	89.6	0	90	0	0	90	89.8
Heavy Vehicles	0	0	4	0	4	0	0	0	0	0	7	6	0	16	29	0	2	0	0	2	35
% Heavy Vehicles	0	0	9.1	0	9.1	0	0	0	0	0	15.9	6.7	0	11	10.4	0	10	0	0	10	10.2

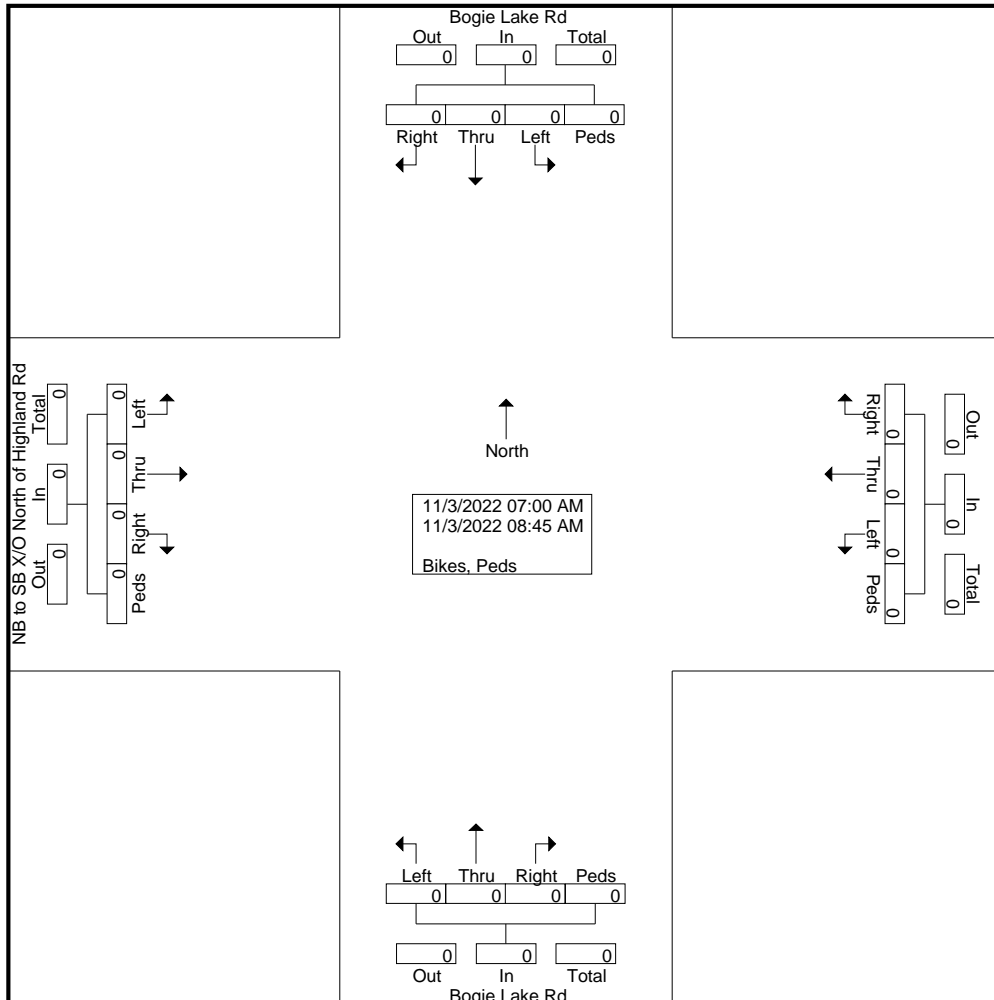


Start Time	NB to SB X/O North of Highland Rd Eastbound					Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	0	7	0	7	0	0	0	0	0	5	9	0	13	27	0	3	0	0	3	37
08:15 AM	0	0	2	0	2	0	0	0	0	0	6	14	0	24	44	0	3	0	0	3	49
08:30 AM	0	0	7	0	7	0	0	0	0	0	7	16	0	12	35	0	3	0	0	3	45
08:45 AM	0	0	4	0	4	0	0	0	0	0	5	17	0	16	38	0	4	0	0	4	46
Total Volume	0	0	20	0	20	0	0	0	0	0	23	56	0	65	144	0	13	0	0	13	177
% App. Total	0	0	100	0		0	0	0	0		16	38.9	0	45.1		0	100	0	0		
PHF	.000	.000	.714	.000	.714	.000	.000	.000	.000	.000	.821	.824	.000	.677	.818	.000	.813	.000	.000	.813	.903
Passenger Vehicles	0	0	19	0	19	0	0	0	0	0	18	53	0	56	127	0	11	0	0	11	157
% Passenger Vehicles	0	0	95.0	0	95.0	0	0	0	0	0	78.3	94.6	0	86.2	88.2	0	84.6	0	0	84.6	88.7
Heavy Vehicles	0	0	1	0	1	0	0	0	0	0	5	3	0	9	17	0	2	0	0	2	20
% Heavy Vehicles	0	0	5.0	0	5.0	0	0	0	0	0	21.7	5.4	0	13.8	11.8	0	15.4	0	0	15.4	11.3



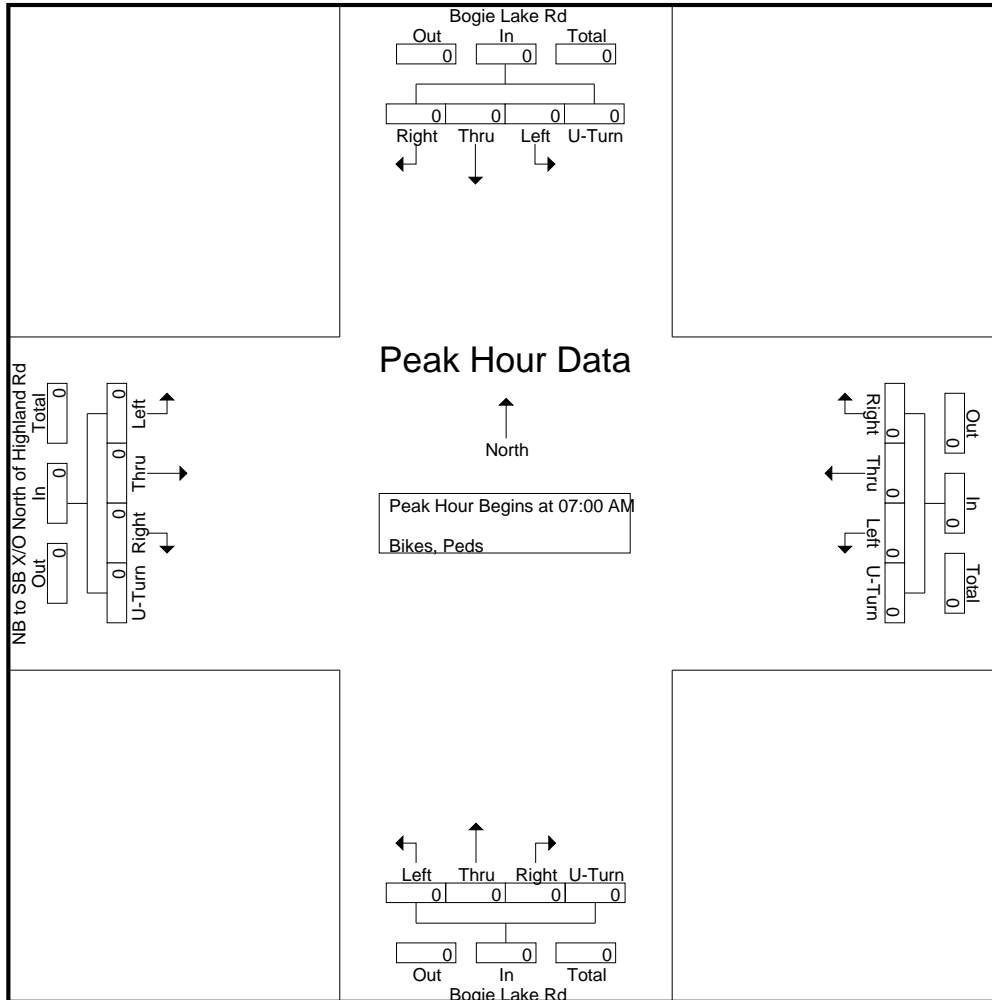
Groups Printed- Bikes, Peds

Start Time	NB to SB X/O North of Highland Rd Eastbound					Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					



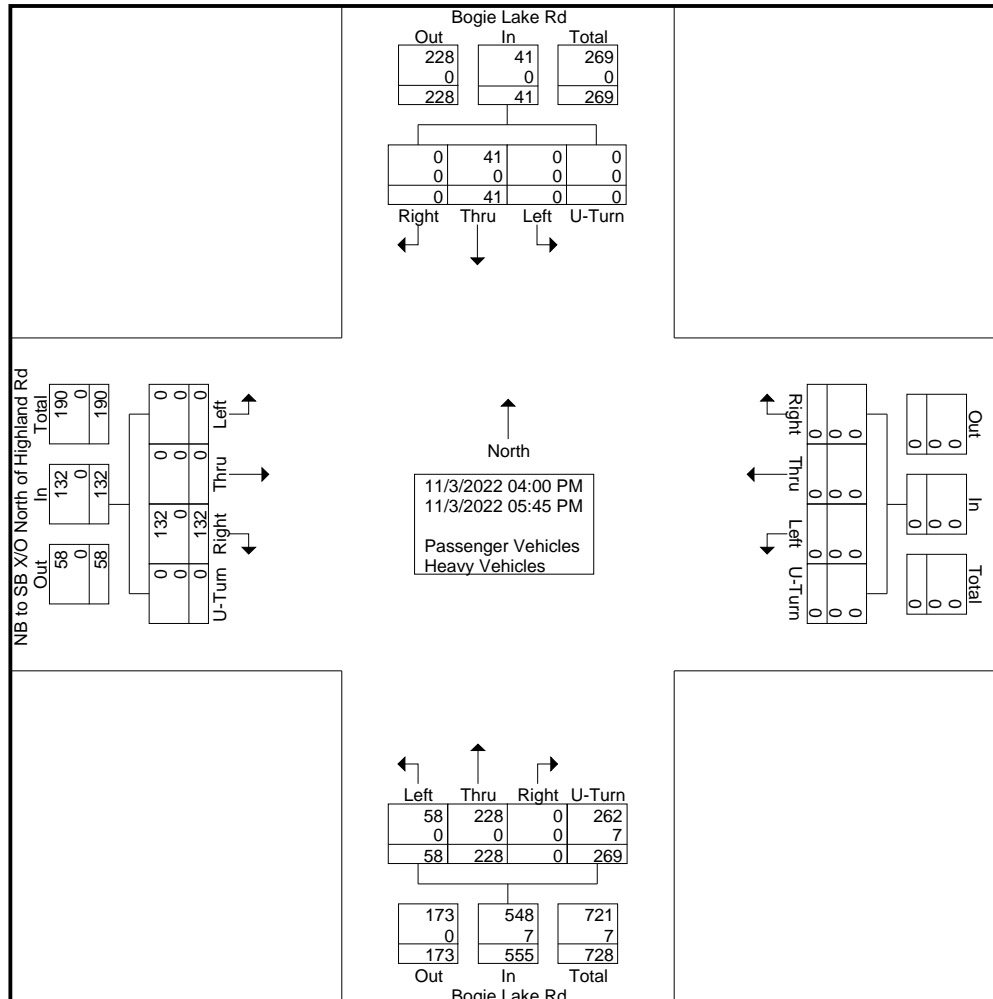


Start Time	NB to SB X/O North of Highland Rd Eastbound					Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total	
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total		
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 07:00 AM																						
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

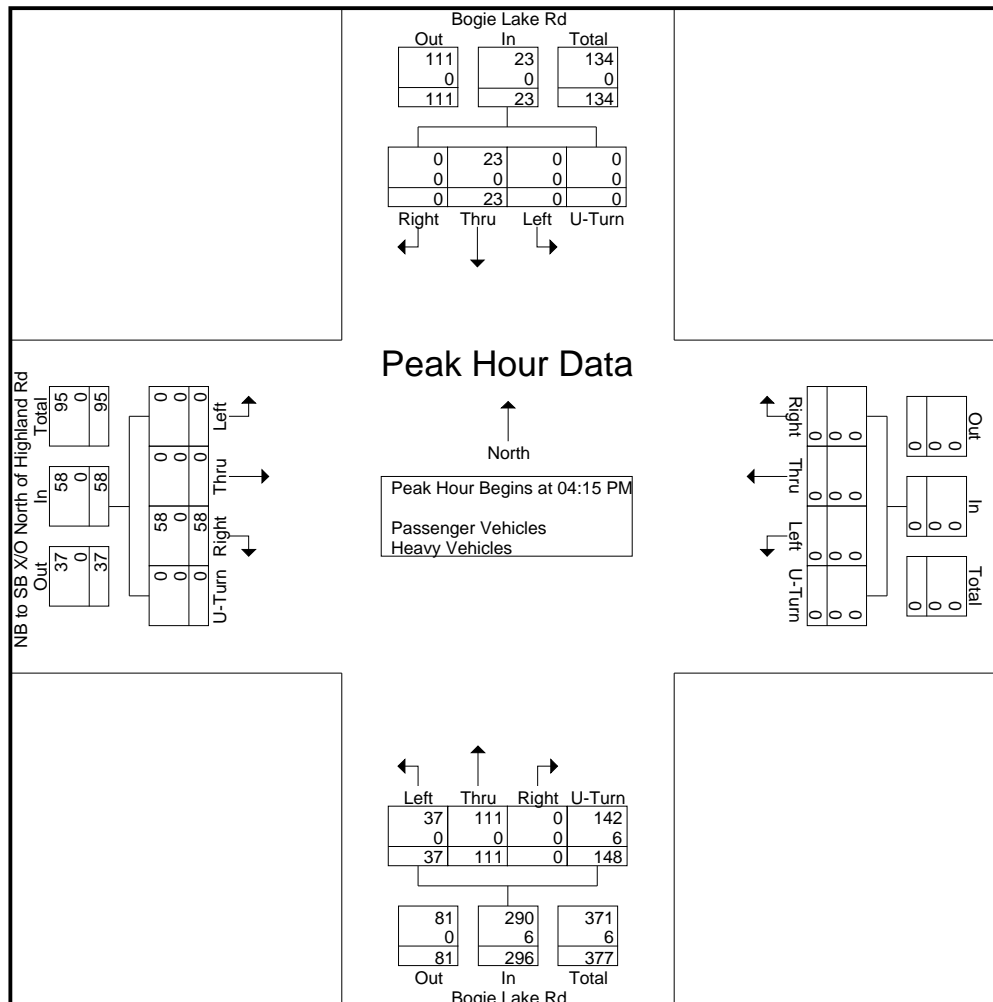


Groups Printed- Passenger Vehicles - Heavy Vehicles

Start Time	NB to SB X/O North of Highland Rd Eastbound					Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
04:00 PM	0	0	18	0	18	0	0	0	0	0	4	28	0	30	62	0	2	0	0	2	82
04:15 PM	0	0	12	0	12	0	0	0	0	0	7	34	0	43	84	0	11	0	0	11	107
04:30 PM	0	0	13	0	13	0	0	0	0	0	8	16	0	36	60	0	3	0	0	3	76
04:45 PM	0	0	18	0	18	0	0	0	0	0	12	34	0	40	86	0	4	0	0	4	108
<b>Total</b>	<b>0</b>	<b>0</b>	<b>61</b>	<b>0</b>	<b>61</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>31</b>	<b>112</b>	<b>0</b>	<b>149</b>	<b>292</b>	<b>0</b>	<b>20</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>373</b>
05:00 PM	0	0	15	0	15	0	0	0	0	0	10	27	0	29	66	0	5	0	0	5	86
05:15 PM	0	0	18	0	18	0	0	0	0	0	5	26	0	38	69	0	9	0	0	9	96
05:30 PM	0	0	15	0	15	0	0	0	0	0	6	30	0	26	62	0	4	0	0	4	81
05:45 PM	0	0	23	0	23	0	0	0	0	0	6	33	0	27	66	0	3	0	0	3	92
<b>Total</b>	<b>0</b>	<b>0</b>	<b>71</b>	<b>0</b>	<b>71</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>27</b>	<b>116</b>	<b>0</b>	<b>120</b>	<b>263</b>	<b>0</b>	<b>21</b>	<b>0</b>	<b>0</b>	<b>21</b>	<b>355</b>
Grand Total	0	0	132	0	132	0	0	0	0	0	58	228	0	269	555	0	41	0	0	41	728
Apprch %	0	0	100	0	100	0	0	0	0	0	10.5	41.1	0	48.5	100	0	100	0	0	100	
Total %	0	0	18.1	0	18.1	0	0	0	0	0	8	31.3	0	37	76.2	0	5.6	0	0	5.6	
Passenger Vehicles	0	0	132	0	132	0	0	0	0	0	58	228	0	262	548	0	41	0	0	41	721
% Passenger Vehicles	0	0	100	0	100	0	0	0	0	0	100	100	0	97.4	98.7	0	100	0	0	100	99
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7	0	0	0	0	0	7
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	2.6	1.3	0	0	0	0	0	1

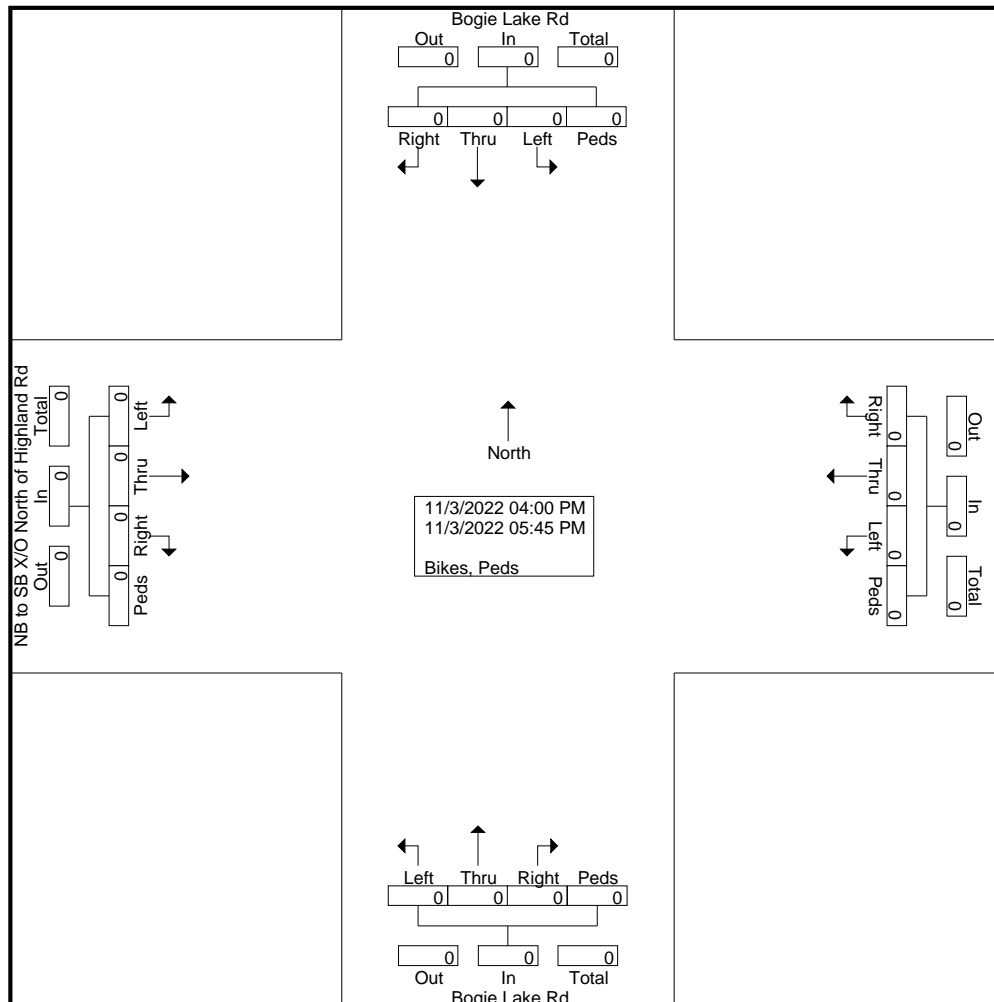


Start Time	NB to SB X/O North of Highland Rd Eastbound					Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	0	12	0	12	0	0	0	0	0	7	34	0	43	84	0	11	0	0	11	107
04:30 PM	0	0	13	0	13	0	0	0	0	0	8	16	0	36	60	0	3	0	0	3	76
04:45 PM	0	0	18	0	18	0	0	0	0	0	12	34	0	40	86	0	4	0	0	4	108
05:00 PM	0	0	15	0	15	0	0	0	0	0	10	27	0	29	66	0	5	0	0	5	86
Total Volume	0	0	58	0	58	0	0	0	0	0	37	111	0	148	296	0	23	0	0	23	377
% App. Total	0	0	100	0		0	0	0	0		12.5	37.5	0	50		0	100	0	0		
PHF	.000	.000	.806	.000	.806	.000	.000	.000	.000	.000	.771	.816	.000	.860	.860	.000	.523	.000	.000	.523	.873
Passenger Vehicles	0	0	58	0	58	0	0	0	0	0	37	111	0	142	290	0	23	0	0	23	371
% Passenger Vehicles	0	0	100	0	100	0	0	0	0	0	100	100	0	95.9	98.0	0	100	0	0	100	98.4
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	0	0	0	0	0	6
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	2.0	0	0	0	0	0	1.6

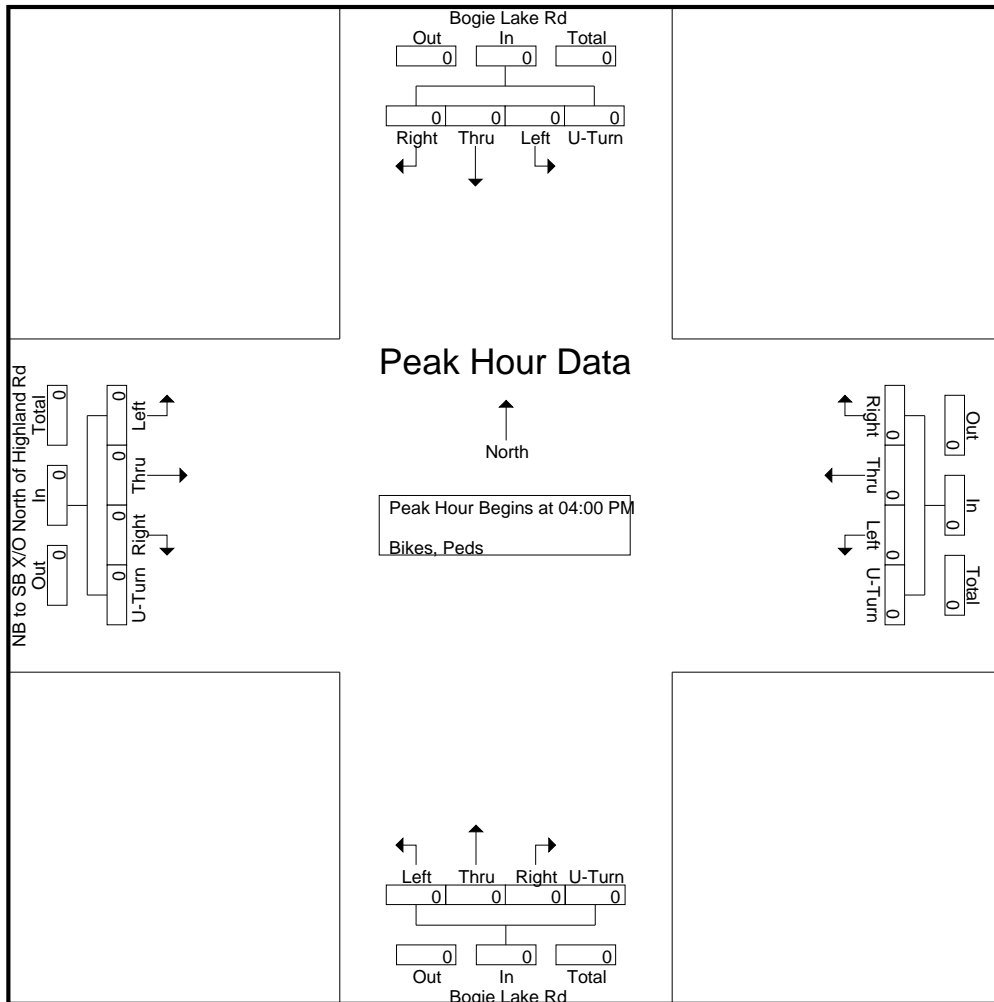


Groups Printed- Bikes, Peds

Start Time	NB to SB X/O North of Highland Rd Eastbound					Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					



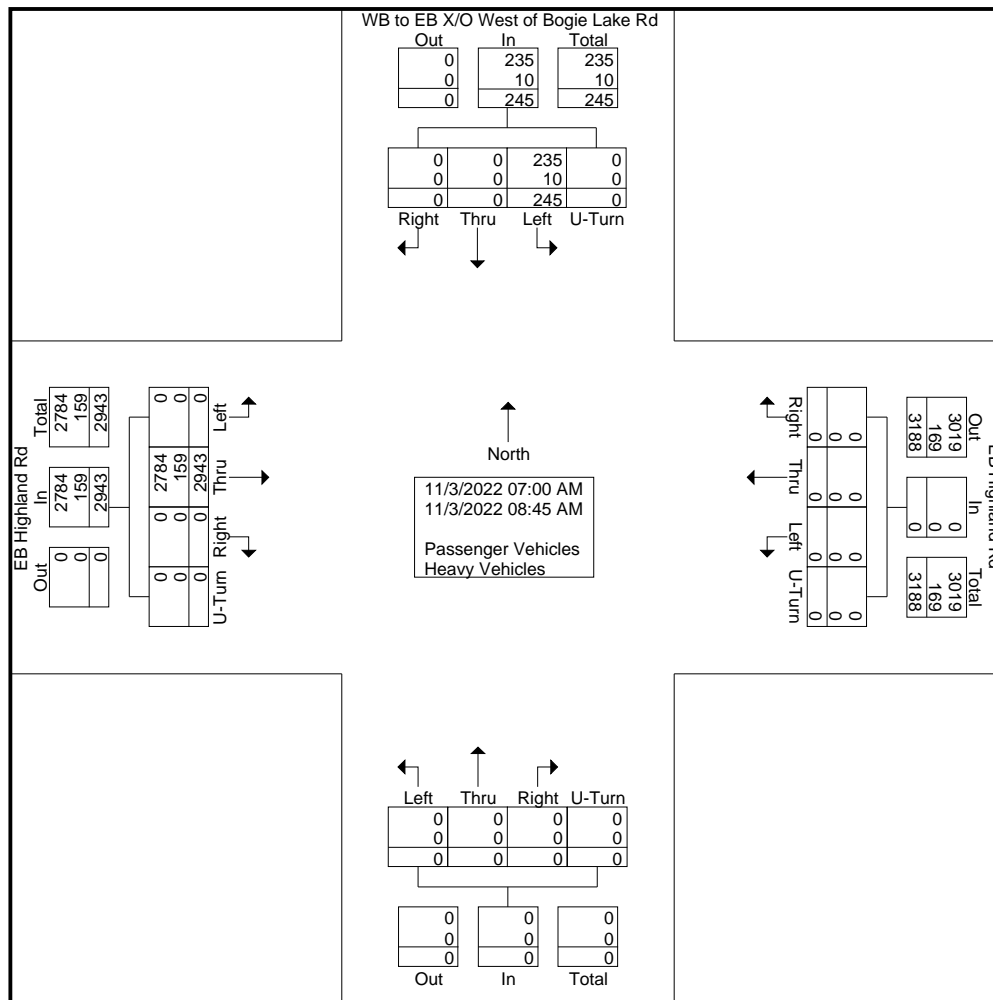
Start Time	NB to SB X/O North of Highland Rd Eastbound					Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total	
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total		
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 04:00 PM																						
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000





Groups Printed- Passenger Vehicles - Heavy Vehicles

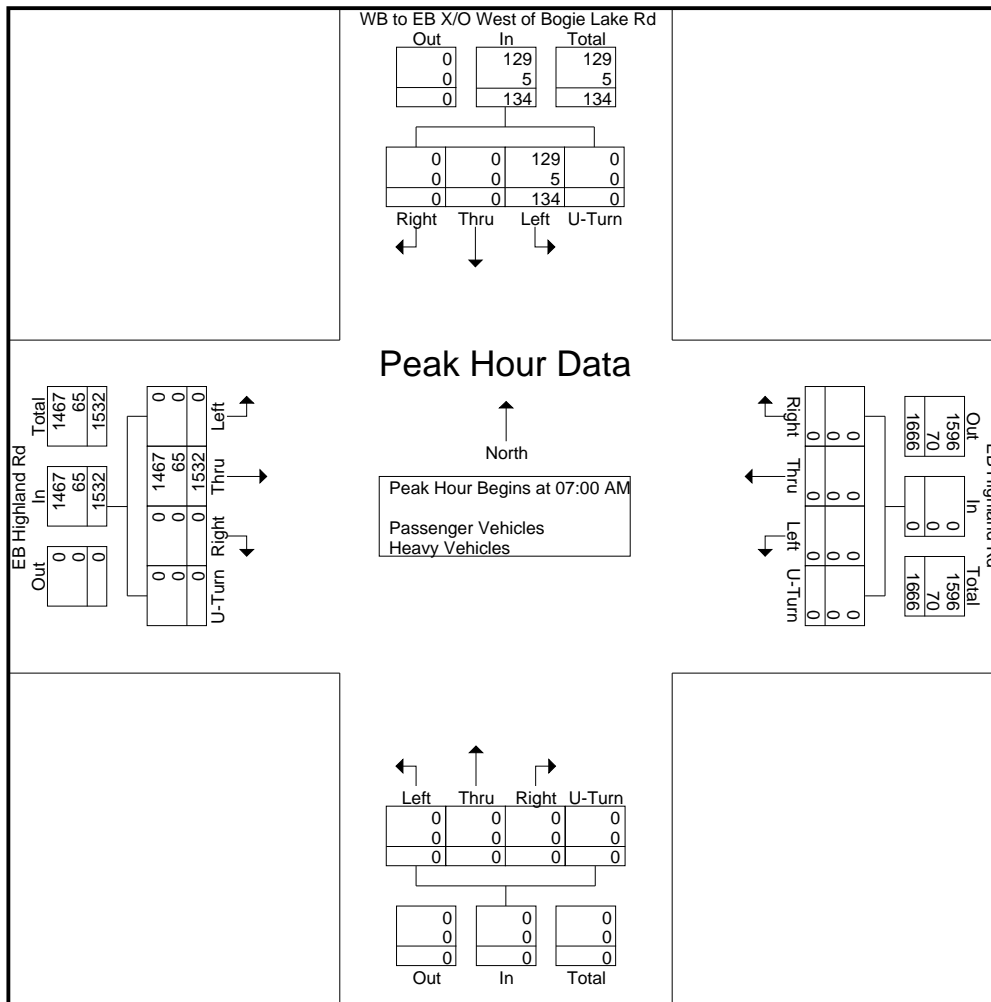
Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Northbound					WB to EB X/O West of Bogie Lake Rd Southbound					Int. Total	
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total		
07:00 AM	0	423	0	0	423	0	0	0	0	0	0	0	0	0	0	55	0	0	0	0	55	478
07:15 AM	0	369	0	0	369	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	25	394
07:30 AM	0	393	0	0	393	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	20	413
07:45 AM	0	347	0	0	347	0	0	0	0	0	0	0	0	0	0	34	0	0	0	0	34	381
Total	0	1532	0	0	1532	0	0	0	0	0	0	0	0	0	0	134	0	0	0	0	134	1666
08:00 AM	0	356	0	0	356	0	0	0	0	0	0	0	0	0	0	41	0	0	0	0	41	397
08:15 AM	0	361	0	0	361	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	28	389
08:30 AM	0	343	0	0	343	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	11	354
08:45 AM	0	351	0	0	351	0	0	0	0	0	0	0	0	0	0	31	0	0	0	0	31	382
Total	0	1411	0	0	1411	0	0	0	0	0	0	0	0	0	0	111	0	0	0	0	111	1522
Grand Total	0	2943	0	0	2943	0	0	0	0	0	0	0	0	0	0	245	0	0	0	0	245	3188
Apprch %	0	100	0	0		0	0	0	0		0	0	0	0		100	0	0	0			
Total %	0	92.3	0	0	92.3	0	0	0	0	0	0	0	0	0	0	7.7	0	0	0	0	7.7	
Passenger Vehicles	0	2784	0	0	2784	0	0	0	0	0	0	0	0	0	0	235	0	0	0	0	235	3019
% Passenger Vehicles	0	94.6	0	0	94.6	0	0	0	0	0	0	0	0	0	0	95.9	0	0	0	0	95.9	94.7
Heavy Vehicles	0	159	0	0	159	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	10	169
% Heavy Vehicles	0	5.4	0	0	5.4	0	0	0	0	0	0	0	0	0	0	4.1	0	0	0	0	4.1	5.3





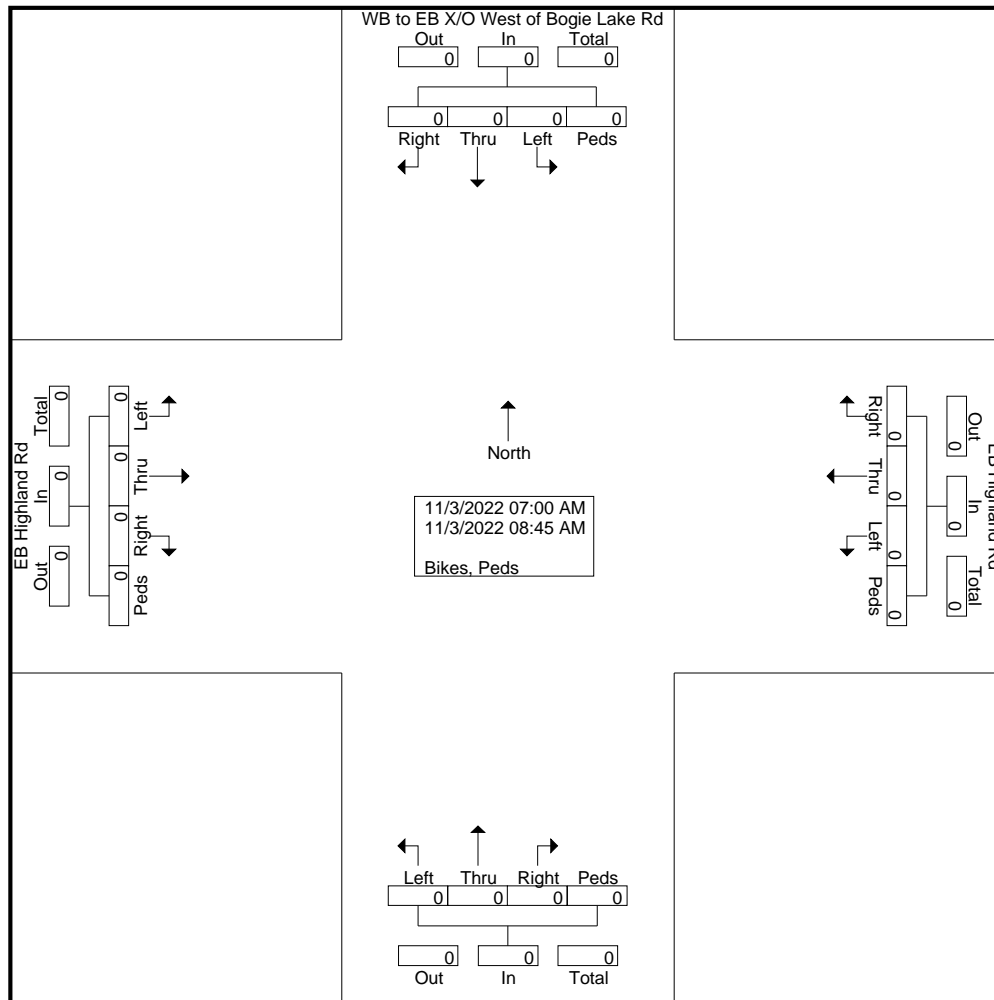


Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Northbound					WB to EB X/O West of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	423	0	0	423	0	0	0	0	0	0	0	0	0	0	55	0	0	0	55	478
07:15 AM	0	369	0	0	369	0	0	0	0	0	0	0	0	0	0	25	0	0	0	25	394
07:30 AM	0	393	0	0	393	0	0	0	0	0	0	0	0	0	0	20	0	0	0	20	413
07:45 AM	0	347	0	0	347	0	0	0	0	0	0	0	0	0	0	34	0	0	0	34	381
Total Volume	0	1532	0	0	1532	0	0	0	0	0	0	0	0	0	0	134	0	0	0	134	1666
% App. Total	0	100	0	0		0	0	0	0	0	0	0	0	0	0	100	0	0	0		
PHF	.000	.905	.000	.000	.905	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.609	.000	.000	.000	.609	.871
Passenger Vehicles	0	1467	0	0	1467	0	0	0	0	0	0	0	0	0	0	129	0	0	0	129	1596
% Passenger Vehicles	0	95.8	0	0	95.8	0	0	0	0	0	0	0	0	0	0	96.3	0	0	0	96.3	95.8
Heavy Vehicles	0	65	0	0	65	0	0	0	0	0	0	0	0	0	0	5	0	0	0	5	70
% Heavy Vehicles	0	4.2	0	0	4.2	0	0	0	0	0	0	0	0	0	0	3.7	0	0	0	3.7	4.2

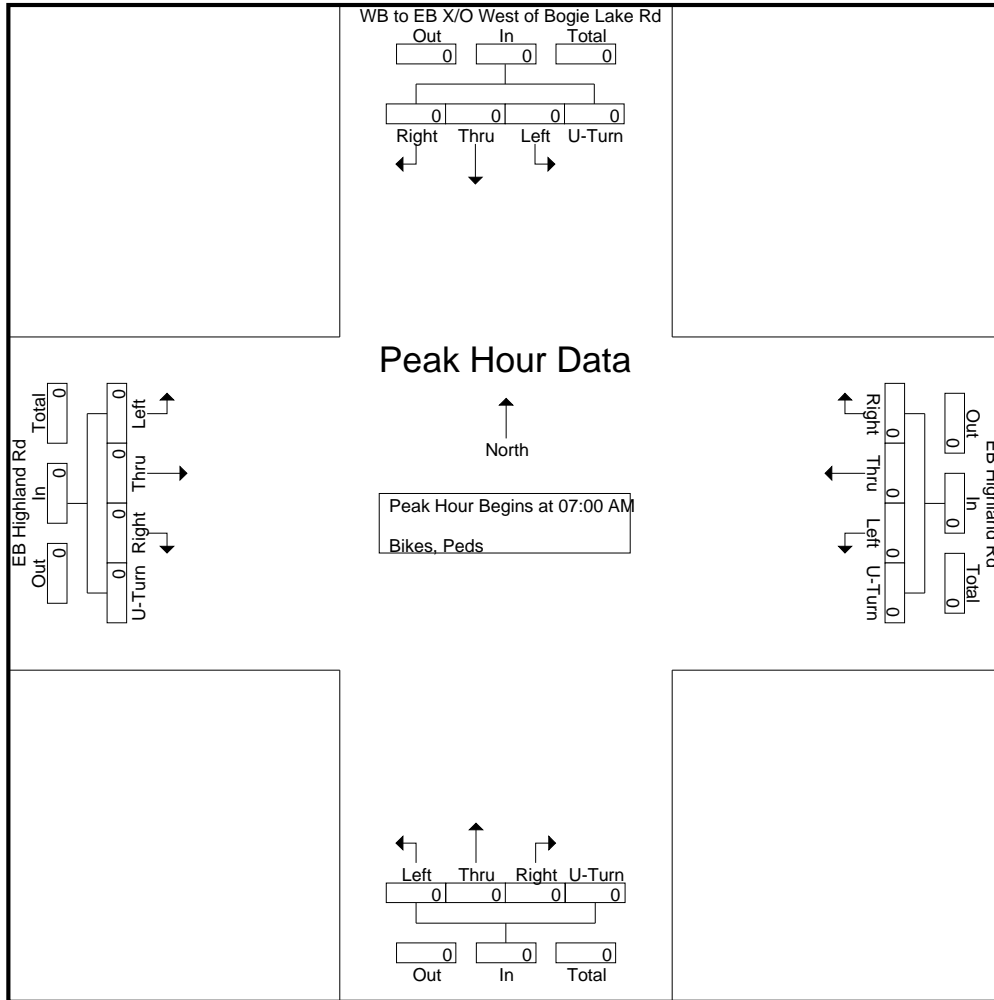


Groups Printed- Bikes, Peds

Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Northbound					WB to EB X/O West of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					

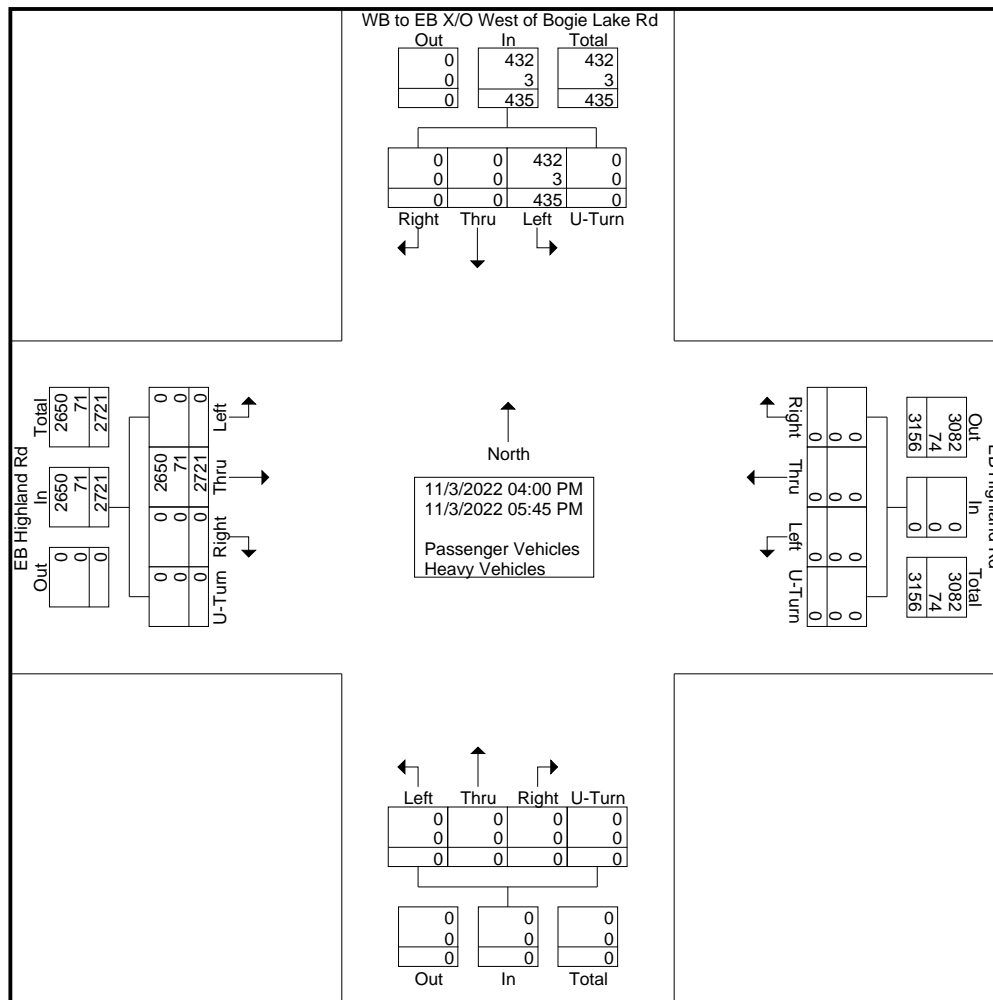


	EB Highland Rd Eastbound					EB Highland Rd Westbound					Northbound					WB to EB X/O West of Bogie Lake Rd Southbound						
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 07:00 AM																						
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

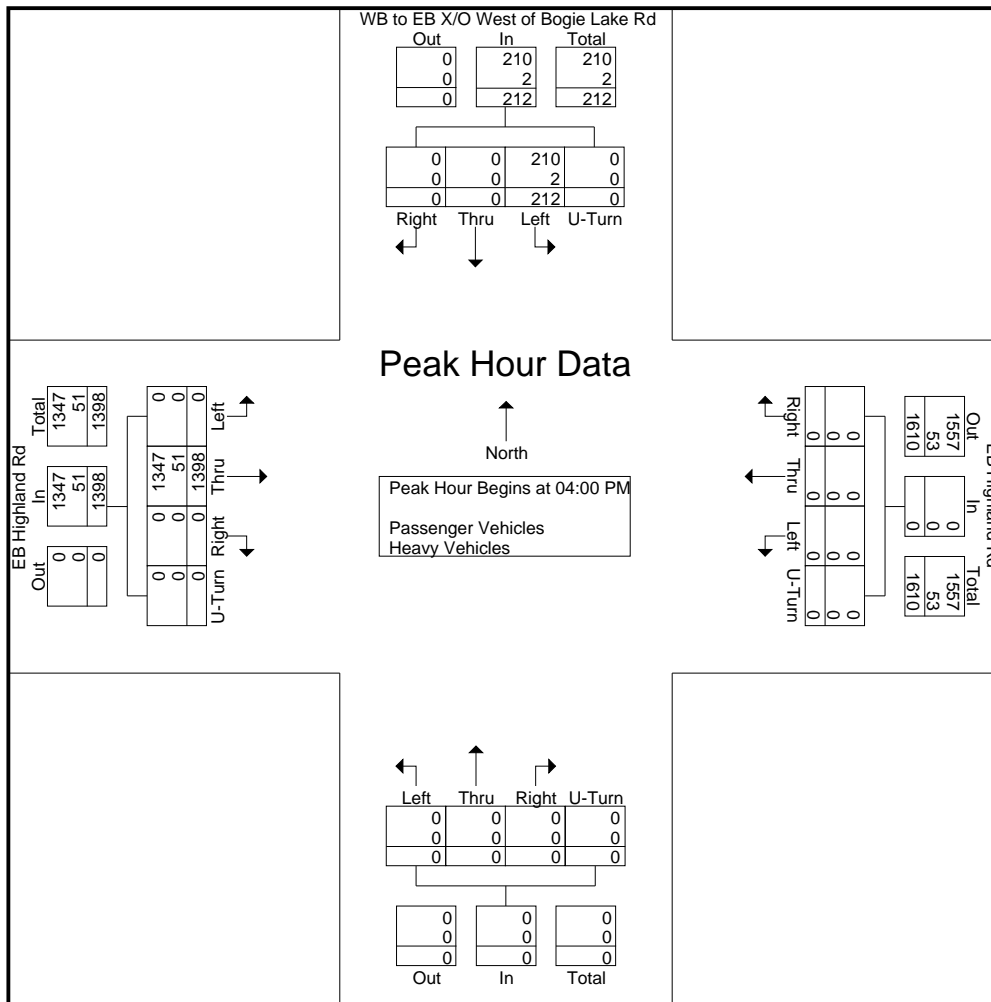


Groups Printed- Passenger Vehicles - Heavy Vehicles

Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Northbound					WB to EB X/O West of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
04:00 PM	0	352	0	0	352	0	0	0	0	0	0	0	0	0	0	52	0	0	0	52	404
04:15 PM	0	338	0	0	338	0	0	0	0	0	0	0	0	0	0	60	0	0	0	60	398
04:30 PM	0	373	0	0	373	0	0	0	0	0	0	0	0	0	0	43	0	0	0	43	416
04:45 PM	0	335	0	0	335	0	0	0	0	0	0	0	0	0	0	57	0	0	0	57	392
<b>Total</b>	<b>0</b>	<b>1398</b>	<b>0</b>	<b>0</b>	<b>1398</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>212</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>212</b>	<b>1610</b>
05:00 PM	0	309	0	0	309	0	0	0	0	0	0	0	0	0	0	64	0	0	0	64	373
05:15 PM	0	355	0	0	355	0	0	0	0	0	0	0	0	0	0	61	0	0	0	61	416
05:30 PM	0	334	0	0	334	0	0	0	0	0	0	0	0	0	0	60	0	0	0	60	394
05:45 PM	0	325	0	0	325	0	0	0	0	0	0	0	0	0	0	38	0	0	0	38	363
<b>Total</b>	<b>0</b>	<b>1323</b>	<b>0</b>	<b>0</b>	<b>1323</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>223</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>223</b>	<b>1546</b>
<b>Grand Total</b>	<b>0</b>	<b>2721</b>	<b>0</b>	<b>0</b>	<b>2721</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>435</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>435</b>	<b>3156</b>
<b>Apprch %</b>	<b>0</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>100</b>	
<b>Total %</b>	<b>0</b>	<b>86.2</b>	<b>0</b>	<b>0</b>	<b>86.2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>13.8</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>13.8</b>	
Passenger Vehicles	0	2650	0	0	2650	0	0	0	0	0	0	0	0	0	0	432	0	0	0	432	3082
% Passenger Vehicles	0	97.4	0	0	97.4	0	0	0	0	0	0	0	0	0	0	99.3	0	0	0	99.3	97.7
Heavy Vehicles	0	71	0	0	71	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	74
% Heavy Vehicles	0	2.6	0	0	2.6	0	0	0	0	0	0	0	0	0	0	0.7	0	0	0	0.7	2.3

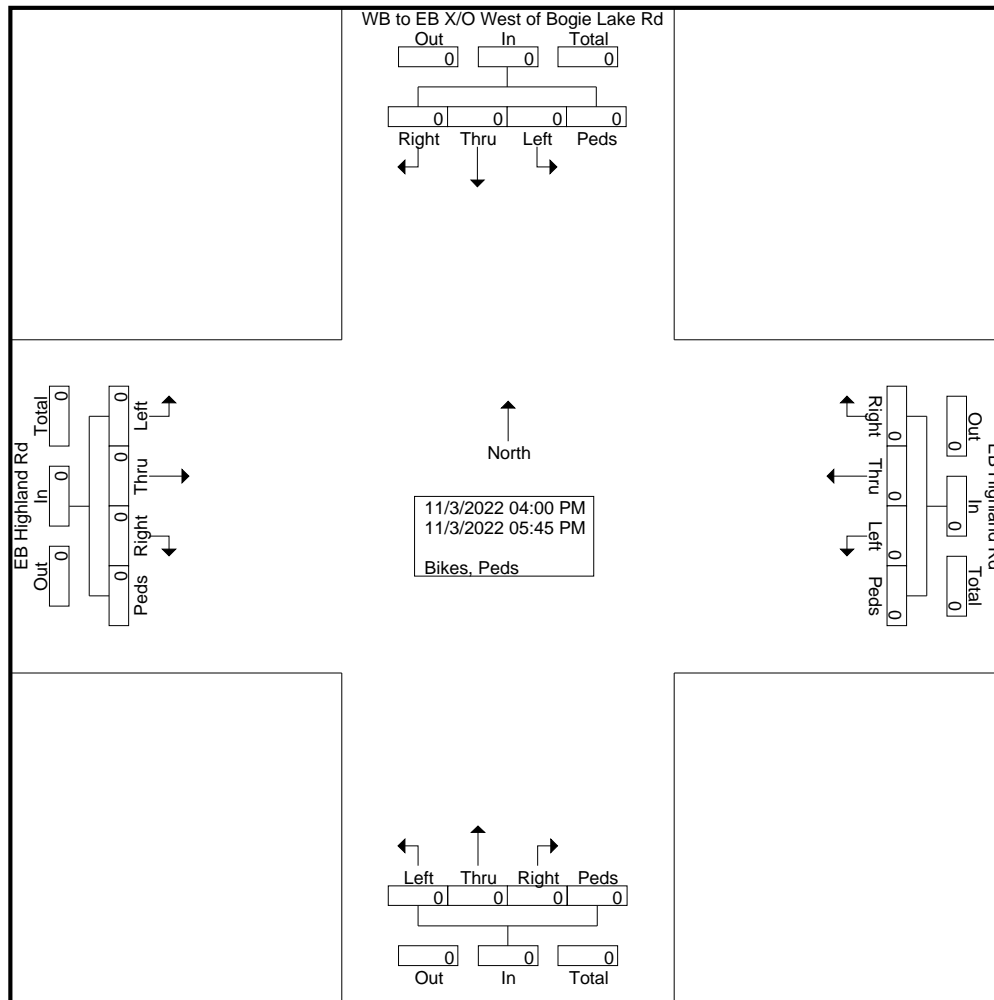


Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Northbound					WB to EB X/O West of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	352	0	0	352	0	0	0	0	0	0	0	0	0	0	52	0	0	0	52	404
04:15 PM	0	338	0	0	338	0	0	0	0	0	0	0	0	0	0	60	0	0	0	60	398
04:30 PM	0	<b>373</b>	0	0	<b>373</b>	0	0	0	0	0	0	0	0	0	0	43	0	0	0	43	<b>416</b>
04:45 PM	0	335	0	0	335	0	0	0	0	0	0	0	0	0	0	57	0	0	0	57	392
Total Volume	0	1398	0	0	1398	0	0	0	0	0	0	0	0	0	0	212	0	0	0	212	1610
% App. Total	0	100	0	0		0	0	0	0	0	0	0	0	0	0	100	0	0	0		
PHF	.000	.937	.000	.000	.937	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.883	.000	.000	.000	.883	.968
Passenger Vehicles	0	1347	0	0	1347	0	0	0	0	0	0	0	0	0	0	210	0	0	0	210	1557
% Passenger Vehicles	0	96.4	0	0	96.4	0	0	0	0	0	0	0	0	0	0	99.1	0	0	0	99.1	96.7
Heavy Vehicles	0	51	0	0	51	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	53
% Heavy Vehicles	0	3.6	0	0	3.6	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0	0.9	3.3



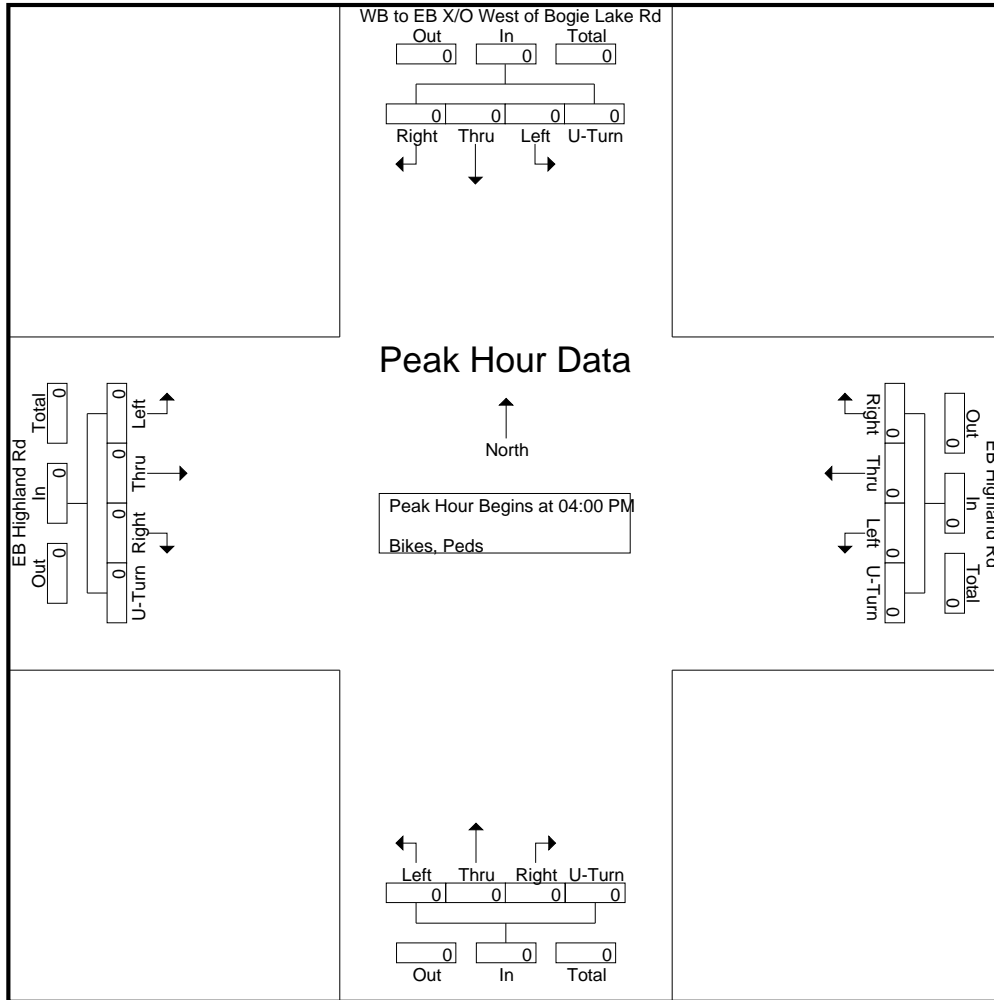
Groups Printed- Bikes, Peds

Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Northbound					WB to EB X/O West of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					





	EB Highland Rd Eastbound					EB Highland Rd Westbound					Northbound					WB to EB X/O West of Bogie Lake Rd Southbound						
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 04:00 PM																						
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000



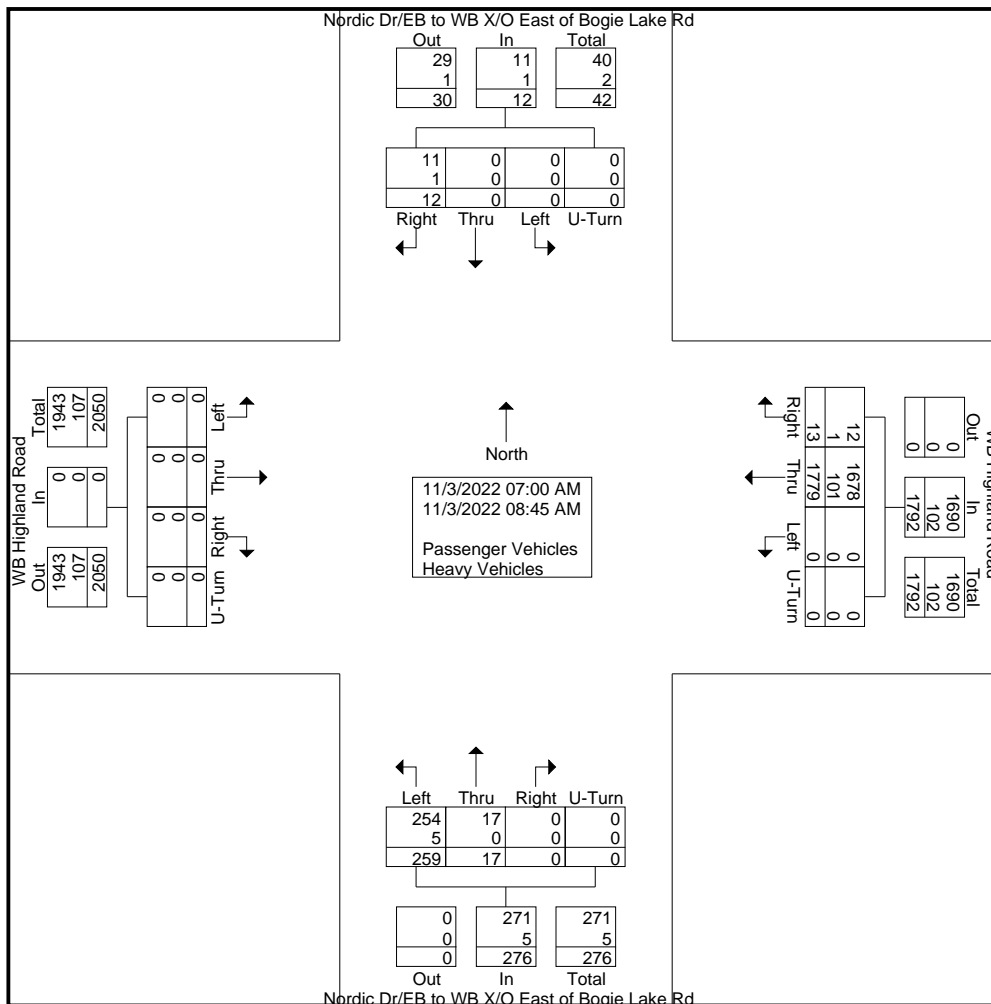


File Name : 15997005 - Nordic Dr\_EB to WB X\_O East of Bogie Lake Rd -- WB Highland  
 Site Code : 15997005  
 Start Date : 11/3/2022  
 Page No : 1

Item A.

Groups Printed- Passenger Vehicles - Heavy Vehicles

Start Time	WB Highland Road Eastbound					WB Highland Road Westbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Northbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
07:00 AM	0	0	0	0	0	0	189	1	0	190	28	0	0	0	28	0	0	1	0	1	219
07:15 AM	0	0	0	0	0	0	220	1	0	221	37	4	0	0	41	0	0	2	0	2	264
07:30 AM	0	0	0	0	0	0	231	2	0	233	27	1	0	0	28	0	0	1	0	1	262
07:45 AM	0	0	0	0	0	0	243	3	0	246	30	3	0	0	33	0	0	2	0	2	281
Total	0	0	0	0	0	0	883	7	0	890	122	8	0	0	130	0	0	6	0	6	1026
08:00 AM	0	0	0	0	0	0	231	1	0	232	25	1	0	0	26	0	0	1	0	1	259
08:15 AM	0	0	0	0	0	0	208	0	0	208	46	2	0	0	48	0	0	1	0	1	257
08:30 AM	0	0	0	0	0	0	226	2	0	228	29	1	0	0	30	0	0	0	0	0	258
08:45 AM	0	0	0	0	0	0	231	3	0	234	37	5	0	0	42	0	0	4	0	4	280
Total	0	0	0	0	0	0	896	6	0	902	137	9	0	0	146	0	0	6	0	6	1054
Grand Total	0	0	0	0	0	0	1779	13	0	1792	259	17	0	0	276	0	0	12	0	12	2080
Apprch %	0	0	0	0	0	0	99.3	0.7	0	99.3	93.8	6.2	0	0	93.8	0	0	100	0	100	
Total %	0	0	0	0	0	0	85.5	0.6	0	86.2	12.5	0.8	0	0	13.3	0	0	0.6	0	0.6	
Passenger Vehicles	0	0	0	0	0	0	1678	12	0	1690	254	17	0	0	271	0	0	11	0	11	1972
% Passenger Vehicles	0	0	0	0	0	0	94.3	92.3	0	94.3	98.1	100	0	0	98.2	0	0	91.7	0	91.7	94.8
Heavy Vehicles	0	0	0	0	0	0	101	1	0	102	5	0	0	0	5	0	0	1	0	1	108
% Heavy Vehicles	0	0	0	0	0	0	5.7	7.7	0	5.7	1.9	0	0	0	1.8	0	0	8.3	0	8.3	5.2

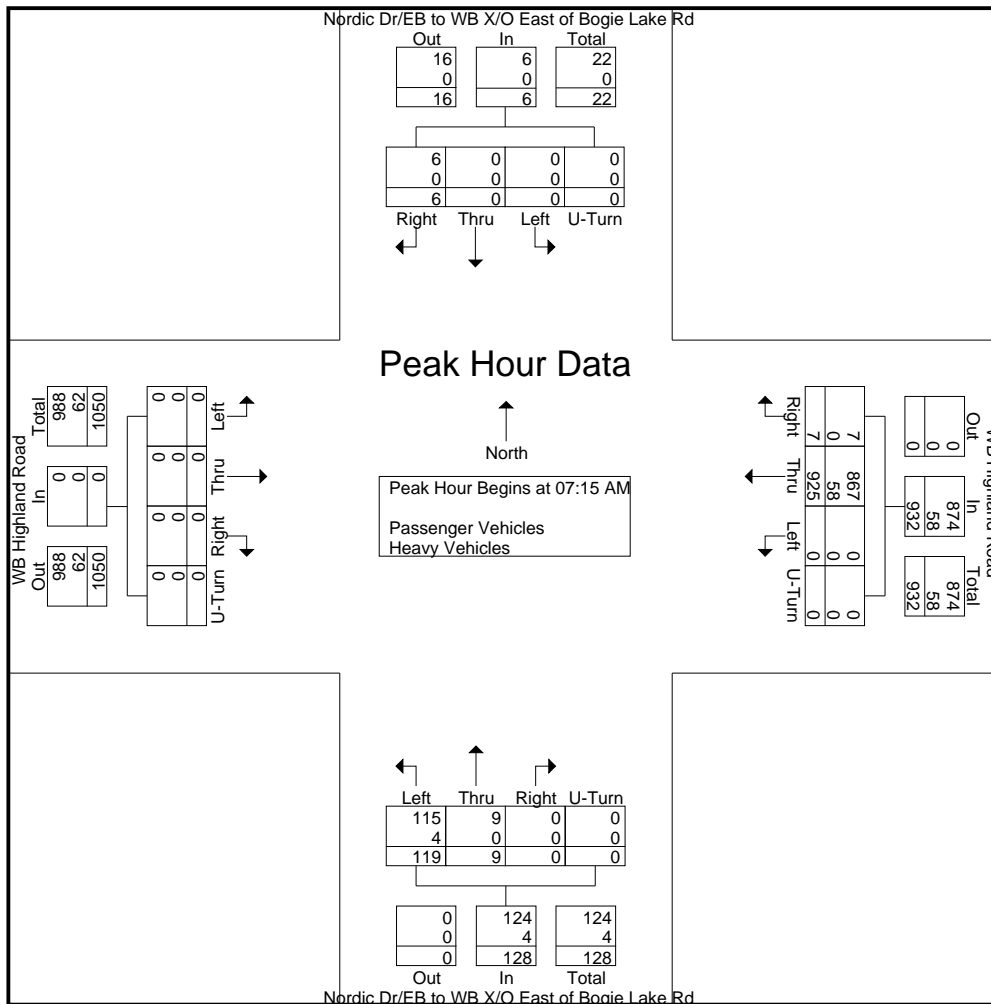




File Name : 15997005 - Nordic Dr\_EB to WB X\_O East of Bogie Lake Rd -- WB Highland  
 Site Code : 15997005  
 Start Date : 11/3/2022  
 Page No : 2

Item A.

Start Time	WB Highland Road Eastbound					WB Highland Road Westbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Northbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	0	0	0	0	0	0	220	1	0	221	37	4	0	0	41	0	0	2	0	2	264
07:30 AM	0	0	0	0	0	0	231	2	0	233	27	1	0	0	28	0	0	1	0	1	262
07:45 AM	0	0	0	0	0	0	243	3	0	246	30	3	0	0	33	0	0	2	0	2	281
08:00 AM	0	0	0	0	0	0	231	1	0	232	25	1	0	0	26	0	0	1	0	1	259
Total Volume	0	0	0	0	0	0	925	7	0	932	119	9	0	0	128	0	0	6	0	6	1066
% App. Total	0	0	0	0	0	0	99.2	0.8	0	0	93	7	0	0	0	0	0	100	0	0	
PHF	.000	.000	.000	.000	.000	.000	.952	.583	.000	.947	.804	.563	.000	.000	.780	.000	.000	.750	.000	.750	.948
Passenger Vehicles	0	0	0	0	0	0	867	7	0	874	115	9	0	0	124	0	0	6	0	6	1004
% Passenger Vehicles	0	0	0	0	0	0	93.7	100	0	93.8	96.6	100	0	0	96.9	0	0	100	0	100	94.2
Heavy Vehicles	0	0	0	0	0	0	58	0	0	58	4	0	0	0	4	0	0	0	0	0	62
% Heavy Vehicles	0	0	0	0	0	0	6.3	0	0	6.2	3.4	0	0	0	3.1	0	0	0	0	0	5.8



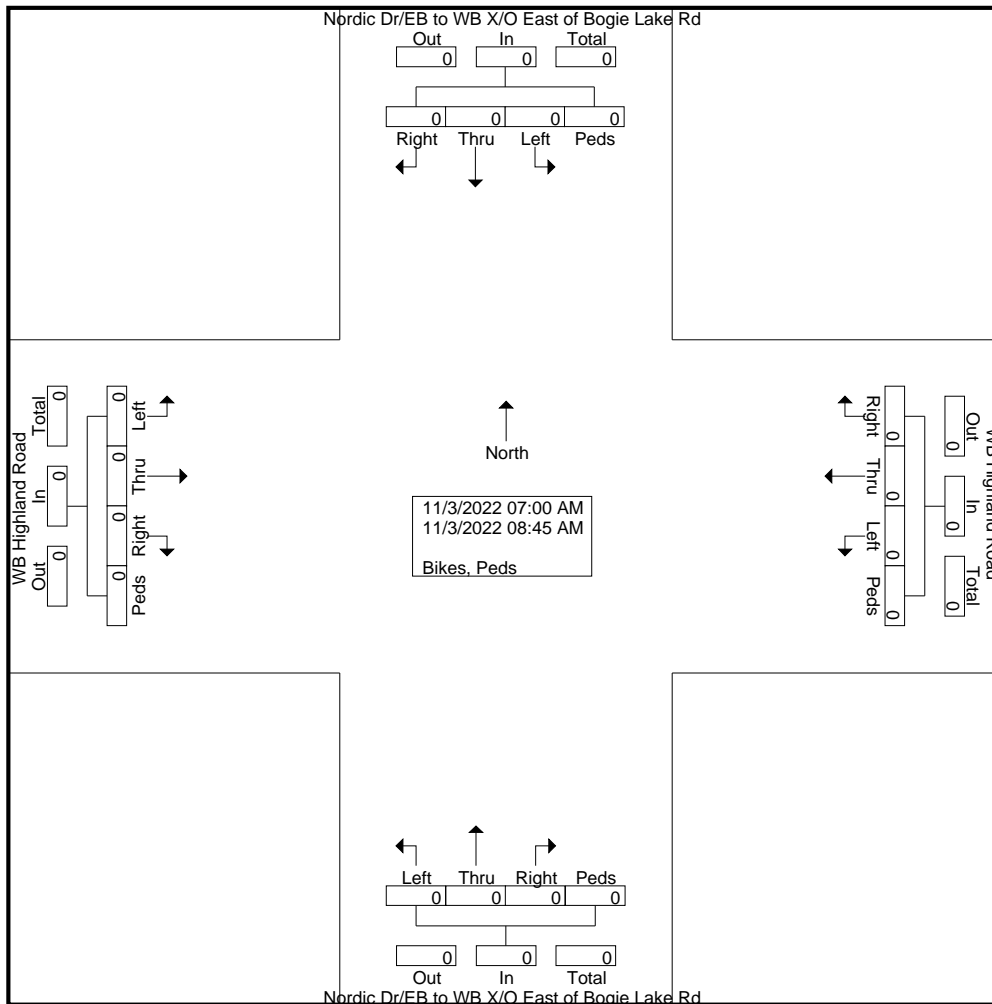


File Name : 15997005 - Nordic Dr\_EB to WB X\_O East of Bogie Lake Rd -- WB Highlan  
 Site Code : 15997005  
 Start Date : 11/3/2022  
 Page No : 1

Item A.

Groups Printed- Bikes, Peds

Start Time	WB Highland Road Eastbound					WB Highland Road Westbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Northbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					

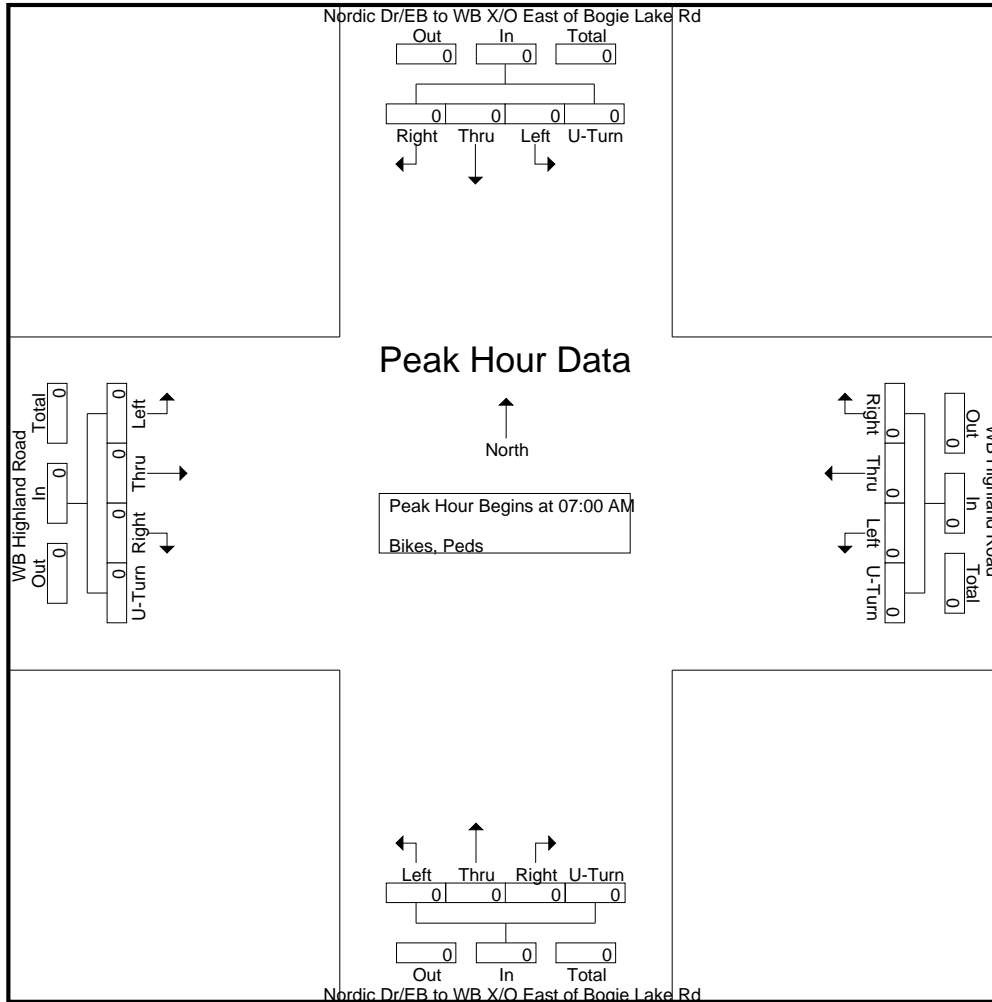




File Name : 15997005 - Nordic Dr\_EB to WB X\_O East of Bogie Lake Rd -- WB Highlan  
 Site Code : 15997005  
 Start Date : 11/3/2022  
 Page No : 2

Item A.

Start Time	WB Highland Road Eastbound					WB Highland Road Westbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Northbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000





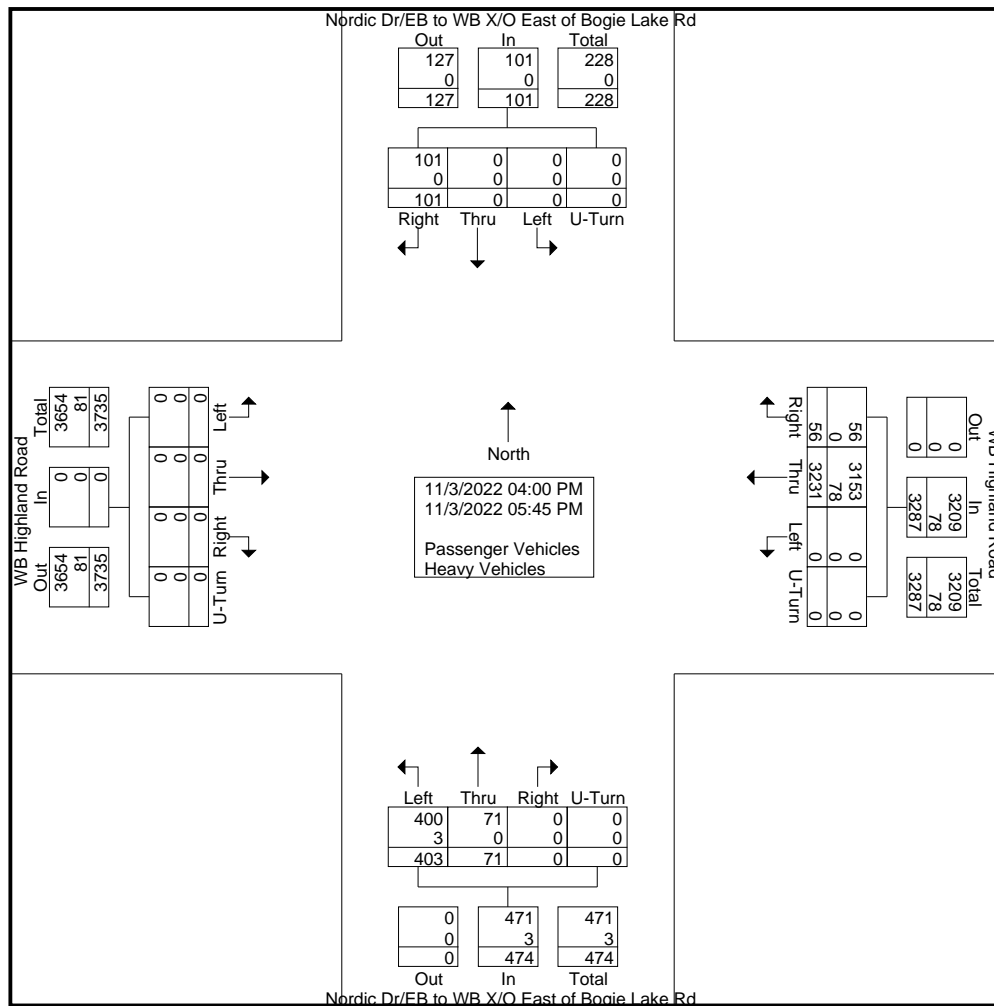


File Name : 15997006 - Nordic Dr\_EB to WB X\_O East of Bogie Lake Rd -- WB Highland  
 Site Code : 15997006  
 Start Date : 11/3/2022  
 Page No : 1

Item A.

Groups Printed- Passenger Vehicles - Heavy Vehicles

Start Time	WB Highland Road Eastbound					WB Highland Road Westbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Northbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
04:00 PM	0	0	0	0	0	0	426	4	0	430	50	7	0	0	57	0	0	6	0	6	493
04:15 PM	0	0	0	0	0	0	438	3	0	441	58	7	0	0	65	0	0	14	0	14	520
04:30 PM	0	0	0	0	0	0	381	5	0	386	45	11	0	0	56	0	0	10	0	10	452
04:45 PM	0	0	0	0	0	0	438	7	0	445	45	12	0	0	57	0	0	19	0	19	521
Total	0	0	0	0	0	0	1683	19	0	1702	198	37	0	0	235	0	0	49	0	49	1986
05:00 PM	0	0	0	0	0	0	416	7	0	423	46	8	0	0	54	0	0	8	0	8	485
05:15 PM	0	0	0	0	0	0	411	13	0	424	67	8	0	0	75	0	0	12	0	12	511
05:30 PM	0	0	0	0	0	0	390	11	0	401	45	6	0	0	51	0	0	20	0	20	472
05:45 PM	0	0	0	0	0	0	331	6	0	337	47	12	0	0	59	0	0	12	0	12	408
Total	0	0	0	0	0	0	1548	37	0	1585	205	34	0	0	239	0	0	52	0	52	1876
Grand Total	0	0	0	0	0	0	3231	56	0	3287	403	71	0	0	474	0	0	101	0	101	3862
Apprch %	0	0	0	0	0	0	98.3	1.7	0	0	85	15	0	0	0	0	0	100	0	0	
Total %	0	0	0	0	0	0	83.7	1.5	0	85.1	10.4	1.8	0	0	12.3	0	0	2.6	0	2.6	
Passenger Vehicles	0	0	0	0	0	0	3153	56	0	3209	400	71	0	0	471	0	0	101	0	101	3781
% Passenger Vehicles	0	0	0	0	0	0	97.6	100	0	97.6	99.3	100	0	0	99.4	0	0	100	0	100	97.9
Heavy Vehicles	0	0	0	0	0	0	78	0	0	78	3	0	0	0	3	0	0	0	0	0	81
% Heavy Vehicles	0	0	0	0	0	0	2.4	0	0	2.4	0.7	0	0	0	0.6	0	0	0	0	0	2.1

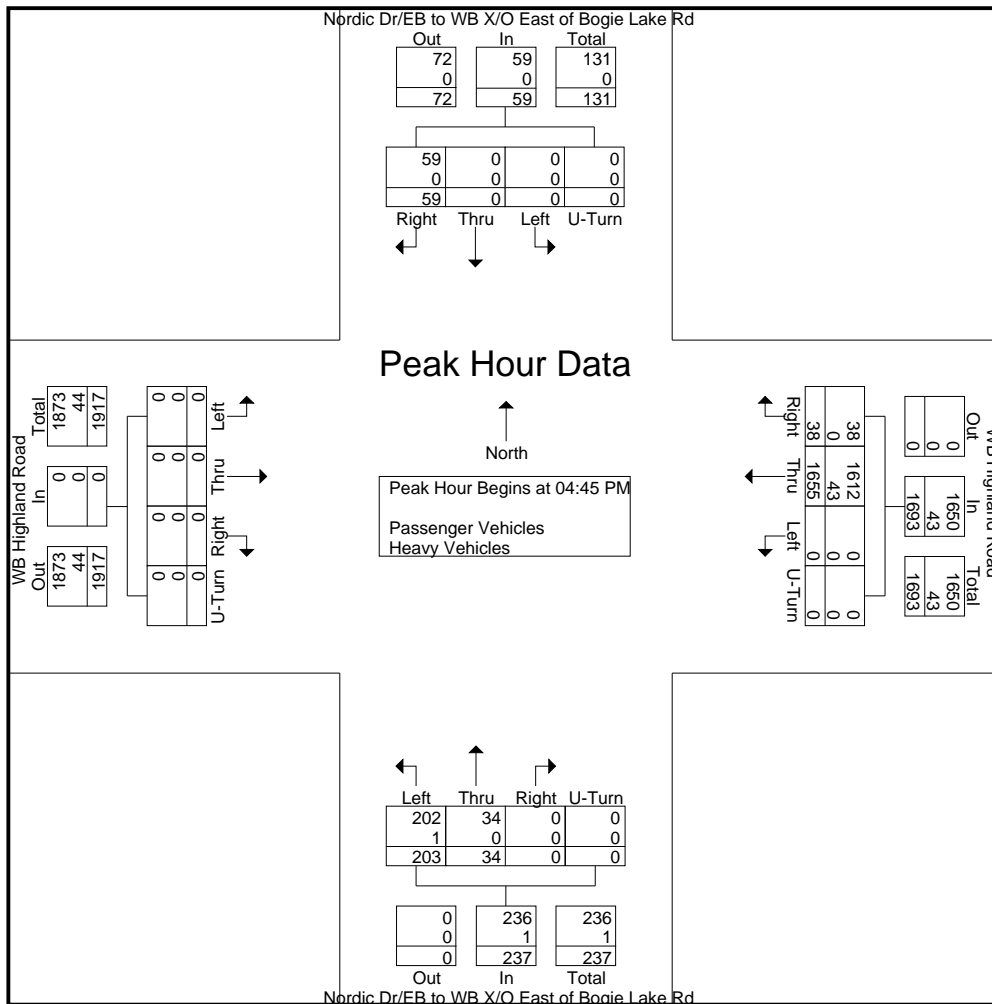




File Name : 15997006 - Nordic Dr\_EB to WB X\_O East of Bogie Lake Rd -- WB Highland  
 Site Code : 15997006  
 Start Date : 11/3/2022  
 Page No : 2

Item A.

Start Time	WB Highland Road Eastbound					WB Highland Road Westbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Northbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	0	0	0	0	0	<b>438</b>	7	0	<b>445</b>	45	<b>12</b>	0	0	57	0	0	19	0	19	<b>521</b>
05:00 PM	0	0	0	0	0	0	416	7	0	423	46	8	0	0	54	0	0	8	0	8	485
05:15 PM	0	0	0	0	0	0	411	<b>13</b>	0	424	<b>67</b>	8	0	0	<b>75</b>	0	0	12	0	12	511
05:30 PM	0	0	0	0	0	0	390	11	0	401	45	6	0	0	51	0	0	<b>20</b>	0	<b>20</b>	472
Total Volume	0	0	0	0	0	0	1655	38	0	1693	203	34	0	0	237	0	0	59	0	59	1989
% App. Total	0	0	0	0	0	0	97.8	2.2	0		85.7	14.3	0	0		0	0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.945	.731	.000	.951	.757	.708	.000	.000	.790	.000	.000	.738	.000	.738	.954
Passenger Vehicles	0	0	0	0	0	0	1612	38	0	1650	202	34	0	0	236	0	0	59	0	59	1945
% Passenger Vehicles	0	0	0	0	0	0	97.4	100	0	97.5	99.5	100	0	0	99.6	0	0	100	0	100	97.8
Heavy Vehicles	0	0	0	0	0	0	43	0	0	43	1	0	0	0	1	0	0	0	0	0	44
% Heavy Vehicles	0	0	0	0	0	0	2.6	0	0	2.5	0.5	0	0	0	0.4	0	0	0	0	0	2.2



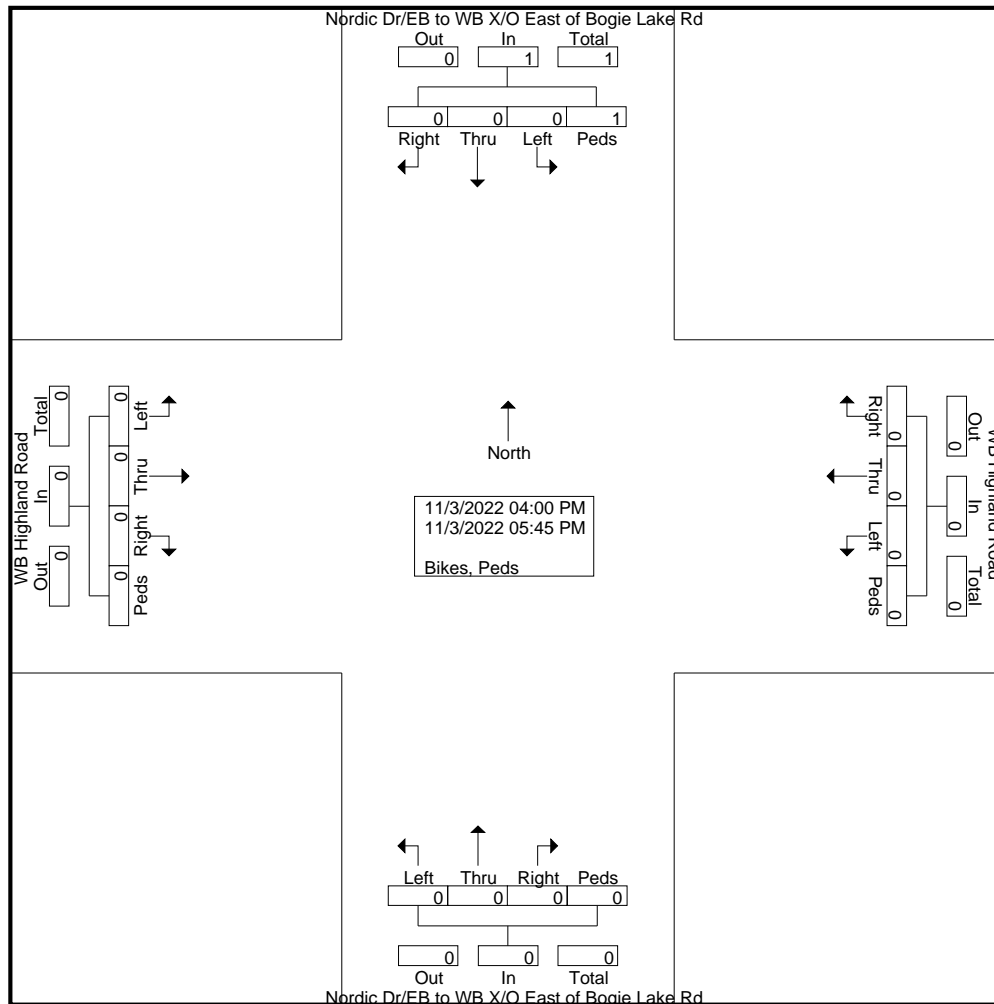


File Name : 15997006 - Nordic Dr\_EB to WB X\_O East of Bogie Lake Rd -- WB Highlan  
 Site Code : 15997006  
 Start Date : 11/3/2022  
 Page No : 1

Item A.

Groups Printed- Bikes, Peds

Start Time	WB Highland Road Eastbound					WB Highland Road Westbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Northbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Southbound					Int. Total	
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total		
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	
Apprch %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100			
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100		

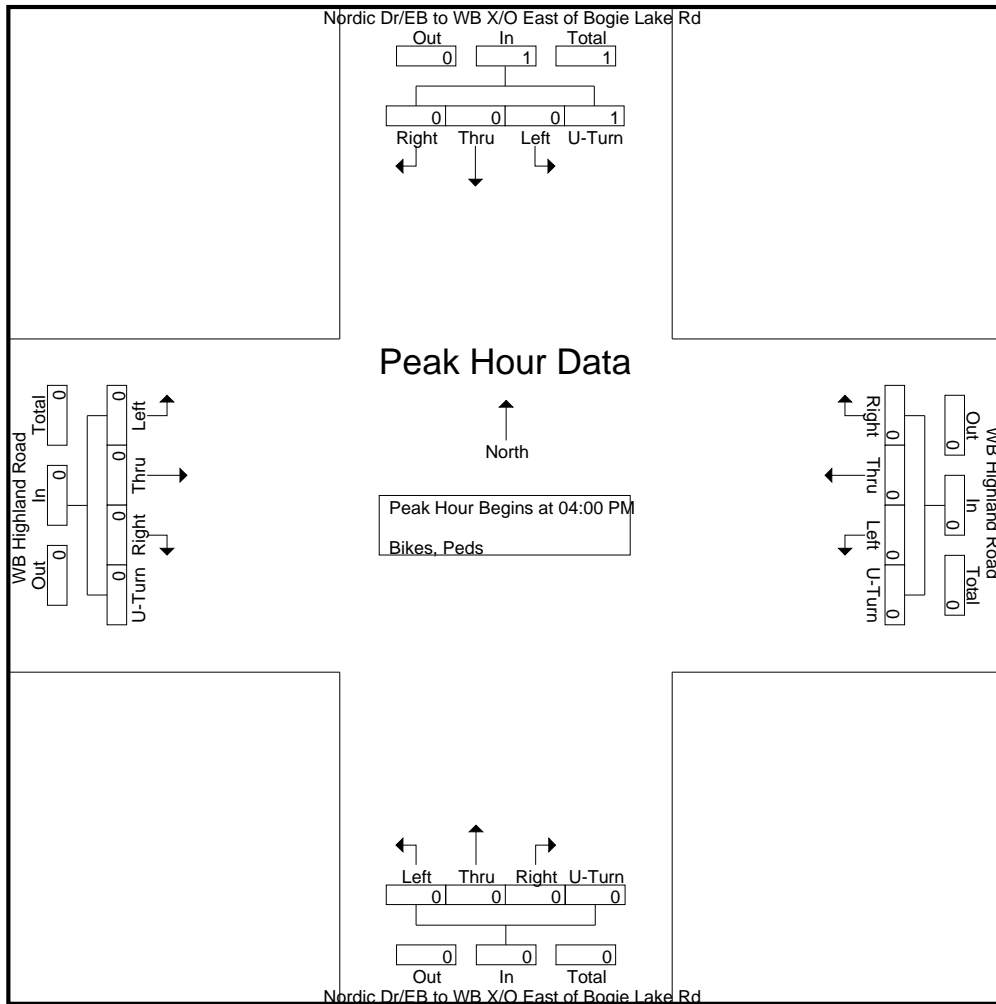




File Name : 15997006 - Nordic Dr\_EB to WB X\_O East of Bogie Lake Rd -- WB Highlan  
 Site Code : 15997006  
 Start Date : 11/3/2022  
 Page No : 2

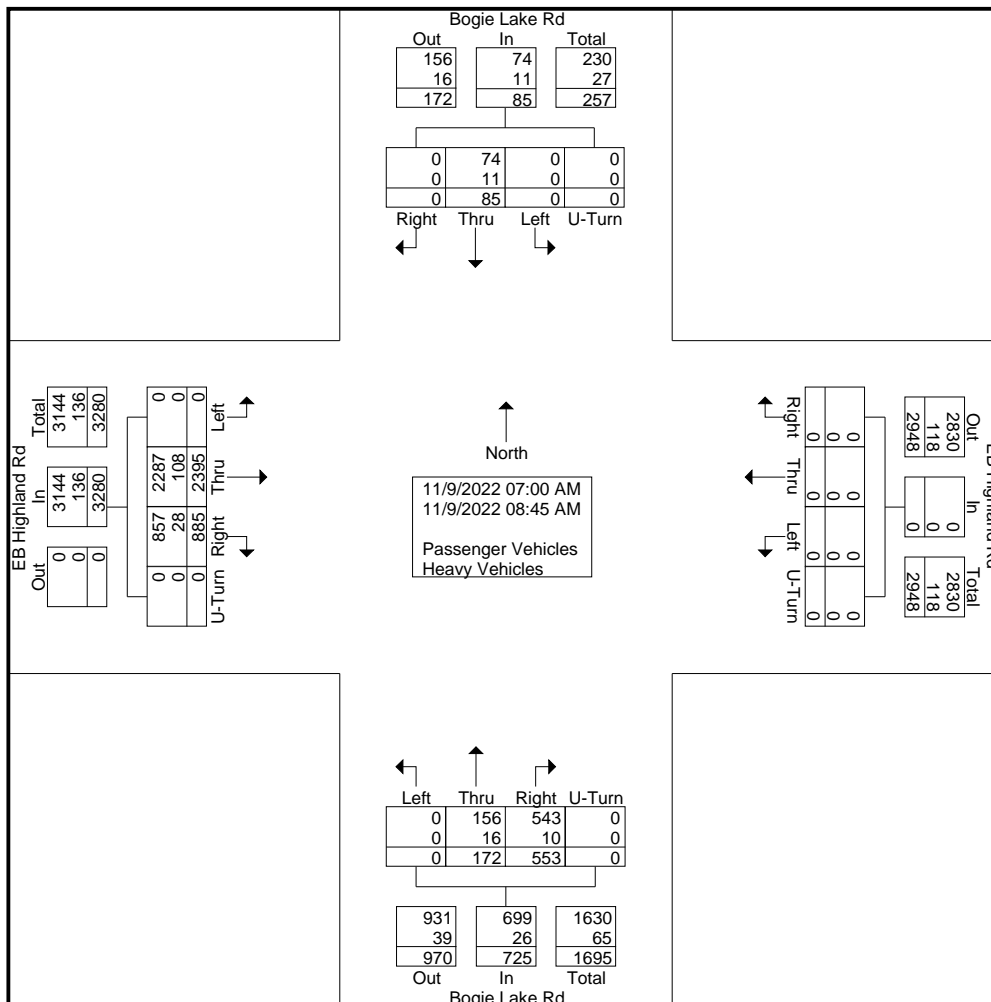
Item A.

Start Time	WB Highland Road Eastbound					WB Highland Road Westbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Northbound					Nordic Dr/EB to WB X/O East of Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100	100
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.250	.250



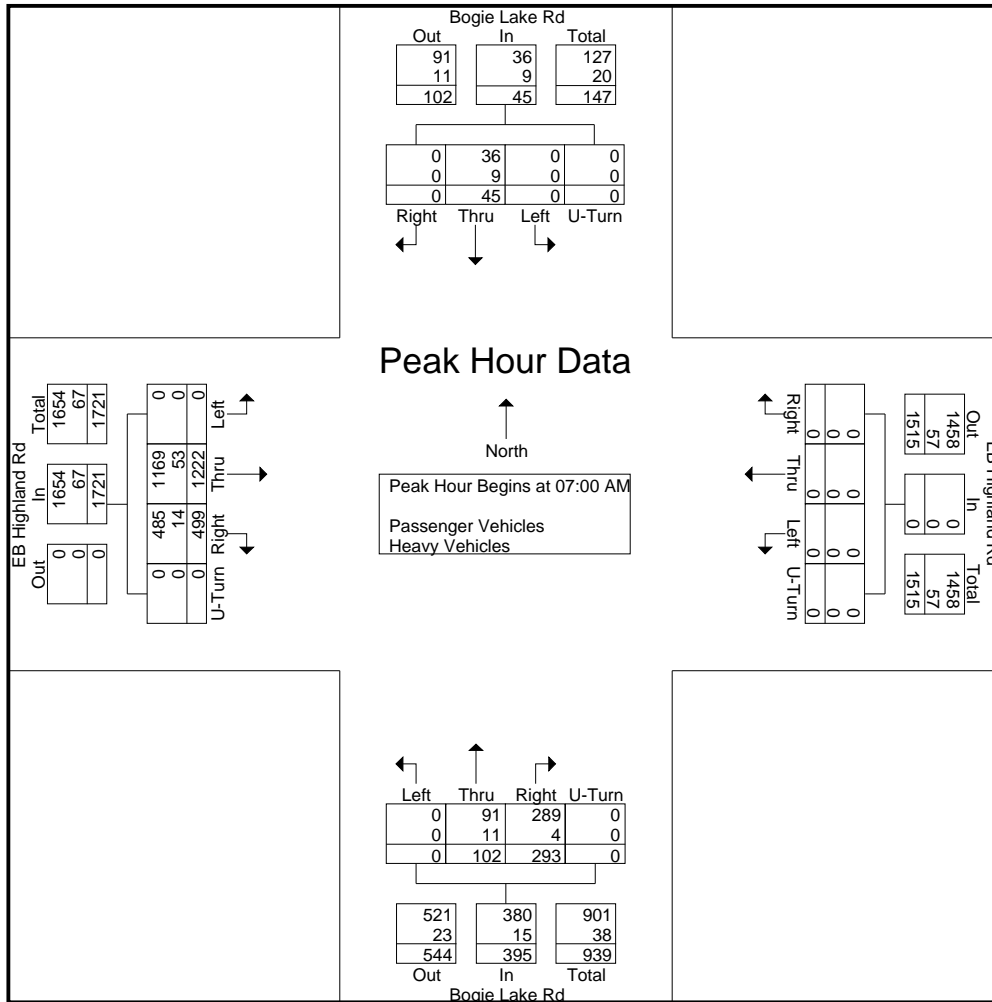
Groups Printed- Passenger Vehicles - Heavy Vehicles

Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
07:00 AM	0	294	190	0	484	0	0	0	0	0	0	32	76	0	108	0	14	0	0	14	606
07:15 AM	0	331	85	0	416	0	0	0	0	0	0	29	84	0	113	0	7	0	0	7	536
07:30 AM	0	313	110	0	423	0	0	0	0	0	0	24	69	0	93	0	10	0	0	10	526
07:45 AM	0	284	114	0	398	0	0	0	0	0	0	17	64	0	81	0	14	0	0	14	493
<b>Total</b>	0	1222	499	0	1721	0	0	0	0	0	0	102	293	0	395	0	45	0	0	45	2161
08:00 AM	0	293	130	0	423	0	0	0	0	0	0	26	78	0	104	0	11	0	0	11	538
08:15 AM	0	317	91	0	408	0	0	0	0	0	0	19	64	0	83	0	7	0	0	7	498
08:30 AM	0	283	68	0	351	0	0	0	0	0	0	14	49	0	63	0	7	0	0	7	421
08:45 AM	0	280	97	0	377	0	0	0	0	0	0	11	69	0	80	0	15	0	0	15	472
<b>Total</b>	0	1173	386	0	1559	0	0	0	0	0	0	70	260	0	330	0	40	0	0	40	1929
Grand Total	0	2395	885	0	3280	0	0	0	0	0	0	172	553	0	725	0	85	0	0	85	4090
Apprch %	0	73	27	0		0	0	0	0		0	23.7	76.3	0		0	100	0	0		
Total %	0	58.6	21.6	0	80.2	0	0	0	0	0	0	4.2	13.5	0	17.7	0	2.1	0	0	2.1	
Passenger Vehicles	0	2287	857	0	3144	0	0	0	0	0	0	156	543	0	699	0	74	0	0	74	3917
% Passenger Vehicles	0	95.5	96.8	0	95.9	0	0	0	0	0	0	90.7	98.2	0	96.4	0	87.1	0	0	87.1	95.8
Heavy Vehicles	0	108	28	0	136	0	0	0	0	0	0	16	10	0	26	0	11	0	0	11	173
% Heavy Vehicles	0	4.5	3.2	0	4.1	0	0	0	0	0	0	9.3	1.8	0	3.6	0	12.9	0	0	12.9	4.2



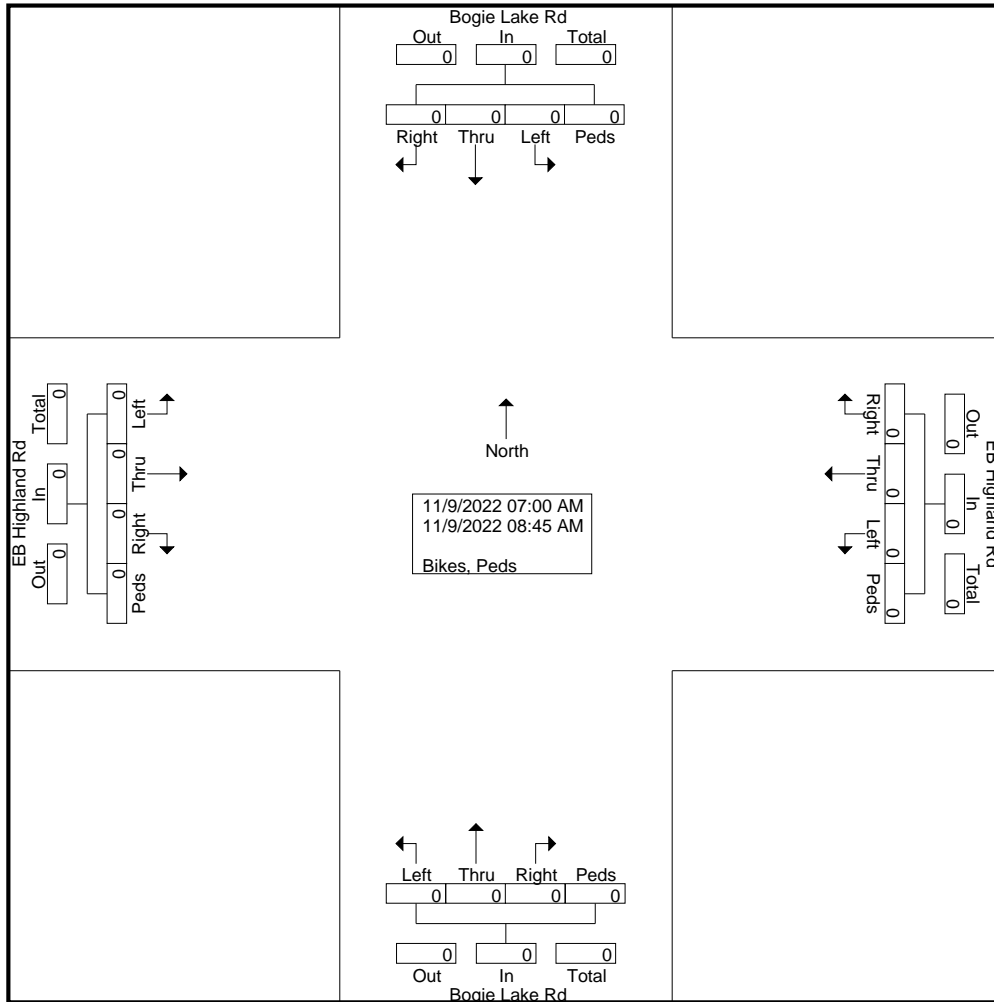


Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	294	190	0	484	0	0	0	0	0	0	32	76	0	108	0	14	0	0	14	606
07:15 AM	0	331	85	0	416	0	0	0	0	0	0	29	84	0	113	0	7	0	0	7	536
07:30 AM	0	313	110	0	423	0	0	0	0	0	0	24	69	0	93	0	10	0	0	10	526
07:45 AM	0	284	114	0	398	0	0	0	0	0	0	17	64	0	81	0	14	0	0	14	493
Total Volume	0	1222	499	0	1721	0	0	0	0	0	0	102	293	0	395	0	45	0	0	45	2161
% App. Total	0	71	29	0		0	0	0	0	0	0	25.8	74.2	0		0	100	0	0		
PHF	.000	.923	.657	.000	.889	.000	.000	.000	.000	.000	.000	.797	.872	.000	.874	.000	.804	.000	.000	.804	.892
Passenger Vehicles	0	1169	485	0	1654	0	0	0	0	0	0	91	289	0	380	0	36	0	0	36	2070
% Passenger Vehicles	0	95.7	97.2	0	96.1	0	0	0	0	0	0	89.2	98.6	0	96.2	0	80.0	0	0	80.0	95.8
Heavy Vehicles	0	53	14	0	67	0	0	0	0	0	0	11	4	0	15	0	9	0	0	9	91
% Heavy Vehicles	0	4.3	2.8	0	3.9	0	0	0	0	0	0	10.8	1.4	0	3.8	0	20.0	0	0	20.0	4.2

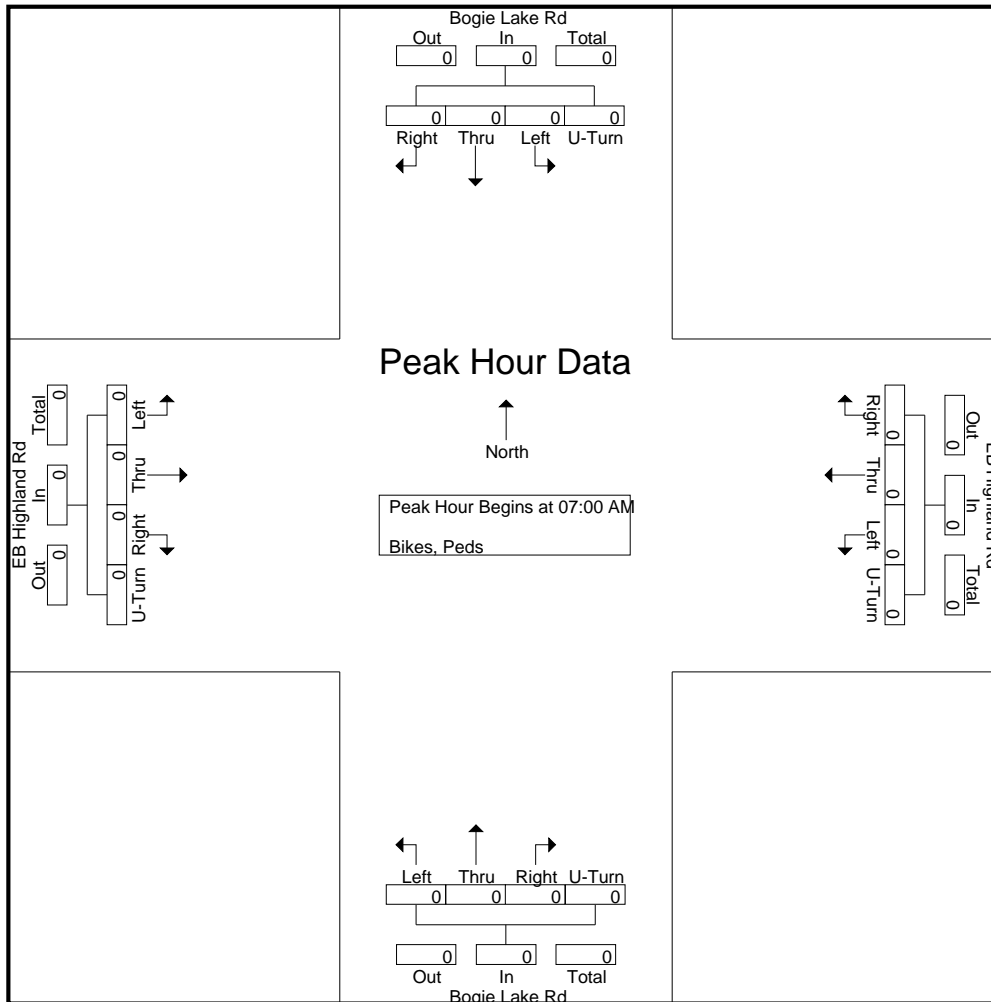


Groups Printed- Bikes, Peds

Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					

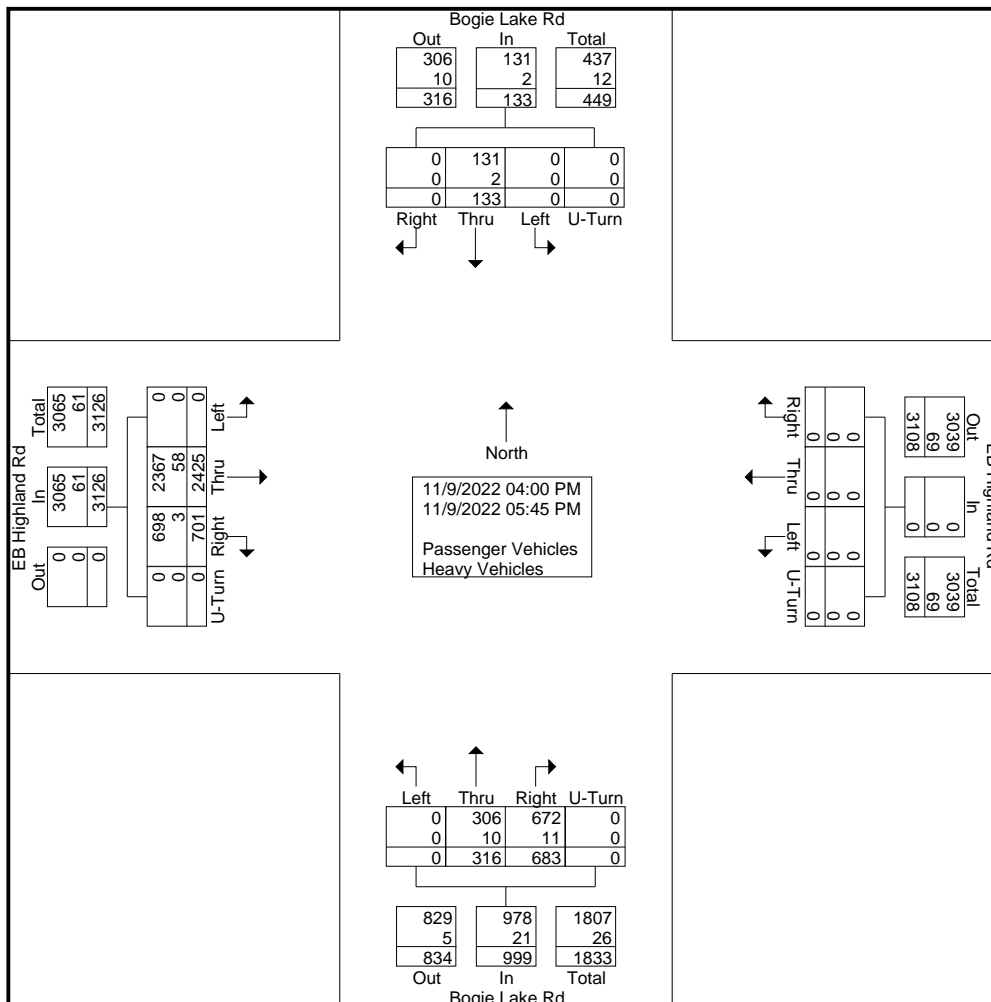


Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total	
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total		
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 07:00 AM																						
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

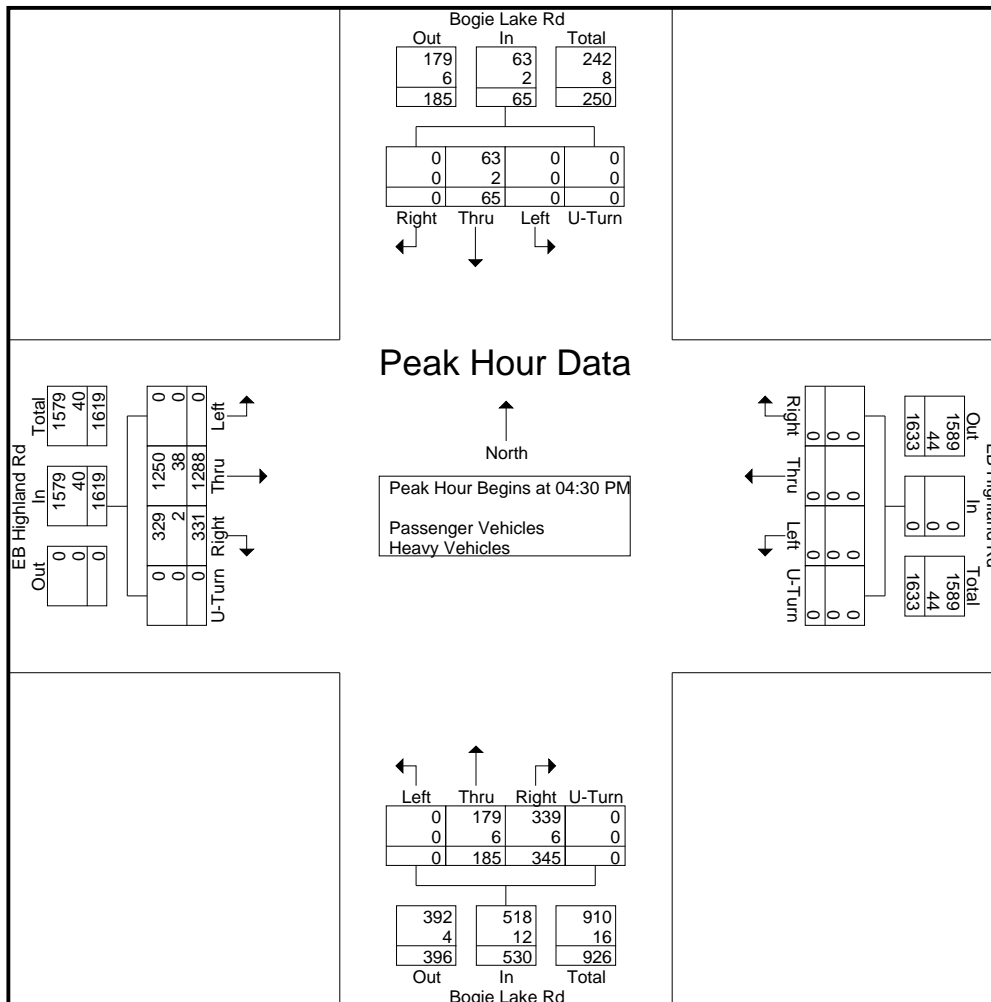


Groups Printed- Passenger Vehicles - Heavy Vehicles

Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
04:00 PM	0	266	64	0	330	0	0	0	0	0	0	31	106	0	137	0	18	0	0	18	485
04:15 PM	0	291	82	0	373	0	0	0	0	0	0	40	100	0	140	0	15	0	0	15	528
04:30 PM	0	336	80	0	416	0	0	0	0	0	0	48	87	0	135	0	19	0	0	19	570
04:45 PM	0	334	82	0	416	0	0	0	0	0	0	44	86	0	130	0	15	0	0	15	561
Total	0	1227	308	0	1535	0	0	0	0	0	0	163	379	0	542	0	67	0	0	67	2144
05:00 PM	0	295	85	0	380	0	0	0	0	0	0	54	88	0	142	0	16	0	0	16	538
05:15 PM	0	323	84	0	407	0	0	0	0	0	0	39	84	0	123	0	15	0	0	15	545
05:30 PM	0	306	100	0	406	0	0	0	0	0	0	39	66	0	105	0	16	0	0	16	527
05:45 PM	0	274	124	0	398	0	0	0	0	0	0	21	66	0	87	0	19	0	0	19	504
Total	0	1198	393	0	1591	0	0	0	0	0	0	153	304	0	457	0	66	0	0	66	2114
Grand Total	0	2425	701	0	3126	0	0	0	0	0	0	316	683	0	999	0	133	0	0	133	4258
Apprch %	0	77.6	22.4	0		0	0	0	0	0	0	31.6	68.4	0		0	100	0	0		
Total %	0	57	16.5	0	73.4	0	0	0	0	0	0	7.4	16	0	23.5	0	3.1	0	0	3.1	
Passenger Vehicles	0	2367	698	0	3065	0	0	0	0	0	0	306	672	0	978	0	131	0	0	131	4174
% Passenger Vehicles	0	97.6	99.6	0	98	0	0	0	0	0	0	96.8	98.4	0	97.9	0	98.5	0	0	98.5	98
Heavy Vehicles	0	58	3	0	61	0	0	0	0	0	0	10	11	0	21	0	2	0	0	2	84
% Heavy Vehicles	0	2.4	0.4	0	2	0	0	0	0	0	0	3.2	1.6	0	2.1	0	1.5	0	0	1.5	2



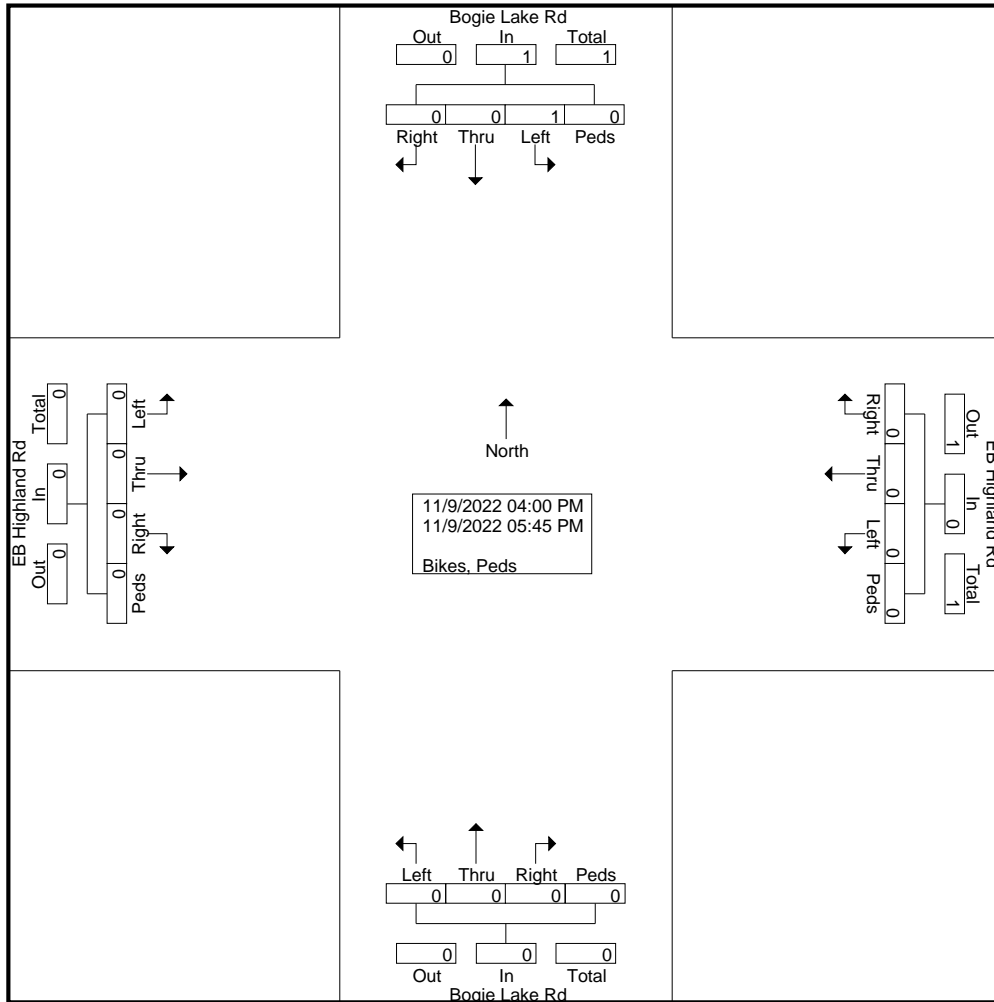
Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	0	336	80	0	416	0	0	0	0	0	0	48	87	0	135	0	19	0	0	19	570
04:45 PM	0	334	82	0	416	0	0	0	0	0	0	44	86	0	130	0	15	0	0	15	561
05:00 PM	0	295	85	0	380	0	0	0	0	0	0	54	88	0	142	0	16	0	0	16	538
05:15 PM	0	323	84	0	407	0	0	0	0	0	0	39	84	0	123	0	15	0	0	15	545
Total Volume	0	1288	331	0	1619	0	0	0	0	0	0	185	345	0	530	0	65	0	0	65	2214
% App. Total	0	79.6	20.4	0		0	0	0	0	0	0	34.9	65.1	0		0	100	0	0		
PHF	.000	.958	.974	.000	.973	.000	.000	.000	.000	.000	.000	.856	.980	.000	.933	.000	.855	.000	.000	.855	.971
Passenger Vehicles	0	1250	329	0	1579	0	0	0	0	0	0	179	339	0	518	0	63	0	0	63	2160
% Passenger Vehicles	0	97.0	99.4	0	97.5	0	0	0	0	0	0	96.8	98.3	0	97.7	0	96.9	0	0	96.9	97.6
Heavy Vehicles	0	38	2	0	40	0	0	0	0	0	0	6	6	0	12	0	2	0	0	2	54
% Heavy Vehicles	0	3.0	0.6	0	2.5	0	0	0	0	0	0	3.2	1.7	0	2.3	0	3.1	0	0	3.1	2.4



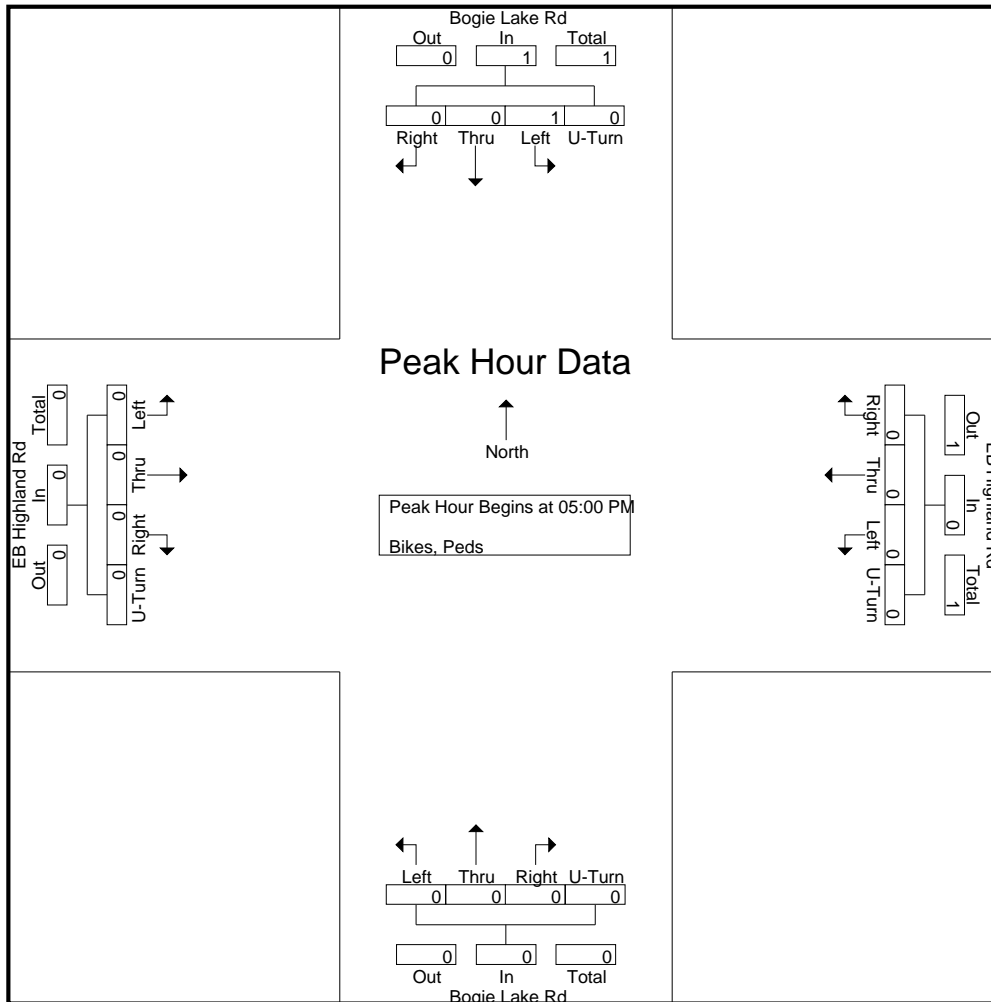


Groups Printed- Bikes, Peds

Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Apprch %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	100

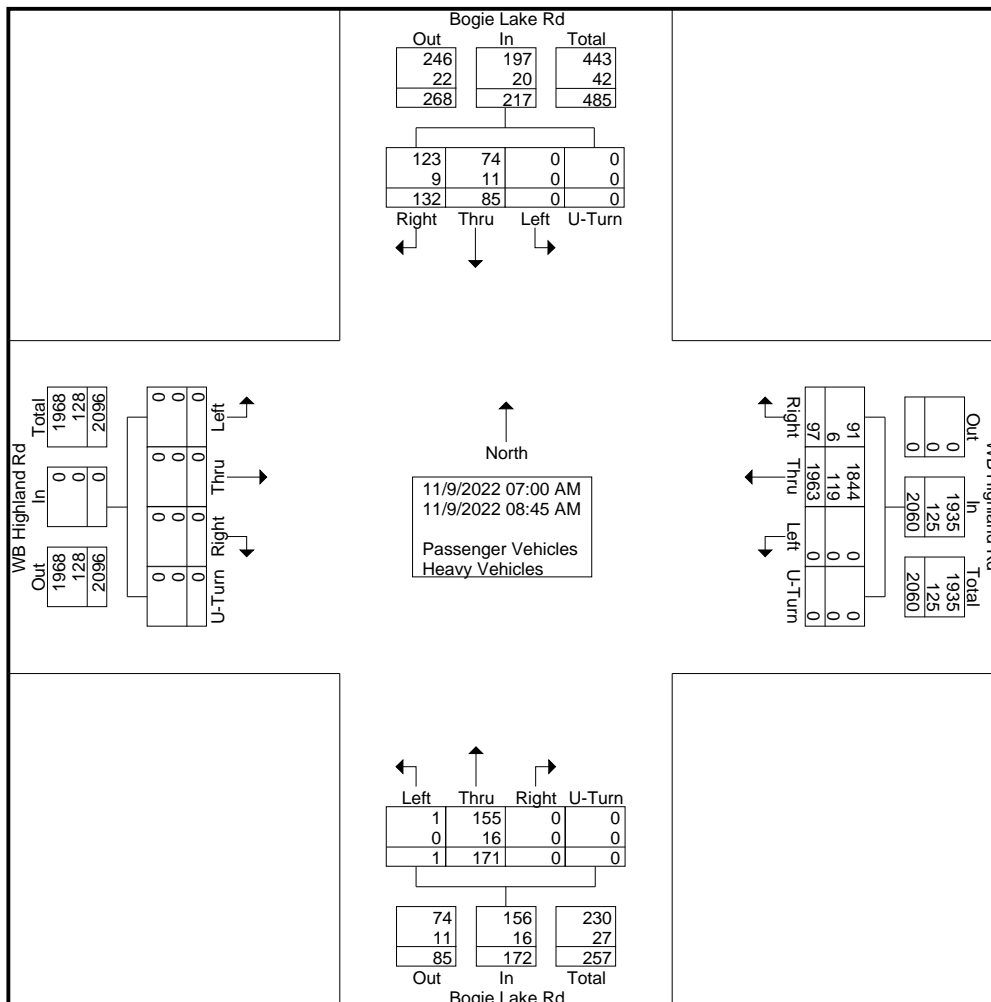


Start Time	EB Highland Rd Eastbound					EB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	1
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000	.000	.000	.250	.250

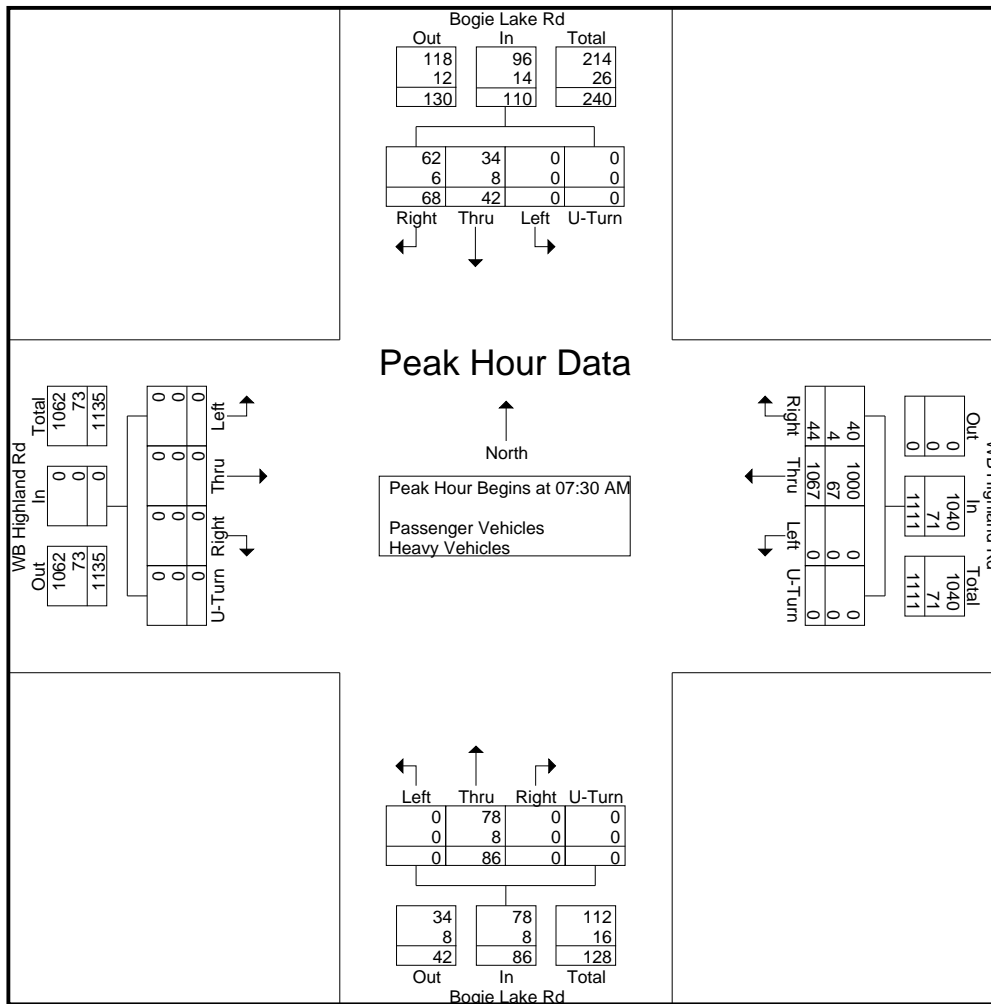


Groups Printed- Passenger Vehicles - Heavy Vehicles

Start Time	WB Highland Rd Eastbound					WB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
07:00 AM	0	0	0	0	0	0	211	9	0	220	1	31	0	0	32	0	14	24	0	38	290
07:15 AM	0	0	0	0	0	0	218	9	0	227	0	29	0	0	29	0	7	23	0	30	286
07:30 AM	0	0	0	0	0	0	290	11	0	301	0	24	0	0	24	0	10	16	0	26	351
07:45 AM	0	0	0	0	0	0	282	9	0	291	0	17	0	0	17	0	14	14	0	28	336
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1001</b>	<b>38</b>	<b>0</b>	<b>1039</b>	<b>1</b>	<b>101</b>	<b>0</b>	<b>0</b>	<b>102</b>	<b>0</b>	<b>45</b>	<b>77</b>	<b>0</b>	<b>122</b>	<b>1263</b>
08:00 AM	0	0	0	0	0	0	247	14	0	261	0	26	0	0	26	0	11	18	0	29	316
08:15 AM	0	0	0	0	0	0	248	10	0	258	0	19	0	0	19	0	7	20	0	27	304
08:30 AM	0	0	0	0	0	0	229	16	0	245	0	14	0	0	14	0	7	9	0	16	275
08:45 AM	0	0	0	0	0	0	238	19	0	257	0	11	0	0	11	0	15	8	0	23	291
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>962</b>	<b>59</b>	<b>0</b>	<b>1021</b>	<b>0</b>	<b>70</b>	<b>0</b>	<b>0</b>	<b>70</b>	<b>0</b>	<b>40</b>	<b>55</b>	<b>0</b>	<b>95</b>	<b>1186</b>
<b>Grand Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1963</b>	<b>97</b>	<b>0</b>	<b>2060</b>	<b>1</b>	<b>171</b>	<b>0</b>	<b>0</b>	<b>172</b>	<b>0</b>	<b>85</b>	<b>132</b>	<b>0</b>	<b>217</b>	<b>2449</b>
<b>Apprch %</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>		<b>0</b>	<b>95.3</b>	<b>4.7</b>	<b>0</b>		<b>0.6</b>	<b>99.4</b>	<b>0</b>	<b>0</b>		<b>0</b>	<b>39.2</b>	<b>60.8</b>	<b>0</b>		
<b>Total %</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>80.2</b>	<b>4</b>	<b>0</b>	<b>84.1</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>3.5</b>	<b>5.4</b>	<b>0</b>	<b>8.9</b>	
Passenger Vehicles	0	0	0	0	0	0	1844	91	0	1935	1	155	0	0	156	0	74	123	0	197	2288
% Passenger Vehicles	0	0	0	0	0	0	93.9	93.8	0	93.9	100	90.6	0	0	90.7	0	87.1	93.2	0	90.8	93.4
Heavy Vehicles	0	0	0	0	0	0	119	6	0	125	0	16	0	0	16	0	11	9	0	20	161
% Heavy Vehicles	0	0	0	0	0	0	6.1	6.2	0	6.1	0	9.4	0	0	9.3	0	12.9	6.8	0	9.2	6.6

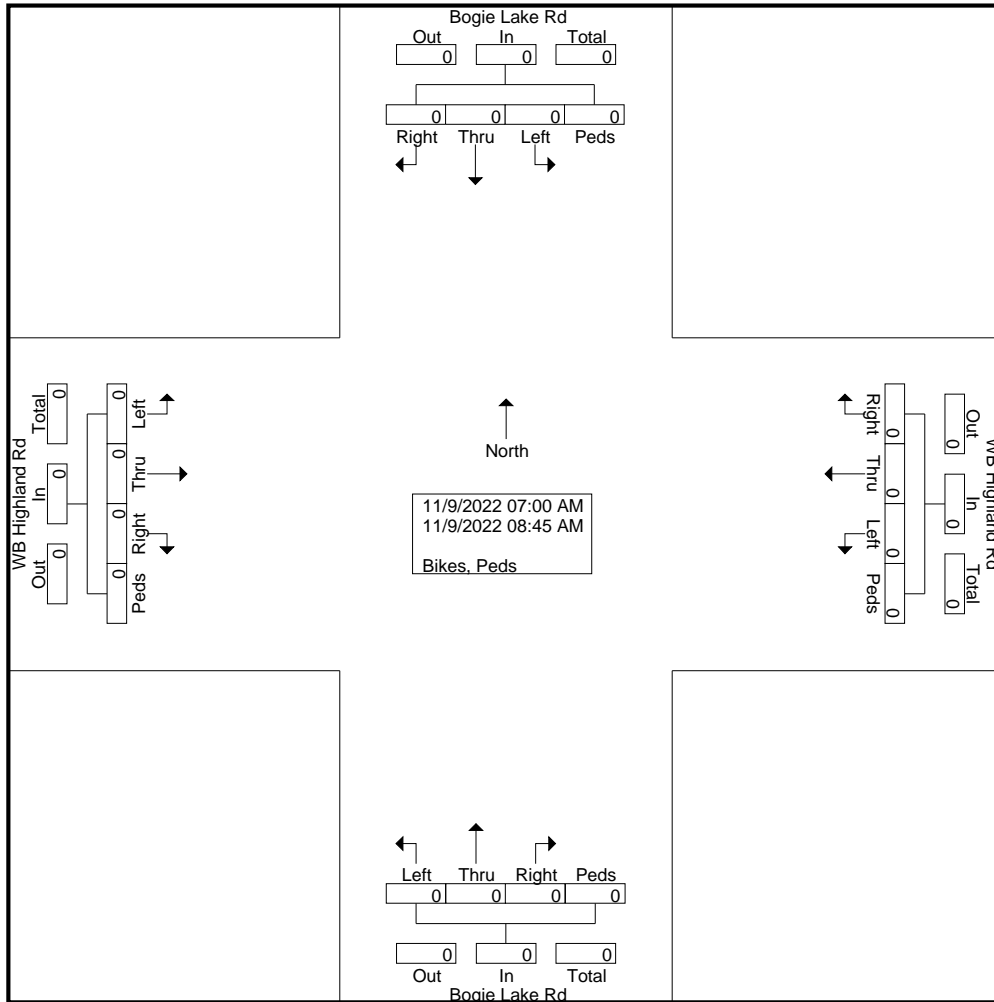


Start Time	WB Highland Rd Eastbound					WB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	0	<b>290</b>	11	0	<b>301</b>	0	24	0	0	24	0	10	16	0	26	<b>351</b>
07:45 AM	0	0	0	0	0	0	282	9	0	291	0	17	0	0	17	0	<b>14</b>	14	0	28	336
08:00 AM	0	0	0	0	0	0	247	<b>14</b>	0	261	0	<b>26</b>	0	0	<b>26</b>	0	11	<b>18</b>	0	<b>29</b>	316
08:15 AM	0	0	0	0	0	0	248	10	0	258	0	19	0	0	19	0	7	<b>20</b>	0	27	304
Total Volume	0	0	0	0	0	0	1067	44	0	1111	0	86	0	0	86	0	42	68	0	110	1307
% App. Total	0	0	0	0	0	0	96	4	0	100	0	100	0	0	100	0	38.2	61.8	0	100	
PHF	.000	.000	.000	.000	.000	.000	.920	.786	.000	.923	.000	.827	.000	.000	.827	.000	.750	.850	.000	.948	.931
Passenger Vehicles	0	0	0	0	0	0	1000	40	0	1040	0	78	0	0	78	0	34	62	0	96	1214
% Passenger Vehicles	0	0	0	0	0	0	93.7	90.9	0	93.6	0	90.7	0	0	90.7	0	81.0	91.2	0	87.3	92.9
Heavy Vehicles	0	0	0	0	0	0	67	4	0	71	0	8	0	0	8	0	8	6	0	14	93
% Heavy Vehicles	0	0	0	0	0	0	6.3	9.1	0	6.4	0	9.3	0	0	9.3	0	19.0	8.8	0	12.7	7.1



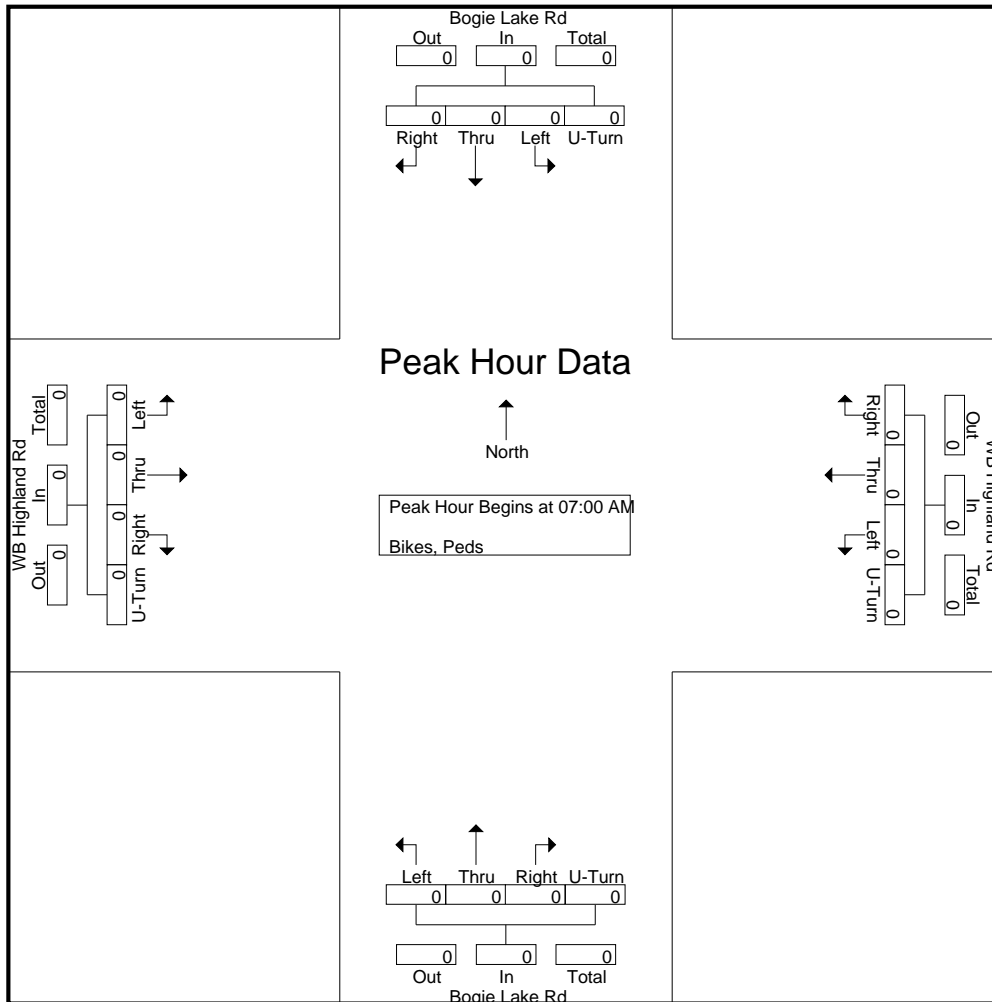
Groups Printed- Bikes, Peds

Start Time	WB Highland Rd Eastbound					WB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					





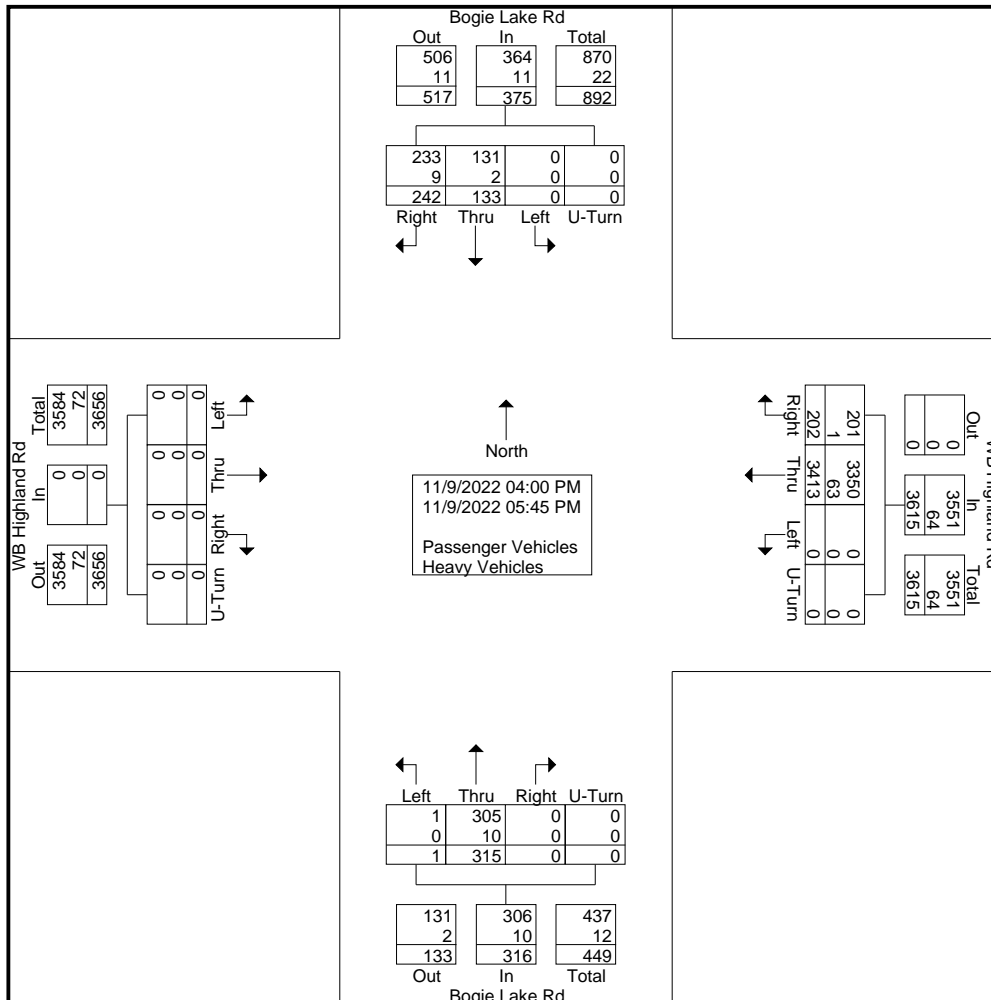
Start Time	WB Highland Rd Eastbound					WB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000



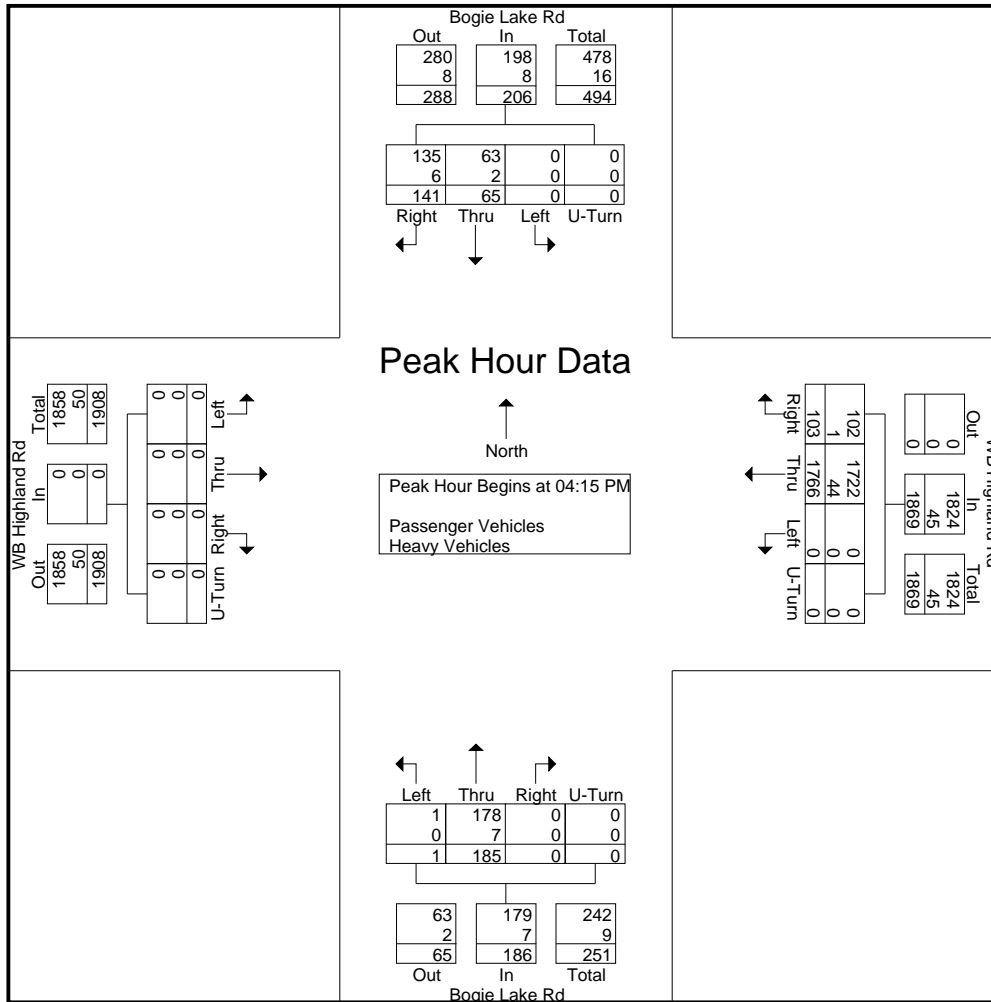


Groups Printed- Passenger Vehicles - Heavy Vehicles

Start Time	WB Highland Rd Eastbound					WB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
04:00 PM	0	0	0	0	0	0	378	21	0	399	0	31	0	0	31	0	18	23	0	41	471
04:15 PM	0	0	0	0	0	0	489	29	0	518	1	39	0	0	40	0	15	30	0	45	603
04:30 PM	0	0	0	0	0	0	390	24	0	414	0	48	0	0	48	0	19	34	0	53	515
04:45 PM	0	0	0	0	0	0	454	29	0	483	0	44	0	0	44	0	15	37	0	52	579
Total	0	0	0	0	0	0	1711	103	0	1814	1	162	0	0	163	0	67	124	0	191	2168
05:00 PM	0	0	0	0	0	0	433	21	0	454	0	54	0	0	54	0	16	40	0	56	564
05:15 PM	0	0	0	0	0	0	456	26	0	482	0	39	0	0	39	0	15	34	0	49	570
05:30 PM	0	0	0	0	0	0	420	36	0	456	0	39	0	0	39	0	16	30	0	46	541
05:45 PM	0	0	0	0	0	0	393	16	0	409	0	21	0	0	21	0	19	14	0	33	463
Total	0	0	0	0	0	0	1702	99	0	1801	0	153	0	0	153	0	66	118	0	184	2138
Grand Total	0	0	0	0	0	0	3413	202	0	3615	1	315	0	0	316	0	133	242	0	375	4306
Apprch %	0	0	0	0		0	94.4	5.6	0		0.3	99.7	0	0		0	35.5	64.5	0		
Total %	0	0	0	0	0	0	79.3	4.7	0	84	0	7.3	0	0	7.3	0	3.1	5.6	0	8.7	
Passenger Vehicles	0	0	0	0	0	0	3350	201	0	3551	1	305	0	0	306	0	131	233	0	364	4221
% Passenger Vehicles	0	0	0	0	0	0	98.2	99.5	0	98.2	100	96.8	0	0	96.8	0	98.5	96.3	0	97.1	98
Heavy Vehicles	0	0	0	0	0	0	63	1	0	64	0	10	0	0	10	0	2	9	0	11	85
% Heavy Vehicles	0	0	0	0	0	0	1.8	0.5	0	1.8	0	3.2	0	0	3.2	0	1.5	3.7	0	2.9	2

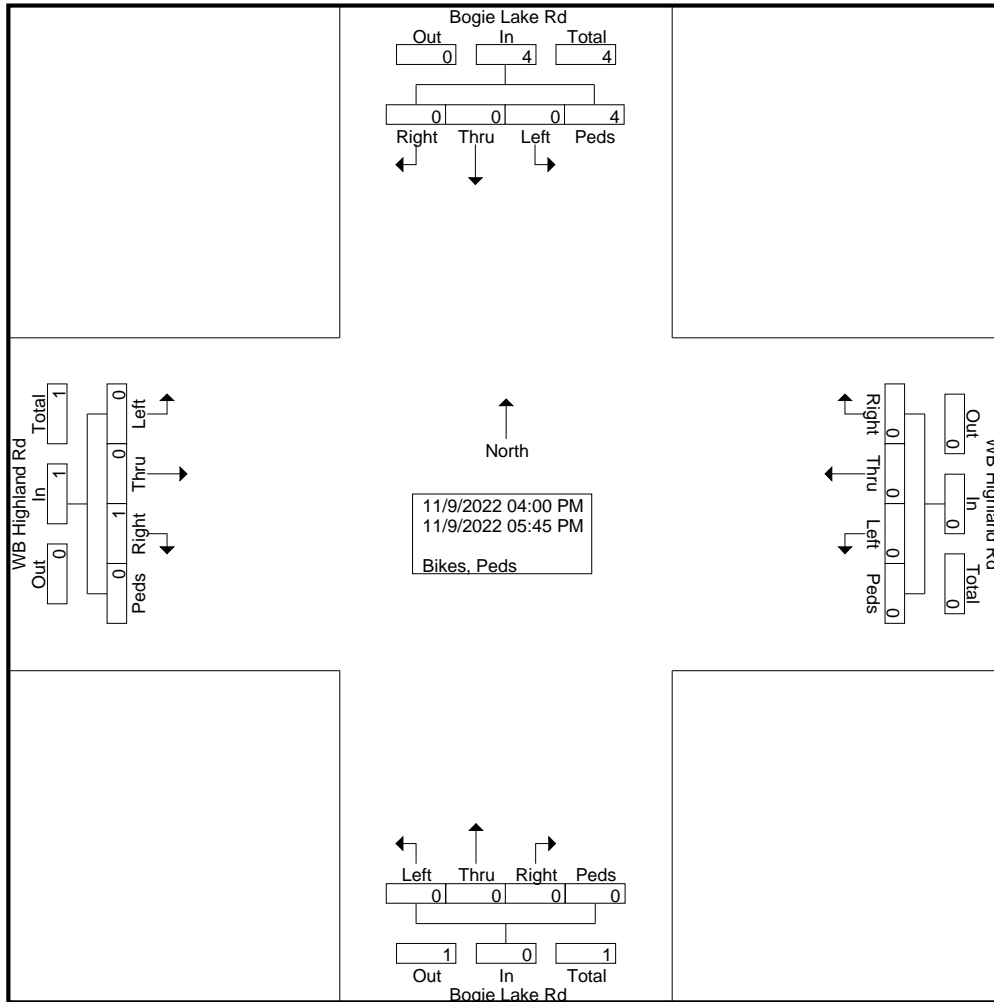


Start Time	WB Highland Rd Eastbound					WB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	Left	Thru	Right	U-Turn	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	0	0	0	0	0	<b>489</b>	<b>29</b>	0	<b>518</b>	<b>1</b>	39	0	0	40	0	15	30	0	45	<b>603</b>
04:30 PM	0	0	0	0	0	0	390	24	0	414	0	48	0	0	48	0	<b>19</b>	34	0	53	515
04:45 PM	0	0	0	0	0	0	454	29	0	483	0	44	0	0	44	0	15	37	0	52	579
05:00 PM	0	0	0	0	0	0	433	21	0	454	0	<b>54</b>	0	0	<b>54</b>	0	16	<b>40</b>	0	<b>56</b>	564
Total Volume	0	0	0	0	0	0	1766	103	0	1869	1	185	0	0	186	0	65	141	0	206	2261
% App. Total	0	0	0	0	0	0	94.5	5.5	0		0.5	99.5	0	0		0	31.6	68.4	0		
PHF	.000	.000	.000	.000	.000	.000	.903	.888	.000	.902	.250	.856	.000	.000	.861	.000	.855	.881	.000	.920	.937
Passenger Vehicles	0	0	0	0	0	0	1722	102	0	1824	1	178	0	0	179	0	63	135	0	198	2201
% Passenger Vehicles	0	0	0	0	0	0	97.5	99.0	0	97.6	100	96.2	0	0	96.2	0	96.9	95.7	0	96.1	97.3
Heavy Vehicles	0	0	0	0	0	0	44	1	0	45	0	7	0	0	7	0	2	6	0	8	60
% Heavy Vehicles	0	0	0	0	0	0	2.5	1.0	0	2.4	0	3.8	0	0	3.8	0	3.1	4.3	0	3.9	2.7

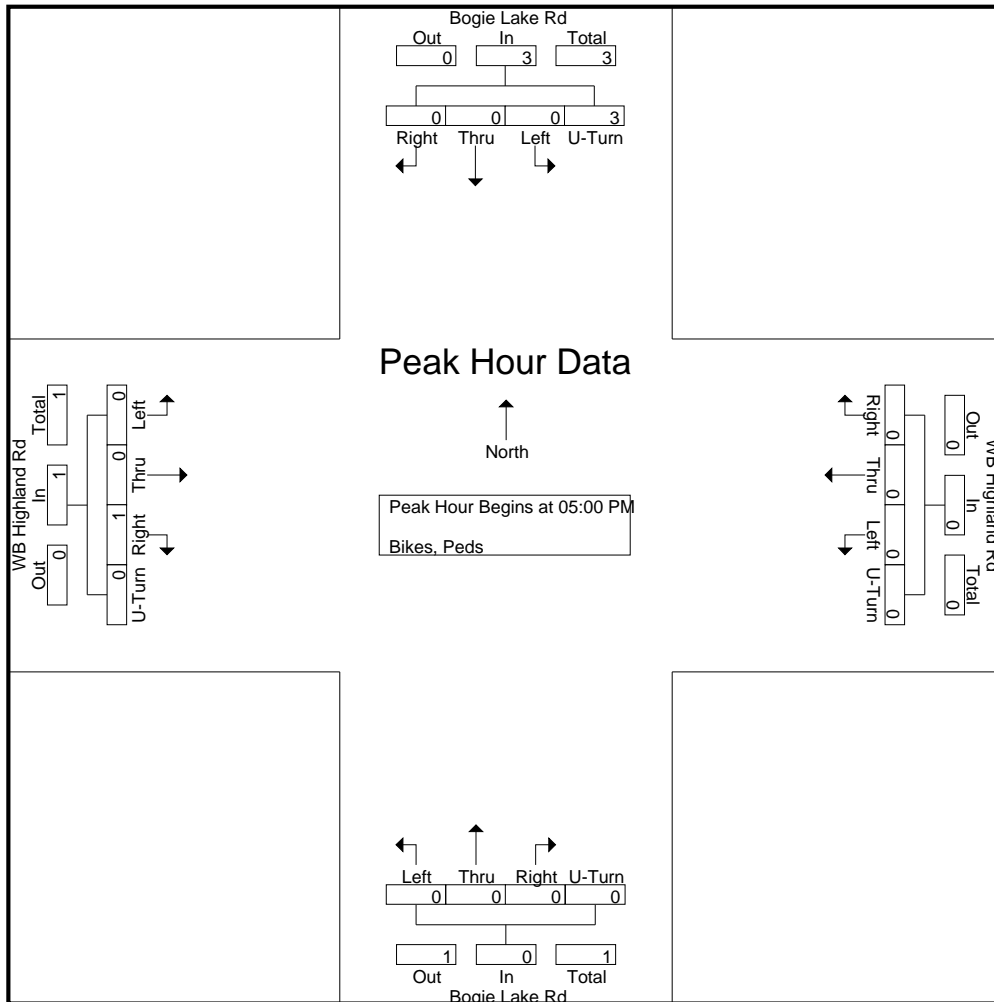


Groups Printed- Bikes, Peds

Start Time	WB Highland Rd Eastbound					WB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	4
Grand Total	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	5
Apprch %	0	0	100	0		0	0	0	0		0	0	0	0		0	0	0	100		
Total %	0	0	20	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	80	80	



Start Time	WB Highland Rd Eastbound					WB Highland Rd Westbound					Bogie Lake Rd Northbound					Bogie Lake Rd Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	4
% App. Total	0	0	100	0		0	0	0	0		0	0	0	0		0	0	0	100		
PHF	.000	.000	.250	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.250	.333



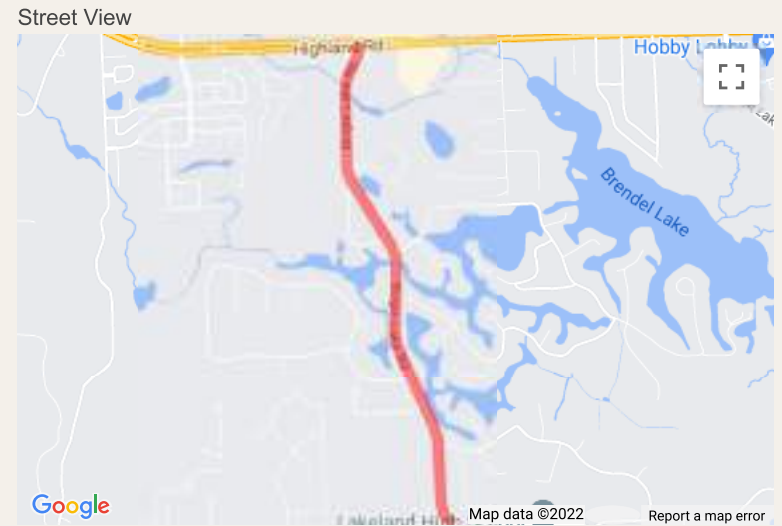
# Crash and Road Data

## Road Segment Report

### Bogie Lake Rd, (PR Number 703507)

<b>From:</b>	Bogie Lake Rd 0.000 BMP
<b>To:</b>	Highland Rd 1.555 EMP
<b>Jurisdiction:</b>	County
<b>FALINK ID:</b>	2902
<b>Community:</b>	White Lake Township
<b>County:</b>	Oakland
<b>Functional Class:</b>	4 - Minor Arterial
<b>Direction:</b>	1 Way
<b>Length:</b>	1.555 miles
<b>Number of Lanes:</b>	2
<b>Posted Speed:</b>	45 (source: TCO)
<b>Route Classification:</b>	Not a route
<b>Annual Crash Average 2017-2021:</b>	<u>21</u>
<b>Traffic Volume (2021)*:</b>	10,200 (Observed AADT)
<b>Pavement Type (2021):</b>	Asphalt
<b>Pavement Rating (2021):</b>	Fair
<b>Short Range (TIP) Projects:</b>	No TIP projects for this segment.
<b>Long Range (RTP) Projects:</b>	No long-range projects for this segment.

\* AADT values are derived from **Traffic Counts**





# Crash and Road Data

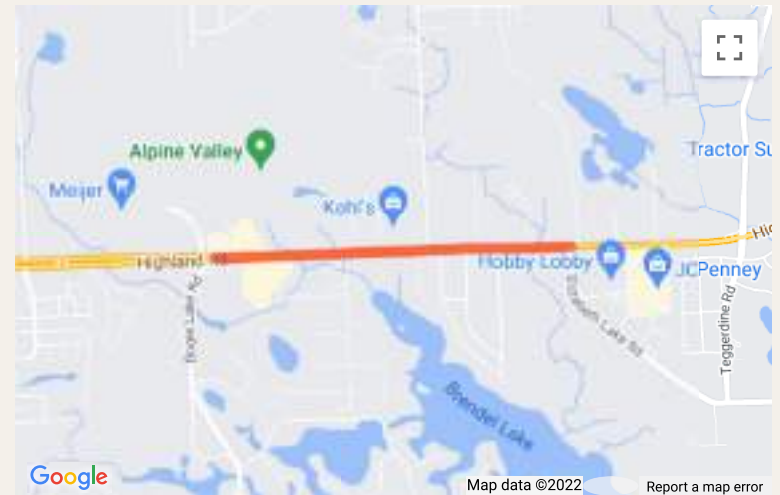
## Road Segment Report

### Highland Rd, (PR Number 648906)

<b>From:</b>	Highland Rd 8.294 BMP
<b>To:</b>	Elizabeth Lake Rd 9.396 EMP
<b>Jurisdiction:</b>	State
<b>FALINK ID:</b>	1764
<b>Community:</b>	White Lake Township
<b>County:</b>	Oakland
<b>Functional Class:</b>	3 - Other Principal Arterial
<b>Direction:</b>	2 Way
<b>Length:</b>	1.102 miles
<b>Number of Lanes:</b>	5
<b>Posted Speed:</b>	50 (source: TCO)
<b>Route Classification:</b>	I-75
<b>Annual Crash Average 2017-2021:</b>	<u>42</u>
<b>Traffic Volume (2016)*:</b>	40,000 (Observed AADT)
<b>Pavement Type (2021):</b>	Asphalt
<b>Pavement Rating (2021):</b>	Poor
<b>Short Range (TIP) Projects:</b>	No TIP projects for this segment.
<b>Long Range (RTP) Projects:</b>	No long-range projects for this segment.

\* AADT values are derived from **Traffic Counts**

Street View



**OAKLAND COUNTY ROAD COMMISSION  
TRAFFIC - SAFETY DEPARTMENT  
SIGNAL WORK ORDER**

Item A.

LOCATION: BOGIE LAKE & X10 N/O M-59 DATE: 9-25-18  
 CITY/TOWNSHIP: WHITE LAKE TWP BY: RACHEL JONES  
 COUNTY#: 1228 STATE#: — CHARGES: 78 012280

PLEASE PERFORM THE FOLLOWING:

ELECTRICAL DEVICE:  INSTALL  MODERNIZE  MAINTENANCE  
 UNDERGROUND: \_\_\_\_\_  
 EDISON OK:  YES  NO JOB#: \_\_\_\_\_  
 COORDINATE W/DISTRICT 7: \_\_\_\_\_

	DIAL..	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4
	SPLIT.	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<input type="checkbox"/> CHANGE TIMING.....																	
<input type="checkbox"/> CHANGE OFFSET.....																	
<input type="checkbox"/> CHANGE CYCLE LENGTH.....																	
<input type="checkbox"/> ADD DIAL/SPLIT.....																	

CHANGE BREAKOUT OR EPROM: \_\_\_\_\_  
 CHANGE HOURS OF OPERATION:  
 OLD: \_\_\_\_\_  
 NEW: \_\_\_\_\_

REPROGRAM TBC  
 INSTALL INTERCONNECT:  TBC  MINITROL  TONE  
 MBT OK:  YES  NO  
 NO CHANGE - RECORD CORRECTION

OTHER: CREW INSTALLED GPS 9-13-18. PLEASE CHECK DST  
AND GPS W/PANTS.

(RWS)

APPROVED BY: [Signature] DATE: 9/25/18  
 DATE INSTALLED: 9/25/18  
 INSTALLED BY: Richardson Wickert

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER - MOD 52 EPAC**

Item A.

INTERSECTION: BOGIE LAKE & X/O N/O M-59

CITY/VILLAGE/TOWNSHIP: WHITE LAKE TWP

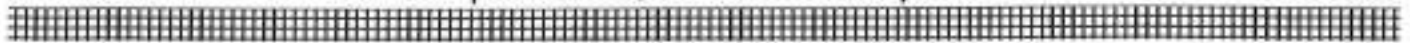
COUNTY#: 1228 MDOT#: - REV#: 5 DETROIT EDISON#: \_\_\_\_\_

DRAWN BY: Rachel Jones APPROVED BY: [Signature] DATE DRAWN: 9/25/18

INSTALLED BY: \_\_\_\_\_ DATE INSTLD: 1 1

HOURS OF OPERATION: M-F: 6am-8pm; SAT & SUN: 8am-8pm

HOURS OF FLASHING: M-F: 8pm-6am; SAT & SUN: 8pm-8am



**2. UTILITIES - 1. ACCESS**

CODE.....: 1642 CODE: Four digits (0000 - 9999)



**2. UTILITIES - 6. LOAD DEFAULT**

**C - CHANGE CURRENT SOFTWARE OPTION**

SELECT SOFTWARE OPTION 1 1- FIO (TS1 ONLY); 2- TS2 (TS2 ONLY)



**4. UNIT DATA - 5. RING STRUCTURE**

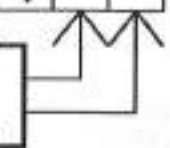
\*\*\*\* NOTE: INSERT ALL RING #'S FIRST, THEN NXT & CONCUR \*\*\*\*

CHANNEL:	RING	PHNXT	CONCURRENT PHASES																CHANNEL			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	VEH	PED		
PHASE 1:			1																			
PHASE 2:	1	4		1																		2
PHASE 3:					1																	
PHASE 4:	1	2				1																4
PHASE 5:							1															
PHASE 6:								1														
PHASE 7:									1													
PHASE 8:										1												
PHASE 9:											1											
PHASE 10:												1										
PHASE 11:													1									
PHASE 12:														1								
PHASE 13:															1							
PHASE 14:																1						
PHASE 15:																	1					
PHASE 16:																						1

**CODES:**

RING Ring Number for Phase (1-4)  
 PHNXT Phase Next in Ring (1-16)  
 CONCUR PH Phases To Be Concurrent (0=NO, 1=YES)

For vehicle channel & ped channel, enter "1" under channel# shown.



**3. PHASE DATA - 1. BASIC TIMINGS**

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	RANGE	
Minimum Green		15		5														00-99
Passage																		0.0-9.9
Maximum #1		50		25														000-999
Maximum #2																		000-999
Yellow Clearance		3.5		3.5														3.0-9.9
Red Clearance		1.9		1.4														0.0-9.9

3. PHASE DATA - 3. PEDESTRIAN TIMINGS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	RANGE (SEC)
Walk																	00-99
Pedest Clearance																	00-99
Flashing Walk																	
Extend Ped Clear																	0-no, 1-Y+R, 2-Y
Act Rest In-Walk																	

3. PHASE DATA - 4. INITIALIZE & NON ACTUATED RESPONSE

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Initial		4		1												
NA Response																
CODES:		0		1		2		3		4						
Initial		none		inactive		red		yellow		green						
NA Response		none		to 1		to 2		both		----						

3. PHASE DATA - 5. VEHICLE & PEDESTRIAN RECALLS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Vehicle Recall		3		3												
Pedestrian Recall																
CODES:		0		1		2		3		4						
Vehicle		none		1 call		min		max		soft						
Pedestrian		none		1 call		ped		bot N. A.		----						

3. PHASE DATA - 6. NONLOCK & MISC CONTROLS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Nonlock Memory																
Dual Entry																
Last Car Passage																
Conditional Service																
CODES:		0 = NO		1 = YES												

3. PHASE DATA - 7. SPECIAL SEQUENCE

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Omit																
-Yel																
Ocal																

3. PHASE DATA - 8. SPECIAL DETECTOR - 0. SPC 1-8 (TS1 ONLY)

Detector # on Print	1	2	3	4	5	6	7	8
Assigned Phase								
CODES:		0		1		2		3
Operation Mode:		Norm Veh		Norm Ped		1 call		St Bar A
								St Bar B

A. CONTROLS

	RANGE (SEC)
Extend Time	00-99
Delay Time	00-999

3. PHASE DATA - 8. SPECIAL DETECTOR - 1. VEH 1-8 OR 2. VEH 9-16 (TS2 ONLY)

Detector # on Print	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Assigned Phase																
CODES:		0		1		2		3		4						
Operation Mode:		Norm Veh		Norm Ped		1 call		St Bar A		St Bar B						

A. CONTROLS

	RANGE (SEC)
Extend Time	00-99
Delay Time	00-999



3. PHASE DATA - 0. MISC PED+VEH OPT

Phase	1	2	3	4	5	6	7	8
WOFF/10								
MODE								
Walk Offset MODE: 0 = Advance Walk 1 = Delay Walk								
GDLY/10								
YDLY/10								

GDLY = Amt of time Advance Warning remains ON after the beginning of Green  
 YDLY = Amt of time the Advance Warning turns ON before the end of Green

4. UNIT DATA - 1. STARTUP & MISCELLANEOUS

Start up time : 10 (00-99) State : 0 (0 = fl, 1 = red)  
 Auto ped clear : 0 Red revert : 7.0 (2.0 - 9.9)  
 Stop time reset : 0 (0 = No, 1 = Yes)

4. UNIT DATA - 2. REMOTE FLASH

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FLASH																
ALT																
ENTER				1												
EXIT		1														

Test A = Remote Flash: 0 (0 = no & 1 = yes)

6. TIME BASE - 0. SPC FUNCTION MAPPING

FUNCTION NAME  
 AS 8-15 = OLI - P FL G PHS  
 AS 8-15 = OLI - P FL R PHS

SPC FUNC							
1	2	3	4	5	6	7	8

NOTE: Go up after entering to get this screen.

4. UNIT DATA - 6. ALT SEQ. 08-15  
 EPAC ALT SEQ (PHASE PAIR TO REVERSE)

SEQ	.PP1	.PP2	.PP3	.PP4	.PP5	.PP6
08						
09						
10						
11						

SEQ	.PP1	.PP2	.PP3	.PP4	.PP5	.PP6
12						
13						
14						
15						

4. UNIT DATA - 3. OVERLAP STANDARD

Phase	1	2	3	4	5	6	7	8	CH#
OVL A Phses									
+GRN Phses									
OVL B Phses									
+GRN Phses									
OVL C Phses									
+GRN Phses									
OVL D Phses									
+GRN Phses									

Phase	1	2	3	4	5	6	7	8	CH#
Overlap I									
Overlap J									
Overlap K									
Overlap L									
Overlap M									
Overlap N									
Overlap O									
Overlap P									

\* For FYA operation, '+GRN' entry is the thru phase opposing the FYA phase

4. UNIT DATA - 4. OVERLAP SPECIAL

Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Trail green																
Trail yellow																
Trail red																
-Green / -yellow (-G/Y)																
TG Preempt																

\* Overlap green omitted by # - phase green; Overlap yellow omitted by # - phase yellow  
 \* For FYA operation, '-G/Y' entry defines the phase that is the green arrow

**4. UNIT DATA - 7. PORT 1 / ITS DATA (TS2 ONLY)**

ADDRESS	DESCRIPTION	PRES	M40
0	T&F BIU #1 TS2		
1	T&F BIU #2 TS2		
2	T&F BIU #3 TS2		
3	T&F BIU #4 TS2		
4	T&F BIU #5 RESERVED		
5	T&F BIU #6 RESERVED		
6	T&F BIU #7 MFG USE		
7	T&F BIU #8 MFG USE		
8	DET BIU #1 TS2		
9	DET BIU #2 TS2		
10	DET BIU #3 TS2		
11	DET BIU #4 TS2		
12	DET BIU #5 RESERVED		
13	DET BIU #6 RESERVED		
14	DET BIU #7 MFG USE		
15	DET BIU #8 MFG USE		
16	MALFUNCTION UNIT		
17	DIAGNOSTIC (MSG 30)		
18	CONTROLLER UNIT		

CODES: 0=NO / 1=YES

**4. UNIT DATA - 8. I/O MISCELLANEOUS**

Ring#	1	2	3	4
Input Response				
Output Select				

I/O Modes	INPUT	OUTPUT
"ABC" Connector		
"D" Connector		

Controller with Detection (TS1 ONLY):

EPAC300/M52 enter "1" under D Conn Input

2070 enter "0" under D Conn Input

**5. COORDINATION DATA - 1. COORD SETUP**

	0	1	2	3	4	5
OPER: <u>1</u>	FRE	AUT	MAN	-----	-----	-----
MODE: <u>0</u>	PRM	YLD	PYL	POM	SOM	FAC
MAX : <u>0</u>	INH	MX1	MX2	-----	-----	-----
CORR: <u>2</u>	DWL	MDW	SWY	SW+	-----	-----
OFST: _____	BEG	END OF GREEN				
FRCE: _____	PLN CYC LE TIME					
MX DWELL: _____	YIELD PERIOD: _____					

**5. COORDINATION DATA - 3. DIAL/SPLIT DATA**

Mode: 0 = actuated  
 1 = coord phase  
 2 = minimum recall  
 3 = maximum recall  
 4 = pedestrain recall  
 5 = maximum + pedestrain recall  
 6 = phase omit  
 7 = dual coord phase

Sequence: 00 - 15 (Unit data has definition)

Ring Lag: Ring offset from local cycle zero when not barrier locked to Ring #1.

Time: 00 - 99 seconds.



Item A.

**5. COORDINATION DATA - 3. DIAL/SPLIT DATA**

**LEVEL 2**

**DIAL 1 / SPLIT 1 CYCLE LENGTH:** 110 SEC

PHASE	1	2	3	4	5	6	7	8
TIME		86		24				
MODE		1		3				

**DIAL 1 / SPLIT 2 CYCLE LENGTH:**

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

**DIAL 1 / SPLIT 3 CYCLE LENGTH:**

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

**DIAL 1 / SPLIT 4 CYCLE LENGTH:**

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

**DIAL 2 / SPLIT 1 CYCLE LENGTH:** 90 SEC

PHASE	1	2	3	4	5	6	7	8
TIME		63		27				
MODE		1		3				

**DIAL 2 / SPLIT 2 CYCLE LENGTH:**

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

**DIAL 2 / SPLIT 3 CYCLE LENGTH:**

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

**DIAL 2 / SPLIT 4 CYCLE LENGTH:**

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

**LEVEL 1**

OFFSET	1	2	3
TIME	21		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

OFFSET	1	2	3
TIME	1		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

5. COORDINATION DATA - 3. DIAL/SPLIT DATA

LEVEL 2

DIAL 3 / SPLIT 1 CYCLE LENGTH: 120 SEC

PHASE	1	2	3	4	5	6	7	8
TIME		92		28				
MODE		1		3				

DIAL 3 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

LEVEL 1

OFFSET	1	2	3
TIME	40		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

~~DIAL 4 / SPLIT 1 CYCLE LENGTH:~~

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

~~DIAL 4 / SPLIT 2 CYCLE LENGTH:~~

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

~~DIAL 4 / SPLIT 3 CYCLE LENGTH:~~

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

~~DIAL 4 / SPLIT 4 CYCLE LENGTH:~~

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER - MOD 52 EPAC**

Item A.

**6. TIME BASE DATA - 2. SET TIME / DATE**

-- DATE --                      -- TIME --                      BEG -- DST -- END  
MM/DD/YY                      HH:MM:SS      MON & WEEK:      MM   SW      MM   SW  
   /                                     /                      3   2      11   1

CYCLE ZERO: 24 : 00      (HH:MM - EVENT)

STZ DIFF: -18000      (GPS OFFSET)



**2. UTILITIES - 8. CONFIGURE PORTS - 8. GPS CONFIGURATION**

GPS: 1      (0-NO, 1-YES)      PORT: 4



**6. TIME BASE DATA - 3. TRAFFIC EVENTS**

PRO DAY	TIME HH:MM	COORD PATRN	MAX 2 PHASE #S					OMIT PHASE #S					
***			D / S / O	*****					*****				
01	00:00	5/5/											
01	08:00	1/1/1											
01	20:00	5/5/											
02	00:00	5/5/											
02	06:00	2/1/1											
02	09:00	1/1/1											
02	15:00	3/1/1											
02	19:00	1/1/1											
02	20:00	5/5/											
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REFERENCE DATA  
PRO DAY = 01 - 99  
(Program day)  
  
HH:MM = 24 Hour clock  
  
PATTERN: (D/S/O)  
FLASH = 5/5/  
FREE = 0/0/4  
  
MAX2 & OMIT:  
Call free, set pattern  
to 0/0/0.  
  
D = DIAL #  
S = SPLIT #  
0 = OFFSET #

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER - MOD 52 EPAC**

Item A.

**6. TIME BASE DATA - 4. AUXILIARY EVENTS**

PRO DAY	TIME HH : MM	AUX			DET VALUE			DIM DIM
		A1	A2	A3	D1	D2	D3	
:	:							
:	:							
:	:							
:	:							
:	:							
:	:							
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:	:							
:	:							
:	:							

REFERENCE DATA:  
PRO DAY = 00 - 99  
(Program day)

HH:MM = 24 Hour clock

AUX = Output states  
DET VALUE:  
1 = Det diag value  
2 = Enables report  
3 = Repeat multiplier

DIM = Dimming state

ALL: 0 = off, 1 = on

**6. TIME BASE DATA - 5. TIME OF YEAR EVENTS**

DATE MM / DD / YY	SPECIAL	
	DAY	WEEK
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DATE MM / DD / YY	SPECIAL	
	DAY	WEEK
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REFERENCE DATA  
Special day = Any  
program day 00 - 99.

Special week:  
Week 0 = Pro Day 01-07  
Week 1 = Pro Day 11-17  
Week 2 = Pro Day 21-27

**6. TIME BASE DATA - 6. EQUATE/TRANSFER**

CODE: 0 (0 = equate, 1 = transfer)

FROM

01 = 07			
02 = 03 04 05 06			
=			
=			
=			
=			
=			

DAY EQUATE: Care must be taken to insure days are not equated to undefined days or days that are equated to other days. The result will be a day without events to run.

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER - MOD 52 EPAC**

Item A.

**7. PREEMPT DATA - 1. ALL PREEMPTS**

RING TIMES	1	2	3	4	
MIN GREEN/WALK					
OVERRIDE	FL	1/2	2/3	3/4	4/5
STATUS					
CODES	0 = NO, 1 = YES				

**7. PREEMPT DATA - PREEMPT 1**

**1. MISC DATA: (0 = no, 1 = yes)**

TEST.: \_\_\_\_\_ N-LOCK.: \_\_\_\_\_ LINK PR#.: \_\_\_\_\_  
 DELAY: \_\_\_\_\_ EXTEND: \_\_\_\_\_ DURATION: \_\_\_\_\_  
 MXCALL: \_\_\_\_\_ LOCK OUT: \_\_\_\_\_

RING	1	2	3	4	5	6	7	8
EXIT								
CALLS								

**4. PEDESTRIAN STATUS:**

PHASE	1	2	3	4	5	6	7	8
TRK GRN								
DWELL								

(0=dont wlk, 1=wlk, 2=flwik, 3=dark)

CYCLE								
-------	--	--	--	--	--	--	--	--

(0 = no, 1 = act, 2 = recall)

**2. INTERVAL TIMES:**

SEL PED CLR : \_\_\_\_\_ TRK YEL CHG : \_\_\_\_\_  
 SEL YEL CHG : \_\_\_\_\_ TRK RED CLR : \_\_\_\_\_  
 SEL RED CLR : \_\_\_\_\_ DWELL GREEN: \_\_\_\_\_  
 TRACK GREEN: \_\_\_\_\_ RET PED CLR : \_\_\_\_\_  
 TRK PED CLR : \_\_\_\_\_ RET YEL CHG : \_\_\_\_\_  
 RET YEL CLR : \_\_\_\_\_

**5. OVERLAP STATUS:**

OVERLAP	A	B	C	D
TRK GRN				
BWELL				

(0=red, 1=grn, 2=flr, 3=fly, 4=dark)

CYCLE								
-------	--	--	--	--	--	--	--	--

(0 = no, 1 = act)

**3. VEHICLE STATUS:**

PHASE	1	2	3	4	5	6	7	8
TRK GRN								
DWELL								

(0=red, 1=grn, 2=flr, 3=fly, 4=dark)

CYCLE								
-------	--	--	--	--	--	--	--	--

(0=no, 1=act, 2=min recall, 3=max recall)

**6. LOW PRIORITY: (0=no, 1=yes)**

TEST.: \_\_\_\_\_ N-LOCK.: \_\_\_\_\_ SKIP.....: \_\_\_\_\_  
 DELAY: \_\_\_\_\_ EXTEND: \_\_\_\_\_ DURATION: \_\_\_\_\_  
 DWELL: \_\_\_\_\_ MXCALL: \_\_\_\_\_ LOCK OUT: \_\_\_\_\_

RING	1	2	3	4	5	6	7	8
DWELL								
CALLS								

**SIGNAL PHASING**

PHASE#	ROAD	PHASE	LOAD SW	FLASH
1				
2	BOGIE LAKE	A	2	FLA
3				
4	X10 N/O M-59	B	4	FLR
5				
6				
7				
8				
OLA				
OLB				
OLC				
OLD				
1PED				
2PED				
3PED				
4PED				
5PED				
6PED				
7PED				
8PED				



Controller Information Sheet  
For Mod 52 EPAC  
Pole Mount "M" Cabinet

Intersection: Bogie Lake & X/O N/O M-59  
 County No: 1228  
 State No: -  
 Prepared By: Dawn Bierlein  
 Date: 12-09-17

Phasing:

Load Switch 2:	Bogie Lake	A	FLA
Load Switch 4:	X/O N/O M-59	B	FLR

Jumpers:

121-213, 151-152, 153-154, 155-156, 173-174, 175-176, 177-178, 233-PB1,  
 237-PB1, 241-PB1, 255-256, 257-258, 259-260, 261-262, 263-PB1.

Conflict Monitor: None.

All switches OFF EXCEPT: Dual Select A&B; G&Y Enable; SSM 2,4.  
 Minimum Flash = 4 + 2 + 1





H: 27' - 4"  
SE QUAD

F ROAD GRADE

MADE  
REFERENCE

POCH = 25' - 3"

- ⑨⑩⑬ 36' ANCHOR BASE STEEL STRAIN POLE PROVIDE SECONDARY SERVICE (BY DELCO)
- ⑥⑦ S.S. ACTUATED CONTROLLER & CABINET

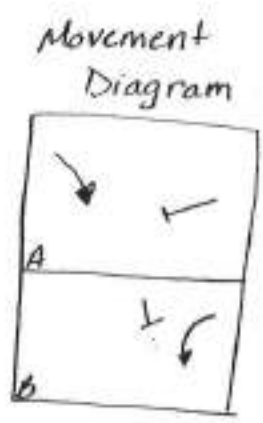
POCH = 27' 4"

- ⑨⑩ 36' ANCHOR BASE STEEL STRAIN POLE

CONTROLLER SHALL BE EAGLE 2070N OR EQUIVALENT S.C.A.T.S COMPATIBLE CONTROLLER.

- ⑪⑫ ALLUMINUM PEDESTAL
- ④ SEE DETAIL "A-2" SHEET ST-5

- ⑤ 4-WAY 24" x 30" ILLUMINATED CASE SIGN
- ① 1-3" DB



BOGIE LAKE RD.

- ⑭ CONTRACTOR SHALL PROVIDE 1-3" CONDUIT RUN EXTENDING TO THE 40' / 1 DECO POLE IN NORTHWEST QUADRANT OF BOGIE LK. & M-59. SEE SHEET C944 FOR DETAILS. CONDUIT AND HANDHOLE QUANTITIES ARE INCLUDED ON THIS SHEET. HANDHOLES SHALL BE SPACED AT 150' INTERVALS.

PLAN  
1" = 30'

ALL CONDUIT IS 1-3" UNLESS SPECIFIED DIFFERENTLY ON PLANS

Co #1228  
Bogie Lake + 1/2 North of  
SAFETY SWITCH M-59

OAKLAND COUNTY ROAD COMMISSION  
 TRAFFIC - SAFETY DEPARTMENT  
 SIGNAL WORK ORDER

JAN 23

Item A.

1-17-17

LOCATION: Bogie LK & M-59 DATE: 12/9/10

CITY/TOWNSHIP: White Lake BY: E Labiano

COUNTY#: 4110 STATE#: 63041-01-029 CHARGES: WO 168612

PLEASE PERFORM THE FOLLOWING:

ELECTRICAL DEVICE:  INSTALL  MODERNIZE  MAINTENANCE  
 UNDERGROUND: \_\_\_\_\_  
 EDISON OK:  YES  NO JOB#: \_\_\_\_\_  
 COORDINATE W/DISTRICT 7: \_\_\_\_\_

DIAL..	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4
SPLIT:	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<input type="checkbox"/> CHANGE TIMING.....																
<input checked="" type="checkbox"/> CHANGE OFFSET.....	X															
<input type="checkbox"/> CHANGE CYCLE LENGTH.....																
<input checked="" type="checkbox"/> ADD DIAL/SPLIT.....													X			

CHANGE BREAKOUT OR EPROM: \_\_\_\_\_  
 CHANGE HOURS OF OPERATION:

OLD: 5am - Midnight  
 NEW: 5:30am - 11pm

REPROGRAM TBC (Traffic Events)

INSTALL INTERCONNECT:  TBC  MINITROL  TONE

MBT OK:  YES  NO

NO CHANGE - RECORD CORRECTION

OTHER: Rev 23

**\* MDOT RETIMING - FINAL \***

APPROVED BY: [Signature] DATE: 1/17/17

DATE INSTALLED: 1/21/17

INSTALLED BY: Richardson

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN**  
**PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070**

Item A.

INTERSECTION: BOGIE LAKE & M-59

CITY/VILLAGE/TOWNSHIP: WHITE LAKE

COUNTY#: 4110 MDOT#: 63041-01-029 REV#: 23 DETROIT EDISON#: 1043

DRAWN BY: E Labiano APPROVED BY: [Signature] DATE DRAWN: 1/17/17

INSTALLED BY: \_\_\_\_\_ DATE INSTLD: 1/1

HOURS OF OPERATION: 7 DAYS: 5:30AM - 11:00PM

HOURS OF FLASHING: 7 DAYS: 11:00PM - 5:30AM

**2. UTILITIES - 1. ACCESS**

CODE: \_\_\_\_\_: 1642 CODE: Four digits (0000 - 9999)

**4. UNIT DATA - 5. RING STRUCTURE**

\*\*\*\*\* NOTE: INSERT ALL RING #'S FIRST, THEN NXT & CONCUR \*\*\*\*\*

CHANNEL:	RING	PHNXT	CONCURRENT PHASES																CHANNEL			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	VEH	PED		
PHASE 1:			1																			
PHASE 2:	1	4		1																	2	9
PHASE 3:					1																	
PHASE 4:	1	2				1															4	10
PHASE 5:							1															
PHASE 6:								1														
PHASE 7:									1													
PHASE 8:										1												
PHASE 9:											1											
PHASE 10:												1										
PHASE 11:													1									
PHASE 12:														1								
PHASE 13:															1							
PHASE 14:																1						
PHASE 15:																	1					
PHASE 16:																		1				

**CODES:**

RING ..... Ring Number for Phase (1-4)  
 PHNXT ..... Phase Next In Ring (1-16)  
 CONCUR PH ..... Phases To Be Concurrent (0=NO, 1=YES)

For vehicle channel & ped channel, enter "1" under channel# shown.

**3. PHASE DATA - 1. BASIC TIMINGS**

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	RANGE	
Minimum Green		10		7														00-99
Passage																		0.0-9.9
Maximum #1		92		29														000-999
Maximum #2																		000-999
Yellow Clearance		4.7		4.3														3.0-9.9
Red Clearance		2.0		6.6														0.0-9.9



3. PHASE DATA - 3. PEDESTRIAN TIMINGS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	RANGE (SEC)
Walk		7		7													00-99
Pedest Clearance		20		12													00-99
Flashing Walk																	
Extend Ped Clear		0		0													
Act Rest in Walk																	

3. PHASE DATA - 4. INITIALIZE & NON ACTUATED RESPONSE

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Initial		4		1												
NA Response																

CODES: 0 1 2 3 4  
 Initial none inactive red yellow green  
 NA Response none to 1 to 2 both -----

3. PHASE DATA - 5. VEHICLE & PEDESTRIAN RECALLS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Vehicle Recall		3		3												
Pedestrian Recall		0		0												

CODES: 0 1 2 3 4  
 Vehicle none 1 call min max soft  
 Pedestrian none 1 call ped bot N. A. -----

3. PHASE DATA - 6. NONLOCK & MISC CONTROLS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Nonlock Memory																
Dual Entry																
Last Car Passage																
Conditional Service																

CODES: 0 = NO 1 = YES

3. PHASE DATA - 8. SPECIAL DETECTOR - 0. SPC 1-8 (Epac 300/M52)

Detector # on Print	1	2	3	4	5	6	7	8
EPAC/M52 "D" Connector	1	6	7	8	4	5	2	3
Assigned Phase								

CODES: 0 1 2 3 4  
 Operation Mode: Norm Veh Norm Ped 1 call St Bar A St Bar B

See attached detection sheet for D-connector pin assignments

A. CONTROLS

	RANGE (SEC)
Extend Time	00-99
Delay Time	00-999

3. PHASE DATA - 8. SPECIAL DETECTOR - 2. VEH 9-16 (2070)

Detector # on Print	1	2	3	4	5	6	7	8
2070 "D" Connector	9	10	11	12	13	14	15	16
Assigned Phase								

CODES: 0 1 2 3 4  
 Operation Mode: Norm Veh Norm Ped 1 call St Bar A St Bar B

See attached detection sheet for D-connector pin assignments

A. CONTROLS

	RANGE (SEC)
Extend Time	00-99
Delay Time	00-999

4. UNIT DATA - 1. STARTUP & MISCELLANEOUS

Start up time : 10 (00-99) State : 0 (0 = fl, 1 = red)  
 Auto ped clear : 0 Red revert : 7.0 (2.0 - 9.9)  
 Stop time reset : 0 (0 = No, 1 = Yes)

4. UNIT DATA - 2. REMOTE FLASH

Phase	1	2	3	4	5	6	7	8	A	B	C	D	E	F	G	H
FLASH																
YEL																
ALT																
ENTER				1												
EXIT		1														

Test A = Remote Flash: 0 (0 = no & 1 = yes)

6. TIME BASE - 0. SPC FUNCTION MAPPING

FUNCTION NAME  
 AS 8-15 = OLI - P FL G PHS  
 AS 8-15 = OLI - P FL R PHS

SPC FUNC							
1	2	3	4	5	6	7	8

NOTE: Go up after entering to get this screen.

4. UNIT DATA - 6 ALT SEQ. 08-15

EPAC ALT SEQ (PHASE PAIR TO REVERSE)

SEQ	.PP1.	.PP2.	.PP3.	.PP4.	.PP5.	.PP6.
08						
09						
10						
11						

SEQ	.PP1.	.PP2.	.PP3.	.PP4.	.PP5.	.PP6.
12						
13						
14						
15						

4. UNIT DATA - 3. OVERLAP STANDARD

Phase	1	2	3	4	5	6	7	8	CH#
Overlap A				1					13
Overlap B									
Overlap C									
Overlap D									
Overlap E									
Overlap F									
Overlap G									
Overlap H									

Phase	1	2	3	4	5	6	7	8	CH#
Overlap I									
Overlap J									
Overlap K									
Overlap L									
Overlap M									
Overlap N									
Overlap O									
Overlap P									

Enter a "1" in the channel # shown.

0 = Phase not part of overlap; 1 = Phase part of overlap.

4. UNIT DATA - 4. OVERLAP SPECIAL

Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Trail green	4															
Trail yellow	A.3															
Trail red	2.6															
-Green / -yellow (-G/Y)																
+Green (+GRN)																

- \* Overlap green omitted by # - phase green; Overlap yellow omitted by # - phase yellow
- \* For FYA operation, '-G/Y' entry defines the phase that is the green arrow
- \* For FYA operation, '+GRN' entry is the thru phase opposing the FYA phase

4. UNIT DATA - 8. I/O MISCELLANEOUS

Ring#	1	2	3	4	CONN	MODE
Input Response	1				"D"	
Output Select	1				"D"	

Connector "D" : 0 = Standard & 1 = Alternate

I/O Modes	INPUT	OUTPUT
"ABC" Connector		
"D" Connector		

Controller with Solo Detection:  
 EPAC300/M52 enter "1" under D Conn Input  
 2070 enter "0" under D Conn Input

5. COORDINATION DATA - 1. COORD SETUP

	0	1	2	3	4	5
OPER: <u>1</u>	FRE	AUT	MAN	-----	-----	-----
MODE: <u>2</u>	PRM	YLD	PYL	POM	SOM	FAC
MAX : <u>0</u>	INH	MX1	MX2	-----	-----	-----
CORR: <u>2</u>	DWL	MDW	SWY	SW+	-----	-----
OFST: _____	BEG END OF GREEN					
FRCE: _____	PLN CYC LE TIME					
MX DWELL: _____	YIELD PERIOD:					

5. COORDINATION DATA - 2. MANUAL CONTROL

DIAL: \_\_\_\_\_ SPLIT: \_\_\_\_\_ OFFSET: \_\_\_\_\_ SYNC: \_\_\_\_\_

To set cycle zero in manual control enter "1" for sync then press "E".

5. COORDINATION DATA - 3. DIAL/SPLIT DATA

Mode: 0 = actuated, 1 = coord phase, 2 = minimum recall, 3 = maximum recall,  
 4 = pedestrian recall, 5 = maximum + pedestrian recall, 6 = phase omit,  
 7 = dual coord phase.

Sequence: 00 - 15 (Unit data has definition)

Ring Lag: Ring offset from local cycle zero when not barrier locked to Ring #1.

Time: 00 - 99 seconds.



5. COORDINATION DATA - 3. DIAL/SPLIT DATA

LEVEL 2

DIAL 1 / SPLIT 1 CYCLE LENGTH: 110 SECS PROGRAM CYCLE LENGTH

PHASE	1	2	3	4	5	6	7	8
TIME		80		24				
MODE		1		3				

DIAL 1 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 1 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 1 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 1 CYCLE LENGTH: 90 SECS PROGRAM CYCLE LENGTH

PHASE	1	2	3	4	5	6	7	8
TIME		60		27				
MODE		1		3				

DIAL 2 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

LEVEL 1

OFFSET	1	2	3
TIME	42		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

OFFSET	1	2	3
TIME	56		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

5. COORDINATION DATA - 3. DIAL/SPLIT DATA

LEVEL 2

DIAL 3 / SPLIT 1 CYCLE LENGTH: *120 SECS PROGRAM CYCLE LENGTH*

PHASE	1	2	3	4	5	6	7	8
TIME		90		28				
MODE		1		3				

DIAL 3 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 1 CYCLE LENGTH: *110 SECS*

PHASE	1	2	3	4	5	6	7	8
TIME		75		35				
MODE		1		3				

DIAL 4 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

LEVEL 1

OFFSET	1	2	3
TIME	93		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

OFFSET	1	2	3
TIME	36		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
 PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

Item A.

6. TIME BASE DATA - 2. SET TIME / DATE

-- DATE -- -- TIME -- BEG -- DST -- END  
 MM/DD/YY HH:MM:SS MON & WEEK: MM SW MM SW  
 / / : : 3 2 11 1

CYCLE ZERO: 24:00 (HH:MM - EVENT)

STZ DIFF: -18000 (GPS OFFSET)

2. UTILITIES - 8. CONFIGURE PORTS - 8. GPS CONFIGURATION

GPS: 1 (0-NO, 1-YES) PORT: 4

6. TIME BASE DATA - 3. TRAFFIC EVENTS

PRO DAY	TIME	COORD	MAX 2			OMIT		
	HH:MM	PATRN	PHASE #S			PHASE #S		
**	**	D/S/O	**	**	**	**	**	**
01	00:00	5/5/1						
01	05:30	1/1/1						
01	23:00	5/5/1						
02	00:00	5/5/1						
02	05:30	1/1/1						
02	06:00	2/1/1						
02	09:00	1/1/1						
02	13:55	4/1/1						
02	14:25	1/1/1						
02	15:00	3/1/1						
02	19:00	1/1/1						
02	23:00	5/5/1						
	:	/ /						
	:	/ /						
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REFERENCE DATA  
 PRO DAY = 01 - 99  
 (Program day)

HH:MM = 24 Hour clock

PATTERN: (D/S/O)  
 FLASH = 5/5/  
 FREE = 0/0/4

MAX2 & OMITs:  
 Call free, set pattern  
 to 0/0/0.

D = DIAL #  
 S = SPLIT #  
 0 = OFFSET #

6. TIME BASE DATA - 4. AUXILIARY EVENTS

PRO DAY	TIME HH : MM	AUX			DET VALUE			DIM DIM
		A1	A2	A3	D1	D2	D3	
:	:							
:	:							
:	:							
:	:							
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REFERENCE DATA:  
PRO DAY = 00 - 99  
(Program day)

HH:MM = 24 Hour clock

AUX = Output states  
DET VALUE:  
1 = Det diag value  
2 = Enables report  
3 = Repeat multiplier

DIM = Dimming state

ALL: 0 = off, 1 = on

6. TIME BASE DATA - 5. TIME OF YEAR EVENTS

DATE MM / DD / YY	SPECIAL	
	DAY	WEEK
/ /		
/ /		
/ /		
/ /		
/ /		
/ /		
/ /		
/ /		

DATE MM / DD / YY	SPECIAL	
	DAY	WEEK
/ /		
/ /		
/ /		
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/ /		

REFERENCE DATA  
Special day = Any program day 00 - 99.

Special week:  
Week 0 = Pro Day 01-07  
Week 1 = Pro Day 11-17  
Week 2 = Pro Day 21-27

6. TIME BASE DATA - 6. EQUATE/TRANSFER

CODE: 0 (0 = equate, 1 = transfer)

FROM	01 = 07						
	02 = 03 04 05 06						
	=						
	=						
	=						
	=						

DAY EQUATE: Care must be taken to insure days are not equated to undefined days or days that are equated to other days. The result will be a day without events to run.



ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

Item A.

7. PREEMPT DATA - 1. ALL PREEMPTS

RING TIMES	1	2	3	4		
MIN GREEN/WALK						
OVERRIDE	FL	1/2	2/3	3/4	4/5	5/6
STATUS						
CODES	0 = NO, 1 = YES					

7. PREEMPT DATA - PREEMPT 1

1. MISC DATA: (0 = no, 1 = yes)  
 TEST...:  N-LOCK.:  LINK PR#.:   
 DELAY:  EXTEND:  DURATION:   
 MXCALL:  LOCK OUT:   
 RING EXIT CALLS

1	2	3	4	5	6	7	8

4. PEDESTRIAN STATUS:  
 PHASE

1	2	3	4	5	6	7	8

TRK GRN  
 DWELL  
 (0=dont wlk, 1=wlk, 2=flwk, 3=dark)  
 CYCLE  
 (0 = no, 1 = act, 2 = recall)

2. INTERVAL TIMES:

SEL PED CLR:  TRK YEL CHG:   
 SEL YEL CHG:  TRK RED CLR:   
 SEL RED CLR:  DWELL GREEN:   
 TRACK GREEN:  RET PED CLR:   
 TRK PED CLR:  RET YEL CHG:   
 RET YEL CLR:

5. OVERLAP STATUS:

OVERLAP

A	B	C	D

TRK GRN  
 DWELL  
 (0=red, 1=grn, 2=flr, 3=fly, 4=dark)  
 CYCLE  
 (0 = no, 1 = act)

3. VEHICLE STATUS:

PHASE

1	2	3	4	5	6	7	8

TRK GRN  
 DWELL  
 (0=red, 1=grn, 2=flr, 3=fly, 4=dark)  
 CYCLE  
 (0=no, 1=act, 2=min recall, 3=max recall)

6. LOW PRIORITY: (0=no, 1=yes)

TEST...:  N-LOCK.:  SKIP.....:   
 DELAY:  EXTEND:  DURATION:   
 DWELL:  MXCALL:  LOCK OUT:   
 RING

1	2	3	4	5	6	7	8

DWELL  
 CALLS

SIGNAL PHASING

PHASE#	ROAD	PHASE	LOAD SW	FLASH
1				
2	M-59	A	2	A
3				
4	BOGIE LAKE (NEAR)	B	4	R
5				
6				
7				
8				
OLA	BOGIE LAKE (FAR)	C	5	R
OLB				
OLC				
OLD				
1PED				
2PED	M-59 PED	WA	6	
3PED				
4PED	BOGIE LAKE PED	WB	8	
5PED				
6PED				
7PED				
8PED				

Controller Information Sheet  
For 4 Phase EPAC  
Pole Mount Cabinet

Intersection: M-59 and Bogie Lake Rd  
 County No: 04110  
 State No: 63041-01-029  
 Prepared By: Rachel Jones  
 Date: 11-30-11

## Phasing:

Load Switch 2:	M-59	A	FLA
Load Switch 4:	Bogie Lake Near	B	FLR
Load Switch 5:(OLA)	Bogie Lake Far	C	FLR
Load Switch 6:	M-59 Peds	WA	
Load Switch 8:	Bogie Lake Ped West	WB	

## Jumpers:

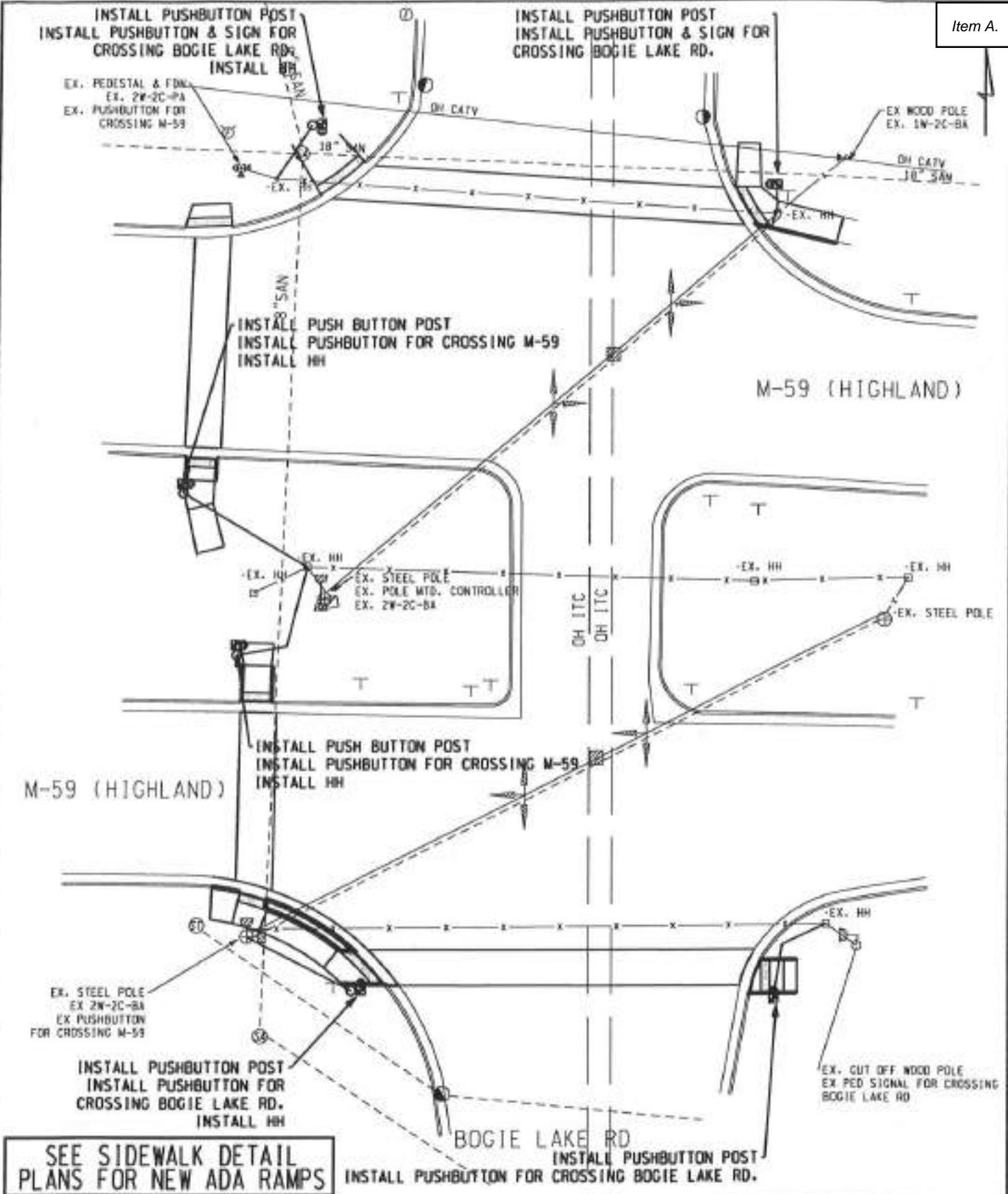
121-213, 151-152, 153-154, 155-156, 158-159, 161-162, 164-165, 173-174,  
 175-176, 177-178, 179-180, 185-186, 223-224, 229-230, 233-PB1, 237-PB1,  
 241-242, 243-244, 245-246, 255-256, 257-258, 259-260, 261-262, 263-PB1,  
 268-269, 273-274.

## Conflict Monitor: 4-5.

All switches OFF EXCEPT: Dual Select A&B; G&Y Enable; SSM 2,4,5.  
 Minimum Flash = 4 + 2 + 1



Item A.



SEE SIDEWALK DETAIL PLANS FOR NEW ADA RAMPs



AUTH. NO.	DRAWN DJP
CONT. SEC. 63041	DATE 03-08-11
REF. 110761	SCALE N.T.S.
PLAN 63041-01-029	SHEET 3 OF 4

M-59 (HIGHLAND) AT BOGIE LAKE RD  
 WHITE LAKE TOWNSHIP  
 OAKLAND COUNTY

OAKLAND COUNTY ROAD COMMISSION  
 TRAFFIC - SAFETY DEPARTMENT  
 SIGNAL WORK ORDER

JAN 23 2017

Item A.

1-13-17

LOCATION: EB M-59 & X/O W/O Bogie LK DATE: ~~1/24/17~~  
 CITY/TOWNSHIP: White Lake BY: E Labiano  
 COUNTY#: 4136 STATE#: 63041-01-129 CHARGES: WO 168612

PLEASE PERFORM THE FOLLOWING:

ELECTRICAL DEVICE:  INSTALL  MODERNIZE  MAINTENANCE  
 UNDERGROUND: \_\_\_\_\_  
 EDISON OK:  YES  NO JOB#: \_\_\_\_\_  
 COORDINATE W/DISTRICT 7: \_\_\_\_\_

	DIAL..								3 3 3 3				4 4 4 4			
	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4
SPLIT.	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<input type="checkbox"/> CHANGE TIMING.....																
<input checked="" type="checkbox"/> CHANGE OFFSET.....	<b>X</b>															
<input type="checkbox"/> CHANGE CYCLE LENGTH.....																
<input checked="" type="checkbox"/> ADD DIAL/SPLIT.....														<b>X</b>		

CHANGE BREAKOUT OR EPROM: \_\_\_\_\_  
 CHANGE HOURS OF OPERATION:  
 7DAYS: 5am - Midnight  
 OLD: \_\_\_\_\_  
 7DAYS: 5:30am - 11pm  
 NEW: \_\_\_\_\_  
 REPROGRAM TBC (Traffic events)  
 INSTALL INTERCONNECT:  TBC  MINITROL  TONE  
 MBT OK:  YES  NO  
 NO CHANGE - RECORD CORRECTION  
 OTHER: Rev 12

\* MOOT RETIMING - FINAL \*

APPROVED BY: [Signature] DATE: 1/17/17  
 DATE INSTALLED: 1/24/17  
 INSTALLED BY: RICHARDSON CASEY

ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
 PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

Item A.

3. PHASE DATA - 3. PEDESTRIAN TIMINGS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	RANGE (SEC)
Walk																	00-99
Pedest Clearance																	00-99
Flashing Walk																	
Extend Ped Clear																	
Act Rest-in-Walk																	

3. PHASE DATA - 4. INITIALIZE & NON ACTUATED RESPONSE

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Initial		4		1												
NA Response																

CODES: 0 1 2 3 4  
 Initial none inactive red yellow green  
 NA Response none to 1 to 2 both -----

3. PHASE DATA - 5. VEHICLE & PEDESTRIAN RECALLS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Vehicle Recall		3		3												
Pedestrian Recall																

CODES: 0 1 2 3 4  
 Vehicle none 1 call min max soft  
 Pedestrian none 1 call ped bot N. A. -----

3. PHASE DATA - 6. NONLOCK & MISC CONTROLS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Nonlock Memory																
Dual Entry																
Last Car Passage																
Conditional Service																

CODES: 0 = NO 1 = YES

3. PHASE DATA - 8. SPECIAL DETECTOR - 0. SPC 1-8 (Epac 300/M52)

Detector # on Print	1	2	3	4	5	6	7	8
EPAC/M52 "D" Connector	1	6	7	8	4	5	2	3
Assigned Phase								

CODES: 0 1 2 3 4  
 Operation Mode: Norm Veh Norm Ped 1 call St Bar A St Bar B

See attached detection sheet  
 for D-connector pin  
 assignments

A. CONTROLS

	RANGE (SEC)
Extend Time	00-99
Delay Time	00-999

3. PHASE DATA - 8. SPECIAL DETECTOR - 2. VEH 9-16 (2070)

Detector # on Print	1	2	3	4	5	6	7	8
2070 "D" Connector	9	10	11	12	13	14	15	16
Assigned Phase								

CODES: 0 1 2 3 4  
 Operation Mode: Norm Veh Norm Ped 1 call St Bar A St Bar B

See attached detection sheet  
 for D-connector pin  
 assignments

A. CONTROLS

	RANGE (SEC)
Extend Time	00-99
Delay Time	00-999

4. UNIT DATA - 1. STARTUP & MISCELLANEOUS

Start up time : 10 (00-99) State : 0 (0 = fl, 1 = red)  
 Auto ped clear : 0 Red revert : 7-0 (2.0 - 9.9)  
 Stop time reset : 0 (0 = No, 1 = Yes)

4. UNIT DATA - 2. REMOTE FLASH

Phase	1	2	3	4	5	6	7	8	A	B	C	D	E	F	G	H
FLASH																
YEL																
ALT																
ENTER				1												
EXIT		1														

Test A = Remote Flash:  (0 = no & 1 = yes)

6. TIME BASE - 0. SPC FUNCTION MAPPING

FUNCTION NAME  
 AS 8-15 = OLI - P FL G PHS  
 AS 8-15 = OLI - P FL R PHS

SPC FUNC							
1	2	3	4	5	6	7	8

NOTE: Go up after entering to get this screen.

4. UNIT DATA - 6. ALT SEQ. 08-15

EPAC ALT SEQ (PHASE PAIR TO REVERSE)

SEQ	.PP1.	.PP2.	.PP3.	.PP4.	.PP5.	.PP6.
08						
09						
10						
11						

SEQ	.PP1.	.PP2.	.PP3.	.PP4.	.PP5.	.PP6.
12						
13						
14						
15						

4. UNIT DATA - 3. OVERLAP STANDARD

Phase	1	2	3	4	5	6	7	8	CH#
Overlap A									
Overlap B									
Overlap C									
Overlap D									
Overlap E									
Overlap F									
Overlap G									
Overlap H									

Phase	1	2	3	4	5	6	7	8	CH#
Overlap I									
Overlap J									
Overlap K									
Overlap L									
Overlap M									
Overlap N									
Overlap O									
Overlap P									

Enter a "1" in the channel # shown.

0 = Phase not part of overlap; 1 = Phase part of overlap.

4. UNIT DATA - 4. OVERLAP SPECIAL

Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Trail green																
Trail yellow																
Trail red																
-Green / -yellow (-G/Y)																
+Green (+GRN)																

- \* Overlap green omitted by # - phase green; Overlap yellow omitted by # - phase yellow
- \* For FYA operation, '-G/Y' entry defines the phase that is the green arrow
- \* For FYA operation, '+GRN' entry is the thru phase opposing the FYA phase



4. UNIT DATA - 8. I/O MISCELLANEOUS

Ring#	1	2	3	4	CONN	MODE
Input Response	1				"D"	
Output Select	1				"D"	

Connector "D" : 0 = Standard & 1 = Alternate

I/O Modes	INPUT	OUTPUT
"ABC" Connector		
"D" Connector		

Controller with Solo Detection:  
 EPAC300/M52 enter "1" under D Conn Input  
 2070 enter "0" under D Conn Input

5. COORDINATION DATA - 1. COORD SETUP

	0	1	2	3	4	5
OPER: <u>1</u>	FRE	AUT	MAN	-----	-----	-----
MODE: <u>0</u>	PRM	YLD	PYL	POM	SOM	FAC
MAX : <u>0</u>	INH	MX1	MX2	-----	-----	-----
CORR: <u>2</u>	DWL	MDW	SWY	SW+	-----	-----
OFST: _____	BEG END OF GREEN					
FRCE: _____	PLN CYC LE TIME					
MX DWELL: _____	YIELD PERIOD:					

5. COORDINATION DATA - 2. MANUAL CONTROL

DIAL: \_\_\_\_\_ SPLIT: \_\_\_\_\_ OFFSET: \_\_\_\_\_ SYNC: \_\_\_\_\_

To set cycle zero in manual control enter "1" for sync then press "E".

5. COORDINATION DATA - 3. DIAL/SPLIT DATA

Mode: 0 = actuated, 1 = coord phase, 2 = minimum recall, 3 = maximum recall,  
 4 = pedestrian recall, 5 = maximum + pedestrian recall, 6 = phase omit,  
 7 = dual coord phase.

Sequence: 00 - 15 (Unit data has definition)

Ring Lag: Ring offset from local cycle zero when not barrier locked to Ring #1.

Time: 00 - 99 seconds.

5. COORDINATION DATA - 3. DIAL/SPLIT DATA

LEVEL 2

DIAL 1 / SPLIT 1 CYCLE LENGTH: 110 sec

PHASE	1	2	3	4	5	6	7	8
TIME		86		24				
MODE		1		3				

DIAL 1 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 1 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 1 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 1 CYCLE LENGTH: 90 secs

PHASE	1	2	3	4	5	6	7	8
TIME		63		27				
MODE		1		3				

DIAL 2 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

LEVEL 1

OFFSET	1	2	3
TIME	25		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

OFFSET	1	2	3
TIME	41		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			



5. COORDINATION DATA - 3. DIAL/SPLIT DATA

LEVEL 2

DIAL 3 / SPLIT 1 CYCLE LENGTH: 120 secs

PHASE	1	2	3	4	5	6	7	8
TIME		92		28				
MODE		1		3				

DIAL 3 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 1 CYCLE LENGTH: 110 secs

PHASE	1	2	3	4	5	6	7	8
TIME		75		35				
MODE		1		3				

DIAL 4 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

LEVEL 1

OFFSET	1	2	3
TIME	78		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

OFFSET	1	2	3
TIME	25		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN**  
**PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070**

Item A.

6. TIME BASE DATA - 2. SET TIME / DATE

-- DATE --	-- TIME --	BEG	-- DST --	END
MM/DD/YY	HH:MM:SS	MM SW	MM	SW
/   /	:   :	<u>  3  </u> <u>  2  </u>	<u> 11 </u>	<u>  1  </u>

CYCLE ZERO: 24:00 (HH:MM - EVENT)

STZ DIFF: -18000 (GPS OFFSET)

2. UTILITIES - 8. CONFIGURE PORTS - 8. GPS CONFIGURATION

GPS:   1   (0-NO, 1-YES)    PORT:   4  

6. TIME BASE DATA - 3. TRAFFIC EVENTS

PRO DAY	TIME H H : M M	COORD P A T R N	MAX 2					OMIT					
			P H A S E # S					P H A S E # S					
* * *	* * * * *	D / S / O	* * * * *	* * * * *	* * * * *	* * * * *	* * * * *	* * * * *	* * * * *	* * * * *	* * * * *	* * * * *	
01	00:00	5151											
01	05:30	1111											
01	23:00	5151											
02	00:00	5151											
02	05:30	1111											
02	06:00	2111											
02	09:00	1111											
02	13:55	4111											
02	14:25	1111											
02	15:00	3111											
02	19:00	1111											
02	23:00	5151											
	:	11											
	:	11											
	:	11											
	:	11											
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	:	11											

REFERENCE DATA  
 PRO DAY = 01 - 99  
 (Program day)

HH:MM = 24 Hour clock

PATTERN: (D/S/O)  
 FLASH = 5/5/  
 FREE = 0/0/4

MAX2 & OMIT:  
 Call free, set pattern  
 to 0/0/0.

D = DIAL #  
 S = SPLIT #  
 0 = OFFSET #

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN**  
**PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070**

Item A.

**6. TIME BASE DATA - 4. AUXILIARY EVENTS**

PRO DAY	TIME HH : MM	AUX			DET VALUE			DIM DIM
		A1	A2	A3	D1	D2	D3	
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							
	:							

REFERENCE DATA:  
 PRO DAY = 00 - 99  
 (Program day)

HH:MM = 24 Hour clock

AUX = Output states  
 DET VALUE:  
 1 = Det diag value  
 2 = Enables report  
 3 = Repeat multiplier

DIM = Dimming state

ALL: 0 = off, 1 = on

**6. TIME BASE DATA - 5. TIME OF YEAR EVENTS**

DATE			SPECIAL		DATE			SPECIAL	
MM	DD	YY	DAY	WEEK	MM	DD	YY	DAY	WEEK
/	/	/			/	/	/		
/	/	/			/	/	/		
/	/	/			/	/	/		
/	/	/			/	/	/		
/	/	/			/	/	/		
/	/	/			/	/	/		
/	/	/			/	/	/		
/	/	/			/	/	/		

REFERENCE DATA  
 Special day = Any  
 program day 00 - 99.

Special week:  
 Week 0 = Pro Day 01-07  
 Week 1 = Pro Day 11-17  
 Week 2 = Pro Day 21-27

**6. TIME BASE DATA - 6. EQUATE/TRANSFER**

CODE: 0 (0 = equate, 1 = transfer)

FROM	<u>01</u>	<u>=</u>	<u>07</u>						
	<u>02</u>	<u>=</u>	<u>03</u>	<u>04</u>	<u>05</u>	<u>06</u>			
		<u>=</u>							
		<u>=</u>							
		<u>=</u>							
		<u>=</u>							

DAY EQUATE: Care must be taken to insure days are not equated to undefined days or days that are equated to other days. The result will be a day without events to run.

7. PREEMPT DATA - 1. ALL PREEMPTS

RING TIMES	1	2	3	4		
MIN GREEN/WALK						
OVERRIDE	FL	1/2	2/3	3/4	4/5	5/6
STATUS						
CODES	0 = NO, 1 = YES					

7. PREEMPT DATA - PREEMPT 1

1. MISC DATA: (0 = no, 1 = yes)

TEST.:  N-LOCK.:  LINK PR#.:   
 DELAY:  EXTEND:  DURATION:   
 MXCALL:  LOCK OUT:

RING	1	2	3	4	5	6	7	8
EXIT								
CALLS								

2. INTERVAL TIMES:

SEL PED CLR:  TRK YEL CHG:   
 SEL YEL CHG:  TRK RED CLR:   
 SEL RED CLR:  DWELL GREEN:   
 TRACK GREEN:  RET PED CLR:   
 TRK PED CLR:  RET YEL CHG:   
 RET YEL CLR:

3. VEHICLE STATUS:

PHASE	1	2	3	4	5	6	7	8
TRK GRN								
DWELL								
(0=red, 1=grn, 2=flr, 3=fly, 4=dark)								
CYCLE								
(0=no, 1=act, 2=min recall, 3=max recall)								

4. PEDESTRIAN STATUS:

PHASE	1	2	3	4	5	6	7	8
TRK GRN								
DWELL								
(0=dont wlk, 1=wlk, 2=flwlk, 3=dark)								
CYCLE								
(0 = no, 1 = act, 2 = recall)								

5. OVERLAP STATUS:

OVERLAP	A	B	C	D
TRK GRN				
DWELL				
(0=red, 1=grn, 2=flr, 3=fly, 4=dark)				
CYCLE				
(0 = no, 1 = act)				

6. LOW PRIORITY: (0=no, 1=yes)

TEST.: <input type="checkbox"/>	N-LOCK.: <input type="checkbox"/>	SKIP.....: <input type="checkbox"/>						
DELAY: <input type="checkbox"/>	EXTEND: <input type="checkbox"/>	DURATION: <input type="checkbox"/>						
DWELL: <input type="checkbox"/>	MXCALL: <input type="checkbox"/>	LOCK OUT: <input type="checkbox"/>						
RING	1	2	3	4	5	6	7	8
DWELL								
CALLS								

SIGNAL PHASING

PHASE#	ROAD	PHASE	LOAD SW	FLASH
1				
2	EB M-59	A	2	A
3				
4	X10 W/O BOGIE LAKE	B	A	R
5				
6				
7				
8				
OLA				
OLB				
OLC				
OLD				
1PED				
2PED				
3PED				
4PED				
5PED				
6PED				
7PED				
8PED				

Controller Information Sheet  
4 Phase EPAC

Intersection : EB M-59 & X/O W/O Bogie Lake  
 City/Twp : White Lake  
 State No. : 63041-01-129  
 County No. : 4136  
 Prepared By : Rachel Jones  
 Date : 11/1/11

## Phasing:

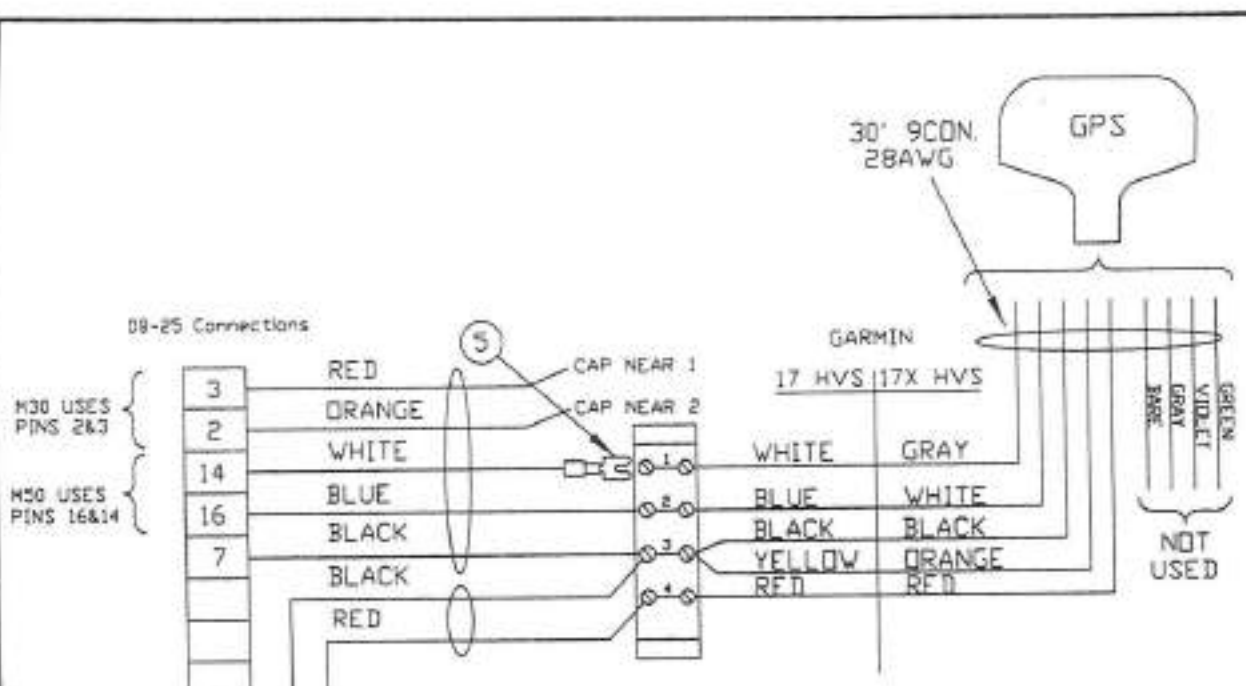
Load Switch 2: EB M-59	A	FLA
Load Switch 4: X/O W/O Bogie Lake	B	FLR

## Jumpers:

121-213, 151-152, 153-154, 155-156, 173-174, 175-176, 177-178, 233-PB1, 237-PB1, 241-PB1,  
 255-256, 257-258, 259-260, 261-262, 263-PB1.

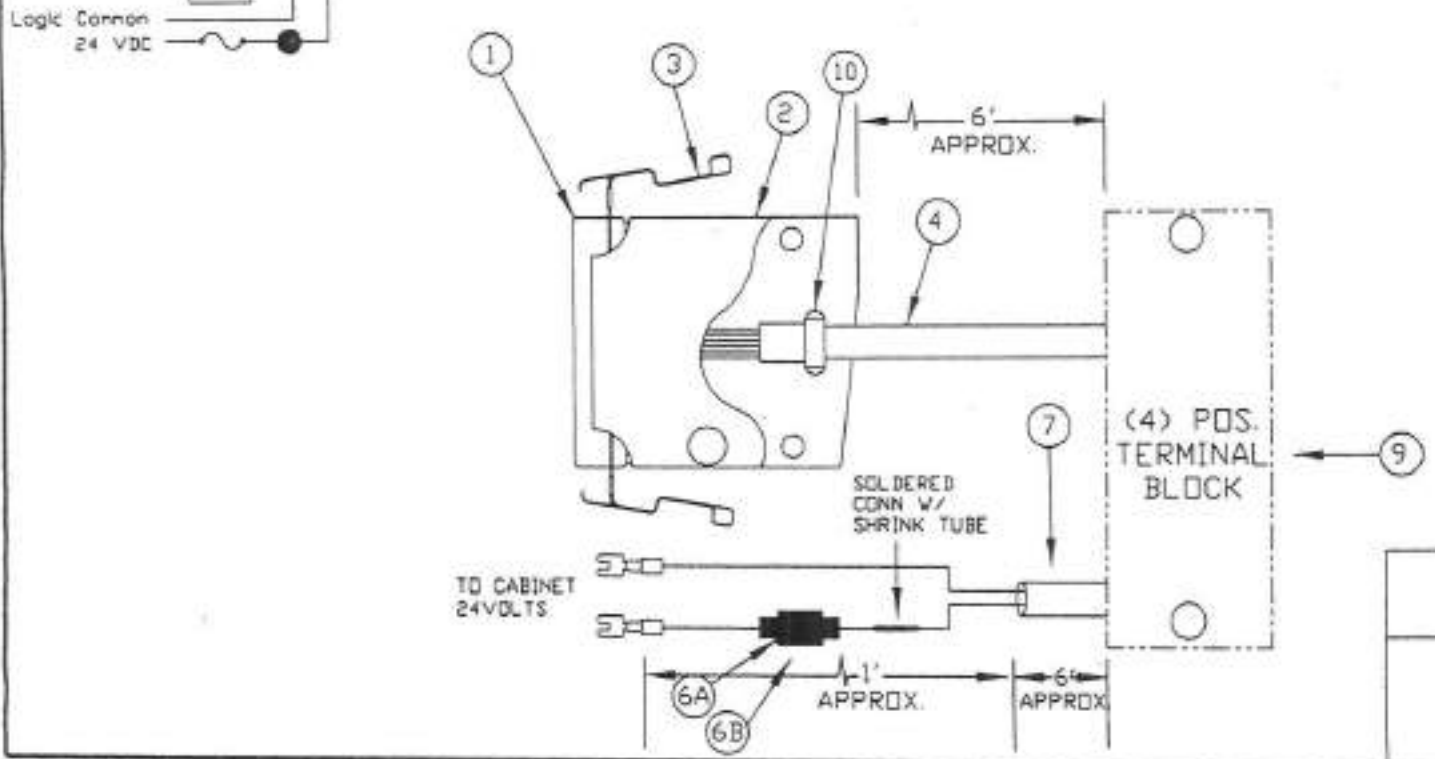
## Signal Monitor : NONE

All switched OFF EXCEPT: Dual Select A&B; G&Y Enable; SSM 2,4.  
 Minimum Flash = 4+2+1



DET. No.	DESCRIPTION	VENDOR	PART No.	QTY.
1	DB-25 MALE	AMP	747912-4	1
2	HOUSING KIT	AMP	207343-1	1
3	SPRING LATCH DB CONNECTOR	NEWARK	44F8751	2
4	6 CONDUCTOR 28AWG	Alpha	1176C	6 FT
5	TERMINAL	3M	HV58-1878	7
6A	FUSE HOLDER NEWARK #6TK1434			
6B	FUSE (1/2A), NEWARK #277654			
7	2 CONDUCTOR BOLDEN CABLE # 8205-060			
8	(2) CHANNEL NUTS UNISTRUT TEAL #A4006-1032EG			
8A	(2) Screw 10-32 x 1" pan head phillips SS			
8B	(2ea) #10 lock washer/flat washer/fender washer			
9	4 POSITION TERMINAL BLOCK NEWARK #28F724			
10	TIE-RAP			

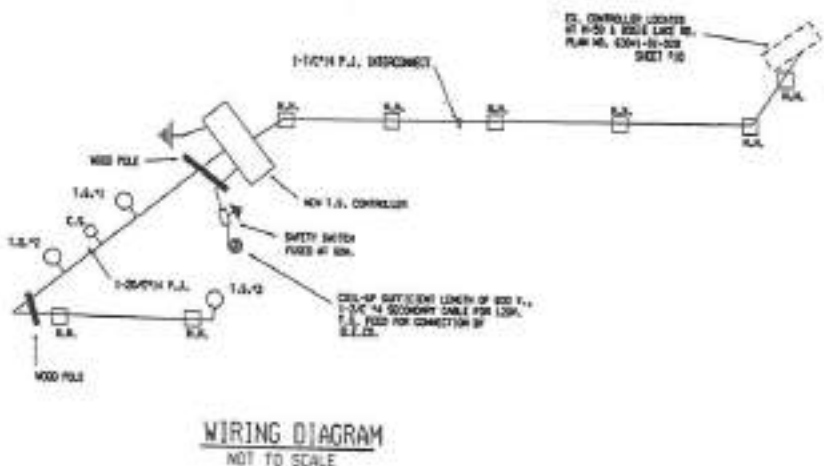
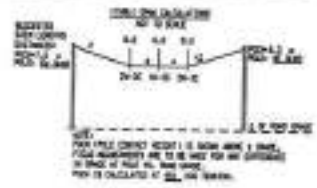
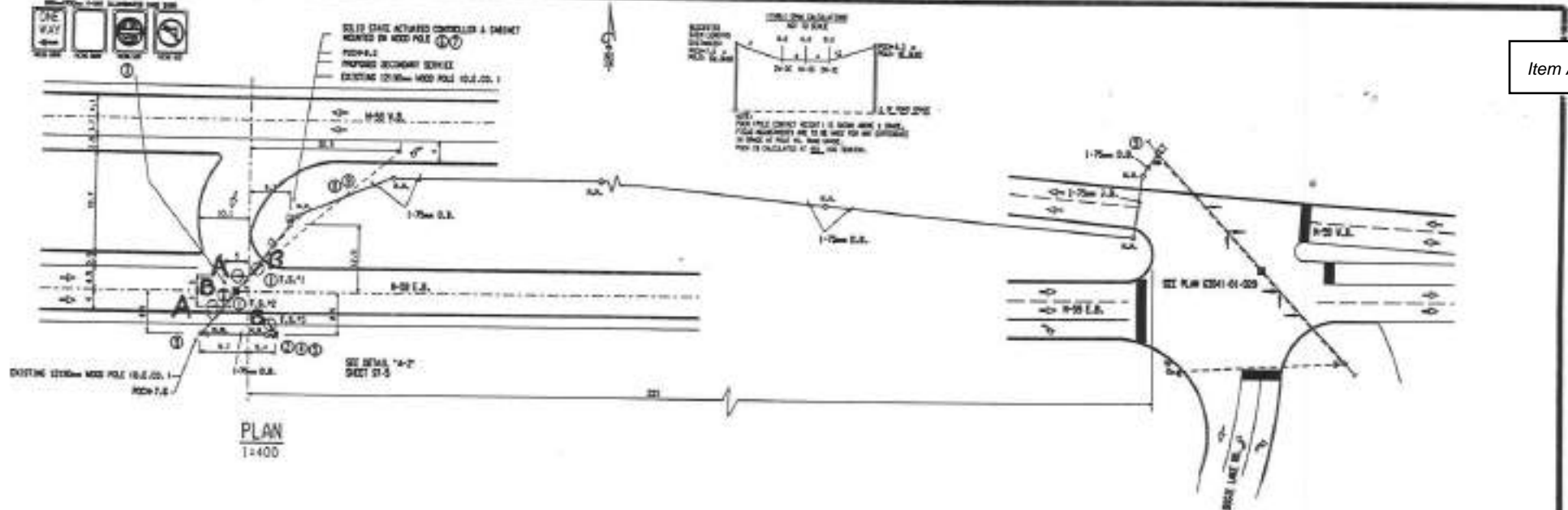
REVISED 11/10/09 DG (17X HVS)



CARRIER AND GABLE INC.  
TECH SERVICES

5020  
GPS TO SEPAC





CONTACT: GARY WILLIAMS (D.E.CO.)  
 248-745-9036 FOR INSTALLATION OF 12" 12190mm  
 WOOD POLES, SPAN WIRE AND SECONDARY SERVICE.  
 NO COST TO CONTRACTOR.

FOR ELECTRICAL SERVICE INSPECTION  
 CONTACT THE MICHIGAN DEPARTMENT OF  
 LABOR AT 517-241-9320.  
 COST TO CONTRACTOR WILL BE \$40.00.

**LIST OF MATERIAL**

NO.	ITEM	QUANTITY	UNIT PRICE
①	75, 2 Way Span Wire Pole	2 EACH	4500.00
②	75, 1 Way Federal Pole	1 EACH	800.00
③	Case Study, Coy. No. 522 mm by 750 mm	3 EACH	4200.00
④	Federal, Pole	1 EACH	8200.00
⑤	Federal, Pole	1 EACH	8200.00
⑥	Controller and Cabinet, Solid State Actuated	1 EACH	8200.00
⑦	Controller and Cabinet, Solid State Actuated, Delivered	1 EACH	8200.00
⑧	Safety Switch	1 EACH	800.00
⑨	Wood Pole, 75' dia, 75' Cable Pole	3 EACH	8100.00
⑩	W. Board	6 Ea.	8100.00
⑪	Conductors, 3/4" 75 mm	230m	8100.00
⑫	Conductors, Jacketed Board	10, 7m	8100.00
⑬	P.J., Cable, 800V, 1, 120' x 1/4"	24m	8100.00

All dimensions are in meters unless otherwise noted.

CONTROL SECTION	JOB NUMBER	PROJECT	ITEM	DATE	NO.	BY	SCALE
MIG 63900	457506						

**MDOT**  
 Michigan Department of Transportation  
 DIVISION OF HIGHWAYS  
 400 EAST LANSING AVENUE  
 LANSING, MICHIGAN 48201

H-55 (INDUSTRIAL) E.S. AT  
 2-DIVER N. OF BOULEVARD NO.  
 WHITE LAKE TWP.,  
 WASHTENAW COUNTY, MI.

OAKLAND COUNTY ROAD COMMISSION  
TRAFFIC - SAFETY DEPARTMENT  
SIGNAL WORK ORDER

1-17-17

LOCATION: WB M-59 & X/O E/O Bogie LK/No DATE: ~~12/9/16~~

CITY/TOWNSHIP: White Lake BY: E Labiano

COUNTY#: 4139 STATE#: 63041-01-229 CHARGES: WO 168612

PLEASE PERFORM THE FOLLOWING:

ELECTRICAL DEVICE:  INSTALL  MODERNIZE  MAINTENANCE

UNDERGROUND: \_\_\_\_\_ JAN 23 2017

EDISON OK:  YES  NO JOB#: \_\_\_\_\_

COORDINATE W/DISTRICT 7: \_\_\_\_\_

	DIAL..															
	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4
	SPLIT.															
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<input checked="" type="checkbox"/> CHANGE TIMING/MODE.....									X							
<input checked="" type="checkbox"/> CHANGE OFFSET.....	X															
<input type="checkbox"/> CHANGE CYCLE LENGTH.....																
<input checked="" type="checkbox"/> ADD DIAL/SPLIT.....													X			

CHANGE BREAKOUT OR EPROM: \_\_\_\_\_

CHANGE HOURS OF OPERATION:  
OLD: 5am - Midnight  
NEW: 5:30 am - 11pm

REPROGRAM TBC (Traffic Events)

INSTALL INTERCONNECT:  TBC  MINITROL  TONE

MBT OK:  YES  NO

NO CHANGE - RECORD CORRECTION

OTHER: Rev 9

\* MDOT RETIMING - FINAL

APPROVED BY:  DATE: 1/17/17

DATE INSTALLED: 1/21/17

INSTALLED BY: Richardson Casey

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN**  
**PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070**

INTERSECTION: WB M50 (HIGHLAND) & X/O E/O BOGIE LAKE (NORDIC)

CITY/VILLAGE/TOWNSHIP: WHITE LAKE

COUNTY#: 4139 MDOT#: 63041-01-229 REV#: 9 DETROIT EDISON#: \_\_\_\_\_

DRAWN BY: E Labiano APPROVED BY: [Signature] DATE DRAWN: 1/17/17

INSTALLED BY: \_\_\_\_\_ DATE INSTLD: 1/1/17

HOURS OF OPERATION: 7 DAYS: 5:30 AM - 11:00 PM

HOURS OF FLASHING: 7 DAYS: 11:00 PM - 5:30 AM

2. UTILITIES - 1. ACCESS

CODE: \_\_\_\_\_: 1612 CODE: Four digits (0000 - 9999)

4. UNIT DATA - 5. RING STRUCTURE

\*\*\*\*\*  
 \*\*\*\*\* NOTE: INSERT ALL RING #'S FIRST, THEN NXT & CONCUR \*\*\*\*\*  
 \*\*\*\*\*

CHANNEL:	RING	PHNXT	CONCURRENT PHASES																CHANNEL									
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	VEH	PED								
PHASE 1:			1																									
PHASE 2:	1	4		1																							2	9
PHASE 3:					1																							
PHASE 4:	1	2				1																					4	
PHASE 5:							1																					
PHASE 6:								1																				
PHASE 7:									1																			
PHASE 8:										1																		
PHASE 9:											1																	
PHASE 10:												1																
PHASE 11:													1															
PHASE 12:														1														
PHASE 13:															1													
PHASE 14:																1												
PHASE 15:																	1											
PHASE 16:																		1										

CODES:  
 RING ..... Ring Number for Phase (1-4)  
 PHNXT ..... Phase Next in Ring (1-16)  
 CONCUR PH Phases To Be Concurrent (0=NO, 1=YES)  
 For vehicle channel & ped channel, enter "1" under channel# shown.

3. PHASE DATA - 1. BASIC TIMINGS

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	RANGE	
Minimum Green		10		7														00-99
Passage																		0.0-9.9
Maximum #1		9.2		2.8														000-999
Maximum #2																		000-999
Yellow Clearance		4.7		3.0														3.0-9.9
Red Clearance		1.4		2.9														0.0-9.9

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070**

Item A.

**3. PHASE DATA - 3. PEDESTRIAN TIMINGS**

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	RANGE (SEC)
Walk		7															00-99
Pedest Clearance		11															00-99
Flashing Walk																	
Extend Ped Clear																	
Act Rest in Walk																	

**3. PHASE DATA - 4. INITIALIZE & NON ACTUATED RESPONSE**

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Initial		4		1												
NA Response																

CODES:                    0                    1                    2                    3                    4  
 Initial                none                inactive            red                yellow            green  
 NA Response        none                to 1                to 2                both                -----

**3. PHASE DATA - 5. VEHICLE & PEDESTRIAN RECALLS**

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Vehicle Recall		3		3												
Pedestrian Recall		2														

CODES:                    0                    1                    2                    3                    4  
 Vehicle                none                1 call                min                max                soft  
 Pedestrian            none                1 call                ped                bot N. A.            -----

**3. PHASE DATA - 6. NONLOCK & MISC CONTROLS**

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Nonlock Memory																
Dual Entry																
Last Car Passage																
Conditional Service																

CODES:                    0 = NO                1 = YES

**3. PHASE DATA - 8. SPECIAL DETECTOR - 0. SPC 1-8 (Epac 300/M52)**

Detector # on Print	1	2	3	4	5	6	7	8
EPAC/M52 "D" Connector	1	6	7	8	4	5	2	3
Assigned Phase								

CODES:                    0                    1                    2                    3                    4  
 Operation Mode: Norm Veh    Norm Ped    1 call    St Bar A    St Bar B

See attached detection sheet  
for D-connector pin  
assignments

**A. CONTROLS**

	RANGE (SEC)
Extend Time	00-99
Delay Time	00-999

**3. PHASE DATA - 8. SPECIAL DETECTOR - 2. VEH 9-16 (2070)**

Detector # on Print	1	2	3	4	5	6	7	8
2070 "D" Connector	9	10	11	12	13	14	15	16
Assigned Phase								

CODES:                    0                    1                    2                    3                    4  
 Operation Mode: Norm Veh    Norm Ped    1 call    St Bar A    St Bar B

See attached detection sheet  
for D-connector pin  
assignments

**A. CONTROLS**

	RANGE (SEC)
Extend Time	00-99
Delay Time	00-999



ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

4. UNIT DATA - 1. STARTUP & MISCELLANEOUS

Start up time : 10 (00-99) State : 0 (0 = fl, 1 = red)  
Auto ped clear : 0 Red revert : 7-0 (2.0 - 9.9)  
Stop time reset : 0 (0 = No, 1 = Yes)

4. UNIT DATA - 2. REMOTE FLASH

Phase	1	2	3	4	5	6	7	8	A	B	C	D	E	F	G	H
FLASH																
YEL																
ALT																
ENTER				1												
EXIT		1														

Test A = Remote Flash: 0 (0 = no & 1 = yes)

6. TIME BASE - 0. SPC FUNCTION MAPPING

FUNCTION NAME	SPC FUNC							
	1	2	3	4	5	6	7	8
AS 8-15 = OLI - P FL G PHS								
AS 8-15 = OLI - P FL R PHS								

NOTE: Go up after entering to get this screen.

4. UNIT DATA - 6. ALT SEQ. 08-15

EPAC ALT SEQ (PHASE PAIR TO REVERSE)

SEQ	.PP1.	.PP2.	.PP3.	.PP4.	.PP5.	.PP6.	SEQ	.PP1.	.PP2.	.PP3.	.PP4.	.PP5.	.PP6.
08							12						
09							13						
10							14						
11							15						

4. UNIT DATA - 3. OVERLAP STANDARD

Phase	1	2	3	4	5	6	7	8	CH#	Phase	1	2	3	4	5	6	7	8	CH#	
Overlap A										Overlap I										
Overlap B										Overlap J										
Overlap C										Overlap K										
Overlap D										Overlap L										
Overlap E										Overlap M										
Overlap F										Overlap N										
Overlap G										Overlap O										
Overlap H										Overlap P										

Enter a "1" in the channel # shown.

0 = Phase not part of overlap; 1 = Phase part of overlap.

4. UNIT DATA - 4. OVERLAP SPECIAL

Overlap	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Trail green																
Trail yellow																
Trail red																
-Green / -yellow (-G/Y)																
+Green (+GRN)																

- \* Overlap green omitted by # - phase green; Overlap yellow omitted by # - phase yellow
- \* For FYA operation, '-G/Y' entry defines the phase that is the green arrow
- \* For FYA operation, '+GRN' entry is the thru phase opposing the FYA phase

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070**

**4. UNIT DATA - 8. I/O MISCELLANEOUS**

Ring#	1	2	3	4	CONN	MODE
Input Response	1				"D"	
Output Select	1				"D"	

Connector "D" : 0 = Standard & 1 = Alternate

I/O Modes	INPUT	OUTPUT
"ABC" Connector	1	
"D" Connector		

Controller with Solo Detection:  
EPAC300/M52 enter "1" under D Conn Input  
2070 enter "0" under D Conn Input

**5. COORDINATION DATA - 1. COORD SETUP**

	0	1	2	3	4	5
OPER: <u>1</u>	FRE	AUT	MAN	-----	-----	-----
MODE: <u>0</u>	PRM	YLD	PYL	POM	SOM	FAC
MAX : <u>0</u>	INH	MX1	MX2	-----	-----	-----
CORR: <u>2</u>	DWL	MDW	SWY	SW+	-----	-----
OFST: <u>0</u>	BEG	END	OF GREEN			
FRCE: <u>0</u>	PLN	CYC	LE TIME			
MX DWELL: <u>0</u>			YIELD PERIOD: <u>0</u>			

**5. COORDINATION DATA - 2. MANUAL CONTROL**

DIAL: \_\_\_\_\_ SPLIT: \_\_\_\_\_ OFFSET: \_\_\_\_\_ SYNC: \_\_\_\_\_

To set cycle zero in manual control enter "1" for sync then press "E".

**5. COORDINATION DATA - 3. DIAL/SPLIT DATA**

Mode: 0 = actuated, 1 = coord phase, 2 = minimum recall, 3 = maximum recall,  
4 = pedestrian recall, 5 = maximum + pedestrian recall, 6 = phase omit,  
7 = dual coord phase.

Sequence: 00 - 15 (Unit data has definition)

Ring Lag: Ring offset from local cycle zero when not barrier locked to Ring #1.

Time: 00 - 99 seconds.



ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
 PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

5. COORDINATION DATA - 3. DIAL/SPLIT DATA

LEVEL 2

DIAL 1 / SPLIT 1 CYCLE LENGTH: 110 secs

PHASE	1	2	3	4	5	6	7	8
TIME		86		24				
MODE		1		3				

DIAL 1 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 1 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 1 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 1 CYCLE LENGTH: 90 secs

PHASE	1	2	3	4	5	6	7	8
TIME		63		27				
MODE		1		3				

DIAL 2 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 2 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

LEVEL 1

OFFSET	1	2	3
TIME	29		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

OFFSET	1	2	3
TIME	45		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
 PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

Item A.

5. COORDINATION DATA - 3. DIAL/SPLIT DATA

LEVEL 2

DIAL 3 / SPLIT 1 CYCLE LENGTH: 120 secs

PHASE	1	2	3	4	5	6	7	8
TIME		92		28				
MODE		1		3				

DIAL 3 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 3 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 1 CYCLE LENGTH: 110 secs

PHASE	1	2	3	4	5	6	7	8
TIME		75		35				
MODE		1		3				

DIAL 4 / SPLIT 2 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 3 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

DIAL 4 / SPLIT 4 CYCLE LENGTH:

PHASE	1	2	3	4	5	6	7	8
TIME								
MODE								

LEVEL 1

OFFSET	1	2	3
TIME	31		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

OFFSET	1	2	3
TIME	29		
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			
OFFSET	1	2	3
TIME			
SEQUENCE			
RING 2 LAG			
RING 3 LAG			
RING 4 LAG			

ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN  
 PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070

Item A.

6. TIME BASE DATA - 2. SET TIME / DATE

-- DATE --                                      -- TIME --                                      BEG -- DST -- END  
 MM/DD/YY                                      HH:MM:SS       MON & WEEK:    MM   SW       MM   SW  
     /       :    :    3   2       11   1

CYCLE ZERO: 24 : 00 (HH:MM - EVENT)

STZ DIFF: -18000 (GPS OFFSET)

2. UTILITIES - 8. CONFIGURE PORTS - 8. GPS CONFIGURATION

GPS: 1 (0-NO, 1-YES)       PORT: 4

6. TIME BASE DATA - 3. TRAFFIC EVENTS

PRO DAY	TIME H H : M M	COORD PATRN	MAX 2 PHASE #S	OMIT PHASE #S
* * *	* * * * *	D / S / O	* * * * * * * * *	* * * * * * * * *
01	00:00	5/5/1		
01	05:30	1/1/1		
01	23:00	5/5/1		
02	00:00	5/5/1		
02	05:30	1/1/1		
02	06:00	2/1/1		
02	09:00	1/1/1		
02	13:55	4/1/1		
02	14:25	1/1/1		
02	25:00	3/1/1		
02	19:00	1/1/1		
02	23:00	5/5/1		
	:	/ /		
	:	/ /		
	:	/ /		
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REFERENCE DATA  
 PRO DAY = 01 - 99  
 (Program day)

HH:MM = 24 Hour clock

PATTERN: (D/S/O)  
 FLASH = 5/5/  
 FREE = 0/0/4

MAX2 & OMITs:  
 Call free, set pattern  
 to 0/0/0.

D = DIAL #  
 S = SPLIT #  
 O = OFFSET #

Item A.

6. TIME BASE DATA - 4. AUXILIARY EVENTS

PRO DAY	TIME HH : MM	AUX			DET VALUE			DIM DIM
		A1	A2	A3	D1	D2	D3	
:	:							
:	:							
:	:							
:	:							
:	:							
:	:							
:	:							
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REFERENCE DATA:  
 PRO DAY = 00 - 99  
 (Program day)  
  
 HH:MM = 24 Hour clock  
  
 AUX = Output states  
 DET VALUE:  
 1 = Det diag value  
 2 = Enables report  
 3 = Repeat multiplier  
  
 DIM = Dimming state  
  
 ALL: 0 = off, 1 = on

6. TIME BASE DATA - 5. TIME OF YEAR EVENTS

DATE			SPECIAL		DATE			SPECIAL	
MM / DD / YY			DAY	WEEK	MM / DD / YY			DAY	WEEK
/ /					/ /				
/ /					/ /				
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/ /					/ /				
/ /					/ /				

REFERENCE DATA  
 Special day = Any  
 program day 00 - 99.  
  
 Special week:  
 Week 0 = Pro Day 01-07  
 Week 1 = Pro Day 11-17  
 Week 2 = Pro Day 21-27

6. TIME BASE DATA - 6. EQUATE/TRANSFER

CODE: 0 (0 = equate, 1 = transfer)

FROM

01	=	07					
02	=	03	04	05	06		
	=						
	=						
	=						
	=						
	=						
	=						

DAY EQUATE: Care must be taken to insure days are not equated to undefined days or days that are equated to other days. The result will be a day without events to run.

**ROAD COMMISSION FOR OAKLAND COUNTY, WATERFORD, MICHIGAN**  
**PROGRAM LOG FOR EAGLE SIGNAL CONTROLLER Epac300, Mod 52 and 2070**

Item A.

**7. PREEMPT DATA - 1. ALL PREEMPTS**

RING TIMES	1	2	3	4		
MIN GREEN/WALK						
OVERRIDE	FL	1/2	2/3	3/4	4/5	5/6
STATUS						
CODES	0 = NO, 1 = YES					

**7. PREEMPT DATA - PREEMPT 1**

1. MISC DATA: (0 = no, 1 = yes)

TEST..: \_\_\_ N-LOCK.: \_\_\_ LINK PR#..: \_\_\_  
 DELAY: \_\_\_ EXTEND: \_\_\_ DURATION: \_\_\_  
 MXCALL: \_\_\_ LOCK OUT: \_\_\_

RING	1	2	3	4	5	6	7	8
EXIT								
CALLS								

2. INTERVAL TIMES:

SEL PED CLR: \_\_\_ TRK YEL CHG: \_\_\_  
 SEL YEL CHG: \_\_\_ TRK RED CLR: \_\_\_  
 SEL RED CLR: \_\_\_ DWELL GREEN: \_\_\_  
 TRACK GREEN: \_\_\_ RET PED CLR: \_\_\_  
 TRK PED CLR: \_\_\_ RET YEL CHG: \_\_\_  
 RET YEL CLR: \_\_\_

3. VEHICLE STATUS:

PHASE	1	2	3	4	5	6	7	8
TRK GRN								
DWELL								
(0=red, 1=grn, 2=flr, 3=fly, 4=dark)								
CYCLE								
(0=no, 1=act, 2=min recall, 3=max recall)								

4. PEDESTRIAN STATUS:

PHASE	1	2	3	4	5	6	7	8
TRK GRN								
DWELL								
(0=dont wlk, 1=wlk, 2=flwk, 3=dark)								
CYCLE								
(0 = no, 1 = act, 2 = recall)								

5. OVERLAP STATUS:

OVERLAP	A	B	C	D
TRK GRN				
DWELL				
(0=red, 1=grn, 2=flr, 3=fly, 4=dark)				
CYCLE				
(0 = no, 1 = act)				

6. LOW PRIORITY: (0=no, 1=yes)

TEST..: ___	N-LOCK.: ___	SKIP.....: ___						
DELAY: ___	EXTEND: ___	DURATION: ___						
DWELL: ___	MXCALL: ___	LOCK OUT: ___						
RING	1	2	3	4	5	6	7	8
DWELL								
CALLS								

**SIGNAL PHASING**

PHASE#	ROAD	PHASE	LOAD SW	FLASH
1				
2	M59	A	2	A
3				
4	X10 E10 BOGIE LAKE / NORDIC	B&C	4	R
5				
6				
7				
8				
OLA				
OLB				
OLC				
OLD				
1PED				
2PED	WB M-59 PED (NORTH LEG)	WA	6	-
3PED				
4PED				
5PED				
6PED				
7PED				
8PED				



Controller Information Sheet  
4 Phase EPAC  
M Cabinet

Intersection: WB M-59 & X/O EIO Bogie Lake / Nordic  
City/Twp/State No.: White Lake  
County No. Prepared: 63041-01-229  
By Date: 4139  
Dawn Bierlein  
11/16/15

Phasing:

Load Switch 2: M-59	A	FLA
Load Switch 4: X/O EIO Bogie Lake / Nordic	B&C	FLR
Load Switch 6: WB M-59 Ped (North Leg)	WA	

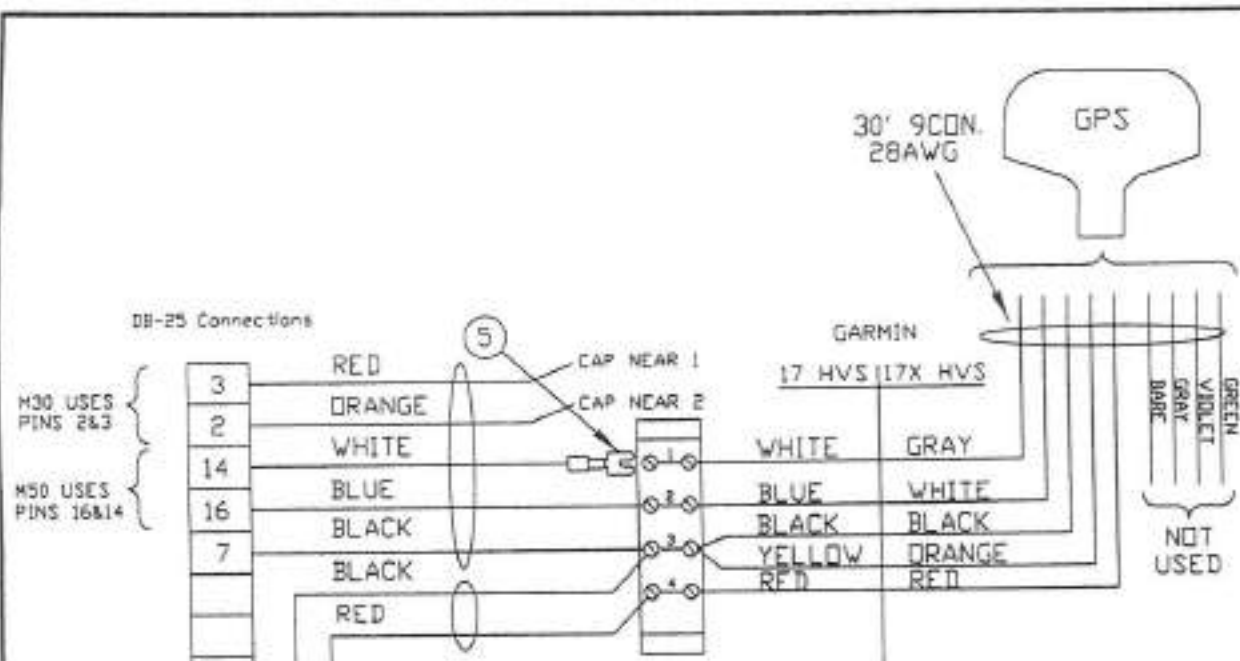
Jumpers:

121-213, 151-152, 153-154, 155-156, 173-174, 175-176, 177-178, 179-180, 185-186,  
233-PB1, 237-PB1, 241-PB1, 255-256, 257-258, 259-260, 261-262, 263-PB1, 268-269.

Signal Monitor : NONE

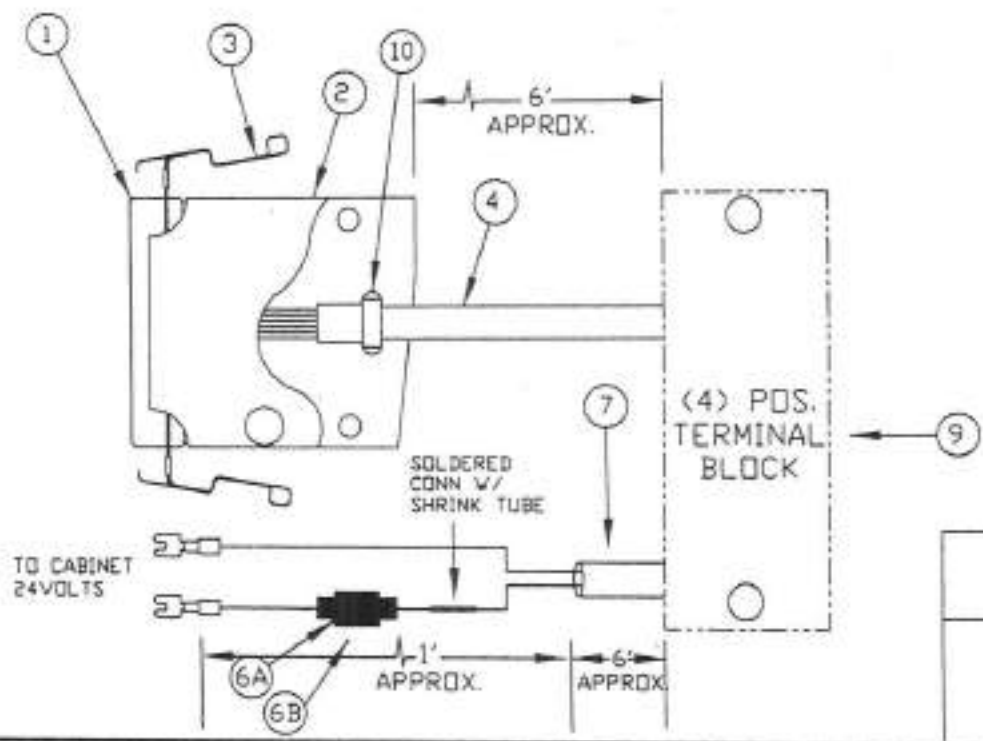
All switched OFF EXCEPT: Dual Select A&B; G&Y Enable; SSM 2,4.  
Minimum Flash = 4+2+1





DET. No.	DESCRIPTION	VENDOR	PART No.	QTY.
1	DB-25 MALE	AMP	747912-4	1
2	HOUSING KIT	AMP	207345-1	1
3	SPRING LATCH DB CONNECTOR	NEWARK	44F8751	2
4	6 CONDUCTOR 28AWG	Alpha	1176C	6 FT
5	TERMINAL	3M	nv08-109ax	7
6A	FUSE HOLDER NEWARK #67K1434			
6B	FUSE (1/2A), NEWARK #27F654			
7	2 CONDUCTOR BELDEN CABLE # B205-060			
8	(2) CHANNEL NUTS UNISTRUT TEAL #A4006-103REG			
8A	(2) Screw 10-32 x 1" pan head philips SS			
8B	(2ea) #10 lock washer/flat washer/fender washer			
9	4 POSITION TERMINAL BLOCK NEWARK #28F724			
10	TIE-RAP			

REVISED 11/10/09 DG (17X HVS)



CARRIER AND GABLE INC.  
TECH SERVICES

5020  
GPS TO SEPAC



④ PEDESTRIAN PEDESTAL  
 ③ PEDESTAL FOUNDATION  
 ⑤② SEE DETAIL "I-2" SIG-028-A

NORDIC DRIVE  
 SPEED LIMIT = 25 MPH

PROPOSED HIGHWAY EASEMENT

EX 45' / 4 WOOD POLE  
 SEE DETAIL "B-1" SIG-029-B ⑥

1-3" CONDUIT

EX 50' / 4 WOOD POLE  
 EX SERVICE DISCONNECT  
 EX ELECTRICAL SERVICE

① 1-1 1/2" DB  
 PROPOSED CONSENT TO GRADE

EX WOOD POLE

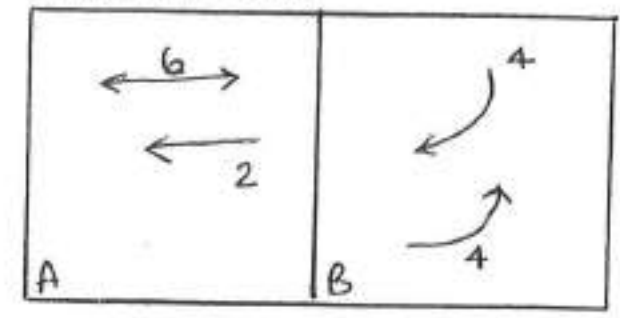
EXISTING SANITARY EASEMENT

CS #1  
 EXISTING 24" X 30" 4-WAY ILLUMINATED CASE SIGN



WESTBOUND M-59 (HIGHLAND ROAD)  
 SPEED LIMIT = 55 MPH

WESTBOUND M-59 (HIGHLAND ROAD)  
 SPEED LIMIT = 55 MPH



EASTBOUND M-59 (HIGHLAND ROAD)  
 SPEED LIMIT = 55 MPH

EASTBOUND M-59 (HIGHLAND ROAD)  
 SPEED LIMIT = 55 MPH

EX 36' STEEL STRAIN POLE  
 EX SOLID STATE ACTUATED  
 CONTROLLER & CABINET  
 EX GPS MODULE

LIST OF MATERIAL		
NO.	ITEM	QUANTITIES
①	Conduit, 0B, 1, 1 1/2 inch	10 FT
②	TS, One Way Pedestal Mtd (LED)	1 Ea
③	Pedestal, Alum	1 Ea
④	Pedestal, Fdn	1 Ea
⑤	TS, Pedestrian, One Way Pedestal Mtd (LED) Countdown	1 Ea
⑥	TS, Pedestrian, One Way Bracket Arm Mtd (LED) Countdown	1 Ea
⑦	Wp, Round	1 Ea
⑧	Conduit, 0B, 1, 3 inch	11 FT

PLAN

OPENINGS	
CYCLIC	2755
STEADY	250

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	Gateway Crossing TIS	Organization:	
Project Location:	White Lake Twp	Performed By:	Fleis & VandenBrink Engineering
Scenario Description:		Date:	12/13/2022
Analysis Year:		Checked By:	
Analysis Period:	AM Street Peak Hour	Date:	

Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips <sup>3</sup>		
	ITE LUCs <sup>1</sup>	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				14	8	6
Restaurant				197	100	97
Cinema/Entertainment				0		
Residential				0		
Hotel				0		
All Other Land Uses <sup>2</sup>				0		
				211	108	103

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ. <sup>4</sup>	% Transit	% Non-Motorized	Veh. Occ. <sup>4</sup>	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses <sup>2</sup>						

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail	0		1	0	0	0
Restaurant	0	1		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	0	0	0		0
Hotel	0	0	0	0	0	

	Total	Entering	Exiting
All Person-Trips	211	108	103
Internal Capture Percentage	2%	2%	2%
External Vehicle-Trips <sup>5</sup>	207	106	101
External Transit-Trips <sup>6</sup>	0	0	0
External Non-Motorized Trips <sup>6</sup>	0	0	0

Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	13%	17%
Restaurant	1%	1%
Cinema/Entertainment	N/A	N/A
Residential	N/A	N/A
Hotel	N/A	N/A

<sup>1</sup>Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

<sup>2</sup>Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

<sup>3</sup>Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

<sup>4</sup>Enter vehicle occupancy assumed in Table 1-A vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-A, 9-A (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.

<sup>5</sup>Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A.

<sup>6</sup>Person-Trips

\*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:		Organization:	
Project Location:		Performed By:	
Scenario Description:		Date:	
Analysis Year:		Checked By:	
Analysis Period:	PM Street Peak Hour	Date:	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips <sup>3</sup>		
	ITE LUCs <sup>1</sup>	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				54	27	27
Restaurant				223	115	108
Cinema/Entertainment				0		
Residential				0		
Hotel				0		
All Other Land Uses <sup>2</sup>				0		
				277	142	135

Table 2-P: Mode Split and Vehicle Occupancy Estimates						
Land Use	Entering Trips			Exiting Trips		
	Veh. Occ. <sup>4</sup>	% Transit	% Non-Motorized	Veh. Occ. <sup>4</sup>	% Transit	% Non-Motorized
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						
All Other Land Uses <sup>2</sup>						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		8	0	0	0
Restaurant	0	14		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	0	0	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	277	142	135
Internal Capture Percentage	16%	15%	16%
External Vehicle-Trips <sup>5</sup>	233	120	113
External Transit-Trips <sup>6</sup>	0	0	0
External Non-Motorized Trips <sup>6</sup>	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	52%	30%
Restaurant	7%	13%
Cinema/Entertainment	N/A	N/A
Residential	N/A	N/A
Hotel	N/A	N/A

<sup>1</sup>Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

<sup>2</sup>Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

<sup>3</sup>Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

<sup>4</sup>Enter vehicle occupancy assumed in Table 1-P vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made.

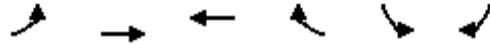
<sup>5</sup>Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P.

<sup>6</sup>Person-Trips

\*Indicates computation that has been rounded to the nearest whole number.

HCM Signalized Intersection Capacity Analysis  
 10: EB Highland Road & WB-to-EB X/O

Existing Condition Item A.  
 AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↘	
Traffic Volume (vph)	0	1587	0	0	134	0
Future Volume (vph)	0	1587	0	0	134	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			5.9	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3471			1736	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3471			1736	
Peak-hour factor, PHF	0.91	0.91	0.92	0.92	0.61	0.61
Adj. Flow (vph)	0	1744	0	0	220	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1744	0	0	220	0
Heavy Vehicles (%)	4%	4%	2%	2%	4%	4%
Turn Type		NA			Prot	
Protected Phases		2!			4 2!	
Permitted Phases						
Actuated Green, G (s)		56.9			90.0	
Effective Green, g (s)		56.9			83.9	
Actuated g/C Ratio		0.63			0.93	
Clearance Time (s)		6.1				
Vehicle Extension (s)		3.0				
Lane Grp Cap (vph)		2194			1618	
v/s Ratio Prot		c0.50			c0.13	
v/s Ratio Perm						
v/c Ratio		0.79			0.14	
Uniform Delay, d1		12.2			0.2	
Progression Factor		1.00			1.00	
Incremental Delay, d2		3.1			0.2	
Delay (s)		15.3			0.4	
Level of Service		B			A	
Approach Delay (s)		15.3	0.0		0.4	
Approach LOS		B	A		A	

Intersection Summary			
HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		

! Phase conflict between lane groups.  
 c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
20: Bogie Lake Road & EB Highland Road













Existing Condition Item A.  
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗					↑	↗↗		↑		
Traffic Volume (vph)	0	1222	499	0	0	0	0	102	293	0	45	0	
Future Volume (vph)	0	1222	499	0	0	0	0	102	293	0	45	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.7	6.7					10.9	10.9		6.9		
Lane Util. Factor		0.95	1.00					1.00	0.88		1.00		
Frt		1.00	0.85					1.00	0.85		1.00		
Flt Protected		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (prot)		3471	1553					1827	2733		1681		
Flt Permitted		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (perm)		3471	1553					1827	2733		1681		
Peak-hour factor, PHF	0.89	0.89	0.89	0.92	0.92	0.92	0.87	0.87	0.87	0.95	0.95	0.95	
Adj. Flow (vph)	0	1373	561	0	0	0	0	117	337	0	47	0	
RTOR Reduction (vph)	0	0	229	0	0	0	0	0	67	0	0	0	
Lane Group Flow (vph)	0	1373	332	0	0	0	0	117	270	0	47	0	
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	4%	4%	4%	13%	13%	13%	
Turn Type		NA	Perm					NA	Perm		NA		
Protected Phases		2						4			8		
Permitted Phases			2						4				
Actuated Green, G (s)		53.3	53.3					19.1	19.1		23.1		
Effective Green, g (s)		53.3	53.3					19.1	19.1		23.1		
Actuated g/C Ratio		0.59	0.59					0.21	0.21		0.26		
Clearance Time (s)		6.7	6.7					10.9	10.9		6.9		
Vehicle Extension (s)		3.0	3.0					3.0	3.0		3.0		
Lane Grp Cap (vph)		2055	919					387	580		431		
v/s Ratio Prot		c0.40						0.06			0.03		
v/s Ratio Perm			0.21						c0.10				
v/c Ratio		0.67	0.36					0.30	0.47		0.11		
Uniform Delay, d1		12.4	9.5					29.8	31.0		25.6		
Progression Factor		0.16	0.24					1.00	1.00		0.00		
Incremental Delay, d2		1.2	0.7					2.0	2.7		0.5		
Delay (s)		3.2	3.0					31.8	33.7		0.5		
Level of Service		A	A					C	C		A		
Approach Delay (s)		3.1			0.0			33.2			0.5		
Approach LOS		A			A			C			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			8.7									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.61										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	17.6
Intersection Capacity Utilization			58.7%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													















HCM Signalized Intersection Capacity Analysis  
21: Bogie Lake Road & WB Highland Road

Existing Conditions Item A.  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑			↑	↑↑
Traffic Volume (vph)	0	0	0	0	1067	44	0	102	0	0	45	68
Future Volume (vph)	0	0	0	0	1067	44	0	102	0	0	45	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.7	6.7		6.9			10.9	10.9
Lane Util. Factor					0.95	1.00		1.00			1.00	0.88
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3406	1524		1827			1681	2515
Flt Permitted					1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3406	1524		1827			1681	2515
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.87	0.87	0.87	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	0	1160	48	0	117	0	0	47	72
RTOR Reduction (vph)	0	0	0	0	0	20	0	0	0	0	0	57
Lane Group Flow (vph)	0	0	0	0	1160	28	0	117	0	0	47	15
Heavy Vehicles (%)	2%	2%	2%	6%	6%	6%	4%	4%	4%	13%	13%	13%
Turn Type					NA	Perm		NA			NA	Perm
Protected Phases					6			8			4	
Permitted Phases						6						4
Actuated Green, G (s)					53.3	53.3		23.1			19.1	19.1
Effective Green, g (s)					53.3	53.3		23.1			19.1	19.1
Actuated g/C Ratio					0.59	0.59		0.26			0.21	0.21
Clearance Time (s)					6.7	6.7		6.9			10.9	10.9
Vehicle Extension (s)					3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)					2017	902		468			356	533
v/s Ratio Prot					c0.34			c0.06			0.03	
v/s Ratio Perm						0.02						0.01
v/c Ratio					0.58	0.03		0.25			0.13	0.03
Uniform Delay, d1					11.3	7.6		26.6			28.7	28.1
Progression Factor					0.48	0.47		0.00			1.25	2.12
Incremental Delay, d2					1.1	0.1		1.2			0.8	0.1
Delay (s)					6.5	3.7		1.3			36.8	59.6
Level of Service					A	A		A			D	E
Approach Delay (s)		0.0			6.4			1.3			50.6	
Approach LOS		A			A			A			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			9.6		HCM 2000 Level of Service						A	
HCM 2000 Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)						17.6	
Intersection Capacity Utilization			58.7%		ICU Level of Service						B	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 30: EB-to-WB X/O/Nordic Drive & WB Highland Road

Existing Conditions Item A.  
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↓				↑
Traffic Volume (vph)	0	0	0	0	986	7	119	9	0	0	0	6
Future Volume (vph)	0	0	0	0	986	7	119	9	0	0	0	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.1	6.1		5.9				5.9
Lane Util. Factor					0.95	1.00		1.00				1.00
Frt					1.00	0.85		1.00				0.86
Flt Protected					1.00	1.00		0.96				1.00
Satd. Flow (prot)					3406	1524		1763				1644
Flt Permitted					1.00	1.00		0.96				1.00
Satd. Flow (perm)					3406	1524		1763				1644
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.78	0.78	0.78	0.75	0.75	0.75
Adj. Flow (vph)	0	0	0	0	1038	7	153	12	0	0	0	8
RTOR Reduction (vph)	0	0	0	0	0	3	0	96	0	0	0	6
Lane Group Flow (vph)	0	0	0	0	1038	4	0	69	0	0	0	2
Heavy Vehicles (%)	2%	2%	2%	6%	6%	6%	3%	3%	3%	0%	0%	0%
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					2!			4				
Permitted Phases						2	4 2!					4
Actuated Green, G (s)					56.9	56.9		21.1				21.1
Effective Green, g (s)					56.9	56.9		21.1				21.1
Actuated g/C Ratio					0.63	0.63		0.23				0.23
Clearance Time (s)					6.1	6.1		5.9				5.9
Vehicle Extension (s)					3.0	3.0		3.0				3.0
Lane Grp Cap (vph)					2153	963		413				385
v/s Ratio Prot					c0.30							
v/s Ratio Perm						0.00		0.04				0.00
v/c Ratio					0.48	0.00		0.17				0.00
Uniform Delay, d1					8.8	6.1		27.5				26.4
Progression Factor					1.00	1.00		1.32				1.00
Incremental Delay, d2					0.8	0.0		0.7				0.0
Delay (s)					9.5	6.1		36.9				26.4
Level of Service					A	A		D				C
Approach Delay (s)		0.0			9.5			36.9			26.4	
Approach LOS		A			A			D			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.3		HCM 2000 Level of Service					B		
HCM 2000 Volume to Capacity ratio			0.40									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					12.0		
Intersection Capacity Utilization			55.1%		ICU Level of Service					B		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
40: Bogie Lake Road & NB-to-SB X/O

Existing Condition Item A.  
AM Peak Hour



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘					↑↑
Traffic Volume (vph)	88	0	0	0	0	25
Future Volume (vph)	88	0	0	0	0	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9					5.4
Lane Util. Factor	1.00					0.95
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1556					3139
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1556					3139
Peak-hour factor, PHF	0.82	0.82	0.92	0.92	0.81	0.81
Adj. Flow (vph)	107	0	0	0	0	31
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	107	0	0	0	0	31
Heavy Vehicles (%)	16%	16%	2%	2%	15%	15%
Turn Type	Prot					NA
Protected Phases	4 2!					2!
Permitted Phases						
Actuated Green, G (s)	90.0					57.6
Effective Green, g (s)	84.6					57.6
Actuated g/C Ratio	0.94					0.64
Clearance Time (s)						5.4
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	1462					2008
v/s Ratio Prot	c0.07					0.01
v/s Ratio Perm						
v/c Ratio	0.07					0.02
Uniform Delay, d1	0.2					5.9
Progression Factor	1.00					1.00
Incremental Delay, d2	0.1					0.0
Delay (s)	0.3					5.9
Level of Service	A					A
Approach Delay (s)	0.3		0.0			5.9
Approach LOS	A		A			A

Intersection Summary

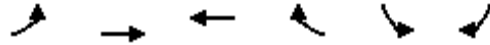
HCM 2000 Control Delay	1.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.08		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	25.2%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 10: EB Highland Road & WB-to-EB X/O

Existing Condition Item A.  
 PM Peak Hour















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↘	
Traffic Volume (vph)	0	1407	0	0	212	0
Future Volume (vph)	0	1407	0	0	212	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			5.9	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3471			1787	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3471			1787	
Peak-hour factor, PHF	0.94	0.94	0.92	0.92	0.88	0.88
Adj. Flow (vph)	0	1497	0	0	241	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1497	0	0	241	0
Heavy Vehicles (%)	4%	4%	2%	2%	1%	1%
Turn Type		NA			Prot	
Protected Phases		2!			4 2!	
Permitted Phases						
Actuated Green, G (s)		85.9			120.0	
Effective Green, g (s)		85.9			113.9	
Actuated g/C Ratio		0.72			0.95	
Clearance Time (s)		6.1				
Vehicle Extension (s)		3.0				
Lane Grp Cap (vph)		2484			1696	
v/s Ratio Prot		c0.43			c0.13	
v/s Ratio Perm						
v/c Ratio		0.60			0.14	
Uniform Delay, d1		8.5			0.2	
Progression Factor		1.00			1.00	
Incremental Delay, d2		1.1			0.1	
Delay (s)		9.6			0.3	
Level of Service		A			A	
Approach Delay (s)		9.6	0.0		0.3	
Approach LOS		A	A		A	

Intersection Summary			
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		

! Phase conflict between lane groups.  
 c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
20: Bogie Lake Road & EB Highland Road

Existing Conditions Item A.  
PM Peak Hour

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗					↑	↗↗		↑		
Traffic Volume (vph)	0	1288	331	0	0	0	0	186	345	0	65	0	
Future Volume (vph)	0	1288	331	0	0	0	0	186	345	0	65	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.7	6.7					10.9	10.9		6.9		
Lane Util. Factor		0.95	1.00					1.00	0.88		1.00		
Frt		1.00	0.85					1.00	0.85		1.00		
Flt Protected		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (prot)		3505	1568					1863	2787		1827		
Flt Permitted		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (perm)		3505	1568					1863	2787		1827		
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92	
Adj. Flow (vph)	0	1356	348	0	0	0	0	200	371	0	71	0	
RTOR Reduction (vph)	0	0	106	0	0	0	0	0	120	0	0	0	
Lane Group Flow (vph)	0	1356	242	0	0	0	0	200	251	0	71	0	
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	4%	4%	
Turn Type		NA	Perm					NA	Perm		NA		
Protected Phases		2						4			8		
Permitted Phases			2						4				
Actuated Green, G (s)		83.3	83.3					19.1	19.1		23.1		
Effective Green, g (s)		83.3	83.3					19.1	19.1		23.1		
Actuated g/C Ratio		0.69	0.69					0.16	0.16		0.19		
Clearance Time (s)		6.7	6.7					10.9	10.9		6.9		
Vehicle Extension (s)		3.0	3.0					3.0	3.0		3.0		
Lane Grp Cap (vph)		2433	1088					296	443		351		
v/s Ratio Prot		c0.39						c0.11			0.04		
v/s Ratio Perm			0.15						0.09				
v/c Ratio		0.56	0.22					0.68	0.57		0.20		
Uniform Delay, d1		9.2	6.6					47.5	46.6		40.7		
Progression Factor		0.23	0.24					1.00	1.00		0.00		
Incremental Delay, d2		0.8	0.4					11.7	5.2		1.3		
Delay (s)		2.9	2.0					59.3	51.8		1.3		
Level of Service		A	A					E	D		A		
Approach Delay (s)		2.7			0.0			54.4			1.3		
Approach LOS		A			A			D			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			15.2									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.58										
Actuated Cycle Length (s)			120.0									Sum of lost time (s)	17.6
Intersection Capacity Utilization			71.1%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis  
 21: Bogie Lake Road & WB Highland Road

Existing Conditions Item A.  
 PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑			↑	↑↑
Traffic Volume (vph)	0	0	0	0	1807	110	0	186	0	0	65	143
Future Volume (vph)	0	0	0	0	1807	110	0	186	0	0	65	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.7	6.7		6.9			10.9	10.9
Lane Util. Factor					0.95	1.00		1.00			1.00	0.88
Frbp, ped/bikes					1.00	0.99		1.00			1.00	0.98
Flpb, ped/bikes					1.00	1.00		1.00			1.00	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3539	1562		1863			1827	2670
Flt Permitted					1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3539	1562		1863			1827	2670
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	2008	122	0	200	0	0	71	155
RTOR Reduction (vph)	0	0	0	0	0	37	0	0	0	0	0	31
Lane Group Flow (vph)	0	0	0	0	2008	85	0	200	0	0	71	124
Confl. Peds. (#/hr)						3						1
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	4%	4%
Turn Type					NA	Perm		NA			NA	Perm
Protected Phases					6			8			4	
Permitted Phases						6						4
Actuated Green, G (s)					83.3	83.3		23.1			19.1	19.1
Effective Green, g (s)					83.3	83.3		23.1			19.1	19.1
Actuated g/C Ratio					0.69	0.69		0.19			0.16	0.16
Clearance Time (s)					6.7	6.7		6.9			10.9	10.9
Vehicle Extension (s)					3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)					2456	1084		358			290	424
v/s Ratio Prot					c0.57			c0.11			0.04	
v/s Ratio Perm						0.05						0.05
v/c Ratio					0.82	0.08		0.56			0.24	0.29
Uniform Delay, d1					13.0	5.9		43.8			44.1	44.5
Progression Factor					0.91	0.33		0.00			1.34	1.45
Incremental Delay, d2					2.3	0.1		4.5			2.0	1.7
Delay (s)					14.2	2.1		4.6			61.2	66.4
Level of Service					B	A		A			E	E
Approach Delay (s)		0.0			13.5			4.6			64.8	
Approach LOS		A			B			A			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			17.3		HCM 2000 Level of Service						B	
HCM 2000 Volume to Capacity ratio			0.79									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						17.6	
Intersection Capacity Utilization			71.1%		ICU Level of Service						C	
Analysis Period (min)			15									
c Critical Lane Group												



HCM Signalized Intersection Capacity Analysis  
 30: EB-to-WB X/O/Nordic Drive & WB Highland Road

Existing Conditions Item A.  
 PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑	↑		↑				↑	
Traffic Volume (vph)	0	0	0	0	1655	38	203	34	0	0	0	59	
Future Volume (vph)	0	0	0	0	1655	38	203	34	0	0	0	59	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)					6.1	6.1		5.9				5.9	
Lane Util. Factor					0.95	1.00		1.00				1.00	
Frbp, ped/bikes					1.00	0.98		1.00				1.00	
Flpb, ped/bikes					1.00	1.00		1.00				1.00	
Frt					1.00	0.85		1.00				0.86	
Flt Protected					1.00	1.00		0.96				1.00	
Satd. Flow (prot)					3505	1536		1822				1644	
Flt Permitted					1.00	1.00		0.96				1.00	
Satd. Flow (perm)					3505	1536		1822				1644	
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.79	0.79	0.79	0.74	0.74	0.74	
Adj. Flow (vph)	0	0	0	0	1742	40	257	43	0	0	0	80	
RTOR Reduction (vph)	0	0	0	0	0	7	0	33	0	0	0	33	
Lane Group Flow (vph)	0	0	0	0	1742	33	0	267	0	0	0	47	
Confl. Peds. (#/hr)						1							
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	0%	0%	0%	
Turn Type					NA	Perm	custom	NA				Perm	
Protected Phases					2!			4					
Permitted Phases						2	4 2!					4	
Actuated Green, G (s)					85.9	85.9		22.1				22.1	
Effective Green, g (s)					85.9	85.9		22.1				22.1	
Actuated g/C Ratio					0.72	0.72		0.18				0.18	
Clearance Time (s)					6.1	6.1		5.9				5.9	
Vehicle Extension (s)					3.0	3.0		3.0				3.0	
Lane Grp Cap (vph)					2508	1099		335				302	
v/s Ratio Prot					c0.50								
v/s Ratio Perm						0.02		0.15				0.03	
v/c Ratio					0.69	0.03		0.80				0.15	
Uniform Delay, d1					9.6	5.0		46.8				41.1	
Progression Factor					1.00	1.00		1.06				1.00	
Incremental Delay, d2					1.6	0.1		15.1				1.1	
Delay (s)					11.2	5.0		65.0				42.2	
Level of Service					B	A		E				D	
Approach Delay (s)		0.0			11.1			65.0			42.2		
Approach LOS		A			B			E			D		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			19.7		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.71										
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						12.0		
Intersection Capacity Utilization			79.5%		ICU Level of Service						D		
Analysis Period (min)			15										
! Phase conflict between lane groups.													
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis  
40: Bogie Lake Road & NB-to-SB X/O

Existing Condition Item A.  
PM Peak Hour



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖					↗↗
Traffic Volume (vph)	185	0	0	0	0	23
Future Volume (vph)	185	0	0	0	0	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9					5.4
Lane Util. Factor	1.00					0.95
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1752					3610
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1752					3610
Peak-hour factor, PHF	0.86	0.86	0.92	0.92	0.60	0.60
Adj. Flow (vph)	215	0	0	0	0	38
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	215	0	0	0	0	38
Heavy Vehicles (%)	3%	3%	2%	2%	0%	0%
Turn Type	Prot					NA
Protected Phases	4 2!					2!
Permitted Phases						
Actuated Green, G (s)	120.0					86.6
Effective Green, g (s)	114.6					86.6
Actuated g/C Ratio	0.95					0.72
Clearance Time (s)						5.4
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	1673					2605
v/s Ratio Prot	c0.12					0.01
v/s Ratio Perm						
v/c Ratio	0.13					0.01
Uniform Delay, d1	0.1					4.7
Progression Factor	1.00					1.00
Incremental Delay, d2	0.2					0.0
Delay (s)	0.3					4.7
Level of Service	A					A
Approach Delay (s)	0.3		0.0			4.7
Approach LOS	A		A			A

Intersection Summary			
HCM 2000 Control Delay	1.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.13		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	30.6%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.  
c Critical Lane Group

**Intersection: 10: EB Highland Road & WB-to-EB X/O**

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	295	316	69
Average Queue (ft)	152	150	36
95th Queue (ft)	250	258	68
Link Distance (ft)	708	708	35
Upstream Blk Time (%)			12
Queuing Penalty (veh)			20
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 11: WB-to-EB X/O & WB Highland Road**

Movement	WB
Directions Served	L
Maximum Queue (ft)	100
Average Queue (ft)	21
95th Queue (ft)	73
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 20: Bogie Lake Road & EB Highland Road**

Movement	EB	EB	EB	NB	NB	NB	SB
Directions Served	T	T	R	T	R	R	T
Maximum Queue (ft)	132	138	95	130	136	120	14
Average Queue (ft)	35	42	41	55	61	48	0
95th Queue (ft)	88	94	75	108	109	94	10
Link Distance (ft)	330	330	330	291	291	291	37
Upstream Blk Time (%)							0
Queuing Penalty (veh)							0
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

**Intersection: 21: Bogie Lake Road & WB Highland Road**

Movement	WB	WB	WB	SB	SB	SB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	114	100	39	94	67	47
Average Queue (ft)	28	29	3	30	25	16
95th Queue (ft)	79	82	18	73	55	42
Link Distance (ft)	477	477	477	152	152	152
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 30: EB-to-WB X/O/Nordic Drive & WB Highland Road**

Movement	WB	WB	WB	NB	SB
Directions Served	T	T	R	LT	R
Maximum Queue (ft)	196	180	21	55	30
Average Queue (ft)	112	64	1	35	5
95th Queue (ft)	180	132	11	62	23
Link Distance (ft)	905	905		11	94
Upstream Blk Time (%)				17	
Queuing Penalty (veh)				23	
Storage Bay Dist (ft)			50		
Storage Blk Time (%)		9			
Queuing Penalty (veh)		1			

**Intersection: 31: EB Highland Road & EB-to-WB X/O**

Movement	EB
Directions Served	L
Maximum Queue (ft)	114
Average Queue (ft)	23
95th Queue (ft)	73
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 40: Bogie Lake Road & NB-to-SB X/O**

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	10	54	6
Average Queue (ft)	0	8	0
95th Queue (ft)	5	34	4
Link Distance (ft)	28	192	192
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 41: Bogie Lake Road & NB-to-SB X/O**

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: 50: W. Site Drive & EB Highland 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)

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Intersection: 60: Bogie Lake Road & E. Site Drive

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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)

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Zone Summary

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Zone wide Queuing Penalty: 44
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**Intersection: 10: EB Highland Road & WB-to-EB X/O**

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	255	250	56
Average Queue (ft)	148	120	45
95th Queue (ft)	231	214	61
Link Distance (ft)	708	708	35
Upstream Blk Time (%)			22
Queuing Penalty (veh)			47
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 11: WB-to-EB X/O & WB Highland Road**

Movement	WB	WB
Directions Served	L	T
Maximum Queue (ft)	127	10
Average Queue (ft)	31	0
95th Queue (ft)	89	7
Link Distance (ft)		745
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	325	
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 20: Bogie Lake Road & EB Highland Road**

Movement	EB	EB	EB	NB	NB	NB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	90	104	62	238	154	137
Average Queue (ft)	35	39	24	124	77	62
95th Queue (ft)	75	83	57	206	128	110
Link Distance (ft)	330	330	330	291	291	291
Upstream Blk Time (%)				0		
Queuing Penalty (veh)				0		
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 21: Bogie Lake Road & WB Highland Road**

Movement	WB	WB	WB	NB	SB	SB	SB
Directions Served	T	T	R	T	T	R	R
Maximum Queue (ft)	226	240	46	5	111	127	116
Average Queue (ft)	68	77	7	0	50	52	48
95th Queue (ft)	151	160	30	6	95	101	94
Link Distance (ft)	477	477	477	37	152	152	152
Upstream Blk Time (%)		0		1	0	0	0
Queuing Penalty (veh)		0		1	0	0	0
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

**Intersection: 30: EB-to-WB X/O/Nordic Drive & WB Highland Road**

Movement	WB	WB	WB	NB	SB
Directions Served	T	T	R	LT	R
Maximum Queue (ft)	300	263	28	48	77
Average Queue (ft)	175	140	6	47	31
95th Queue (ft)	266	234	23	54	62
Link Distance (ft)	905	905		11	94
Upstream Blk Time (%)				54	0
Queuing Penalty (veh)				129	0
Storage Bay Dist (ft)			50		
Storage Blk Time (%)		15			
Queuing Penalty (veh)		6			

**Intersection: 31: EB Highland Road & EB-to-WB X/O**

Movement	EB
Directions Served	L
Maximum Queue (ft)	250
Average Queue (ft)	112
95th Queue (ft)	214
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	0
Queuing Penalty (veh)	1

**Intersection: 40: Bogie Lake Road & NB-to-SB X/O**

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	34	35
Average Queue (ft)	2	4
95th Queue (ft)	15	22
Link Distance (ft)	28	192
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 41: Bogie Lake Road & NB-to-SB X/O**

Movement	NB
Directions Served	L
Maximum Queue (ft)	11
Average Queue (ft)	1
95th Queue (ft)	10
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 50: W. Site Drive & EB Highland 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)

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Intersection: 60: Bogie Lake Road & E. Site Drive

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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)

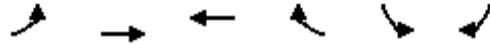
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Zone Summary

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Zone wide Queuing Penalty: 184

HCM Signalized Intersection Capacity Analysis  
 10: EB Highland Road & WB-to-EB X/O















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↘	
Traffic Volume (vph)	0	1603	0	0	135	0
Future Volume (vph)	0	1603	0	0	135	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			5.9	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3471			1736	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3471			1736	
Peak-hour factor, PHF	0.91	0.91	0.92	0.92	0.61	0.61
Adj. Flow (vph)	0	1762	0	0	221	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1762	0	0	221	0
Heavy Vehicles (%)	4%	4%	2%	2%	4%	4%
Turn Type		NA			Prot	
Protected Phases		2!			4 2!	
Permitted Phases						
Actuated Green, G (s)		56.9			90.0	
Effective Green, g (s)		56.9			83.9	
Actuated g/C Ratio		0.63			0.93	
Clearance Time (s)		6.1				
Vehicle Extension (s)		3.0				
Lane Grp Cap (vph)		2194			1618	
v/s Ratio Prot		c0.51			c0.13	
v/s Ratio Perm						
v/c Ratio		0.80			0.14	
Uniform Delay, d1		12.4			0.2	
Progression Factor		1.00			1.00	
Incremental Delay, d2		3.2			0.2	
Delay (s)		15.6			0.4	
Level of Service		B			A	
Approach Delay (s)		15.6	0.0		0.4	
Approach LOS		B	A		A	

Intersection Summary			
HCM 2000 Control Delay	13.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

! Phase conflict between lane groups.  
 c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
20: Bogie Lake Road & EB Highland Road

Background Condition Item A.  
AM Peak Hour

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗					↑	↗↗		↑		
Traffic Volume (vph)	0	1234	504	0	0	0	0	103	296	0	45	0	
Future Volume (vph)	0	1234	504	0	0	0	0	103	296	0	45	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.7	6.7					10.9	10.9		6.9		
Lane Util. Factor		0.95	1.00					1.00	0.88		1.00		
Frt		1.00	0.85					1.00	0.85		1.00		
Flt Protected		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (prot)		3471	1553					1827	2733		1681		
Flt Permitted		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (perm)		3471	1553					1827	2733		1681		
Peak-hour factor, PHF	0.89	0.89	0.89	0.92	0.92	0.92	0.87	0.87	0.87	0.95	0.95	0.95	
Adj. Flow (vph)	0	1387	566	0	0	0	0	118	340	0	47	0	
RTOR Reduction (vph)	0	0	231	0	0	0	0	0	65	0	0	0	
Lane Group Flow (vph)	0	1387	335	0	0	0	0	118	275	0	47	0	
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	4%	4%	4%	13%	13%	13%	
Turn Type		NA	Perm					NA	Perm		NA		
Protected Phases		2						4			8		
Permitted Phases			2						4				
Actuated Green, G (s)		53.3	53.3					19.1	19.1		23.1		
Effective Green, g (s)		53.3	53.3					19.1	19.1		23.1		
Actuated g/C Ratio		0.59	0.59					0.21	0.21		0.26		
Clearance Time (s)		6.7	6.7					10.9	10.9		6.9		
Vehicle Extension (s)		3.0	3.0					3.0	3.0		3.0		
Lane Grp Cap (vph)		2055	919					387	580		431		
v/s Ratio Prot		c0.40						0.06			0.03		
v/s Ratio Perm			0.22						c0.10				
v/c Ratio		0.67	0.36					0.30	0.47		0.11		
Uniform Delay, d1		12.5	9.5					29.9	31.0		25.6		
Progression Factor		0.16	0.23					1.00	1.00		0.00		
Incremental Delay, d2		1.2	0.7					2.0	2.8		0.5		
Delay (s)		3.2	3.0					31.9	33.8		0.5		
Level of Service		A	A					C	C		A		
Approach Delay (s)		3.1			0.0			33.3			0.5		
Approach LOS		A			A			C			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			8.7									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.62										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	17.6
Intersection Capacity Utilization			59.1%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													



HCM Signalized Intersection Capacity Analysis  
21: Bogie Lake Road & WB Highland Road

Background Condition Item A.  
AM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑			↑	↑↑
Traffic Volume (vph)	0	0	0	0	1078	44	0	103	0	0	45	69
Future Volume (vph)	0	0	0	0	1078	44	0	103	0	0	45	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.7	6.7		6.9			10.9	10.9
Lane Util. Factor					0.95	1.00		1.00			1.00	0.88
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3406	1524		1827			1681	2515
Flt Permitted					1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3406	1524		1827			1681	2515
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.87	0.87	0.87	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	0	1172	48	0	118	0	0	47	73
RTOR Reduction (vph)	0	0	0	0	0	20	0	0	0	0	0	58
Lane Group Flow (vph)	0	0	0	0	1172	28	0	118	0	0	47	15
Heavy Vehicles (%)	2%	2%	2%	6%	6%	6%	4%	4%	4%	13%	13%	13%
Turn Type					NA	Perm		NA			NA	Perm
Protected Phases					6			8			4	
Permitted Phases						6						4
Actuated Green, G (s)					53.3	53.3		23.1			19.1	19.1
Effective Green, g (s)					53.3	53.3		23.1			19.1	19.1
Actuated g/C Ratio					0.59	0.59		0.26			0.21	0.21
Clearance Time (s)					6.7	6.7		6.9			10.9	10.9
Vehicle Extension (s)					3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)					2017	902		468			356	533
v/s Ratio Prot					c0.34			c0.06			0.03	
v/s Ratio Perm						0.02						0.01
v/c Ratio					0.58	0.03		0.25			0.13	0.03
Uniform Delay, d1					11.4	7.6		26.6			28.7	28.1
Progression Factor					0.48	0.47		0.00			1.25	2.15
Incremental Delay, d2					1.1	0.1		1.3			0.8	0.1
Delay (s)					6.6	3.7		1.3			36.7	60.4
Level of Service					A	A		A			D	E
Approach Delay (s)		0.0			6.5			1.3			51.1	
Approach LOS		A			A			A			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			9.8		HCM 2000 Level of Service						A	
HCM 2000 Volume to Capacity ratio			0.51									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)						17.6	
Intersection Capacity Utilization			59.1%		ICU Level of Service						B	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 30: EB-to-WB X/O/Nordic Drive & WB Highland Road

Background Condition Item A.  
 AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑				↑
Traffic Volume (vph)	0	0	0	0	996	7	120	9	0	0	0	6
Future Volume (vph)	0	0	0	0	996	7	120	9	0	0	0	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.1	6.1		5.9				5.9
Lane Util. Factor					0.95	1.00		1.00				1.00
Frt					1.00	0.85		1.00				0.86
Flt Protected					1.00	1.00		0.96				1.00
Satd. Flow (prot)					3406	1524		1763				1644
Flt Permitted					1.00	1.00		0.96				1.00
Satd. Flow (perm)					3406	1524		1763				1644
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.78	0.78	0.78	0.75	0.75	0.75
Adj. Flow (vph)	0	0	0	0	1048	7	154	12	0	0	0	8
RTOR Reduction (vph)	0	0	0	0	0	3	0	93	0	0	0	6
Lane Group Flow (vph)	0	0	0	0	1048	4	0	73	0	0	0	2
Heavy Vehicles (%)	2%	2%	2%	6%	6%	6%	3%	3%	3%	0%	0%	0%
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					2!			4				
Permitted Phases						2	4 2!					4
Actuated Green, G (s)					56.9	56.9		21.1				21.1
Effective Green, g (s)					56.9	56.9		21.1				21.1
Actuated g/C Ratio					0.63	0.63		0.23				0.23
Clearance Time (s)					6.1	6.1		5.9				5.9
Vehicle Extension (s)					3.0	3.0		3.0				3.0
Lane Grp Cap (vph)					2153	963		413				385
v/s Ratio Prot					c0.31							
v/s Ratio Perm						0.00		0.04				0.00
v/c Ratio					0.49	0.00		0.18				0.00
Uniform Delay, d1					8.8	6.1		27.5				26.4
Progression Factor					1.00	1.00		1.28				1.00
Incremental Delay, d2					0.8	0.0		0.7				0.0
Delay (s)					9.6	6.1		36.0				26.4
Level of Service					A	A		D				C
Approach Delay (s)		0.0			9.6			36.0			26.4	
Approach LOS		A			A			D			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.2		HCM 2000 Level of Service						B	
HCM 2000 Volume to Capacity ratio			0.40									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					12.0		
Intersection Capacity Utilization			55.4%		ICU Level of Service					B		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
40: Bogie Lake Road & NB-to-SB X/O

Background Condition Item A.  
AM Peak Hour



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖					↗↗
Traffic Volume (vph)	89	0	0	0	0	25
Future Volume (vph)	89	0	0	0	0	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9					5.4
Lane Util. Factor	1.00					0.95
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1556					3139
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1556					3139
Peak-hour factor, PHF	0.82	0.82	0.92	0.92	0.81	0.81
Adj. Flow (vph)	109	0	0	0	0	31
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	109	0	0	0	0	31
Heavy Vehicles (%)	16%	16%	2%	2%	15%	15%
Turn Type	Prot					NA
Protected Phases	4 2!					2!
Permitted Phases						
Actuated Green, G (s)	90.0					57.6
Effective Green, g (s)	84.6					57.6
Actuated g/C Ratio	0.94					0.64
Clearance Time (s)						5.4
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	1462					2008
v/s Ratio Prot	c0.07					0.01
v/s Ratio Perm						
v/c Ratio	0.07					0.02
Uniform Delay, d1	0.2					5.9
Progression Factor	1.00					1.00
Incremental Delay, d2	0.1					0.0
Delay (s)	0.3					5.9
Level of Service	A					A
Approach Delay (s)	0.3		0.0			5.9
Approach LOS	A		A			A

**Intersection Summary**

HCM 2000 Control Delay	1.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.08		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
10: EB Highland Road & WB-to-EB X/O

Background Condition Item A.  
PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↘	
Traffic Volume (vph)	0	1421	0	0	214	0
Future Volume (vph)	0	1421	0	0	214	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			5.9	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3471			1787	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3471			1787	
Peak-hour factor, PHF	0.94	0.94	0.92	0.92	0.88	0.88
Adj. Flow (vph)	0	1512	0	0	243	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1512	0	0	243	0
Heavy Vehicles (%)	4%	4%	2%	2%	1%	1%
Turn Type		NA			Prot	
Protected Phases		2!			4 2!	
Permitted Phases						
Actuated Green, G (s)		85.9			120.0	
Effective Green, g (s)		85.9			113.9	
Actuated g/C Ratio		0.72			0.95	
Clearance Time (s)		6.1				
Vehicle Extension (s)		3.0				
Lane Grp Cap (vph)		2484			1696	
v/s Ratio Prot		c0.44			c0.14	
v/s Ratio Perm						
v/c Ratio		0.61			0.14	
Uniform Delay, d1		8.6			0.2	
Progression Factor		1.00			1.00	
Incremental Delay, d2		1.1			0.1	
Delay (s)		9.7			0.3	
Level of Service		A			A	
Approach Delay (s)		9.7	0.0		0.3	
Approach LOS		A	A		A	

Intersection Summary			
HCM 2000 Control Delay	8.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		

! Phase conflict between lane groups.  
c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 20: Bogie Lake Road & EB Highland Road













Background Condition Item A.  
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗					↑	↗↘		↑		
Traffic Volume (vph)	0	1301	334	0	0	0	0	188	348	0	66	0	
Future Volume (vph)	0	1301	334	0	0	0	0	188	348	0	66	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.7	6.7					10.9	10.9		6.9		
Lane Util. Factor		0.95	1.00					1.00	0.88		1.00		
Frt		1.00	0.85					1.00	0.85		1.00		
Flt Protected		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (prot)		3505	1568					1863	2787		1827		
Flt Permitted		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (perm)		3505	1568					1863	2787		1827		
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92	
Adj. Flow (vph)	0	1369	352	0	0	0	0	202	374	0	72	0	
RTOR Reduction (vph)	0	0	108	0	0	0	0	0	117	0	0	0	
Lane Group Flow (vph)	0	1369	244	0	0	0	0	202	257	0	72	0	
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	4%	4%	
Turn Type		NA	Perm					NA	Perm		NA		
Protected Phases		2						4			8		
Permitted Phases			2						4				
Actuated Green, G (s)		83.3	83.3					19.1	19.1		23.1		
Effective Green, g (s)		83.3	83.3					19.1	19.1		23.1		
Actuated g/C Ratio		0.69	0.69					0.16	0.16		0.19		
Clearance Time (s)		6.7	6.7					10.9	10.9		6.9		
Vehicle Extension (s)		3.0	3.0					3.0	3.0		3.0		
Lane Grp Cap (vph)		2433	1088					296	443		351		
v/s Ratio Prot		c0.39						c0.11			0.04		
v/s Ratio Perm			0.16						0.09				
v/c Ratio		0.56	0.22					0.68	0.58		0.21		
Uniform Delay, d1		9.2	6.6					47.6	46.7		40.7		
Progression Factor		0.23	0.23					1.00	1.00		0.00		
Incremental Delay, d2		0.8	0.4					12.1	5.5		1.3		
Delay (s)		2.9	2.0					59.6	52.2		1.3		
Level of Service		A	A					E	D		A		
Approach Delay (s)		2.7			0.0			54.8			1.3		
Approach LOS		A			A			D			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			15.3									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.58										
Actuated Cycle Length (s)			120.0									Sum of lost time (s)	17.6
Intersection Capacity Utilization			71.7%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 21: Bogie Lake Road & WB Highland Road

Background Condition Item A.  
PM Peak Hour

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑	↗		↑			↑	↗↗	
Traffic Volume (vph)	0	0	0	0	1825	111	0	188	0	0	66	144	
Future Volume (vph)	0	0	0	0	1825	111	0	188	0	0	66	144	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)					6.7	6.7		6.9			10.9	10.9	
Lane Util. Factor					0.95	1.00		1.00			1.00	0.88	
Frbp, ped/bikes					1.00	0.99		1.00			1.00	0.98	
Flpb, ped/bikes					1.00	1.00		1.00			1.00	1.00	
Frt					1.00	0.85		1.00			1.00	0.85	
Flt Protected					1.00	1.00		1.00			1.00	1.00	
Satd. Flow (prot)					3539	1562		1863			1827	2670	
Flt Permitted					1.00	1.00		1.00			1.00	1.00	
Satd. Flow (perm)					3539	1562		1863			1827	2670	
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.93	0.93	0.93	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	0	2028	123	0	202	0	0	72	157	
RTOR Reduction (vph)	0	0	0	0	0	38	0	0	0	0	0	30	
Lane Group Flow (vph)	0	0	0	0	2028	85	0	202	0	0	72	127	
Confl. Peds. (#/hr)						3						1	
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	4%	4%	
Turn Type					NA	Perm		NA			NA	Perm	
Protected Phases					6			8			4		
Permitted Phases						6						4	
Actuated Green, G (s)					83.3	83.3		23.1			19.1	19.1	
Effective Green, g (s)					83.3	83.3		23.1			19.1	19.1	
Actuated g/C Ratio					0.69	0.69		0.19			0.16	0.16	
Clearance Time (s)					6.7	6.7		6.9			10.9	10.9	
Vehicle Extension (s)					3.0	3.0		3.0			3.0	3.0	
Lane Grp Cap (vph)					2456	1084		358			290	424	
v/s Ratio Prot					c0.57			c0.11			0.04		
v/s Ratio Perm						0.05						0.05	
v/c Ratio					0.83	0.08		0.56			0.25	0.30	
Uniform Delay, d1					13.1	5.9		43.9			44.2	44.5	
Progression Factor					0.91	0.33		0.00			1.34	1.44	
Incremental Delay, d2					2.4	0.1		4.6			2.0	1.8	
Delay (s)					14.4	2.0		4.7			61.0	66.1	
Level of Service					B	A		A			E	E	
Approach Delay (s)		0.0			13.7			4.7			64.5		
Approach LOS		A			B			A			E		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			17.5		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.80										
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						17.6		
Intersection Capacity Utilization			71.7%		ICU Level of Service						C		
Analysis Period (min)			15										
c Critical Lane Group													



HCM Signalized Intersection Capacity Analysis  
 30: EB-to-WB X/O/Nordic Drive & WB Highland Road

Background Condition Item A.  
 PM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑				↑
Traffic Volume (vph)	0	0	0	0	1671	38	205	34	0	0	0	60
Future Volume (vph)	0	0	0	0	1671	38	205	34	0	0	0	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.1	6.1		5.9				5.9
Lane Util. Factor					0.95	1.00		1.00				1.00
Frbp, ped/bikes					1.00	0.98		1.00				1.00
Flpb, ped/bikes					1.00	1.00		1.00				1.00
Frt					1.00	0.85		1.00				0.86
Flt Protected					1.00	1.00		0.96				1.00
Satd. Flow (prot)					3505	1536		1822				1644
Flt Permitted					1.00	1.00		0.96				1.00
Satd. Flow (perm)					3505	1536		1822				1644
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.79	0.79	0.79	0.74	0.74	0.74
Adj. Flow (vph)	0	0	0	0	1759	40	259	43	0	0	0	81
RTOR Reduction (vph)	0	0	0	0	0	7	0	33	0	0	0	33
Lane Group Flow (vph)	0	0	0	0	1759	33	0	269	0	0	0	48
Confl. Peds. (#/hr)						1						
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					2!			4				
Permitted Phases						2	4 2!					4
Actuated Green, G (s)					85.9	85.9		22.1				22.1
Effective Green, g (s)					85.9	85.9		22.1				22.1
Actuated g/C Ratio					0.72	0.72		0.18				0.18
Clearance Time (s)					6.1	6.1		5.9				5.9
Vehicle Extension (s)					3.0	3.0		3.0				3.0
Lane Grp Cap (vph)					2508	1099		335				302
v/s Ratio Prot					c0.50							
v/s Ratio Perm						0.02		0.15				0.03
v/c Ratio					0.70	0.03		0.80				0.16
Uniform Delay, d1					9.7	5.0		46.9				41.1
Progression Factor					1.00	1.00		1.07				1.00
Incremental Delay, d2					1.7	0.1		15.7				1.1
Delay (s)					11.4	5.0		65.7				42.3
Level of Service					B	A		E				D
Approach Delay (s)		0.0			11.3			65.7			42.3	
Approach LOS		A			B			E			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			19.9		HCM 2000 Level of Service					B		
HCM 2000 Volume to Capacity ratio			0.72									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)					12.0		
Intersection Capacity Utilization			80.1%		ICU Level of Service					D		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 40: Bogie Lake Road & NB-to-SB X/O

Background Condition Item A.  
PM Peak Hour



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰					↱↱
Traffic Volume (vph)	187	0	0	0	0	23
Future Volume (vph)	187	0	0	0	0	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9					5.4
Lane Util. Factor	1.00					0.95
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1752					3610
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1752					3610
Peak-hour factor, PHF	0.86	0.86	0.92	0.92	0.60	0.60
Adj. Flow (vph)	217	0	0	0	0	38
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	217	0	0	0	0	38
Heavy Vehicles (%)	3%	3%	2%	2%	0%	0%
Turn Type	Prot					NA
Protected Phases	4 2!					2!
Permitted Phases						
Actuated Green, G (s)	120.0					86.6
Effective Green, g (s)	114.6					86.6
Actuated g/C Ratio	0.95					0.72
Clearance Time (s)						5.4
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	1673					2605
v/s Ratio Prot	c0.12					0.01
v/s Ratio Perm						
v/c Ratio	0.13					0.01
Uniform Delay, d1	0.1					4.7
Progression Factor	1.00					1.00
Incremental Delay, d2	0.2					0.0
Delay (s)	0.3					4.7
Level of Service	A					A
Approach Delay (s)	0.3		0.0			4.7
Approach LOS	A		A			A

### Intersection Summary

HCM 2000 Control Delay	0.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.14		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	30.7%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.

c Critical Lane Group

**Intersection: 10: EB Highland Road & WB-to-EB X/O**

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	285	308	55
Average Queue (ft)	147	157	36
95th Queue (ft)	240	263	65
Link Distance (ft)	708	708	35
Upstream Blk Time (%)			12
Queuing Penalty (veh)			19
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 11: WB-to-EB X/O & WB Highland Road**

Movement	WB
Directions Served	L
Maximum Queue (ft)	108
Average Queue (ft)	15
95th Queue (ft)	59
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 20: Bogie Lake Road & EB Highland Road**

Movement	EB	EB	EB	NB	NB	NB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	99	112	110	126	111	119
Average Queue (ft)	35	41	46	55	60	48
95th Queue (ft)	80	91	86	107	101	92
Link Distance (ft)	330	330	330	291	291	291
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 21: Bogie Lake Road & WB Highland Road**

Movement	WB	WB	WB	SB	SB	SB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	82	68	38	100	61	50
Average Queue (ft)	28	23	4	34	24	16
95th Queue (ft)	64	57	22	82	51	41
Link Distance (ft)	477	477	477	152	152	152
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 30: EB-to-WB X/O/Nordic Drive & WB Highland Road**

Movement	WB	WB	WB	NB	SB
Directions Served	T	T	R	LT	R
Maximum Queue (ft)	207	162	16	61	30
Average Queue (ft)	113	70	1	35	4
95th Queue (ft)	187	141	9	59	21
Link Distance (ft)	905	905		11	94
Upstream Blk Time (%)				16	
Queuing Penalty (veh)				21	
Storage Bay Dist (ft)			50		
Storage Blk Time (%)		9			
Queuing Penalty (veh)		1			

**Intersection: 31: EB Highland Road & EB-to-WB X/O**

Movement	EB
Directions Served	L
Maximum Queue (ft)	66
Average Queue (ft)	19
95th Queue (ft)	55
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 40: Bogie Lake Road & NB-to-SB X/O**

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	16	44
Average Queue (ft)	1	8
95th Queue (ft)	7	32
Link Distance (ft)	28	192
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 41: Bogie Lake Road & NB-to-SB X/O**

Movement	NB
Directions Served	L
Maximum Queue (ft)	6
Average Queue (ft)	0
95th Queue (ft)	3
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 50: W. Site Drive & EB Highland 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)

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Intersection: 60: Bogie Lake Road & E. Site Drive

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**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)

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**Zone Summary**

Zone wide Queuing Penalty: 41



**Intersection: 10: EB Highland Road & WB-to-EB X/O**

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	269	252	60
Average Queue (ft)	153	125	45
95th Queue (ft)	238	216	65
Link Distance (ft)	708	708	35
Upstream Blk Time (%)			23
Queuing Penalty (veh)			49
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 11: WB-to-EB X/O & WB Highland Road**

Movement	WB
Directions Served	L
Maximum Queue (ft)	135
Average Queue (ft)	32
95th Queue (ft)	91
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 20: Bogie Lake Road & EB Highland Road**

Movement	EB	EB	EB	NB	NB	NB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	98	113	61	243	155	140
Average Queue (ft)	39	45	22	138	79	62
95th Queue (ft)	81	95	52	221	127	110
Link Distance (ft)	330	330	330	291	291	291
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 21: Bogie Lake Road & WB Highland Road**

Movement	WB	WB	WB	NB	SB	SB	SB
Directions Served	T	T	R	T	T	R	R
Maximum Queue (ft)	200	189	59	17	133	118	116
Average Queue (ft)	69	78	11	1	61	51	49
95th Queue (ft)	146	152	39	9	114	93	94
Link Distance (ft)	477	477	477	37	152	152	152
Upstream Blk Time (%)				1	0	0	0
Queuing Penalty (veh)				2	0	0	0
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

**Intersection: 30: EB-to-WB X/O/Nordic Drive & WB Highland Road**

Movement	WB	WB	WB	NB	SB
Directions Served	T	T	R	LT	R
Maximum Queue (ft)	316	285	101	48	88
Average Queue (ft)	169	130	9	47	32
95th Queue (ft)	258	232	58	56	67
Link Distance (ft)	905	905		11	94
Upstream Blk Time (%)				54	0
Queuing Penalty (veh)				131	0
Storage Bay Dist (ft)			50		
Storage Blk Time (%)		14	0		
Queuing Penalty (veh)		5	0		

**Intersection: 31: EB Highland Road & EB-to-WB X/O**

Movement	EB	EB
Directions Served	L	T
Maximum Queue (ft)	324	198
Average Queue (ft)	121	4
95th Queue (ft)	240	65
Link Distance (ft)		518
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	300	
Storage Blk Time (%)	1	
Queuing Penalty (veh)	9	

**Intersection: 40: Bogie Lake Road & NB-to-SB X/O**

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	31	49	6
Average Queue (ft)	2	7	0
95th Queue (ft)	15	30	6
Link Distance (ft)	28	192	192
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 41: Bogie Lake Road & NB-to-SB X/O**

Movement	NB
Directions Served	L
Maximum Queue (ft)	12
Average Queue (ft)	1
95th Queue (ft)	8
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 50: W. Site Drive & EB Highland Road**

Movement	EB
Directions Served	TR
Maximum Queue (ft)	9
Average Queue (ft)	0
95th Queue (ft)	7
Link Distance (ft)	348
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 60: Bogie Lake Road & E. Site Drive

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**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)

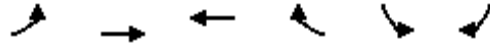
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**Zone Summary**

Zone wide Queuing Penalty: 198

HCM Signalized Intersection Capacity Analysis  
 10: EB Highland Road & WB-to-EB X/O

Future Condition Item A.  
 AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↘	
Traffic Volume (vph)	0	1633	0	0	167	0
Future Volume (vph)	0	1633	0	0	167	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			5.9	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3471			1736	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3471			1736	
Peak-hour factor, PHF	0.91	0.91	0.92	0.92	0.61	0.61
Adj. Flow (vph)	0	1795	0	0	274	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1795	0	0	274	0
Heavy Vehicles (%)	4%	4%	2%	2%	4%	4%
Turn Type		NA			Prot	
Protected Phases		2!			4 2!	
Permitted Phases						
Actuated Green, G (s)		56.9			90.0	
Effective Green, g (s)		56.9			83.9	
Actuated g/C Ratio		0.63			0.93	
Clearance Time (s)		6.1				
Vehicle Extension (s)		3.0				
Lane Grp Cap (vph)		2194			1618	
v/s Ratio Prot		c0.52			c0.16	
v/s Ratio Perm						
v/c Ratio		0.82			0.17	
Uniform Delay, d1		12.6			0.2	
Progression Factor		1.00			1.00	
Incremental Delay, d2		3.5			0.2	
Delay (s)		16.1			0.5	
Level of Service		B			A	
Approach Delay (s)		16.1	0.0		0.5	
Approach LOS		B	A		A	

Intersection Summary			
HCM 2000 Control Delay	14.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		

! Phase conflict between lane groups.  
 c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
20: Bogie Lake Road & EB Highland Road

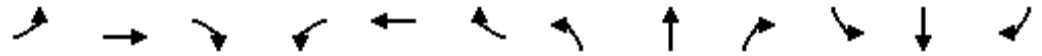
Future Condition Item A.  
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗					↑	↗↘		↑		
Traffic Volume (vph)	0	1292	504	0	0	0	0	103	296	0	45	0	
Future Volume (vph)	0	1292	504	0	0	0	0	103	296	0	45	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.7	6.7					10.9	10.9		6.9		
Lane Util. Factor		0.95	1.00					1.00	0.88		1.00		
Frt		1.00	0.85					1.00	0.85		1.00		
Flt Protected		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (prot)		3471	1553					1827	2733		1681		
Flt Permitted		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (perm)		3471	1553					1827	2733		1681		
Peak-hour factor, PHF	0.89	0.89	0.89	0.92	0.92	0.92	0.87	0.87	0.87	0.95	0.95	0.95	
Adj. Flow (vph)	0	1452	566	0	0	0	0	118	340	0	47	0	
RTOR Reduction (vph)	0	0	231	0	0	0	0	0	56	0	0	0	
Lane Group Flow (vph)	0	1452	335	0	0	0	0	118	284	0	47	0	
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	4%	4%	4%	13%	13%	13%	
Turn Type		NA	Perm					NA	Perm		NA		
Protected Phases		2						4			8		
Permitted Phases			2						4				
Actuated Green, G (s)		53.3	53.3					19.1	19.1		23.1		
Effective Green, g (s)		53.3	53.3					19.1	19.1		23.1		
Actuated g/C Ratio		0.59	0.59					0.21	0.21		0.26		
Clearance Time (s)		6.7	6.7					10.9	10.9		6.9		
Vehicle Extension (s)		3.0	3.0					3.0	3.0		3.0		
Lane Grp Cap (vph)		2055	919					387	580		431		
v/s Ratio Prot		c0.42						0.06			0.03		
v/s Ratio Perm			0.22						c0.10				
v/c Ratio		0.71	0.36					0.30	0.49		0.11		
Uniform Delay, d1		12.9	9.5					29.9	31.2		25.6		
Progression Factor		0.20	0.18					1.00	1.00		0.00		
Incremental Delay, d2		1.5	0.8					2.0	2.9		0.5		
Delay (s)		4.1	2.5					31.9	34.1		0.5		
Level of Service		A	A					C	C		A		
Approach Delay (s)		3.7			0.0			33.5			0.5		
Approach LOS		A			A			C			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			9.0									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.65										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	17.6
Intersection Capacity Utilization			60.7%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													



HCM Signalized Intersection Capacity Analysis  
 21: Bogie Lake Road & WB Highland Road













Future Condition Item A.  
 AM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑	↑		↑			↑	↑↑	
Traffic Volume (vph)	0	0	0	0	1138	44	0	103	0	0	45	69	
Future Volume (vph)	0	0	0	0	1138	44	0	103	0	0	45	69	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)					6.7	6.7		6.9			10.9	10.9	
Lane Util. Factor					0.95	1.00		1.00			1.00	0.88	
Frt					1.00	0.85		1.00			1.00	0.85	
Flt Protected					1.00	1.00		1.00			1.00	1.00	
Satd. Flow (prot)					3406	1524		1827			1681	2515	
Flt Permitted					1.00	1.00		1.00			1.00	1.00	
Satd. Flow (perm)					3406	1524		1827			1681	2515	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.87	0.87	0.87	0.95	0.95	0.95	
Adj. Flow (vph)	0	0	0	0	1237	48	0	118	0	0	47	73	
RTOR Reduction (vph)	0	0	0	0	0	20	0	0	0	0	0	58	
Lane Group Flow (vph)	0	0	0	0	1237	28	0	118	0	0	47	15	
Heavy Vehicles (%)	2%	2%	2%	6%	6%	6%	4%	4%	4%	13%	13%	13%	
Turn Type					NA	Perm		NA			NA	Perm	
Protected Phases					6			8			4		
Permitted Phases						6						4	
Actuated Green, G (s)					53.3	53.3		23.1			19.1	19.1	
Effective Green, g (s)					53.3	53.3		23.1			19.1	19.1	
Actuated g/C Ratio					0.59	0.59		0.26			0.21	0.21	
Clearance Time (s)					6.7	6.7		6.9			10.9	10.9	
Vehicle Extension (s)					3.0	3.0		3.0			3.0	3.0	
Lane Grp Cap (vph)					2017	902		468			356	533	
v/s Ratio Prot					c0.36			c0.06			0.03		
v/s Ratio Perm						0.02						0.01	
v/c Ratio					0.61	0.03		0.25			0.13	0.03	
Uniform Delay, d1					11.8	7.6		26.6			28.7	28.1	
Progression Factor					0.60	0.42		0.00			1.24	2.16	
Incremental Delay, d2					1.3	0.1		1.3			0.8	0.1	
Delay (s)					8.3	3.3		1.3			36.4	60.7	
Level of Service					A	A		A			D	E	
Approach Delay (s)		0.0			8.1			1.3			51.2		
Approach LOS		A			A			A			D		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			11.0		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.53										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					17.6			
Intersection Capacity Utilization			60.7%		ICU Level of Service					B			
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis  
 30: EB-to-WB X/O/Nordic Drive & WB Highland Road

Future Condition Item A.  
 AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↓				↑
Traffic Volume (vph)	0	0	0	0	1015	7	161	9	0	0	0	6
Future Volume (vph)	0	0	0	0	1015	7	161	9	0	0	0	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.1	6.1		5.9				5.9
Lane Util. Factor					0.95	1.00		1.00				1.00
Frt					1.00	0.85		1.00				0.86
Flt Protected					1.00	1.00		0.95				1.00
Satd. Flow (prot)					3406	1524		1761				1644
Flt Permitted					1.00	1.00		0.95				1.00
Satd. Flow (perm)					3406	1524		1761				1644
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.78	0.78	0.78	0.75	0.75	0.75
Adj. Flow (vph)	0	0	0	0	1068	7	206	12	0	0	0	8
RTOR Reduction (vph)	0	0	0	0	0	3	0	90	0	0	0	6
Lane Group Flow (vph)	0	0	0	0	1068	4	0	128	0	0	0	2
Heavy Vehicles (%)	2%	2%	2%	6%	6%	6%	3%	3%	3%	0%	0%	0%
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					2!			4				
Permitted Phases						2	4 2!					4
Actuated Green, G (s)					56.9	56.9		21.1				21.1
Effective Green, g (s)					56.9	56.9		21.1				21.1
Actuated g/C Ratio					0.63	0.63		0.23				0.23
Clearance Time (s)					6.1	6.1		5.9				5.9
Vehicle Extension (s)					3.0	3.0		3.0				3.0
Lane Grp Cap (vph)					2153	963		412				385
v/s Ratio Prot					c0.31							
v/s Ratio Perm						0.00		0.07				0.00
v/c Ratio					0.50	0.00		0.31				0.00
Uniform Delay, d1					8.9	6.1		28.5				26.4
Progression Factor					1.00	1.00		1.10				1.00
Incremental Delay, d2					0.8	0.0		1.4				0.0
Delay (s)					9.7	6.1		32.6				26.4
Level of Service					A	A		C				C
Approach Delay (s)		0.0			9.7			32.6			26.4	
Approach LOS		A			A			C			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.6		HCM 2000 Level of Service						B	
HCM 2000 Volume to Capacity ratio			0.45									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					12.0		
Intersection Capacity Utilization			58.2%		ICU Level of Service					B		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
40: Bogie Lake Road & NB-to-SB X/O

Future Condition Item A.  
AM Peak Hour



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↘					↑↑
Traffic Volume (vph)	89	0	0	0	0	25
Future Volume (vph)	89	0	0	0	0	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9					5.4
Lane Util. Factor	1.00					0.95
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1556					3139
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1556					3139
Peak-hour factor, PHF	0.82	0.82	0.92	0.92	0.81	0.81
Adj. Flow (vph)	109	0	0	0	0	31
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	109	0	0	0	0	31
Heavy Vehicles (%)	16%	16%	2%	2%	15%	15%
Turn Type	Prot					NA
Protected Phases	4 2!					2!
Permitted Phases						
Actuated Green, G (s)	90.0					57.6
Effective Green, g (s)	84.6					57.6
Actuated g/C Ratio	0.94					0.64
Clearance Time (s)						5.4
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	1462					2008
v/s Ratio Prot	c0.07					0.01
v/s Ratio Perm						
v/c Ratio	0.07					0.02
Uniform Delay, d1	0.2					5.9
Progression Factor	1.00					1.00
Incremental Delay, d2	0.1					0.0
Delay (s)	0.3					5.9
Level of Service	A					A
Approach Delay (s)	0.3		0.0			5.9
Approach LOS	A		A			A

Intersection Summary			
HCM 2000 Control Delay	1.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.08		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.  
c Critical Lane Group

Intersection						
Int Delay, s/veh	0.6					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑					↑
Traffic Vol, veh/h	1715	85	0	0	0	81
Future Vol, veh/h	1715	85	0	0	0	81
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	1081577472	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	92	92	92	92
Heavy Vehicles, %	4	4	2	2	2	2
Mvmt Flow	1927	96	0	0	0	88

Major/Minor	Major1		Minor1	
Conflicting Flow All	0	0	-	1012
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	*441
Stage 1	-	-	0	-
Stage 2	-	-	0	-
Platoon blocked, %	-	-	-	1
Mov Cap-1 Maneuver	-	-	-	*441
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	NB
HCM Control Delay, s	0	15.2
HCM LOS		C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	441	-	-
HCM Lane V/C Ratio	0.2	-	-
HCM Control Delay (s)	15.2	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	0.7	-	-

Notes  
 ~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		
Traffic Vol, veh/h	5	15	13	394	541	8
Future Vol, veh/h	5	15	13	394	541	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	87	87	92	92
Heavy Vehicles, %	2	2	4	4	2	2
Mvmt Flow	5	16	15	453	588	9

Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	1076	593	597	0	-	0
Stage 1	593	-	-	-	-	-
Stage 2	483	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.14	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.236	-	-	-
Pot Cap-1 Maneuver	*214	*634	*942	-	-	-
Stage 1	*598	-	-	-	-	-
Stage 2	*620	-	-	-	-	-
Platoon blocked, %	1	1	1	-	-	-
Mov Cap-1 Maneuver	*210	*634	*942	-	-	-
Mov Cap-2 Maneuver	*210	-	-	-	-	-
Stage 1	*586	-	-	-	-	-
Stage 2	*620	-	-	-	-	-

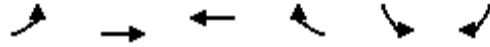
Approach	EB	NB	SB
HCM Control Delay, s	14	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	* 942	-	421	-	-
HCM Lane V/C Ratio	0.016	-	0.052	-	-
HCM Control Delay (s)	8.9	0	14	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Notes  
 ~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

HCM Signalized Intersection Capacity Analysis  
 10: EB Highland Road & WB-to-EB X/O

Future Condition Item A.  
 PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑			↙	
Traffic Volume (vph)	0	1444	0	0	266	0
Future Volume (vph)	0	1444	0	0	266	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.1			5.9	
Lane Util. Factor		0.95			1.00	
Frt		1.00			1.00	
Flt Protected		1.00			0.95	
Satd. Flow (prot)		3471			1787	
Flt Permitted		1.00			0.95	
Satd. Flow (perm)		3471			1787	
Peak-hour factor, PHF	0.94	0.94	0.92	0.92	0.88	0.88
Adj. Flow (vph)	0	1536	0	0	302	0
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1536	0	0	302	0
Heavy Vehicles (%)	4%	4%	2%	2%	1%	1%
Turn Type		NA			Prot	
Protected Phases		2!			4 2!	
Permitted Phases						
Actuated Green, G (s)		85.9			120.0	
Effective Green, g (s)		85.9			113.9	
Actuated g/C Ratio		0.72			0.95	
Clearance Time (s)		6.1				
Vehicle Extension (s)		3.0				
Lane Grp Cap (vph)		2484			1696	
v/s Ratio Prot		c0.44			c0.17	
v/s Ratio Perm						
v/c Ratio		0.62			0.18	
Uniform Delay, d1		8.7			0.2	
Progression Factor		1.00			1.00	
Incremental Delay, d2		1.2			0.1	
Delay (s)		9.9			0.3	
Level of Service		A			A	
Approach Delay (s)		9.9	0.0		0.3	
Approach LOS		A	A		A	

Intersection Summary			
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.4%	ICU Level of Service	F
Analysis Period (min)	15		

! Phase conflict between lane groups.  
 c Critical Lane Group



HCM Signalized Intersection Capacity Analysis  
20: Bogie Lake Road & EB Highland Road

Future Condition Item A.  
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗					↑	↗↘		↑		
Traffic Volume (vph)	0	1370	334	0	0	0	0	188	348	0	66	0	
Future Volume (vph)	0	1370	334	0	0	0	0	188	348	0	66	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.7	6.7					10.9	10.9		6.9		
Lane Util. Factor		0.95	1.00					1.00	0.88		1.00		
Frt		1.00	0.85					1.00	0.85		1.00		
Flt Protected		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (prot)		3505	1568					1863	2787		1827		
Flt Permitted		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (perm)		3505	1568					1863	2787		1827		
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92	
Adj. Flow (vph)	0	1442	352	0	0	0	0	202	374	0	72	0	
RTOR Reduction (vph)	0	0	108	0	0	0	0	0	101	0	0	0	
Lane Group Flow (vph)	0	1442	244	0	0	0	0	202	273	0	72	0	
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	4%	4%	
Turn Type		NA	Perm					NA	Perm		NA		
Protected Phases		2						4			8		
Permitted Phases			2						4				
Actuated Green, G (s)		83.3	83.3					19.1	19.1		23.1		
Effective Green, g (s)		83.3	83.3					19.1	19.1		23.1		
Actuated g/C Ratio		0.69	0.69					0.16	0.16		0.19		
Clearance Time (s)		6.7	6.7					10.9	10.9		6.9		
Vehicle Extension (s)		3.0	3.0					3.0	3.0		3.0		
Lane Grp Cap (vph)		2433	1088					296	443		351		
v/s Ratio Prot		c0.41						c0.11			0.04		
v/s Ratio Perm			0.16						0.10				
v/c Ratio		0.59	0.22					0.68	0.62		0.21		
Uniform Delay, d1		9.5	6.6					47.6	47.0		40.7		
Progression Factor		0.30	0.20					1.00	1.00		0.00		
Incremental Delay, d2		0.9	0.4					12.1	6.3		1.3		
Delay (s)		3.8	1.7					59.6	53.3		1.3		
Level of Service		A	A					E	D		A		
Approach Delay (s)		3.4			0.0			55.5			1.3		
Approach LOS		A			A			E			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			15.6									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.61										
Actuated Cycle Length (s)			120.0									Sum of lost time (s)	17.6
Intersection Capacity Utilization			73.7%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis  
 21: Bogie Lake Road & WB Highland Road

Future Condition Item A.  
 PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↗		↑			↑	↗↗
Traffic Volume (vph)	0	0	0	0	1897	111	0	188	0	0	66	144
Future Volume (vph)	0	0	0	0	1897	111	0	188	0	0	66	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.7	6.7		6.9			10.9	10.9
Lane Util. Factor					0.95	1.00		1.00			1.00	0.88
Frbp, ped/bikes					1.00	0.99		1.00			1.00	0.98
Flpb, ped/bikes					1.00	1.00		1.00			1.00	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3539	1562		1863			1827	2670
Flt Permitted					1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3539	1562		1863			1827	2670
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	2108	123	0	202	0	0	72	157
RTOR Reduction (vph)	0	0	0	0	0	37	0	0	0	0	0	29
Lane Group Flow (vph)	0	0	0	0	2108	86	0	202	0	0	72	128
Confl. Peds. (#/hr)						3						1
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	4%	4%
Turn Type					NA	Perm		NA			NA	Perm
Protected Phases					6			8			4	
Permitted Phases						6						4
Actuated Green, G (s)					83.3	83.3		23.1			19.1	19.1
Effective Green, g (s)					83.3	83.3		23.1			19.1	19.1
Actuated g/C Ratio					0.69	0.69		0.19			0.16	0.16
Clearance Time (s)					6.7	6.7		6.9			10.9	10.9
Vehicle Extension (s)					3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)					2456	1084		358			290	424
v/s Ratio Prot					c0.60			c0.11			0.04	
v/s Ratio Perm						0.06						0.05
v/c Ratio					0.86	0.08		0.56			0.25	0.30
Uniform Delay, d1					13.9	5.9		43.9			44.2	44.6
Progression Factor					0.99	0.48		0.00			1.34	1.44
Incremental Delay, d2					2.9	0.1		4.6			2.0	1.8
Delay (s)					16.6	3.0		4.7			61.2	66.0
Level of Service					B	A		A			E	E
Approach Delay (s)		0.0			15.9			4.7			64.5	
Approach LOS		A			B			A			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			19.2		HCM 2000 Level of Service						B	
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						17.6	
Intersection Capacity Utilization			73.7%		ICU Level of Service						D	
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 30: EB-to-WB X/O/Nordic Drive & WB Highland Road

Future Condition Item A.  
 PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑				↑
Traffic Volume (vph)	0	0	0	0	1698	38	250	34	0	0	0	60
Future Volume (vph)	0	0	0	0	1698	38	250	34	0	0	0	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.1	6.1		5.9				5.9
Lane Util. Factor					0.95	1.00		1.00				1.00
Frbp, ped/bikes					1.00	0.98		1.00				1.00
Flpb, ped/bikes					1.00	1.00		1.00				1.00
Frt					1.00	0.85		1.00				0.86
Flt Protected					1.00	1.00		0.96				1.00
Satd. Flow (prot)					3505	1536		1820				1644
Flt Permitted					1.00	1.00		0.96				1.00
Satd. Flow (perm)					3505	1536		1820				1644
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.79	0.79	0.79	0.74	0.74	0.74
Adj. Flow (vph)	0	0	0	0	1787	40	316	43	0	0	0	81
RTOR Reduction (vph)	0	0	0	0	0	7	0	31	0	0	0	31
Lane Group Flow (vph)	0	0	0	0	1787	33	0	328	0	0	0	50
Confl. Peds. (#/hr)						1						
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					2!			4				
Permitted Phases						2	4 2!					4
Actuated Green, G (s)					85.9	85.9		22.1				22.1
Effective Green, g (s)					85.9	85.9		22.1				22.1
Actuated g/C Ratio					0.72	0.72		0.18				0.18
Clearance Time (s)					6.1	6.1		5.9				5.9
Vehicle Extension (s)					3.0	3.0		3.0				3.0
Lane Grp Cap (vph)					2508	1099		335				302
v/s Ratio Prot					c0.51							
v/s Ratio Perm						0.02		0.18				0.03
v/c Ratio					0.71	0.03		0.98				0.17
Uniform Delay, d1					9.9	5.0		48.7				41.2
Progression Factor					1.00	1.00		1.06				1.00
Incremental Delay, d2					1.8	0.1		39.6				1.2
Delay (s)					11.6	5.0		91.2				42.4
Level of Service					B	A		F				D
Approach Delay (s)		0.0			11.5			91.2			42.4	
Approach LOS		A			B			F			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			25.2		HCM 2000 Level of Service					C		
HCM 2000 Volume to Capacity ratio			0.77									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)					12.0		
Intersection Capacity Utilization			83.3%		ICU Level of Service					E		
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
40: Bogie Lake Road & NB-to-SB X/O

Future Condition Item A.  
PM Peak Hour



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↖					↗↗
Traffic Volume (vph)	187	0	0	0	0	23
Future Volume (vph)	187	0	0	0	0	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9					5.4
Lane Util. Factor	1.00					0.95
Frt	1.00					1.00
Flt Protected	0.95					1.00
Satd. Flow (prot)	1752					3610
Flt Permitted	0.95					1.00
Satd. Flow (perm)	1752					3610
Peak-hour factor, PHF	0.86	0.86	0.92	0.92	0.60	0.60
Adj. Flow (vph)	217	0	0	0	0	38
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	217	0	0	0	0	38
Heavy Vehicles (%)	3%	3%	2%	2%	0%	0%
Turn Type	Prot					NA
Protected Phases	4 2!					2!
Permitted Phases						
Actuated Green, G (s)	120.0					86.6
Effective Green, g (s)	114.6					86.6
Actuated g/C Ratio	0.95					0.72
Clearance Time (s)						5.4
Vehicle Extension (s)						3.0
Lane Grp Cap (vph)	1673					2605
v/s Ratio Prot	c0.12					0.01
v/s Ratio Perm						
v/c Ratio	0.13					0.01
Uniform Delay, d1	0.1					4.7
Progression Factor	1.00					1.00
Incremental Delay, d2	0.2					0.0
Delay (s)	0.3					4.7
Level of Service	A					A
Approach Delay (s)	0.3		0.0			4.7
Approach LOS	A		A			A

Intersection Summary			
HCM 2000 Control Delay	0.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.14		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.3
Intersection Capacity Utilization	30.7%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.  
c Critical Lane Group

Intersection						
Int Delay, s/veh	0.8					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑					↑
Traffic Vol, veh/h	1612	98	0	0	0	92
Future Vol, veh/h	1612	98	0	0	0	92
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Stop	Stop	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	1081577472	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	92	92	92	92
Heavy Vehicles, %	3	3	2	2	2	2
Mvmt Flow	1697	103	0	0	0	100

Major/Minor	Major1		Minor1	
Conflicting Flow All	0	0	-	900
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	*458
Stage 1	-	-	0	-
Stage 2	-	-	0	-
Platoon blocked, %	-	-	-	1
Mov Cap-1 Maneuver	-	-	-	*458
Mov Cap-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	NB
HCM Control Delay, s	0	15
HCM LOS		C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR
Capacity (veh/h)	458	-	-
HCM Lane V/C Ratio	0.218	-	-
HCM Control Delay (s)	15	-	-
HCM Lane LOS	C	-	-
HCM 95th %tile Q(veh)	0.8	-	-

Notes  
 ~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

Intersection						
Int Delay, s/veh	0.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			T		
Traffic Vol, veh/h	7	14	16	529	394	6
Future Vol, veh/h	7	14	16	529	394	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
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	8	15	17	569	428	7

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	1035	432	435	0	0
Stage 1	432	-	-	-	-
Stage 2	603	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	237	772	1151	-	-
Stage 1	728	-	-	-	-
Stage 2	546	-	-	-	-
Platoon blocked, %	1	1	1	-	-
Mov Cap-1 Maneuver	231	772	1151	-	-
Mov Cap-2 Maneuver	231	-	-	-	-
Stage 1	712	-	-	-	-
Stage 2	546	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.8	0.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1151	-	434	-	-
HCM Lane V/C Ratio	0.015	-	0.053	-	-
HCM Control Delay (s)	8.2	0	13.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-



**Intersection: 10: EB Highland Road & WB-to-EB X/O**

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	300	305	69
Average Queue (ft)	153	159	41
95th Queue (ft)	241	255	68
Link Distance (ft)	708	708	35
Upstream Blk Time (%)			15
Queuing Penalty (veh)			30
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 11: WB-to-EB X/O & WB Highland Road**

Movement	WB
Directions Served	L
Maximum Queue (ft)	140
Average Queue (ft)	32
95th Queue (ft)	101
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 20: Bogie Lake Road & EB Highland Road**

Movement	EB	EB	EB	NB	NB	NB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	129	144	109	119	120	123
Average Queue (ft)	56	70	46	55	64	49
95th Queue (ft)	110	125	84	104	107	97
Link Distance (ft)	330	330	330	291	291	291
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 21: Bogie Lake Road & WB Highland Road**

Movement	WB	WB	WB	SB	SB	SB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	102	102	39	92	70	52
Average Queue (ft)	40	36	4	31	29	16
95th Queue (ft)	83	83	20	71	62	44
Link Distance (ft)	477	477	477	152	152	152
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 30: EB-to-WB X/O/Nordic Drive & WB Highland Road**

Movement	WB	WB	WB	NB	SB
Directions Served	T	T	R	LT	R
Maximum Queue (ft)	203	161	11	52	30
Average Queue (ft)	115	65	1	39	5
95th Queue (ft)	180	137	9	59	23
Link Distance (ft)	905	905		11	94
Upstream Blk Time (%)				22	
Queuing Penalty (veh)				39	
Storage Bay Dist (ft)			50		
Storage Blk Time (%)		9			
Queuing Penalty (veh)		1			

**Intersection: 31: EB Highland Road & EB-to-WB X/O**

Movement	EB
Directions Served	L
Maximum Queue (ft)	120
Average Queue (ft)	31
95th Queue (ft)	88
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 40: Bogie Lake Road & NB-to-SB X/O**

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	5	62
Average Queue (ft)	0	11
95th Queue (ft)	6	40
Link Distance (ft)	28	192
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 41: Bogie Lake Road & NB-to-SB X/O**

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: 50: W. Site Drive & EB Highland Road**

Movement	EB	NB
Directions Served	TR	R
Maximum Queue (ft)	21	96
Average Queue (ft)	1	42
95th Queue (ft)	11	76
Link Distance (ft)	348	334
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Intersection: 60: Bogie Lake Road & E. Site Drive

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Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	40	46
Average Queue (ft)	17	3
95th Queue (ft)	43	21
Link Distance (ft)	294	343
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Zone Summary

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Zone wide Queuing Penalty: 70

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**Intersection: 10: EB Highland Road & WB-to-EB X/O**

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	238	236	68
Average Queue (ft)	138	123	48
95th Queue (ft)	218	210	63
Link Distance (ft)	708	708	35
Upstream Blk Time (%)			26
Queuing Penalty (veh)			70
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 11: WB-to-EB X/O & WB Highland Road**

Movement	WB
Directions Served	L
Maximum Queue (ft)	185
Average Queue (ft)	51
95th Queue (ft)	137
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 20: Bogie Lake Road & EB Highland Road**

Movement	EB	EB	EB	NB	NB	NB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	144	151	69	261	157	140
Average Queue (ft)	58	68	28	125	82	66
95th Queue (ft)	117	128	57	224	135	115
Link Distance (ft)	330	330	330	291	291	291
Upstream Blk Time (%)				0		
Queuing Penalty (veh)				0		
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 21: Bogie Lake Road & WB Highland Road**

Movement	WB	WB	WB	NB	SB	SB	SB
Directions Served	T	T	R	T	T	R	R
Maximum Queue (ft)	239	237	43	15	110	120	117
Average Queue (ft)	78	89	9	1	49	52	46
95th Queue (ft)	144	156	32	11	95	99	94
Link Distance (ft)	477	477	477	37	152	152	152
Upstream Blk Time (%)				2	0		0
Queuing Penalty (veh)				4	0		0
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

**Intersection: 30: EB-to-WB X/O/Nordic Drive & WB Highland Road**

Movement	WB	WB	WB	NB	SB
Directions Served	T	T	R	LT	R
Maximum Queue (ft)	303	277	95	48	82
Average Queue (ft)	172	126	8	47	31
95th Queue (ft)	265	229	48	52	65
Link Distance (ft)	905	905		11	94
Upstream Blk Time (%)				57	0
Queuing Penalty (veh)				164	0
Storage Bay Dist (ft)			50		
Storage Blk Time (%)		14	0		
Queuing Penalty (veh)		5	0		

**Intersection: 31: EB Highland Road & EB-to-WB X/O**

Movement	EB	EB
Directions Served	L	T
Maximum Queue (ft)	268	121
Average Queue (ft)	136	4
95th Queue (ft)	252	65
Link Distance (ft)		518
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	300	
Storage Blk Time (%)	1	
Queuing Penalty (veh)	4	



**Intersection: 40: Bogie Lake Road & NB-to-SB X/O**

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	25	40
Average Queue (ft)	1	7
95th Queue (ft)	12	29
Link Distance (ft)	28	192
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 41: Bogie Lake Road & NB-to-SB X/O**

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: 50: W. Site Drive & EB Highland Road**

Movement	NB
Directions Served	R
Maximum Queue (ft)	108
Average Queue (ft)	43
95th Queue (ft)	83
Link Distance (ft)	334
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

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Intersection: 60: Bogie Lake Road & E. Site Drive

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Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	45	48
Average Queue (ft)	15	5
95th Queue (ft)	43	25
Link Distance (ft)	294	343
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

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Zone Summary













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Zone wide Queuing Penalty: 248

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










HCM Signalized Intersection Capacity Analysis  
20: Bogie Lake Road & EB Highland Road

Future Conditions w/ IN Item A.  
AM Peak Hour

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗					↑	↗↗		↑		
Traffic Volume (vph)	0	1292	504	0	0	0	0	103	296	0	45	0	
Future Volume (vph)	0	1292	504	0	0	0	0	103	296	0	45	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.7	6.7					10.9	10.9		6.9		
Lane Util. Factor		0.95	1.00					1.00	0.88		1.00		
Frt		1.00	0.85					1.00	0.85		1.00		
Flt Protected		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (prot)		3471	1553					1827	2733		1681		
Flt Permitted		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (perm)		3471	1553					1827	2733		1681		
Peak-hour factor, PHF	0.89	0.89	0.89	0.92	0.92	0.92	0.87	0.87	0.87	0.95	0.95	0.95	
Adj. Flow (vph)	0	1452	566	0	0	0	0	118	340	0	47	0	
RTOR Reduction (vph)	0	0	281	0	0	0	0	0	31	0	0	0	
Lane Group Flow (vph)	0	1452	285	0	0	0	0	118	309	0	47	0	
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	4%	4%	4%	13%	13%	13%	
Turn Type		NA	Perm					NA	Perm		NA		
Protected Phases		2						4			8		
Permitted Phases			2						4				
Actuated Green, G (s)		45.3	45.3					27.1	27.1		31.1		
Effective Green, g (s)		45.3	45.3					27.1	27.1		31.1		
Actuated g/C Ratio		0.50	0.50					0.30	0.30		0.35		
Clearance Time (s)		6.7	6.7					10.9	10.9		6.9		
Vehicle Extension (s)		3.0	3.0					3.0	3.0		3.0		
Lane Grp Cap (vph)		1747	781					550	822		580		
v/s Ratio Prot		c0.42						0.06			0.03		
v/s Ratio Perm			0.18						c0.11				
v/c Ratio		0.83	0.36					0.21	0.38		0.08		
Uniform Delay, d1		19.1	13.6					23.5	24.8		19.8		
Progression Factor		0.43	0.21					1.00	1.00		0.00		
Incremental Delay, d2		3.4	0.9					0.9	1.3		0.3		
Delay (s)		11.5	3.8					24.4	26.1		0.3		
Level of Service		B	A					C	C		A		
Approach Delay (s)		9.4			0.0			25.7			0.3		
Approach LOS		A			A			C			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			12.2									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.66										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	17.6
Intersection Capacity Utilization			60.7%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													













HCM Signalized Intersection Capacity Analysis  
21: Bogie Lake Road & WB Highland Road

Future Conditions w/ IN Item A.  
AM Peak Hour

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑	↑		↑			↑	↑↑	
Traffic Volume (vph)	0	0	0	0	1138	44	0	103	0	0	45	69	
Future Volume (vph)	0	0	0	0	1138	44	0	103	0	0	45	69	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)					6.7	6.7		6.9			10.9	10.9	
Lane Util. Factor					0.95	1.00		1.00			1.00	0.88	
Frt					1.00	0.85		1.00			1.00	0.85	
Flt Protected					1.00	1.00		1.00			1.00	1.00	
Satd. Flow (prot)					3406	1524		1827			1681	2515	
Flt Permitted					1.00	1.00		1.00			1.00	1.00	
Satd. Flow (perm)					3406	1524		1827			1681	2515	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.87	0.87	0.87	0.95	0.95	0.95	
Adj. Flow (vph)	0	0	0	0	1237	48	0	118	0	0	47	73	
RTOR Reduction (vph)	0	0	0	0	0	24	0	0	0	0	0	49	
Lane Group Flow (vph)	0	0	0	0	1237	24	0	118	0	0	47	24	
Heavy Vehicles (%)	2%	2%	2%	6%	6%	6%	4%	4%	4%	13%	13%	13%	
Turn Type					NA	Perm		NA			NA	Perm	
Protected Phases					6			8			4		
Permitted Phases						6						4	
Actuated Green, G (s)					45.3	45.3		31.1			27.1	27.1	
Effective Green, g (s)					45.3	45.3		31.1			27.1	27.1	
Actuated g/C Ratio					0.50	0.50		0.35			0.30	0.30	
Clearance Time (s)					6.7	6.7		6.9			10.9	10.9	
Vehicle Extension (s)					3.0	3.0		3.0			3.0	3.0	
Lane Grp Cap (vph)					1714	767		631			506	757	
v/s Ratio Prot					c0.36			c0.06			0.03		
v/s Ratio Perm						0.02						0.01	
v/c Ratio					0.72	0.03		0.19			0.09	0.03	
Uniform Delay, d1					17.4	11.3		20.6			22.6	22.2	
Progression Factor					0.71	0.27		0.00			1.39	2.38	
Incremental Delay, d2					2.4	0.1		0.6			0.4	0.1	
Delay (s)					14.7	3.1		0.7			31.8	52.9	
Level of Service					B	A		A			C	D	
Approach Delay (s)		0.0			14.3			0.7			44.6		
Approach LOS		A			B			A			D		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			15.6		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.53										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					17.6			
Intersection Capacity Utilization			60.7%		ICU Level of Service					B			
Analysis Period (min)			15										
c Critical Lane Group													













HCM Signalized Intersection Capacity Analysis  
20: Bogie Lake Road & EB Highland Road

Future Conditions w/ IN Item A.  
PM Peak Hour

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑	↗					↑	↗↗		↑		
Traffic Volume (vph)	0	1370	334	0	0	0	0	188	348	0	66	0	
Future Volume (vph)	0	1370	334	0	0	0	0	188	348	0	66	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)		6.7	6.7					10.9	10.9		6.9		
Lane Util. Factor		0.95	1.00					1.00	0.88		1.00		
Frt		1.00	0.85					1.00	0.85		1.00		
Flt Protected		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (prot)		3505	1568					1863	2787		1827		
Flt Permitted		1.00	1.00					1.00	1.00		1.00		
Satd. Flow (perm)		3505	1568					1863	2787		1827		
Peak-hour factor, PHF	0.95	0.95	0.95	0.92	0.92	0.92	0.93	0.93	0.93	0.92	0.92	0.92	
Adj. Flow (vph)	0	1442	352	0	0	0	0	202	374	0	72	0	
RTOR Reduction (vph)	0	0	137	0	0	0	0	0	61	0	0	0	
Lane Group Flow (vph)	0	1442	215	0	0	0	0	202	313	0	72	0	
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	4%	4%	
Turn Type		NA	Perm					NA	Perm		NA		
Protected Phases		2						4			8		
Permitted Phases			2						4				
Actuated Green, G (s)		73.3	73.3					29.1	29.1		33.1		
Effective Green, g (s)		73.3	73.3					29.1	29.1		33.1		
Actuated g/C Ratio		0.61	0.61					0.24	0.24		0.28		
Clearance Time (s)		6.7	6.7					10.9	10.9		6.9		
Vehicle Extension (s)		3.0	3.0					3.0	3.0		3.0		
Lane Grp Cap (vph)		2140	957					451	675		503		
v/s Ratio Prot		c0.41						0.11			0.04		
v/s Ratio Perm			0.14						c0.11				
v/c Ratio		0.67	0.22					0.45	0.46		0.14		
Uniform Delay, d1		15.4	10.5					38.6	38.8		32.8		
Progression Factor		0.52	0.17					1.00	1.00		0.00		
Incremental Delay, d2		1.5	0.5					3.2	2.3		0.6		
Delay (s)		9.5	2.2					41.8	41.1		0.6		
Level of Service		A	A					D	D		A		
Approach Delay (s)		8.1			0.0			41.3			0.6		
Approach LOS		A			A			D			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			15.7									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.61										
Actuated Cycle Length (s)			120.0									Sum of lost time (s)	17.6
Intersection Capacity Utilization			73.7%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis  
21: Bogie Lake Road & WB Highland Road

Future Conditions w/ IN Item A.  
PM Peak Hour

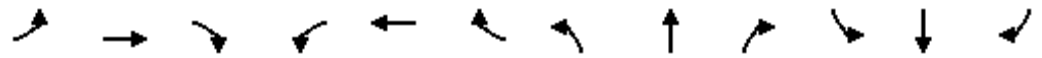
													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑	↑		↑			↑	↑↑	
Traffic Volume (vph)	0	0	0	0	1897	111	0	188	0	0	66	144	
Future Volume (vph)	0	0	0	0	1897	111	0	188	0	0	66	144	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Total Lost time (s)					6.7	6.7		6.9			10.9	10.9	
Lane Util. Factor					0.95	1.00		1.00			1.00	0.88	
Frbp, ped/bikes					1.00	0.99		1.00			1.00	0.98	
Flpb, ped/bikes					1.00	1.00		1.00			1.00	1.00	
Frt					1.00	0.85		1.00			1.00	0.85	
Flt Protected					1.00	1.00		1.00			1.00	1.00	
Satd. Flow (prot)					3539	1562		1863			1827	2673	
Flt Permitted					1.00	1.00		1.00			1.00	1.00	
Satd. Flow (perm)					3539	1562		1863			1827	2673	
Peak-hour factor, PHF	0.92	0.92	0.92	0.90	0.90	0.90	0.93	0.93	0.93	0.92	0.92	0.92	
Adj. Flow (vph)	0	0	0	0	2108	123	0	202	0	0	72	157	
RTOR Reduction (vph)	0	0	0	0	0	37	0	0	0	0	0	26	
Lane Group Flow (vph)	0	0	0	0	2108	86	0	202	0	0	72	131	
Confl. Peds. (#/hr)						3						1	
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	4%	4%	4%	
Turn Type					NA	Perm		NA			NA	Perm	
Protected Phases					6			8			4		
Permitted Phases						6						4	
Actuated Green, G (s)					73.3	73.3		33.1			29.1	29.1	
Effective Green, g (s)					73.3	73.3		33.1			29.1	29.1	
Actuated g/C Ratio					0.61	0.61		0.28			0.24	0.24	
Clearance Time (s)					6.7	6.7		6.9			10.9	10.9	
Vehicle Extension (s)					3.0	3.0		3.0			3.0	3.0	
Lane Grp Cap (vph)					2161	954		513			443	648	
v/s Ratio Prot					c0.60			c0.11			0.04		
v/s Ratio Perm						0.06						0.05	
v/c Ratio					0.98	0.09		0.39			0.16	0.20	
Uniform Delay, d1					22.5	9.6		35.3			35.8	36.2	
Progression Factor					0.60	1.04		0.00			1.46	1.59	
Incremental Delay, d2					10.0	0.1		2.1			0.8	0.7	
Delay (s)					23.5	10.1		2.1			53.3	58.2	
Level of Service					C	B		A			D	E	
Approach Delay (s)		0.0			22.8			2.1			56.6		
Approach LOS		A			C			A			E		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			24.1		HCM 2000 Level of Service						C		
HCM 2000 Volume to Capacity ratio			0.83										
Actuated Cycle Length (s)			120.0		Sum of lost time (s)						17.6		
Intersection Capacity Utilization			73.7%		ICU Level of Service						D		
Analysis Period (min)			15										

c Critical Lane Group



HCM Signalized Intersection Capacity Analysis  
 30: EB-to-WB X/O/Nordic Drive & WB Highland Road

Future Conditions w/ IN Item A.  
 PM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑				↑
Traffic Volume (vph)	0	0	0	0	1698	38	250	34	0	0	0	60
Future Volume (vph)	0	0	0	0	1698	38	250	34	0	0	0	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.1	6.1		5.9				5.9
Lane Util. Factor					0.95	1.00		1.00				1.00
Frbp, ped/bikes					1.00	0.98		1.00				1.00
Flpb, ped/bikes					1.00	1.00		1.00				1.00
Frt					1.00	0.85		1.00				0.86
Flt Protected					1.00	1.00		0.96				1.00
Satd. Flow (prot)					3505	1535		1820				1644
Flt Permitted					1.00	1.00		0.96				1.00
Satd. Flow (perm)					3505	1535		1820				1644
Peak-hour factor, PHF	0.92	0.92	0.92	0.95	0.95	0.95	0.79	0.79	0.79	0.74	0.74	0.74
Adj. Flow (vph)	0	0	0	0	1787	40	316	43	0	0	0	81
RTOR Reduction (vph)	0	0	0	0	0	11	0	19	0	0	0	19
Lane Group Flow (vph)	0	0	0	0	1787	29	0	340	0	0	0	62
Confl. Peds. (#/hr)						1						
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Turn Type					NA	Perm	custom	NA				Perm
Protected Phases					2!			4				
Permitted Phases						2	4 2!					4
Actuated Green, G (s)					68.9	68.9		39.1				39.1
Effective Green, g (s)					68.9	68.9		39.1				39.1
Actuated g/C Ratio					0.57	0.57		0.33				0.33
Clearance Time (s)					6.1	6.1		5.9				5.9
Vehicle Extension (s)					3.0	3.0		3.0				3.0
Lane Grp Cap (vph)					2012	881		593				535
v/s Ratio Prot					c0.51							
v/s Ratio Perm						0.02		0.19				0.04
v/c Ratio					0.89	0.03		0.57				0.12
Uniform Delay, d1					22.2	11.1		33.5				28.3
Progression Factor					1.00	1.00		1.48				1.00
Incremental Delay, d2					6.3	0.1		3.2				0.4
Delay (s)					28.5	11.2		53.0				28.8
Level of Service					C	B		D				C
Approach Delay (s)		0.0			28.1			53.0			28.8	
Approach LOS		A			C			D			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			32.1		HCM 2000 Level of Service				C			
HCM 2000 Volume to Capacity ratio			0.77									
Actuated Cycle Length (s)			120.0		Sum of lost time (s)				12.0			
Intersection Capacity Utilization			83.3%		ICU Level of Service				E			
Analysis Period (min)			15									
! Phase conflict between lane groups.												
c Critical Lane Group												

**Intersection: 10: EB Highland Road & WB-to-EB X/O**

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	298	363	61
Average Queue (ft)	157	169	42
95th Queue (ft)	254	287	66
Link Distance (ft)	708	708	35
Upstream Blk Time (%)			15
Queuing Penalty (veh)			29
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 11: WB-to-EB X/O & WB Highland Road**

Movement	WB
Directions Served	L
Maximum Queue (ft)	109
Average Queue (ft)	26
95th Queue (ft)	83
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 20: Bogie Lake Road & EB Highland Road**

Movement	EB	EB	EB	NB	NB	NB	SB
Directions Served	T	T	R	T	R	R	T
Maximum Queue (ft)	245	260	148	122	123	111	7
Average Queue (ft)	110	116	70	50	64	51	0
95th Queue (ft)	193	201	118	100	108	95	5
Link Distance (ft)	330	330	330	291	291	291	37
Upstream Blk Time (%)							0
Queuing Penalty (veh)							0
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

**Intersection: 21: Bogie Lake Road & WB Highland Road**

Movement	WB	WB	WB	SB	SB	SB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	157	158	35	76	74	78
Average Queue (ft)	79	77	9	26	27	18
95th Queue (ft)	133	139	30	62	62	50
Link Distance (ft)	477	477	477	152	152	152
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 30: EB-to-WB X/O/Nordic Drive & WB Highland Road**

Movement	WB	WB	WB	NB	SB
Directions Served	T	T	R	LT	R
Maximum Queue (ft)	213	165	24	55	30
Average Queue (ft)	112	62	1	37	3
95th Queue (ft)	183	126	9	60	17
Link Distance (ft)	905	905		11	94
Upstream Blk Time (%)				17	
Queuing Penalty (veh)				30	
Storage Bay Dist (ft)			50		
Storage Blk Time (%)		8			
Queuing Penalty (veh)		1			

**Intersection: 31: EB Highland Road & EB-to-WB X/O**

Movement	EB
Directions Served	L
Maximum Queue (ft)	113
Average Queue (ft)	31
95th Queue (ft)	85
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 40: Bogie Lake Road & NB-to-SB X/O**

Movement	WB	SB
Directions Served	L	T
Maximum Queue (ft)	20	52
Average Queue (ft)	1	7
95th Queue (ft)	10	32
Link Distance (ft)	28	192
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	0	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 41: Bogie Lake Road & NB-to-SB X/O**

Movement	NB
Directions Served	L
Maximum Queue (ft)	6
Average Queue (ft)	0
95th Queue (ft)	4
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 50: W. Site Drive & EB Highland Road**

Movement	NB
Directions Served	R
Maximum Queue (ft)	98
Average Queue (ft)	38
95th Queue (ft)	70
Link Distance (ft)	334
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 60: Bogie Lake Road & E. Site Drive

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	60	38
Average Queue (ft)	18	4
95th Queue (ft)	47	23
Link Distance (ft)	294	343
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Zone Summary

Zone wide Queuing Penalty: 60

**Intersection: 10: EB Highland Road & WB-to-EB X/O**

Movement	EB	EB	SB
Directions Served	T	T	L
Maximum Queue (ft)	258	265	63
Average Queue (ft)	147	130	48
95th Queue (ft)	232	234	63
Link Distance (ft)	708	708	35
Upstream Blk Time (%)			25
Queuing Penalty (veh)			67
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 11: WB-to-EB X/O & WB Highland Road**

Movement	WB
Directions Served	L
Maximum Queue (ft)	156
Average Queue (ft)	45
95th Queue (ft)	122
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	325
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 20: Bogie Lake Road & EB Highland Road**

Movement	EB	EB	EB	NB	NB	NB	SB
Directions Served	T	T	R	T	R	R	T
Maximum Queue (ft)	210	217	78	219	171	146	5
Average Queue (ft)	110	112	38	109	78	58	0
95th Queue (ft)	178	185	67	185	130	104	4
Link Distance (ft)	330	330	330	291	291	291	37
Upstream Blk Time (%)	0	0					0
Queuing Penalty (veh)	0	0					0
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							



**Intersection: 21: Bogie Lake Road & WB Highland Road**

Movement	WB	WB	WB	SB	SB	SB
Directions Served	T	T	R	T	R	R
Maximum Queue (ft)	488	475	134	105	100	101
Average Queue (ft)	313	308	28	41	46	41
95th Queue (ft)	457	449	85	89	88	83
Link Distance (ft)	477	477	477	152	152	152
Upstream Blk Time (%)	1	0		0		
Queuing Penalty (veh)	4	2		0		
Storage Bay Dist (ft)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

**Intersection: 30: EB-to-WB X/O/Nordic Drive & WB Highland Road**

Movement	WB	WB	WB	NB	SB
Directions Served	T	T	R	LT	R
Maximum Queue (ft)	572	527	200	48	76
Average Queue (ft)	346	309	26	47	28
95th Queue (ft)	494	463	117	53	65
Link Distance (ft)	905	905		11	94
Upstream Blk Time (%)				54	0
Queuing Penalty (veh)				154	0
Storage Bay Dist (ft)			50		
Storage Blk Time (%)		32	0		
Queuing Penalty (veh)		12	0		

**Intersection: 31: EB Highland Road & EB-to-WB X/O**

Movement	EB	EB
Directions Served	L	T
Maximum Queue (ft)	296	85
Average Queue (ft)	167	3
95th Queue (ft)	260	61
Link Distance (ft)		518
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	300	
Storage Blk Time (%)	0	
Queuing Penalty (veh)	3	

**Intersection: 40: Bogie Lake Road & NB-to-SB X/O**

Movement	WB	SB	SB
Directions Served	L	T	T
Maximum Queue (ft)	22	44	6
Average Queue (ft)	2	7	0
95th Queue (ft)	12	30	4
Link Distance (ft)	28	192	192
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 41: Bogie Lake Road & NB-to-SB X/O**

Movement	NB
Directions Served	L
Maximum Queue (ft)	6
Average Queue (ft)	0
95th Queue (ft)	4
Link Distance (ft)	
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	300
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 50: W. Site Drive & EB Highland Road**

Movement	EB	EB	NB
Directions Served	T	TR	R
Maximum Queue (ft)	21	6	96
Average Queue (ft)	1	0	39
95th Queue (ft)	11	4	72
Link Distance (ft)	348	348	334
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 60: Bogie Lake Road & E. Site Drive

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	44	68
Average Queue (ft)	16	9
95th Queue (ft)	43	42
Link Distance (ft)	294	343
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Zone Summary

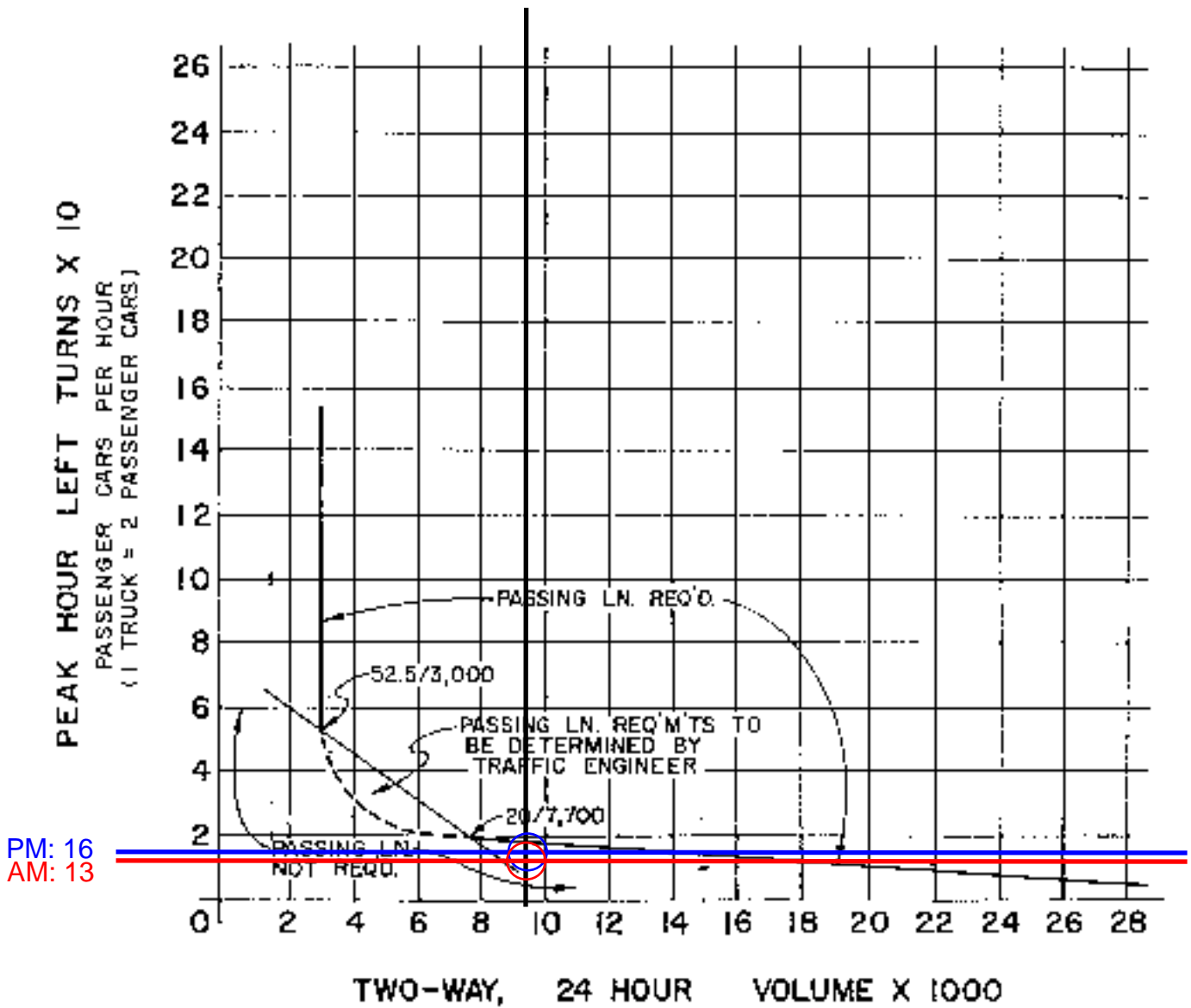
Zone wide Queuing Penalty: 242

# Bogie Lake Road and E. Site Drive (LT Warrant)

Item A.

## WARRANT FOR LEFT TURN PASSING LANE

(BASED ON TOTAL DEVELOPMENT)



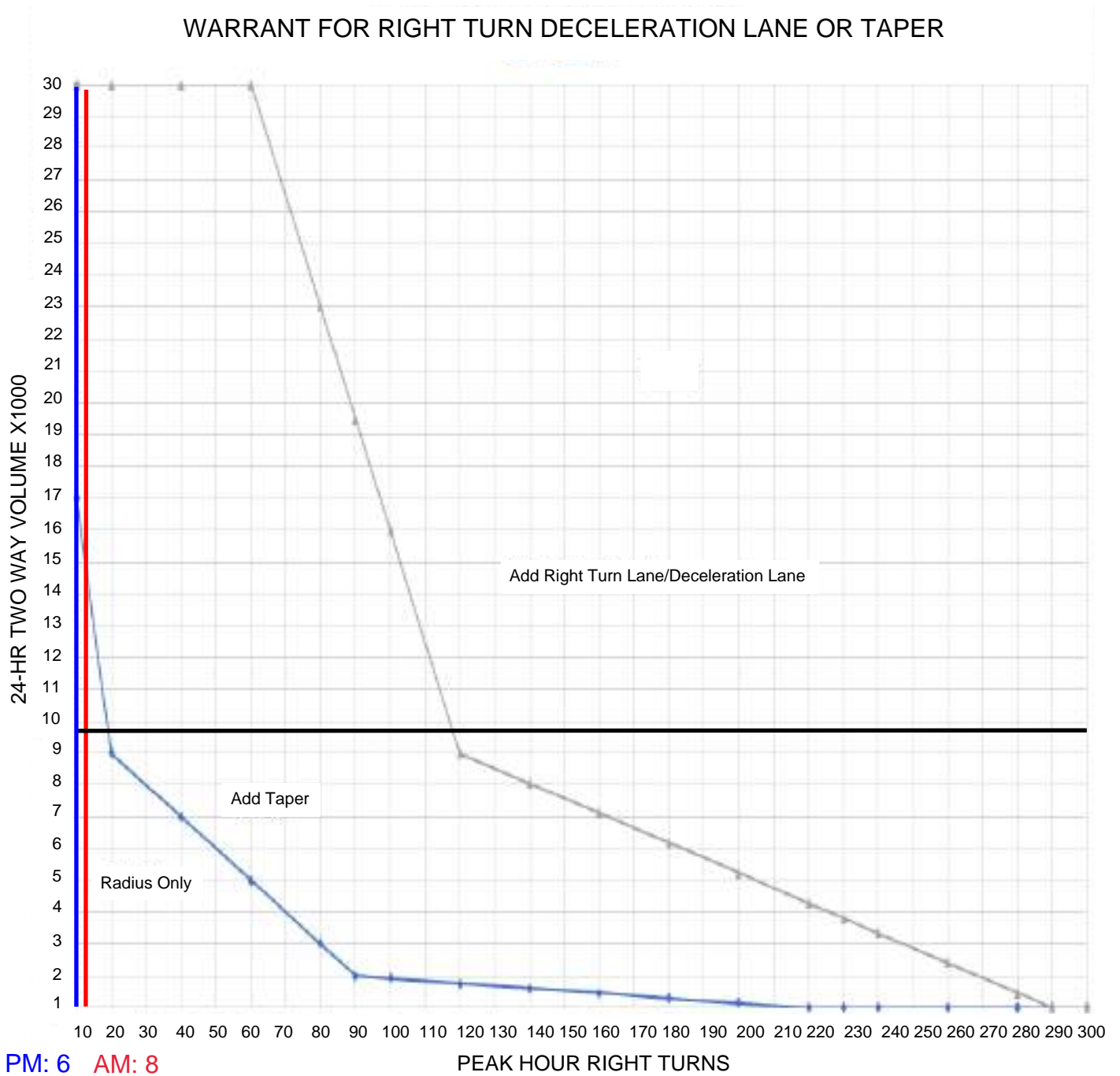
2-way Peak Volume (AM) = 956 vph  
 2-way Peak Volume (PM) = 945 vph  
 2-way Peak Volume (Avg.) = 951 vph  
 Assuming k-factor is 10% of ADT volume  
**2-way 24-Hr Volume = 9,510 vpd**

**LT TREATMENT  
NOT  
RECOMMENDED**

# Bogie Lake Road and E. Site Drive (RT Warrant)

Item A.

FIGURE 6-3

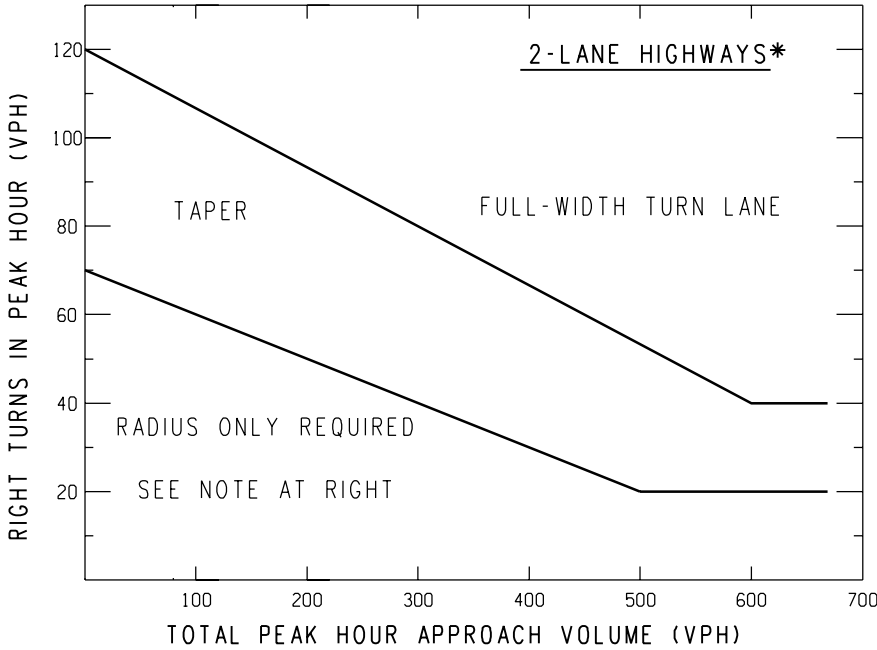


2-way Peak Volume (AM) = 956 vph  
 2-way Peak Volume (PM) = 945 vph  
 2-way Peak Volume (Avg.) = 951 vph  
 Assuming k-factor is 10% of ADT volume  
**2-way 24-Hr Volume = 9,510 vpd**

**RT TREATMENT  
NOT  
RECOMMENDED**

# Highland Road (M-59) and W. Site Drive (RT Warrant)

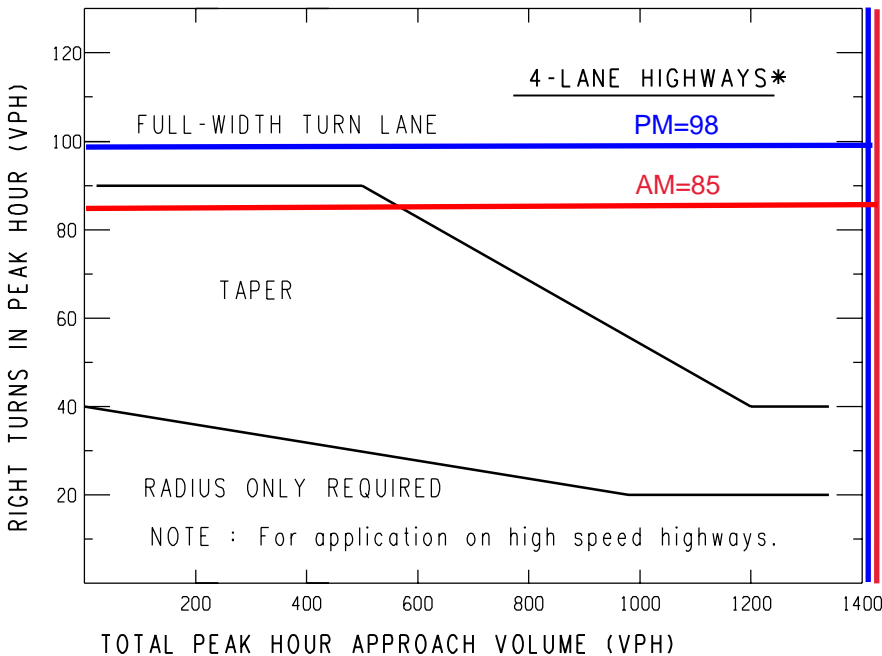
Item A.



**NOTE:**

For posted speeds at or under 45 mph, peak hour right turns greater than 40 vph, and total peak hour approach less than 300 vph, adjust right turn volumes.

Adjust peak hour right turns = Peak hour right turns - 20



\*If a center left-turn lane exists (i.e. 3 or 5 lane highway), subtract the number of left turns in approach volume from the total approach volume to get an adjusted total approach volume.

**Sample Problem:**

The Design Speed is 55 mph. The Peak Hour Approach Volume is 300 vph. The Number of Right Turns in the Peak Hour is 100 vph. Determine if a right turn lane is recommended.

**Solution:**

Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus, a right-turn lane may be recommended.

		<b>TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS</b>	
<b>TRAFFIC AND SAFETY NOTE</b>			
DRAWN BY: MTS	08/05/2004	<b>604A</b>	2 of 2
CHECKED BY: JAT	PLAN DATE:		
FILE: K:/DGN/ts_notes/Note604A tsn.dgn		REV. 08/05/2004	

Coffee Shop Drive Through Lane  
 95th Percentile Probability - Drive Through Queue Length (# of Vehicles)

Volume = 70 vph  
 service rate = 60 veh/hr  
 $\lambda = 1.166667$

	1	2	3	4	5	6	7	8	9	
$\lambda^x$	No Veh in Cycle	x	x!	$P = (e^{(-\lambda)})(\lambda^x)/x!$	$\Sigma P$	P* # Cycle containing Volume in 1	$\Sigma$ Cycles in 6	Volume in Cycle (1*6)	$\Sigma$ volume	Poisson Queue
1.0000	0	0	1	31.14%	31.14%	19	19	0	0	NO
1.1667	1	1	1	36.33%	67.47%	22	40	22	22	NO
1.3611	2	2	2	21.19%	88.66%	13	11	25	47	NO
1.5880	3	3	6	8.24%	96.91%	5	16	15	62	NO
1.8526	4	4	24	2.40%	99.31%	1	17	6	68	NO
2.1614	5	5	120	0.56%	99.87%	0	18	2	70	MET
2.5216	6	6	720	0.11%	99.98%	0	18	0	70	MET
2.9419	7	7	5040	0.02%	100.00%	0	18	0	70	MET
3.4322	8	8	40320	0.00%	100.00%	0	18	0	70	MET
4.0042	9	9	362880	0.00%	100.00%	0	18	0	70	MET
4.6716	10	10	3628800	0.00%	100.00%	0	18	0	70	MET
5.4502	11	11	39916800	0.00%	100.00%	0	18	0	70	MET



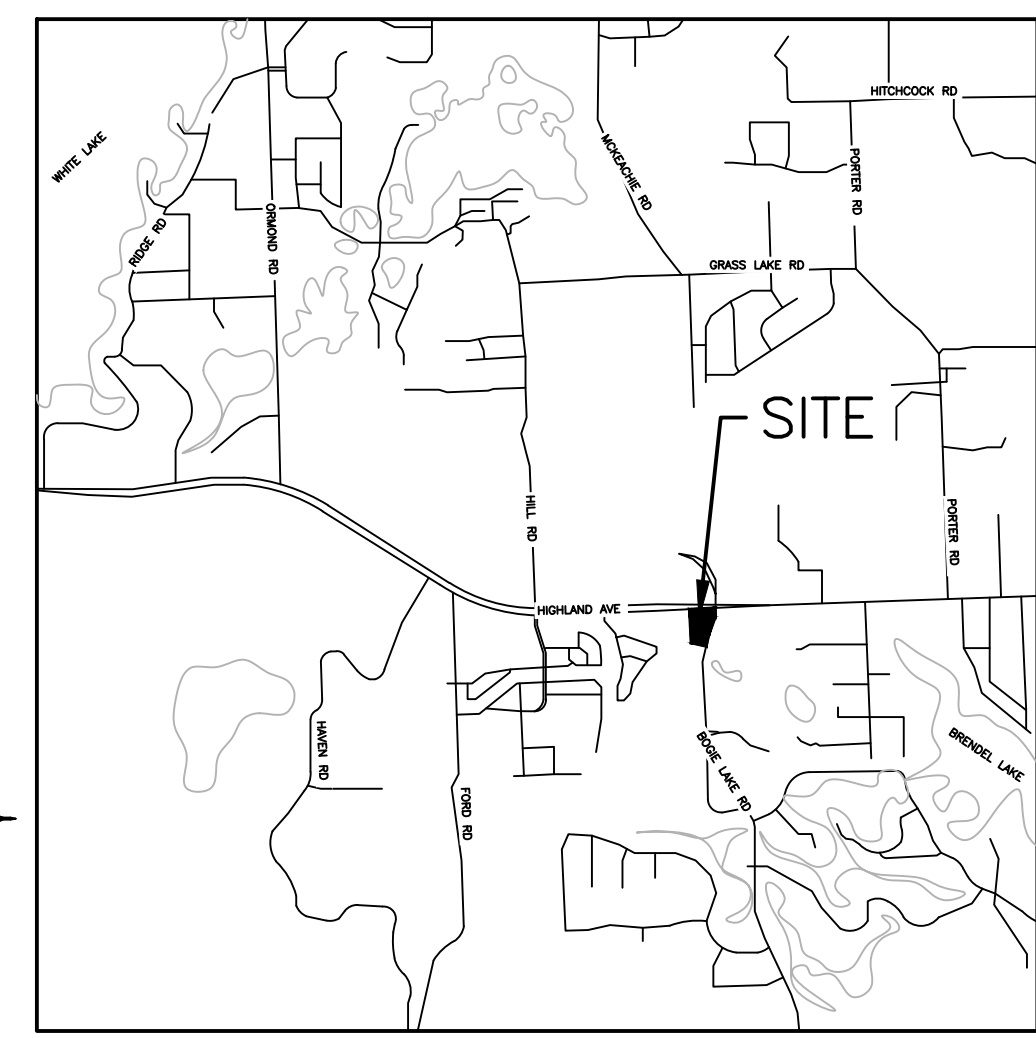
Fast-Food Restaurant Drive Through Lane  
 95th Percentile Probability - Drive Through Queue Length (# of Vehicles)

Volume = 49 vph  
 service rate = 90 veh/hr  
 $\lambda = 0.544444$

$\lambda^x$	1	2	3	4	5	6	7	8	9	Poisson Queue
	No Veh in Cycle	X	X!	$P = (e^{(-\lambda)})(\lambda^x)/X!$	$\Sigma P$	P* # Cycle containing Volume in 1	$\Sigma$ Cycles in 6	Volume in Cycle (1*6)	$\Sigma$ volume	
1.0000	0	0	1	58.02%	58.02%	52	52	0	0	NO
0.5444	1	1	1	31.59%	89.60%	28	81	28	28	NO
0.2964	2	2	2	8.60%	98.20%	8	11	15	44	NO
0.1614	3	3	6	1.56%	99.76%	1	12	4	48	NO
0.0879	4	4	24	0.21%	99.97%	0	13	1	49	MET
0.0478	5	5	120	0.02%	100.00%	0	13	0	49	MET
0.0260	6	6	720	0.00%	100.00%	0	13	0	49	MET
0.0142	7	7	5040	0.00%	100.00%	0	13	0	49	MET
0.0077	8	8	40320	0.00%	100.00%	0	13	0	49	MET
0.0042	9	9	362880	0.00%	100.00%	0	13	0	49	MET
0.0023	10	10	3628800	0.00%	100.00%	0	13	0	49	MET
0.0012	11	11	39916800	0.00%	100.00%	0	13	0	49	MET

# PRELIMINARY SITE PLAN FOR GATEWAY CROSSING

## PART OF NORTHEAST QUARTER OF SOUTHEAST QUARTER, SECTION 20 WHITE LAKE TOWNSHIP, OAKLAND COUNTY, MICHIGAN



**LOCATION MAP**  
NO SCALE

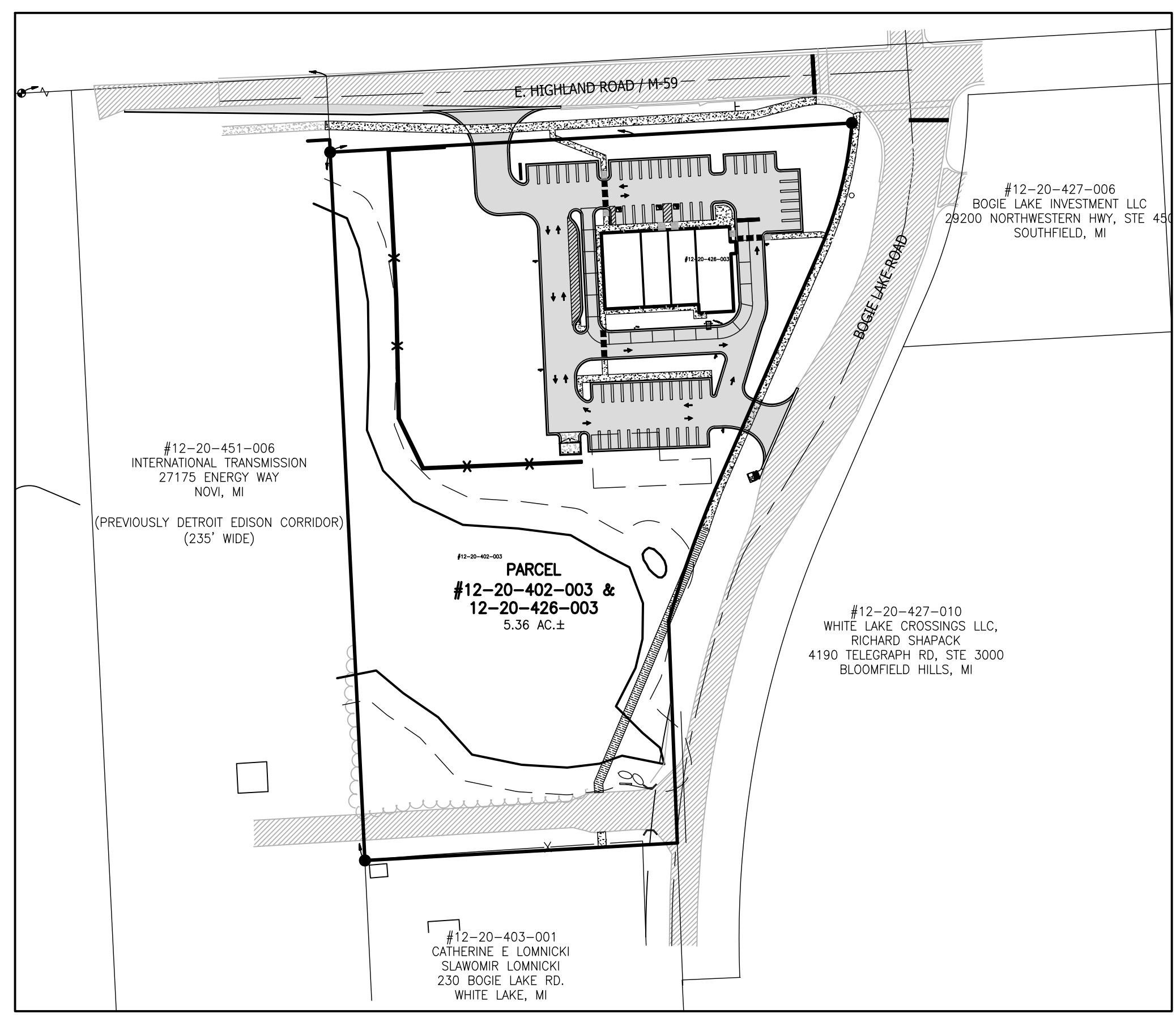
**PROPERTY DESCRIPTION:**

DESCRIPTION OF COMBINED PARCEL, AS SURVEYED BY KIEFT ENGINEERING, INC., JOB NO. KE 2012.247, DATED 1-30-13, AS SHOWN ON SURVEY BY ALPINE ENGINEERING, INC., JOB NO. 15-113, DATED 2-10-15:

PART OF THE NORTH 1/2 OF THE SOUTHEAST 1/4 OF SECTION 20, T3N-R8E, WHITE LAKE TOWNSHIP, OAKLAND COUNTY, MICHIGAN, DESCRIBED AS BEGINNING AT A POINT ON THE SOUTH RIGHT-OF-WAY LINE OF HIGHLAND ROAD (M-59, 70 FOOT HALF WIDTH) LOCATED S88°58'48"E 1032.50 FEET AND S01°25'12"W 70.00 FEET FROM THE CENTER OF SECTION 20, T3N-R8E; THENCE S88°58'48"E 480.35 FEET TO A POINT ON THE WESTERLY RIGHT-OF-WAY LINE OF BOGIE LAKE ROAD; THENCE ALONG SAID WESTERLY RIGHT-OF-WAY LINE ON A CURVE TO THE RIGHT 119.37 FEET, SAID CURVE HAVING A RADIUS OF 356.47 FEET, A DELTA OF 19°11'09" AND A LONG CHORD OF S18°14'12"W 118.81 FEET; THENCE S27°49'48"W 242.55 FEET; THENCE ALONG A CURVE TO THE LEFT 127.93 FEET, SAID CURVE HAVING A RADIUS OF 1060.72 FEET, A DELTA OF 06°54'37" AND A LONG CHORD OF S23°39'55"W 127.85 FEET; S01°58'42"W 203.96 FEET; THENCE N88°58'48"W 287.70 FEET; THENCE N01°25'12"E 652.00 FEET TO THE POINT OF BEGINNING. SUBJECT TO THE RIGHTS OF THE PUBLIC IN BOGIE LAKE ROAD. CONTAINING 5.36 ACRES.

**CONSTRUCTION NOTES**

- THE CONTRACTOR SHALL COMPLY WITH THE FOLLOWING NOTES AND ANY WORK INVOLVED SHALL BE CONSIDERED INCIDENTAL TO THE CONTRACT.
- THE CONTRACTOR SHALL HOLD HARMLESS THE DESIGN PROFESSIONAL, MUNICIPALITY, COUNTY, STATE AND ALL OF ITS SUB CONSULTANTS, PUBLIC AND PRIVATE UTILITY COMPANIES, AND LANDOWNERS FOR DAMAGES TO INDIVIDUALS AND PROPERTY, REAL OR OTHERWISE, DUE TO THE OPERATIONS OF THE CONTRACTOR AND/OR THEIR SUBCONTRACTORS.
  - A GRADING PERMIT FOR SOIL EROSION-SEDIMENTATION CONTROL SHALL BE OBTAINED FROM THE GOVERNING AGENCY PRIOR TO THE START OF CONSTRUCTION.
  - IF DUST PROBLEM OCCURS DURING CONSTRUCTION, CONTROL WILL BE PROVIDED BY AN APPLICATION OF WATER, EITHER BY SPRINKLER OR TANK TRUCK.
  - ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH LOCAL MUNICIPAL STANDARDS AND SPECIFICATIONS.
  - THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL REQUIRED TOWNSHIP, COUNTY, AND STATE OF MICHIGAN PERMITS.
  - PAVED SURFACES, WALKWAYS, SIGNS, LIGHTING AND OTHER STRUCTURES SHALL BE MAINTAINED IN A SAFE, ATTRACTIVE CONDITION AS ORIGINALLY DESIGNED AND CONSTRUCTED.
  - ALL BARRIER-FREE FEATURES SHALL BE CONSTRUCTED TO MEET ALL LOCAL, STATE AND A.D.A. REQUIREMENTS.
  - ANY DISCREPANCY IN THIS PLAN AND ACTUAL FIELD CONDITIONS SHALL BE REPORTED TO THE DESIGN ENGINEER PRIOR TO THE START OF CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF ALL SETBACKS, EASEMENTS AND DIMENSIONS SHOWN HEREON BEFORE BEGINNING CONSTRUCTION.
  - THE CONTRACTOR SHALL CONTACT ALL OWNERS OF EASEMENTS, UTILITIES AND RIGHTS-OF-WAY, PUBLIC OR PRIVATE, PRIOR TO THE START OF CONSTRUCTION.
  - THE CONTRACTOR SHALL COORDINATE WITH ALL OWNERS TO DETERMINE THE LOCATION OF EXISTING LANDSCAPING, IRRIGATION LINES & PRIVATE UTILITY LINES. THE CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE TO EXISTING LANDSCAPING, IRRIGATION LINES, AND PRIVATE UTILITY LINES.
  - THE CONTRACTOR SHALL REMOVE ALL TRASH AND DEBRIS FROM THE SITE UPON COMPLETION OF THE PROJECT.
  - THE CONTRACTOR SHALL MAINTAIN THE SITE IN A MANNER SO THAT WORKMEN AND PUBLIC SHALL BE PROTECTED FROM INJURY, AND ADJOINING PROPERTY PROTECTED FROM DAMAGE.
  - THE CONTRACTOR SHALL KEEP THE AREA OUTSIDE THE "CONSTRUCTION LIMITS" BROOM CLEAN AT ALL TIMES.
  - THE CONTRACTOR SHALL CALL MISS DIG A MINIMUM OF 72 HOURS PRIOR TO THE START OF CONSTRUCTION.
  - ALL EXCAVATION UNDER OR WITHIN 3 FEET OF PUBLIC PAVEMENT, EXISTING OR PROPOSED SHALL BE BACKFILLED AND COMPACTED WITH SAND (MDOT CLASS II).
  - ALL PAVEMENT REPLACEMENT AND OTHER WORKS COVERED BY THESE PLANS SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF THE TOWNSHIP, INCLUDING THE LATEST MICHIGAN DEPARTMENT OF TRANSPORTATION (MDOT) SPECIFICATIONS FOR HIGHWAY CONSTRUCTION.
  - THE CONTRACTOR IS RESPONSIBLE FOR ALL DAMAGE TO EXISTING UTILITIES.
  - NO ADDITIONAL COMPENSATION WILL BE PAID TO THE CONTRACTOR FOR ANY DELAY OR INCONVENIENCE DUE TO THE MATERIAL SHORTAGES OR RESPONSIBLE DELAYS DUE TO THE OPERATIONS OF SUCH OTHER PARTIES DOING WORK INDICATED OR SHOWN ON THE PLANS OR IN THE SPECIFICATION OR FOR ANY REASONABLE DELAYS IN CONSTRUCTION DUE TO THE ENCOUNTERING OR EXISTING UTILITIES THAT MAY OR MAY NOT BE SHOWN ON THE PLANS.
  - DURING THE CONSTRUCTION OPERATIONS, THE CONTRACTOR SHALL NOT PERFORM WORK BY PRIVATE AGREEMENT WITH PROPERTY OWNERS ADJACENT TO THE PROJECT.
  - IF WORK EXTENDS BEYOND NOVEMBER 15, NO COMPENSATION WILL BE DUE TO THE CONTRACTOR FOR ANY WINTER PROTECTION MEASURES THAT MAY BE REQUIRED BY THE ENGINEER.
  - NO TREES ARE TO BE REMOVED UNTIL MARKED IN THE FIELD BY THE ENGINEER.
  - THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO THE PROPERTY BEYOND THE CONSTRUCTION LIMITS INCLUDING BUT NOT LIMITED TO EXISTING FENCE, LAWN, TREES AND SHRUBBERY.
  - ALL AREAS DISTURBED BY THE CONTRACTOR BEYOND THE NORMAL CONSTRUCTION LIMITS OF THE PROJECT SHALL BE SODDED OR SEEDED AS SPECIFIED OR DIRECTED BY THE ENGINEER.
  - ALL ROOTS, STUMPS AND OTHER OBJECTIONABLE MATERIALS SHALL BE REMOVED AND THE HOLE BACKFILLED WITH SUITABLE MATERIAL. WHERE GRADE CORRECTION IS REQUIRED, THE SUBGRADE SHALL BE CUT TO CONFORM TO THE CROSS-SECTION AS SHOWN IN THE PLANS.
  - TRAFFIC SHALL BE MAINTAINED DURING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL SIGNS AND TRAFFIC CONTROL DEVICES. FLAG PERSONS SHALL BE PROVIDED BY THE CONTRACTOR IF DETERMINED NECESSARY BY THE ENGINEER. ALL SIGNS SHALL CONFORM TO THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES AT NO COST TO THE TOWNSHIP. NO WORK SHALL BE DONE UNLESS THE APPROPRIATE TRAFFIC CONTROL DEVICES ARE IN PLACE.
  - ALL DEMOLISHED MATERIALS AND SOIL SPOILS SHALL BE REMOVED FROM THE SITE AT NO ADDITIONAL COST, AND DISPOSED OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.
  - AFTER REMOVAL OF TOPSOIL, THE SUBGRADE SHALL BE COMPACTED TO 95% OF ITS UNIT WEIGHT.
  - ALL GRADING IN THE PLANS SHALL BE DONE AS PART OF THIS CONTRACT. ALL DELETERIOUS MATERIAL SHALL BE REMOVED FROM THE SUBGRADE PRIOR TO COMPACTING.
  - NO SEEDING SHALL BE DONE AFTER OCTOBER 15 WITHOUT APPROVAL OF THE ENGINEER.
  - ANY EXISTING APPURTENANCES SUCH AS MANHOLES, GATE VALVES, ETC. SHALL BE ADJUSTED TO THE PROPOSED GRADE AND SHALL BE CONSIDERED INCIDENTAL TO THE CONTRACT.
  - SOIL EROSION MEASURES SHALL BE MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION HAS BEEN RE-ESTABLISHED.
  - ALL PERMANENT SIGNS AND PAVEMENT MARKINGS SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST REVISION OF THE MICHIGAN MUTCD MANUAL AND SHALL BE INCIDENTAL TO THE CONTRACT.



**OVERALL SITE MAP**  
1" = 100'

PERMITS & APPROVALS		
AGENCY	DATE SUBMITTED	DATE APPROVED
• TOWNSHIP ENGINEERING APPROVAL	-	-
• RCOC	-	-
• SESC	-	-
• MDEGLE ACT 399	-	-
• MDEGLE PART 41	-	-
• MDEGLE WETLANDS	-	-

**INDEMNIFICATION STATEMENT**

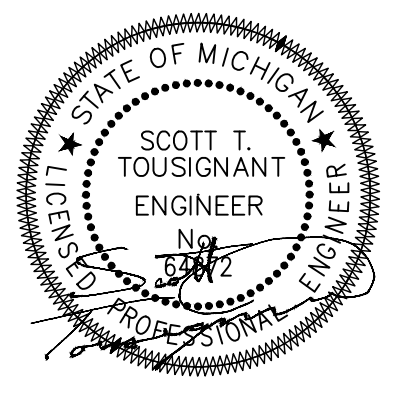
THE CONTRACTOR SHALL HOLD HARMLESS THE DESIGN PROFESSIONAL, MUNICIPALITY, COUNTY, STATE AND ALL OF ITS SUB CONSULTANTS, PUBLIC AND PRIVATE UTILITY COMPANIES, AND LANDOWNERS FOR DAMAGES TO INDIVIDUALS AND PROPERTY, REAL OR OTHERWISE, DUE TO THE OPERATIONS OF THE CONTRACTOR AND/OR THEIR SUBCONTRACTORS.

SHEET INDEX	
SHEET NO.	DESCRIPTION
1	COVER
2	GENERAL NOTES & LEGEND
3	EXISTING CONDITIONS & DEMOLITION PLAN
4	SITE PLAN
5	UTILITY PLAN
6	GRADING PLAN
7	DRAINAGE PLAN
8	SESC PLAN
9	DETENTION BASIN DETAILS
10	CONTECH UNDERGROUND DETAILS
11	CONSTRUCTION DETAILS
12	TOWNSHIP STORM SEWER DETAILS
13	TOWNSHIP SANITARY DETAILS
14	TOWNSHIP WATERMAIN DETAILS
15	WRC SESC DETAILS
SHEET NO.	DRAWINGS BY DETROIT ARCHITECTURAL GROUP
PP-4	MULTI-TENANT BUILDING PRELIMINARY FLOOR PLAN & DETAILS
PP-4.1	MULTI-TENANT BUILDING PRELIMINARY ELEVATIONS

**PREPARED FOR:**  
  
GATEWAY CROSSING, LLC  
600 N. OLD WOODWARD, SUITE 101  
BIRMINGHAM, MI 48009  
BRIAN NAJOR  
248.433.7000  
BRIAN@NAJORCOMPANIES.COM

**ARCHITECT:**  
  
DETROIT ARCHITECTURAL GROUP  
1644 FORD AVENUE  
WYANDOTTE, MI 48192  
JAKE ROOT, PRINCIPAL  
734-556-3259  
JROOT@DETROITARCH.COM

**PREPARED BY:**  
  
**BEBOSS**  
*Engineering*  
Engineers Surveyors Planners Landscape Architects  
3121 E. GRAND RIVER AVE.  
HOWELL, MI. 48843  
517.546.4836 FAX 517.548.1670  
CONTACT: JENNIFER AUSTIN  
EMAIL: JENNIFERA@BOSSENG.COM



NO	BY	CK	REVISION	DATE	JOB NO:
3	ST	ST	REVISION PER TWP #3 REVIEW	2/28/24	22-029-1
2	MJD	ST	REVISION PER TWP #2 REVIEW	1/12/24	
1	JA	ST	REVISION PER TWP #1 REVIEW	08/08/23	ISSUE DATE: 01/05/23
NO	BY	CK	REVISION	DATE	

FOR SITE PLAN APPROVAL ONLY!  
NOT FOR CONSTRUCTION



**GENERAL NOTES**

- 1. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL REQUIRED TOWNSHIP, COUNTY, AND STATE OF MICHIGAN PERMITS.
2. A GRADING PERMIT FOR SOIL EROSION-SEDIMENTATION CONTROL SHALL BE OBTAINED FROM THE GOVERNING AGENCY PRIOR TO THE START OF CONSTRUCTION.
3. IF DUST PROBLEM OCCURS DURING CONSTRUCTION, CONTROL WILL BE PROVIDED BY AN APPLICATION OF WATER, EITHER BY SPRINKLER OR TANK TRUCK.
... [Remaining 29 items follow a similar pattern]

**INDEMNIFICATION STATEMENT**

THE CONTRACTOR SHALL HOLD HARMLESS THE DESIGN PROFESSIONAL, MUNICIPALITY, COUNTY, STATE, AND ALL OF ITS SUB CONSULTANTS, PUBLIC AND PRIVATE UTILITY COMPANIES, AND LANDOWNERS FOR DAMAGES TO INDIVIDUALS AND PROPERTY, REAL OR OTHERWISE, DUE TO THE OPERATIONS OF THE CONTRACTOR AND/OR THEIR SUBCONTRACTORS.

**CONTRACTOR TO FOLLOW MANUFACTURER SPECS/RECOMMENDATIONS THAT SUPERCEDE PLANS**

**GENERAL GRADING & SESC NOTES**

- 1. THE CONTRACTOR SHALL HAVE IN PLACE ALL REQUIRED EROSION CONTROL METHODS AS INDICATED ON THE CONSTRUCTION PLANS AND AS REQUIRED BY GENERAL PRACTICE. SPECIFIC MEANS, METHODS AND SEQUENCES OF CONSTRUCTION MAY DICTATE ADDITIONAL SOIL EROSION CONTROL MEASURES BE NEEDED.
2. ACTUAL FIELD CONDITIONS MAY DICTATE ADDITIONAL OR ALTERNATE SOIL EROSION CONTROL MEASURES BE UTILIZED.
... [Remaining 10 items follow a similar pattern]

**GENERAL LANDSCAPE NOTES**

- 1. ALL PLANT MATERIAL SHALL CONFORM TO THE REQUIREMENTS AND SPECIFICATIONS OF THE GOVERNING MUNICIPALITY. ALL STOCK SHALL BE NURSERY GROWN, CONFORMING TO ANSI Z601.
2. ALL PLANT MATERIALS SHALL BE BALLED AND BURLAPPED OR CONTAINER STOCK. NO BARE ROOT STOCK IS PERMITTED.
... [Remaining 14 items follow a similar pattern]

**GENERAL UTILITY NOTES**

- 1. BEDDING SHALL EXTEND A MINIMUM OF 4" BELOW THE PIPE, UNLESS OTHERWISE NOTED ON THE PLANS.
2. WHERE UNSTABLE GROUND CONDITIONS ARE ENCOUNTERED, STONE BEDDING SHALL BE USED AS DIRECTED BY THE ENGINEER.
... [Remaining 3 items follow a similar pattern]

**GENERAL STORM NOTES**

- 1. ALL STORM PIPE LENGTHS ARE SHOWN FROM C/L TO C/L OF STRUCTURE OR FROM C/L OF STRUCTURE TO DISCHARGE END OF FLARED END SECTION.
2. STORM PIPE MATERIALS SHALL BE AS FOLLOWS:
2.1. RCP(REINFORCED CONCRETE PIPE): SHALL MEET THE REQUIREMENTS OF ASTM C76 WITH MODIFIED GROOVED TONGUE AND RUBBER GASKETS MEETING THE REQUIREMENTS OF ASTM C443.
... [Remaining 9 items follow a similar pattern]

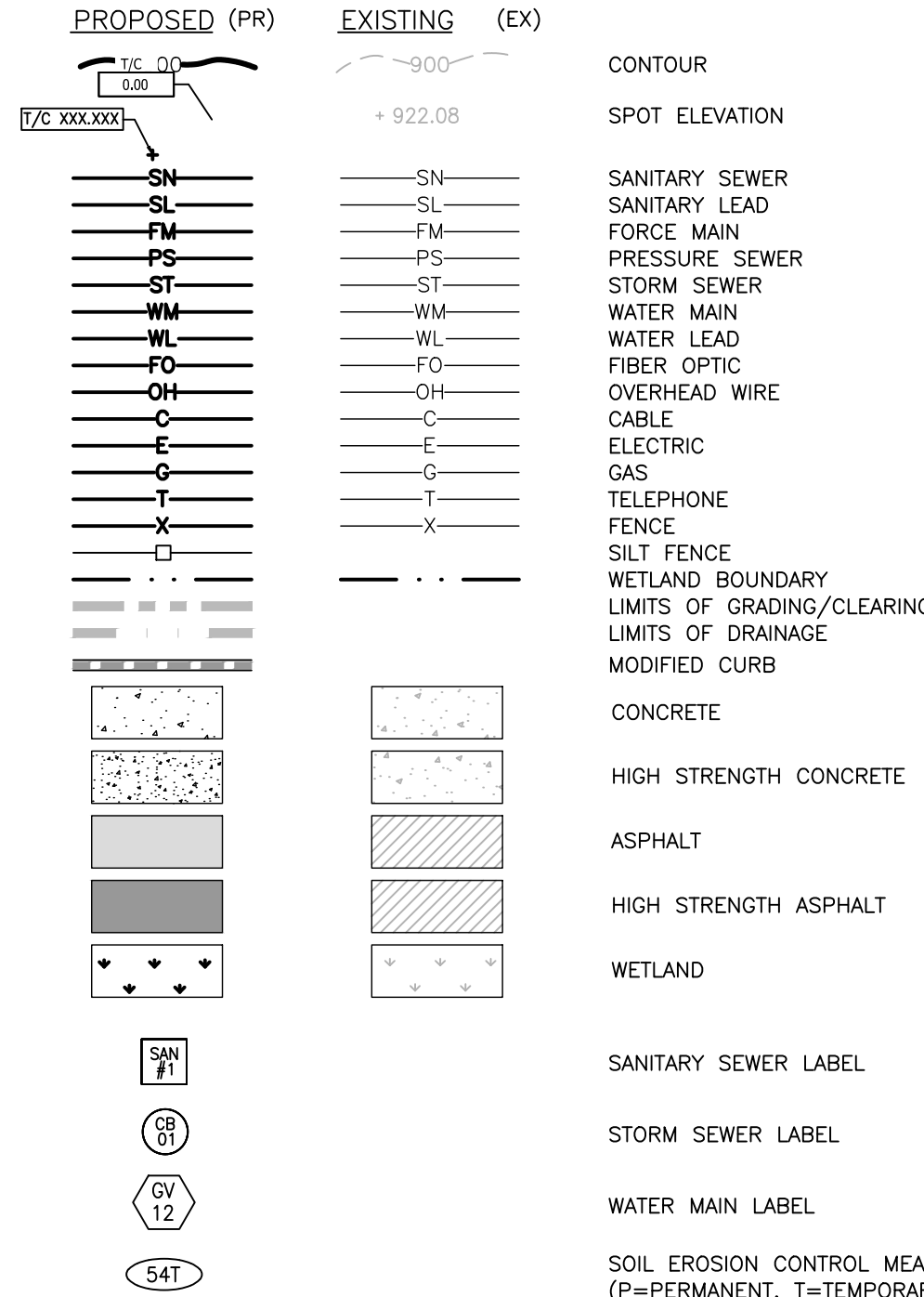
**GENERAL SANITARY NOTES**

- 1. ALL SANITARY PIPE LENGTHS ARE SHOWN FROM C/L OF STRUCTURE TO C/L OF STRUCTURE.
2. SANITARY PIPE MATERIALS SHALL BE AS FOLLOWS:
2.1. PVC SDR-26 (SANITARY MAIN)
... [Remaining 12 items follow a similar pattern]

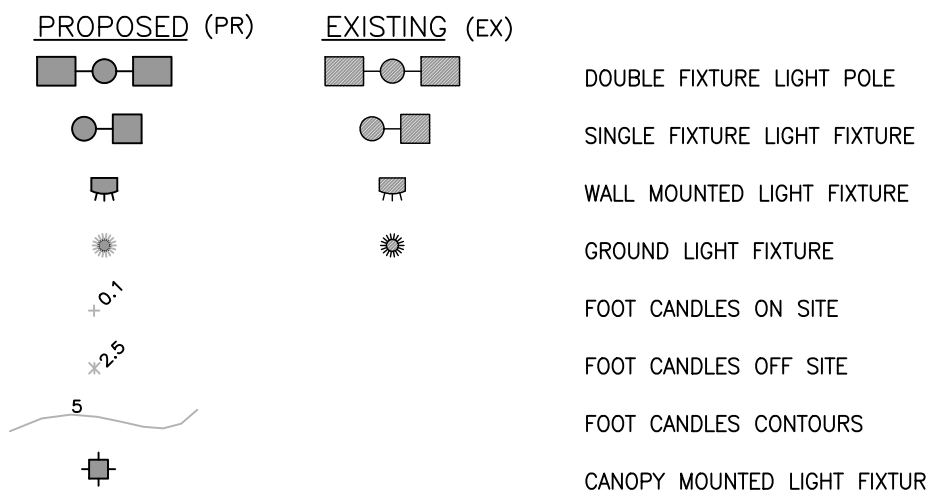
**GENERAL WATERMAIN NOTES**

- 1. WATERMAIN PIPE MATERIALS SHALL BE AS FOLLOWS:
1.1. D.I.P. CL52 (WATERMAIN)
... [Remaining 10 items follow a similar pattern]

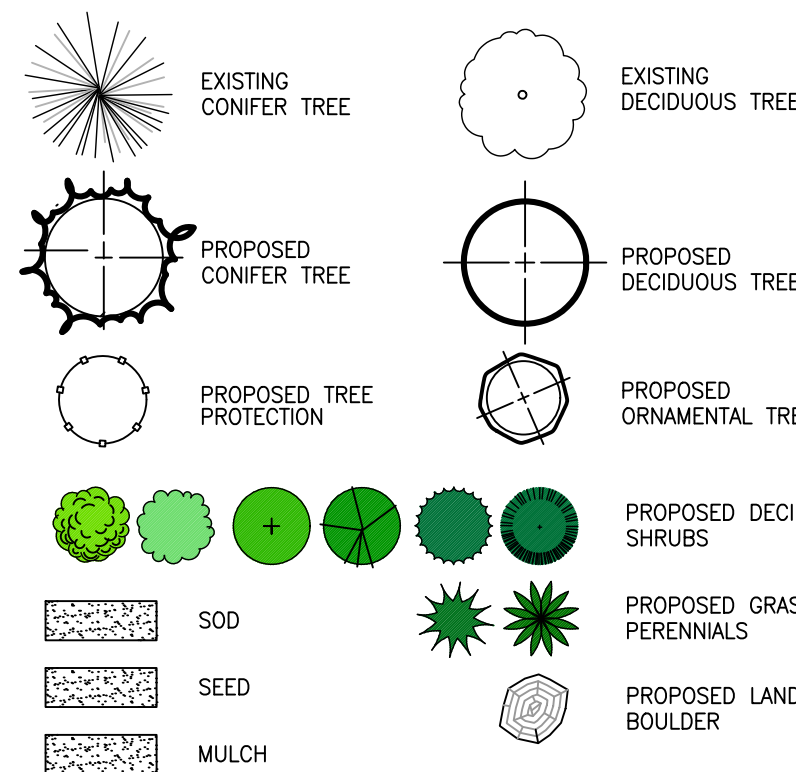
**LINES & HATCHES LEGEND**



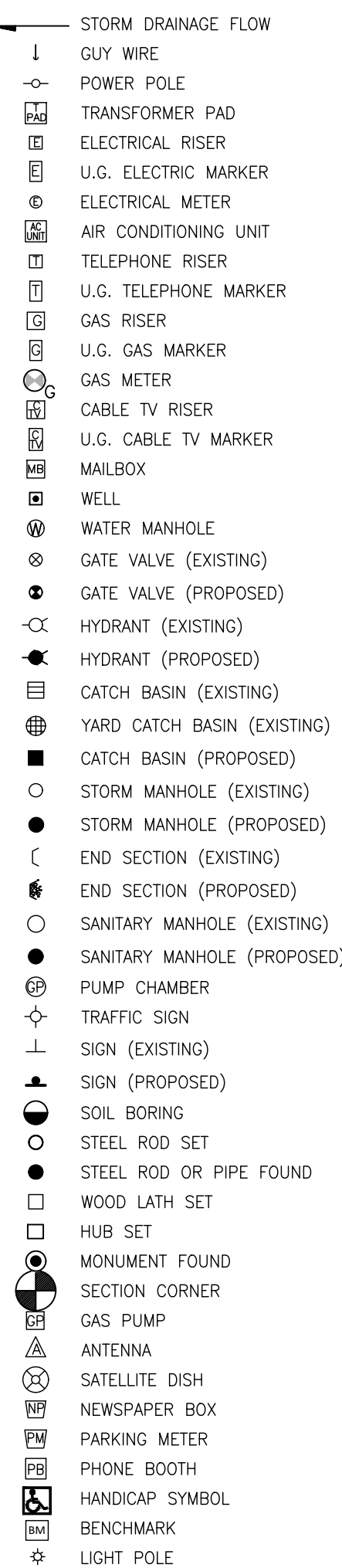
**LIGHTING LEGEND**



**LANDSCAPE LEGEND**



**SYMBOL LEGEND**

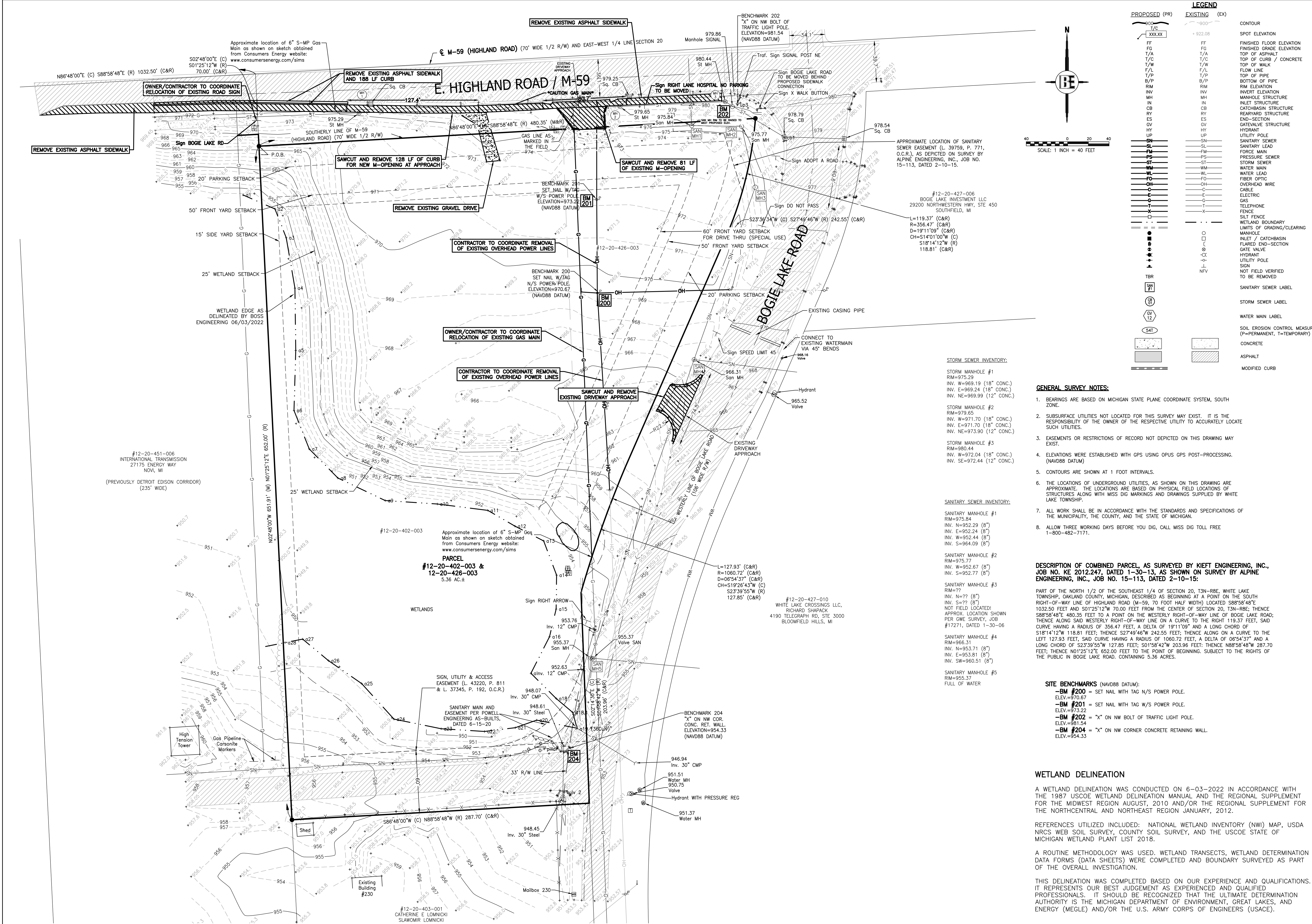


**ABBREVIATIONS**

Table listing abbreviations: FFE (Finished Floor Elevation), BFE (Basement Floor Elevation), GFE (Garage Floor Elevation), FG (Finished Grade), T/A (Top of Asphalt), T/C (Top of Concrete/Curb), T/W (Top of Walk), T/P (Top of Pipe), B/P (Bottom of Pipe), F/L (Flow Line), RIM (Rim Elevation at Flow Line), INV (Invert Elevation), MH (Manhole), CB (Catch Basin), RY (Rear Yard), YD (Yard Drain), RD (Roof Drain), FES (Flared End Section), CMP (Corrugated Metal Pipe), CPP (Corrugated Plastic Pipe), RCP (Reinforced Concrete Pipe), HDPE (High Density Polyethylene), PVC (Polyvinyl Chloride), DIP (Ductile Iron Pipe), GV (Gate Valve), GW (Gate Valve in Well), GVB (Gate Valve in Box), HYD (Hydrant), FDC (Fire Department Connection), UP (Utility Pole), NFV (Not Field Verified), TR (To Be Removed), LIB (Liber), P (Page), L.C.R. (Livingston County Records & M&R), L.O.B. (Point of Beginning).

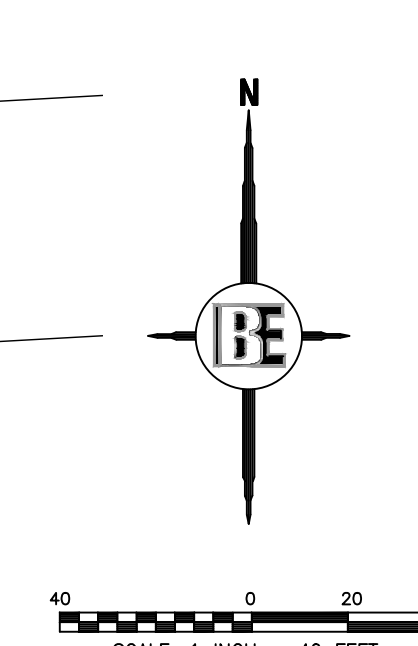
Item A. GATEWAY CROSSING PROJECT. BEBOSS ENGINEERING logo and contact info: 3121 E. GRAND RIVER AVE. HOWELL, MI. 48843. 517.546.4836. FAX 517.548.1670. GATEWAY CROSSING, LLC 600 NORTH OLD WOODWARD, SUITE 103 BIRMINGHAM, MI. 48009. 248-433-7000. PREPARED FOR: GATEWAY CROSSING, LLC. TITLE: GATEWAY CROSSING & LEGEND. PROJECT: GATEWAY CROSSING. DESIGNED BY: ST. DRAWN BY: JS. CHECKED BY: BL. SCALE: NO SCALE. JOB NO: 22-029-1. DATE: 01/05/23. SHEET NO. 2. BOSS ENGINEERING logo.





### LEGEND

PROPOSED (PR)	EXISTING (EX)	DESCRIPTION
900	900	CONTOUR
T/C	XXX.XX	SPOT ELEVATION
FF	FF	FINISHED FLOOR ELEVATION
FG	FG	FINISHED GRADE ELEVATION
T/A	T/A	TOP OF ASPHALT
T/C	T/C	TOP OF CURB / CONCRETE
T/W	T/W	TOP OF WALK
F/L	F/L	FLOW LINE
T/P	T/P	TOP OF PIPE
B/P	B/P	BOTTOM OF PIPE
RM	RM	RIM ELEVATION
INV	INV	INVERT ELEVATION
MH	MH	MANHOLE STRUCTURE
IN	IN	INLET STRUCTURE
CB	CB	CATCHBASIN STRUCTURE
RY	RY	REARWARD STRUCTURE
ES	ES	END-SECTION
OV	OV	GATEVALVE STRUCTURE
HY	HY	HYDRANT
UP	UP	UTILITY POLE
SN	SN	SANITARY SEWER
SM	SM	SANITARY LEAD
PS	PS	PRESSURE SEWER
ST	ST	STORM SEWER
WM	WM	WATER MAIN
WL	WL	WATER LEAD
FO	FO	FIBER OPTIC
OH	OH	OVERHEAD WIRE
C	C	CABLE
E	E	ELECTRIC
G	G	GAS
T	T	TELEPHONE
F	F	FENCE
S	S	SILT FENCE
W	W	WETLAND BOUNDARY
L	L	LIMITS OF GRADING/CLEARING
IN	IN	INLET / CATCHBASIN
FL	FL	FLARED END-SECTION
GV	GV	GATE VALVE
HY	HY	HYDRANT
UP	UP	UTILITY POLE
S	S	NOT FIELD VERIFIED
NFV	NFV	NOT FIELD VERIFIED TO BE REMOVED
SS	SS	SANITARY SEWER LABEL
SS	SS	STORM SEWER LABEL
WM	WM	WATER MAIN LABEL
SC	SC	SOIL EROSION CONTROL MEASURE (P=PERMANENT, T=TEMPORARY)
C	C	CONCRETE
A	A	ASPHALT
M	M	MODIFIED CURB



- #### STORM SEWER INVENTORY:
- STORM MANHOLE #1  
RM=975.29  
INV. W=969.19 (18" CONC.)  
INV. E=969.24 (18" CONC.)  
INV. NE=969.99 (12" CONC.)
  - STORM MANHOLE #2  
RM=979.65  
INV. W=971.70 (18" CONC.)  
INV. E=971.70 (18" CONC.)  
INV. NE=973.90 (12" CONC.)
  - STORM MANHOLE #3  
RM=980.44  
INV. W=972.04 (18" CONC.)  
INV. S=972.44 (12" CONC.)

- #### SANITARY SEWER INVENTORY:
- SANITARY MANHOLE #1  
RM=975.84  
INV. N=952.29 (8")  
INV. E=952.24 (8")  
INV. W=952.44 (8")  
INV. S=964.09 (8")
  - SANITARY MANHOLE #2  
RM=975.77  
INV. W=952.67 (8")  
INV. S=952.77 (8")
  - SANITARY MANHOLE #3  
RM=?  
INV. N=? (8")  
INV. S=? (8")  
NOT FIELD LOCATED!  
APPROX. LOCATION SHOWN PER GWE SURVEY, JOB #17271, DATED 1-30-06
  - SANITARY MANHOLE #4  
RM=966.31  
INV. N=953.71 (8")  
INV. E=953.81 (8")  
INV. SW=960.51 (8")
  - SANITARY MANHOLE #5  
RM=955.37  
FULL OF WATER

#### GENERAL SURVEY NOTES:

- BEARINGS ARE BASED ON MICHIGAN STATE PLANE COORDINATE SYSTEM, SOUTH ZONE.
- SUBSURFACE UTILITIES NOT LOCATED FOR THIS SURVEY MAY EXIST. IT IS THE RESPONSIBILITY OF THE OWNER OF THE RESPECTIVE UTILITY TO ACCURATELY LOCATE SUCH UTILITIES.
- EASEMENTS OR RESTRICTIONS OF RECORD NOT DEPICTED ON THIS DRAWING MAY EXIST.
- ELEVATIONS WERE ESTABLISHED WITH GPS USING OPUS GPS POST-PROCESSING. (NAVD88 DATUM)
- CONTOURS ARE SHOWN AT 1 FOOT INTERVALS.
- THE LOCATIONS OF UNDERGROUND UTILITIES, AS SHOWN ON THIS DRAWING ARE APPROXIMATE. THE LOCATIONS ARE BASED ON PHYSICAL FIELD LOCATIONS OF STRUCTURES ALONG WITH MISS DIG MARKINGS AND DRAWINGS SUPPLIED BY WHITE LAKE TOWNSHIP.
- ALL WORK SHALL BE IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF THE MUNICIPALITY, THE COUNTY, AND THE STATE OF MICHIGAN.
- ALLOW THREE WORKING DAYS BEFORE YOU DIG, CALL MISS DIG TOLL FREE 1-800-482-7171.

#### DESCRIPTION OF COMBINED PARCEL, AS SURVEYED BY KIEFT ENGINEERING, INC., JOB NO. KE 2012.247, DATED 1-30-13, AS SHOWN ON SURVEY BY ALPINE ENGINEERING, INC., JOB NO. 15-113, DATED 2-10-15:

PART OF THE NORTH 1/2 OF THE SOUTHEAST 1/4 OF SECTION 20, T3N-R8E, WHITE LAKE TOWNSHIP, OAKLAND COUNTY, MICHIGAN, DESCRIBED AS BEGINNING AT A POINT ON THE SOUTH RIGHT-OF-WAY LINE OF HIGHLAND ROAD (M-59, 70 FOOT HALF WIDTH) LOCATED 588'58"48"E 1032.50 FEET AND S01°25'12"W 70.00 FEET FROM THE CENTER OF SECTION 20, T3N-R8E; THENCE S88°58'48"E 480.35 FEET TO A POINT ON THE WESTERLY RIGHT-OF-WAY LINE OF BOGIE LAKE ROAD; THENCE ALONG SAID WESTERLY RIGHT-OF-WAY LINE ON A CURVE TO THE RIGHT 119.37 FEET, SAID CURVE HAVING A RADIUS OF 356.47 FEET, A DELTA OF 19°11'09" AND A LONG CHORD OF S18°14'12"W 118.81 FEET; THENCE S27°49'46"W 242.55 FEET; THENCE ALONG ON A CURVE TO THE LEFT 127.93 FEET, SAID CURVE HAVING A RADIUS OF 1060.72 FEET, A DELTA OF 06°54'37" AND A LONG CHORD OF S23°39'55"W 127.85 FEET; S01°58'42"W 203.96 FEET; THENCE N88°58'48"W 287.70 FEET; THENCE N01°25'12"E 652.00 FEET TO A POINT OF BEGINNING, SUBJECT TO THE RIGHTS OF THE PUBLIC IN BOGIE LAKE ROAD, CONTAINING 5.36 ACRES.

- #### SITE BENCHMARKS (NAVD88 DATUM):
- BM #200 = SET NAIL WITH TAG N/S POWER POLE. ELEV.=970.67
  - BM #201 = SET NAIL WITH TAG W/S POWER POLE. ELEV.=973.22
  - BM #202 = "X" ON NW BOLT OF TRAFFIC LIGHT POLE. ELEV.=981.54
  - BM #204 = "X" ON NW CORNER CONCRETE RETAINING WALL. ELEV.=954.33

#### WETLAND DELINEATION

A WETLAND DELINEATION WAS CONDUCTED ON 6-03-2022 IN ACCORDANCE WITH THE 1987 USCOE WETLAND DELINEATION MANUAL AND THE REGIONAL SUPPLEMENT FOR THE MIDWEST REGION AUGUST, 2010 AND/OR THE REGIONAL SUPPLEMENT FOR THE NORTHCENTRAL AND NORTHEAST REGION JANUARY, 2012.

REFERENCES UTILIZED INCLUDED: NATIONAL WETLAND INVENTORY (NW) MAP, USDA NRCS WEB SOIL SURVEY, COUNTY SOIL SURVEY, AND THE USCOE STATE OF MICHIGAN WETLAND PLANT LIST 2018.

A ROUTINE METHODOLOGY WAS USED. WETLAND TRANSECTS, WETLAND DETERMINATION DATA FORMS (DATA SHEETS) WERE COMPLETED AND BOUNDARY SURVEYED AS PART OF THE OVERALL INVESTIGATION.

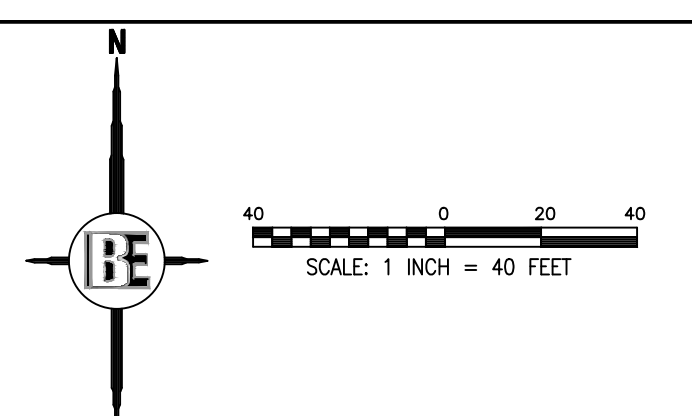
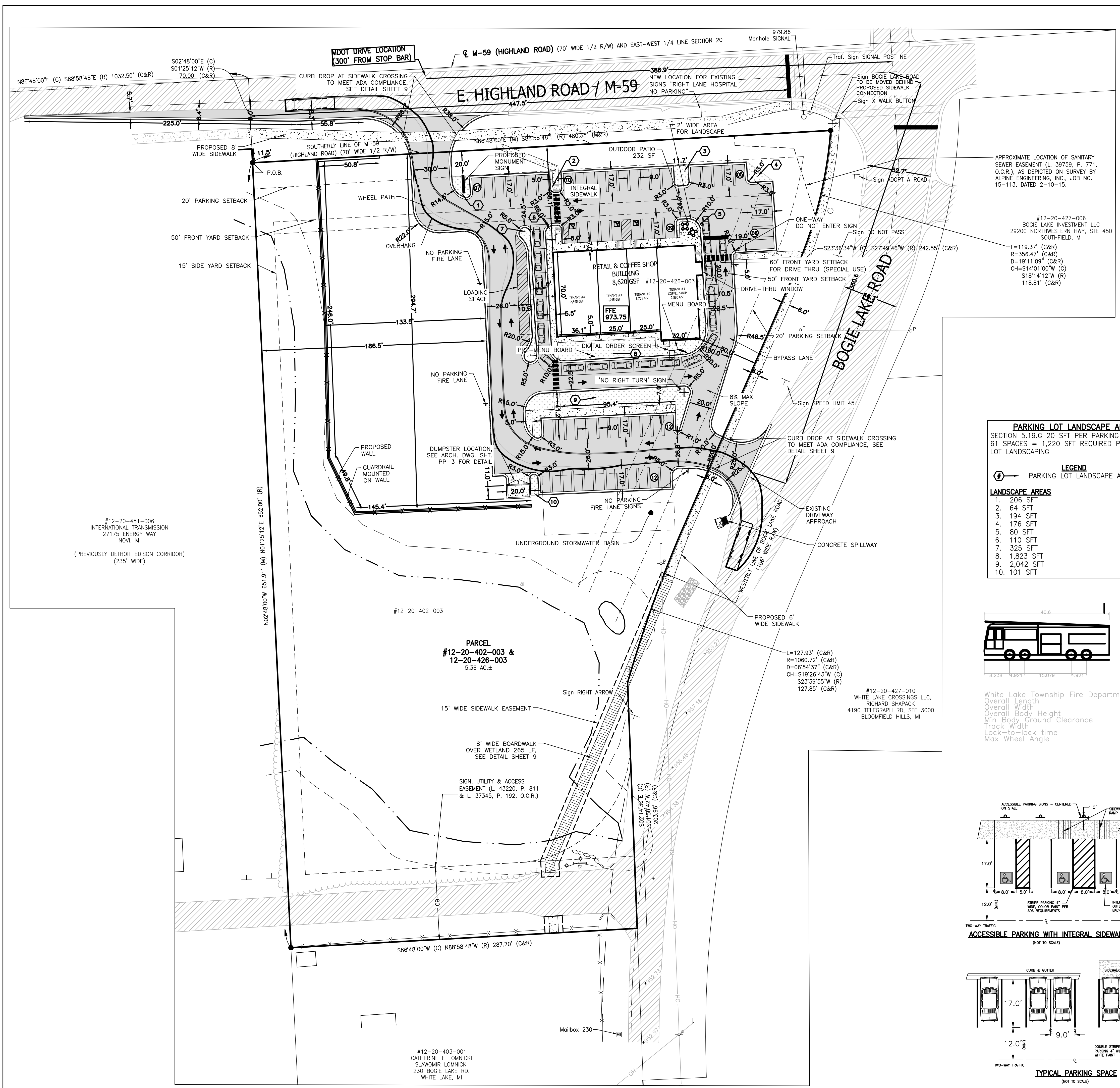
THIS DELINEATION WAS COMPLETED BASED ON OUR EXPERIENCE AND QUALIFICATIONS. IT REPRESENTS OUR BEST JUDGEMENT AS EXPERIENCED AND QUALIFIED PROFESSIONALS. IT SHOULD BE RECOGNIZED THAT THE ULTIMATE DETERMINATION AUTHORITY IS THE MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY (MEGLE) AND/OR THE U.S. ARMY CORPS OF ENGINEERS (USACE).

## BEBOSS

Engineers Surveyors Planners Landscape Architects  
 3121 E. GRAND RIVER AVE.  
 HOWELL, MI. 48843  
 517.546.4836 FAX 517.548.1670

PROJECT	PREPARED FOR	TITLE	DATE
GATEWAY CROSSING	GATEWAY CROSSING, LLC 600 NORTH OLD WOODWARD, SUITE 101 BIRMINGHAM, MI 48009 248-937-7000	EXISTING CONDITIONS & DEMOLITION PLAN	
DESIGNED BY:	AEB	DATE:	01/05/23
DRAWN BY:	RR/CZ	REVISION PER:	
CHECKED BY:		REVISION PER:	
SCALE:	1" = 40'	REVISION PER:	
JOB NO.:	22-029-1	REVISION PER:	
DATE:	01/05/23	REVISION PER:	
SHEET NO.:	3	REVISION PER:	





LEGEND		
PROPOSED (PR)	EXISTING (EX)	
000	+922.08	CONTOUR
T/C		FINISHED FLOOR ELEVATION
XXXXXX		FINISHED GRADE ELEVATION
FF	FF	TOP OF ASPHALT
FC	FC	TOP OF CURB / CONCRETE
T/A	T/A	TOP OF WALK
T/W	T/W	TOP OF FLOW LINE
F/L	F/L	TOP OF PIPE
T/P	T/P	INVERT ELEVATION
B/P	B/P	BOTTOM OF PIPE
RM	RM	RIM ELEVATION
INV	INV	INVERT ELEVATION
MH	MH	MANHOLE STRUCTURE
IN	IN	INLET STRUCTURE
CB	CB	CATCHBASIN STRUCTURE
RY	RY	REAR-YARD STRUCTURE
ES	ES	END-SECTION
OV	OV	GATEVALVE STRUCTURE
HY	HY	HYDRANT
UP	UP	UTILITY POLE
SN	SN	SANITARY SEWER
SL	SL	SANITARY LEAD
FM	FM	FORCE MAIN
PS	PS	PRESSURE SEWER
ST	ST	STORM SEWER
WM	WM	WATER MAIN
WL	WL	WATER LEAD
FO	FO	FIBER OPTIC
OH	OH	OVERHEAD WIRE
C	C	CABLE
E	E	ELECTRIC
T	T	TELEPHONE
X	X	FENCE
W	W	WETLAND BOUNDARY
L	L	LIMITS OF GRADING/CLEARING
○	○	MANHOLE
□	□	INLET / CATCHBASIN
○	○	FLARED END-SECTION
○	○	GATE VALVE
○	○	HYDRANT
○	○	UTILITY POLE
○	○	SIGN
○	○	NOT FIELD VERIFIED TO BE REMOVED
○	○	CONCRETE
○	○	ASPHALT
○	○	PARKING LOT LANDSCAPING

SITE DATA:

WHITE LAKE TOWNSHIP  
 COMBINED PARCELS # 4712-20-402-003 AND # 4712-20-426-003  
 HIGHLAND ROAD  
 WHITE LAKE, MI 48383  
 5.36 AC +/-

ZONING: GENERAL BUSINESS

USE: RETAIL BUILDING SQUARE FOOTAGE (FOOTPRINT): RETAIL WITH DRIVE-THROUGH 8,620 GSF  
 SINGLE OWNER LEASABLE BUILDING WITH ADDITIONAL DEVELOPABLE SPACE ON THE WEST SIDE OF THE PARCEL. PARCEL TO REMAIN UNDER SINGLE OWNER AT THIS TIME.

MIN. LOT AREA REQUIRED FOR ZONING: 1 ACRE  
 MIN. LOT WIDTH: 200 FT  
 TOTAL EX. LOT WIDTH: 485.39  
 MAX. LOT COVERAGE: 40% BLDG, 85% IMPERVIOUS

MIN. SETBACKS REQUIRED: PROPOSED SETBACKS  
 FRONT: 50'-FT FRONT (NORTH): 88.1 FT  
 FRONT (EAST): 50.0 FT  
 REAR: 20'-FT REAR (SOUTH): 487.6 FT  
 SIDE: 15'-FT SIDE (WEST): 245.2 FT

REQUIRED PARKING:  
 TENANT #1: (COFFEE SHOP W/ DRIVE-THROUGH)  
 = 1.0 SPACE PER 75 GROSS FLOOR AREA  
 2,565 / 75 = 34.20 SPACES ~ 34 SPACES PLUS 8 STACKING SPACES

TENANT #2: (GENERAL RETAIL)  
 = 1.0 SPACE PER 200 GFA  
 1,751 GFA / 200 = 8.76 SPACES ~ 9 SPACES

TENANT #3: (GENERAL RETAIL)  
 = 1.0 SPACE PER 200 GFA  
 1,745 GFA / 200 = 8.73 SPACES ~ 9 SPACES

TENANT #4: (RESTAURANT)  
 = 1.0 SPACE PER 100 GFA  
 2,545 GFA / 100 = 25.45 SPACES ~ 25 SPACES

SPACES REQUIRED: 34 + 9 + 9 + 25 = 77 SPACES AND 8 STACKING SPACES  
**PROVIDED: 61 SPACES INCLUDING 3 ADA SPACES, PLUS 16 STACKING SPACES**

SITE PLAN NOTES

- VARIANCES TO BE REQUESTED:
  - 155-FOOT VARIANCE FOR PROPOSED LOCATION OF HIGHLAND ROAD DRIVEWAY WHICH IS LOCATED 386.9 FEET FROM BOGIE LAKE ROAD INTERSECTION (MIN. DISTANCE BETWEEN PROPOSED DRIVEWAY AND NEAREST INTERSECTION SHALL NOT BE LESS THAN 455 FEET WHERE SPEED LIMIT IS GREATER THAN OR EQUAL TO 50 MPH.)
  - VARIANCE FOR PARKING DEFICIENCY ~ 77 SPACES AND 8 STACKING SPACES REQUIRED. PROPOSED 61 SPACES WITH 16 STACKING SPACES.
  - VARIANCE FROM ACCESS MANAGEMENT STANDARDS - DISTANCE BETWEEN HIGHLAND ROAD ENTRANCE AND INTERSECTION WITH BOGIE LAKE ROAD CANNOT BE LESS THAN 455 FEET. CURRENT PROPOSED DISTANCE IS 300 FEET.
  - (SPECIAL USE) DRIVE-THRU REQUIRES A 60-FOOT FRONT YARD SETBACK FROM BOGIE LAKE ROAD R.O.W. THE DRIVE-THRU WINDOW IS MORE THAN 60' FROM THE R.O.W. BUT THE CLOSEST CORNER OF THE BUILDING IS THE BUILDING IS 50 FEET WAY. REQUEST ZONING BOARD OF APPEALS MAKES AN INTERPRETATION ALLOWING THE SETBACK AS PROPOSED BEING CONFORMING TO THE 60-FOOT FRONT YARD SETBACK.
  - (SPECIAL USE) VARIANCE FOR HIGHLAND ROAD DRIVEWAY LOCATED LESS THAN 200 FEET FROM THE RESIDENTIAL ZONING DISTRICT TO THE WEST.
  - VARIANCE FOR REDUCTION IN GLASS FACADE ON EAST ELEVATION. REQUIRED 30% GLASS COVERAGE, PROVIDED 9.27% GLASS COVERAGE.
- ACCESS DRIVE SHALL BE DESIGNED AND MAINTAINED TO SUPPORT THE IMPOSED LOADS OF FIRE APPARATUS AND SHALL BE SURFACED SO AS TO PROVIDE ALL-WEATHER DRIVING CAPABILITIES.
- THE OUTDOOR DINING MAY OPERATE ONLY DURING THE FOLLOWING HOURS:
  - M-TH: 8:00AM TO 12:00AM (MIDNIGHT),
  - FRIDAY: 8:00 AM TO 2:00 AM,
  - SATURDAY: 10:00 AM TO 2:00 AM
  - SUNDAY: 10:00 AM TO 10:00 PM
- PARKING SPACES AT THE SOUTH END OF THE SITE SHALL BE DESIGNATED/MARKED AS EMPLOYEE PARKING.

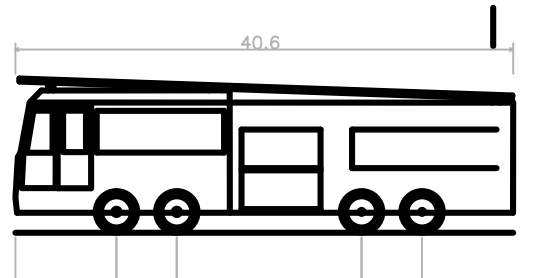
PARKING LOT LANDSCAPE AREA:

SECTION 5.19.G 20 SFT PER PARKING SPACE X 61 SPACES = 1,220 SFT REQUIRED PARKING LOT LANDSCAPING

LEGEND  
 PARKING LOT LANDSCAPE AREA LABEL

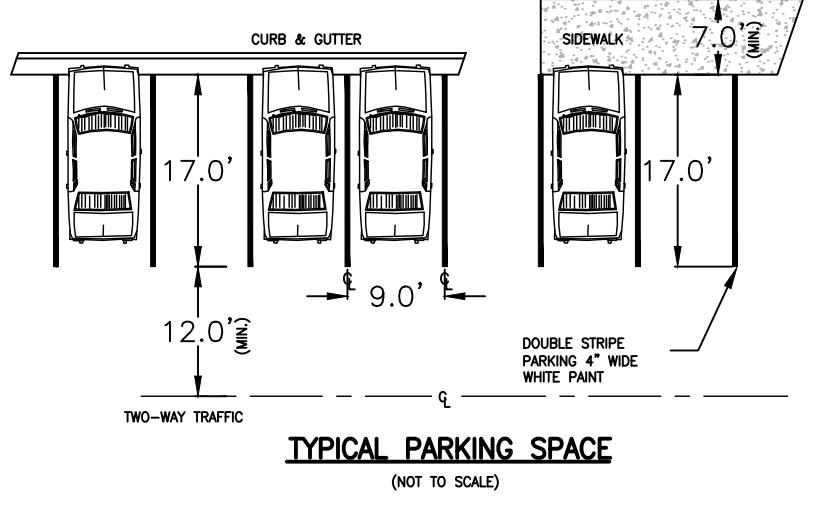
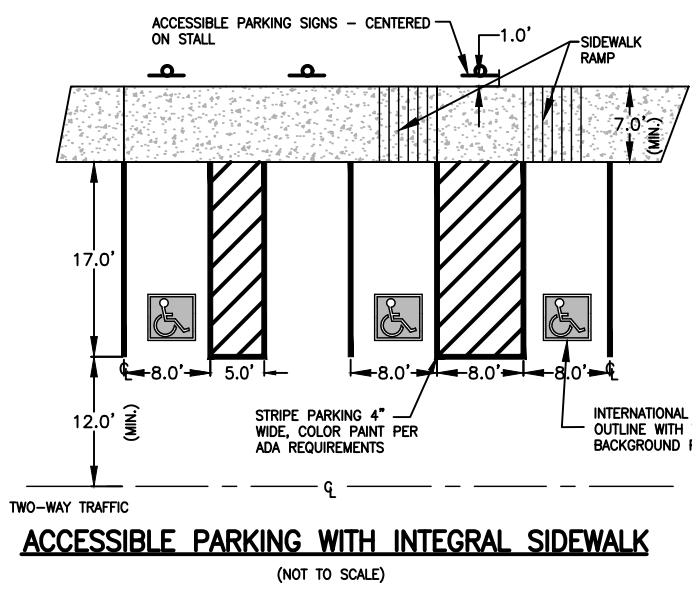
LANDSCAPE AREAS

- 206 SFT
- 64 SFT
- 194 SFT
- 176 SFT
- 80 SFT
- 110 SFT
- 325 SFT
- 1,823 SFT
- 2,042 SFT
- 101 SFT



White Lake Township Fire Department

Overall Length	40.600ft
Overall Width	9.665ft
Overall Body Height	12.565ft
Min. Body Ground Clearance	1.628ft
Track Width	9.665ft
Lock-to-lock time	6.00s
Max Wheel Angle	45.00°



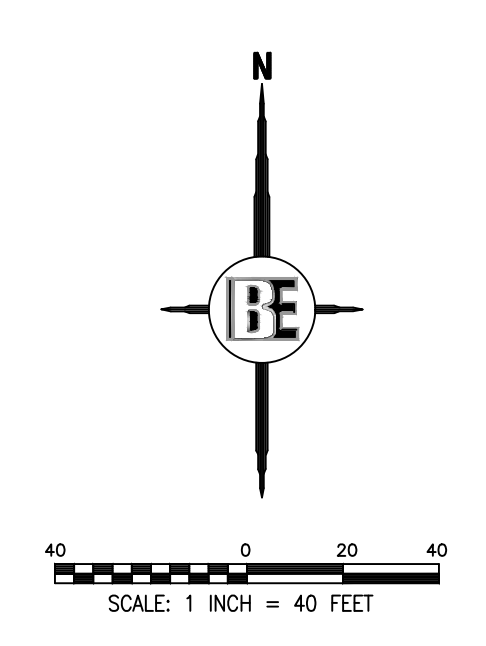
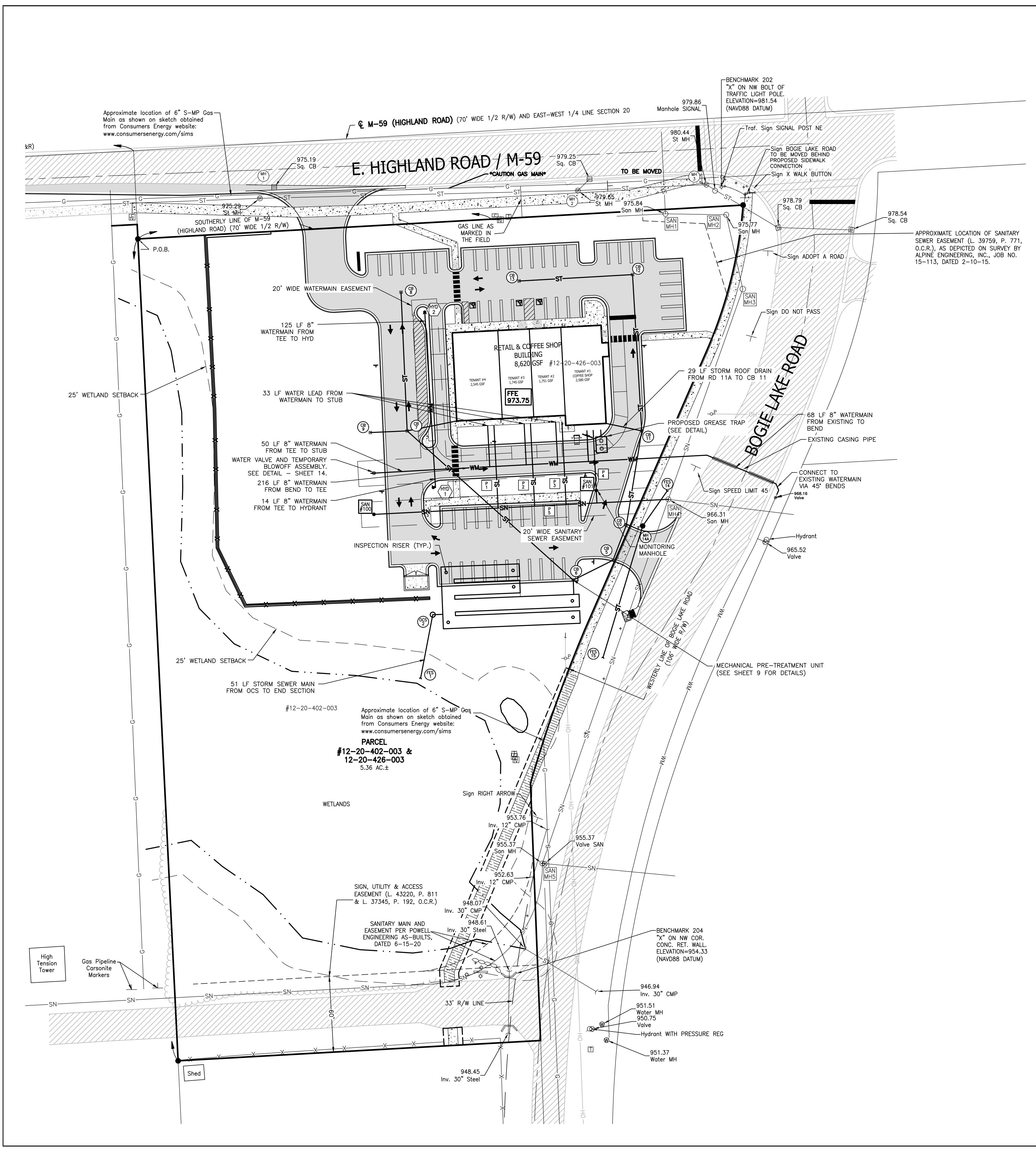
**BEBOSS Engineering**  
 Engineers Surveyors Planners Landscape Architects  
 3121 E. GRAND RIVER AVE.  
 HOWELL, MI. 48843  
 517.546.4836 FAX 517.548.1670

PROJECT: GATEWAY CROSSING  
 PREPARED FOR: GATEWAY CROSSING, LLC  
 600 NORTH OLD WOODWARD, SUITE 101  
 BIRMINGHAM, MI 48009  
 248-433-7000

TITLE: SITE PLAN

NO.	DATE	REVISION PER	BY
1	09/09/23	REVISION PER TWP PISP REV #1	JAV
2	11/02/24	REVISION PER TWP PISP REV #2	ST
3	2/28/24	REVISION PER TWP PISP REV #3	ST

DESIGNED BY: ST  
 DRAWN BY: JS  
 CHECKED BY: BL  
 SCALE: 1" = 40'  
 JOB NO: 22-029-1  
 DATE: 01/05/23  
 SHEET NO. 4



**SITE BENCHMARKS (NAVD88 DATUM):**  
 -BM #200 = SET NAIL WITH TAG N/S POWER POLE. ELEV.=970.57  
 -BM #201 = SET NAIL WITH TAG W/S POWER POLE. ELEV.=973.22  
 -BM #202 = "X" ON NW BOLT OF TRAFFIC LIGHT POLE. ELEV.=981.54  
 -BM #204 = "X" ON NW CORNER CONCRETE RETAINING WALL. ELEV.=954.33

LEGEND		CONTOUR
PROPOSED (PR)	EXISTING (EX)	
000 T/C	+922.08	SPOT ELEVATION
FF	FF	FINISHED FLOOR ELEVATION
T/A	T/A	FINISHED GRADE ELEVATION
T/C	T/C	TOP OF ASPHALT
T/W	T/W	TOP OF CURB / CONCRETE
F/L	F/L	TOP OF WALK
T/P	T/P	FLOW LINE
B/P	B/P	TOP OF PIPE
RM	RM	RIM ELEVATION
INV	INV	INVERT ELEVATION
MH	MH	MANHOLE STRUCTURE
IN	IN	INLET STRUCTURE
CB	CB	CATCHBASIN STRUCTURE
RY	RY	REARWARD STRUCTURE
ES	ES	END-SECTION
OV	OV	GATEVALVE STRUCTURE
HY	HY	HYDRANT
UP	UP	UTILITY POLE
SN	SN	SANITARY SEWER
SL	SL	SANITARY LEAD
FM	FM	FORCE MAIN
PS	PS	PRESSURE SEWER
ST	ST	STORM SEWER
WM	WM	WATER MAIN
WL	WL	WATER LEAD
FO	FO	FIBER OPTIC
OH	OH	OVERHEAD WIRE
C	C	CABLE
E	E	ELECTRIC
T	T	TELEPHONE
L	L	FENCE
□	□	SILT FENCE
○	○	WETLAND BOUNDARY
○	○	LIMITS OF GRADING/CLEARING
○	○	MANHOLE
○	○	INLET / CATCHBASIN
○	○	FLARED END-SECTION
○	○	GATE VALVE
○	○	HYDRANT
○	○	UTILITY POLE
○	○	SIGN
○	○	NOT FIELD VERIFIED
○	○	TO BE REMOVED
○	○	SANITARY SEWER LABEL
○	○	STORM SEWER LABEL
○	○	WATER MAIN LABEL
○	○	SOIL EROSION CONTROL MEASURE (P=PERMANENT, T=TEMPORARY)
○	○	CONCRETE
○	○	ASPHALT
○	○	MODIFIED CURB

PIPE #	SIZE	LENGTH	MATERIAL	DESCRIPTION
1	6"	66 LF	SDR 23.5	SANITARY LEAD FROM RETAIL #1 TO SANITARY MAIN
2	6"	66 LF	SDR 23.5	SANITARY LEAD FROM RETAIL #2 TO SANITARY MAIN
3	6"	66 LF	SDR 23.5	SANITARY LEAD FROM RETAIL #3 TO SANITARY MAIN
4	6"	56 LF	SDR 23.5	SANITARY LEAD FROM COFFEE SHOP TO SANITARY MAIN
5	8"	222 LF	SDR 26	SANITARY MAIN FROM MH #100 TO EX MH 4

**BEBOSS Engineering**  
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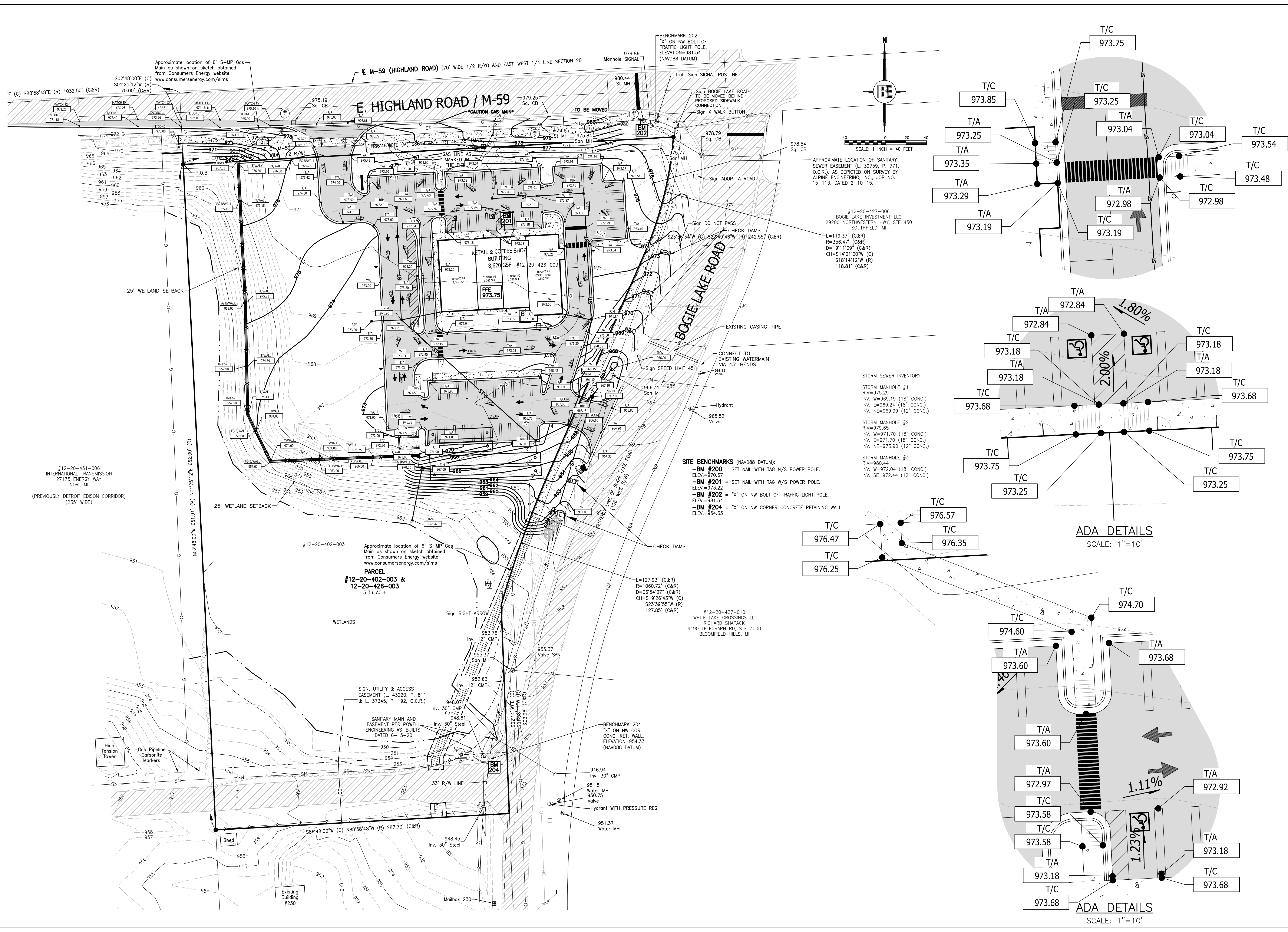
**GATEWAY CROSSING**  
 PREPARED FOR: GATEWAY CROSSING, LLC  
 600 NORTH OLD WOODWARD, SUITE 101  
 BIRMINGHAM, MI. 48009  
 248-433-7000

**UTILITY PLAN**

NO	BY	DATE	REVISION PER
1	JAV	09/09/23	REVISION PER
2	MJD	1/12/24	REVISION PER
3	ST	2/28/24	REVISION PER TWP PSP REV #3

DESIGNED BY: ST  
 DRAWN BY: JS  
 CHECKED BY:  
 SCALE: 1" = 40'  
 JOB NO: 22-029-1  
 DATE: 01/05/23  
 SHEET NO. **5**





THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THESE DRAWINGS ARE ONLY APPROXIMATE. NO GUARANTEE IS MADE FOR THE ACCURACY OF THESE UTILITIES. THE CONTRACTOR SHALL BE EXCLUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT LOCATION AND ELEVATION OF EXISTING UTILITIES. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN ANY CONFLICTS ARE FOUND. THE CONTRACTOR SHALL VERIFY THE LOCATION OR DEPTH OFFERS SIGNIFICANTLY FROM THE PLANS.

BE ENGINEERING  
3121 E. GRAND RIVER AVE.  
HOWELL, MI. 48843  
517.546.4836 FAX 517.548.1670

**BEBOSS**  
Engineers Surveyors Planners Landscape Architects

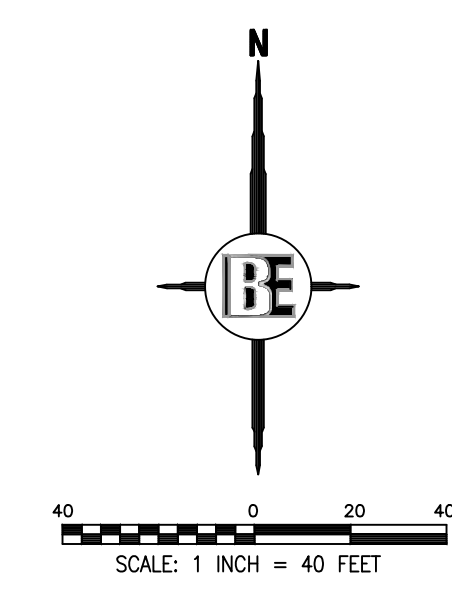
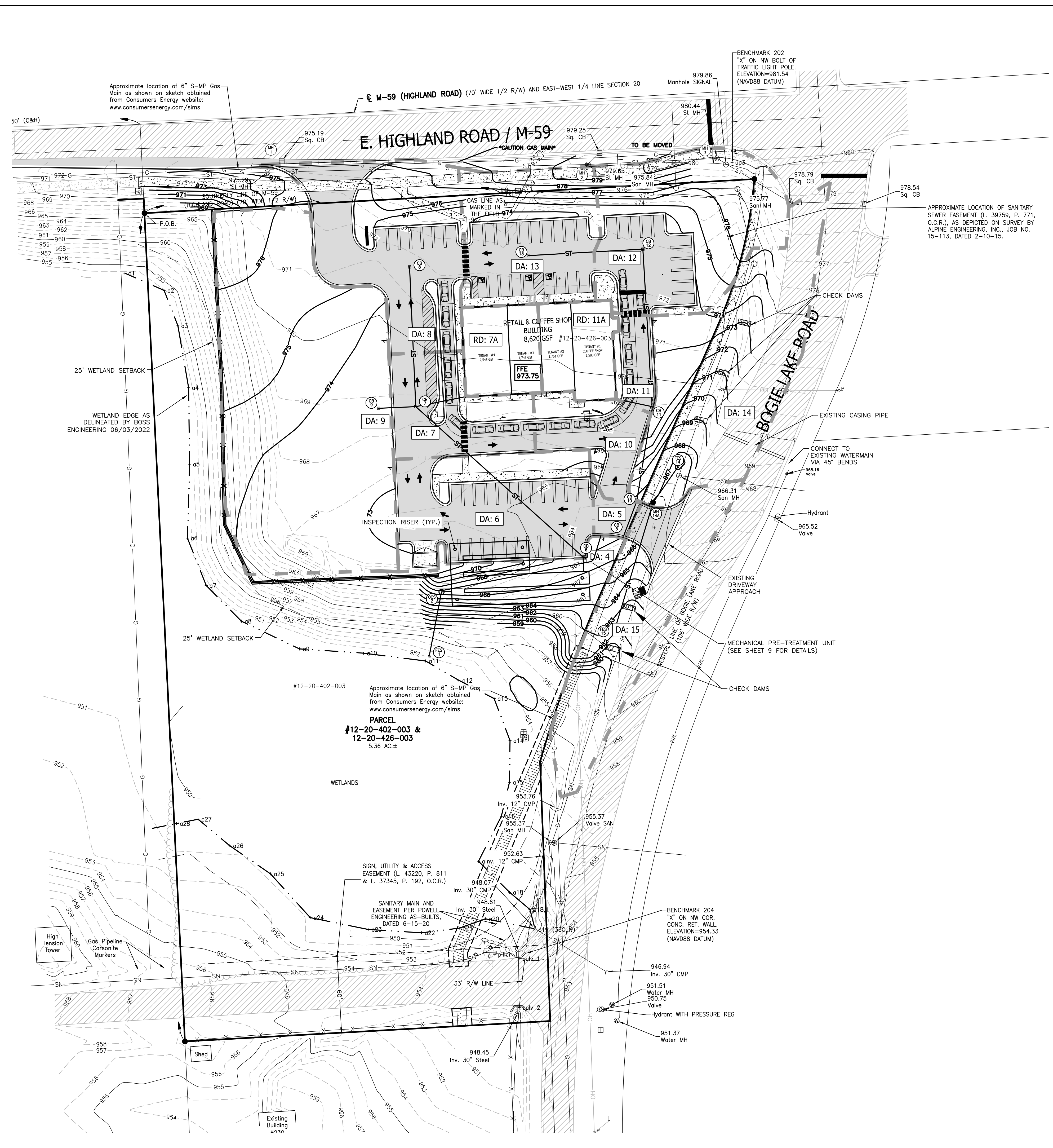
**GATEWAY CROSSING**  
GATEWAY CROSSING, LLC  
600 NORTH OGDENWOOD, SUITE 101  
BIRMINGHAM, MI 48209  
248-433-7000

**GRADING PLAN**

NO.	BY	DATE	REVISION PER
1	IAV	09/09/23	REVISION PER
2	MD	1/12/24	REVISION PER
3	ST	2/28/24	REVISION PER

DESIGNED BY: ST  
DRAWN BY: JS  
CHECKED BY:  
SCALE: 1" = 40'  
JOB NO: 22-029-1  
DATE: 01/05/23  
SHEET NO. **6**





**LEGEND**

PROPOSED (PR)	EXISTING (EX)	CONTOUR
000	+922.08	CONTOUR
T/C		SPOT ELEVATION
FF	FF	FINISHED FLOOR ELEVATION
F/S	F/S	FINISHED GRADE ELEVATION
T/A	T/A	TOP OF ASPHALT
T/W	T/W	TOP OF CURB / CONCRETE
F/L	F/L	TOP OF WALK
T/P	T/P	FLOW LINE
B/P	B/P	TOP OF PIPE
RM	RM	RIM ELEVATION
INV	INV	INVERT ELEVATION
MH	MH	MANHOLE STRUCTURE
IN	IN	INLET STRUCTURE
CB	CB	CATCHBASIN STRUCTURE
RY	RY	REARWARD STRUCTURE
ES	ES	END-SECTION
OV	OV	GATEVALVE STRUCTURE
HY	HY	HYDRANT
UP	UP	UTILITY POLE
SN	SN	SANITARY SEWER
SL	SL	SANITARY LEAD
FM	FM	FORCE MAIN
PS	PS	PRESSURE SEWER
ST	ST	STORM SEWER
WM	WM	WATER MAIN
WL	WL	WATER LEAD
FO	FO	FIBER OPTIC
OH	OH	OVERHEAD WIRE
C	C	CABLE
E	E	ELECTRIC
T	T	TELEPHONE
S	S	SIGN
D	D	DITCH
W	W	WETLAND BOUNDARY
L	L	LIMITS OF GRADING/CLEARING
M	M	MANHOLE
I	I	INLET / CATCHBASIN
G	G	GATE VALVE
V	V	VALVE
H	H	HYDRANT
U	U	UTILITY POLE
N	N	NOT FIELD VERIFIED
R	R	TO BE REMOVED
S	S	SANITARY SEWER LABEL
ST	ST	STORM SEWER LABEL
W	W	WATER MAIN LABEL
SE	SE	SOIL EROSION CONTROL MEASURE (P=PERMANENT, T=TEMPORARY)
C	C	CONCRETE
A	A	ASPHALT
M	M	MODIFIED CURB

**STORMWATER NARRATIVE**

EXISTING: THE EXISTING SITE IS A HEAVILY SLOPED SITE WITH A WETLAND IN THE SOUTHWEST. THE SITE DRAINS TO THE SOUTH EITHER TO THE WETLAND OR TO A SERIES OF CULVERTS IN THE SOUTH WITH AN ULTIMATE OUTLET TO THE SOUTHEAST THROUGH A 30" CMP PIPE.

PROPOSED: THE PROPOSED SITE WILL UTILIZE A SERIES OF STORM STRUCTURES IN ORDER TO BRING ALL RUNOFF TO THE PROPOSED BASIN IN THE SOUTH. THE STORM SYSTEM WILL UTILIZE A MECHANICAL PRETREATMENT STRUCTURE IN REPLACEMENT OF A FOREBAY AND DRAIN INTO THE BASIN WHERE IT WILL EVENTUALLY OUTLET TO THE WETLAND TO THE SOUTH. THE SYSTEM IS SET TO HANDLE THE RUNOFF EXPECTED FROM DEVELOPMENT OF THE WEST SIDE OF THE SITE AS WELL AS THE ENTIRE SITE PROPOSED. ONCE AGAIN, THE WETLAND WILL ULTIMATELY OUTLET VIA A 24" RCP PIPE TO THE SOUTHEAST.

**DRAINAGE AREA TABLE**

DRAINAGE AREA TABLE (TRIBUTARY TO BASIN)				
DRAINAGE AREA	TOTAL AREA (AC)	IMP. AREA (AC)	C VALUE	A <sup>2</sup> C
2	0.00	-	0.00	0.00
4	0.00	-	0.00	0.00
5	0.02	0.02	0.89	0.02
6	0.30	0.25	0.84	0.25
7	0.17	0.15	0.85	0.14
7A	0.10	0.10	0.95	0.09
8	0.34	0.27	0.78	0.27
9	0.79	0.79	0.95	0.75
10	0.11	0.08	0.73	0.08
11	0.05	0.05	0.86	0.05
11A	0.10	0.10	0.95	0.09
12	0.38	0.17	0.54	0.20
13	0.24	0.16	0.70	0.17
<b>TOTAL</b>	<b>2.60</b>	<b>2.13</b>	<b>0.81</b>	<b>2.12</b>
DRAINAGE AREA TABLE (NOT-TRIBUTARY TO BASIN)				
14	0.44	0.18	0.51	0.22
15	0.29	0.15	0.59	0.17

\*FUTURE\* DRAINAGE AREA REPRESENTS ESTIMATED AREA TO BE CONSTRUCTED ON THE WEST SIDE OF THE SITE FLOWING THROUGH CB 9

SEE SHEET 9 FOR BASIN DETAIL & STORM DRAINAGE CALCULATIONS

**BOSS Engineering**  
 Engineers Surveyors Planners Landscape Architects  
 3121 E. GRAND RIVER AVE.  
 HOWELL, MI. 48843  
 517.546.4836 FAX 517.548.1670

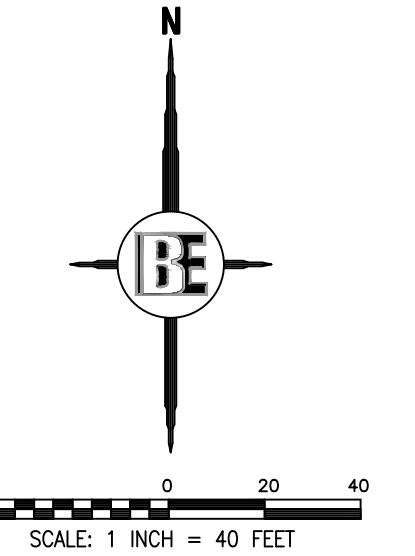
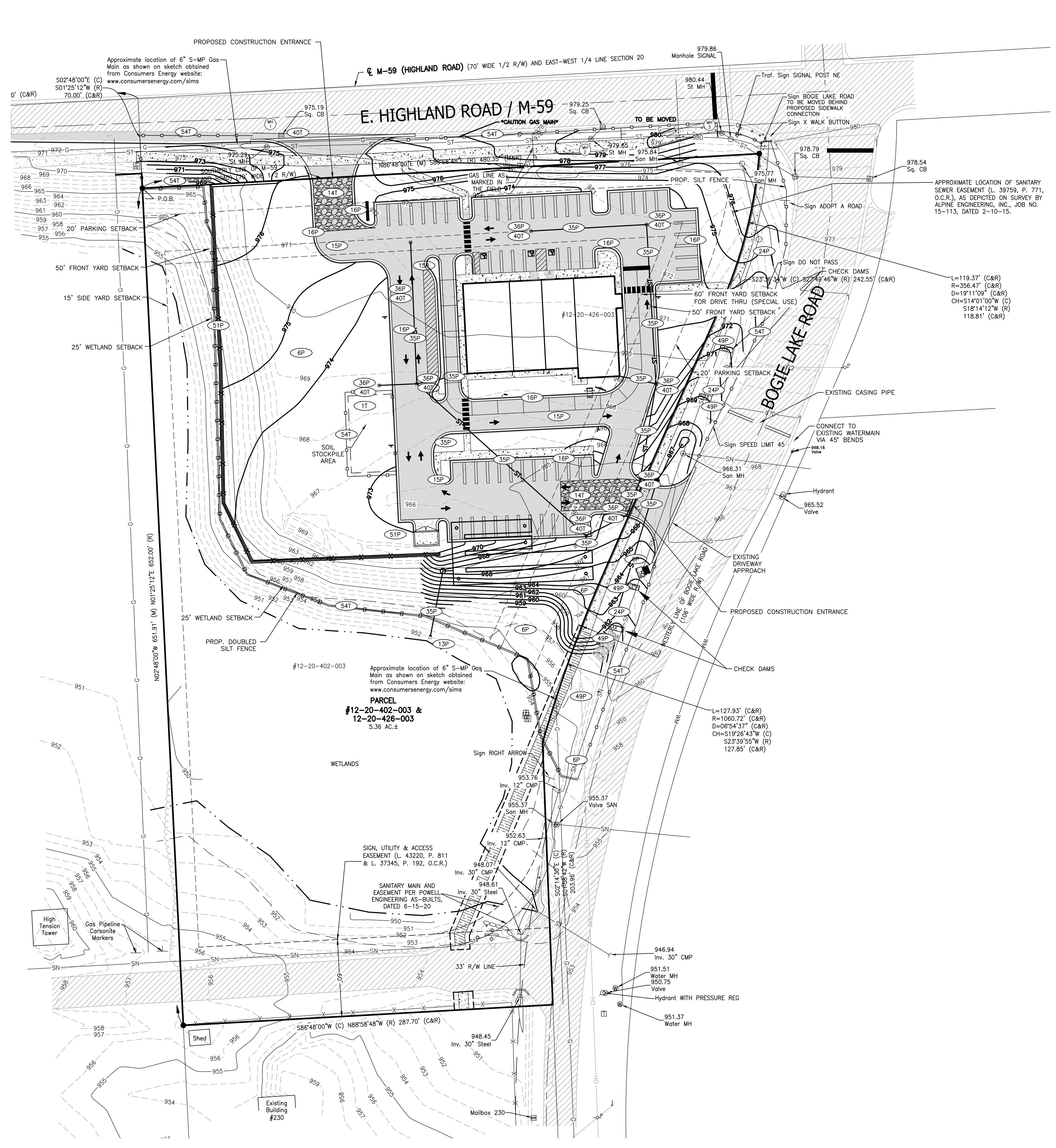
**GATEWAY CROSSING**  
 GATEWAY CROSSING, LLC  
 600 NORTH OLD WOODWARD, SUITE 101  
 BIRMINGHAM, MI 48009  
 248-437-7000

**DRAINAGE PLAN**

NO.	DATE	REVISION PER	BY
1	09/09/23	REVISION PER	NO BY
2	1/12/24	REVISION PER TWP PSP REV #1	NO BY
3	2/28/24	REVISION PER TWP PSP REV #2	NO BY

DESIGNED BY: ST  
 DRAWN BY: JS  
 CHECKED BY:  
 SCALE: 1" = 40'  
 JOB NO: 22-029-1  
 DATE: 01/05/23  
 SHEET NO. **7**





**LEGEND**

PROPOSED (PR)	EXISTING (EX)	DESCRIPTION
---000---	---900---	CONTOUR
T/C	+ 922.XX	SPOT ELEVATION
FF	FF	FINISHED FLOOR ELEVATION
F/S	F/S	FINISHED GRADE ELEVATION
T/A	T/A	TOP OF ASPHALT
T/C	T/C	TOP OF CURB / CONCRETE
T/W	T/W	TOP OF WALK
F/L	F/L	FLOW LINE
T/P	T/P	TOP OF PIPE
B/P	B/P	BOTTOM OF PIPE
RIM	RIM	RIM ELEVATION
INV	INV	INVERT ELEVATION
MH	MH	MANHOLE STRUCTURE
IN	IN	INLET STRUCTURE
CB	CB	CATCHBASIN STRUCTURE
RY	RY	REAR YARD STRUCTURE
ES	ES	END-SECTION
OV	OV	GATEWAY STRUCTURE
HY	HY	HYDRANT
UP	UP	UTILITY POLE
SN	SN	SANITARY SEWER
SL	SL	SANITARY LEAD
FM	FM	FORCE MAIN
PS	PS	PRESSURE SEWER
ST	ST	STORM SEWER
WM	WM	WATER MAIN
WL	WL	WATER LEAD
FO	FO	FIBER OPTIC
OH	OH	OVERHEAD WIRE
C	C	CABLE
E	E	ELECTRIC
G	G	GAS
T	T	TELEPHONE
F	F	FENCE
X	X	SILT FENCE
W	W	WETLAND BOUNDARY
○	○	LIMITS OF GRADING/CLEARING
□	□	MANHOLE
○	○	INLET / CATCHBASIN
○	○	FLARED END-SECTION
○	○	GATE VALVE
○	○	HYDRANT
○	○	UTILITY POLE
○	○	SIGN
○	○	NOT FIELD VERIFIED TO BE REMOVED
○	○	SANITARY SEWER LABEL
○	○	STORM SEWER LABEL
○	○	WATER MAIN LABEL
○	○	SOIL EROSION CONTROL MEASURE (P=PERMANENT, T=TEMPORARY)
○	○	CONCRETE
○	○	ASPHALT
○	○	MODIFIED CURB

**NRCS EXISTING SOILS DATA:**  
 B FOX SANDY LOAM, 2-6% SLOPES  
 BID SEBEWA LOAM, 0-2% SLOPES  
 AID HOUGHTON & ADRIAN MUCK  
 B FOX-RIDDLES SANDY LOAM, 6-12% SLOPES  
 A UDIPSAMMENTS, UNULATING

**GENERAL NOTES:**

- CURRENT ZONING: GB (GENERAL BUSINESS)
- SETBACK REQUIREMENTS:  
 NORTH PARKING = 20 FEET  
 EAST PARKING = 20 FEET  
 NORTH FRONT YARD = 50 FEET  
 EAST FRONT YARD = 50 FEET  
 WEST SIDE YARD = 15 FEET  
 SOUTH/WEST WETLAND = 25 FEET
- OWNER OF SUBJECT PROPERTY: BRIAN NAJOR

CONTROL NUMBER	CONTROL NAME	DESCRIPTION
1	STRIPPING & STOCKPILE TOPSOIL	TOPSOIL MAY BE STOCKPILED ABOVE BORROW AREAS TO ACT AS AN OVERSEEN STOCKPILE SHOULD BE TEMPORARILY SEEDED
6	SEEDING WITH MULCH AND/OR MATING	FACILITATES ESTABLISHMENT OF VEGETATION COVER EFFECTIVE FOR DRAINAGEWAYS WITH LOW VELOCITY FLOW IN SMALL QUANTITIES OF IMPROVED PERSONNEL SHOULD INCLUDE PREPARED TOPSOIL SEE
13	RP-500, RUBBLE, GRASS	USED WHERE VEGETATION IS NOT EASILY ESTABLISHED EFFECTIVE FOR HIGH VELOCITIES OR HIGH CONCENTRATIONS PERMITS RUNOFF TO WITHSTAND SO DISAPPEARS ENERGY FLOW AT SYSTEM OUTLETS
14	AGGREGATE COVER	STABILIZES SOIL SURFACE THIS MINIMUM EROSION PERMITS CONSTRUCTION TRAFFIC IN ADVERSE WEATHER MAY BE USED AS PART OF PERMANENT SIDE CONSTRUCTION OF PAVED AREAS
15	PAVING	PROTECTS AREAS WHICH CANNOT OTHERWISE BE PROTECTED, BUT INCREASES RUNOFF VELOCITY REGULAR SURFACE WILL HELP SLOW VELOCITY
16	CURB & GUTTER	KEEPS HIGH VELOCITY RUNOFF ON PAVED AREAS FROM LEAVING PAVED SURFACE COLLECTS AND CONDUCTS RUNOFF TO ENCLOSED DRAINAGE SYSTEM OR PREPARED DRAINWAYS
24	GRASSED WATERWAY	MUCH MORE STABLE FORM OF DRAINAGEWAY THAN GRADE CHANNEL GRASS TENDS TO SLOW RUNOFF AND FILTER OUT SEDIMENT USED WHERE GRADE CHANNEL WOULD BE EXCEEDED
35	GRASS STRIP SWEEP	SYSTEM REMOVES COLLECTED RUNOFF FROM SILE, PARTICULARLY FROM PAVED AREAS CAN ACCEPT LARGE CONCENTRATIONS OF RUNOFF CONDUCTS RUNOFF TO MUNICIPAL SEWER SYSTEM OR STABILIZED OUTFALL LOCATION USE CAREFUL DESIGN TO COLLECT SEDIMENT
36	CATCH BASIN, DRAIN INLET	COLLECTS HIGH VELOCITY CONCENTRATED RUNOFF MAY USE FILTER CLOTH OVER INLET
40	NETT SEDIMENT FILTER	EASY TO SHAKE COLLECTS SEDIMENT MAY BE CLEANED AND EXPANDED AS NEEDED
49	CHECK DAMS	REDUCES FLOW VELOCITY CATCHES SEDIMENT CAN BE CONSTRUCTED OF LOGS, STRAW, HAY, ROCK, LUMBER, WISKEY OR SAND BAGS
51	RETAINING WALL	REDUCES GRADIENT WHERE SLOPES ARE EXTREMELY STEEP PERMITS RETENTION OF EXISTING VEGETATION, KEEPING SOIL STABLE IN CRITICAL AREAS MINIMIZES MAINTENANCE
54	SILT FENCE	USES GEOTEXTILE FABRIC AND POST OR POLES, EASY TO CONSTRUCT AND LOCATE AS NECESSARY. (SEE DETAIL THIS SHEET)

P = PERMANENT T = TEMPORARY  
 AREA OF DISTURBANCE = 159,061 SF (3.66 ACRES)

- SOIL EROSION CONTROL NOTES:**
- A SOIL EROSION CONTROL PERMIT SHALL BE OBTAINED FROM THE OAKLAND COUNTY DRAIN COMMISSIONER PRIOR TO CONSTRUCTION.
  - SEE CONSTRUCTION AND EROSION CONTROL DETAILS ON SHEET 15 FOR ADDITIONAL OAKLAND COUNTY TEMPORARY CONTROLS REQUIREMENTS.
  - APPROPRIATE SOIL EROSION CONTROL MEASURES SHALL BE ESTABLISHED PRIOR TO CONSTRUCTION AND CONTINUOUSLY MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION HAS BEEN RE-ESTABLISHED. ANY MUD OR DEBRIS TRACKED ONTO ANY STREET ADJACENT TO THE PROJECT SHALL BE REMOVED IMMEDIATELY. IF A TOWNSHIP AGENT REQUESTS IN WRITING THAT THE ROAD BE CLEANED, THE PROPRIETOR WILL HAVE 12 HOURS TO CLEAN IT. IF IT IS NOT CLEANED WITHIN 12 HOURS, THE TOWNSHIP WILL HIRE IT TO BE COMPLETED AND INVOICE THE PROPRIETOR BEFORE THE PERFORMANCE BOND IS RELEASED.
  - CATCH BASIN INLET PROTECTION SHALL BE INSTALLED ON ALL NEW INLETS AS THEY ARE CONSTRUCTED.

**PROPOSED CONST. SCHEDULE FOR THE YEAR 2024**

ACTIVITY	JUNE	JULY	AUG	SEPT	OCT	NOV
ROUGH GRADING						
UNDERGROUND UTILITY						
BUILDING DEMO/CONST.						
PAVING						
LANDSCAPING						
SEED & MULCH						
SECC CLOSURE						

**CONTROLS & MEASURES POST CONSTRUCTION SEQUENCE**

ACTIVITY	WEEKLY	MONTHLY	AS REQUIRED
MAINTAIN LANDSCAPING, REPLACE MULCH	X	X	X
CLEAN INLETS		X	X
COLLECT LITTER	X		X
SWEEP PARKING LOT		X	X

**CONTROLS & MEASURES NARRATIVE**

ACTIVITY	DESCRIPTION
MAINTAIN LANDSCAPING, REPLACE MULCH	COLLECT GRASS, TREE, AND SHRUB CLIPPINGS. DISPOSE IN APPROVED CONTAINER. REPLACE DEAD SOO, TREES AND SHRUBS.
CLEAN INLETS	REMOVE LITTER, SEDIMENT, AND DEBRIS. DISPOSE OF IN APPROVED LANDFILL.
COLLECT LITTER	DISPOSE OF WITH INLET DEBRIS.
SWEEP PARKING LOT	REMOVE MUD, DIRT, GREASE AND OIL WITH PERIODIC SWEEPING
DUST CONTROL	SPRINKLE WATER AS NEEDED

**BEBOSS Engineering**  
 Engineers Surveyors Planners Landscape Architects  
 3121 E. GRAND RIVER AVE.  
 HOWELL, MI. 48843  
 517.546.4836 FAX 517.548.1670

**GATEWAY CROSSING**  
 GATEWAY CROSSING, LLC  
 600 NORTH OLD WOODWARD, SUITE 101  
 BIRMINGHAM, MI. 48009  
 248-933-7000

**SESC PLAN**  
 PROJECT: GATEWAY CROSSING  
 PREPARED FOR: GATEWAY CROSSING, LLC  
 DATE: 01/05/23

NO.	BY	DATE
1	JAV	01/05/23
2	MJD	1/12/24
3	ST	2/28/24

DESIGNED BY: ST  
 DRAWN BY: JP  
 CHECKED BY:  
 SCALE: 1" = 40'  
 JOB NO: 22-029-1  
 DATE: 01/05/23  
 SHEET NO. **8**



### OKLAND COUNTY DETENTION BASIN CALCULATIONS

ACRE

AREA (ACRES)	IMPERVIOUS FACTOR	IMPERVIOUS
2.13	0.95	2.02
0.00	0.7	0.00
0.47	0.2	0.09

COMPOUND C: 0.81  
TOTAL DRAINAGE AREA: 2.60 ACRES

**WATER QUALITY VOLUME  $V_{WQ}$**   
 $V_{WQ} = 3.630(CI/A) = 7645 \text{ FT}^3$   
 $V_{WQ} = 0.15(V_{WQ}) = 1147 \text{ FT}^3$

**WATER QUALITY RATE FOR MECHANICAL STRUCTURE**  
 $T_c = \text{MAX TIME OF CONCENTRATION} = 10.70 \text{ MIN}$   
 $Q_{WQ} = (CI/A)30.2(T_c + 9.17)^{0.81} = 4.55 \text{ CFS}$

**CHANNEL PROTECTION VOLUME CONTROL - REQUIRED**  
 $V_{CPR} = 4.719(CI/A) = 9936 \text{ FT}^3$

**CHANNEL PROTECTION VOLUME CONTROL - PROVIDED**  
 In-Situ Infiltration rate = 0 IN/HR  
 Are upstream infiltration BMP's provided? NO  
 Basin Footprint Infiltration Area Required = NO INFILTRATION  $\text{FT}^2$   
 $V_{CPR} = 0 \text{ FT}^3$

**CHANNEL PROTECTION RATE CONTROL (EXTENDED DETENTION VOLUME)**  
 $V_{ED} = 6.897(CI/A) = 14525 \text{ FT}^3$

**EXTENDED DETENTION OUTLET RATE**  
 $Q_{ED} = V_{ED}/(48hr) = 0.084 \text{ CFS}$   
 $H_{ED} = V_{ED}/4.666(H)^2 = 1.0 \text{ 1" HOLES}$   
 $H = 8.09 \text{ FT}$   
 $ELEV_{ED} = 957.70$

**100-YEAR ALLOWABLE OUTLET RATE**  
 $Q_{OAR} = \text{Restricted Drain Rate} = 0.2 \text{ CFS/ACRE}$   
 $Q_{OAR} = 1.1055 - 0.206LN(A) = 0.909 \text{ CFS/ACRE}$   
 $Q_{100Y} = (\text{LESSER OF } Q_{OAR} \text{ \& } Q_{OAR})^A = 0.520 \text{ CFS}$

**100-YEAR DETENTION VOLUME**

1 CFS/ACRE	< 2 ACRES	VARIABLE RELEASE RATE
$V_{100Y} = 16995(CI/A) = 39962 \text{ FT}^3$	$Q_{100Y} = 0.206LN(A) = 12.56 \text{ CFS}$	0.15 CFS/ACRE < 100 ACRES
$R = 0.206LN(Q_{100Y}/Q_{100Y}) = 0.0836$	$V_{100Y} = V_{100Y} * R * V_{100Y} = 27334 \text{ FT}^3$	
Is $V_{100Y} \geq V_{ED}$ ? YES	$V_{100Y} = 27.334 \text{ FT}^3$	

**BASIN STORAGE PROVIDED**  
 LUNAL FOOTAGE OF PIPE IN SYSTEM: 352 LFT

ELEVATION	INCREMENTAL VOLUME / LFT	VOLUME (FT <sup>3</sup> )	TOTAL VOLUME (FT <sup>3</sup> )	DHWL
962.5	4.0875	1,439	27,646	
961.5	7.0949	2,497	26,207	
960.5	8.6345	3,039	23,710	
959.5	9.5201	3,351	20,670	
958.5	9.9329	3,496	17,316	
957.5	9.9329	3,496	13,823	
956.5	9.5201	3,351	10,327	
955.5	8.6345	3,039	6,976	
954.5	7.0949	2,497	3,966	
953.5	4.0875	1,439	1,439	
952.5	0.0000			

**PROVIDED FOOTPRINT OF BASIN BOTTOM AREA** 4108 FT<sup>2</sup>

**OUTLET CONTROL STRUCTURE**  
 $Q_{ED} \text{ ACTUAL} = 1 \text{ (1" HOLES)}$   
 $A_{ED} = 0.0055 \text{ FT}^2$   
 $Q_{ED} \text{ ACTUAL} = (A_{ED})0.62 \times (2 \times 32.2 \times h)^{0.5} = 0.077 \text{ CFS}$

**ORIFICE OUTLET**  
 $Q_{100Y} \text{ ACTUAL} = Q_{100Y} - Q_{ED} \text{ ACTUAL} = 0.443 \text{ CFS}$   
 $A_{100} = Q_{100Y} \text{ ACTUAL} / (0.62 \times (2 \times 32.2 \times (ELEV_{DHWL} - ELEV_{ED}))^{0.5}) = 0.053 \text{ FT}^2$   
 AREA OF 2 INCH DIAMETER ORIFICE = 0.022 FT<sup>2</sup>  
 $\# \text{ ORIFICES} = A_{100} / 0.022 = 2.0 \text{ ORIFICES}$

**OVERFLOW SPILLWAY DESIGN**  
 Design Flow Rate:  $Q_{100Y} = 12.56 \text{ CFS}$   
 Depth of Spillway:  $F_{WATER} = 9 \text{ INCHES}$   
 Width of Spillway:  $L_{WATER} = Q_{100Y} / 3.33 * F_{WATER}^{0.67} = 5.8 \text{ FT}$

**BASIN DESIGN SUMMARY**

BASIN SIZE REQUIRED	27,334 FT <sup>3</sup>
BASIN SIZE PROVIDED	27,646 FT <sup>3</sup>

**ORIFICE DESIGN SUMMARY**

ELEVATION	# OF HOLES	DIAMETER OF HOLES
952.50	1.0	1-INCH
957.70	2.0	2-INCH

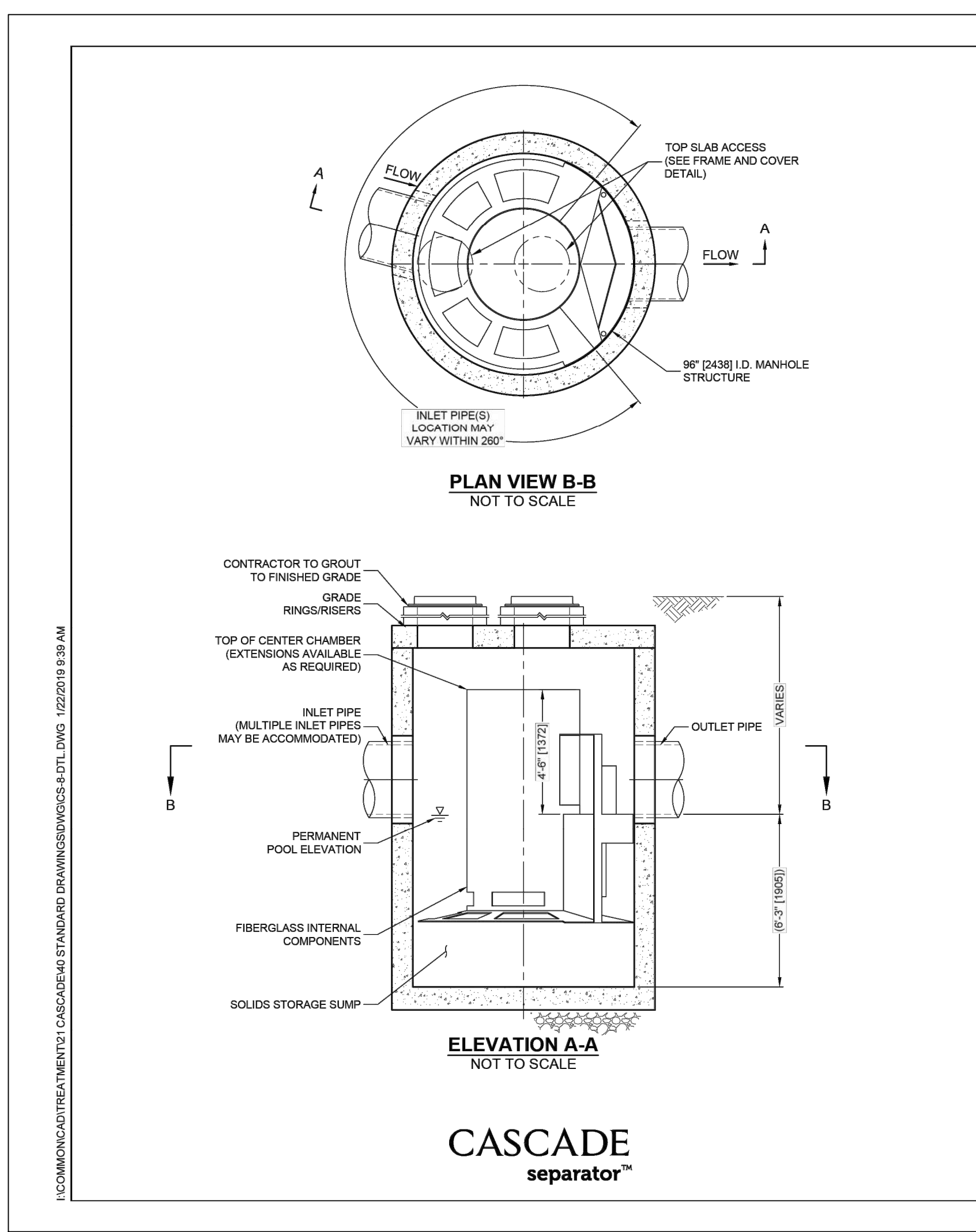
**OVERFLOW SPILLWAY SUMMARY**  
 WIDTH OF OVERFLOW SPILLWAY = 6 FT

**FLOW RESTRICTOR WITH OVERFLOW (NOT TO SCALE)**

FROM	TO	DRAIN AREA	ACRES	RUNOFF COEFF	EQUIV. AREA A * C	INTEN-SITY I	TIME OF CONC. T <sub>c</sub>	ADDL. RUNOFF Q	RUNOFF Q	PIPE LENGTH (LF)	PIPE DIA (IN)	VELOCITY FLOWING FULL (FPS)	HYDRAULIC GRADIENT SLOPE %	ACTUAL SLOPE USED	MANNING COEFFICIENT	MANNING FLOW CAPACITY	MANNING'S VELOCITY (FT/SEC)	TIME (MIN)	HG ELEV UPPER END	HG ELEV LOWER END	RIM ELEV UPPER END	RIM ELEV LOWER END	INVERT UPPER END	INVERT LOWER END	DROP DISTANCE (FT)
8	7	8	0.34	0.78	0.27	4.38	15.00		1.18	110	15	2.61	0.24%	0.50%	0.013	4.58	3.73	0.49	967.17	966.62	972.40	971.90	968.17	965.62	3.00
7	6	7	0.17	0.85	0.14	4.32	15.49	3.68	5.47	177	18	4.70	0.62%	0.75%	0.013	9.12	5.16	0.57	963.62	962.29	971.90	966.50	962.42	961.09	3.00
6	BASIN	6	0.30	0.84	0.25	4.26	16.06	2.65	9.19	6	18	6.93	1.35%	1.50%	0.013	12.90	7.30	0.01	959.29	959.20	966.50	-	958.09	958.00	
9	7	9	0.79	0.95	0.75	4.38	15.00		3.27	29	15	3.55	0.45%	0.50%	0.013	4.58	3.73	0.13	967.31	967.17	973.00	971.90	966.31	966.17	
7A	7	7A	0.10	0.95	0.09	4.38	15.00		0.40	40	8	2.69	0.60%	1.00%	0.013	1.21	3.47	0.19	967.57	967.17	973.75	971.90	967.03	966.63	
13	12	13	0.24	0.70	0.17	4.38	15.00		0.74	90	12	1.99	0.19%	0.32%	0.013	2.02	2.57	0.58	965.46	965.17	972.40	972.41	964.66	964.37	
12	11	12	0.38	0.54	0.20	4.31	15.58		1.62	124	12	2.55	0.31%	0.32%	0.013	2.02	2.57	0.80	965.17	964.78	972.41	971.84	964.37	963.98	
11	10	11	0.05	0.86	0.05	4.23	16.39	0.42	2.23	76	15	4.89	0.86%	1.75%	0.013	8.57	6.98	0.18	960.78	959.45	971.84	967.15	959.78	958.45	
10	5	10	0.11	0.73	0.08	4.21	16.57		2.56	30	15	2.56	0.24%	0.24%	0.013	3.17	2.59	0.19	959.45	959.37	967.15	966.15	958.45	958.37	
5	6	5	0.02	0.89	0.02	4.19	16.76		2.65	35	15	2.84	0.29%	0.24%	0.013	3.17	2.59	0.23	965.56	965.46	966.15	966.50	958.37	958.29	
11A	11	11A	0.10	0.95	0.09	4.38	15.00		0.42	29	8	2.69	0.60%	1.00%	0.013	1.21	3.47	0.14	965.46	965.17	973.75	971.84	964.93	964.64	
14	14A	14	0.44	0.51	0.22	4.38	15.00		0.98	34	12	5.79	1.62%	4.50%	0.013	7.58	9.65	0.06	966.80	965.27	-	967.00	966.00	964.47	1.92
14A	13	-	-	-	-	-	15.06		0.98	109	12	2.57	0.32%	0.50%	0.013	2.53	3.22	0.56	963.35	962.80	967.00	972.40	962.55	962.00	
BASIN	2	ALL	-	-	-	-	15.00	9.19	9.19	8	24	4.22	0.34%	0.40%	0.013	14.35	4.57	0.03	954.10	954.06	-	967.00	952.50	952.46	
2	1	-	-	-	-	-	15.03		9.19	51	24	4.22	0.34%	0.40%	0.013	14.35	4.57	0.19	954.06	953.86	967.00	-	952.46	952.26	

**100-YEAR PIPE FLOW CALCULATION FOR OCS**

BASIN	TO	DRAIN AREA	ACRES	RUNOFF COEFF	EQUIV. AREA A * C	INTEN-SITY I	TIME OF CONC. T <sub>c</sub>	ADDL. RUNOFF Q	RUNOFF Q	PIPE LENGTH (LF)	PIPE DIA (IN)	VELOCITY FLOWING FULL (FPS)	HYDRAULIC GRADIENT SLOPE %	ACTUAL SLOPE USED	MANNING COEFFICIENT	MANNING FLOW CAPACITY	MANNING'S VELOCITY (FT/SEC)	TIME (MIN)	HG ELEV UPPER END	HG ELEV LOWER END	RIM ELEV UPPER END	RIM ELEV LOWER END	INVERT UPPER END	INVERT LOWER END	DROP DISTANCE (FT)
BASIN	2	ALL	2.60	0.81	2.117188	5.96	16.76		12.62	8	24	5.48	0.58%	0.40%	0.013	14.35	4.57	0.03	954.20	954.15	-	967.00	952.50	952.46	
2	1	-	-	-	-	-	16.79		12.62	51	24	5.48	0.58%	0.40%	0.013	14.35	4.57	0.19	954.15	953.86	967.00	-	952.46	952.26	



### CASCADE SEPARATOR DESIGN NOTES

THE STANDARD CS-8 CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

**CONFIGURATION DESCRIPTION**

- GRATED INLET ONLY (NO INLET PIPE)
- GRATED INLET WITH INLET PIPE OR PIPES
- CURB INLET ONLY (NO INLET PIPE)
- CURB INLET WITH INLET PIPE OR PIPES

**SITE SPECIFIC DATA REQUIREMENTS**

STRUCTURE ID	WATER QUALITY FLOW RATE (cfs [L/s])	PEAK FLOW RATE (cfs [L/s])	RETURN PERIOD OF PEAK FLOW (yrs)	RIM ELEVATION

PIPE DATA:	INVERT	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			

NOTES/SPECIAL REQUIREMENTS:

**GENERAL NOTES**

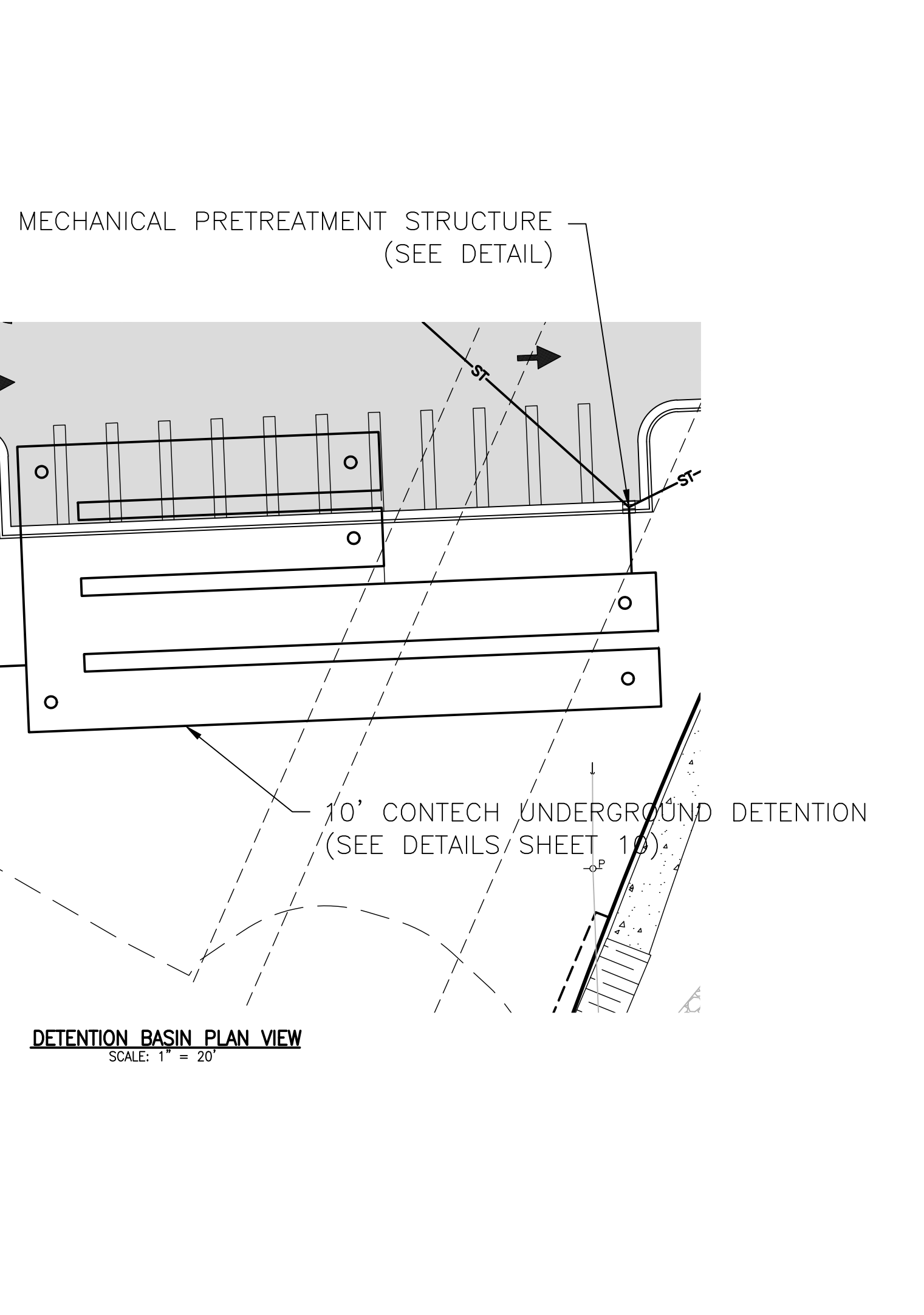
- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. [www.conteches.com](http://www.conteches.com)
- CASCADE SEPARATOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
- CASCADE SEPARATOR STRUCTURE SHALL MEET AASHTO H2020 LOAD RATING, ASSUMING EARTH COVER OF 0' - 2' [610], AND GROUNDWATER ELEVATION AT OR BELOW THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M299 AND BE CAST WITH THE CONTECH LOGO.
- CASCADE SEPARATOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C478 AND AASHTO LOAD FACTOR DESIGN METHOD.
- ALTERNATE UNITS ARE SHOWN IN MILLIMETERS (mm).

**INSTALLATION NOTES**

- ANY SUBGRADE BACKFILL DEPTH AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CASCADE SEPARATOR MANHOLE STRUCTURE.
- CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLY STRUCTURE.
- CONTRACTOR TO PROVIDE, INSTALL AND GROUT INLET AND OUTLET PIPE(S). MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
- CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT. HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

**CONTECH ENGINEERED SOLUTIONS LLC**  
 9025 Centre Pointe Dr., Suite 400, West Chester, OH 45399  
 600-338-1122 513-645-7000 513-645-7993 FAX

**CS-8 CASCADE SEPARATOR STANDARD DETAIL**



**BEBOSS Engineering**  
 Engineers Surveyors Planners Landscape Architects  
 3121 E. GRAND RIVER AVE.  
 HOWELL, MI. 48843  
 517.546.4836 FAX 517.548.1670

**GATEWAY CROSSING**  
 GATEWAY CROSSING, LLC  
 600 NORTH OLD WOODWARD, SUITE 101  
 BIRMINGHAM, MI. 48009  
 248-937-7000

**DETENTION BASIN DETAILS**

NO.	BY	DATE	REVISION PER
1	JW/46	09/09/23	REVISION PER
2	MJD	1/12/24	REVISION PER TWP PISP REV #2
3	ST	2/28/24	REVISION PER TWP PISP REV #3

DESIGNED BY: ST  
 DRAWN BY: JS  
 CHECKED BY:  
 SCALE: 1" = 20'  
 JOB NO: 22-029-1  
 DATE: 01/05/23  
 SHEET NO. **9**



PROJECT SUMMARY

CALCULATION DETAILS
LOADING = HS20S18
APPROX. LINEAR FOOTAGE = 352 LF

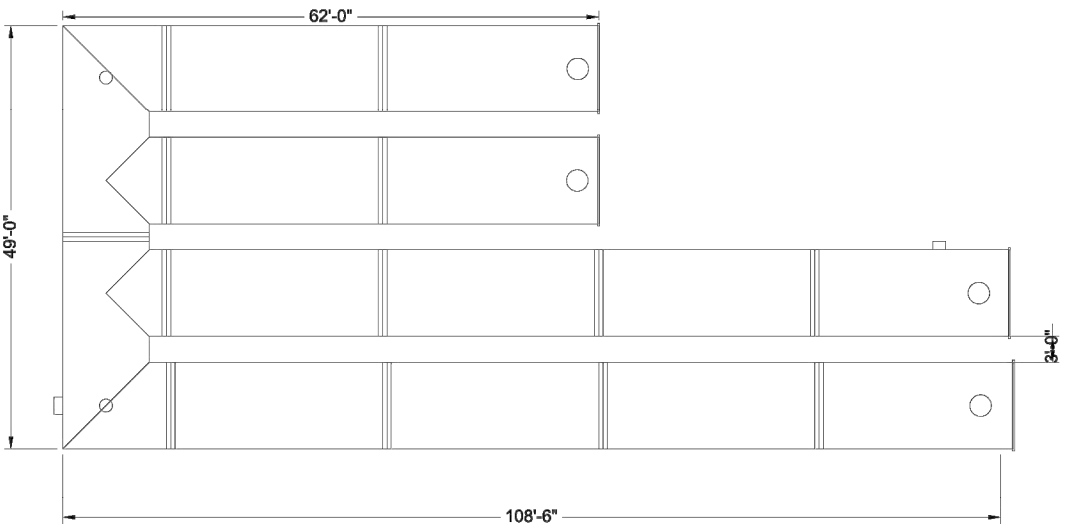
STORAGE SUMMARY
STORAGE VOLUME REQUIRED = 27,334 CF
PIPE STORAGE VOLUME = 27,646 CF
BACKFILL STORAGE VOLUME = 0 CF
TOTAL STORAGE PROVIDED = 27,646 CF

PIPE DETAILS
DIAMETER = 120"
CORROSION = S&I
GAGE = 14
COATING = ALT2
WALL TYPE = SOLID
BARRELS SPACING = 36"

BACKFILL DETAILS
WIDTH AT ENDS = 12"
ABOVE PIPE = 0"
WIDTH AT SIDES = 12"
BELOW PIPE = 0"

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND METLS. SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A578.

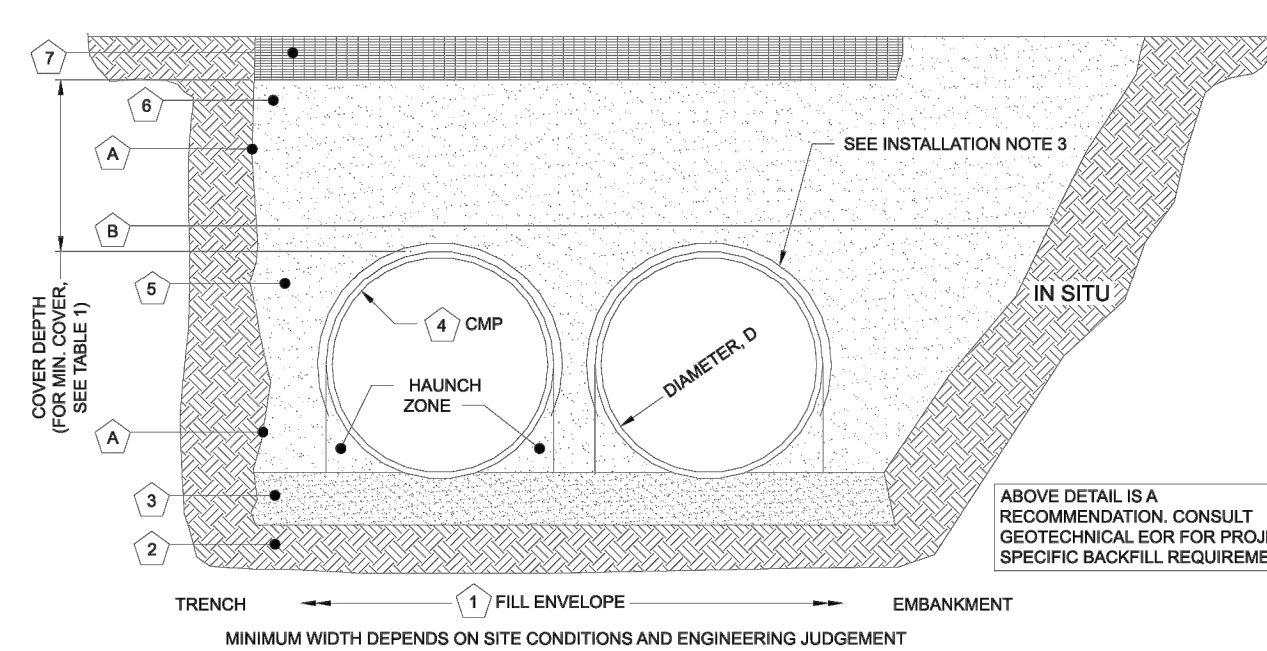


ASSEMBLY SCALE: 1" = 20'



DYO42257 Gateway Commons, LLC
Underground Detention
White Lake, MI
DETENTION SYSTEM

Table with columns: PROJECT NO., SEC. NO., DATE, DESIGNED, DRAWN, CHECKED, APPROVED, SHEET NO.



INSTALLATION NOTES

- 1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.

TABLE 1: DIAMETER, D; MIN. COVER; CORR. PROFILE. Columns include diameter (8"-10", 12", 12"-48", >48"-60", >60") and corresponding min. cover and corr. profile values.

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.

TABLE 2: PERFORATED STANDARD

Table with columns: MATERIAL LOCATION, MATERIAL SPECIFICATION, DESCRIPTION. Rows include Fill Envelope Width, Foundation, Bedding, Backfill, Cover Material, Rigid or Flexible Pavement, and Optional Side Geotextile.

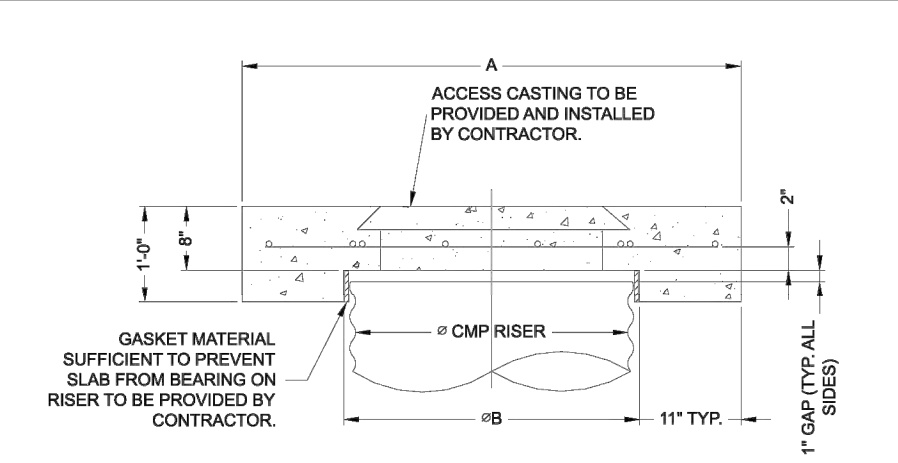
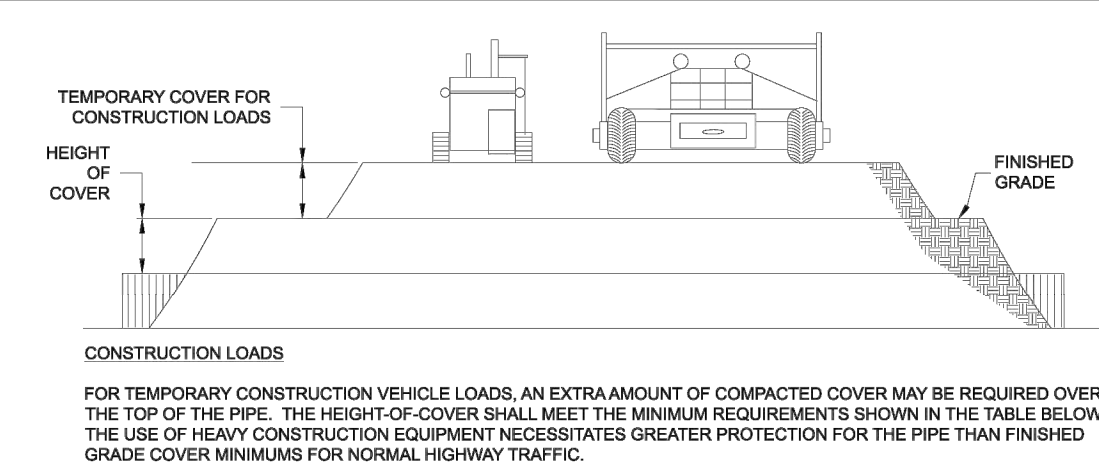
- NOTES: FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL RISERS SHALL BE THE PIPE DIAMETER D BUT NOT LESS THAN 12" FOR DIAMETERS <12" FOR 12" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36" CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

MANUFACTURER RECOMMENDED BACKFILL



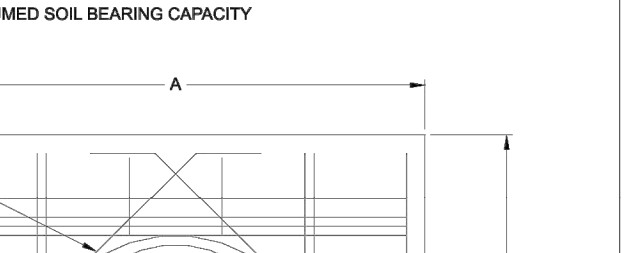
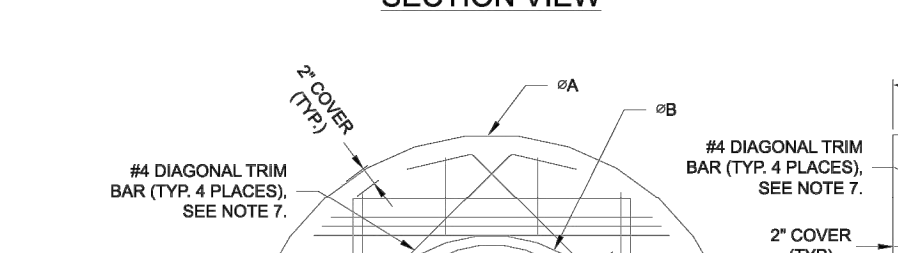
DYO42257 Gateway Commons, LLC
Underground Detention
White Lake, MI
DETENTION SYSTEM

Table with columns: PROJECT NO., SEC. NO., DATE, DESIGNED, DRAWN, CHECKED, APPROVED, SHEET NO.



REINFORCING TABLE with columns: CMP RISER, A, B, REINFORCING, BEARING PRESSURE (PSF). Rows include 24", 30", 36", 42", 48" diameters with corresponding reinforcing bar sizes and bearing pressures.

Table with columns: PIPE SPAN, INCHES; AXLE LOADS (kips); MINIMUM COVER (FT). Rows include spans from 18-50 to 125-150 and axle loads from 2.0 to 4.5 kips.



CONSTRUCTION LOADING DIAGRAM SCALE: N.T.S.

ROUND OPTION PLAN VIEW

SQUARE OPTION PLAN VIEW

SPECIFICATION FOR DESIGNED DETENTION SYSTEM: SCOPE: THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.
MATERIAL: THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW.
LISTED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

NOTES: 1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1" MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.

MANHOLE CAP DETAIL SCALE: N.T.S.
REINFORCING TABLE
BEARING PRESSURE (PSF)
ASSUMED SOIL BEARING CAPACITY



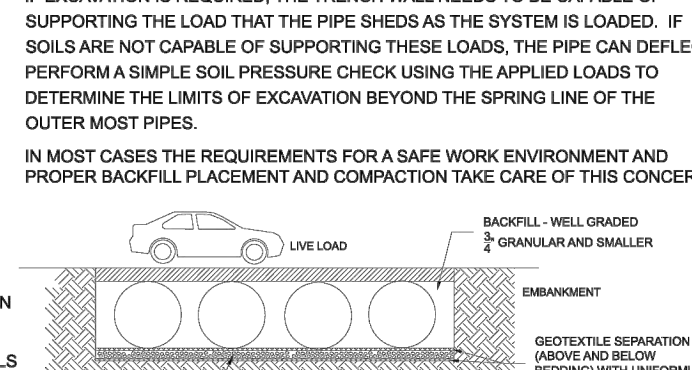
DYO42257 Gateway Commons, LLC
Underground Detention
White Lake, MI
DETENTION SYSTEM

Table with columns: PROJECT NO., SEC. NO., DATE, DESIGNED, DRAWN, CHECKED, APPROVED, SHEET NO.

CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION.

IN-SITU TRENCH WALL



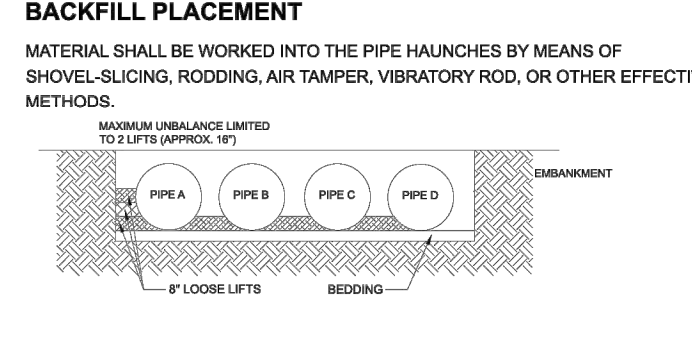
CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.
INSPECTION: INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

BACKFILL PLACEMENT



CONSTRUCTION LOADING

TYPICALLY THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED. SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM.

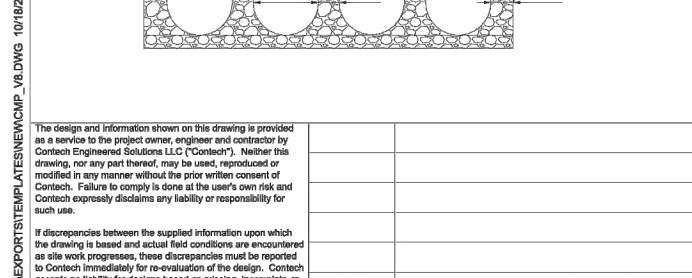
ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION, POTENTIALLY CAUSING FLOATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES.

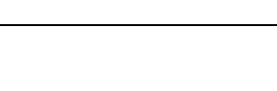
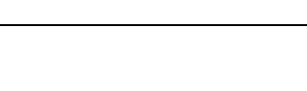
MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

TYPICAL BACKFILL SEQUENCE



CONSTRUCTION EQUIPMENT



DYO42257 Gateway Commons, LLC
Underground Detention
White Lake, MI
DETENTION SYSTEM

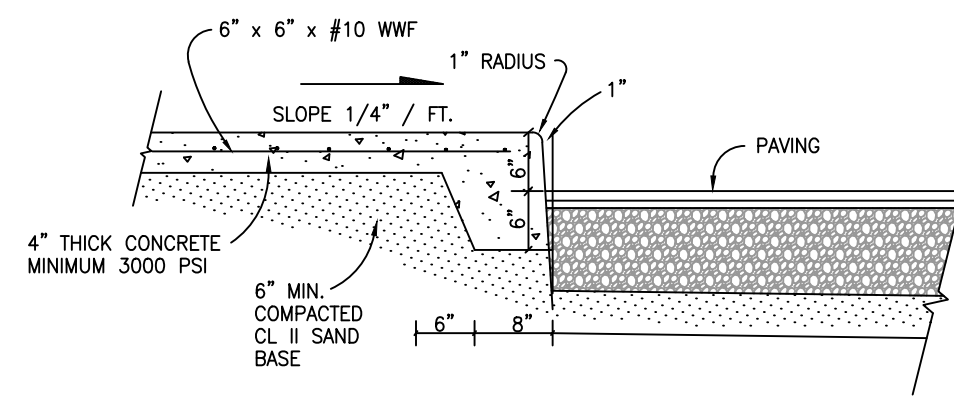
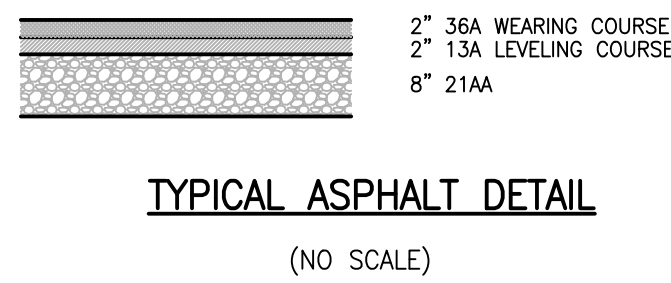
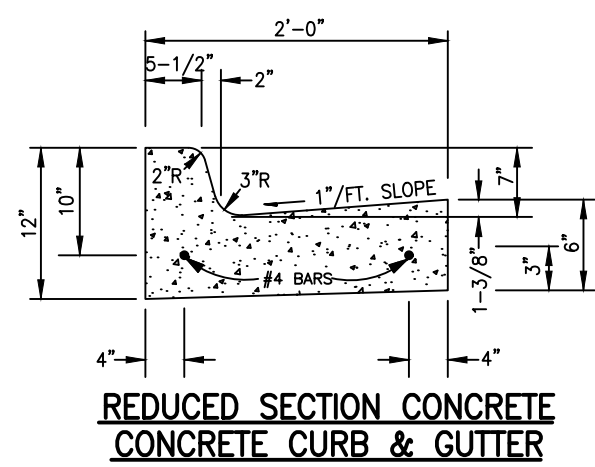
Table with columns: PROJECT NO., SEC. NO., DATE, DESIGNED, DRAWN, CHECKED, APPROVED, SHEET NO.

BOSS Engineering logo and contact information: 3121 E. GRAND RIVER AVE., HOWELL, MI, 48843. 517.546.4836 FAX 517.548.1670

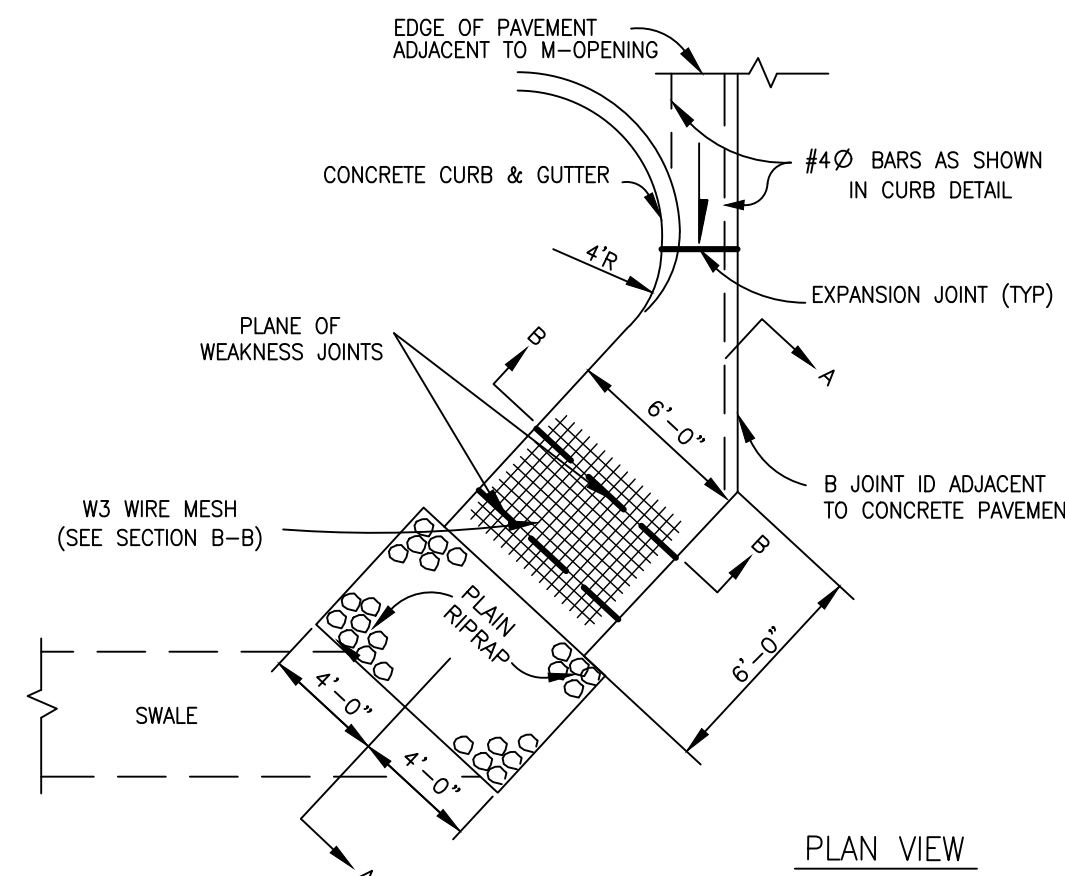
GATEWAY CROSSING PROJECT PREPARED FOR GATEWAY CROSSING, LLC. CONTECH UNDERGROUND DETAILS. Revision table with columns: NO., REV., DATE, REVISION PER.

BOSS Engineering logo and sheet number: 10

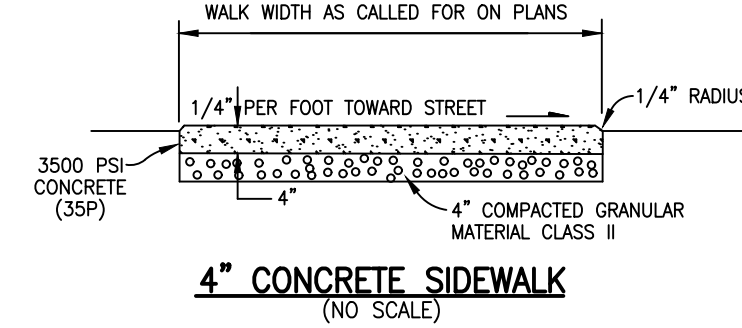




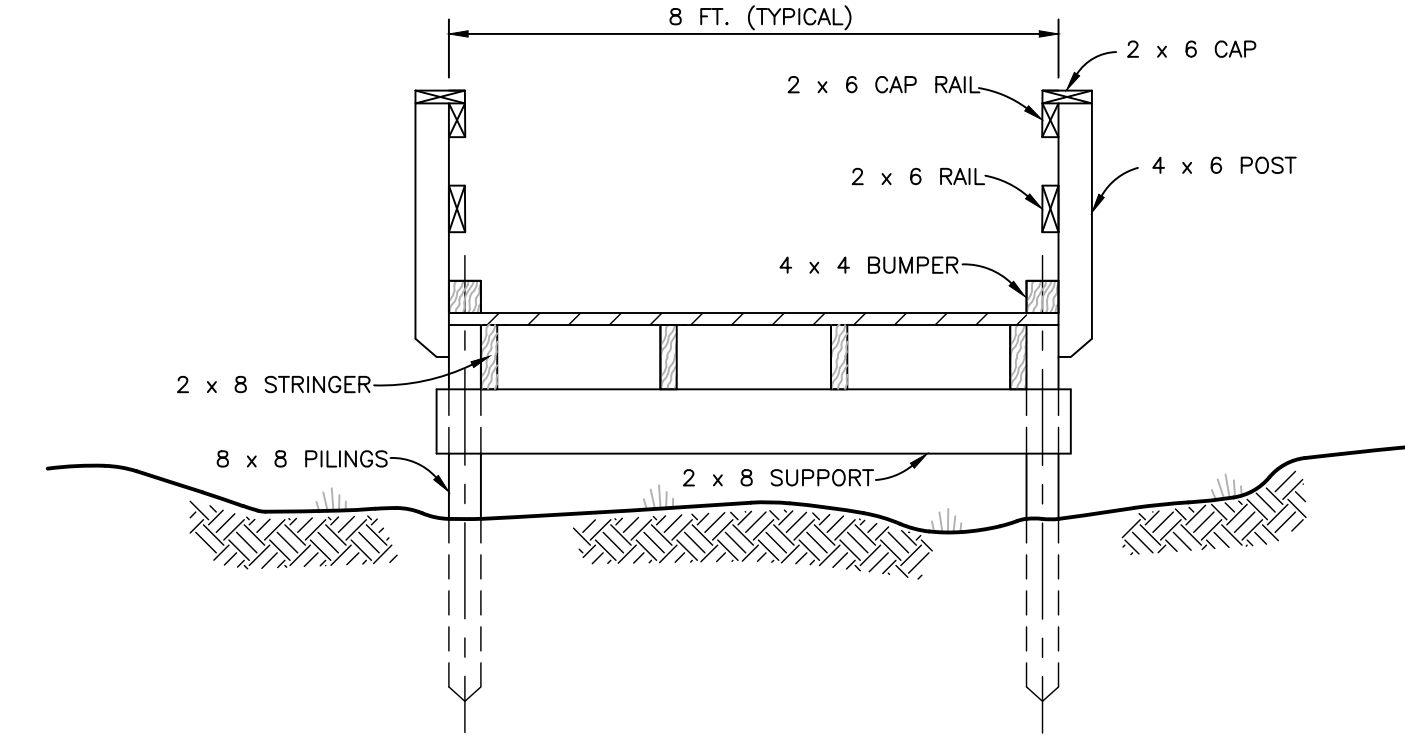
INTEGRAL CONCRETE WALK / CURB DETAIL  
(NO SCALE)



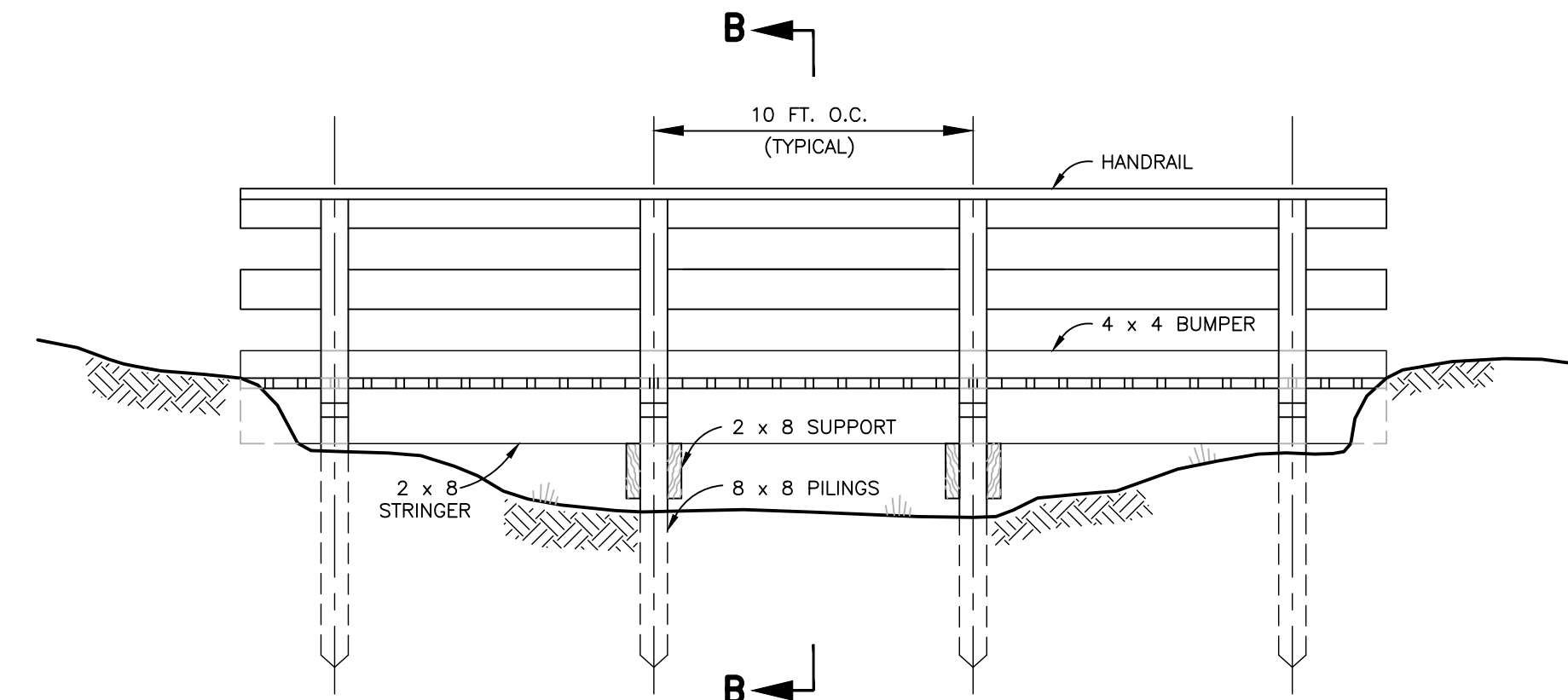
ANGLED CONCRETE SPILLWAY  
FOR USE AT END OF CURB  
(ANGLED)



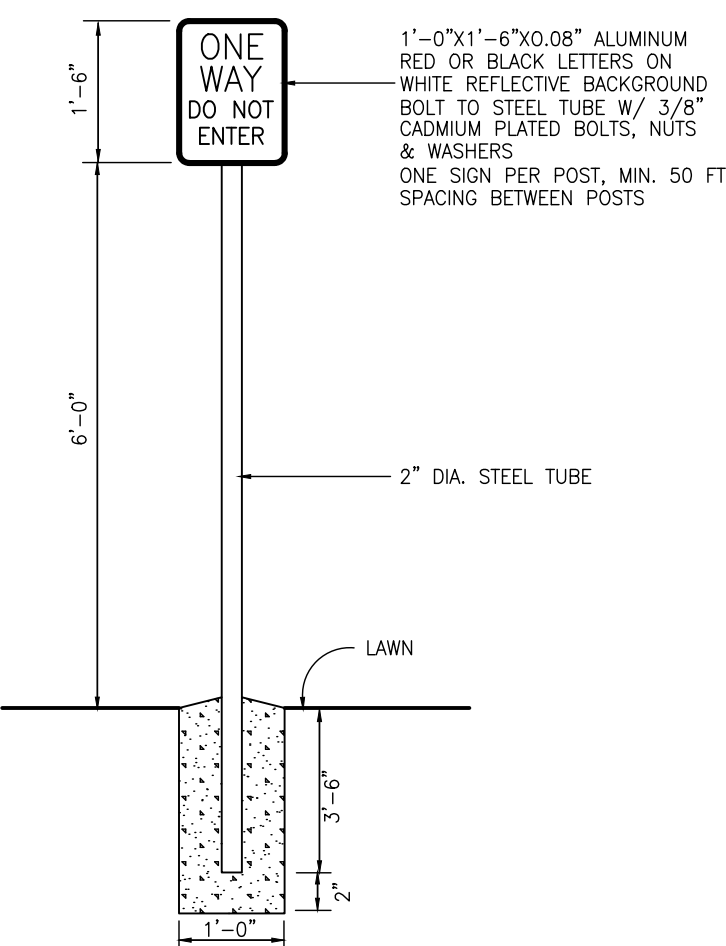
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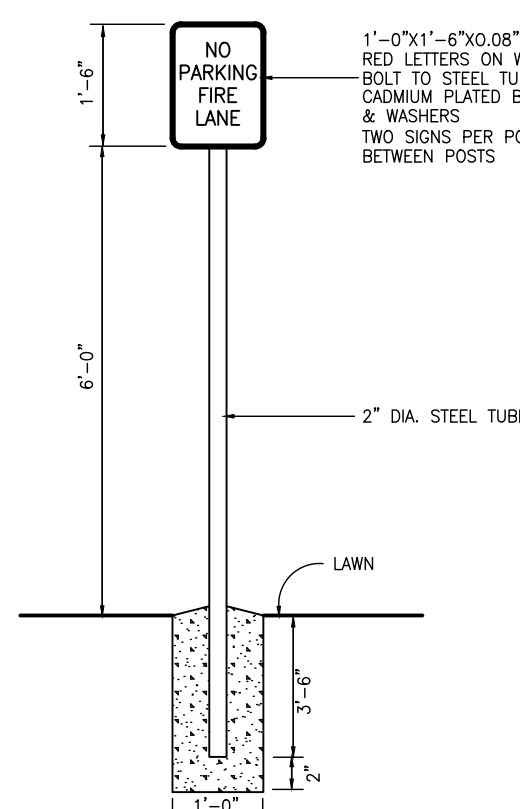
SECTION B-B  
BOARDWALK DETAIL  
SCALE: NONE



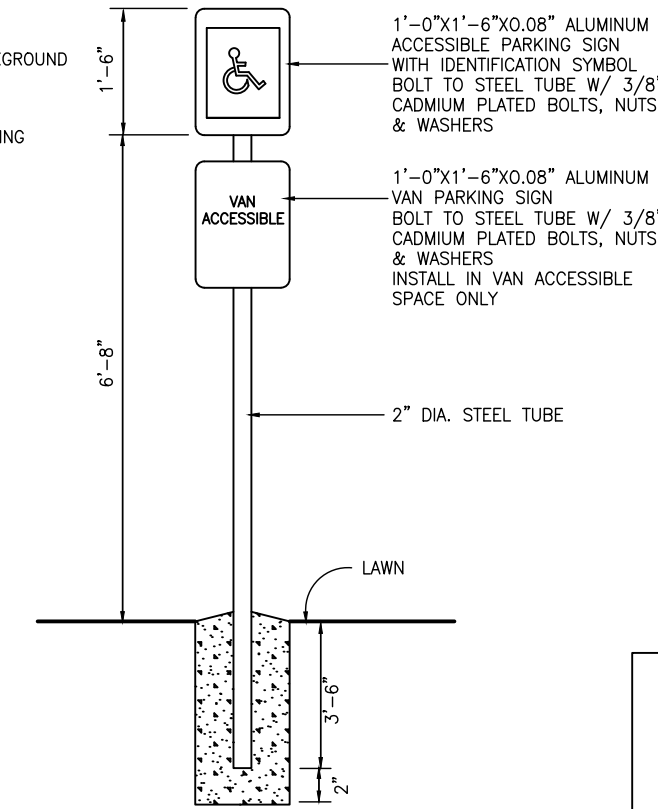
SECTION A-A  
BOARDWALK DETAIL  
SCALE: NONE



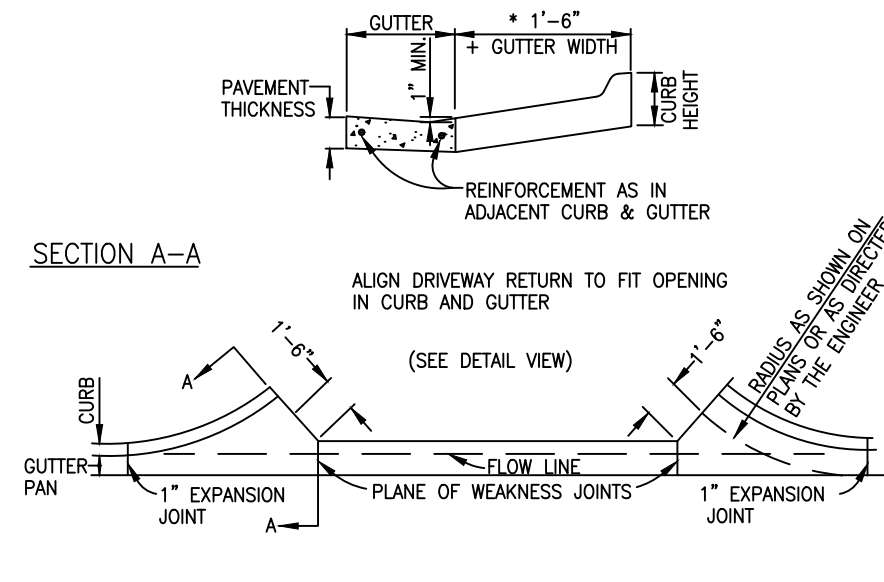
NO PARKING SIGN DETAIL  
(NO SCALE)



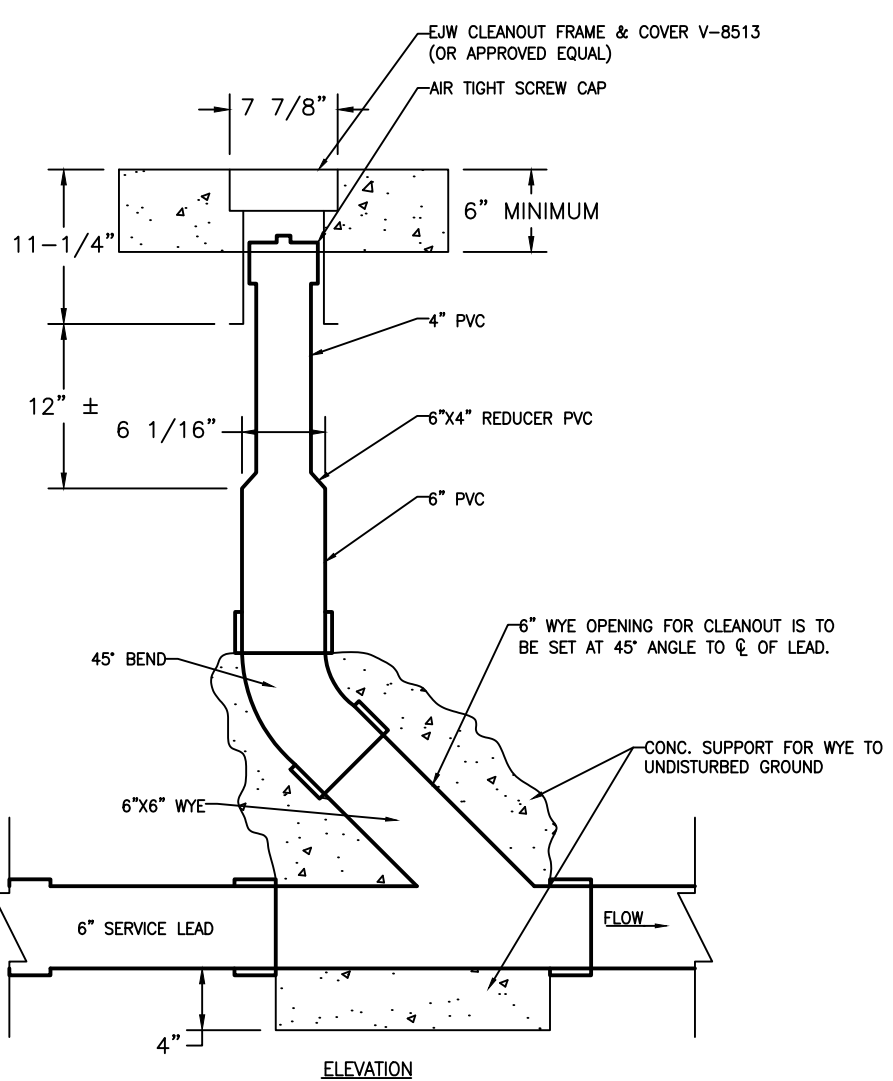
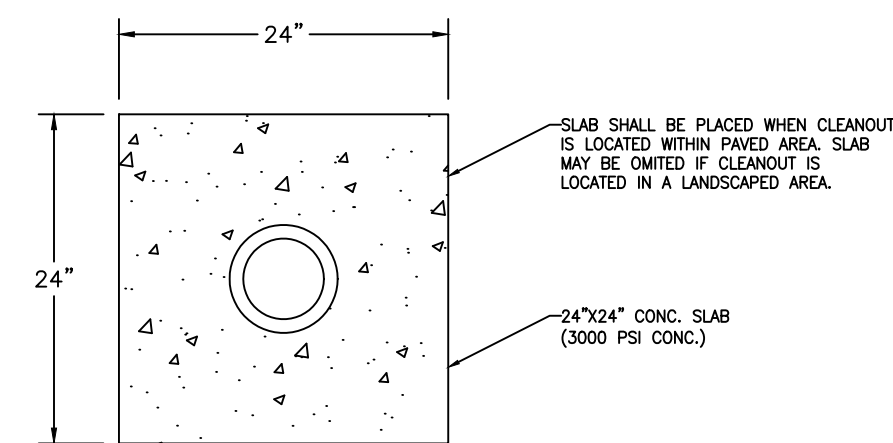
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(NO SCALE)



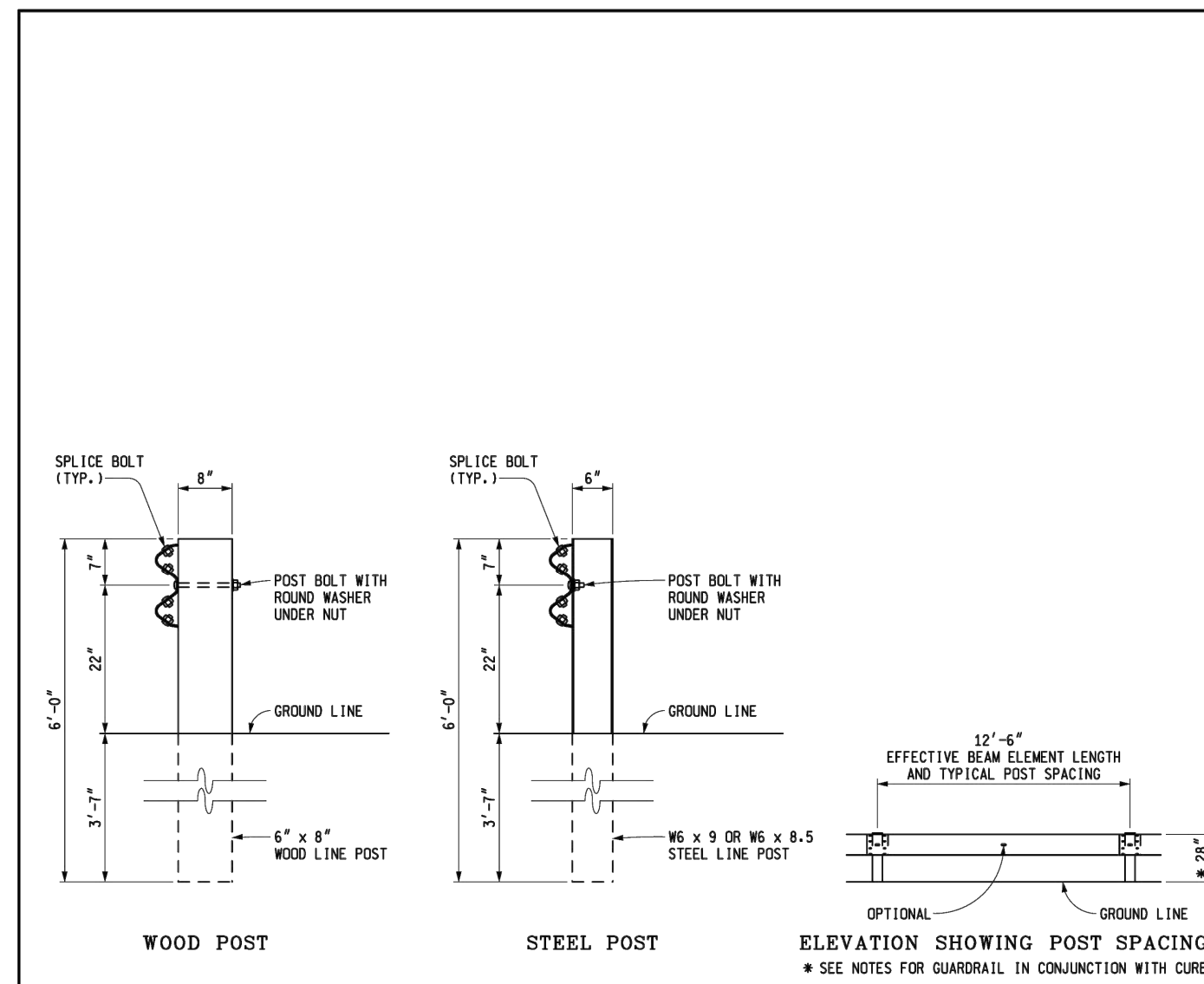
HANDICAP PARKING SIGN DETAIL  
(NO SCALE)



CONCRETE DRIVEWAY OPENING -  
MDOT STANDARD II-42, DETAIL 1M\"/>

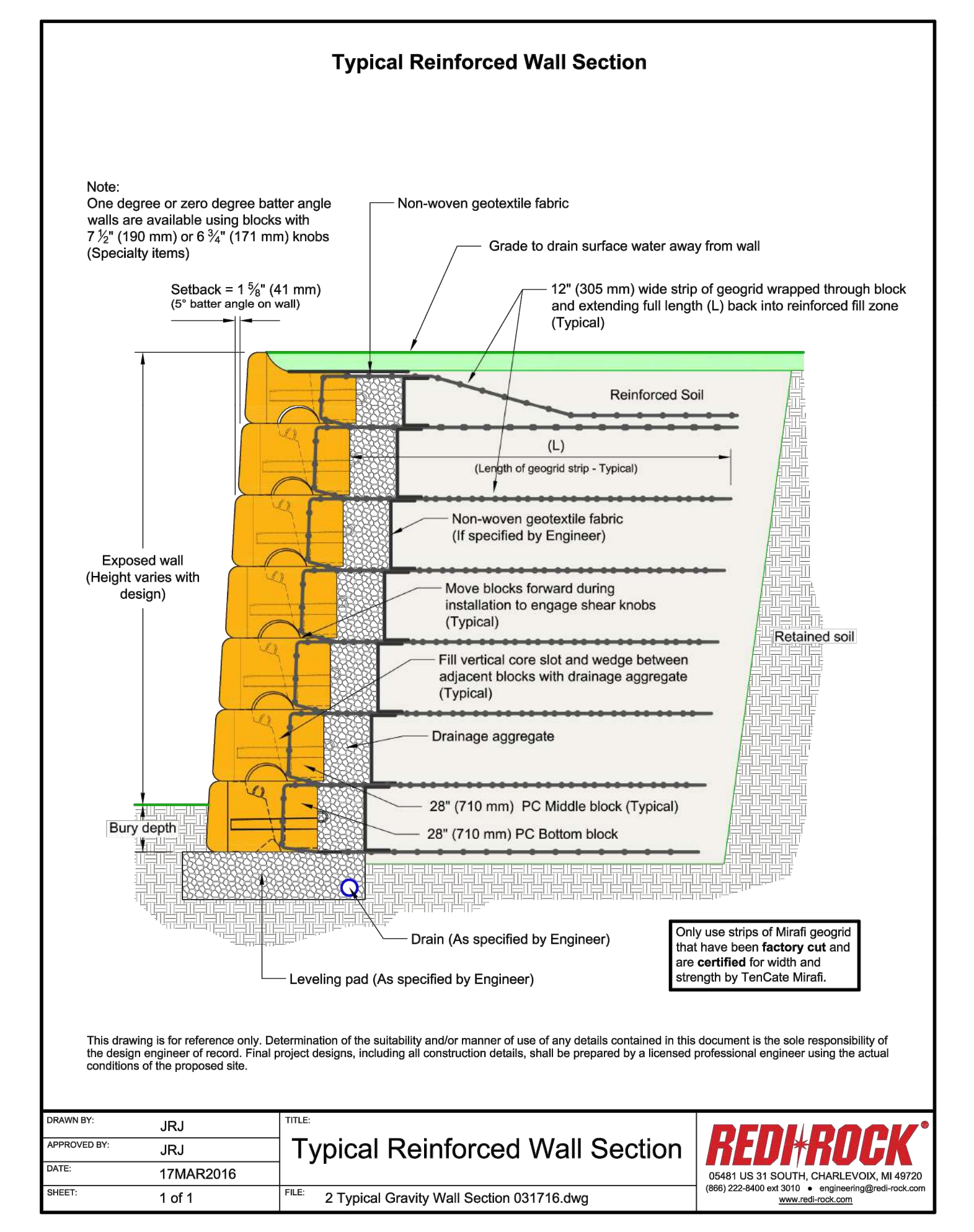


DETAIL OF SANITARY SEWER CLEANOUT  
(NO SCALE)



GUARDRAIL, TYPE A

		DEPARTMENT DIRECTOR Paul C. Argus		MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD PLAN FOR <b>GUARDRAIL,</b> TYPES A, B, BD, T, TD, MGS-B, & MGS-8D	
PREPARED BY: DESIGN DIVISION DRAWN BY: B.S.L. CHECKED BY: M.S.P.	APPROVED BY: DIRECTOR, BUREAU OF FIELD SERVICES	APPROVED BY: DIRECTOR, BUREAU OF DEVELOPMENT	F.S.K.A. APPROVAL	12-3-2021 PLAN DATE	R-60-J SHEET 1 OF 16



DRAWN BY: JRJ APPROVED BY: JRJ DATE: 17MAR2016 SHEET: 1 of 1	TITLE: <b>Typical Reinforced Wall Section</b> FILE: 2 Typical Gravity Wall Section 031716.dwg	
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THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THESE DRAWINGS ARE ONLY APPROXIMATE. NO GUARANTEE IS MADE AS TO THE ACCURACY OF THESE UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING THE EXACT LOCATION AND ELEVATION OF EXISTING UTILITIES. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN ANY CONTACTS ARE MADE. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN ANY CONTACTS ARE MADE. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IN ANY CONTACTS ARE MADE.

**BEBOSS**  
Engineering  
Engineers Surveyors Planners Landscape Architects  
3121 E. GRAND RIVER AVE.  
HOWELL, MI. 48843  
517.546.4836 FAX 517.548.1670

PROJECT: GATEWAY CROSSING  
PREPARED FOR: GATEWAY CROSSING, LLC  
600 NORTH OLD WOODWARD, SUITE 101  
BIRMINGHAM, MI. 38209  
248-433-7000

NO	BY	DATE
1	JAV	09/09/23
2	MJD	1/12/24
3	ST	2/28/24

DESIGNED BY: ST  
DRAWN BY: JS  
CHECKED BY:  
SCALE: NO SCALE  
JOB NO: 22-029-1  
DATE: 01/05/23

SHEET NO. 11



THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THESE DRAWINGS ARE ONLY APPROXIMATE. NO GUARANTEE IS MADE BY THE ENGINEER AS TO THE EXACT LOCATION AND ELEVATION OF EXISTING UTILITIES. THE CONTRACTOR SHALL BE EXCLUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT LOCATION AND ELEVATION OF EXISTING UTILITIES. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS BEFORE THE LOCATION OR DEPTH DIFFERS SIGNIFICANTLY FROM THE PLANS.

BEFORE WORKING DATE  
CALL MISS DIG  
1-800-487-7171  
www.missdig.com

**BEBOSS**  
Engineering  
Engineers Surveyors Planners Landscape Architects  
3121 E. GRAND RIVER AVE.  
HOWELL, MI. 48843  
517.546.4836 FAX 517.548.1670

**GATEWAY CROSSING**  
GATEWAY CROSSING, LLC  
600 NORTH OGDON AVENUE, SUITE 101  
BIRMINGHAM, MI 48209  
248-937-7000

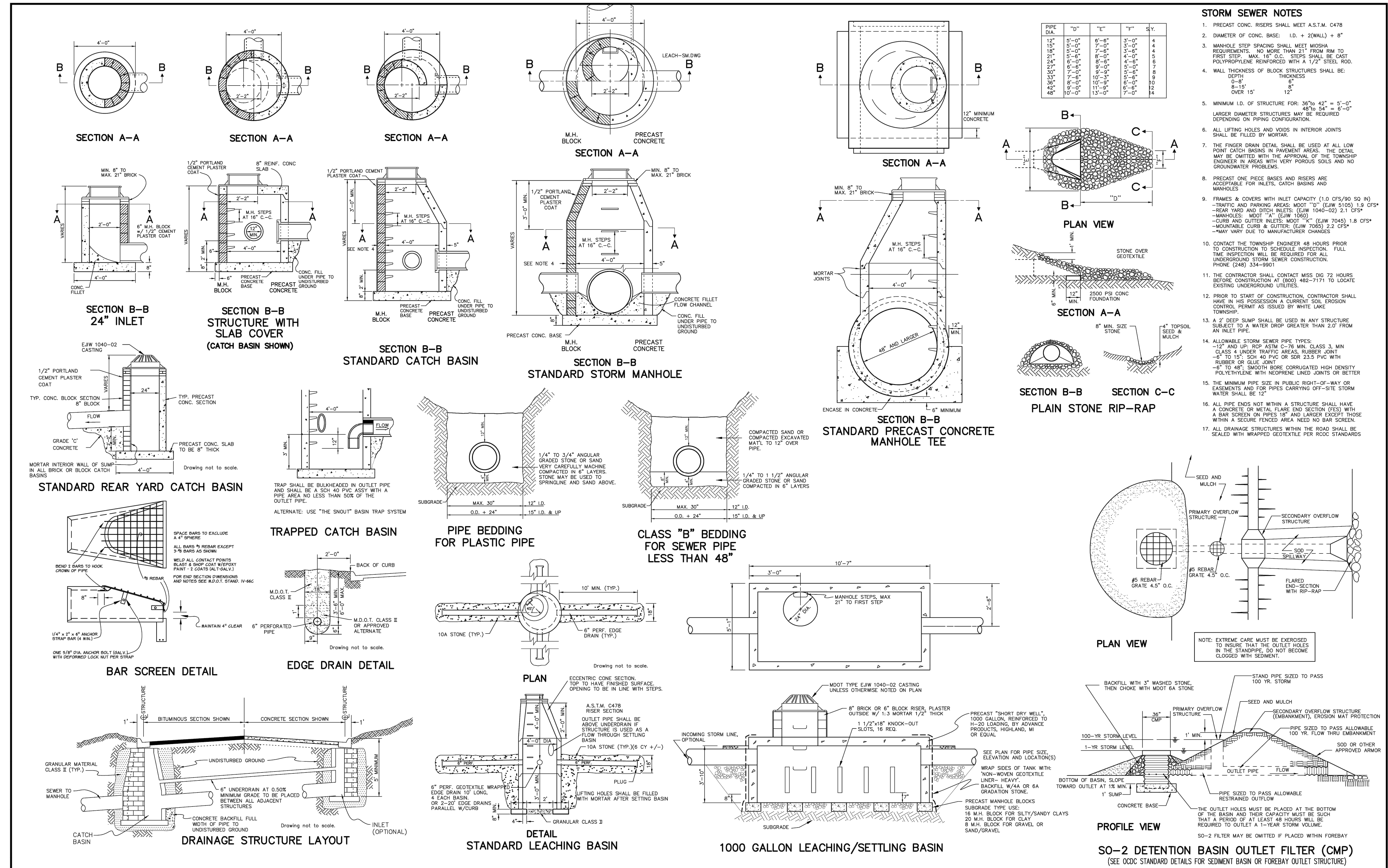
PROJECT: TOWNSHIP STORM SEWER DETAILS

PREPARED FOR: GATEWAY CROSSING, LLC

DATE: 01/05/23

NO.	DATE	REVISION PER	BY
1	09/23/24	REV #1	DA
2	11/12/24	REV #2	DA
3	01/05/23	REV #3	DA

DESIGNED BY: DA  
DRAWN BY: CAD  
CHECKED BY: DA  
SCALE: NO SCALE  
JOB NO: 22-029-1  
DATE: 01/05/23  
SHEET NO. 12



**PIPE DIA.**

PIPE DIA.	"D"	"E"	"F"	S.Y.
12"	5'-0"	6'-6"	3'-0"	4
15"	5'-0"	7'-0"	3'-0"	4
18"	5'-0"	7'-0"	3'-0"	4
21"	5'-0"	8'-0"	4'-0"	5
24"	6'-0"	8'-0"	4'-0"	6
27"	6'-0"	9'-0"	5'-0"	7
30"	7'-0"	9'-0"	5'-0"	8
33"	7'-0"	10'-0"	6'-0"	9
36"	8'-0"	10'-0"	6'-0"	10
42"	9'-0"	11'-0"	7'-0"	12
48"	10'-0"	13'-0"	7'-0"	14

- STORM SEWER NOTES**
- PRECAST CONC. RISERS SHALL MEET A.S.T.M. C478
  - DIAMETER OF CONC. BASE: I.D. + 2(WALL) + 8"
  - MANHOLE STEP SPACING SHALL MEET MISHA REQUIREMENTS. NO MORE THAN 21" FROM RIM TO FIRST STEP. MAX 16" O.C. STEPS SHALL BE CAST POLYPROPYLENE REINFORCED WITH A 1/2" STEEL ROD.
  - WALL THICKNESS OF BLOCK STRUCTURES SHALL BE: DEPTH: 8" THICKNESS: 8" OVER 15' 12"
  - MINIMUM I.D. OF STRUCTURE FOR: 36" TO 42" = 5'-0" 48" TO 54" = 6'-0" LARGER DIAMETER STRUCTURES MAY BE REQUIRED DEPENDING ON PIPING CONFIGURATION.
  - ALL LIFTING HOLES AND VOIDS IN INTERIOR JOINTS SHALL BE FILLED BY MORTAR.
  - THE FINGER DRAIN DETAIL SHALL BE USED AT ALL LOW POINT CATCH BASINS IN PAVEMENT AREAS. THE DETAIL MAY BE OMITTED WITH THE APPROVAL OF THE TOWNSHIP ENGINEER IN AREAS WITH VERY POROUS SOILS AND NO GROUNDWATER PROBLEMS.
  - PRECAST ONE PIECE BASES AND RISERS ARE ACCEPTABLE FOR INLETS, CATCH BASINS AND MANHOLES
  - FRAMES & COVERS WITH INLET CAPACITY (1.0 CFS/90 SQ IN) -TRAFFIC AND PARKING AREAS: MDOT "10" (EJW 5105) 1.9 CFS\* -REAR YARD AND DITCH INLETS: (EJW 1040-02) 2.1 CFS\* -MANHOLES: MDOT "A" (EJW 1060) -CURB AND GUTTER INLETS: MDOT "C" (EJW 7045) 1.8 CFS\* -MOUNTABLE CURB & GUTTER: (EJW 7065) 2.2 CFS\* -MAY VARY DUE TO MANUFACTURER CHANGES
  - CONTACT THE TOWNSHIP ENGINEER 48 HOURS PRIOR TO CONSTRUCTION TO SCHEDULE INSPECTION. FULL TIME INSPECTION WILL BE REQUIRED FOR ALL UNDERGROUND STORM SEWER CONSTRUCTION. PHONE (248) 334-9901
  - THE CONTRACTOR SHALL CONTACT MISS DIG 72 HOURS BEFORE CONSTRUCTION AT (800) 482-7171 TO LOCATE EXISTING UNDERGROUND UTILITIES.
  - PRIOR TO START OF CONSTRUCTION, CONTRACTOR SHALL HAVE IN HIS POSSESSION A CURRENT SOIL EROSION CONTROL PERMIT AS ISSUED BY WHITE LAKE TOWNSHIP.
  - A 2' DEEP SUMP SHALL BE USED IN ANY STRUCTURE SUBJECT TO A WATER DROP GREATER THAN 2.0' FROM AN INLET PIPE.
  - ALLOWABLE STORM SEWER PIPE TYPES: -12" AND UP: RCP ASTM C-76 MIN. CLASS 3, MIN CLASS 4 UNDER TRAFFIC AREAS, RUBBER JOINT -8" TO 15": SCH 40 PVC OR SDR 35.5 PVC WITH RUBBER OR GLEUE JOINT -8" TO 48": SMOOTH BORE CORRUGATED HIGH DENSITY POLYETHYLENE WITH NEOPRENE LINED JOINTS OR BETTER
  - THE MINIMUM PIPE SIZE IN PUBLIC RIGHT-OF-WAY OR EASEMENTS AND FOR PIPES CARRYING OFF-SITE STORM WATER SHALL BE 12"
  - ALL PIPE ENDS NOT WITHIN A STRUCTURE SHALL HAVE A CONCRETE OR METAL FLARE END SECTION (FES) WITH A BAR SCREEN ON PIPES 18" AND LARGER EXCEPT THOSE WITHIN A SECURE FENCED AREA NEED NO BAR SCREEN.
  - ALL DRAINAGE STRUCTURES WITHIN THE ROAD SHALL BE SEALED WITH WRAPPED GEOTEXTILE PER ROAD STANDARDS

DRAWN: CAD  
DESIGN: DA  
CHECKED: DA

NO.	DATE	REVISION PER	BY
1	09/16/95	REV #1	DA
2	08-17-96	REV #2	DA
3	11-03-97	REV #3	DA

**Johnson & Anderson**  
4494 Elizabeth Lake Road  
Waterford, Michigan 48328  
tel (248) 681-7800 fax (248) 681-2660

1060 W. Norton Avenue, Suite 7  
Muskegon, Michigan 49441  
tel (231) 760-3100 fax (231) 760-3115

3910 Lapeer Road  
Port Huron, Michigan 48050  
tel (810) 987-7820 fax (810) 987-7895

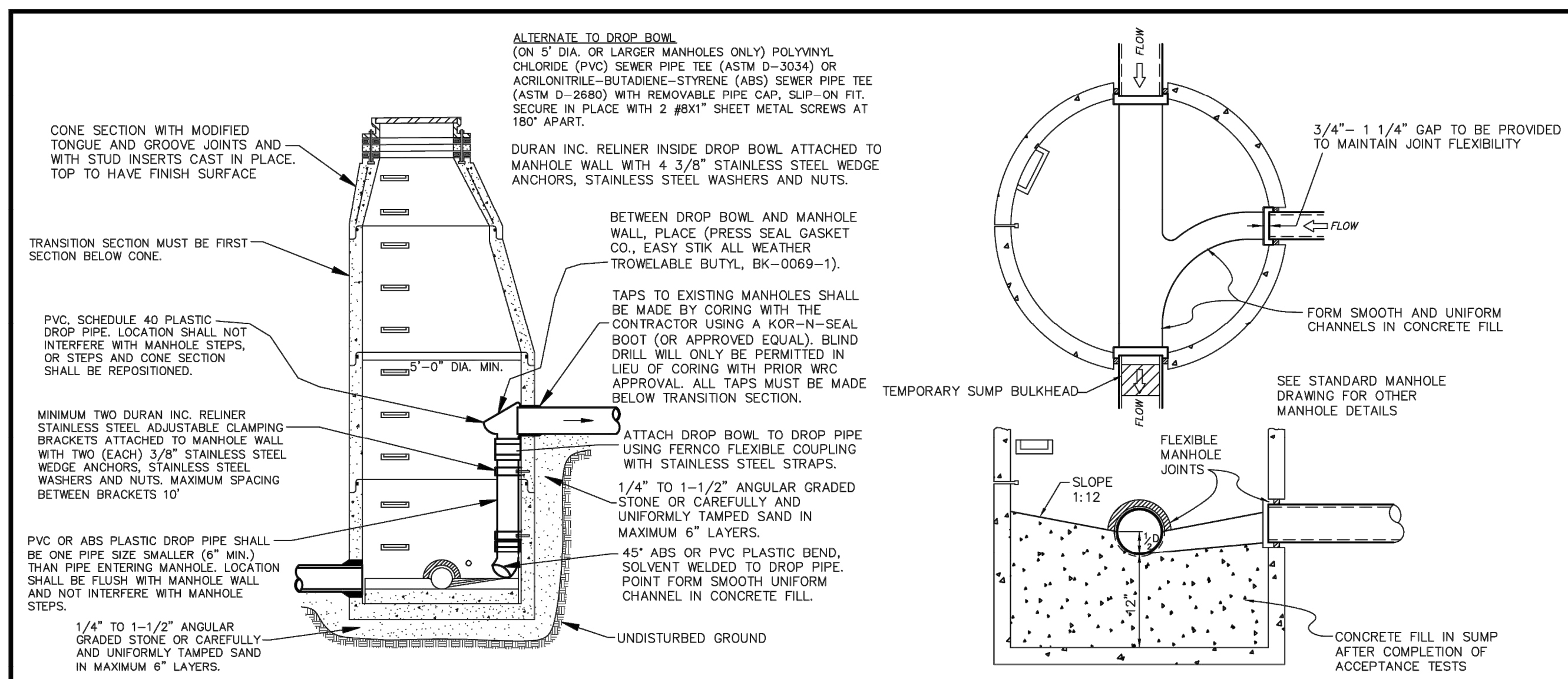
**White Lake Township**  
7525 Highland Road (M-59)  
White Lake, Michigan 48383  
248-698-3300

**STORM SEWER STANDARD DETAILS**

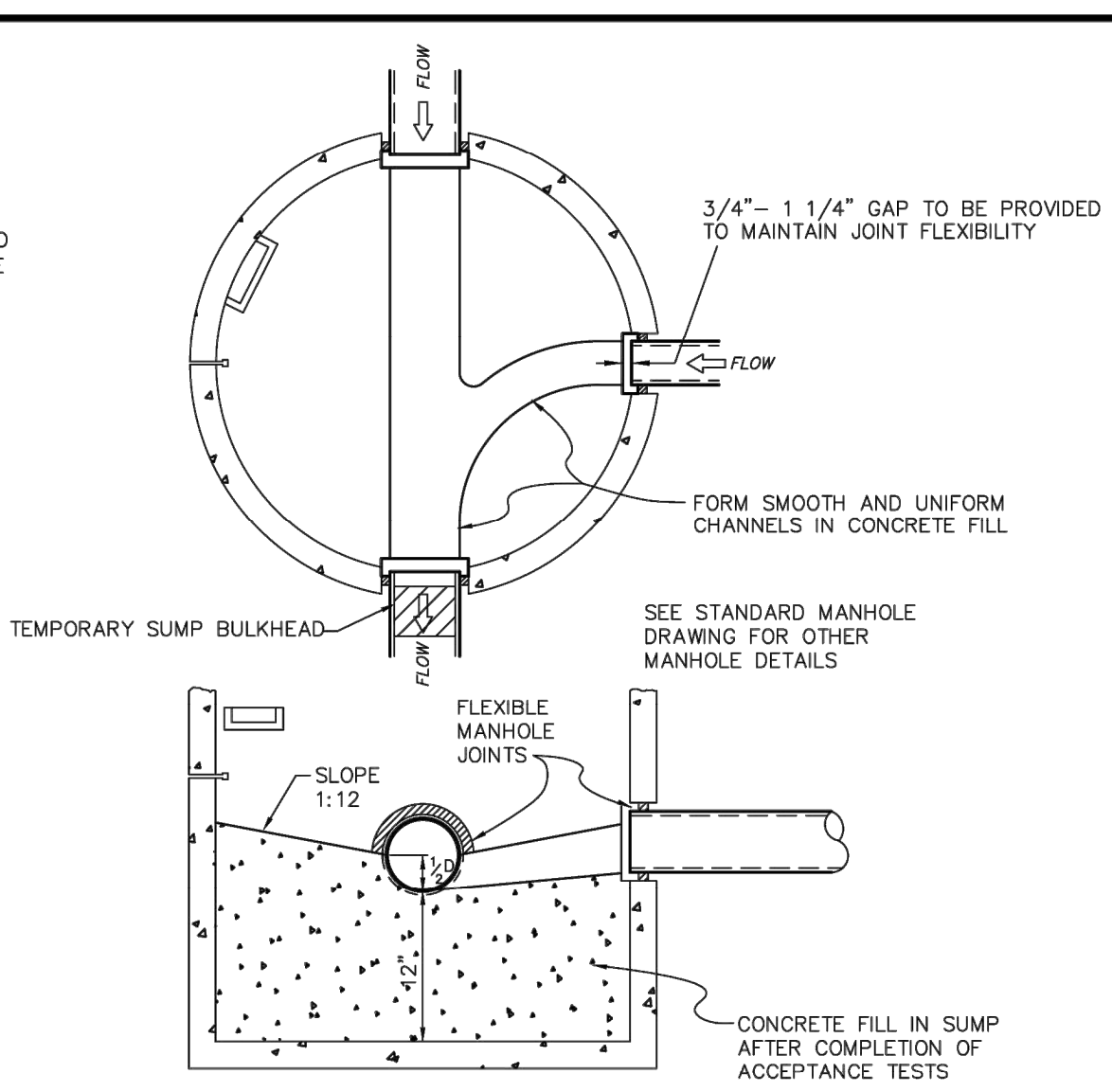
SCALE: VERT. -  
HORZ. AS NOTED

JOB NO. 22-029-1  
DATE ISSUED 08/16/95  
SHEET NO. 12

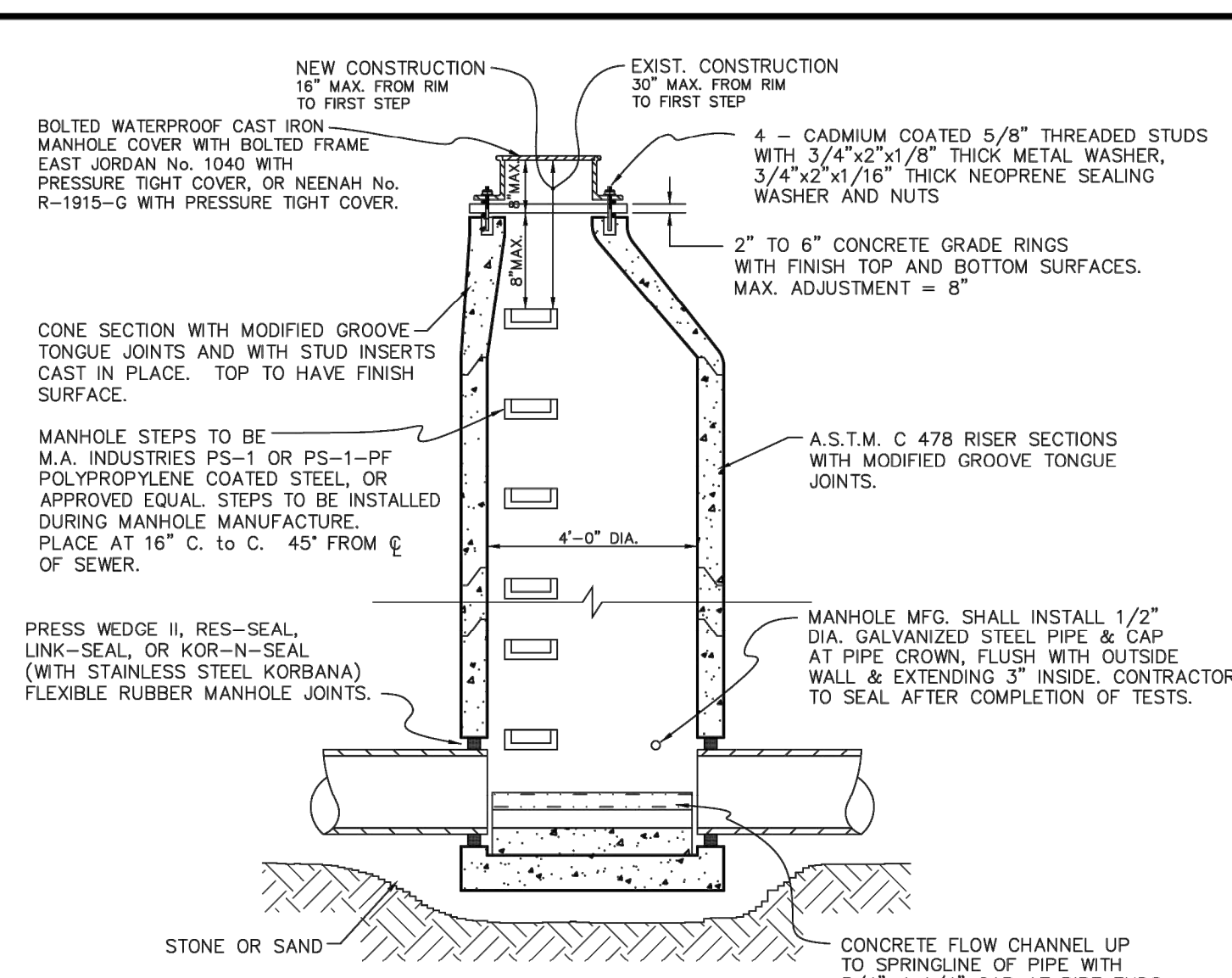




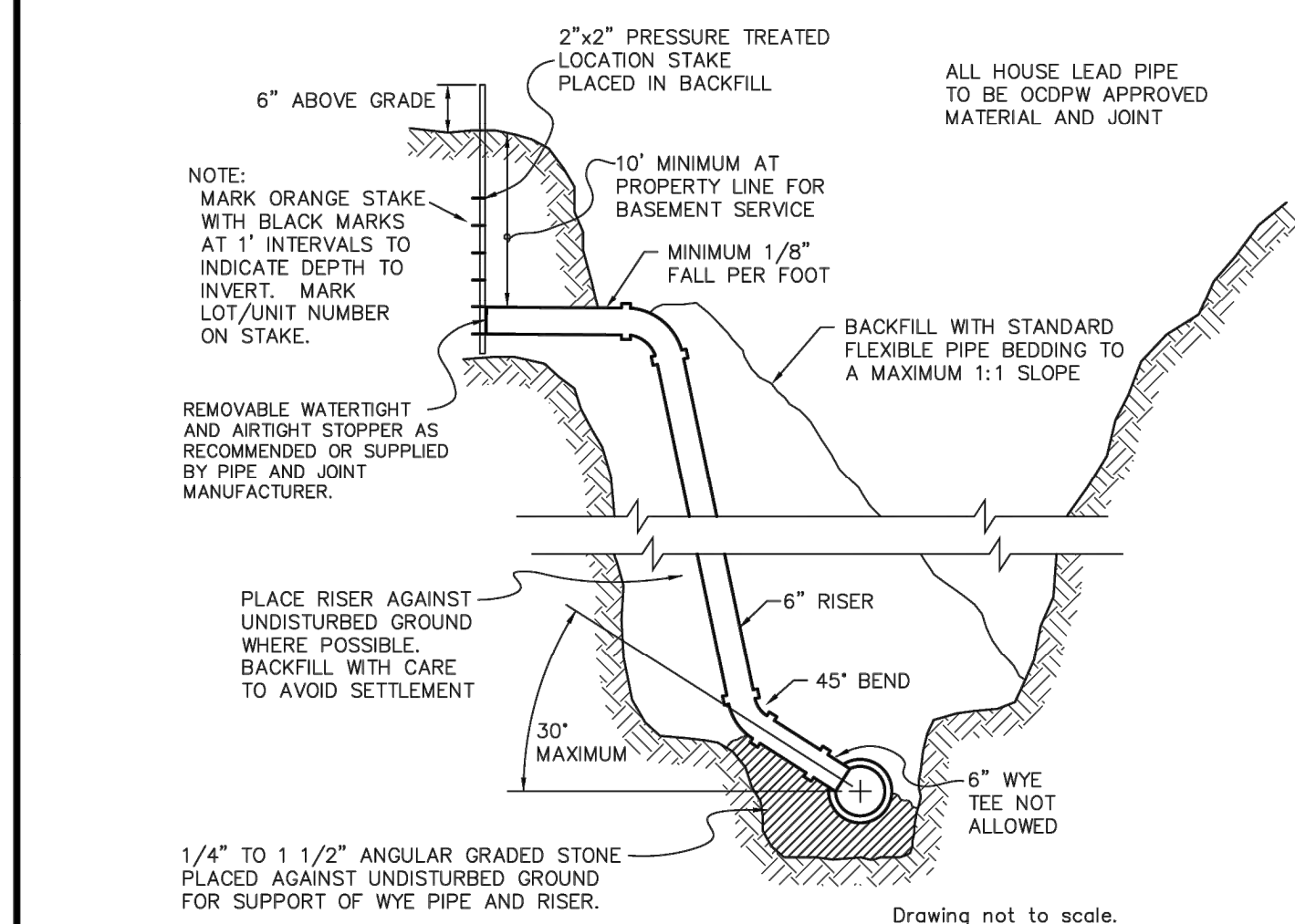
INTERIOR DROP CONNECTION



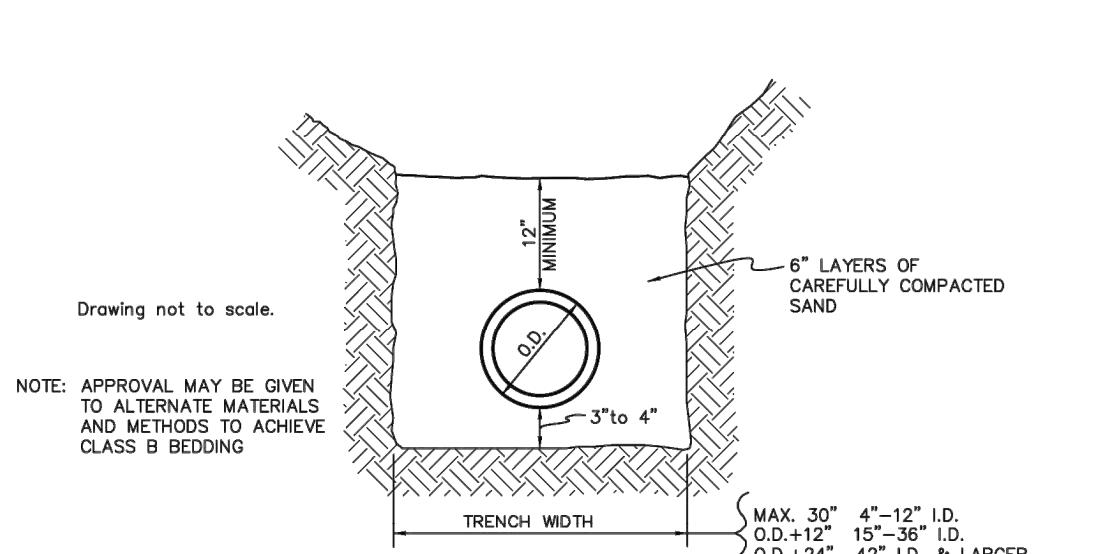
SUMP MANHOLE FOR TESTING, CLEANING, AND DEWATERING



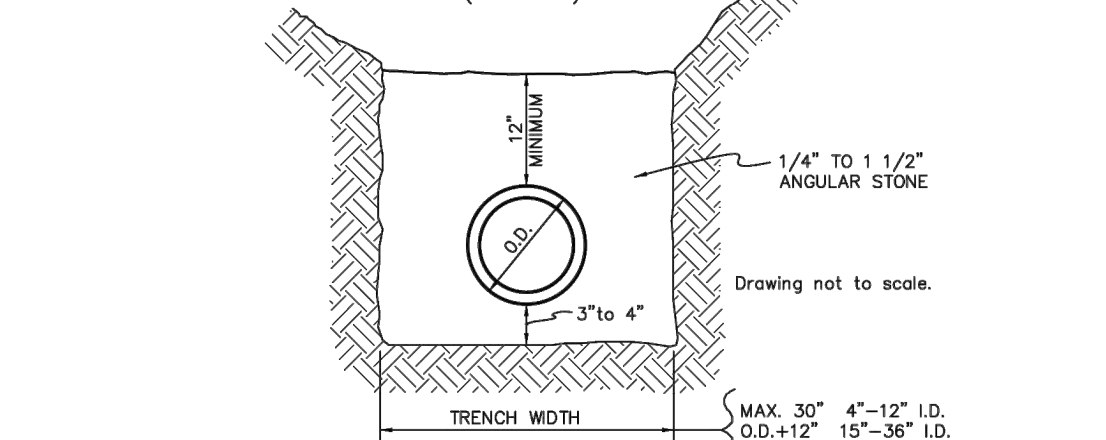
STANDARD MANHOLE ON 8" THROUGH 24" DIAMETER SEWERS



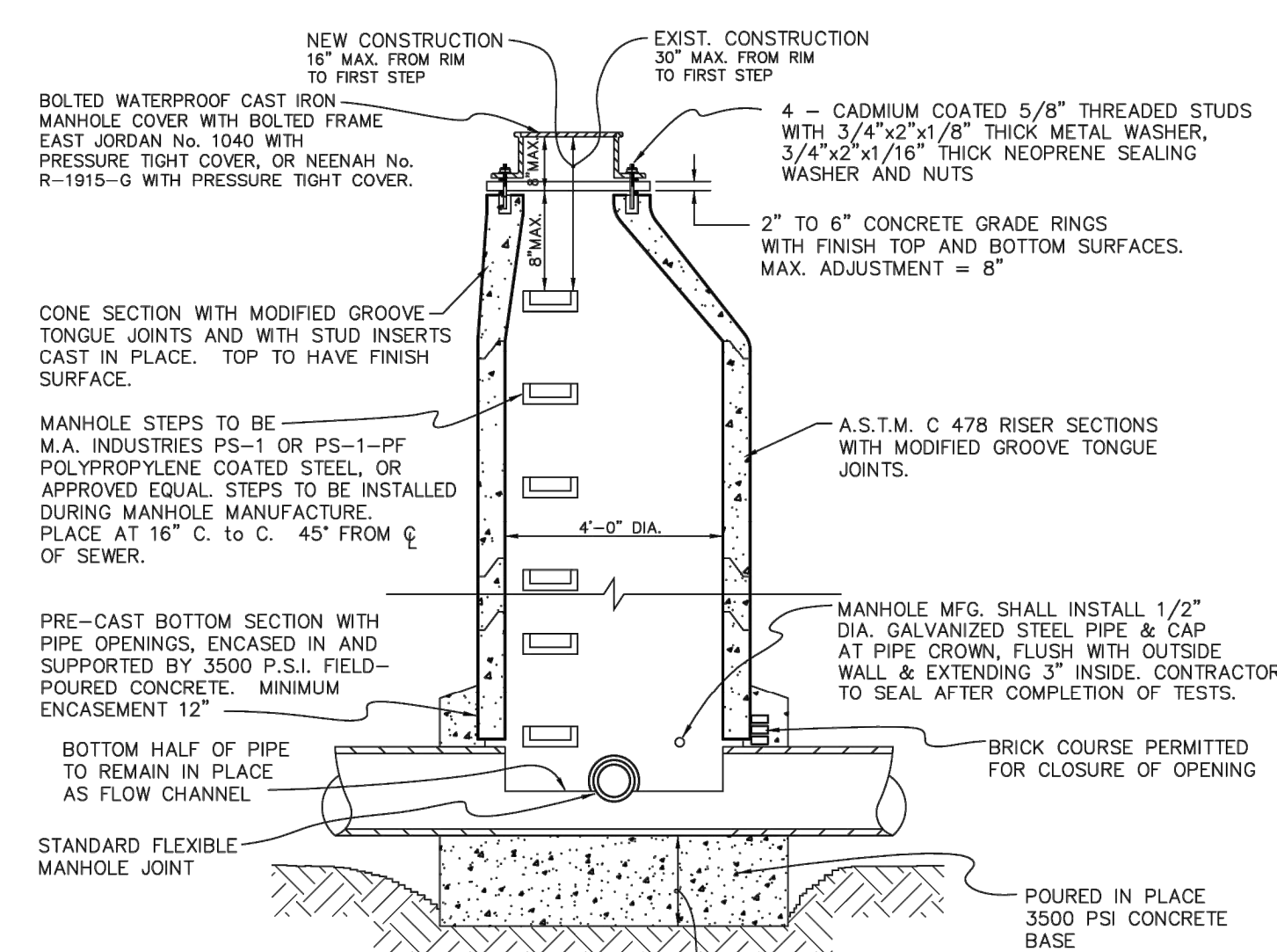
HOUSE/BUILDING LEAD DETAIL



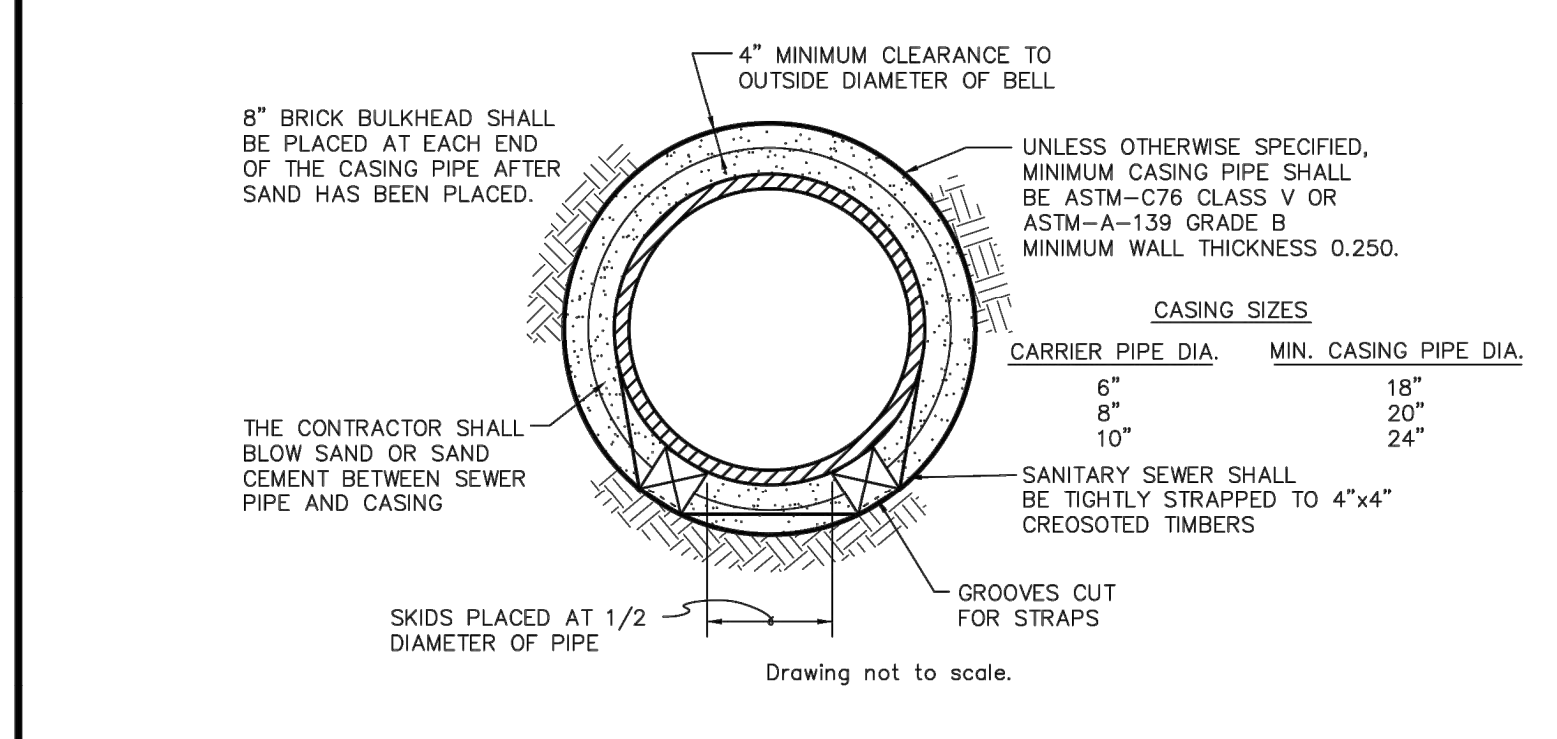
BEDDING DETAIL FOR RIGID PIPE (CLASS B)



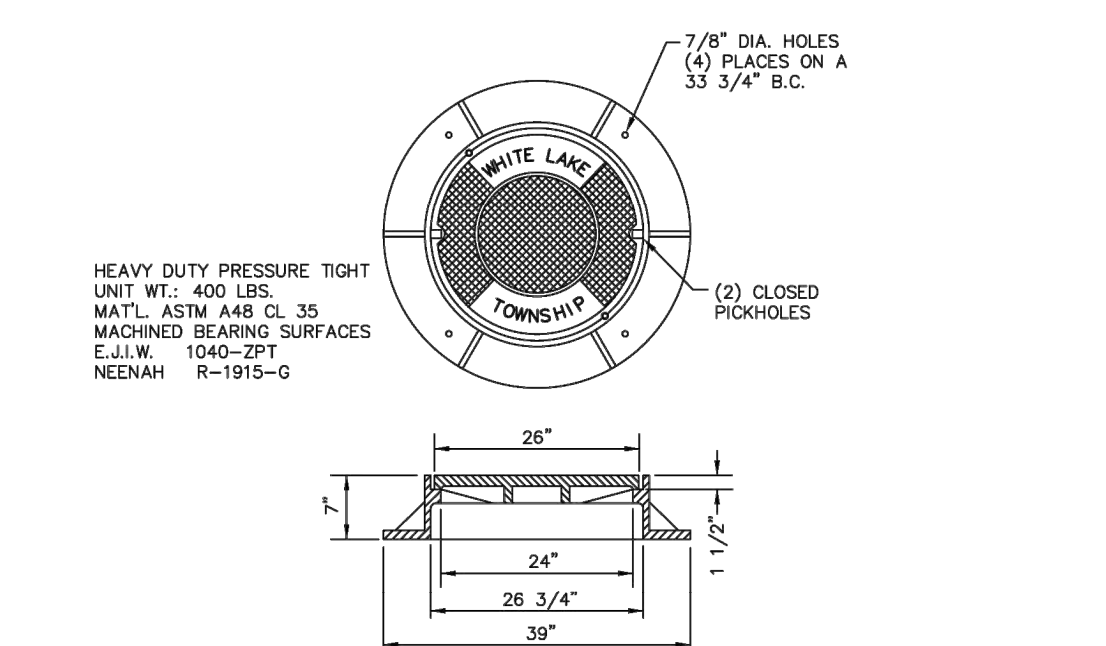
BEDDING DETAIL FOR FLEXIBLE PIPE



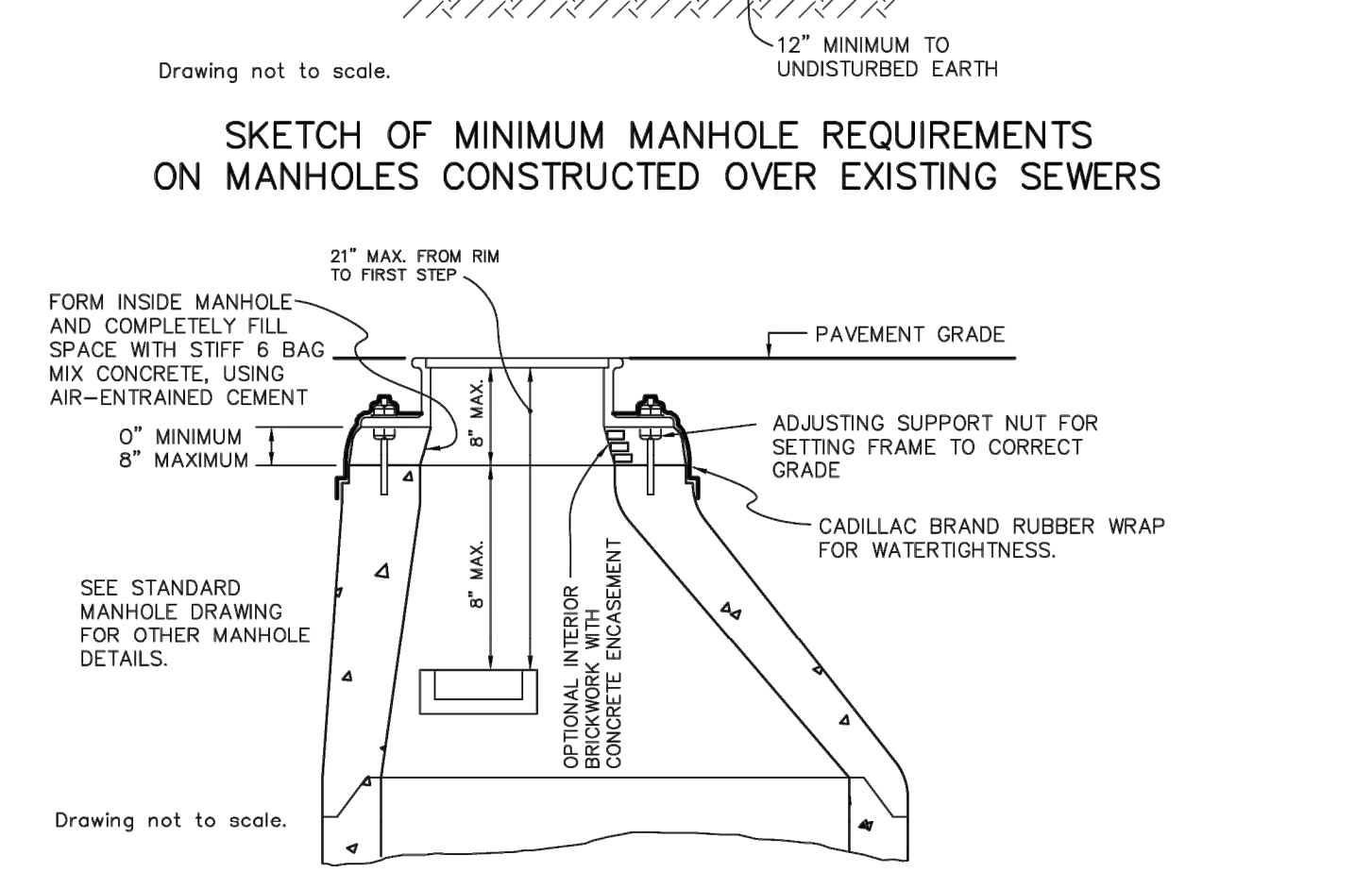
SKETCH OF MINIMUM MANHOLE REQUIREMENTS ON MANHOLES CONSTRUCTED OVER EXISTING SEWERS



PIPE BARREL SUPPORT FOR SEWER



MANHOLE COVER & FRAME



OPTIONAL CONSTRUCTION DETAILS

SANITARY SEWER CONSTRUCTION NOTES

- All construction shall conform to the current standards and specifications of the local unit of government and the Oakland County Water Resources Commissioner (OCWRC). All sanitary sewer construction shall have full time inspection supervised by a professional engineer provided by or caused to be provided by the local unit of government.
- At all connections to Oakland County Water Resources Commissioner's sewers or extensions, and before start of construction, the Contractor must obtain a Sewer Inspection Permit issued by the OCWRC. Gravity sewer permit charges are \$250.00 per each connection plus \$25.00 for each manhole constructed. Pressure sewer permit charges are \$250.00 per 2460 L.F. of force main with a minimum permit fee of \$250.00. Failure to pass any test segment will result in an additional charge to the Contractor for each retest, in accordance with the above price schedule. The Contractor shall also have posted with the OCWRC a \$5,000.00 surety bond and \$500.00 cash deposit. The Contractor shall notify the local unit of government and the OCWRC (248-858-1110) 24 hours prior to the beginning of any construction. Final acceptance tests must be witnessed by County personnel and must be scheduled by Municipality or it's consultant in advance with 24 hour notice at 248-858-1110.
- No sewer installation shall have an infiltration or exfiltration exceeding 100 gallons per inch diameter per mile of pipe in a 24 hour period, and no single run of sewer between manholes shall exceed 100 gallons per inch diameter per mile. Air tests in lieu of infiltration tests shall be as specified in the OCWRC "Acceptance Tests", dated September, 1972. Only pipe and pipe joints approved by the Oakland County Water Resources Commissioner may be used for sanitary sewer construction.
- Located in the first manhole upstream from the point of all connections to an existing OCWRC sewer, or extension thereof, a temporary 12-inch deep sump shall be provided in the first manhole above the connection which will be filled in after such successful completion of any acceptance test up to the standard fill provided for the flow channel. A watertight bulkhead shall be provided on the downstream of the sump manhole.
- All building leads and risers shall be 6-inch S.D.R. 23.5 ABS OR PVC pipe with chemically fused joints, or an approved equal pipe and joint. Sewer pipe wye shall contain factory installed premium joint material of an approved type compatible with that of the building lead pipe used. Building leads to be furnished with removable air tight and water-tight stoppers.
- All rigid sewer pipe shall be installed in Class "B" bedding or better. All flexible, semi-flexible or composite sewer pipe shall be installed in conformance to the Oakland County Water Resources Commissioner specifications.
- All new manholes shall have Oakland County Water Resources Commissioner approved flexible, water-tight seals where pipes pass through walls. Manholes shall be of precast sections with modified groove tongue and rubber gasket type joints. Precast manhole cone sections shall be Oakland County Water Resources Commissioner approved modified eccentric cone type. All manholes shall be provided with bolted, water-tight covers.
- At all connections to manholes on Oakland County Water Resources Commissioner's sewers or extensions thereto drop connections will be required when the difference in invert elevations exceeds 18-inches. Outside drop connections only will be approved.
- Taps to existing manholes shall be made by coring. The Contractor shall place a KOR-N-SEAL boot (or OCWRC approved equal) after coring is completed. Blind drilling will not be permitted in lieu of coring.
- New manholes constructed directly on Oakland County Water Resources Commissioner's sewers shall be provided with covers reading "Oakland County - Sanitary" in raised letters. New manholes built over an existing sanitary sewer shall have monolithic poured bottoms.
- No ground water, storm water, construction water, downspout drainage or weep tile drainage shall be allowed to enter any sanitary sewer installation.
- Prior to excavation, the Contractor shall telephone MISS DIG (647-7344) for the location of underground pipeline and cable facilities, and shall also notify representatives of other utilities located in the vicinity of the work.
- 18" minimum vertical separation and 10' minimum horizontal separation must be maintained between sanitary sewer and water main.
- Manhole frame and cover shall be as follows: East Jordan heavy manhole cover, base flange type #1040 or Neenah Foundry heavy duty #R-1642 manhole frame. Solid lid cover shall be non-rocking and marked "WHITE LAKE TOWNSHIP SEWER DEPARTMENT."

DRAWN CAD  
DESIGN DA  
CHECKED--

REVISIONS	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE
		FIRST ISSUE	09/11/97		OCWRC COMMENTS	11/06/15
		UPDATED TITLE BLOCK	04/30/13			
		UPDATED NOTES	02/17/15			

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 Port Huron, Michigan 48060  
 tel (810) 987-7820 fax (810) 987-7895

**White Lake Township**  
 7525 Highland Road (M-59)  
 White Lake, Michigan 48383  
 248-698-3300



**SANITARY SEWER STANDARD DETAILS**

SCALE: VERT. -  
HORIZ. AS NOTED

JOB NO.	DATE ISSUED
09/11/97	09/11/97
SHEET NO.	

THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THESE DRAWINGS ARE ONLY APPROXIMATE. NO GUARANTEE IS MADE FOR THE ACCURACY OF THESE UTILITIES. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR DETERMINING THE EXACT LOCATION AND ELEVATION OF EXISTING UTILITIES. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS BEFORE THE START OF CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS BEFORE THE START OF CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS BEFORE THE START OF CONSTRUCTION.

**BEBOSS Engineering**  
 Engineers Surveyors Planners Landscape Architects  
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 HOWELL, MI. 48843  
 517.546.4836 FAX 517.548.1670

**GATEWAY CROSSING**  
 GATEWAY CROSSING, LLC  
 600 NORTH OLD WOODWARD, SUITE 101  
 BIRMINGHAM, MI. 48009  
 248-937-7000

PROJECT: TOWNSHIP SANITARY DETAILS

PREPARED FOR: GATEWAY CROSSING, LLC

NO.	DATE	REVISION PER	BY
1	09/09/23	REV #1	DA
2	1/12/24	REV #2	DA
3	2/28/24	REV #3	DA

DESIGNED BY:  
 DRAWN BY:  
 CHECKED BY:  
 SCALE: NO SCALE  
 JOB NO: 22-029-1  
 DATE: 01/05/23  
 SHEET NO. 13

**BEBOSS Engineering**



THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THESE DRAWINGS ARE ONLY APPROXIMATE. NO GUARANTEE IS MADE FOR THE EXACT LOCATION AND ELEVATION OF EXISTING UTILITIES. THEREFORE, THE CONTRACTOR SHALL BE EXCLUSIVELY RESPONSIBLE FOR DETERMINING THE EXACT LOCATION AND ELEVATION OF EXISTING UTILITIES. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY CONTACTS BEFORE THE LOCATION OR DEPTH (UPPER SURFACES ONLY) IS DETERMINED FROM THE PLANS.

BEFORE ANY WORK BEGINS, THE CONTRACTOR SHALL CALL MISS DIG (1-800-487-7171) TO LOCATE ALL UTILITIES.

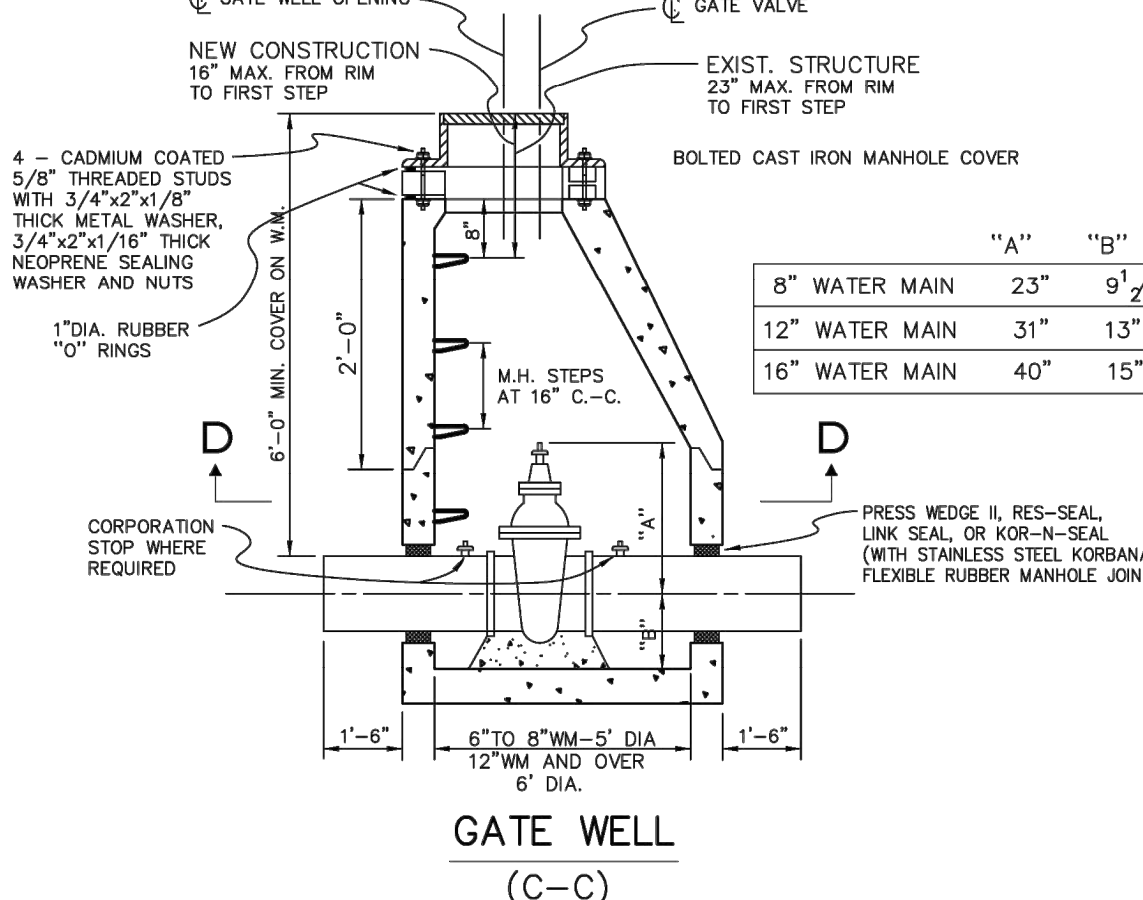
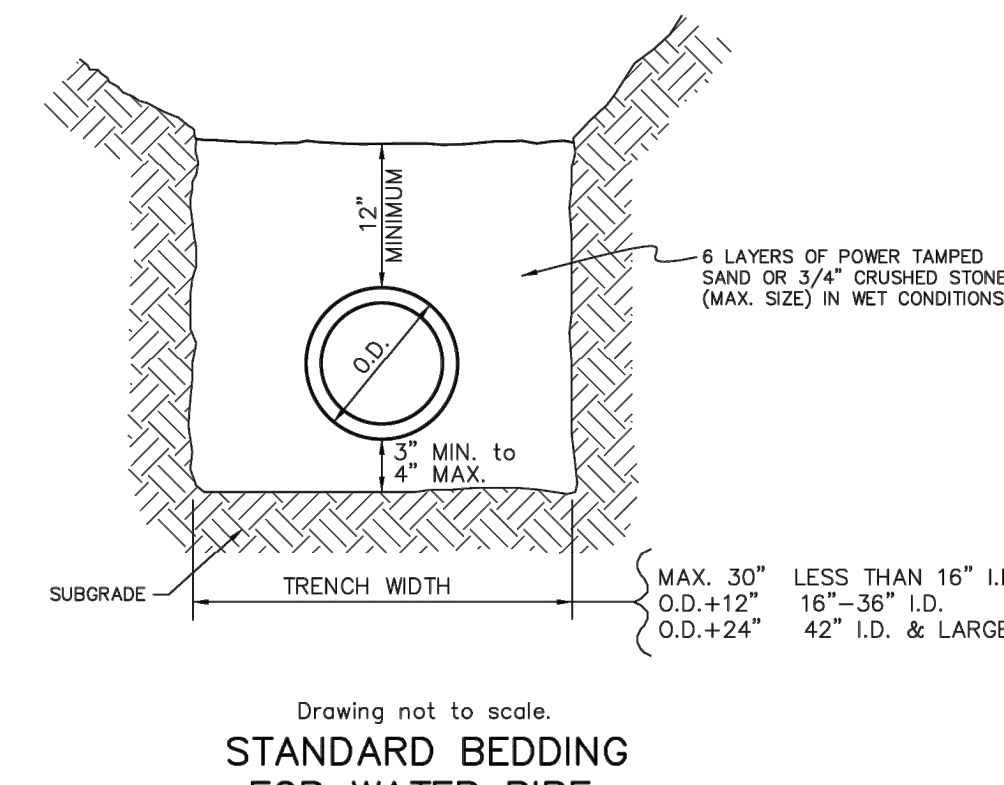
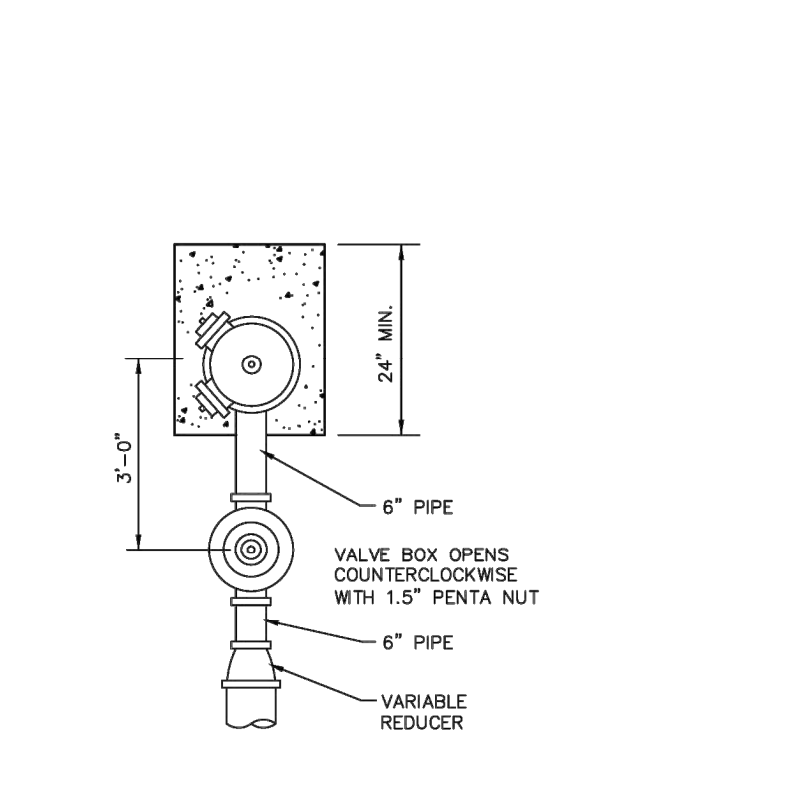
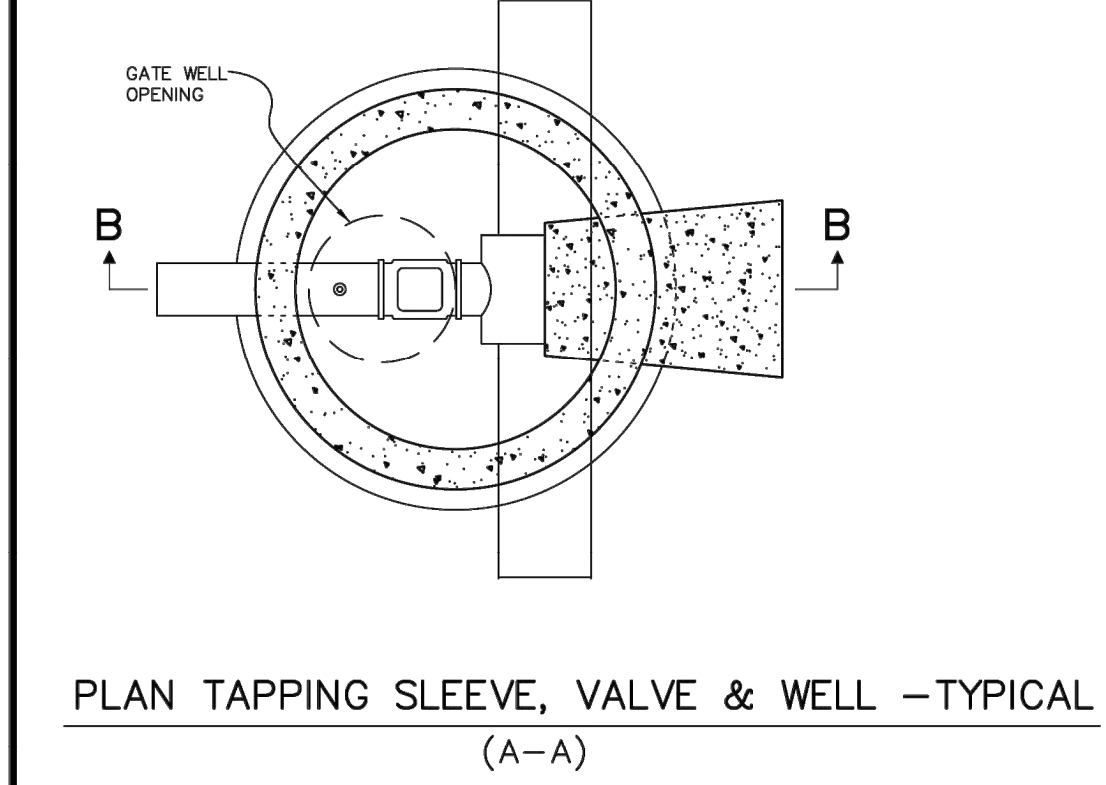
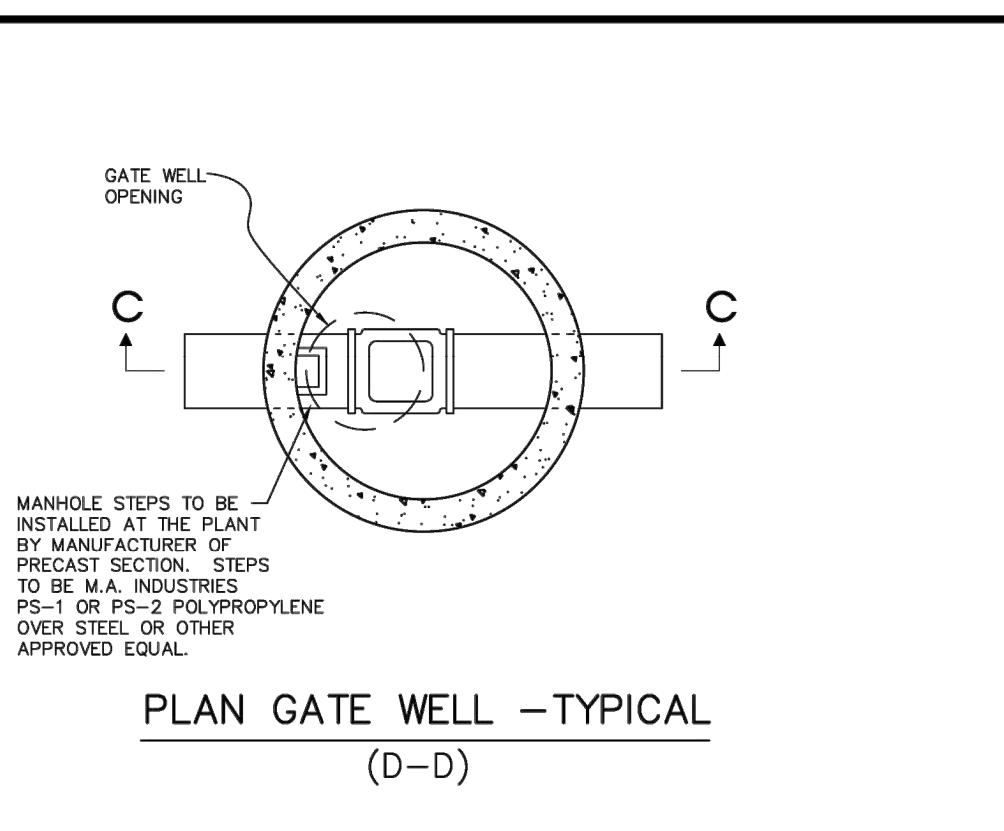
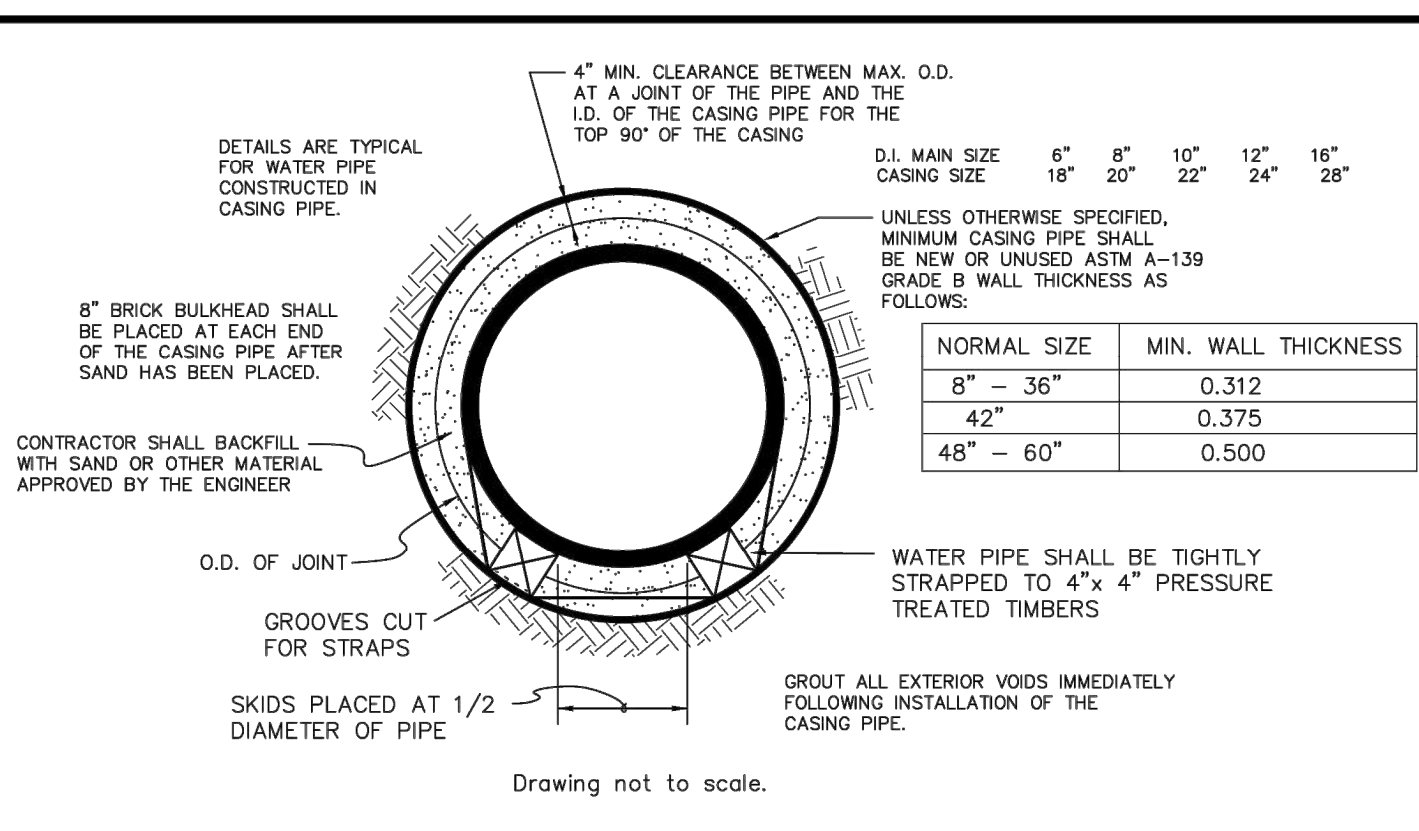
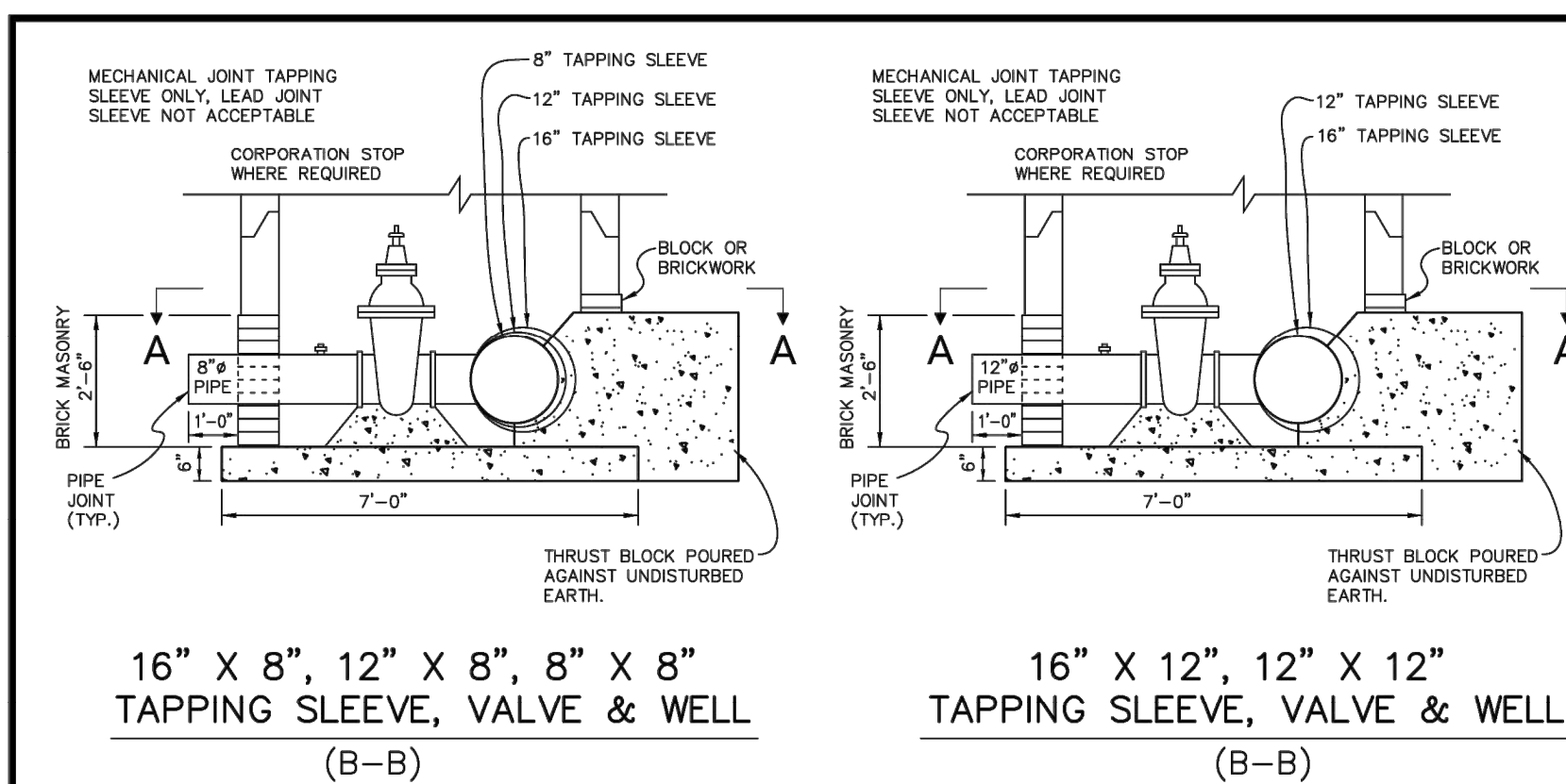
**BEBOSS**  
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Planners Landscape Architects  
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GATEWAY CROSSING, LLC  
600 NORTH OGDENWOOD, SUITE 101  
BIRMINGHAM, MI 48209  
248-837-7000

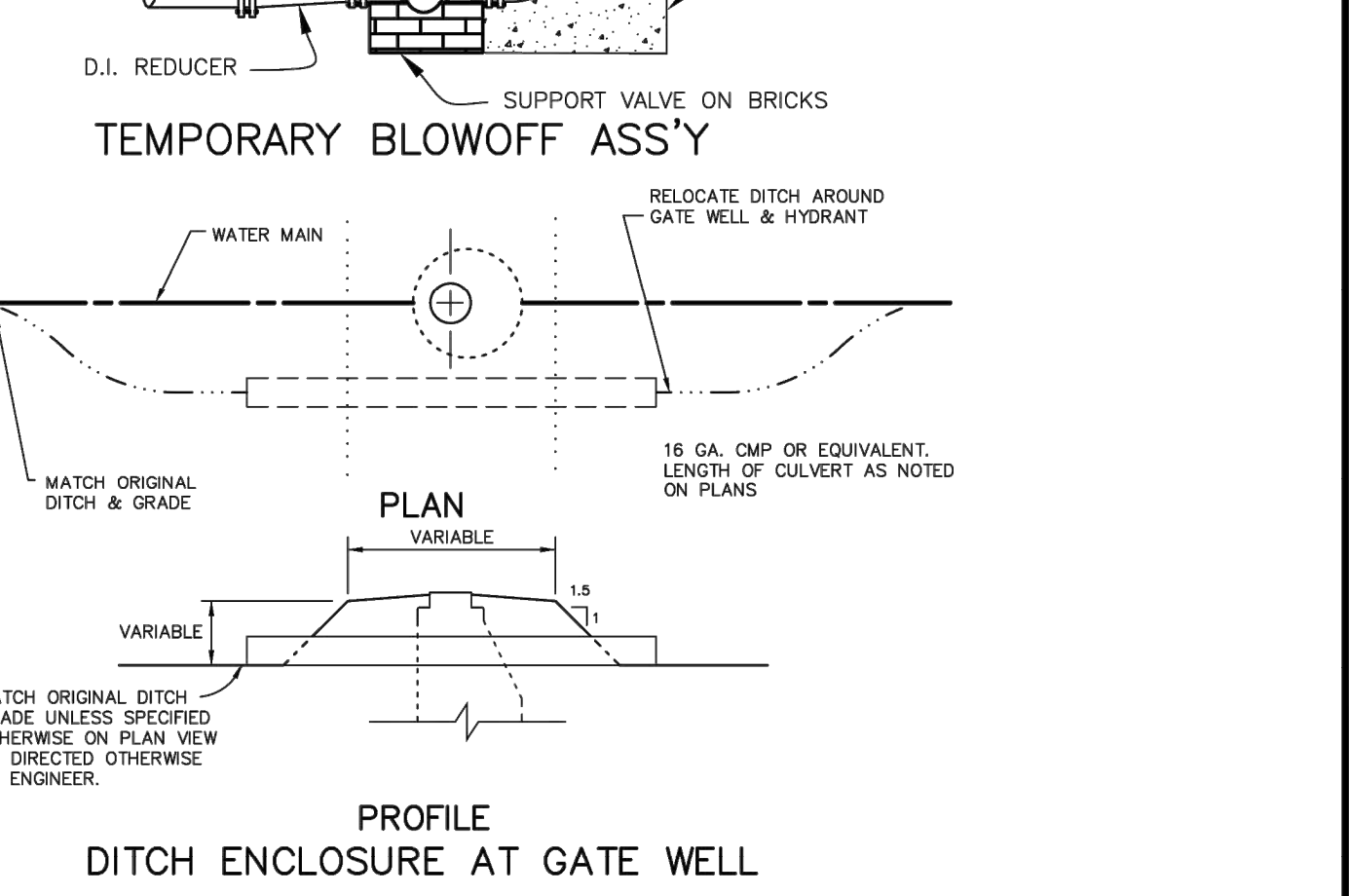
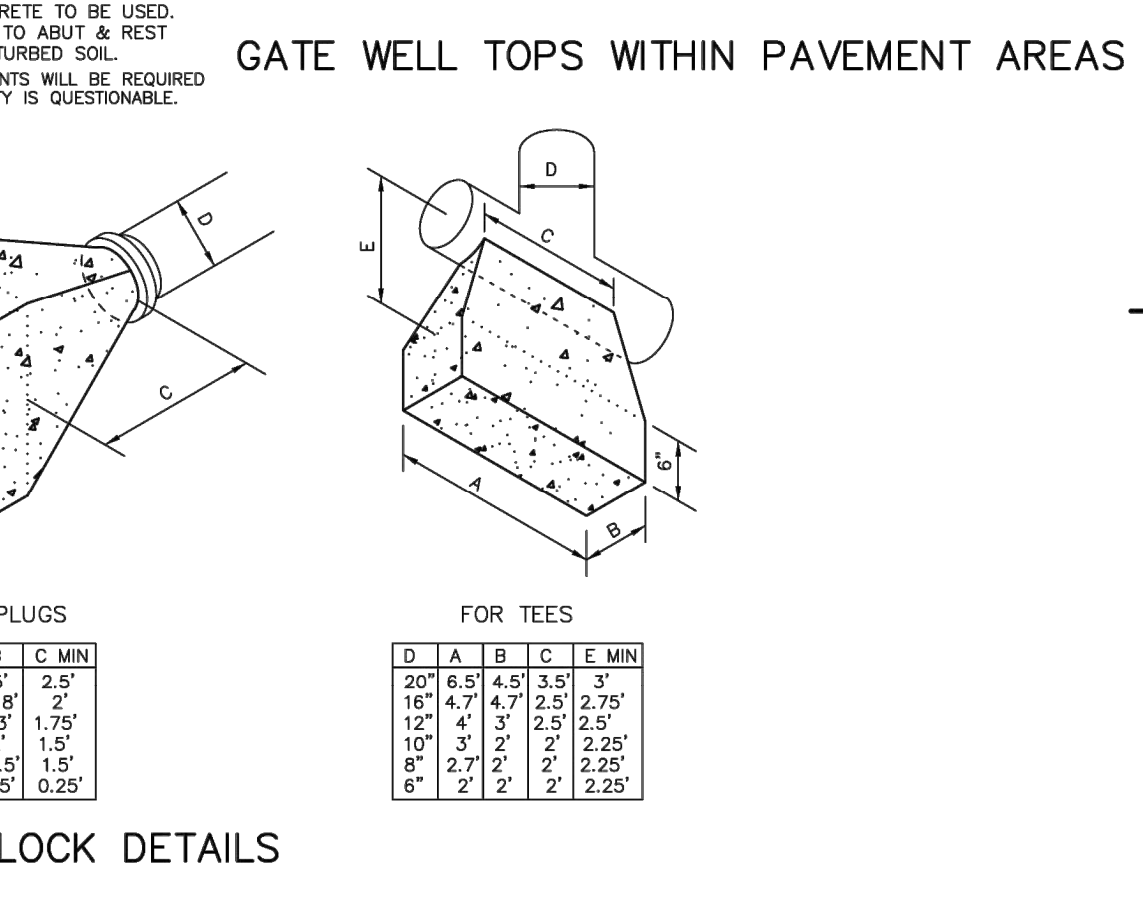
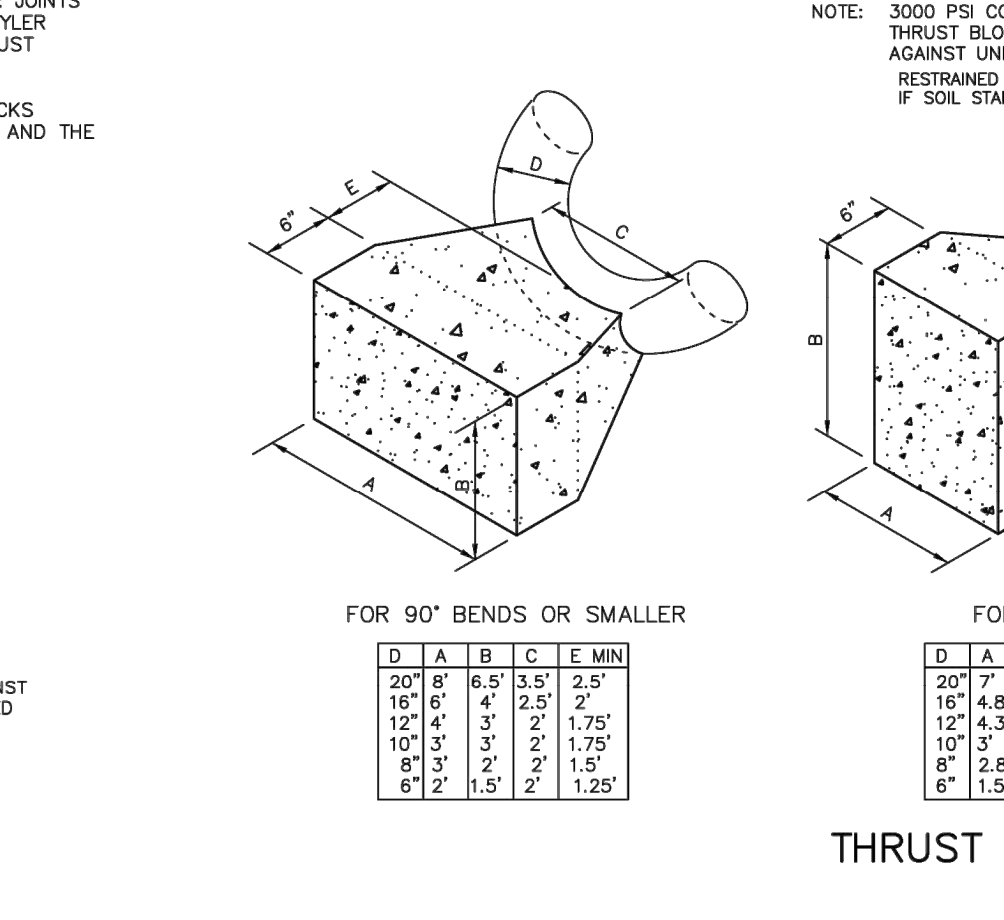
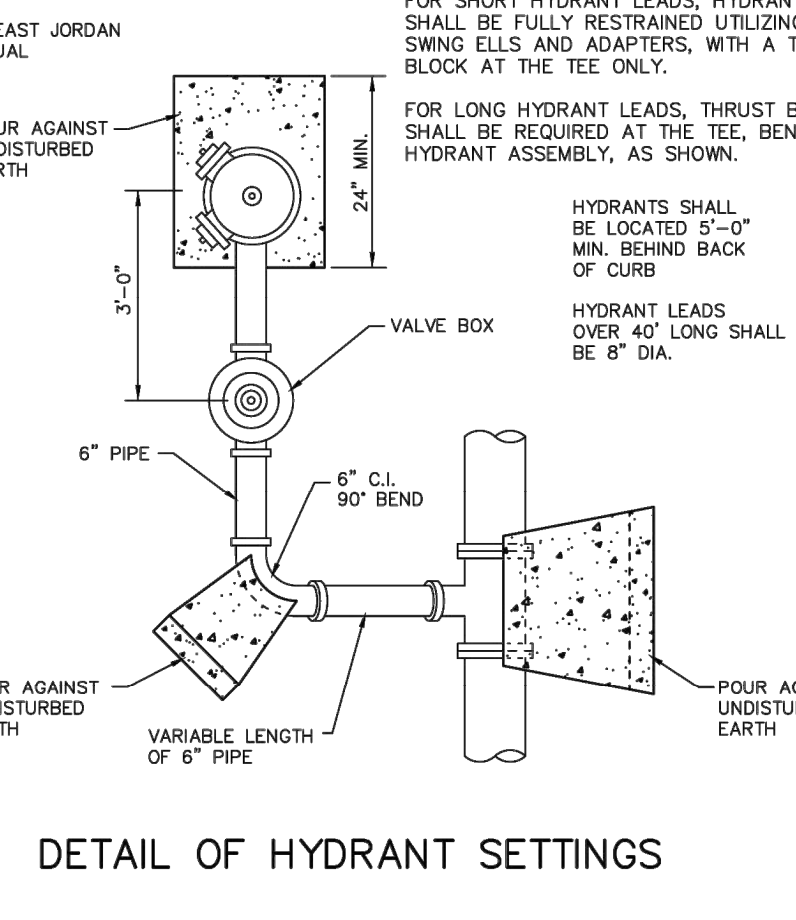
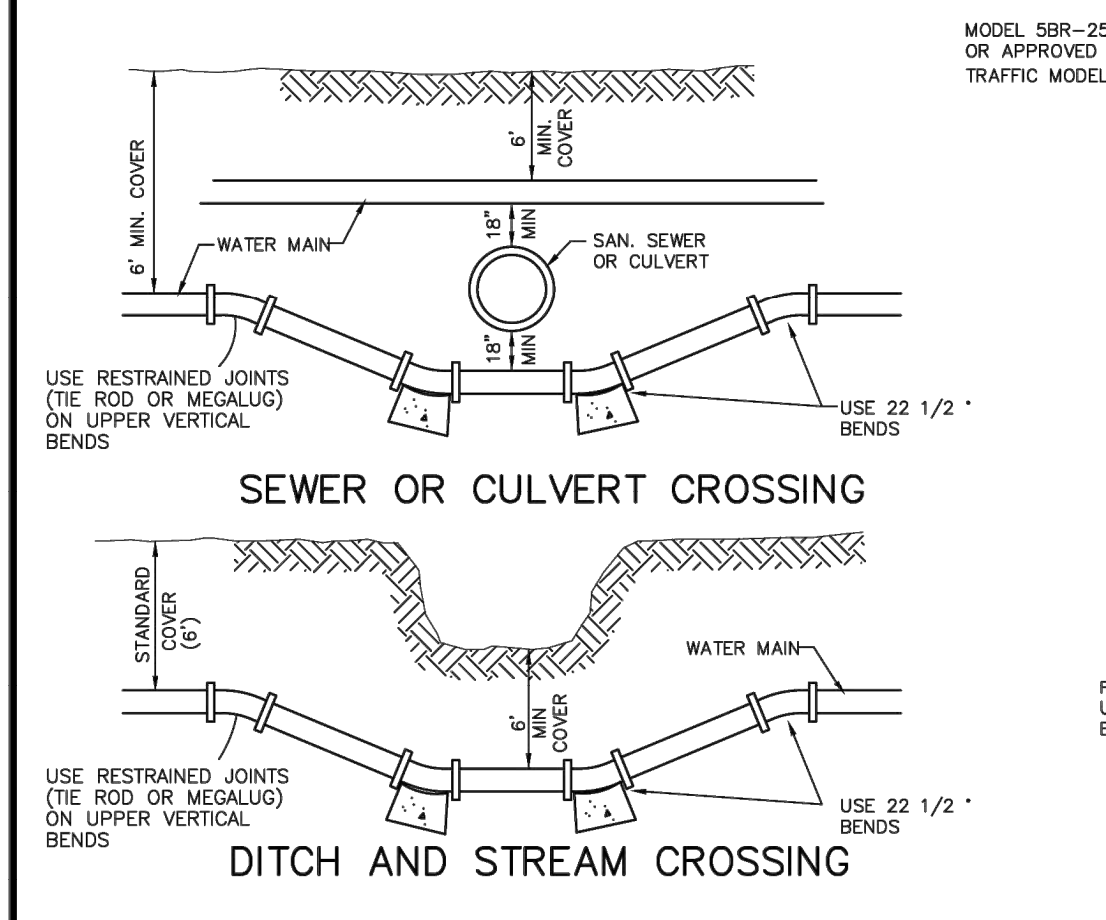
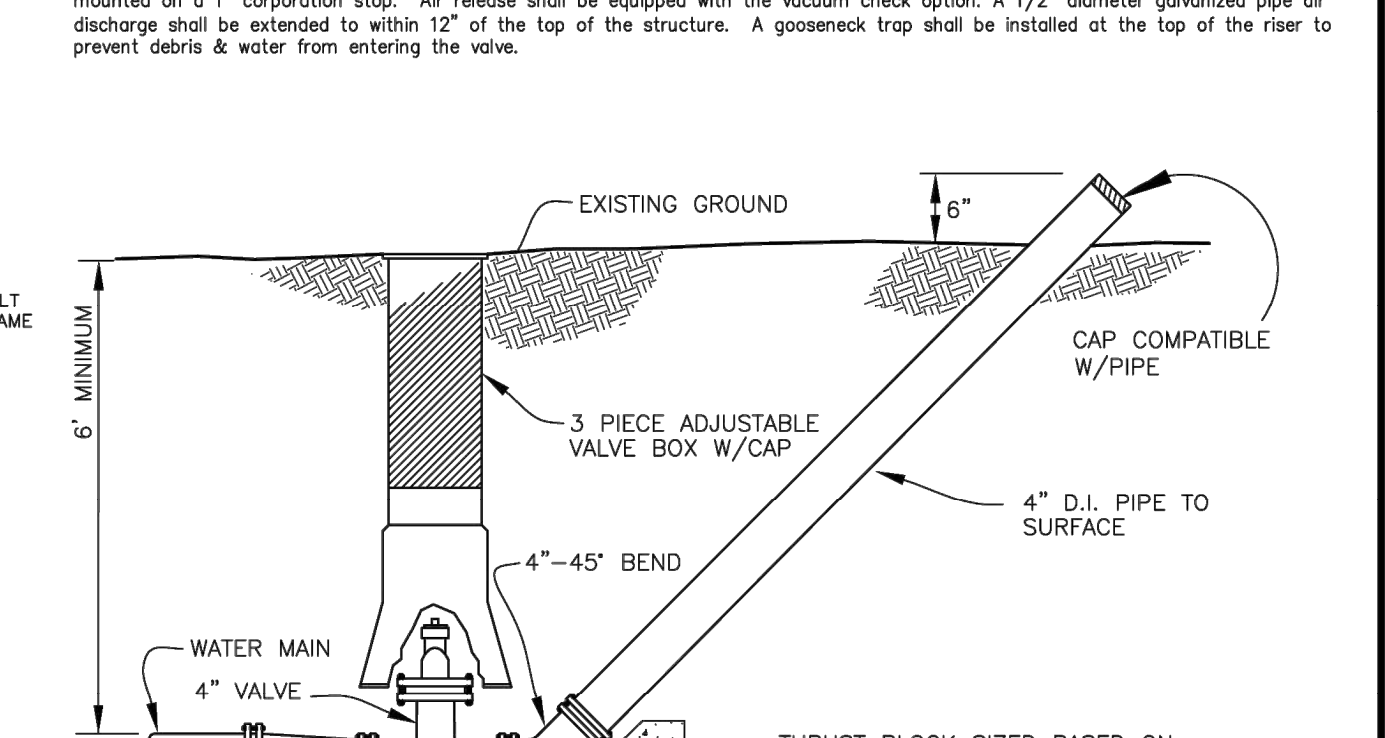
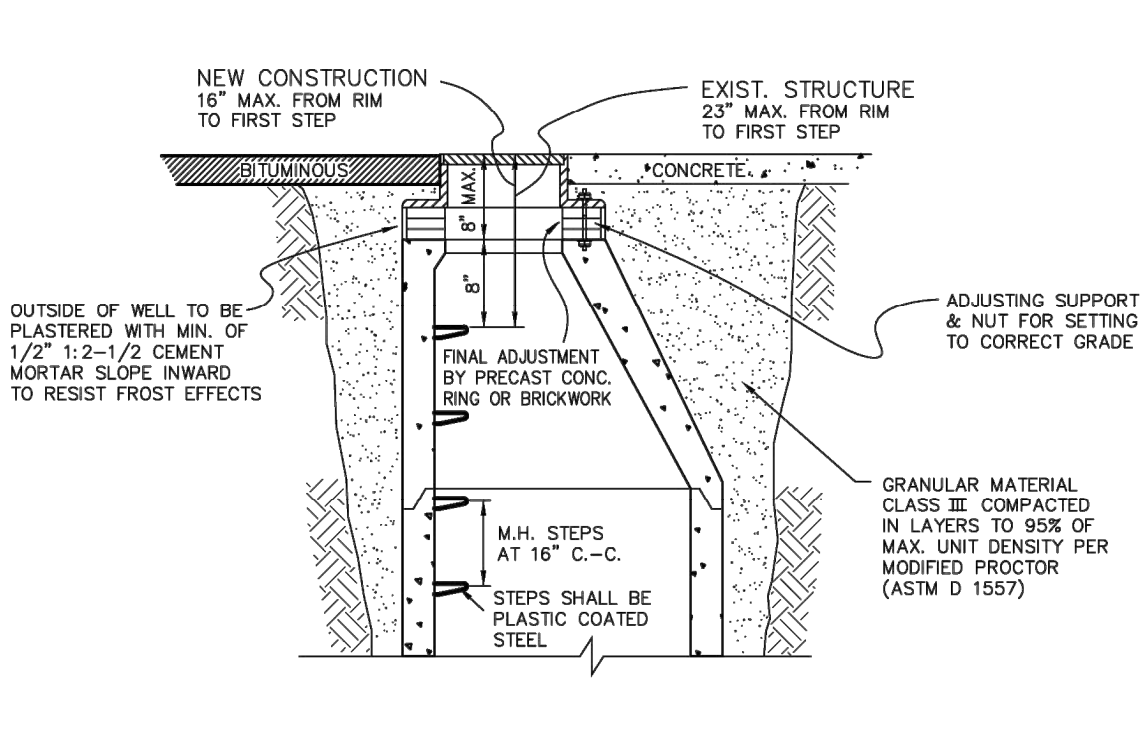
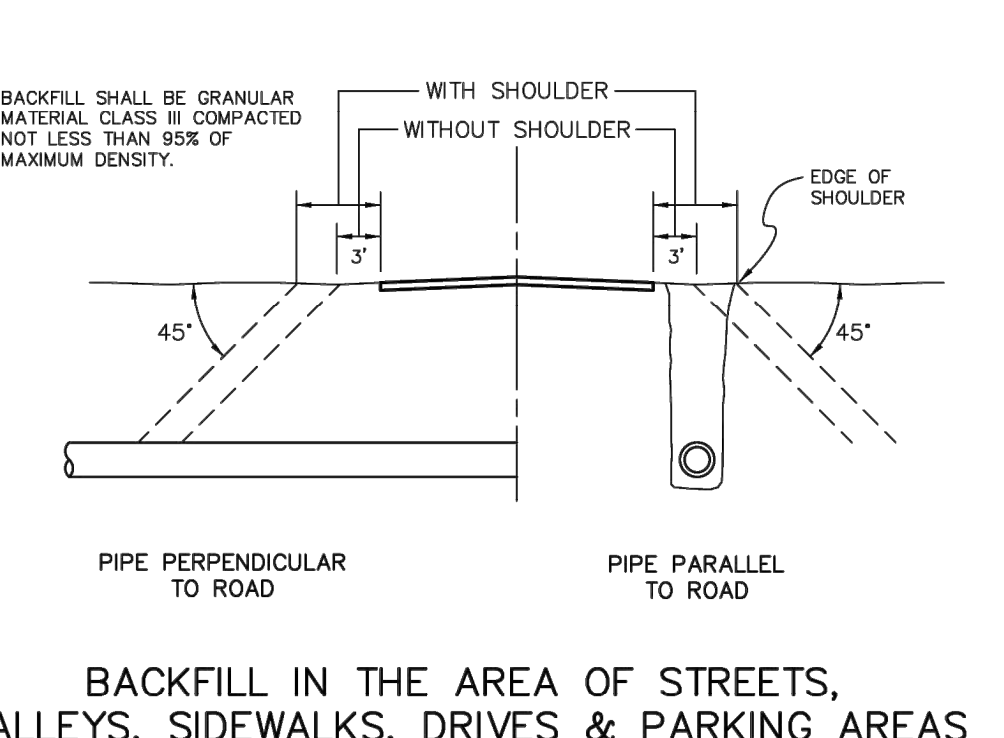
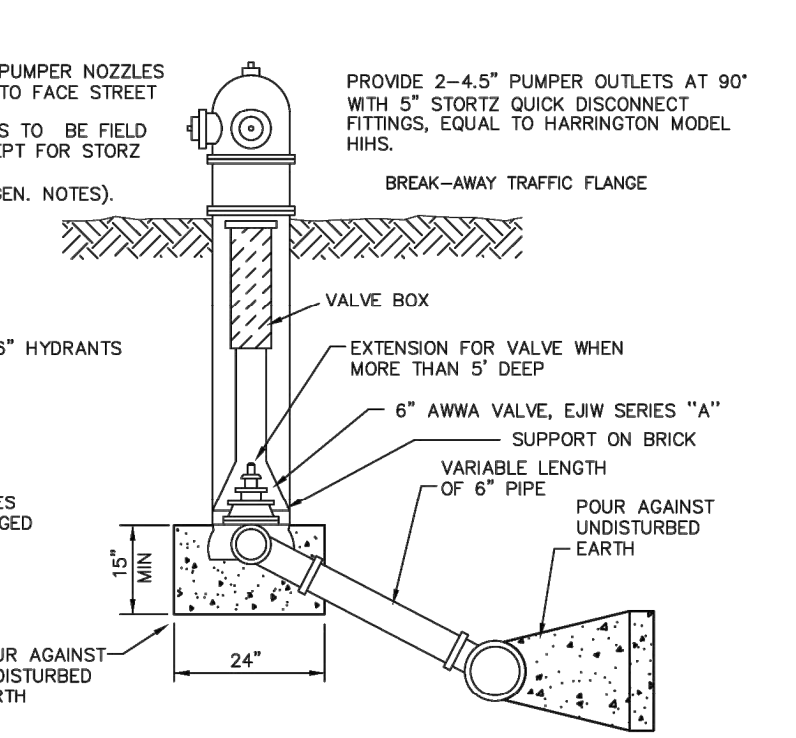
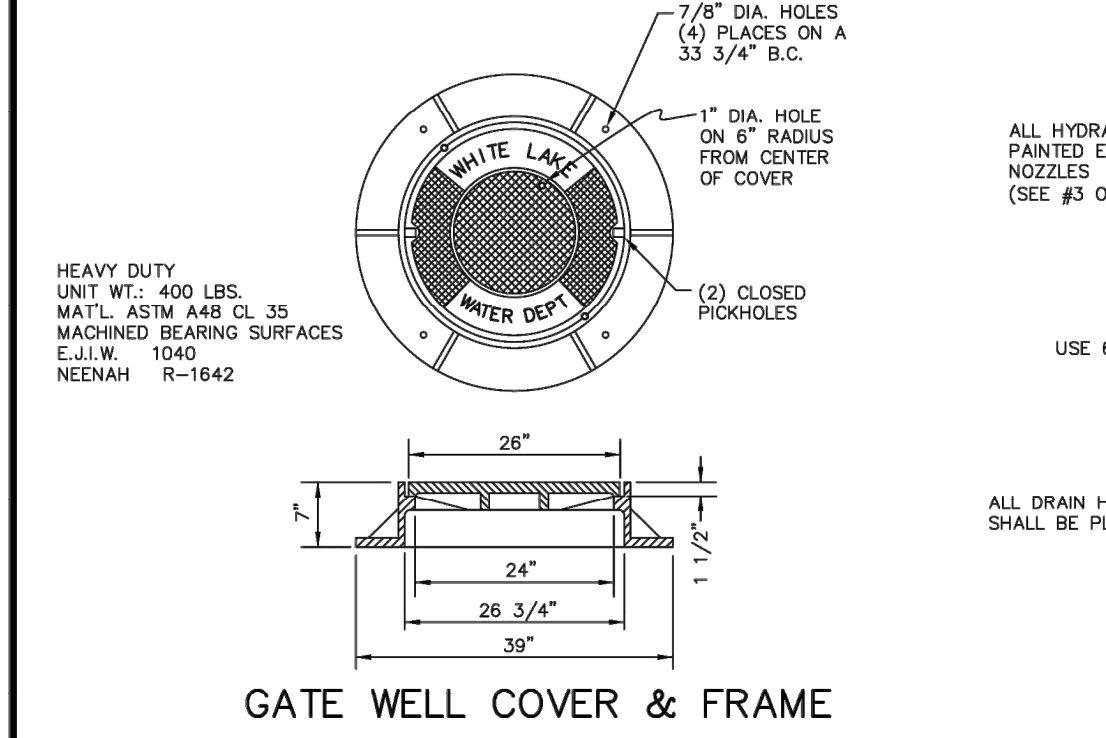
**TOWNSHIP WATERMAIN DETAILS**

PROJECT	PREPARED FOR	TITLE
REVISION PER TWP P&P REV #3	2/28/24	DATE
REVISION PER TWP P&P REV #2	1/12/24	DATE
REVISION PER TWP P&P REV #1	09/09/23	DATE
REVISION PER		DATE
NO BY		

DESIGNED BY:  
DRAWN BY:  
CHECKED BY:  
SCALE: NO SCALE  
JOB NO: 22-029-1  
DATE: 01/05/23  
SHEET NO. 14



- WATER MAIN NOTES**
- All construction procedures and materials used on this project shall conform to White Lake Township current standards and specifications.
  - All hydrants shall be East Jordan Iron Works SBR-250 traffic model. Self-draining hydrants shall not be used. Valve shall have 1-1/2" pentagon nut and shall open counter-clockwise. Provide two 4.5" pumper outlets with 5" Storz quick connect nozzles (Harrington Integral Hydrant Storz, Model HHS) as manufactured by Harrington, Inc. of Erie, PA.
  - All hydrants shall be field painted with a heavy coat of bright safety red polyurethane or alkyd glass enamel, except for the Storz fittings and caps, which shall be left unpainted.
  - All water mains shall be ductile iron pipe Class 54, cement lined with push on joints. Mechanical joints allowed only for tapping sleeves, hydrants & hydrant valves. Only Cor-Blue bolts shall be used for assembling mechanical joints. All bends, tees, valves and hydrant tees shall have a poured concrete thrust block as detailed on this sheet. Joints which have thrust blocks bearing on soil of questionable stability shall be fully restrained utilizing Tyler steel riser and adapters or a system approved by the Township Engineer. HDPE pipe for directional boring, if approved by the Township Engineer, shall meet all of the requirements of the MDEQ and shall be DR9 (200 psi), and shall have two #8 tracer wires, terminated in the nearest gate well at the highest step.
  - Tapping sleeve shall be mechanical joint or approved equal. Ductile iron or stainless steel are allowed.
  - Specifications shall include direction of operation of all valves. All valves shall be counter clockwise open.
  - All necessary easements shall be provided in the name of White Lake Township before acceptance of the water distribution system.
  - The design engineer shall furnish White Lake Township with one reproducible set of "As-Built" water main plans or an AutoCAD file upon completion of the job.
  - All required cross-connection devices shall be installed as required by the local plumbing inspector and in accordance with the standards of the Michigan Department of Public Health.
  - Gate well frame and cover shall be as follows: East Jordan heavy manhole cover, base flange type #1040 or Neenah Foundry heavy duty #R-1642 Manhole frame, solid lid cover shall be non-rocking and marked "White Lake Water Department"
  - Gate valves shall be AWWA approved and of a double disc or resilient wedge design with push on joints, 16" gate valves may be mechanical joint provided Cor-Blue bolts are used. All gate valves with operating nuts greater than 5' below ground surface shall be provided with an extension stem. The length of the extension shall be such that it will be within 5' of the ground surface when an extension is used it shall be held in place by an extension stem guide suitably fastened to the wall of the gate well.
  - 1" corporation stops are to be placed on the main at each side of each main line gate valve and at such other locations as may be required by the engineer.
  - All pipe and fittings shall be subjected to a hydro-static pressure test of 150 PSI for a 2 hour duration; Township Engineer must be present. Maximum segment 2000 feet except that longer segments may be tested with allowable leakage based on 2000 feet.
  - 2 consecutive safe bacteria samples shall be taken from the water system approx. 24 hours apart at points established by the Township Engineer. Samples shall be taken by the Township Engineer.
  - Filling, flushing and sampling of water main can only be performed with a "Jumper" Line. The jumper shall be equipped with an approved R92 type of backflow preventer.
  - Adjustments on gate wells shall be limited to 23" maximum from top of rim to first step in accordance with MGHSA Rule 341.
  - All new water service lines shall have a minimum nominal size of 1". Service from 1" to 2" may be type K copper tubing or plastic DR-9 (200 PSI rated) meeting ASTM D2277-03 (Standard Specification for Polyethylene (PE) plastic tubing). ASTM Designation and pressure rating shall be stamped on the pipe by the manufacturer. Plastic pipe shall also meet AWWA C-901 Specifications. All sizes shall relate to the copper tubing outside diameter standard size (CTS). Copper pipe joints shall be flared. Fittings shall adapt to the plastic pipe with compression or top pipe thread copings. Plastic pipe shall be either compression style with a steel insert or may be fused welded in the larger sizes.



REVISIONS	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE	MARK	ADDENDUM/CHANGE ORDER	DATE
		GENERAL REVISION TO CAD	12/29/95		GW & NUT SIZE	07/23/98		REV. HYD. THRUST, AIR REL.	03/29/04		PIPE COVER & FLANGE TAPE	05/12/99
		ADD NOTE 17	11/04/97		5-BR HYD. WS STAKE	02/27/02		HOPE, HYD. VALVES	07/18/05		ADD NOTE 19	07/23/03
		REVISE HYD. & THRUSTING	05/18/98		ADD BLOWOFF	07/06/99		UPDATED TITLE BLOCK	04/20/13			

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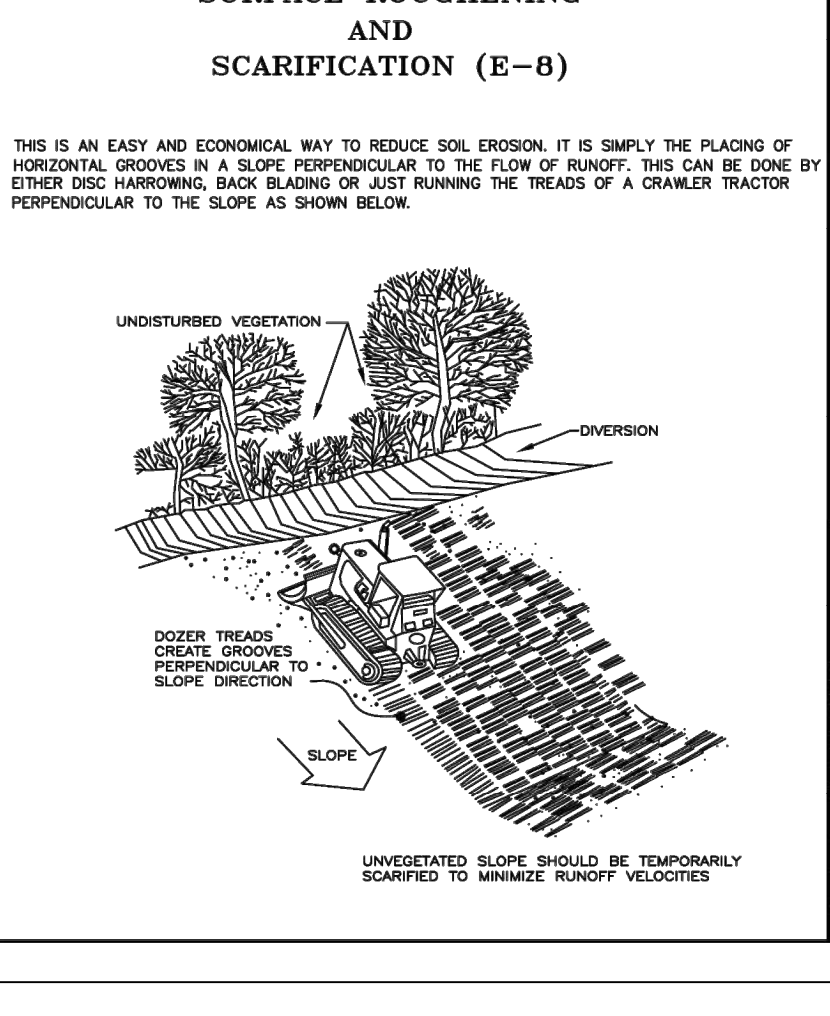
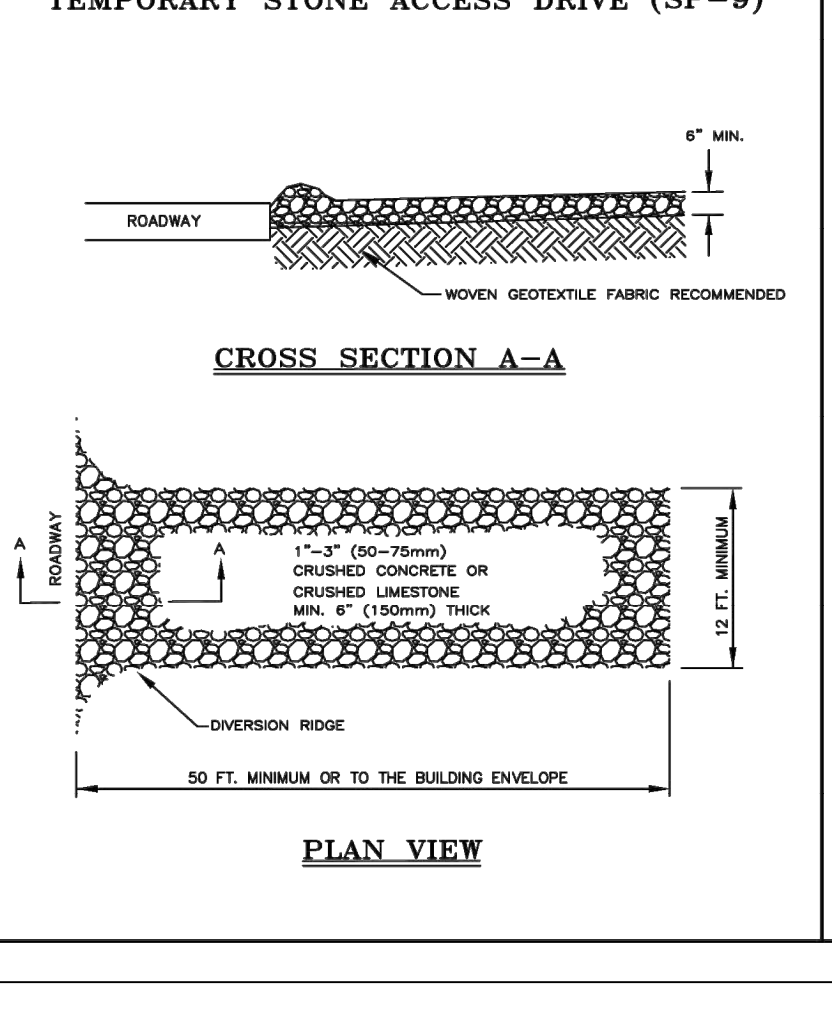
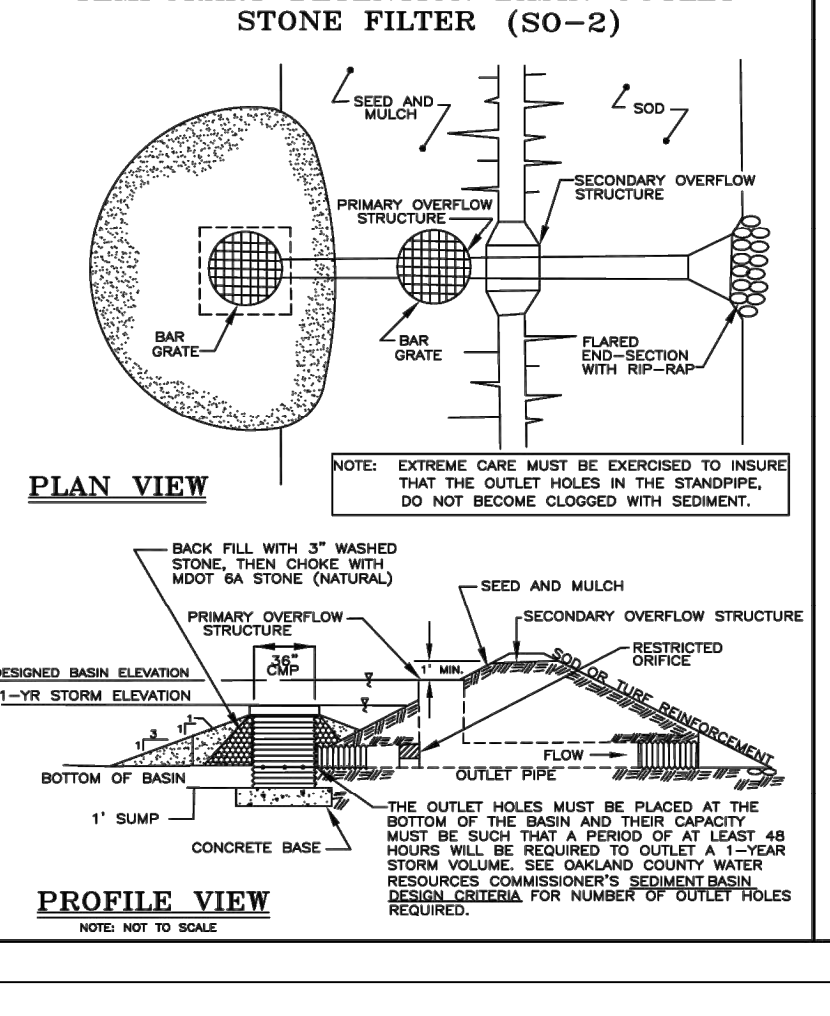
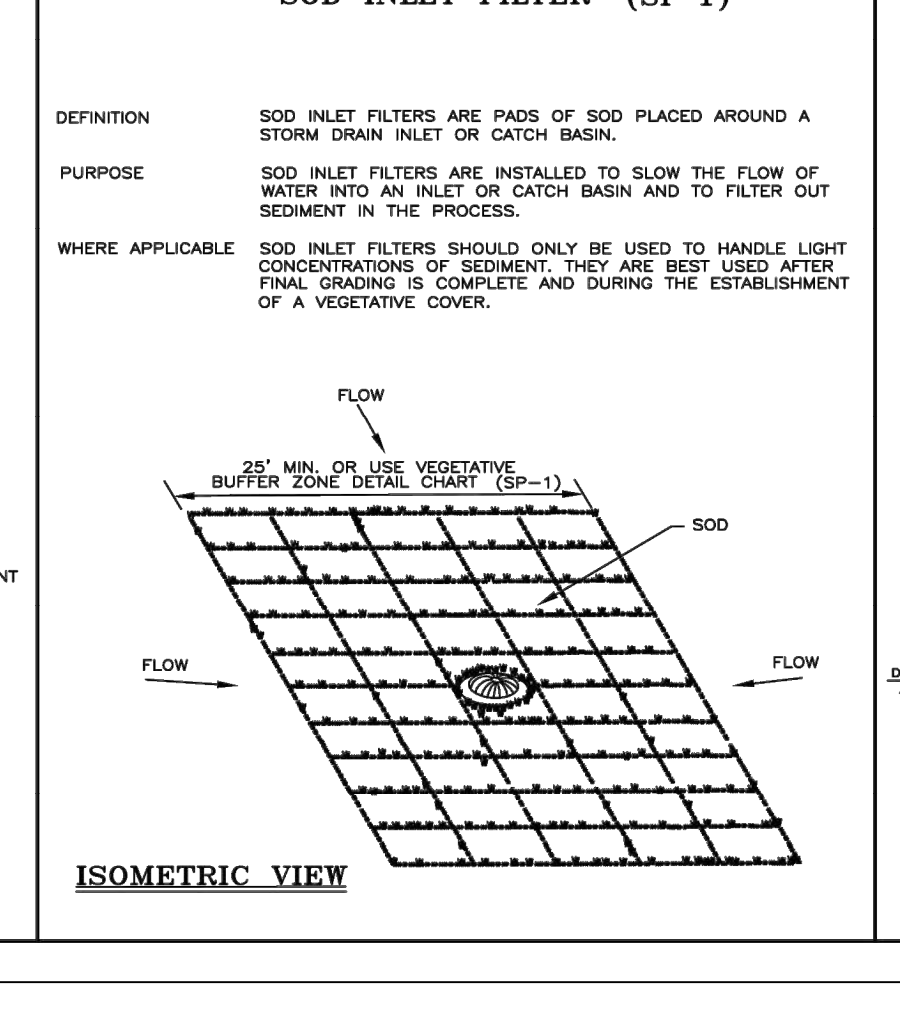
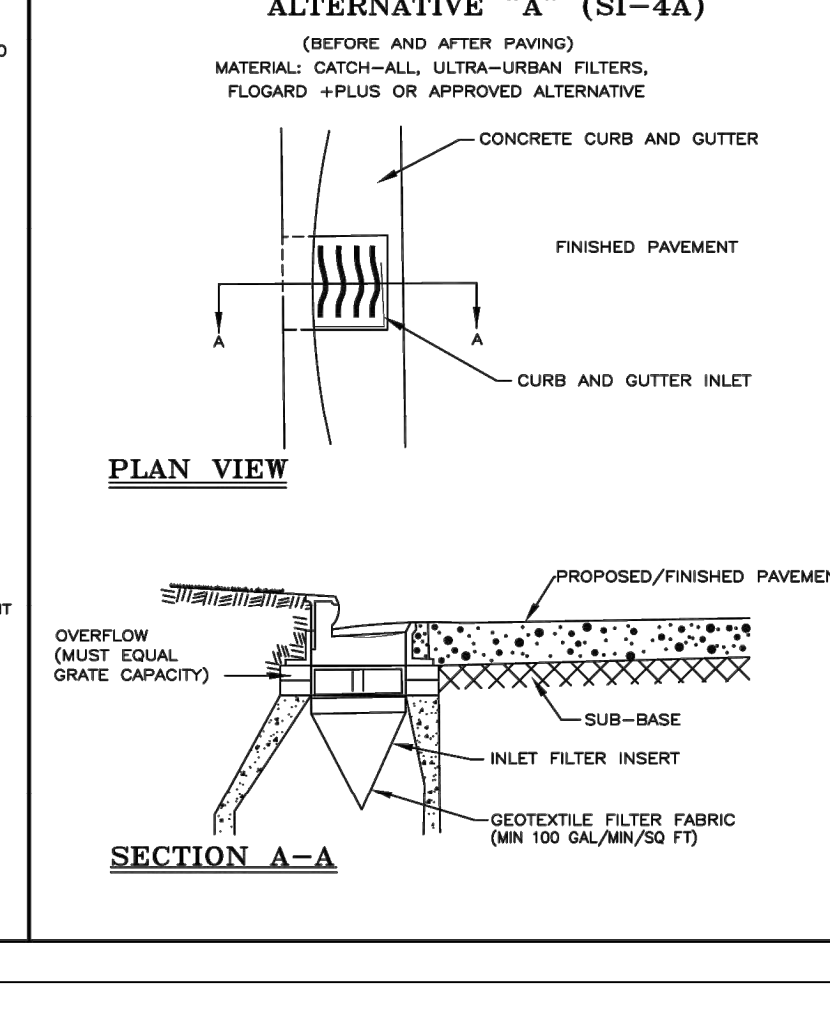
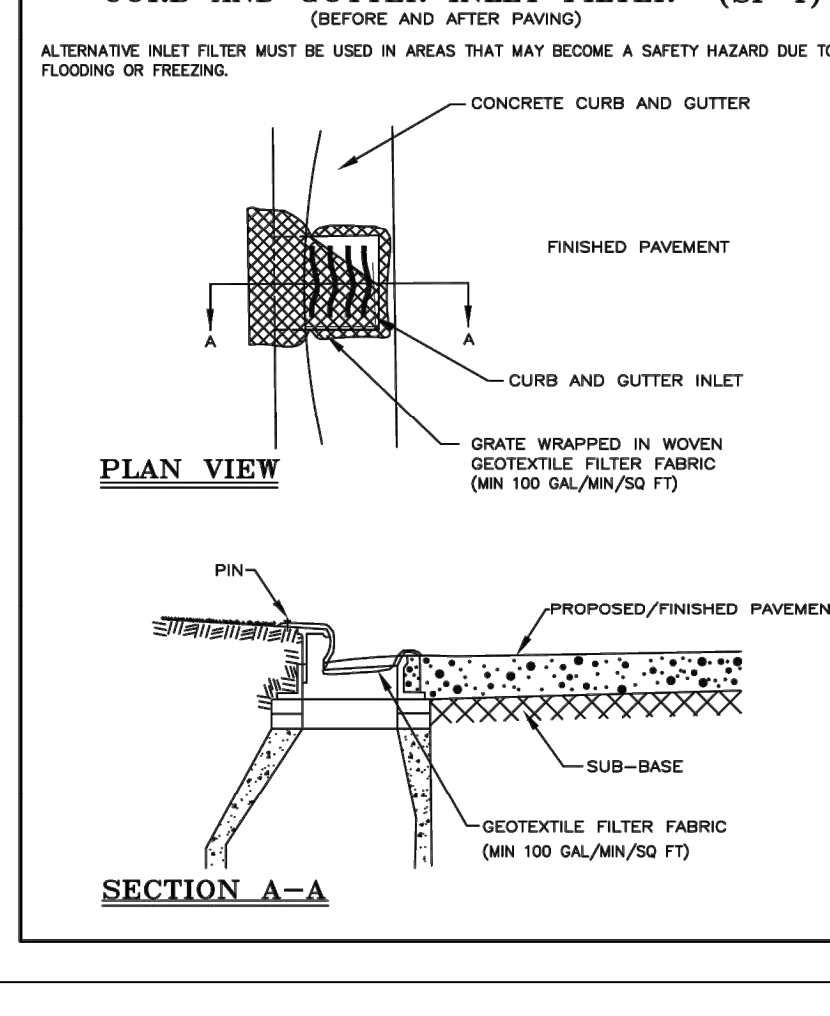
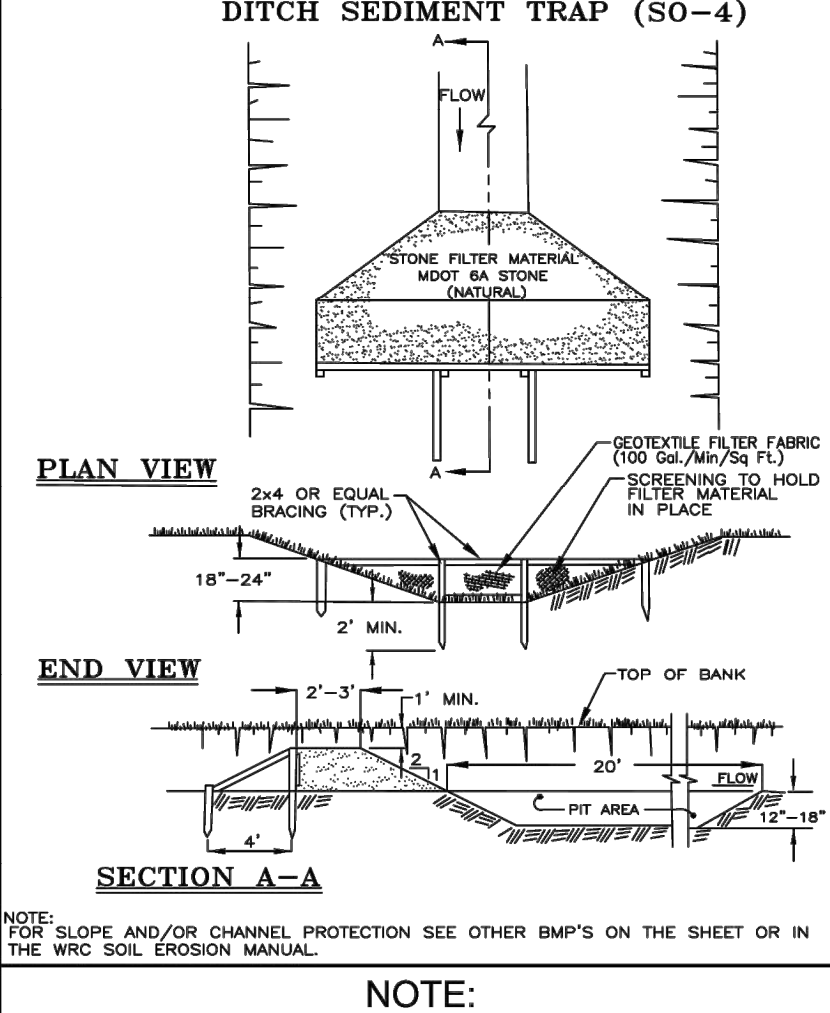
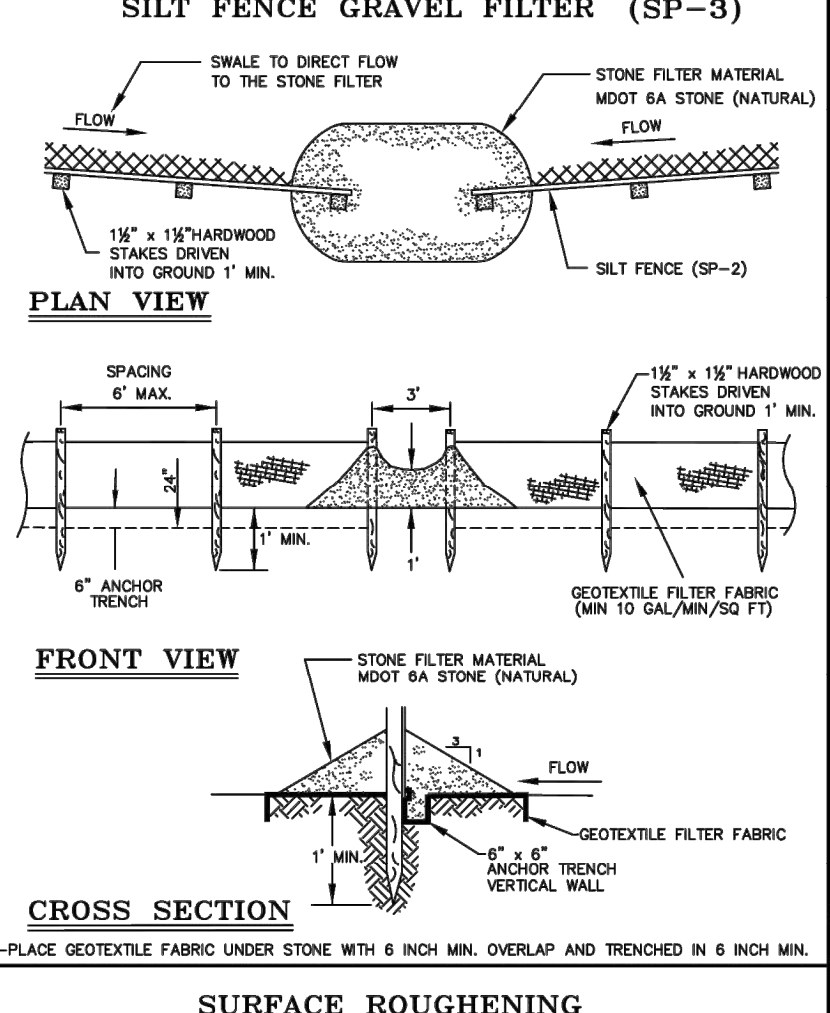
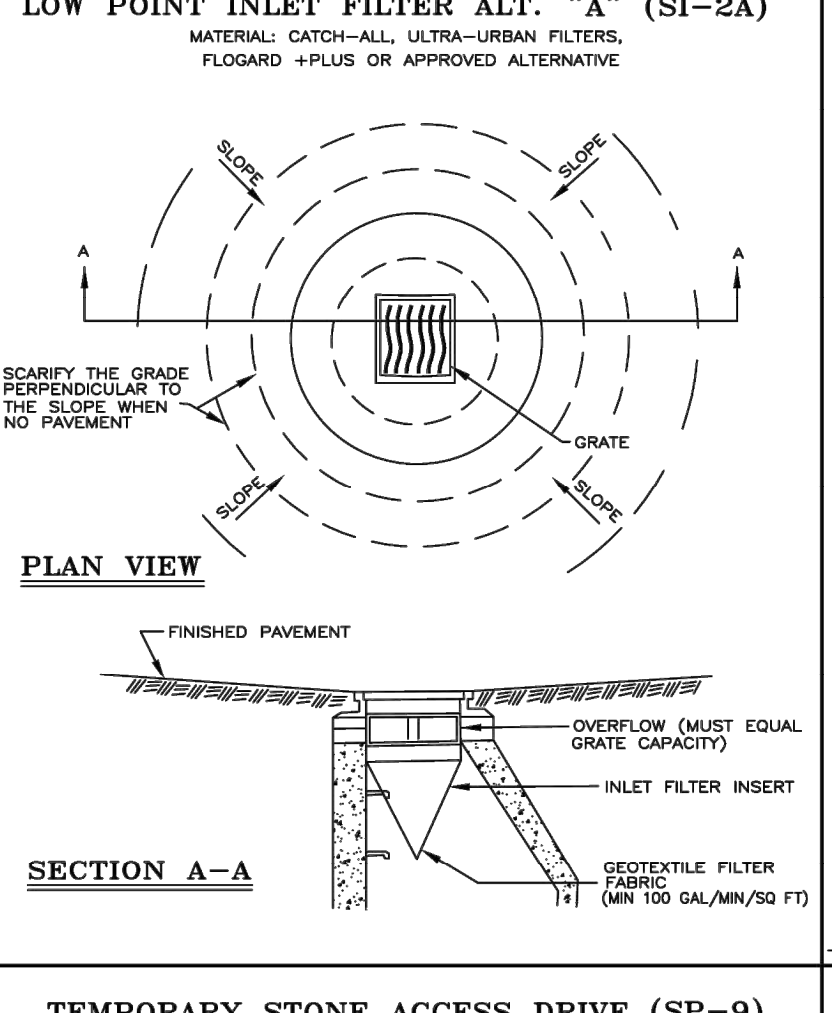
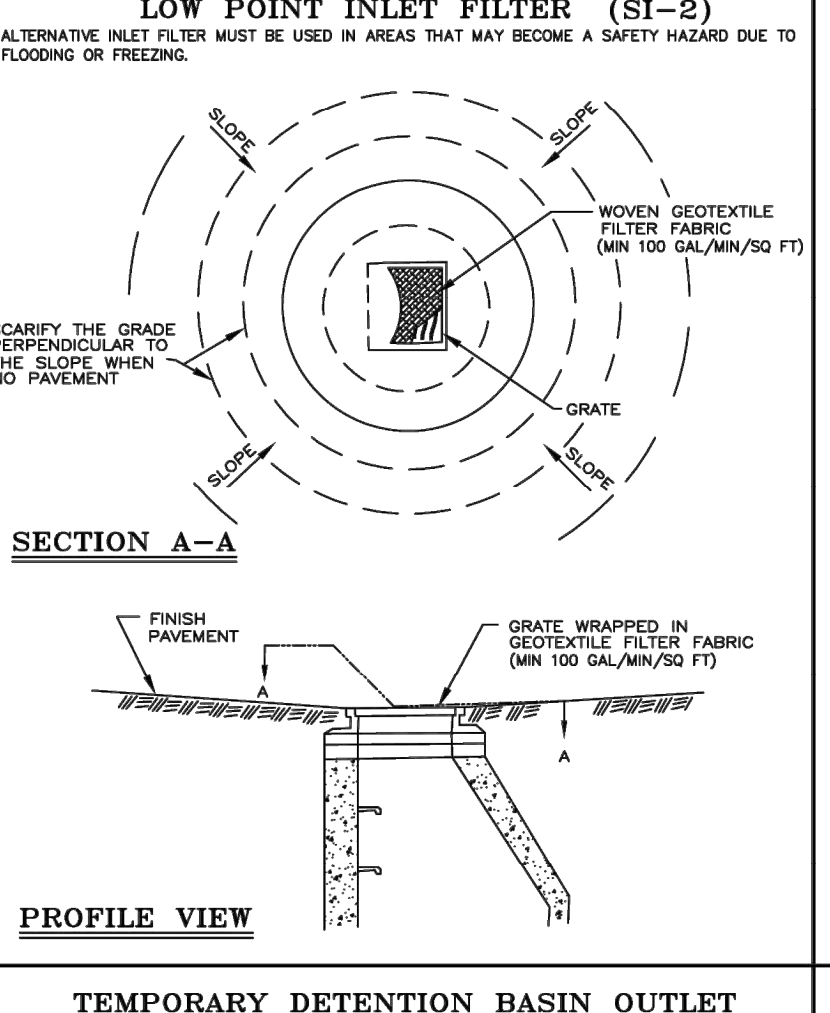
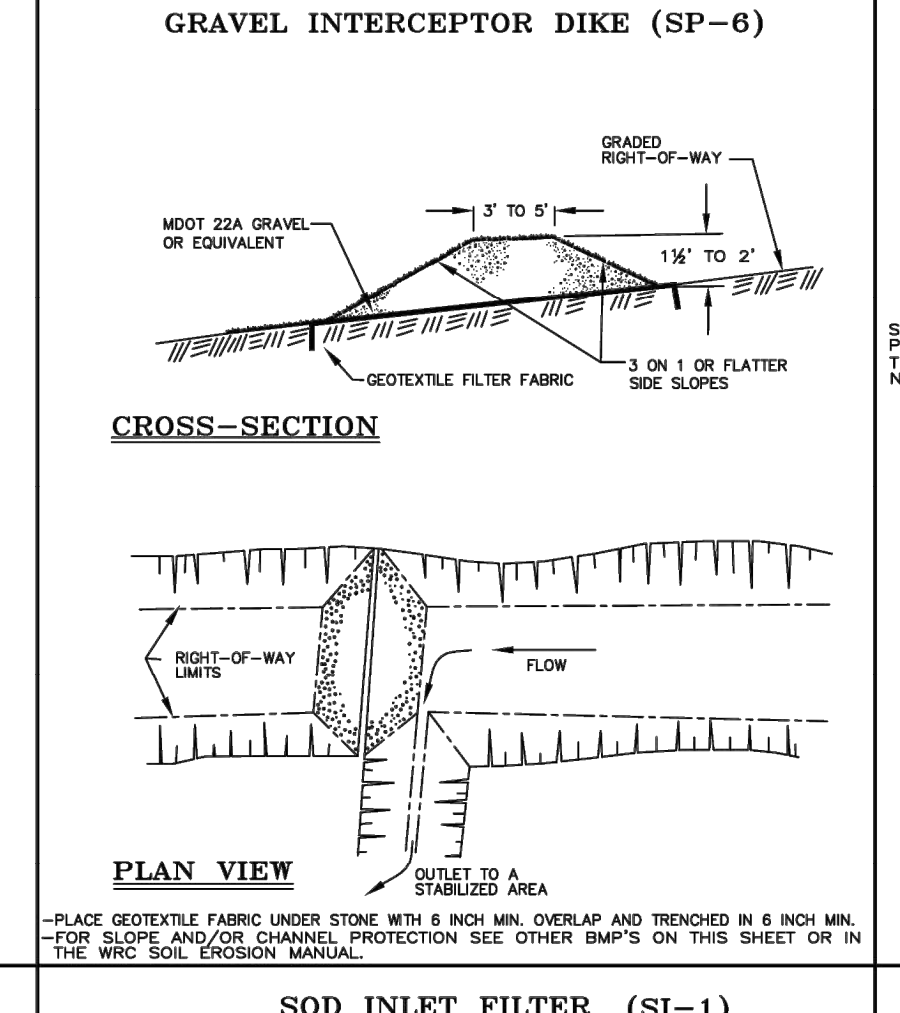
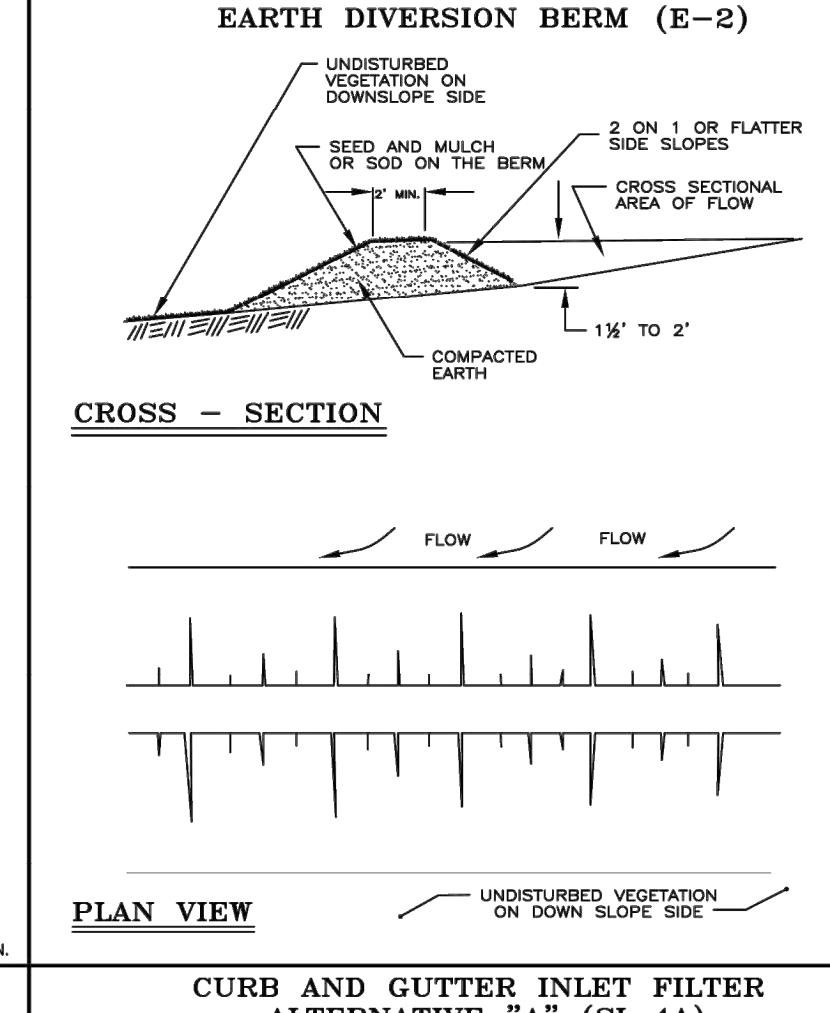
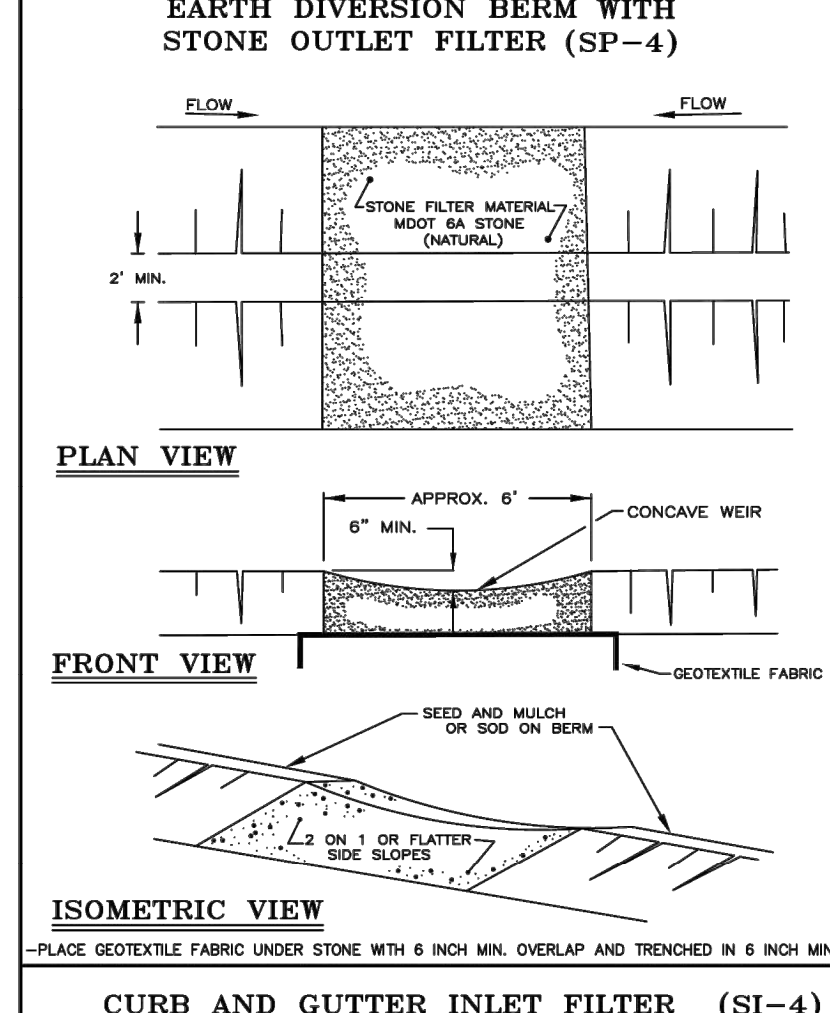
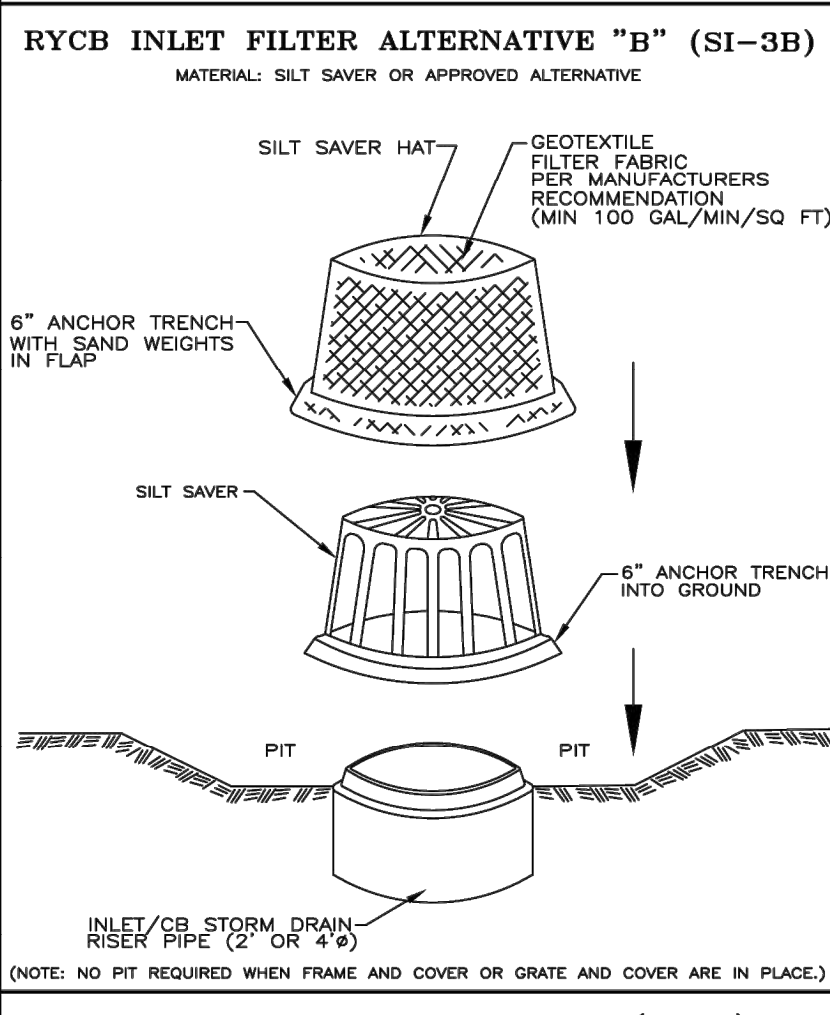
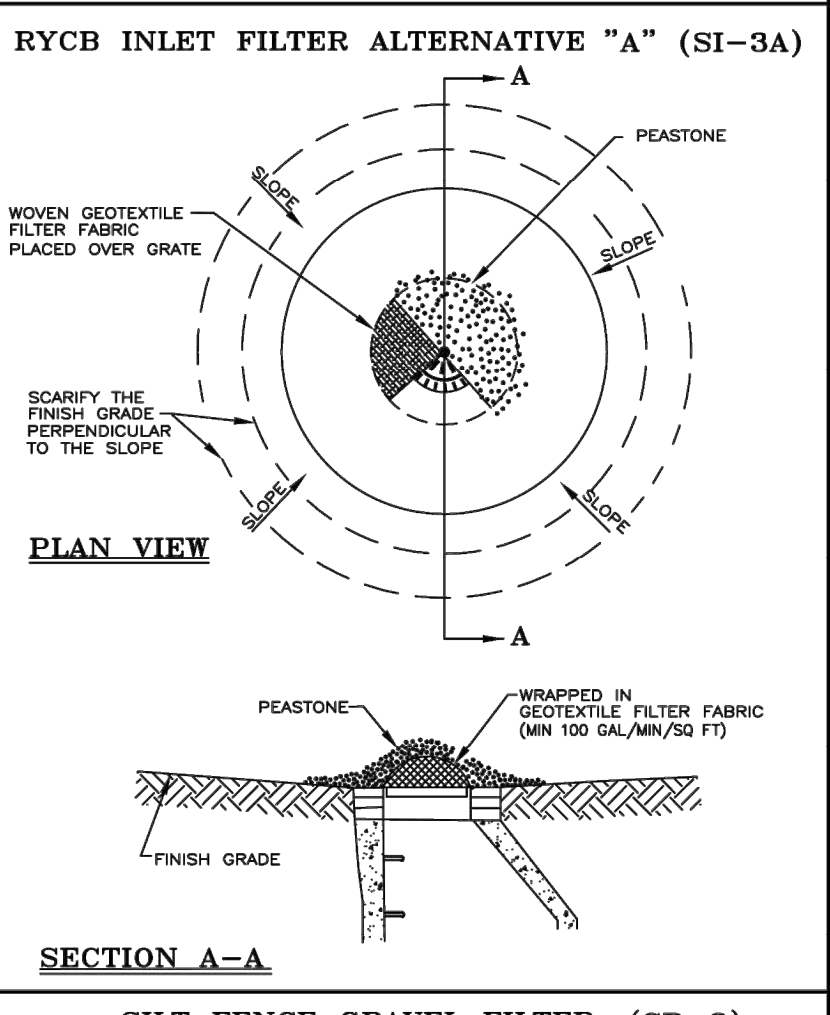
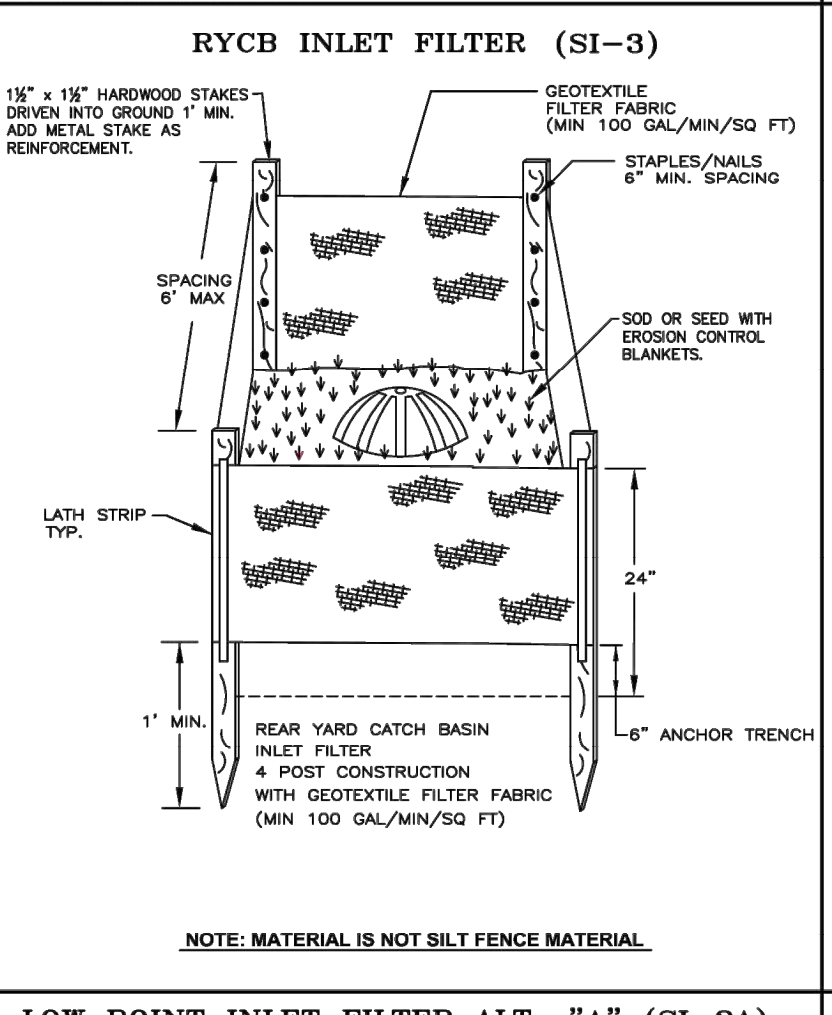
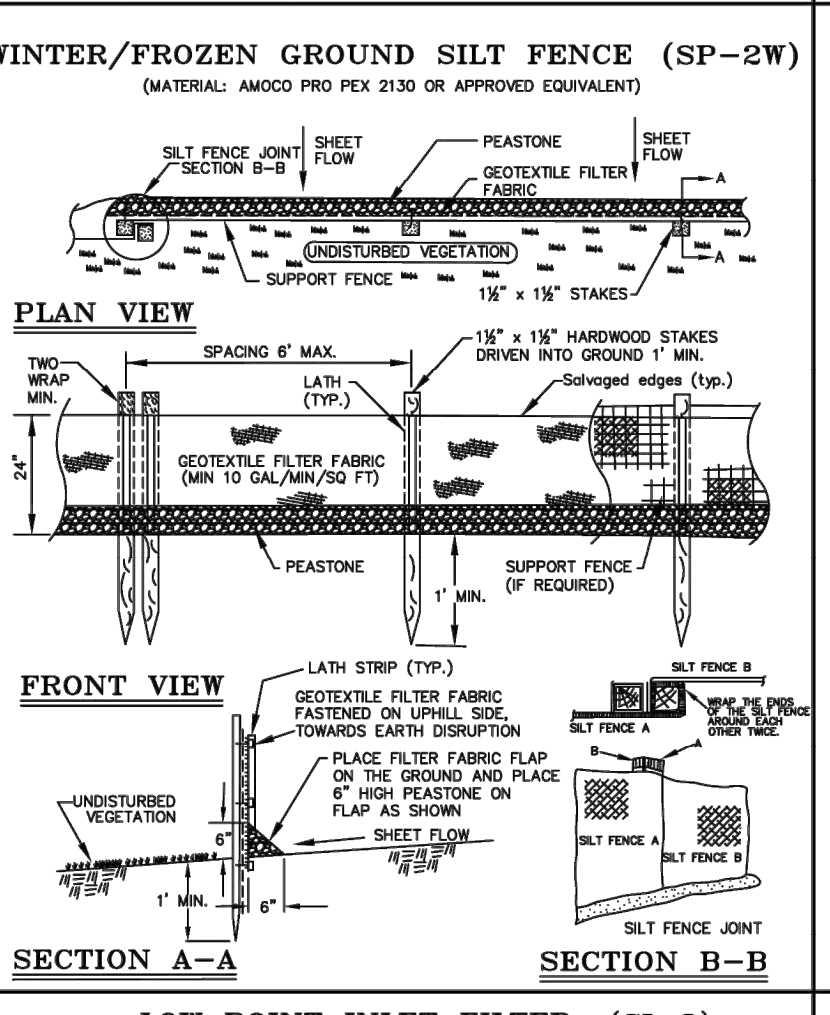
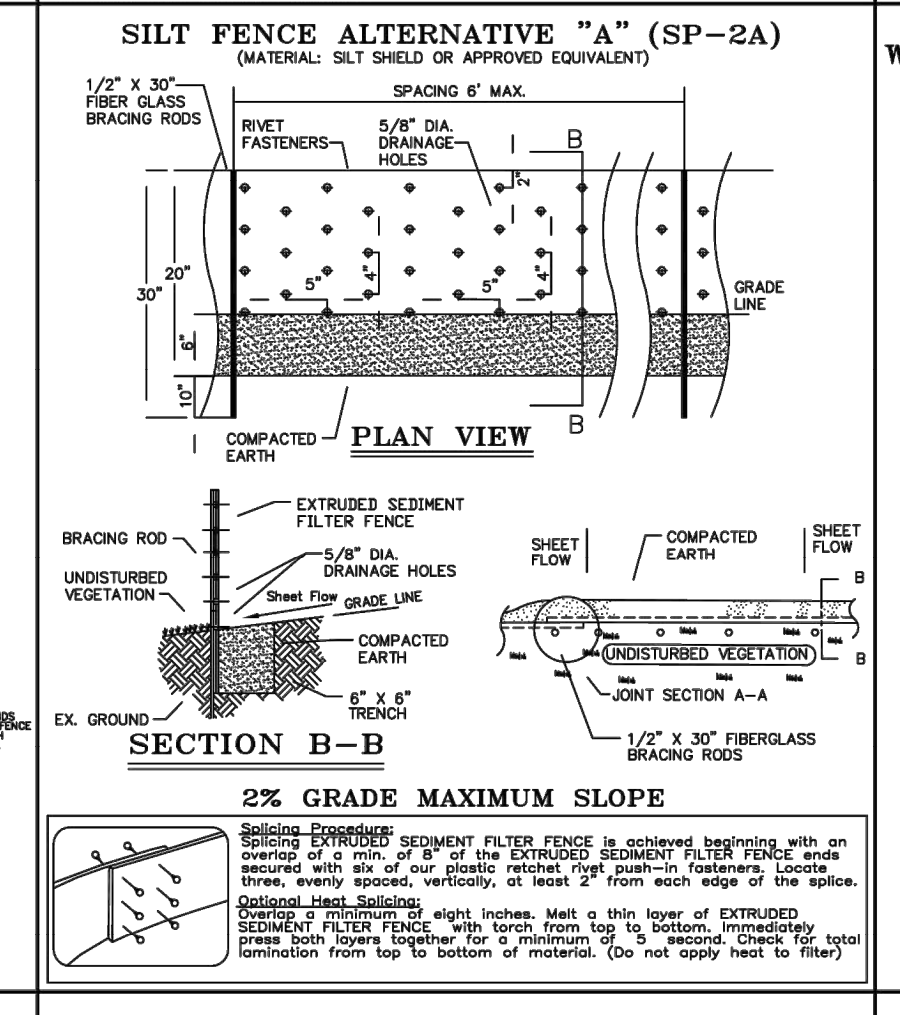
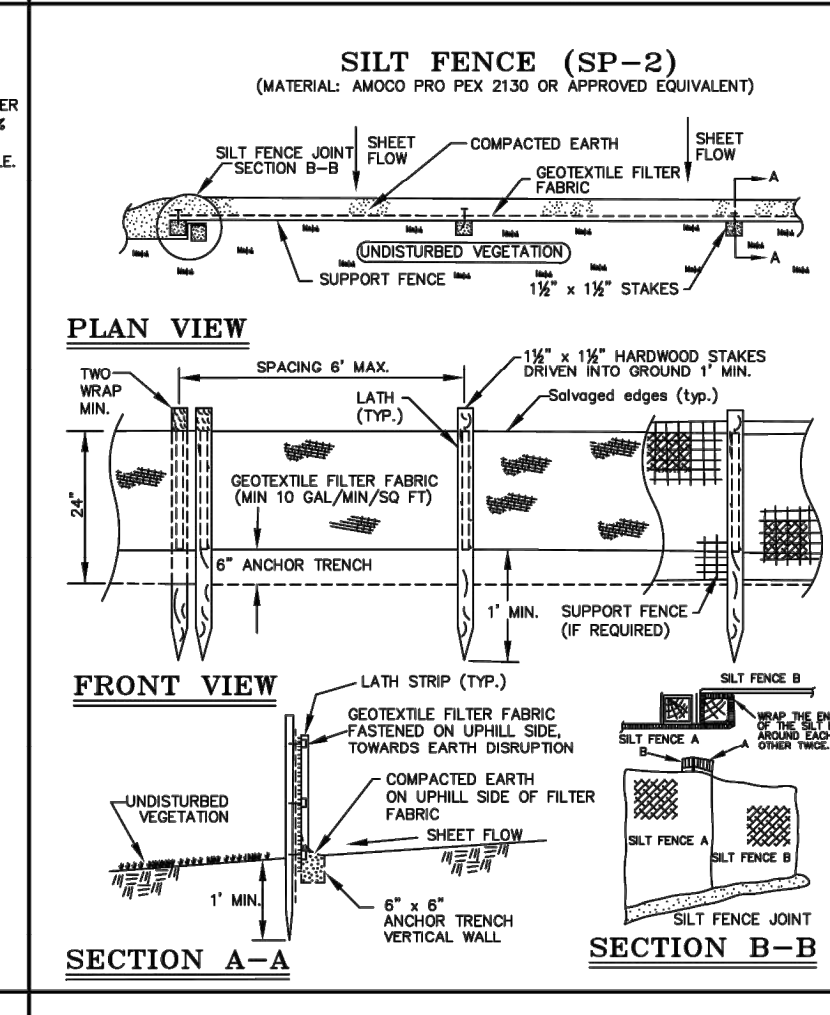
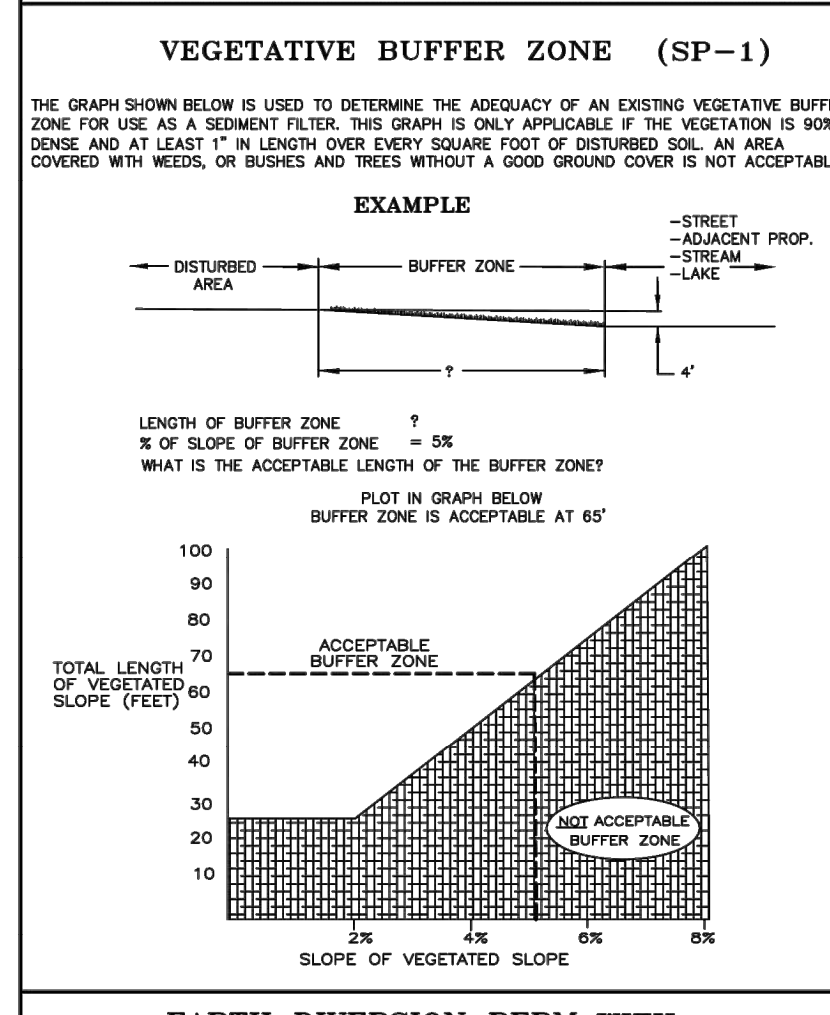
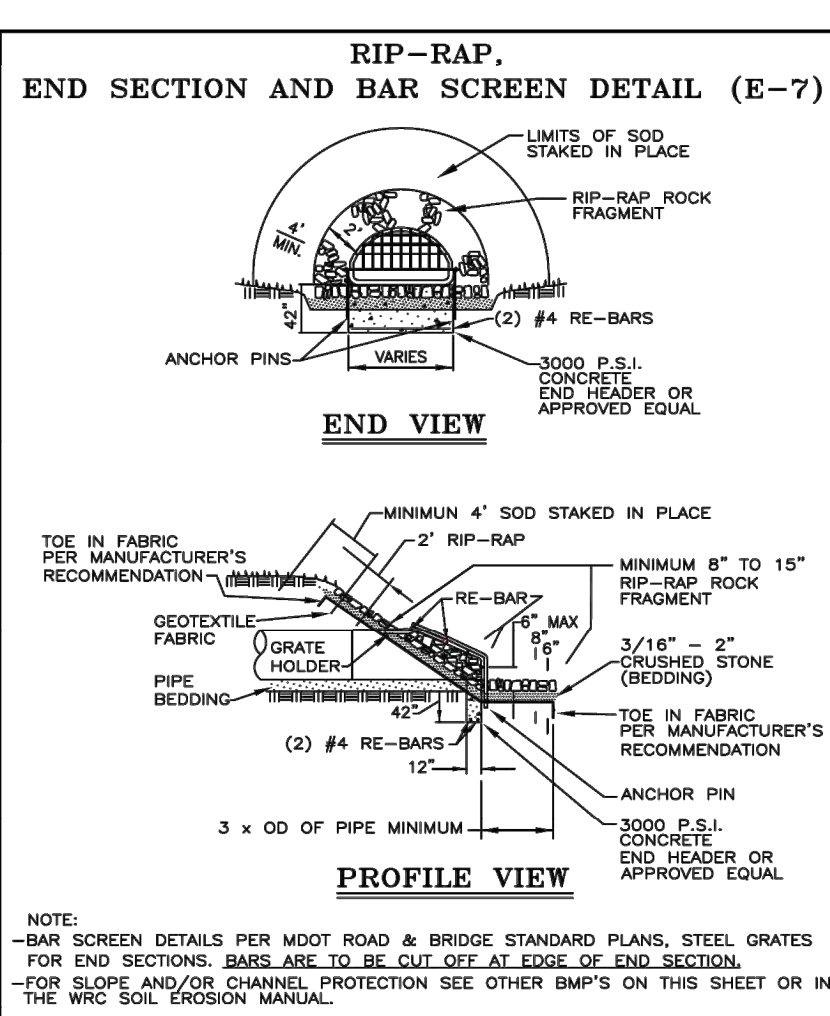
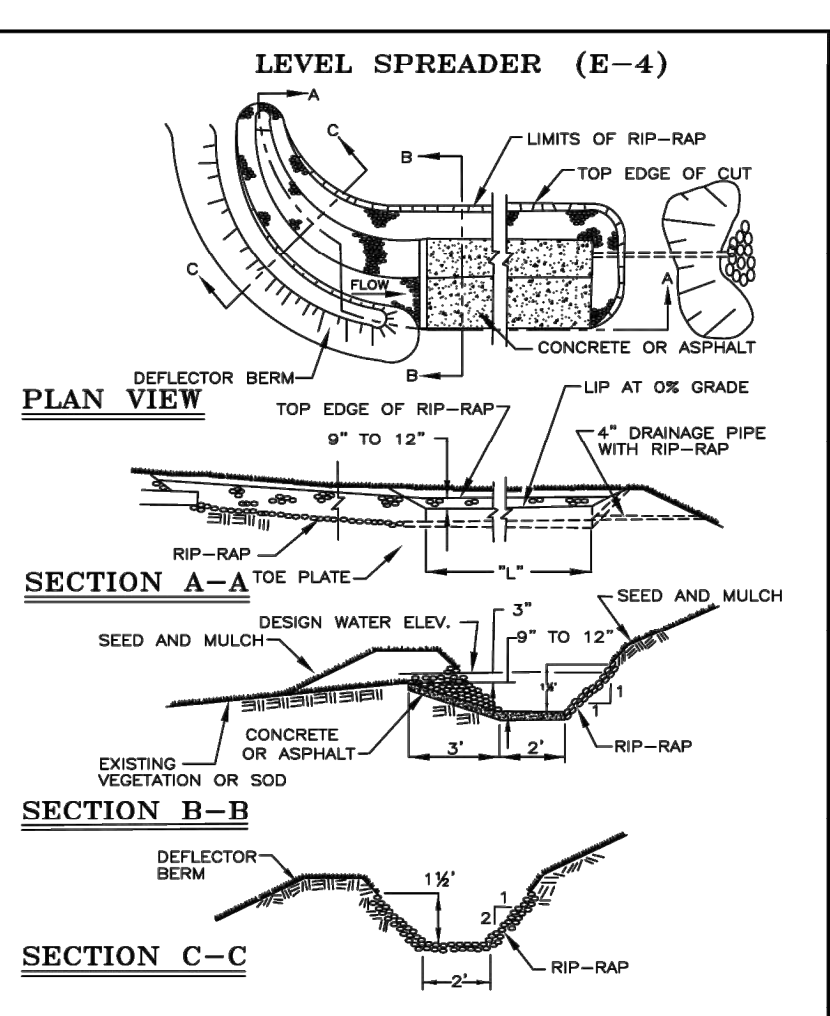
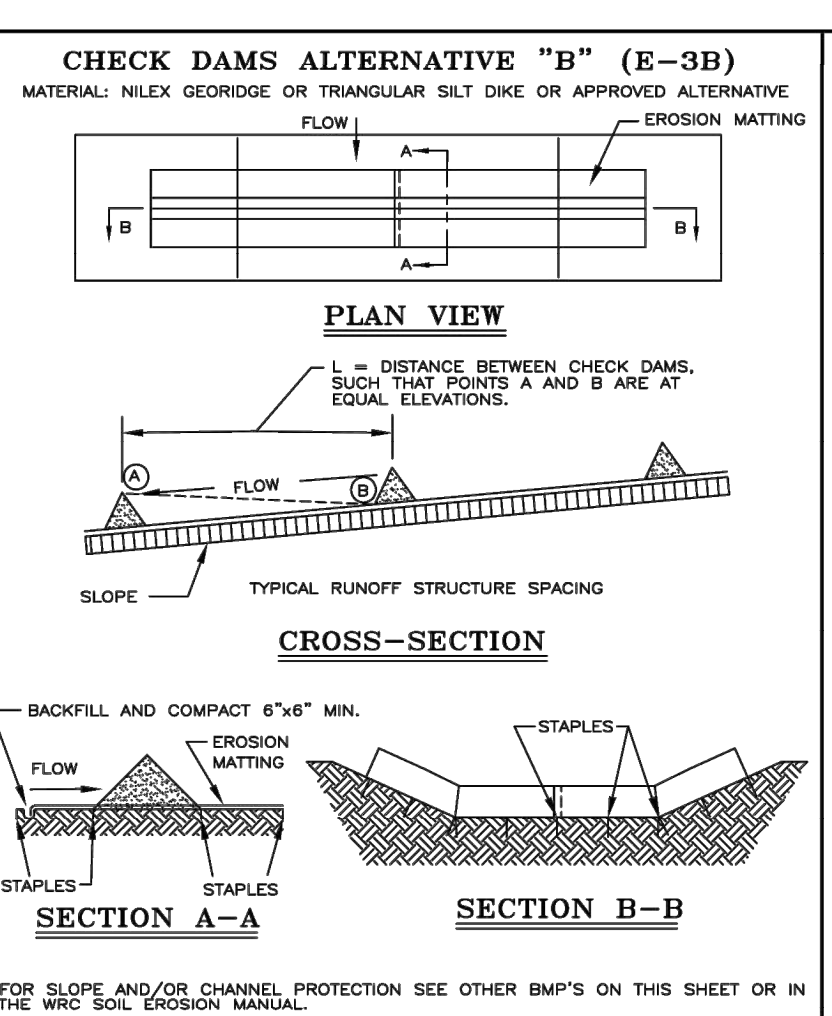
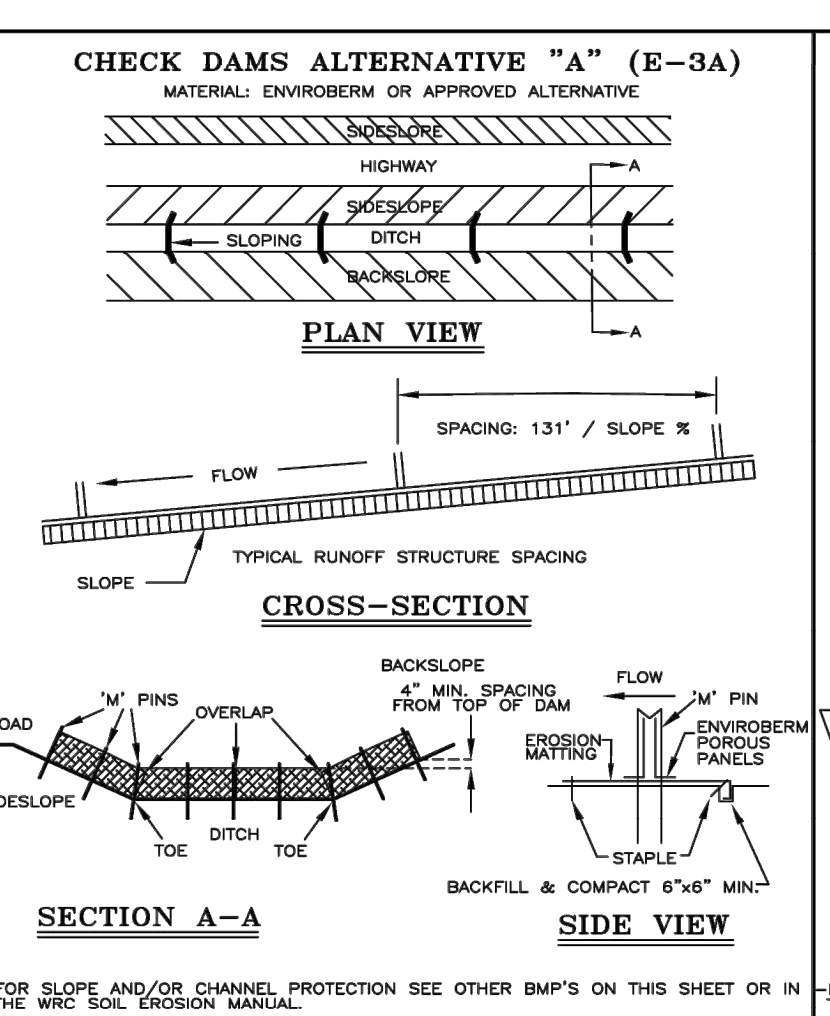
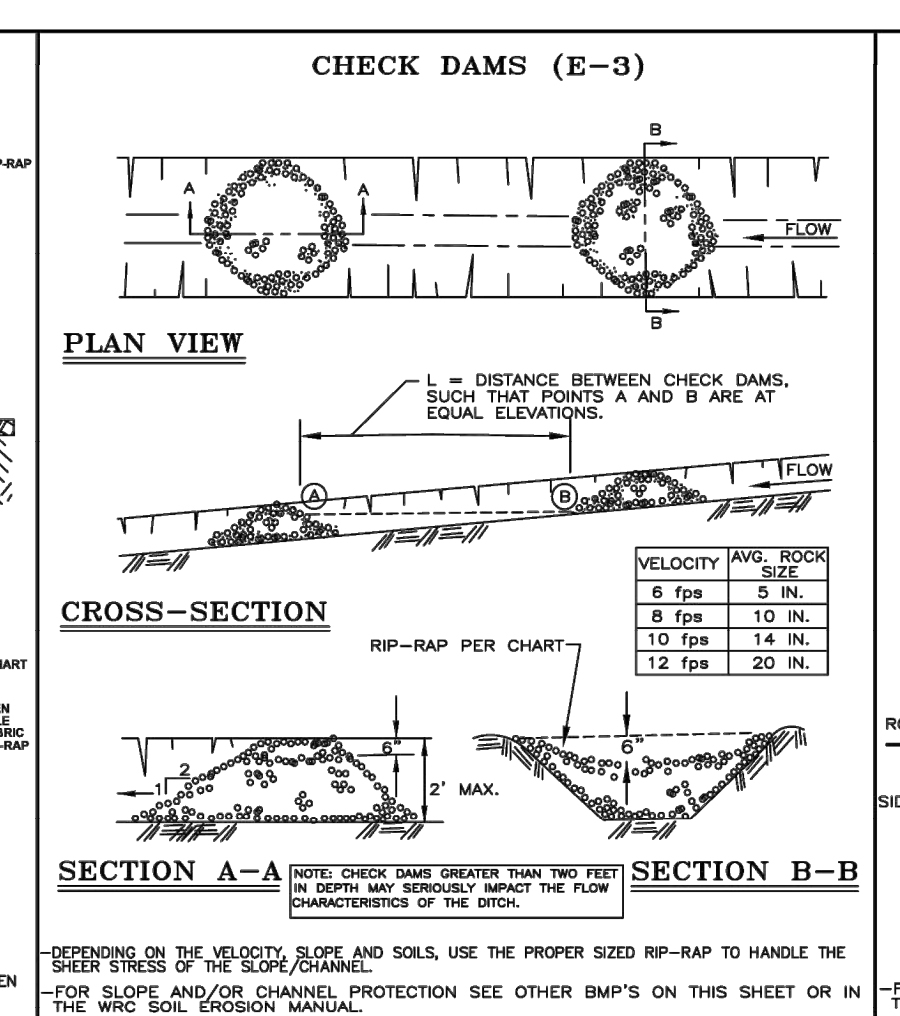
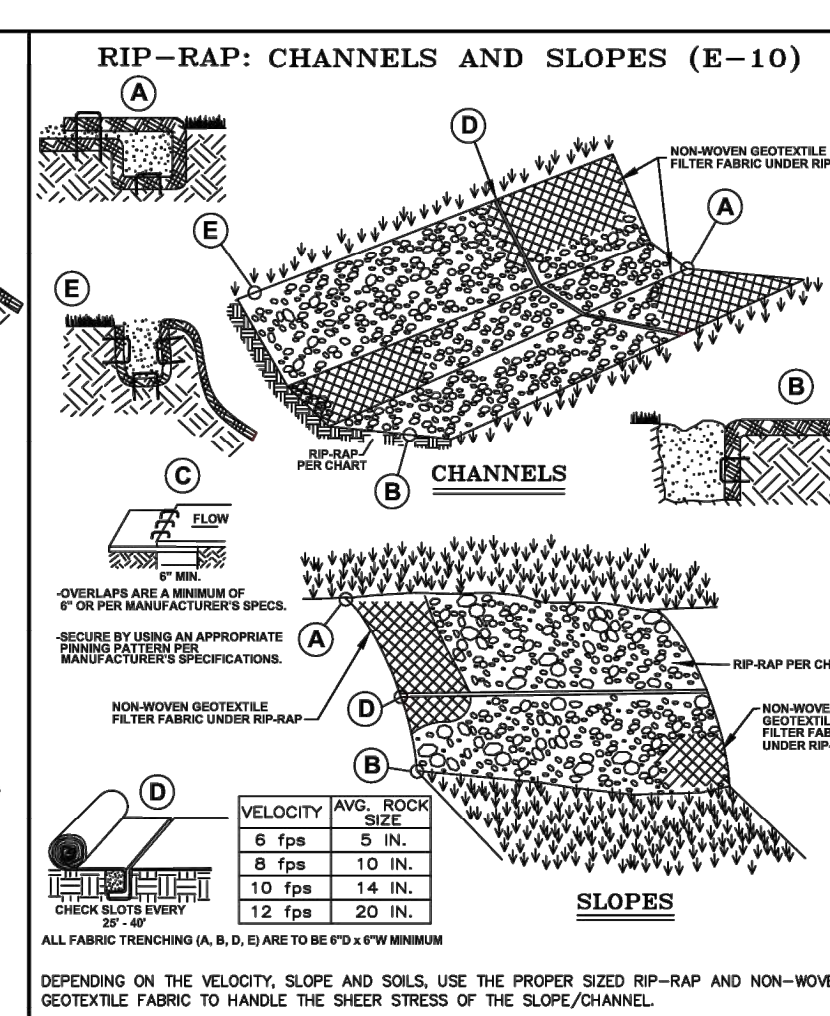
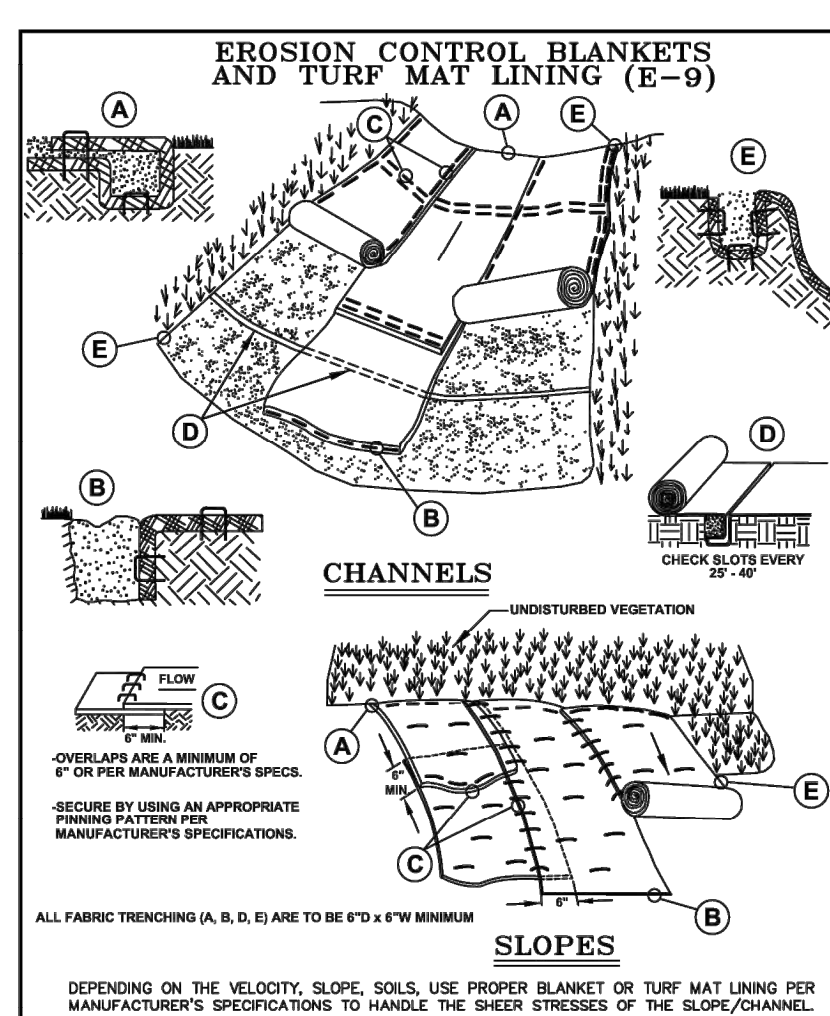
2291 Water Street, Suite 6  
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tel (810) 987-7820 fax (810) 987-7895

**White Lake Township**  
7525 Highland Road (M-59)  
White Lake, Michigan 48383  
248-698-3300

**WATER MAIN STANDARD DETAILS**

JOB NO. \_\_\_\_\_  
DATE ISSUED \_\_\_\_\_  
SHEET NO. \_\_\_\_\_





**NOTE:**

WHILE PERFORMING WORK INVOLVING GROUNDS MAINTENANCE AND/OR THE CONSTRUCTION/MAINTENANCE OF ANY INFRASTRUCTURE, INCLUDING ROADS, WATER MAINS, SANITARY SEWERS, STORM DRAINS AND STORM WATER BEST MANAGEMENT PRACTICES (BMPs), CONTRACTORS SHALL MINIMIZE POLLUTION FROM STORM WATER RUNOFF THAT CAN AFFECT WATER QUALITY RELATED TO WORK ACTIVITIES. POLLUTANTS THAT COULD IMPAIR WATER QUALITY MAY INCLUDE FUEL, GREASE AND OIL, NUTRIENTS, BACTERIA AND PATHOGENS, LITTER AND DEBRIS, AND SOIL EROSION AND SEDIMENTATION. APPLICABLE BMPs SHALL BE IMPLEMENTED BY THE CONTRACTOR TO THE MAXIMUM EXTENT PRACTICABLE TO PROTECT WATER QUALITY AND WILDLIFE HABITAT.

**SOIL EROSION AND SEDIMENTATION CONTROL DETAILS**

NO.	DATE	BY	REVISION
1	01/05/23	WRC	ISSUED FOR PERMIT
2	01/05/23	WRC	REVISION PER TWP PSP REV #2
3	01/05/24	WRC	REVISION PER TWP PSP REV #3
4	01/05/24	WRC	REVISION PER TWP PSP REV #4
5	01/05/24	WRC	REVISION PER TWP PSP REV #5

DESIGNED BY: [Signature]

CHECKED BY: [Signature]

SCALE: NO SCALE

JOB NO: 22-029-1

DATE: 01/05/23

SHEET NO. 1 of 1

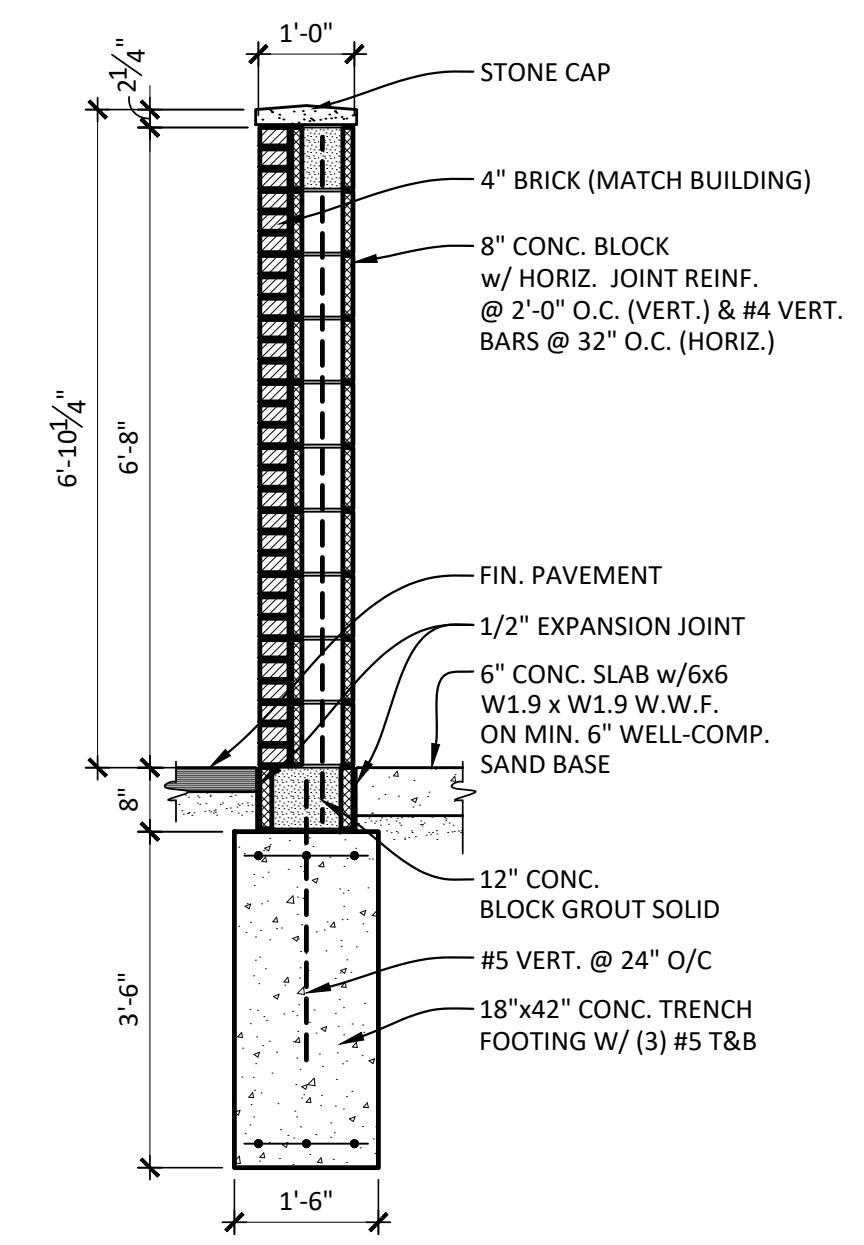
**BEBOSS**  
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Engineers Surveyors Planners Landscape Architects

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HOWELL, MI. 48843  
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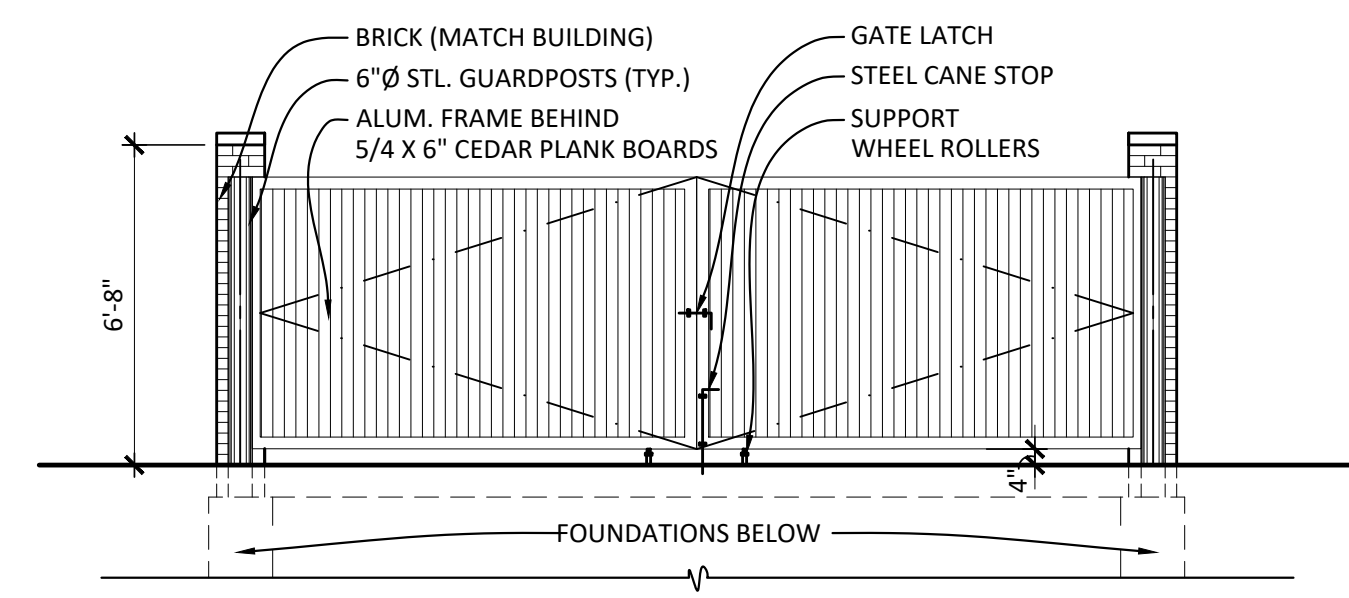
**GATEWAY CROSSING**  
GATEWAY CROSSING, LLC  
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BIRMINGHAM, MI 38209  
248-937-7000

NO.	DATE	BY	REVISION
1	01/05/23	WRC	ISSUED FOR PERMIT
2	01/05/23	WRC	REVISION PER TWP PSP REV #2
3	01/05/24	WRC	REVISION PER TWP PSP REV #3
4	01/05/24	WRC	REVISION PER TWP PSP REV #4
5	01/05/24	WRC	REVISION PER TWP PSP REV #5



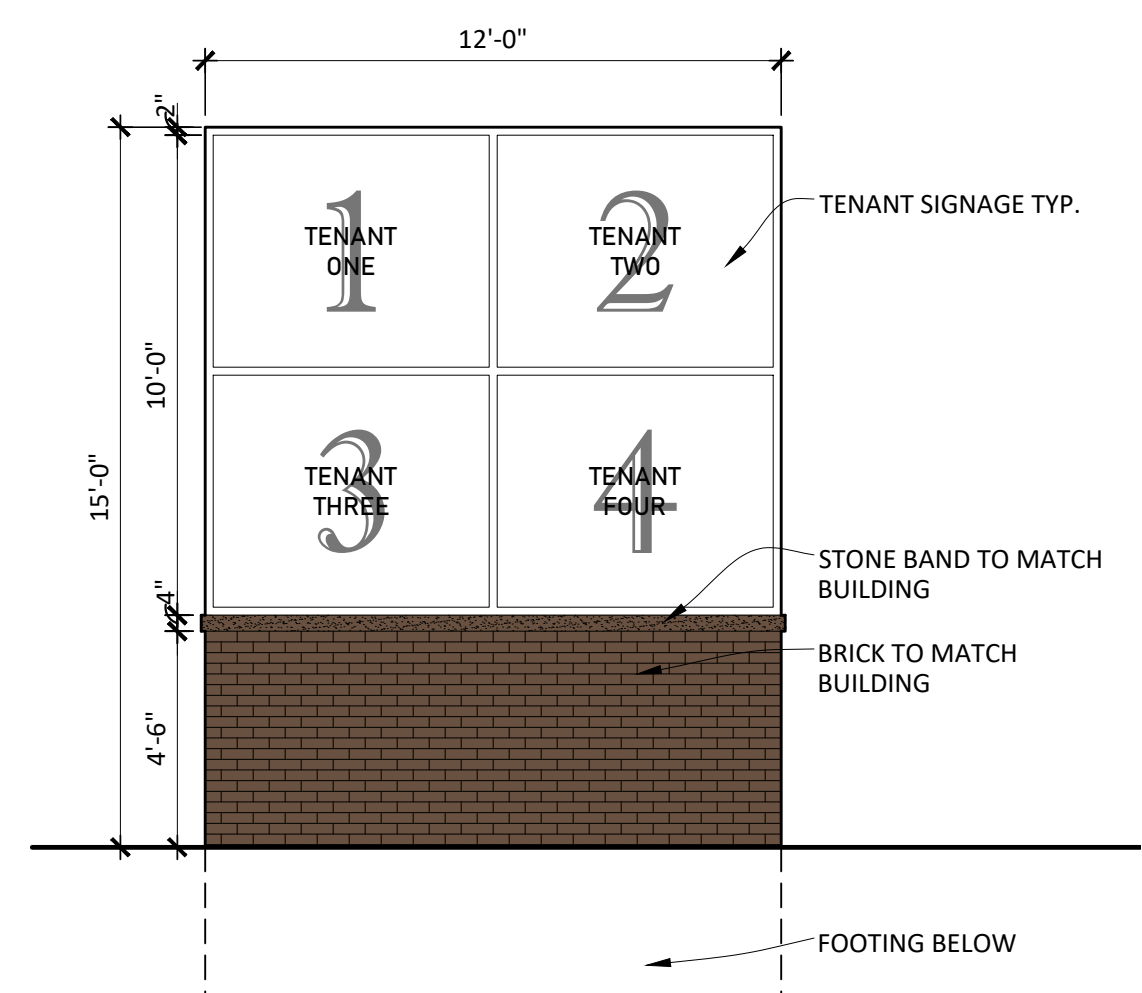


**TRASH ENCLOSURE DETAIL** 3  
 SCALE: 1/2" = 1'-0"

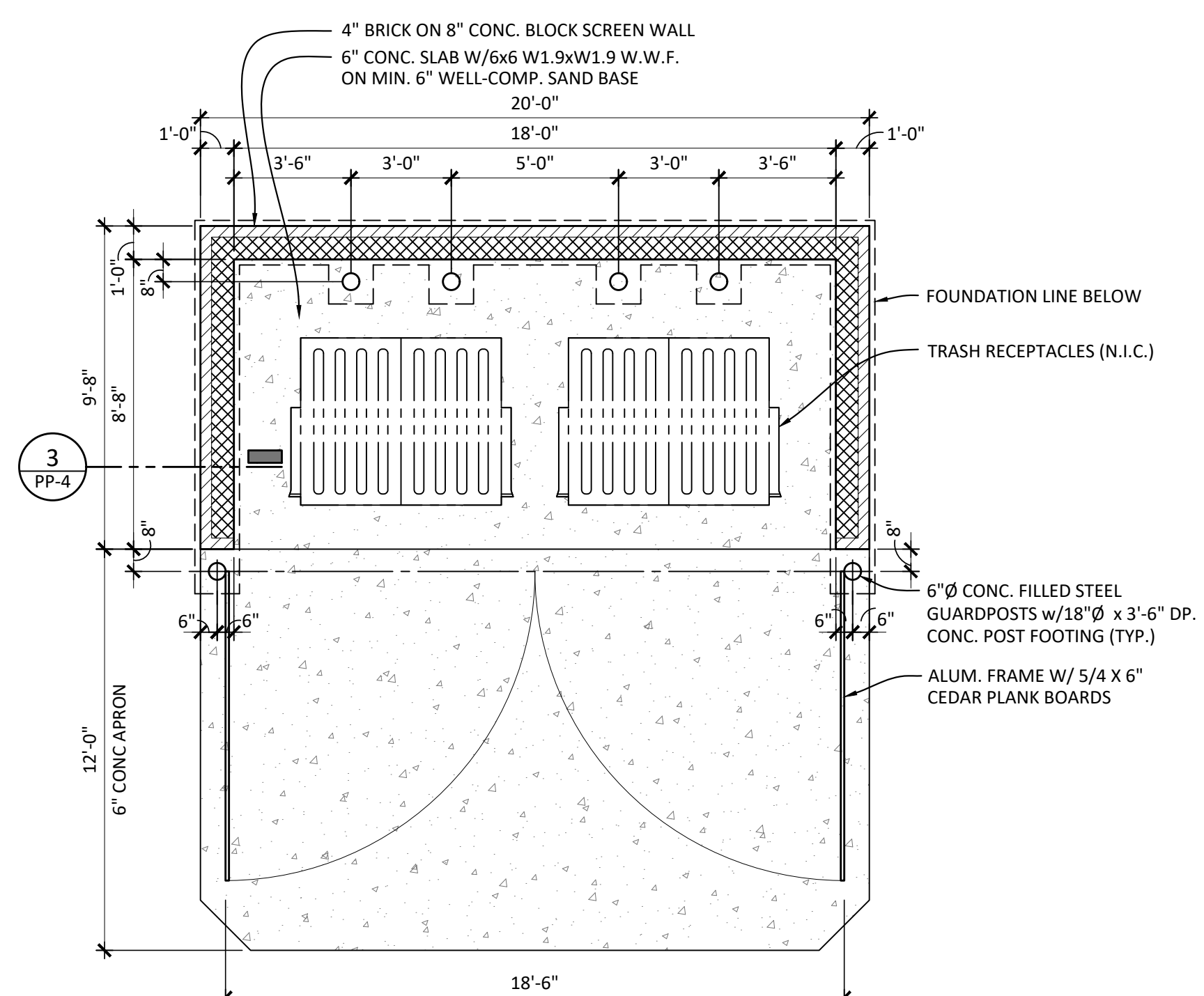


**TRASH ENCLOSURE ELEVATION** 2  
 SCALE: 1/4" = 1'-0"

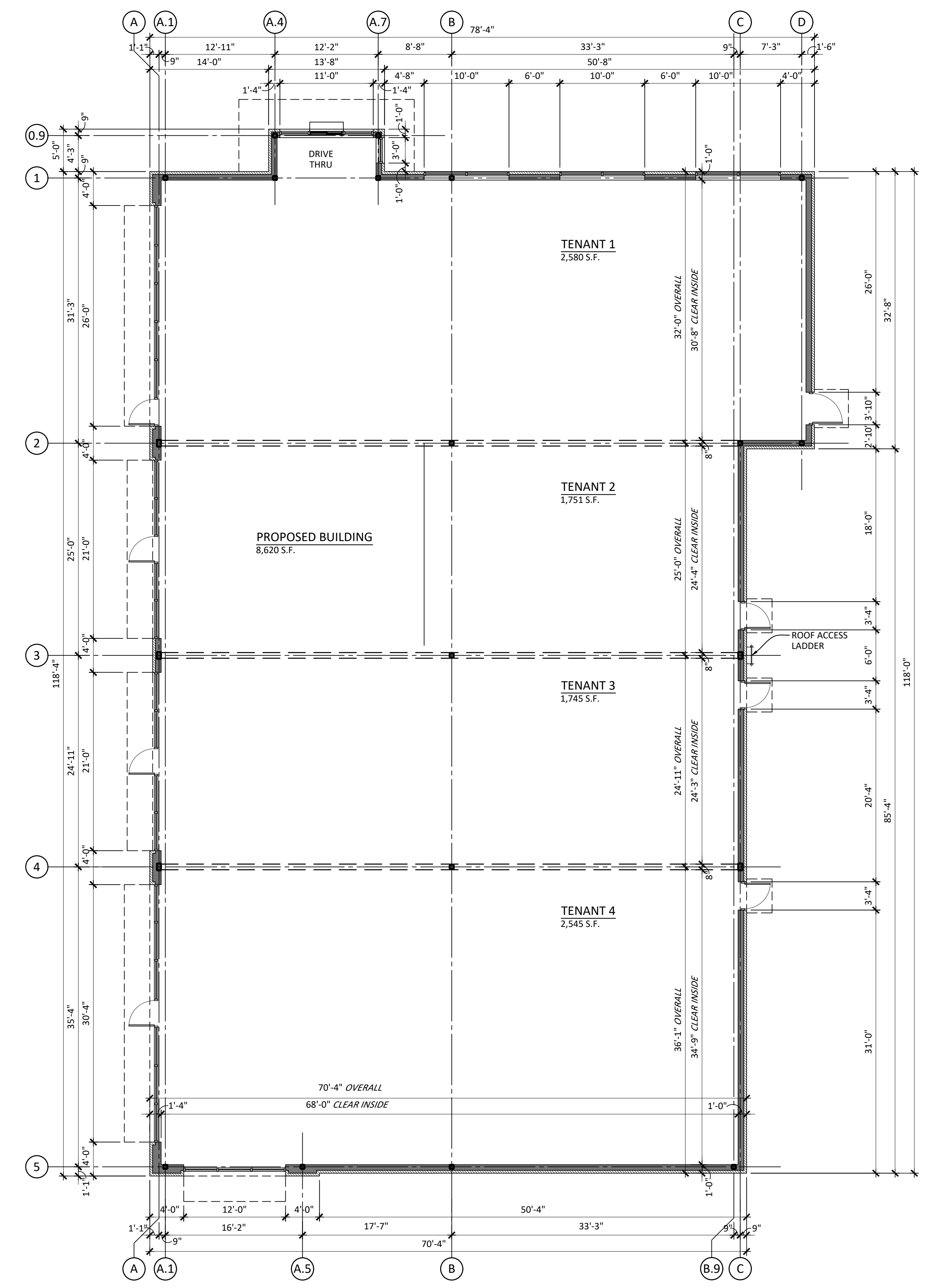
SIGNAGE REQUIREMENTS		
ORD. SECTION	REQUIRED	PROPOSED
SEC 5.9.J.1	FREESTANDING SIGN: ONE SIGN AREA: MAX -150FT <sup>2</sup> HEIGHT: 15 FT MAX.	PROVIDED 120 FT <sup>2</sup> 15'



**MONUMENT SIGN** 5  
 SCALE: 1/4" = 1'-0"



**TRASH ENCLOSURE PLAN** 1  
 SCALE: 1/4" = 1'-0"



**PRELIMINARY FLOOR PLAN** 1  
 SCALE: 1/8" = 1'-0"

Proposed  
**MULTI-TENANT SHELL BUILDING**  
 M-59 & BOGIE LAKE RD.  
 WHITE LAKE, MI 48383

REV	DATE	ISSUED FOR REVIEW	ISSUED
02-28-24		CITY COMMENTS	
02-22-24		ISSUED FOR REVIEW	

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DRAWN BY: CMS  
 CHECKED BY: VW, JR  
 IN CHARGE: WV, JMR  
 SHEET NAME:  
 PRELIMINARY FLOOR PLAN & DETAILS

JOB NO: 22-051

SHEET NO: PP-5

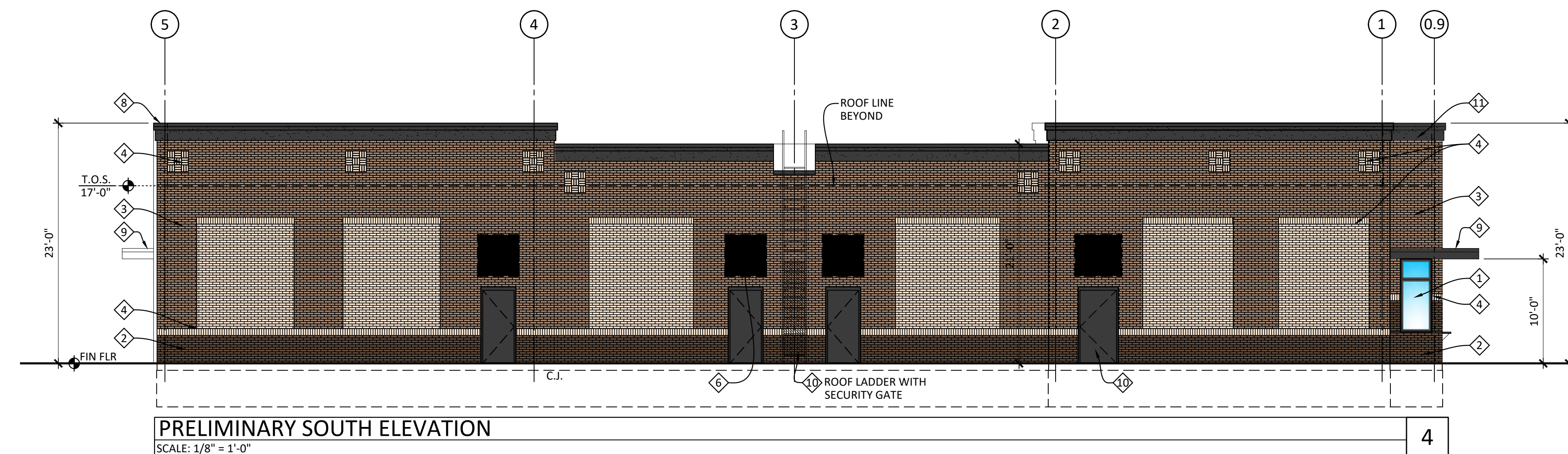
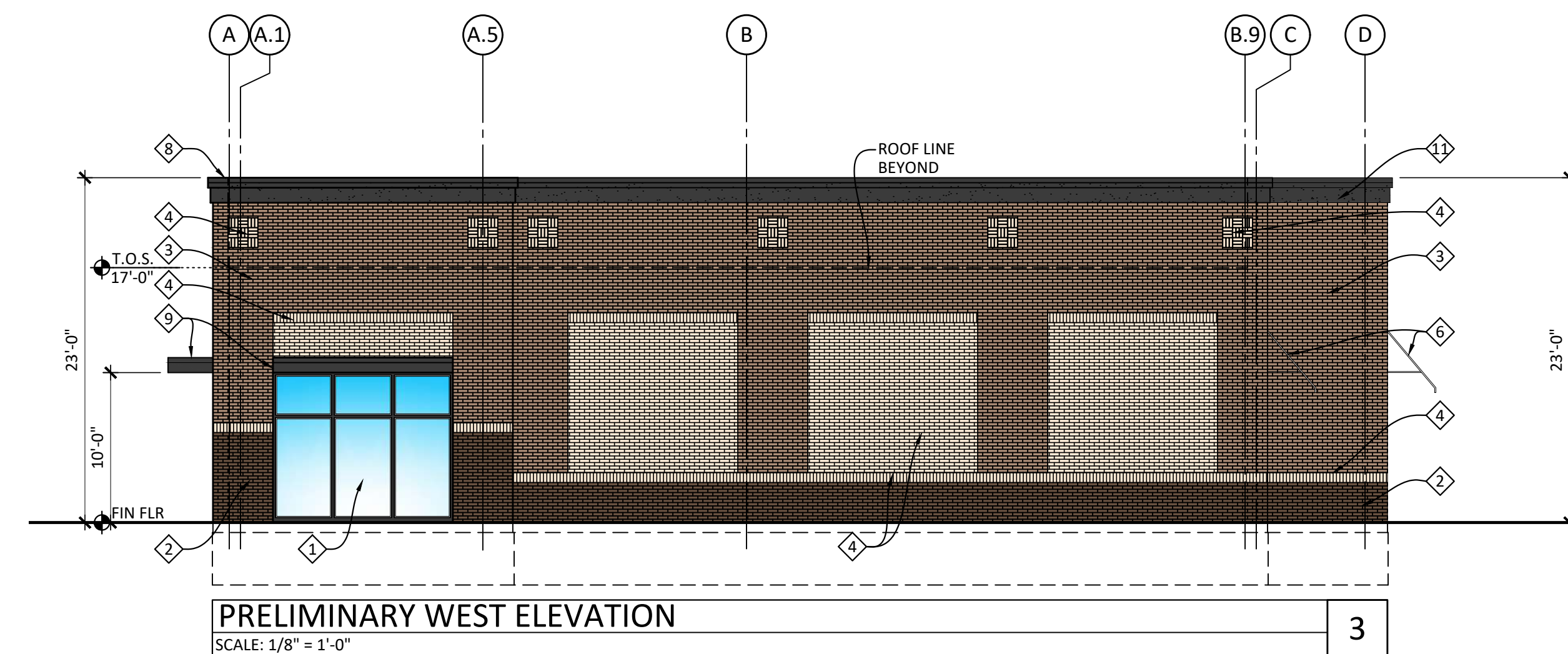
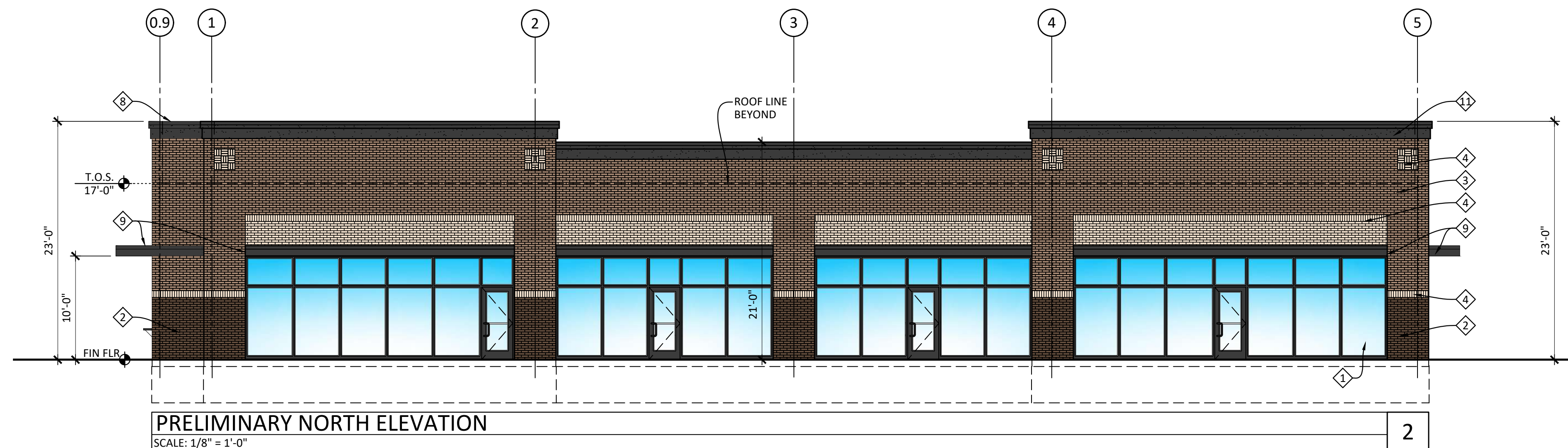
**EXTERIOR FINISH KEY**

- 1 STOREFRONT  
THERMALLY BROKEN ALUM. FRAME  
W/INSULATED GLAZING  
MFR: T.B.D. COLOR: BLACK  
SPL - DENOTES SPANDREL GLAZING
- 2 MODULAR BRICK VENEER  
MANUF.: T.B.D.  
COLOR: DARK BROWN
- 3 MODULAR BRICK VENEER  
MANUF.: T.B.D.  
COLOR: MEDIUM BROWN
- 4 MODULAR BRICK VENEER  
MANUF.: T.B.D.  
COLOR: LIGHT BROWN
- 5 NOT USED
- 6 ALUMINUM FRAME AWNING  
FABRIC ON ALUMINUM FRAME AWNING  
BY LANDLORD  
MANUF.: T.B.D. COLOR: BLACK
- 7 NOT USED
- 8 PREFINISHED METAL COPING  
MFR: FIRESTONE  
COLOR: (MATCH) DARK BROWN
- 9 METAL CANOPY  
MFR: T.B.D.  
COLOR: MATTE BLACK
- 10 PAINT  
MFR: SHERWIN WILLIAMS  
COLOR: SW 6989 "DOMINO"
- 11 EIFS  
MFR: T.B.D.  
COLOR: DARK BROWN

- NOTES:
1. PROVIDE 5/8" FRP PLYWOOD SUBSTRATE AS REQUIRED AS REQUIRED FOR ALL SIGN BOXES, SCUNCES, UTILITIES, AWNINGS.
  2. ALL GLAZING SHALL BE TEMPERED AS REQUIRED ADJACENT TO DOORS AND FINISHED FLOOR

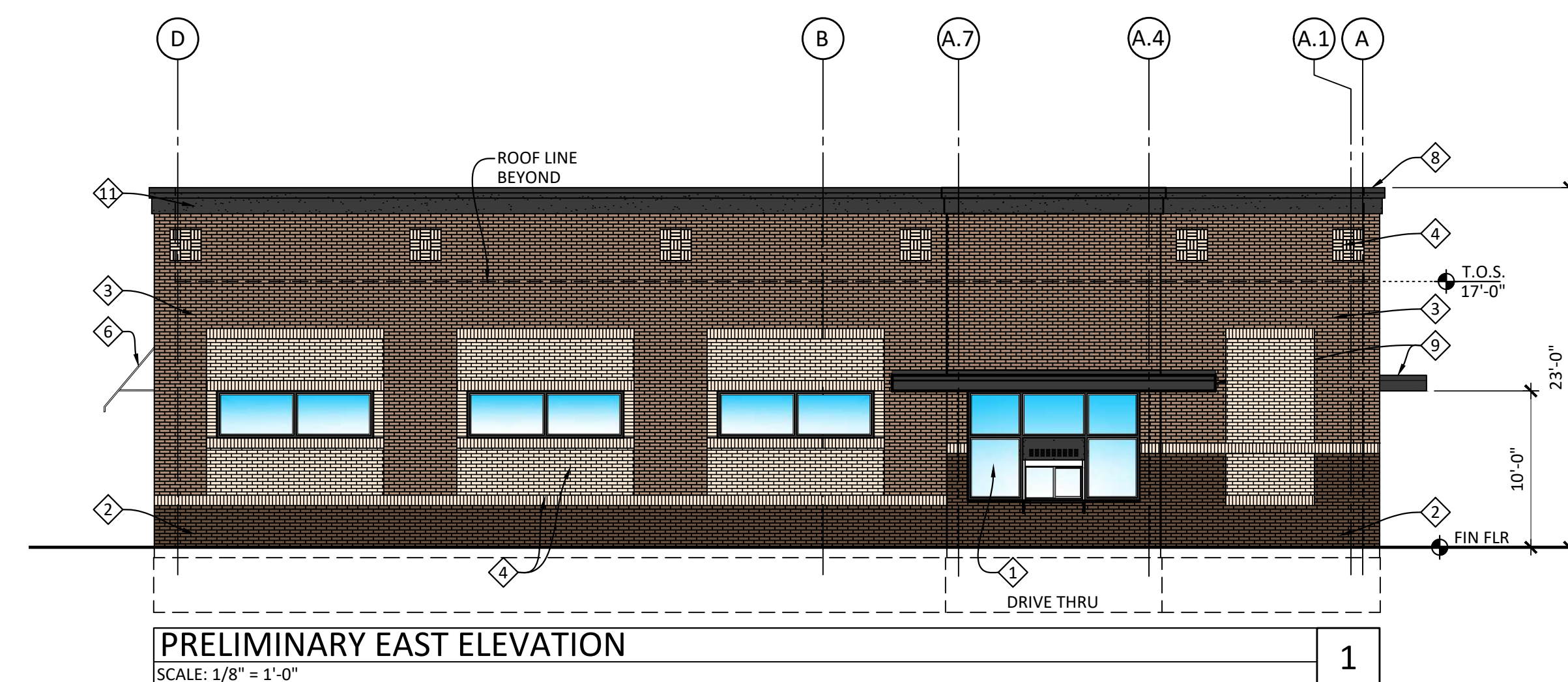
**GLASS CALCULATION**

ELEVATION AREA: 2,631 SF  
 GLASS AREA: 983 SF  
 GLASS RATIO: 983/2,631 = 37.36 %



**GLASS CALCULATION**

ELEVATION AREA: 1,802 SF  
 GLASS AREA: 167 SF  
 GLASS RATIO: 167/1,802 = 9.27 %



**Proposed  
 MULTI-TENANT  
 SHELL BUILDING**

M-59 & BOGIE LAKE RD.  
 WHITE LAKE, MI 48383

REV	DATE	ISSUED
02-28-24		CITY COMMENTS
02-22-24		ISSUED FOR REVIEW

This drawing is an instrument of service, remains the property of Detroit Architectural Group, Inc. Any changes, publication, or unauthorized use is prohibited unless expressly approved.



DRAWN BY: CMS  
 CHECKED BY: VW, JR  
 IN CHARGE: VW, JMR  
 SHEET NAME:  
 PRELIMINARY ELEVATIONS

JOB NO: 22-051  
 SHEET NO: PP-5.1



**WHITE LAKE TOWNSHIP**  
***COMMUNITY DEVELOPMENT DEPARTMENT***

**DATE:** March 22, 2024  
**TO:** Joe Seward, Chairperson  
Planning Commission  
**FROM:** Sean O'Neil, Community Development Director  
**SUBJECT:** 2024 Master Plan

---



Please find attached, the final draft of the 2024 White Lake Township Master Plan. We are now at the point where the plan is ready to take its final steps in the process. Pursuant to Planning Enabling Act 33 of 2008, the Planning Commission is required to hold a public hearing, to receive comments on this draft plan, prior to its adoption.

The Planning Commission will be holding the required public hearing on the draft Master Plan at its April 4<sup>th</sup> meeting. If you have any questions, or require additional information, please do not hesitate to contact the office.

Thank you.



# White Lake Township

## 2024 Master Plan



April 2024

Insert Resolution

# Acknowledgments

## BOARD OF TRUSTEES

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## ADMINISTRATIVE STAFF

Sean O'Neil, AICP, Community Development Director  
Justin Quagliata, Staff Planner  
Hannah Kennedy-Galley, Executive Secretary

## List of Figures

Figure 01: Voorheis' Landing	10
Figure 02: The White Lake Inn	11
Figure 03: Summary of Key Community Indicators	17
Figure 04: Population: White Lake Township & Oakland County (1990-2045)	18
Figure 05: Age Distribution: White Lake Township & Oakland County (2010–2020)	20
Figure 06: Racial Composition: White Lake Township & Oakland County (2020)	21
Figure 07: Disability Characteristics (2020)	21
Figure 08: Educational Attainment: White Lake Township & Other Communities (2020)	22
Figure 09: Median Income: White Lake Township, Oakland County, and State of Michigan (2010-2020)	23
Figure 10: Household Incomes: White Lake Township and Oakland County (2020)	23
Figure 11: Demographics: Key Takeaways	24
Figure 12: Floodplain Vs. Floodway	27
Figure 13: Natural Features & Open Space: Key Takeaways and Recommendations	38
Figure 14: Age of Housing Stock: White Lake Township & Oakland County (2010-2020)	42
Figure 15: Housing Value (2020)	43
Figure 16: Age of Housing Stock: White Lake Township & Oakland County (2010–2020)	44
Figure 17: Homeowner Affordability (2020)	44
Figure 18: Renter Affordability (2020)	44
Figure 19: Monthly Rent: White Lake Township & Oakland County (2020)	45
Figure 20: Current Housing Type and Future Preferences	47
Figure 21: Current Housing Size and Future Preferences	48
Figure 22: Housing Tenure Status by Age of Respondents	49
Figure 23: Housing Attainability by Age of Respondents	49
Figure 24: Duration in Current Home	50
Figure 25: Missing Middle Housing	50
Figure 26: Key Housing Strategies	53
Figure 27: Commute Patterns, White Lake Township, 2019	59
Figure 28: Transportation & Mobility: Ongoing & Proposed Transportation Improvements	65
Figure 29: Community Facilities: Key Takeaways	74
Figure 30: Industry Employment Over Time (2010-2020)	77
Figure 31: Median Annual Earnings by Industry (2020)	78
Figure 32: Conceptual Rendering – Pontiac Lake Gateway	85
Figure 33: Conceptual Rendering – Lakes Town Center	86
Figure 34: Conceptual Rendering – Cedar Island and Bogie Lake Roads	87
Figure 35: Economic Development: Key Takeaways	90
Figure 36: Key Land Use Strategies	98



## List of Maps

Map 01: Regional Location	9
Map 02: FEMA Flood Hazard Zones	28
Map 03: Watersheds	31
Map 04: Annual Groundwater Recharge	32
Map 05: White Lake Township Wellhead Protection Area Map-Wellhead Capture Zones	33
Map 06: Wetlands	35
Map 07: Potential Conservation Areas	36
Map 08: CDBG Area-Wide Benefits: White Lake Township	52
Map 09: National Functional Classification	58
Map 10: The Pavement Surface Evaluation and Rating (PASER)	60
Map 11: Crashes 2021	62
Map 12: Sanitary Sewer Master Plan	70
Map 13: Existing Land Use	93
Map 14: Future Land Use Map	104

## List of Tables

Table 01: Master Plans of Neighboring Municipalities	13
Table 02: Population: White Lake Township & Other Communities (1990-2020)	18
Table 03: Population Forecast: White Lake Township & Oakland County (2020–2045)	19
Table 04: Households: White Lake Township & Oakland County (2010-2020)	19
Table 05: Median Income: White Lake Township & Other Communities (2020)	23
Table 06: Watershed and Subwatershed Management Plans	30
Table 07: Type of Wetlands	34
Table 08: Green Infrastructure Methods	37
Table 09: Total Housing Units: White Lake Township & Other Communities (2010–2020)	41
Table 10: Housing Sale Inventory, White Lake Township (May 2022-May 2023)	42
Table 11: Household Income in the Past 12 Months by Monthly Gross Rent (2020)	45
Table 12: Current Housing Size and Future Preferences by Age	48
Table 13: Injury Caused by Crashes in 2021	61
Table 14: Labor Force Participation (2020)	77
Table 15: Economic Base	79
Table 16: Growth and Decline Spectrum	80
Table 17: Top Industry Trends	80
Table 18: Top Five Export Industries in White Lake Township (2019)	81
Table 19: Top Five Employers in White Lake Township (2019)	82
Table 20: ALICE Budget	82
Table 21: Top Five Largest Industries in White Lake Township by Economic Output (2019)	83
Table 22: COVID Impacts	83
Table 23: Proposed Corridor Improvement Authority Projects	88
Table 24: Economic Development Partners	90
Table 25: Existing Land Use	94
Table 26: Zoning of Vacant Land, 2023	97
Table 27: Goal Survey Results	100
Table 28: Action Plan	101
Table 29: Future Land Use and Zoning	103

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# Table of Contents

Introduction & Background	8
Demographics	16
Natural Features & Open Space	26
Housing	40
Transportation & Mobility	56
Community Facilities	68
Economic Development	76
Land Use	92
Goals & Implementation	100
Appendix	106

# Introduction & Background

## INTRODUCTION

White Lake Township's Master Plan presents an opportunity to set the course for sustainable growth and development over the next decade. This 2024 Master Plan update occurs at a favorable time: following a decade of rapid growth, the pace of growth is slowing down, household compositions are changing, the population is aging, housing preferences are diversifying, value for natural features and open space is exponentially growing in this post COVID-19 pandemic era, and land use patterns are undergoing a transformation. To capture these shifting trends, this Plan is comprehensive in scope; it evaluates existing data, trends, and land use patterns to develop and coordinate strategies for managing natural features, housing, transportation, economic development, and future land use in the Township. Propelled by community input, this Master Plan establishes a vision of the future, defines community goals and objectives, and details actions and land use patterns consistent with the defined goals and visions of the Township.

### What is a Master Plan?

The Michigan Planning Enabling Act (PA 33 of 2008) enables municipalities to write a Master Plan that broadly guides development to meet current and future needs and promotes the health, safety, and general welfare of its residents. A Master Plan is a long-range, comprehensive document that guides decisions about future development based on existing and forecasted conditions and trends, community needs and preferences, and plans best practices. The Plan is intended to represent the community's consensus and serve as a guide for decision-making regarding the Township's future. The Michigan Planning Enabling Act (MPEA) also requires all municipalities to review its Master Plan every five years to determine if an update is needed. Since the adoption of White Lake Township's Master Plan for Land Use 2010-2011, changes in Township

demographics and socio-economic compositions have warranted a re-evaluation of the Township's policies with respect to growth, development, and land use. To this end, White Lake Township's 2024 Master Plan update aims to chart a path for a desirable future with a strong emphasis on short- and long-term goals and action strategies.

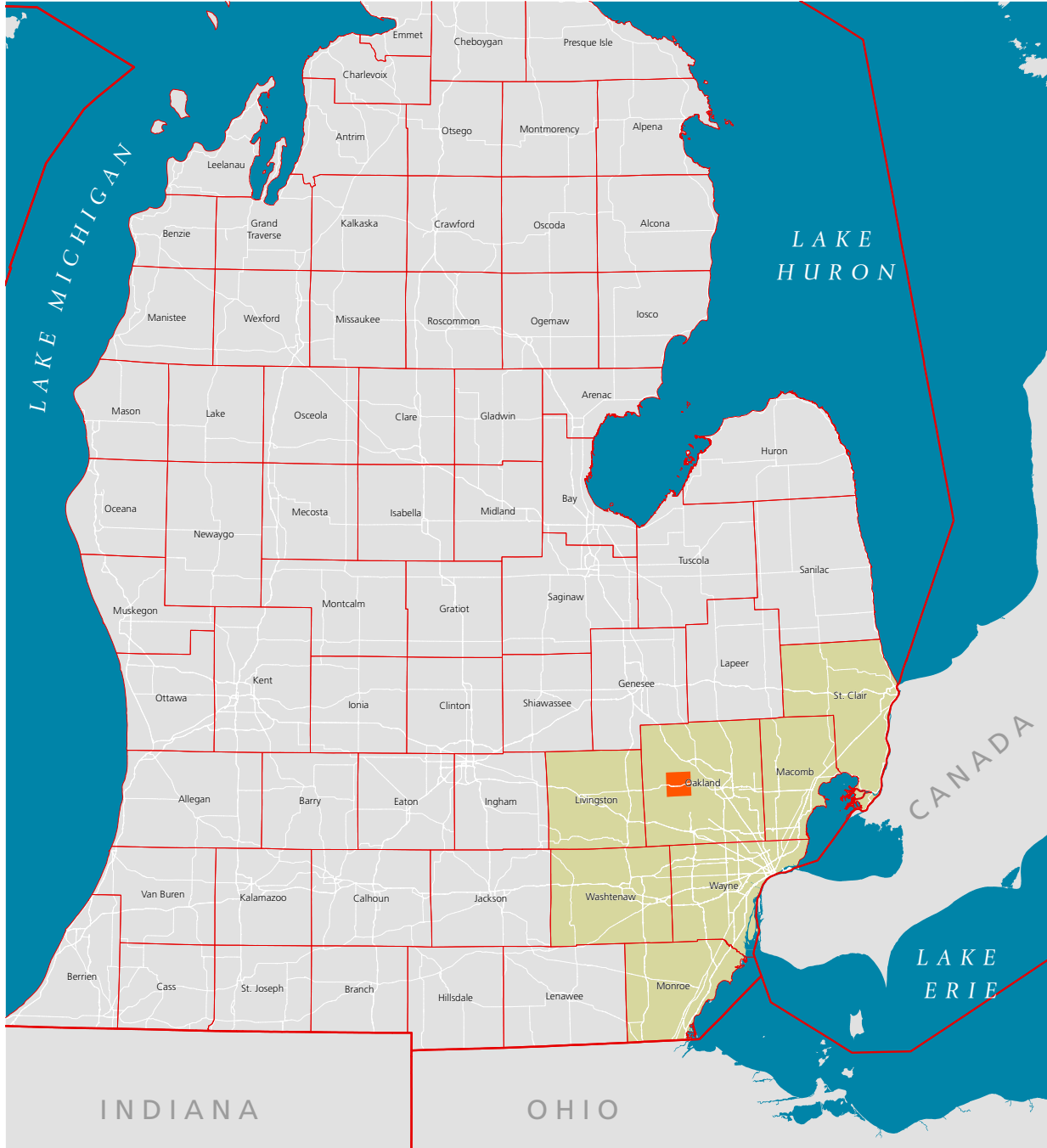
### Relationship to Zoning Ordinance

The Master Plan is not a binding agreement but rather a planning framework. The Zoning Ordinance, on the other hand, is local land use law. The Zoning Ordinance is a set of regulations that provide the details for how and where development can locate to exacting specifications. Thus, the Zoning Ordinance implements the Master Plan; and, as outlined in the MPEA, a direct relationship between the two documents is required. For example, if it emerges through community engagement and research the housing types available do not adequately serve the population, then a vision statement in the Master Plan could read "to plan for housing types that meet all the preferences of all age groups, income levels, and disabilities." To ensure that this vision is implemented, a municipality would revisit the Zoning Ordinance to determine if the land use code is preventing a particular type of development through height restrictions or lot size requirements. Only when the two documents are in sync can they be effective planning tools.

## REGIONAL CONTEXT



White Lake Township is located in central Oakland County in the Western Lakes area and is a suburban community within the Detroit metropolitan area, with the southeastern most area of the Township located 19 miles northwest of the Detroit city limits. The Township is spread over 37.1 square miles with a population of 30,950 in 2020.<sup>1</sup> The development pattern in the Township is determined by the availability of public utilities and is a mix of both urban and rural character.

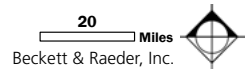
### Map 01: Regional Location



## Regional Location

Sources: Michigan Open Data Portal, Oakland County, White Lake Township

-  White Lake Township
-  SEMCOG





White Lake Township is a part of the Southeast Michigan Council of Governments (SEMCOG) region that consists of Oakland, Livingston, Macomb, Monroe, St. Clair, Washtenaw, and Wayne Counties. The Township is bordered by Springfield Township to the north, Waterford Township to the east, Commerce Township to the south, and Highland Township to the west. West Bloomfield Township meets White Lake Township at its southeast corner, forming the "Four Towns" area along Union Lake and Cooley Lake Roads, with Commerce and Waterford Townships.

The Township is bisected by State Highway M-59 running east-west through the Township. The M-59 thoroughfare continues about 10 miles west to connect the Township with US-23, which runs north to Flint and south to Brighton and Ann Arbor, and continues east through metro Detroit to find a terminus at Chesterfield & Harrison Townships. Interstate 75 (I-75), which runs north to Flint and south to southeast to Detroit, can be accessed about three miles northeast.

With an abundance of greenspace and year-round recreational opportunities (25% of the land use in the Township), the Township's slogan "Four Seasons Playground" is well suited. The Township is also part of the region around the Huron River that has been established as the "Huron River Valley" by Oakland County, which expands recreational access regionally.

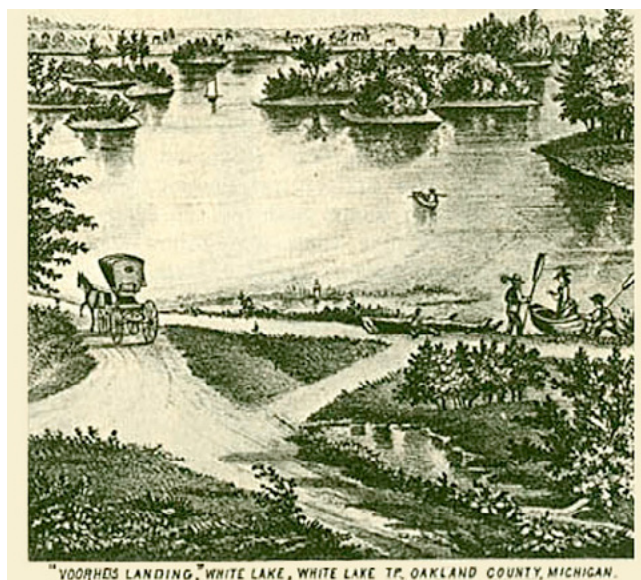
### BRIEF HISTORY OF WHITE LAKE TOWNSHIP

White Lake Township was organized as a Township in Oakland County in 1836; prior to that, there were two villages: White Lake Settlement and Oxbow Lake Village.<sup>2</sup> The White Lake Settlement was located in the area of White Lake and Ormond Roads. The first settlers arrived around the White Lake area in the 1820's. During that time, and for several years to follow, an indigenous encampment was located on the shores of White Lake Road; that is when White Lake Road began as a well-used trail of the Native Americans.<sup>3</sup> Harley Olmsted came to the White Lake Settlement from Monroe County, New York in 1830 and built the first house in 1832.<sup>4</sup> Oxbow Lake Village, located on what is now Elizabeth Lake Road near Oxbow Lake, was started by Erastus Hopkins, who bought 320 acres in 1833 when he came to Michigan from New York.<sup>5</sup> Harley Olmsted, Erastus Hopkins, and other early settlers established churches, schools, post offices, and other business operations.

Agriculture was the early predominant land use and economic driver in the White Lake Settlement and Oxbow Lake Village areas. However, arrival of a stagecoach line as early as 1836 routed through White Lake Road to run between Grand Rapids and Detroit, with a stop at the White Lake Settlement beginning in 1837, opened new opportunities for regional trade.<sup>6</sup> One of the area's most significant achievements was the lumbering era, the impetus for the settlement of the White Lake community.<sup>7</sup> Building on the longstanding history of lumber trade around White Lake and Duck Lake, the Hopkins Mills (grist mill and sawmill) was established in Oxbow Village.<sup>8</sup>

The turn of the 20th century and the Industrial Revolution proved Detroit as an industrial and manufacturing base, and the suburbs around White Lake were beneficiaries of the population and economic growth. During this period, the population in White Lake Township exponentially grew from 1,114 (1930) to 22,608 (1990) and so, seemingly, residential development in the Township also increased.<sup>9</sup> In addition to being a sought-after residential suburb of Detroit, the Township's popularity in the region was furthered by the abundance of recreational opportunities offered around its 21 named lakes.<sup>10</sup> Progressing into the 21st century, White Lake carried forward its rich agricultural history in the rural parts of the Township while continuing its legacy as a recreational destination in Southeast Michigan.

Figure 01: Voorheis' Landing



Source: White Lake Citizens League

Figure 02: The White Lake Inn



Source: The White Lake Inn

### PLANNING EFFORTS IN WHITE LAKE TOWNSHIP

White Lake Township has engaged in multiple planning efforts in the past. The following section is a description of these efforts.

#### 2011 | 2010-2011 White Lake Township Master Plan for Land Use<sup>11</sup>

This 2024 Master Plan update intends to be the next iteration of the White Lake Township Master Plan for Land Use adopted in 2011. It is, therefore, important to evaluate the 2011 Plan to determine which goals have been achieved, which goals are still relevant, and which goals haven't been achieved. For the goals that haven't been achieved, this Master Plan update presents an opportunity to evaluate potential barriers and rethink the actions required to achieve the goal(s) in the future. The 2011 Master Plan contained six goals themed around natural features, infrastructure, residential neighborhoods, land use, services, and recreation. The associated strategies for each goal were divided into tasks in which the Planning Commission took the lead and those that required discussion and partnership with other Township boards and/or groups outside the Township.

#### 2023 | 2024-2029 White Lake Township Capital Improvement Plan (CIP)<sup>12</sup>

The 2024-2029 White Lake Township Capital Improvement Plan (CIP) serves as a tool to assist

White Lake Township in turning long-range policy planning into real improvements on the ground. It provides a schedule of expenditures for constructing, maintaining, upgrading, and/or replacing a community's physical inventory. The Township has several facilities in the pipeline including a new Public Safety headquarters, Township Civic Building, and a Maintenance Building totaling \$35 million. The CIP has also budgeted for several of the improvements outlined in the Township's Park and Recreation Master Plan, including \$1.75 million of Township funds for the construction of Stanley Park. Other major expenses include \$2.2 million towards Western Outlet Sanitary Extension, \$4 million towards the construction of a satellite fire station, and \$5.5 million towards a new iron filtration and sewer connection at the Aspen Meadows well site.

#### 2023 | 2023-2027 White Lake Township Parks and Recreation Master Plan<sup>13</sup>

White Lake Township Parks and Recreation Master Plan is intended to guide future Parks and Recreation programs, services, operations, and maintenance for the five-year term. In addition, the plan is intended to form the basis for future applications for recreation grant funding from the Michigan Department of Natural Resources and other granting agencies and foundations. White Lake operates six Township parks: Stanley Park, Ferdinand C. Vetter Park, Judy Hawley Park, Hidden Pines Park, Bloomer Park, and Fisk Farm. In addition to the Township-owned parks, the public and parochial schools in White Lake provide recreational opportunities. The plan pursues long-range recreational goals and objectives through specific short-range actions on the part of the Township, County, and State as well as private entities.

#### 2017 | Civic District Development Study<sup>14</sup>

The intent of the Civic District (CiDi) Development Study was to leverage the design and planning of the proposed Civic Campus with the surrounding region to create momentum that spurred development with an emphasis on creating a walkable, active small-town center that is sustainable and attractive for residents and business. The design and planning process utilized research, analysis, and community input to develop a planning approach that was uniquely targeted to White Lake Township through a series of strategies that addressed infrastructure,

stormwater management, environment and ecology, recreation, land use, neighborhood connectivity, and development density. The recommendations were as follows:

- » Implementing a focused downtown master plan integrated with the shopping center at Town Center Boulevard and adjacent to Brendel Lake could propel the region as an economic engine for the Township and create a unique destination that would epitomize the identity of the community.
- » Create a higher density of development at the intersection of Elizabeth Lake Road and Town Center Boulevard that would be characterized as a walkable district.

## REGIONAL PLANNING CONTEXT

Regional and County-wide demographic and socio-economic trends and changes influence growth and development patterns in the Township. To capture these larger regional planning trends, this section reviews the surrounding communities and their Master Plans, Oakland County's planning efforts, and SEMCOG's regional plans to determine how land use planning in neighboring jurisdictions and the region may impact White Lake Township.

### Master Plans of Neighboring Municipalities

The Township is bordered by Springfield Township to the north, Waterford Township to the east, Commerce Township to the south, and Highland Township to the west. The Future Land Uses (FLUs) and the Future Land Use Maps (FLUMs) of these four municipalities are summarized in the table titled: "Master Plans of Neighboring Municipalities" with the purpose of ensuring compatible land usage along Township boundaries. An important consideration while reviewing the table is the Master Plans of all four surrounding Townships are either past or approaching the end of the designated adoption period. In the event the municipalities adopt a new Master Plan, the future land use along the periphery may change, warranting a re-evaluation of land use

compatibility along the jurisdictional boundaries.

### 2020 | Oakland County Economic Development Strategic Plan<sup>15</sup>

The purpose of this plan is to provide the Economic Development (ED) Department with the structure, programs, and resources necessary to foster sustainable economic vitality. The plan aims to catalyze innovation, investment, and growth in Oakland County through business vitality and diversification, community development and planning, and talent development and attraction. Oakland County aims to leverage its assets to build a more robust and comprehensive program that will generate long-term prosperity. The plan consists of several strategies including collaboration with the business community and local authorities.

### 2021 | Comprehensive Economic Development Strategy for Southeast Michigan<sup>16</sup>

The Comprehensive Economic Development Strategy for Southeast Michigan (CEDS) serves as a required vehicle through which the U.S. Economic Development Administration (EDA) evaluates grants and resource requests for the seven-county SEMCOG region, including Oakland County. The CEDS outlines the following economic development strategies:

- » Creating and marketing quality places
- » Anticipating demands for land use
- » Investing in critical infrastructure
- » Fostering a competitive business climate
- » Advancing technology, innovation, and entrepreneurship
- » Preparing and connecting talent with jobs.

The Township can coordinate with the County and SEMCOG to determine the current status of the CEDS and tap into potential grants and resource requests through the U.S. EDA.

Table 01: Master Plans of Neighboring Municipalities

	Springfield Township <sup>17</sup>	Waterford Township <sup>18</sup>	Commerce Township <sup>19</sup>	Highland Township <sup>20</sup>	West Bloomfield Township <sup>21</sup>
<b>Location</b>	North of White Lake Township	East of White Lake Township	South of White Lake Township	West of White Lake Township	Small portion South of White Lake Township
<b>Document Title</b>	Springfield Township Master Plan	Waterford Township Master Plan 2003–2023	Commerce Township Master Plan	Highland Township Comprehensive Land Use Plan 2000-2020	The Charter Township of West Bloomfield Master Plan
<b>Year Adopted</b>	2009 (Amended: 2016)	2003	2015	2000	2010
<b>Future Land Uses Along Shared Boundary with White Lake Township</b>	<ul style="list-style-type: none"> <li>» Low Density Residential</li> <li>» Recreation-Conservation</li> <li>» Limited Industrial</li> </ul>	<ul style="list-style-type: none"> <li>» Residential</li> <li>» Public &amp; Open Space</li> <li>» Regional Commerce/Community Business</li> </ul>	<ul style="list-style-type: none"> <li>» Single-Family Residential</li> <li>» Multiple-Family Residential</li> <li>» Public</li> </ul>	<ul style="list-style-type: none"> <li>» Parks and Recreation</li> <li>» Agricultural &amp; Rural Residential</li> <li>» Low Density Residential</li> </ul>	<ul style="list-style-type: none"> <li>» Moderate Density Single Family</li> <li>» Neighborhood Business</li> </ul>
<b>Comparison of Land Use Along Jurisdictional Boundary</b>	<ul style="list-style-type: none"> <li>» The land use in White Lake Township along the northern boundary is also low-density residential barring the Meadow Lake manufactured housing community in the northwest corner.</li> <li>» The recreation land use spills over the boundary with the Indian Springs Metropark &amp; Golf course.</li> <li>» The northeast corner of White Lake Township is largely occupied by Mack Industries.</li> </ul>	<ul style="list-style-type: none"> <li>» The land use in White Lake Township along the eastern boundary is predominantly residential with large areas of recreational land within the Pontiac Lake State Recreation Area and White Lake Oaks Golf Course.</li> <li>» The residential development along this periphery is denser than other areas of White Lake Township.</li> <li>» The commercial land use along Cooley Lake Road extends across the boundary.</li> </ul>	<ul style="list-style-type: none"> <li>» The land use in White Lake Township along the southern boundary is also predominantly residential.</li> </ul>	<ul style="list-style-type: none"> <li>» The Highland State Recreation Area occupies a large portion of the Township south of M-59 along the western boundary of White Lake Township.</li> <li>» There are several recreational/campgrounds and supporting commercial uses around White Lake.</li> </ul>	<ul style="list-style-type: none"> <li>» The land use in White Lake Township along the southern boundary is also predominantly residential.</li> </ul>



	Springfield Township <sup>17</sup>	Waterford Township <sup>18</sup>	Commerce Township <sup>19</sup>	Highland Township <sup>20</sup>	West Bloomfield Township <sup>21</sup>
<p><b>Considerations for White Lake Township's FLUM</b></p>	<ul style="list-style-type: none"> <li>» Future residential land uses along the periphery must be planned carefully depending on the availability of public utilities.</li> <li>» Recreation/ Conservation Areas should be buffered from industrial uses.</li> </ul>	<ul style="list-style-type: none"> <li>» Future residential land uses along the periphery must be planned carefully depending on the availability of public utilities.</li> <li>» Integrate neighborhood scale commercial land uses along its periphery to support the dense residential land uses.</li> </ul>	<ul style="list-style-type: none"> <li>» There are several lakes and natural features scattered along the southern boundary making more intense land uses unsuitable.</li> </ul>	<ul style="list-style-type: none"> <li>» Commercial land uses along this boundary can be consolidated to control development.</li> </ul>	<ul style="list-style-type: none"> <li>» Neighborhood businesses and commercial uses around "Four Towns" can be consolidated to control development.</li> </ul>



Bloomer Park



## Sources

- 1 United States Census Bureau, Decennial Census, 2020.
- 2 White Lake Historical Society, History, <https://www.whitelakehistory.org/history>.
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# Demographics

A demographic analysis provides insights into a community's socio-economic characteristics, growth, and development patterns, and changing needs and preferences. An understanding of demographic trends is a precursor to determining future goals and planning strategies for White Lake Township. It is equally important to recognize demographic trends and growth patterns in a community are not isolated events, but tend to be responses to broader regional socio-economic shifts. Collectively, an awareness of local and regional trends can enable the Township to make the most of its assets while addressing any challenges. To this end, this section examines data and trends relating to the Township's population, households, and economy in comparison to other surrounding communities in Oakland County to provide regional context.

## DATA SOURCES

The demographic data in this chapter is derived from the following sources, in this preferred order:

### 2020, 2010, 2000, and 1990 U.S. Decennial Censuses

Mandated by the United States Constitution, the decennial census is the most accurate source of information recorded by the U.S. Census Bureau as it aims to count 100% of the population. The decennial census is valuable because it provides comparable data points at regular 10-year intervals since 1790. This data is also the basis for congressional apportionment and redistricting which determines funding and resource allocation for a community over the next decade. However, it is important to note the data provided by the decennial census is limited, as the intention is to count 100% of the U.S. population. The survey is intentionally short and covers limited information about household composition, sex, race, and occupancy type (own v. rent). Additionally, the 10-year gap between surveys

means demographic and housing patterns between the decades are not captured in this census.

### American Community Survey (ACS)

The American Community Survey (ACS) was initiated in 2000 and collects more detailed information on social, economic, and housing characteristics compared to the decennial census. Instead of collecting data every 10 years, this survey collects data on an ongoing basis and releases data periodically. However, the long-form format of the ACS makes it logistically difficult to administer the survey for 100% of the population. Instead of surveying the complete population, the ACS samples a percentage of the population to determine estimates for the overall population; therefore, the accuracy of the ACS depends on the population size of the sampling area. To maintain statistical validity, the Census Bureau collects sample data over two different time frames, a one-year or five-year frame, depending on the size of a community. In communities where the population is less than 65,000, data is collected over 60 months (five years) to achieve a valid sample size and generate estimates for the overall population. Since White Lake Township and the surrounding communities (for regional comparison) have a population less than 65,000, this plan uses the ACS five-year estimates.

### Southeast Michigan Council of Governments (SEMCOG)

SEMCOG is a regional planning partnership of governmental units serving the seven-county region of Southeast Michigan including Oakland County. SEMCOG's Regional Forecast provides a long-range and comprehensive view of future demographic and economic changes in Southeast Michigan. This plan uses the 2045 regional forecasts.

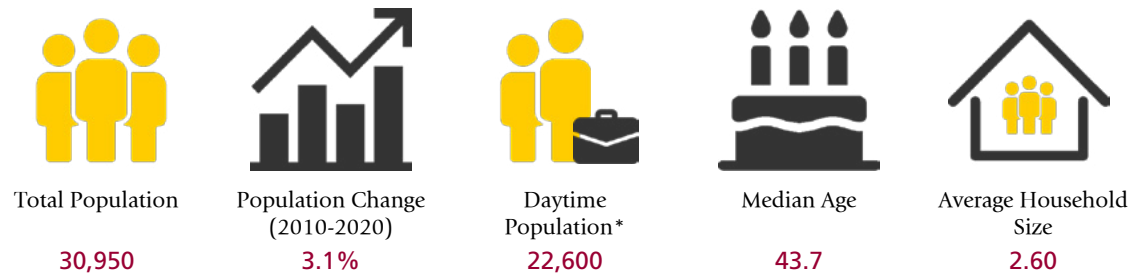
Figure 03: Summary of Key Community Indicators

# SUMMARY OF KEY COMMUNITY INDICATORS

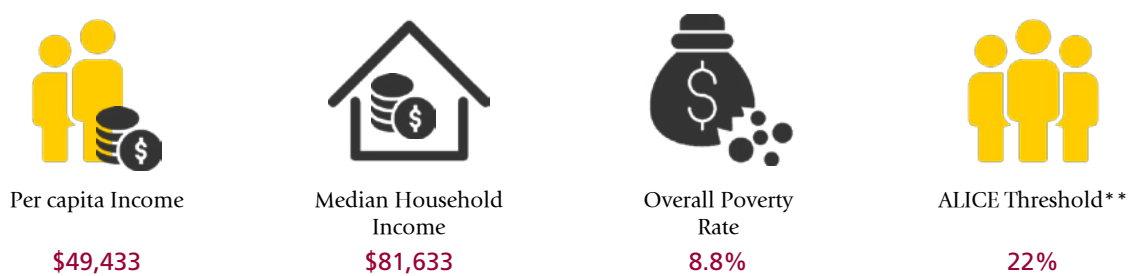
## White Lake Township, MI

### Geography: County Subdivision

#### Population



#### Income



#### Economy & Market



\* Daytime population, refers to the number of people who are present in an area during normal business hours, including workers. This is in contrast to the resident population who are typically present during the evening and nighttime hours.

\*\* Asset Limited, Income Constrained, Employed (ALICE) is a measure that captures individuals who may be above the federal poverty level but still struggle with regular expenses and costs.

\*\*\* Tapestry segmentation profiles are select consumer groups developed by ESRI, defined by shared traits such as demographics, socio-economic status, and behavior.

This infographic contains data provided by the Decennial Census, American Community Survey (ACS), United Force – ALICE, ESRI, ESRI and Data Axle, ESRI and Bureau of Labor Statistics.

# DEMOGRAPHIC PROFILE

## Population

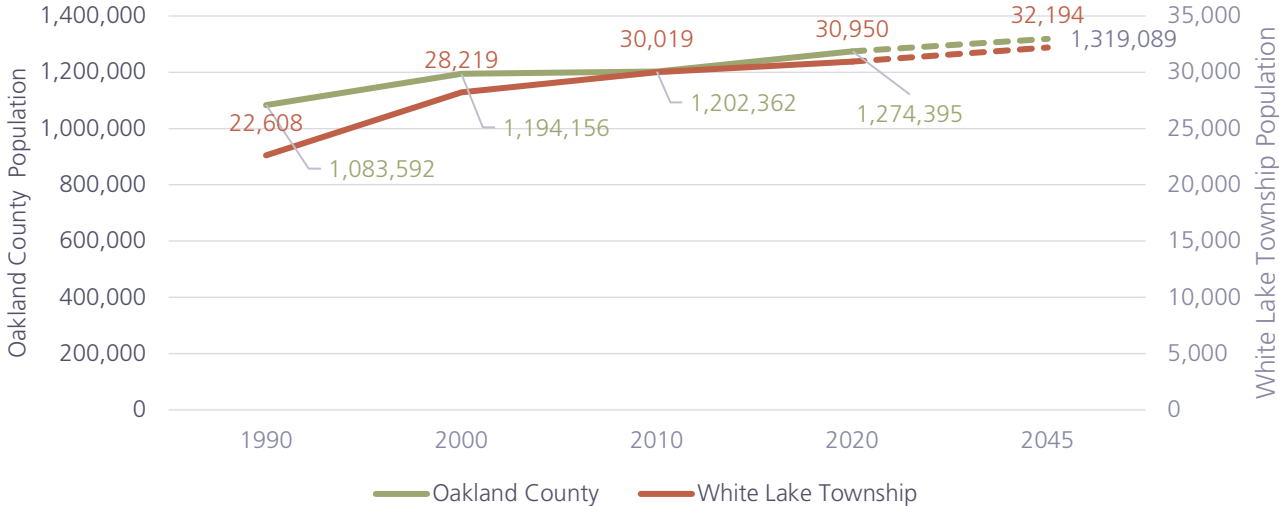
The population of White Lake Township has continually grown in the last three decades to 30,950 in 2020. With the highest growth rate of 25% occurring between 1990–2000, the rate of population growth gradually slowed down to 3.1% between 2010–2020. Even though the Township’s population grew in the last decade, the pace has been slower than the County (6% growth rate) and most surrounding communities, barring Highland Township and Waterford Township where the population declined. The surrounding communities of Commerce Township, Lyon Township, and Orion

Township witnessed a higher growth rate than White Lake Township, likely due to their proximity to urban centers such as Novi and Auburn Hills. These Townships are growing as a result of the out-migration from the densely populated cities, where housing opportunities are scarce, and the cost of living is high.

### Population Forecast

SEMCOG’s 2045 Regional Forecast provides an overview of future population trends in Southeast Michigan. Table 03 titled “Population Forecast” outlines the population forecasts from SEMCOG for the Township and Oakland County over the next several years. SEMCOG anticipates a slow growth

Figure 04: Population: White Lake Township & Oakland County (1990-2045)



Source: U.S. Census Bureau Decennial Census (1990, 2000, 2010, 2020)

Table 02: Population: White Lake Township & Other Communities (1990-2020)

	1990	2000		2010		2020	
	Count	Count	Change	Count	Change	Count	Change
White Lake Twp	22,608	28,219	24.8%	30,019	6.4%	30,950	3.1%
Commerce Twp	26,955	34,764	29.0%	40,186	15.6%	43,058	7.1%
Highland Twp	17,941	19,169	6.8%	19,202	0.2%	19,172	-0.2%
Lyon Twp	9,450	11,041	16.8%	14,545	31.7%	23,271	60.0%
Orion Twp	24,076	33,463	39.0%	35,394	5.8%	38,206	7.9%
Springfield Twp	9,927	13,338	34.4%	13,940	4.5%	14,703	5.5%
Waterford Twp	66,692	73,150	9.7%	71,707	-2.0%	70,565	-1.6%
Oakland County	1,083,592	1,194,156	10.2%	1,202,362	0.7%	1,274,395	6.0%

Source: U.S. Census Bureau Decennial Census (1990, 2000, 2010, 2020)

Table 03: Population Forecast: White Lake Township &amp; Oakland County (2020–2045)

	Census	SEMCOG Regional Forecast					
	2020	2030		2040		2045	
	Count	Count	Change	Count	Change	Count	Change
<b>White Lake Twp</b>	30,950	31,578	2.0%	32,236	2.1%	32,194	-0.1%
<b>Oakland County</b>	1,274,395	1,286,750	1.0%	1,314,016	2.1%	1,319,089	0.4%

Source: United States Census Bureau Decennial Census (2020); Southeast Michigan Council of Governments (SEMCOG)

to occur within both White Lake Township and Oakland County until 2040. The growth is expected to plateau for Oakland County and marginally decline in the Township by 2045.

### Households

Consistent with the population growth in the Township, the total number of households also increased from 10,985 to 11,991 from 2010–2020. However, while the population grew by only 3.1%, the number of households increased by 9.2%. In comparison, Oakland County's population growth rate (6%) was proportionate to the increase in households (5.9%). This pace of growth in the total households in the Township is likely an outcome of changing household dynamics. On one hand, the number of seniors (65 years and above) living alone increased to 10.6% in 2020 from 6.4% in 2010, and the households with at least one senior leaped to 33% from 20%. Additionally, the households with children (under 18 years) slumped to 30% from 37% in 2010.<sup>1</sup> Consequently, the average household size decreased from 2.68 in 2010 to 2.60 in 2020, indicating the population spread out into a greater number of households. The average household size remains larger than the County (2.44) which is typical of townships due to the presence of housing typologies with larger footprints suited for bigger households. In summary, households in White Lake Township are getting smaller but the population is

### Components of Population Change

$$\text{Natural Change} = \text{Total number of Births} - \text{Total number of Deaths}$$

If the number of births is higher than deaths, then the population has undergone a natural increase.

$$\text{Net Migration} = \text{Inward Migration} - \text{Outward Migration}$$

$$\text{Population Change} = \text{Natural Change} + / - \text{Net Migration}$$

continuing to increase. The changing household structure will create a demand for more housing units and infrastructure, which will impact land use in the Township.

### Age

The population of White Lake Township is aging. In 2020, the median age of White Lake Township residents increased to 43.7 years from 41.3 years in 2010. Though the population is also aging in Oakland County (41.0 years median age) and the State of Michigan (39.8 years median age), the median age of the Township is higher.

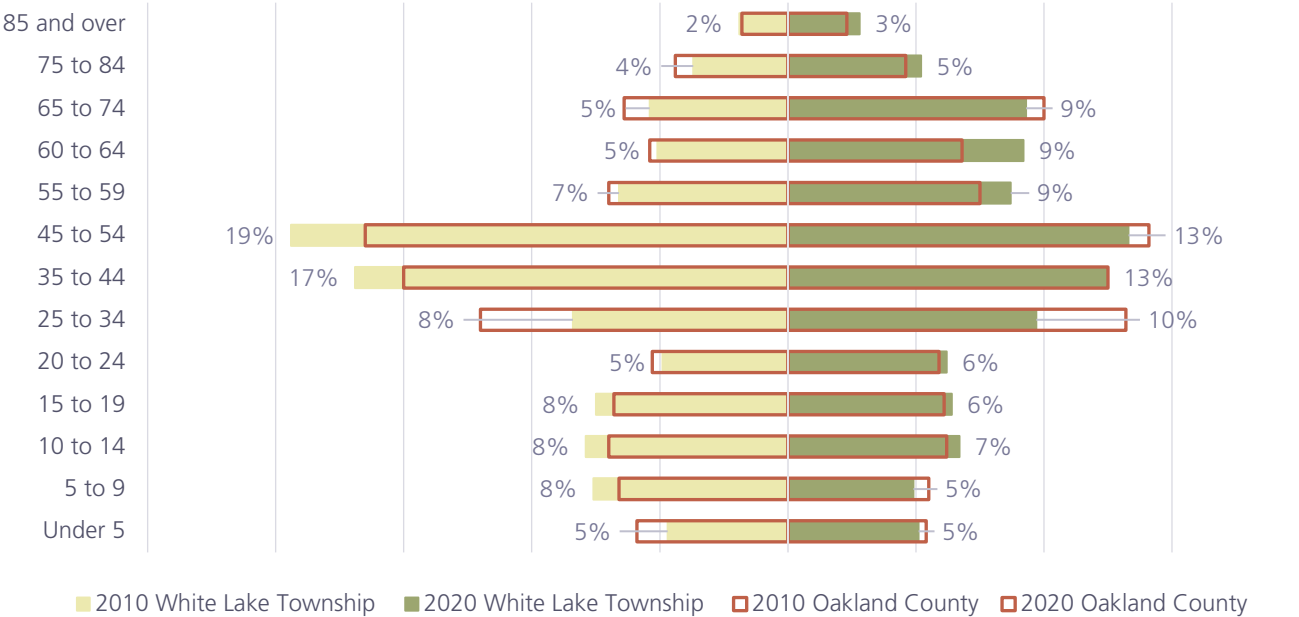
Table 04: Households: White Lake Township &amp; Oakland County (2010-2020)

	Total Households			Average Household Size		Average Family Size	
	2010	2020	Change	2010	2020	2010	2020
<b>White Lake Twp</b>	10,985	11,991	9.2%	2.68	2.60	3.05	3.00
<b>Oakland County</b>	481,040	509,589	5.9%	2.47	2.44	3.08	3.10

Source: United States Census Bureau ACS Five-Year Estimates (2010, 2020)



Figure 05: Age Distribution: White Lake Township & Oakland County (2010–2020)



Source: U.S. Census Bureau ACS Five-Year Estimates (2010, 2020)

The figure titled “Age Distribution: White Lake Township & Oakland County (2010–2020)” illustrates how the age distribution of the Township’s population compares to Oakland County from 2010 to 2020. The 35-44 years (13%) and 45-54 years (13%) cohorts are the largest in the Township. Children and young adults aged 19 years and below represent almost a quarter of the population.

The Township has a lower percentage of younger households in the 25-34 years cohort compared to the County and a relatively low overall concentration of adults in the 20-24 years age group (6%). This depressed number of younger residents may be a consequence of two factors. First, young adults are likely to move out of the Township after graduating high school to pursue higher education or employment opportunities. Second, this cohort may be migrating out in pursuit of wider housing opportunities (smaller units, lesser price points, more rental units, etc.) or quality of life opportunities (vibrant downtowns, better programming for youngsters, etc.). Since the 20-34 years group represents the age at which most people begin to start families, providing diverse housing opportunities and adequate leisure and recreation opportunities tailored to this age group is key to attracting and retaining new and young families.

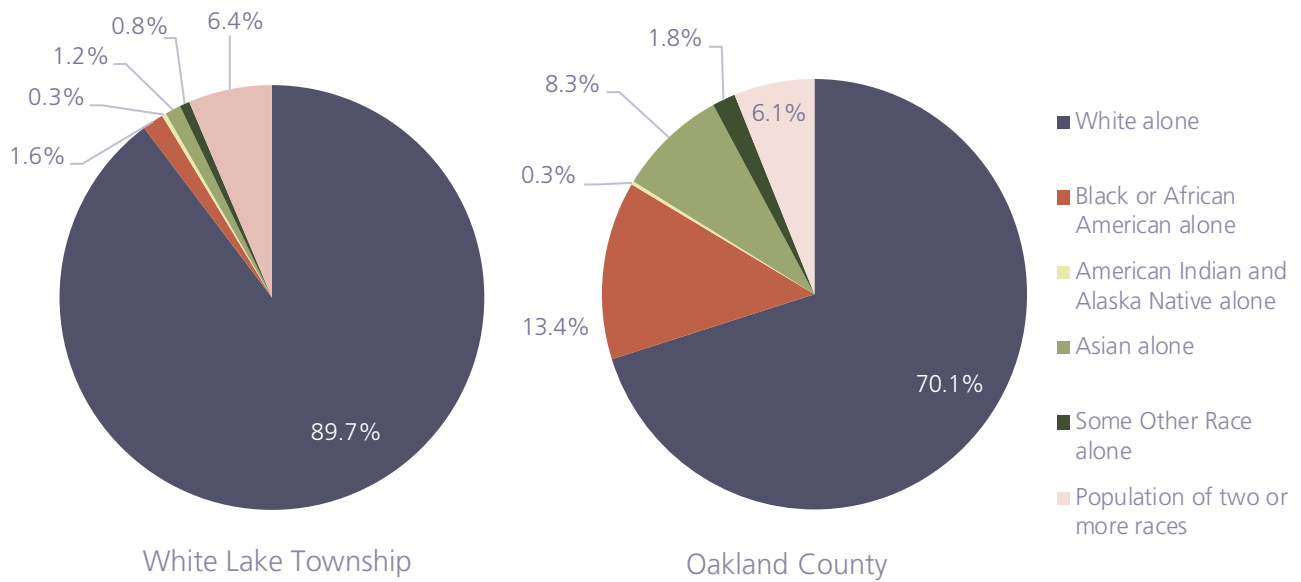
The term “empty nesters” generally refers to

households that no longer have children living at home. Typically aged 55-64 years, this age cohort grew from 12% to 18% between 2010–2020 to surpass the County percentages (14%).<sup>2</sup> Indicative of an aging population, the senior population (65 years and above) in the Township grew from 11% to 17%.<sup>3</sup> SEMCOG’s 2045 Regional Forecast predicts between 2015 and 2045 the senior age cohort will add 3,834 residents while the distribution of population in all other cohorts will decrease.<sup>4</sup> The aging population will result in an increased demand for specific housing options (assisted living, nursing homes, etc.), healthcare facilities, and leisure options so residents can age in place. Land use patterns will also have to be planned for proximity of services for the elderly to address concerns of limited mobility. Altogether, the age dynamics in the Township present challenges to retain (and potentially attract) young households while ensuring mature households and seniors have resources to transition through life and age in the Township.

**Racial and Ethnic Composition**

White Lake Township’s racial and ethnic composition has undergone marginal change over the last decade. In 2020, nearly 90% of the Township’s population identified as solely White compared to 94% in 2010.<sup>5</sup> This change is a result of 6.4% of the residents identifying as biracial or multiracial in 2020

Figure 06: Racial Composition: White Lake Township & Oakland County (2020)



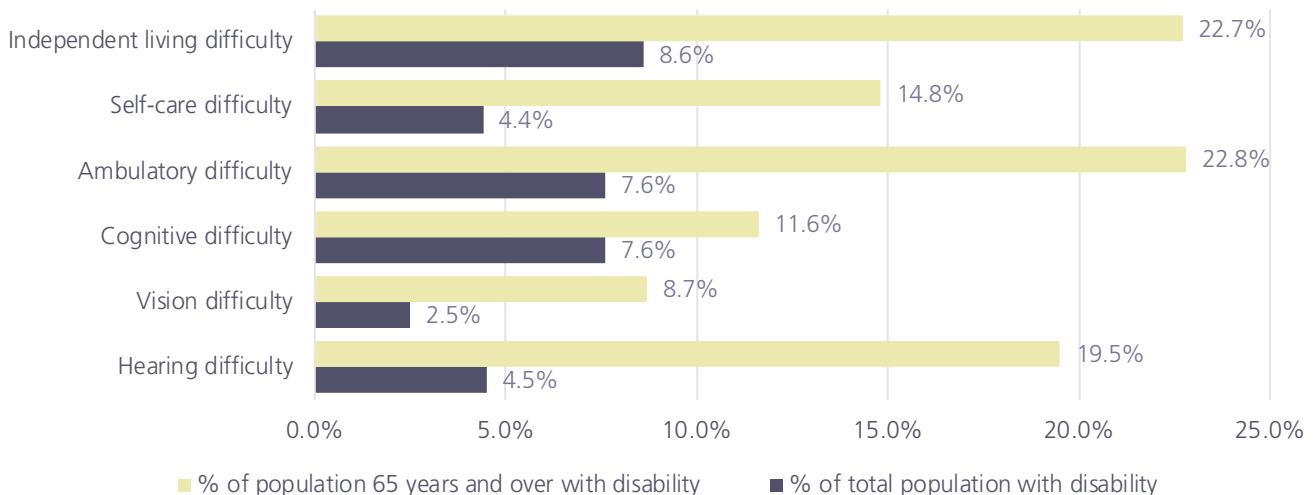
Source: U.S. Census Bureau Decennial Census (2010, 2020)

compared to only 1.3% in 2010. African Americans and Asians account for 1.6% and 1.2% of the population, respectively. All other races together only account for 1% of the population. The percentage of the population identifying as Hispanic or Latino (considered an ethnicity and not a race in the U.S. Census as of 2020) in the Township increased from 3.0% to 3.6% between 2010 to 2020.<sup>6</sup> The Township’s population is racially homogeneous compared to Oakland County’s population wherein only 70% of the population identify as solely White.

### Disability

Land use patterns impact the lives of people with disabilities, especially in aging communities accommodating needs and requirements of the disabled population. Approximately 15% of White Lake Township’s population and almost 40% of seniors have a disability.<sup>7</sup> Independent living difficulty affects 8.6% of the population followed by cognitive difficulty (7.6%) and ambulatory difficulty (movement difficulty, 7.6%). Amongst the elderly population (65 years and above), ambulatory

Figure 07: Disability Characteristics (2020)



Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

difficulty (22.8%) and independent living difficulty (22.7%) are most prevalent. Much of the Township's aging population will require support facilities including mobility assistance, accessible living facilities, or other specialized healthcare services. The needs of this population also have implications for the design of housing and public services and spaces.

## SOCIO-ECONOMIC PROFILE

### Education

Educational attainment is a key indicator of socio-economic status as it influences employment opportunities for residents, and relatedly, the companies located in a community. In 2020, roughly 93% of White Lake Township adults over the age of 25 possess at least a high school diploma and 32% have at least a bachelor's degree.<sup>8</sup> The age of 25 is used as the benchmark for educational attainment because it is assumed most people will have completed their education by the age of 25. In addition to the 32% of residents that have a bachelor's degree, 27% of residents above the age of 25 years have at least some college education, indicating a presence of an educated and skilled workforce.<sup>9</sup> However, in comparison to other nearby communities and the County as shown in the figure titled "Educational Attainment: White Lake Township & Other Communities (2020)," the Township ranks next to last in the percentage of

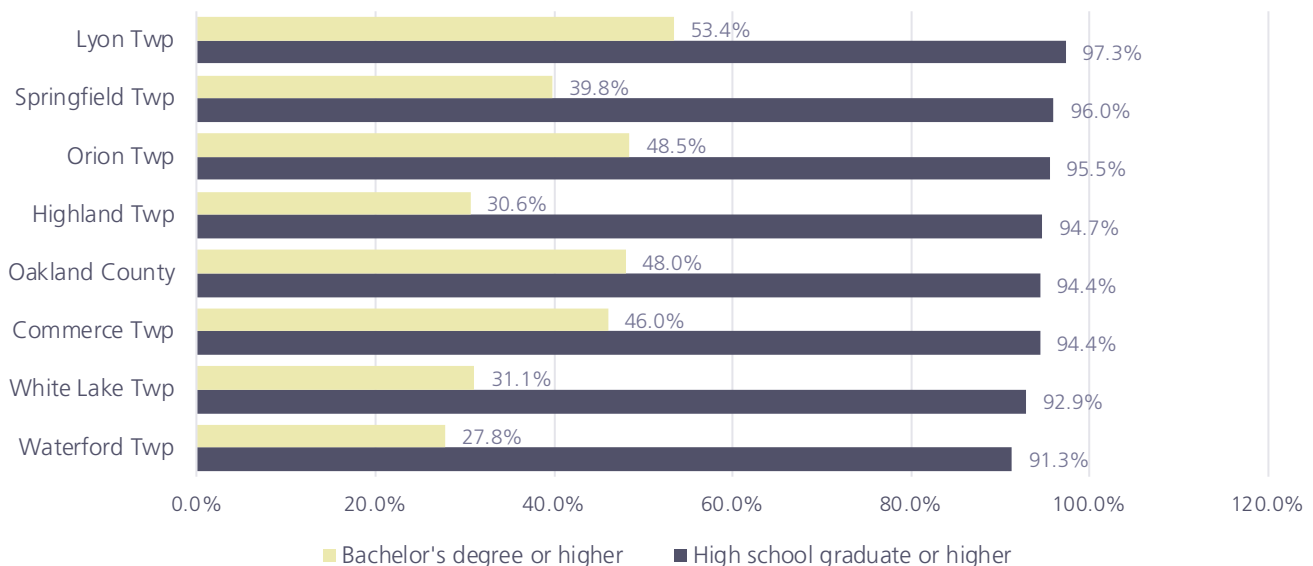
residents with a high school degree and third to last in percentage of residents that have a bachelor's degree. The highly qualified regional population represents a competitive yet economically strong region presenting diverse employment and business opportunities to the Township residents.

### Income & Poverty

Median household income is a metric used to measure the economic strength of a region, and higher educational attainment levels generally correlate with higher income potential and lower poverty rates. The 2020 median household income (inflation-adjusted dollars) in White Lake Township was \$81,633, which is only \$46 higher than the County (\$81,587) but higher than the State of Michigan (\$59,234). Over the last decade, the median income in the Township has risen continually and remained higher than the County, but followed a trajectory similar to the County. However, in comparison to the other communities (listed in Table 05), only Waterford Township has a median income (\$62,893) lower than White Lake Township.<sup>10</sup>

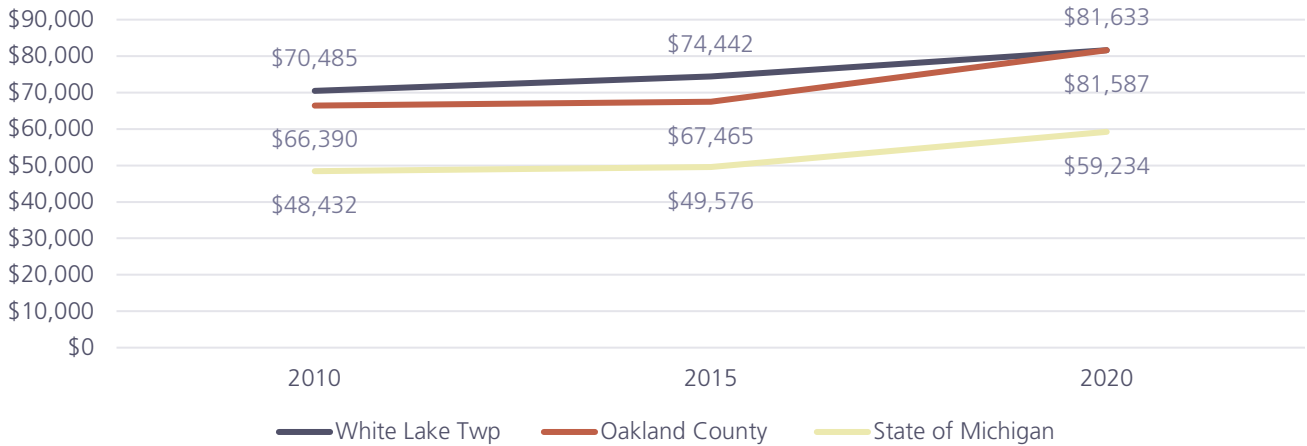
Figure 10 titled "Household Incomes: White Lake Township and Oakland County (2020)" charts the distribution of household incomes in the Township against the County. At the higher end of the income spectrum, roughly 40% of Township households earn more than \$100,000. At the lower end of the spectrum, around 11% of Township households

Figure 08: Educational Attainment: White Lake Township & Other Communities (2020)



Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

**Figure 09: Median Income: White Lake Township, Oakland County, and State of Michigan (2010-2020)**



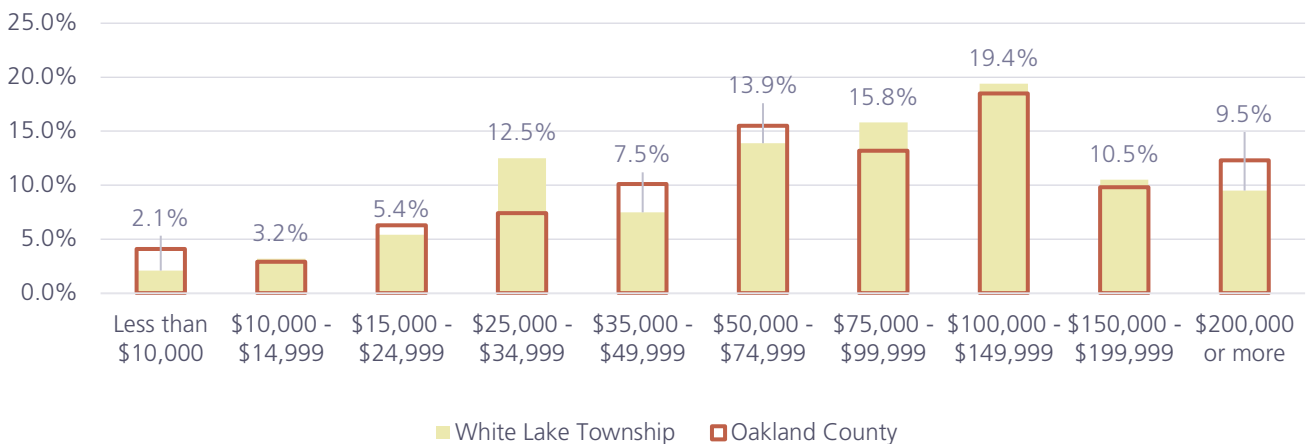
Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

**Table 05: Median Income: White Lake Township & Other Communities (2020)**

	Median Income (Inflation-Adjusted Dollars)
Lyon Township	\$115,600
Orion Township	\$99,063
Commerce Township	\$97,886
Springfield Township	\$91,266
Highland Township	\$88,061
White Lake Township	\$81,633
Waterford Township	\$62,893
Oakland County	\$81,587
State of Michigan	\$59,234

Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

**Figure 10: Household Incomes: White Lake Township and Oakland County (2020)**



Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

earn below \$25,000. The Township has a higher percentage of households in the \$25,000-\$34,999 income range than the County which likely includes some of the Township's retirees living on a fixed income.<sup>11</sup>

The U.S. Census Bureau determines poverty by comparing household annual income with the number of individuals in the household. In 2020, 8.8% of all residents were under the poverty line, slightly higher than the County (7.8%). More importantly, the 8.8% poverty rate in 2020 was an increase from 6.4% in 2010. This increase in poverty rate is partially a result of the economic downturn triggered by the COVID-19 pandemic where earning potential fell nationwide. Single-mother households

with children have the highest poverty rate at 30%.

While poverty is a helpful measure for determining the percentage of people experiencing high levels of financial hardship, it does not capture those who are one accident or large financial cost from falling below the poverty line. ALICE, which stands for Asset Limited, Income Constrained, and Employed, is a measure that captures individuals who may be above the federal poverty level but still struggle with regular expenses and costs. This metric is calculated by totaling minimum basic expenses for food, housing, healthcare, childcare, transportation, technology, etc.<sup>12</sup> In White Lake Township, an estimated 28% of households fall under the ALICE threshold, slightly higher than the County (22%).<sup>13</sup>

### Figure 11: Demographics: Key Takeaways

White Lake Township's population has continually grown until 2020; however, the pace of growth is slowing down and SEMCOG's 2045 Regional Forecast anticipates a marginal decline (-0.1%) by 2045.

Household size in White Lake Township is becoming smaller, so as a result, the total number of households in the Township increased by 9% between 2010 and 2020. Land use patterns and housing opportunities in the Township will have to cater to the shifting household compositions in the Township.

White Lake Township's population is aging. Mature households (35-54 years) continue to remain the largest age cohort (26%), while the percentage of empty nesters and seniors in the Township increased to roughly 18% in 2020. The Township is presented with a challenge to retain younger (20-34 years) households while ensuring mature households and seniors can age in place.

Roughly 15% of the Township's population and almost 40% of seniors have a disability and will require support facilities including mobility assistance, accessible living facilities, or other specialized healthcare services.

The percentage of individuals in poverty has increased to 8.8% in 2020, and an estimated 28% of households fall under the ALICE threshold. Providing affordable housing and economic opportunities will be key in ensuring these households can navigate their way out of poverty.



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Carolling in White Lake Township

# Natural Features & Open Space

Originating around White Lake, the Township was founded amidst treasures of lakes and natural features. The Township boasts a wealth of natural resources, including 21 named lakes and sprawling acres of woodland and farms. The Township's proximity to the growing metro-Detroit region attracts development, fueling the built environment at the cost of the natural environment. However, recognizing management of natural resources is essential to the well-being of residents and the local economy, the Township has strived to create a balance between development and preserving and protecting natural assets. This section of the Master Plan inventories White Lake Township's natural features and open spaces and discusses strategies to coordinate the natural environment, the built environment, and future land uses.

## LAND

### Soils<sup>1</sup>

Of the eight soil associations found in Oakland County, three can be found in White Lake Township. The majority of the eastern half and a small area in the northwest corner of the Township is characterized by the "Urban land-Spinks-Oshtemo" soil association. This association is composed of well-drained sandy soil, located on nearly level to rolling topography. Urban land consists of soils that have been so altered by development that it is no longer possible to determine the original soil type. The "Oshtemo-Spinks-Houghton" soil association is located in a band running from the southwest corner to the northeast corner of the Township. It is found on nearly level to hilly terrain and is composed of well-drained to very poorly-drained loamy, sandy, and mucky soil. The northern border of the Township and a small area in the southwest corner are made up of the "Fox-Oshtemo-Houghton" association. It is an area of nearly level to steep topography. This soil association is also well-drained to very poorly drained sandy, mucky soil.

### Limitations for Septic Fields<sup>2</sup>

Septic system development in the Township is limited by its extensive network of water bodies. The wetland, lake, and river areas are identified as unsuitable for septic uses. Most of the Township, in fact, is not considered suitable for septic uses, although there are small areas scattered around the Township designated as marginally suitable. It is therefore vital to regulate septic systems to ensure proper function. Regular inspection and maintenance of septic systems are essential for preserving water quality, as failing systems can pollute groundwater and nearby surface waters with human waste. The Oakland County Health Division regulates private wells and septic fields in the Township. Currently, septic inspections have to be initiated by the property owner or more commonly are requested during a home inspection during the home buying process.

### Soil Erosion Control<sup>3</sup>

Soil erosion and sedimentation is the greatest pollutant by volume entering lakes and streams. Increased flooding causes damage to plant and animal life while also causing structural damage to buildings and roads. The Oakland County Water Resources Commissioner's Office regulates soil erosion control in the Township and grants soil erosion permits to development within the Township.

### Woodlands and Tree Canopy

Despite White Lake Township's residential and commercial growth and development during the last several decades, there are still many woodland areas scattered throughout the Township. The vast majority of the trees are upland hardwoods. The Highland State Recreation Area and the Pontiac Lake State Recreation Area both have large stands of protected upland hardwoods. White Lake also has a few small areas of upland conifers dispersed throughout the Township. These wooded areas are a resource to both the residents and the wildlife in

the Township. Existing trees can also be “credited” to a development’s landscaping requirements to encourage tree preservation, which includes the practice of replacing any damaged trees during the development process.

### WATER

#### Lakes

The abundance of lakes and easy access to them is one of the biggest attractions in the Township. The Township has a total of 21 named lakes accounting for 3.7 square miles or 9.9% of the Township’s area which are used for both passive and active recreational purposes. The lakes and surrounding recreation areas draw a large seasonal population into the Township year-round and also creates a competitive market for lakefront homes in southeast Michigan.

#### Floodplains

A floodplain is the land surrounding a river, stream, lake, or drain that becomes regularly inundated by the overflow of water. Inundation or flooding typically takes place after rain or snow, and floodplains retain the excess floodwaters. For this reason, keeping floodplains as natural as possible helps to prevent flooding in adjacent low-lying areas.

The Federal Emergency Management Agency (FEMA) designated floodways in White Lake Township to follow existing lakes, portions of the Huron River, and its tributaries which are largely present only south of M-59. The blue floodplain on the map below represents a 1% chance of annual flooding, also known as the 100-year flood area, and the

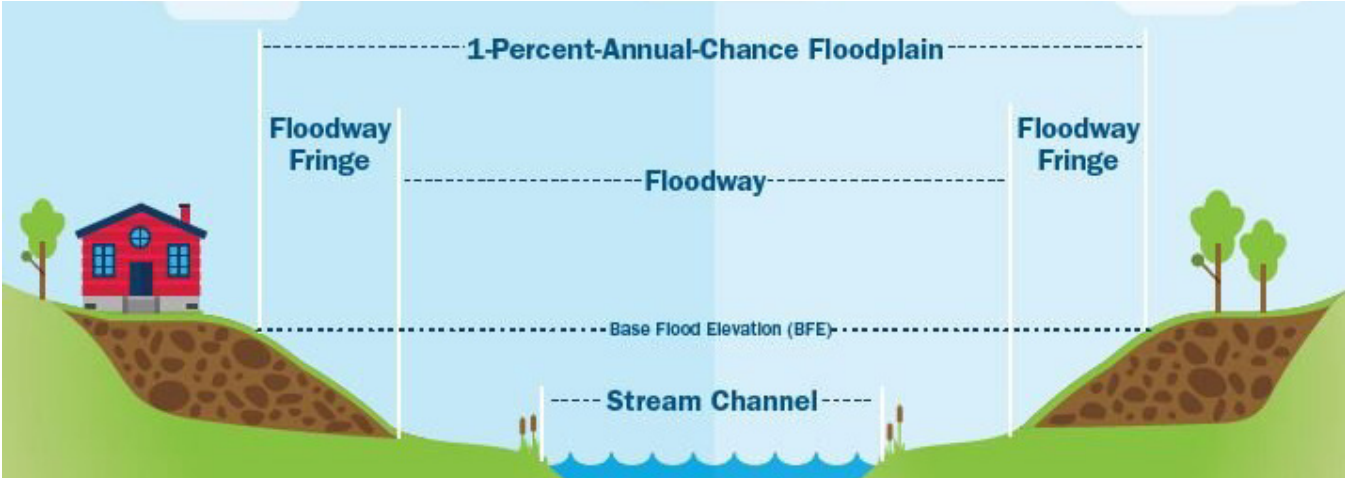
yellow floodplain represents a 0.2% chance of annual flooding, known as the 500-year flood area. However, these definitions are becoming more inaccurate as severe precipitation and flooding become more common. The floodway is the channel directly adjacent to a body of water that is above water during periods of normal water elevation. As seen on the map titled “FEMA Flood Hazard Zones” (p. 28), only small tracts of land around Brendel Lake, Cedar Island Lake, Oxbow Lake, and Tull Lake are susceptible to flooding.

It is worth noting properties outside of the floodplains are still subject to flooding. In fact, due to more frequent and intense storms, instances of flooding are expected to increase in the region. Development around the flood hazard areas must be carefully reviewed to mitigate the effects of flooding in the Township. As of March 2023, most of the land around the flood zones appears to be undeveloped. The Township should encourage the protection of wetlands and the installation of green infrastructure measures along the FEMA flood zones to mitigate the harm caused by flooding. Additionally, the Township can designate the areas around the flood plain as conservation areas to limit development and impervious surfaces. Furthermore, the Township can regulate lakefront development by mandating greenbelts with native vegetation in a buffer zone between the setback and the water’s edge to reduce flooding impacts.

#### Watersheds

A watershed is an area of land in which all surface waters drain to a common outlet such as a creek,

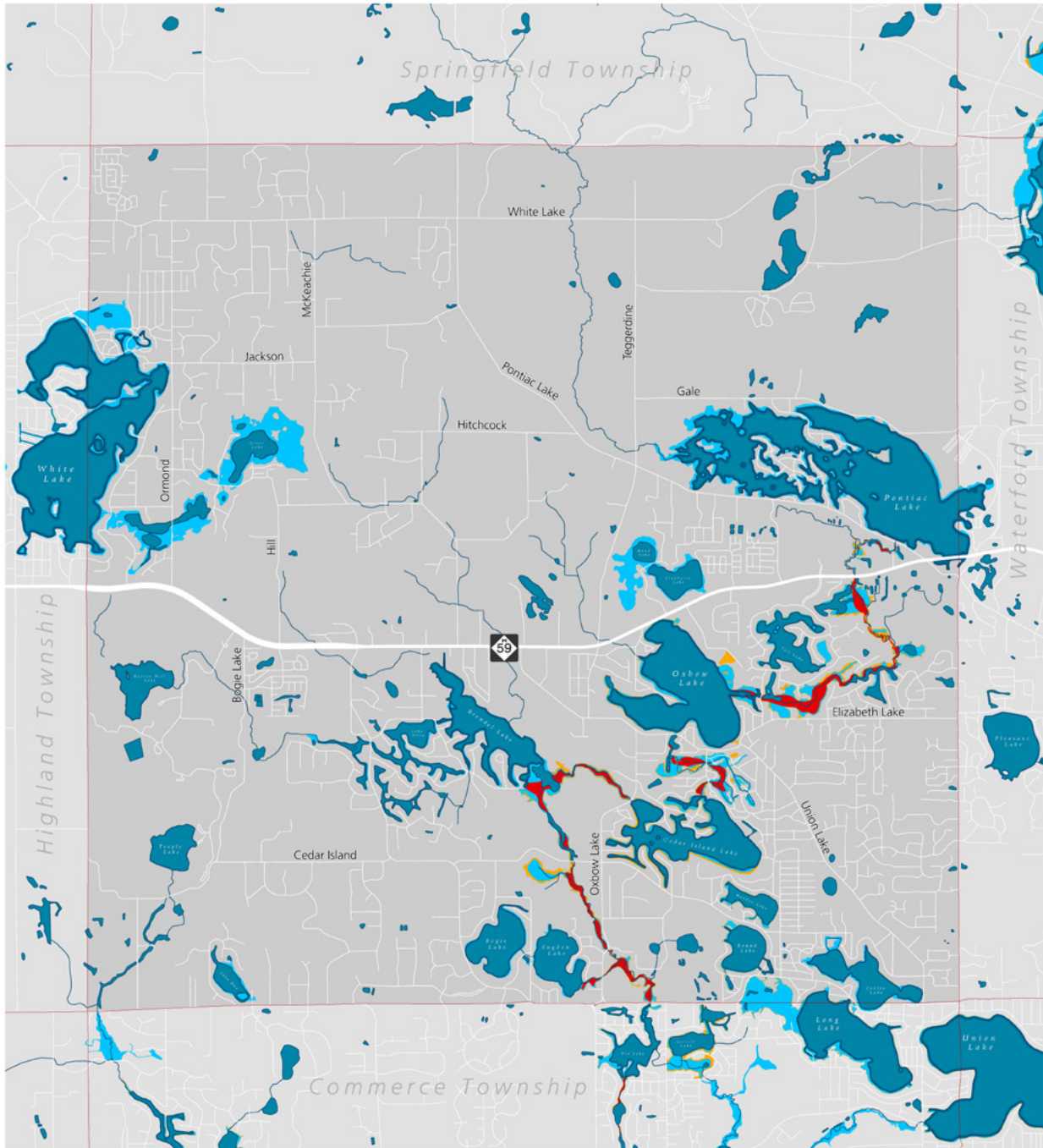
Figure 12: Floodplain Vs. Floodway



Source: Tulsa Engineering & Planning



Map 02: FEMA Flood Hazard Zones



### FEMA Flood Hazard Zones

Sources: Michigan Open Data Portal, Oakland County, White Lake Township

- Floodway
- 1% Annual Flood Hazard
- 0.2% Annual Flood Hazard



river, or lake. Since water and topography do not follow jurisdictional boundaries, jurisdictions are often in more than one watershed. The majority of the Township lies in the Huron River Watershed and small portions of the Township in the northeast corner and southeast edge lie in the Clinton River Watershed.

Within the Huron River Watershed, there are three sub-watersheds (subwatersheds and subbasins function like watersheds but on a much smaller scale). Runoff from the northwest corner of the Township flows into Pettibone Creek, then into the Huron River; water from the southeast corner of the Township flows into Hayes Creek, then into the Huron River; and water from the central portion of the Township flows directly into the Huron River.

The Huron River Watershed Council (HRWC) produces Watershed Management Plans (WMP) outlining best practices and resources to address problems in the watershed.<sup>4</sup> White Lake Township falls in the portion of the Huron River Watershed known as the Upper Huron, associated with the Kent Lake/Upper Huron River Watershed Management Plan developed in 2006.<sup>5</sup> For the subwatersheds, the HRWC provides subwatershed reports to guide and educate communities on subwatershed management. Some key takeaways from the WMP and subwatershed reports are presented in the table titled “Watershed and Subwatershed Management Plans.” Part of the Township falls in the Upper Clinton subwatershed, managed by the Clinton River Watershed Council, associated with the Upper Clinton Subwatershed Management Plan developed in 2005.<sup>6</sup>

## Groundwater Recharge Areas

White Lake Township has a mix of public and private water and wastewater systems. There are 11 community wells in the Township that provide for municipal or communal use, and at last count there were approximately 6,185 individual domestic wells.<sup>7</sup> The map titled “Annual Groundwater Recharge” (p. 32) shows the groundwater recharge capacities throughout the Township, which are highly permeable areas that readily permit water to move into an aquifer underground. The northeast quadrant of the Township has the highest groundwater permeability, 10-12 inches of groundwater recharge per acre, due to the presence of large open spaces under the Pontiac Lake Recreation Area. Similarly, land under the Highland Recreation Area provides high groundwater permeability in the southwest

section of the Township. The central area of the Township south of M-59, around Brendel Lake, has large areas of wetlands with 10 inches per acre annual recharge capacity.

Since 100% of the Township’s drinking water comes from groundwater, maintaining the quality of groundwater is extremely important. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) assists communities in protecting their groundwater through the Wellhead Protection Program (WHPP).<sup>8</sup> Wellhead protection areas are defined as a 10-year travel distance for contaminants around the wellhead. In other words, if a contaminant were spilled at the edge of the wellhead protection area it would take 10 years for the contamination to reach the wellhead.<sup>9</sup> White Lake Township has developed a joint Wellhead Protection Program with neighboring communities along with County and State agencies to protect drinking water in identified protection areas through cooperative management strategies and public education.<sup>10</sup> It is important to plan with these wellhead protection areas in mind so no potential pollutant sources, like heavy industry, are not located within the wellhead protection area.

The 2021 Consumer Confidence Report recorded there were no known significant sources of contamination in the Township’s water supply.<sup>11</sup> The Township has undertaken rigorous efforts to protect the water sources by participating in the Wellhead Protection Program, signage, fencing, site plan reviews, periodic water analysis, and other water management programs.<sup>12</sup>

## Wetlands

Wetlands are one of the most valuable and sensitive natural features in Michigan due to the unique ecosystem services they provide. Wetlands absorb excess water and act as a filtration device by capturing surface water runoff and slowly infiltrating it into the groundwater. Wetlands also nurture wildlife and biodiversity, purify water, and provide recreational benefits.

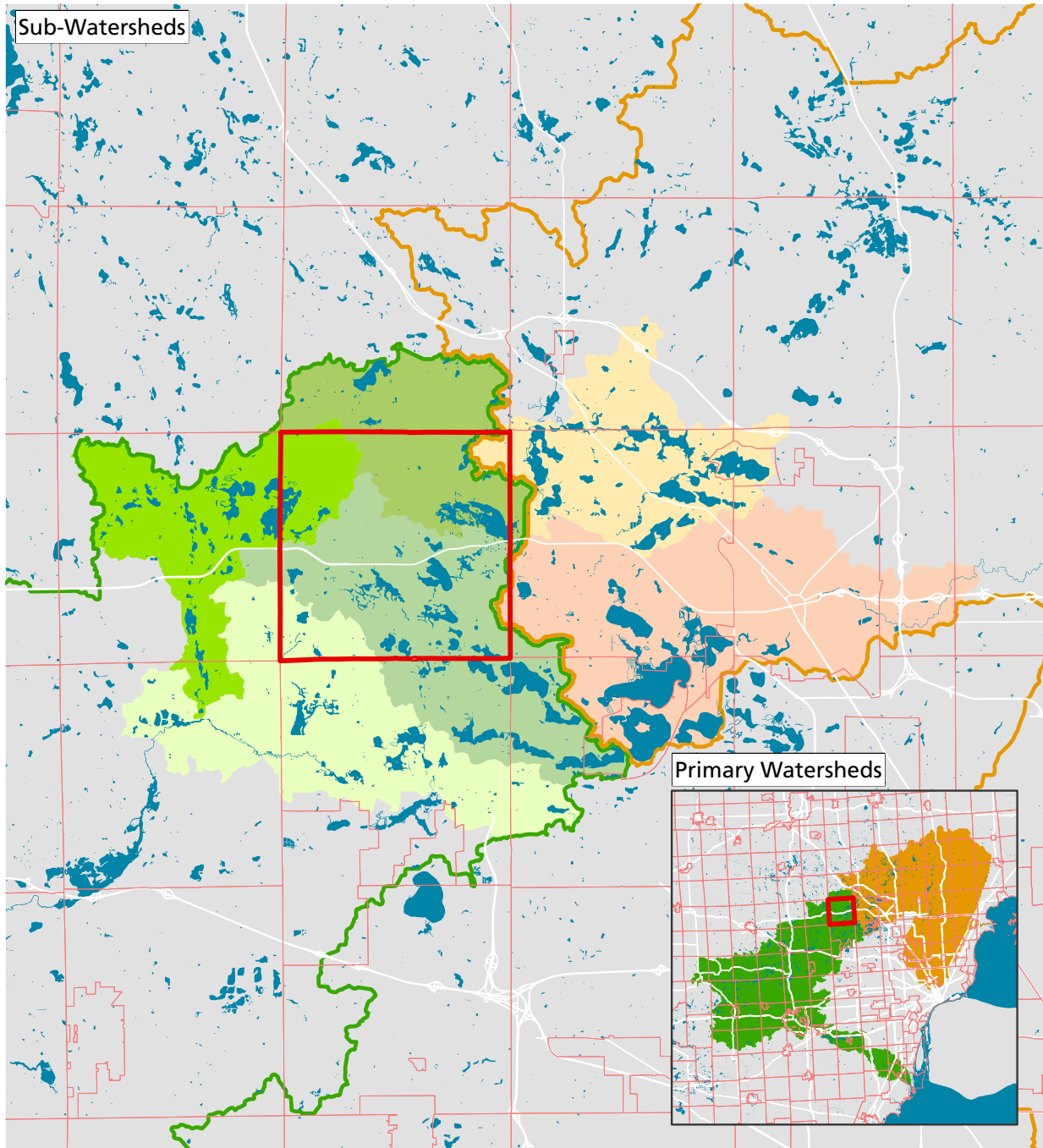
Due to the numerous benefits wetlands provide, it is essential the Township preserve both the quantity and quality of its wetlands. While wetland areas are found throughout the Township, the map titled “Wetlands” (p. 35) shows the greatest concentration is south of M-59 and adjacent to the Huron River. Roughly 20% (7.5 square miles) of White Lake Township is covered by wetlands.



Table 06: Watershed and Subwatershed Management Plans

Kent Lake/Upper Huron River Watershed Management Plan (2006) <sup>13</sup>	
Concerns	Nutrient and bacterial loading, decreased water quality, erosion and sedimentation, flooding, trash and litter on roadways and within stream corridors.
Best Management Practices and Community Action Plans	<ul style="list-style-type: none"> <li>» Ordinances, Regulations, and Standards: including such issues as local fertilizer ordinances, onsite sewage disposal system, native landscaping, natural features setbacks, and soil erosion and sedimentation control improvements.</li> <li>» Coordinated Planning Activities: including such opportunities as recreation plans and integrating natural resources protection into land use planning practice.</li> <li>» Public Education and Stewardship Opportunities: include programs designed to address specific stewardship messages.</li> <li>» Municipal/Organization Housekeeping Practices: includes programs such as training and education for employees and decision-makers, identifying and eliminating illicit discharges, and improved management of other public facilities.</li> <li>» Structural Improvements: includes specific construction, maintenance or repair projects associated with stormwater management and similar projects.</li> </ul>
Pettibone Creekshed Report <sup>14</sup>	
Concerns	Loss of biodiversity, nutrient and bacterial loading, decreased water quality, pollution from recreational uses such as duck hunting, and loss of natural features.
Best Management Practices and Community Action Plans	<ul style="list-style-type: none"> <li>» Inspect septic systems regularly to avoid leakage into water bodies.</li> <li>» Work with a land conservancy to establish an easement to protect natural areas from future development.</li> <li>» Establish and maintain a riparian buffer to minimize erosion and nutrient runoff.</li> </ul>
Hay Creekshed Report <sup>15</sup>	
Concerns	Loss of biodiversity, nutrient and bacterial loading, decreased water quality, and loss of natural features.
Best Management Practices	<ul style="list-style-type: none"> <li>» Inspect septic systems regularly to avoid leakage into water bodies.</li> <li>» Work with a land conservancy to establish an easement to protect natural areas from future development.</li> <li>» Maintain a 25-foot vegetated buffer, ideally made of native plants, from all waterways: ditches, creeks, lakes, and wetlands.</li> </ul>
Upper Clinton Subwatershed Management Plan <sup>16</sup>	
Concerns	Nutrient and bacterial loading, decreased water quality, and sedimentation.
Best Management Practices	<ul style="list-style-type: none"> <li>» Inspect septic systems regularly to avoid leakage into water bodies.</li> <li>» Work with a land conservancy to establish an easement to protect natural areas from future development.</li> <li>» Establish and maintain a riparian buffer to minimize erosion and nutrient runoff.</li> </ul>

# Map 03: Watersheds



## Watersheds

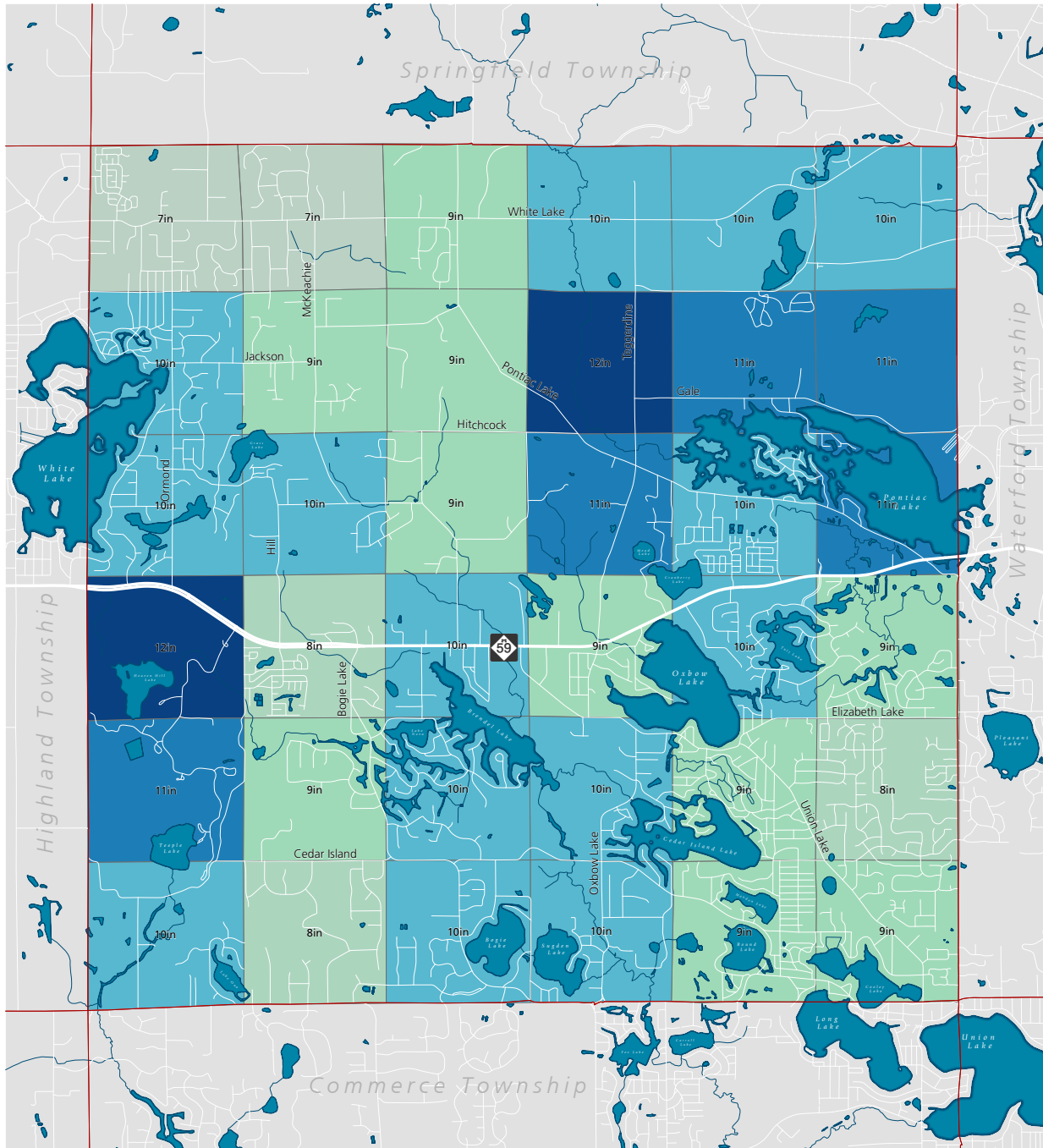
Sources: Michigan Open Data Portal, Oakland County, White Lake Township

White Lake Township

### Primary Watersheds    Sub-Watersheds

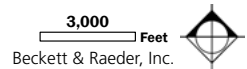
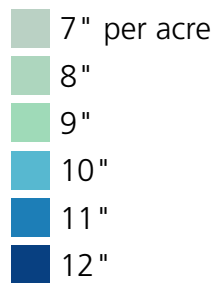
- |   |   |   |
|---|---|---|
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #008000; border: 1px solid black; vertical-align: middle;"></span> Huron River   | <span style="display: inline-block; width: 15px; height: 15px; background-color: #FFA07A; border: 1px solid black; vertical-align: middle;"></span> Pontiac Creek | <span style="display: inline-block; width: 15px; height: 15px; background-color: #90EE90; border: 1px solid black; vertical-align: middle;"></span> Sherwood Creek  |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #FF8C00; border: 1px solid black; vertical-align: middle;"></span> Clinton River | <span style="display: inline-block; width: 15px; height: 15px; background-color: #FFD700; border: 1px solid black; vertical-align: middle;"></span> Loon Lake     | <span style="display: inline-block; width: 15px; height: 15px; background-color: #32CD32; border: 1px solid black; vertical-align: middle;"></span> Pettibone Creek |
|   | <span style="display: inline-block; width: 15px; height: 15px; background-color: #8FBC8F; border: 1px solid black; vertical-align: middle;"></span> Pontiac Lake  | <span style="display: inline-block; width: 15px; height: 15px; background-color: #66CDAA; border: 1px solid black; vertical-align: middle;"></span> Hayes Creek     |

### Map 04: Annual Groundwater Recharge

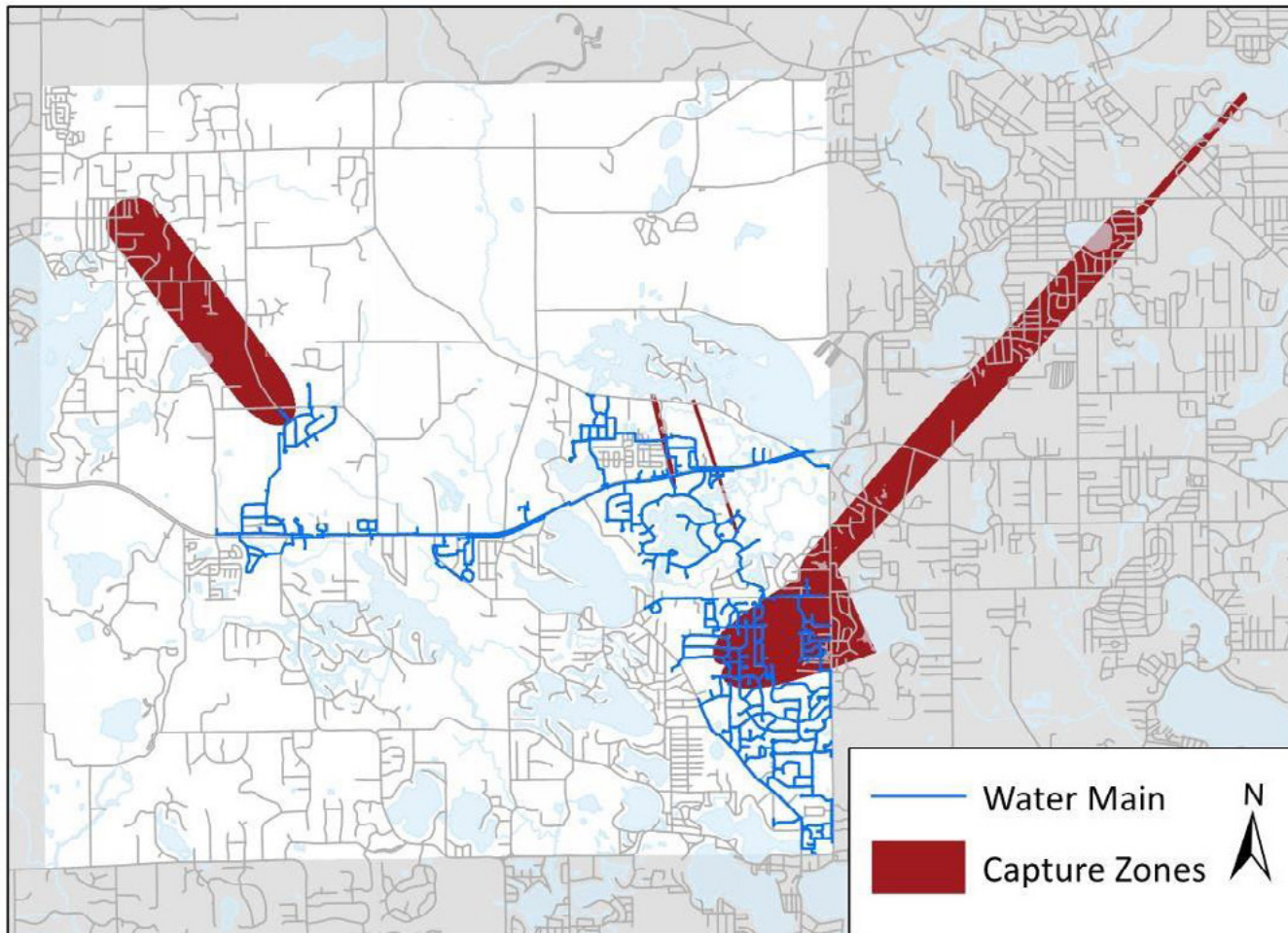


## Annual Groundwater Recharge

Sources: Michigan Open Data Portal, Oakland County, White Lake Township



## Map 05: White Lake Township Wellhead Protection Area Map-Wellhead Capture Zones



Source: White Lake Township Wellhead Protection Program

Among the Township's wetlands, 14% of all wetlands are emergent wetlands and nearly 55% are forested wetlands. Restorative wetlands, wetlands that were historically present and are absent or need intervention to become fully operational again, constitute about 32% of all wetlands.

To protect these fragile areas, wetlands of five acres or more, or smaller wetlands hydrologically connected to large wetlands, are strictly controlled by the Michigan Department of Environment, Great Lakes, and Energy (EGLE). Any development that deposits, fills, dredges, removes, drains, or constructs on a wetland must receive a permit.<sup>17</sup>

### CONSERVATION AREAS<sup>18</sup>

Oakland County and the Michigan Natural Features Inventory (MNFI) coordinated efforts to inventory the County's potential high-quality lands to propel efforts in prioritizing conservation efforts to improve

### Types of Wetlands

**Emergent:** Characterized by rooted herbaceous hydrophytes, like moss and lichen.

**Forested:** Characterized by woody plants taller than six feet and are usually farther away from water than emergent wetlands.

**Restorative:** Areas where wetlands can be fully, or as closely as possible, restored to their pre-existing conditions.

Source: Michigan Department of Environment, Great Lakes, and Energy (EGLE)



Table 07: Type of Wetlands

Wetland Type	Acres	Percent of Wetlands
Emergent	653	20%
Forested	2,649	80%
<b>Existing Wetland Total</b>	<b>3,302</b>	<b>100%</b>
Restorative	1,532	-

natural resource-based decision-making. The information is used to help find opportunities to establish an open space system of linked natural areas throughout Oakland County. The Map titled “Potential Conservation Areas” (p. 36) displays the conservation areas identified within White Lake Township. The yellow circles, depicting the existing Existing Conservation Easement layer, represents land protected from development by a Conservation Easement recorded with the State of Michigan. The potential natural areas (PNAs) are defined as places on the landscape dominated by native vegetation that have various levels of potential for harboring high-quality natural areas and unique natural features. These areas may provide critical ecological services such as maintaining water quality and quantity, soil development and stabilization, pollination, wildlife corridors, migratory bird stopover sites, sources of genetic diversity, and floodwater retention. The High-Quality Habitat, represented on the map in green, is a spatial representation of specific patches of natural vegetation within larger intact landscapes that have the potential to harbor high-quality natural communities and/or for harboring rare/sensitive plants and animals. The location of these high-quality natural lands should be considered whenever development takes place within the community. Additionally, White Lake Township can provide information about voluntary conservation easements to residents, especially those living in the designated areas on the map.

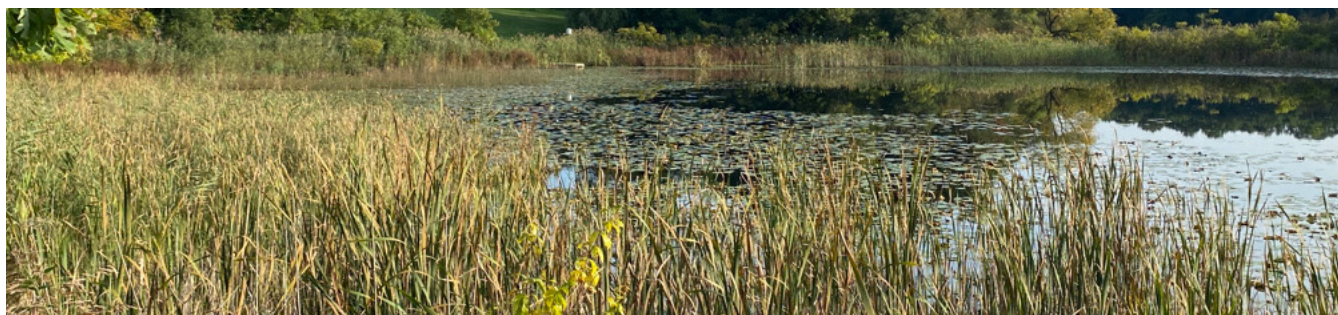
The Oakland County Cooperative Invasive Species Management Area (CISMA) is a source for education/outreach materials, technical assistance, best practices, and funding for protecting and improving natural habitat.<sup>19</sup> Collaboration with CISMA can help expand upon the lakes/wetlands protection and preservation efforts in White Lake Township.

## GREEN INFRASTRUCTURE

Green infrastructure planning focuses on developing a connected network of natural land, open spaces, and waterways. Green infrastructure is both a network of green space and natural areas, along with man-made techniques such as rain gardens and bioswales that preserve the function of the natural ecosystem. It is a system that protects water quality, functions as a filtration and drainage network at little or no cost, and provides recreational benefits for residents.

### Green Infrastructure Methods

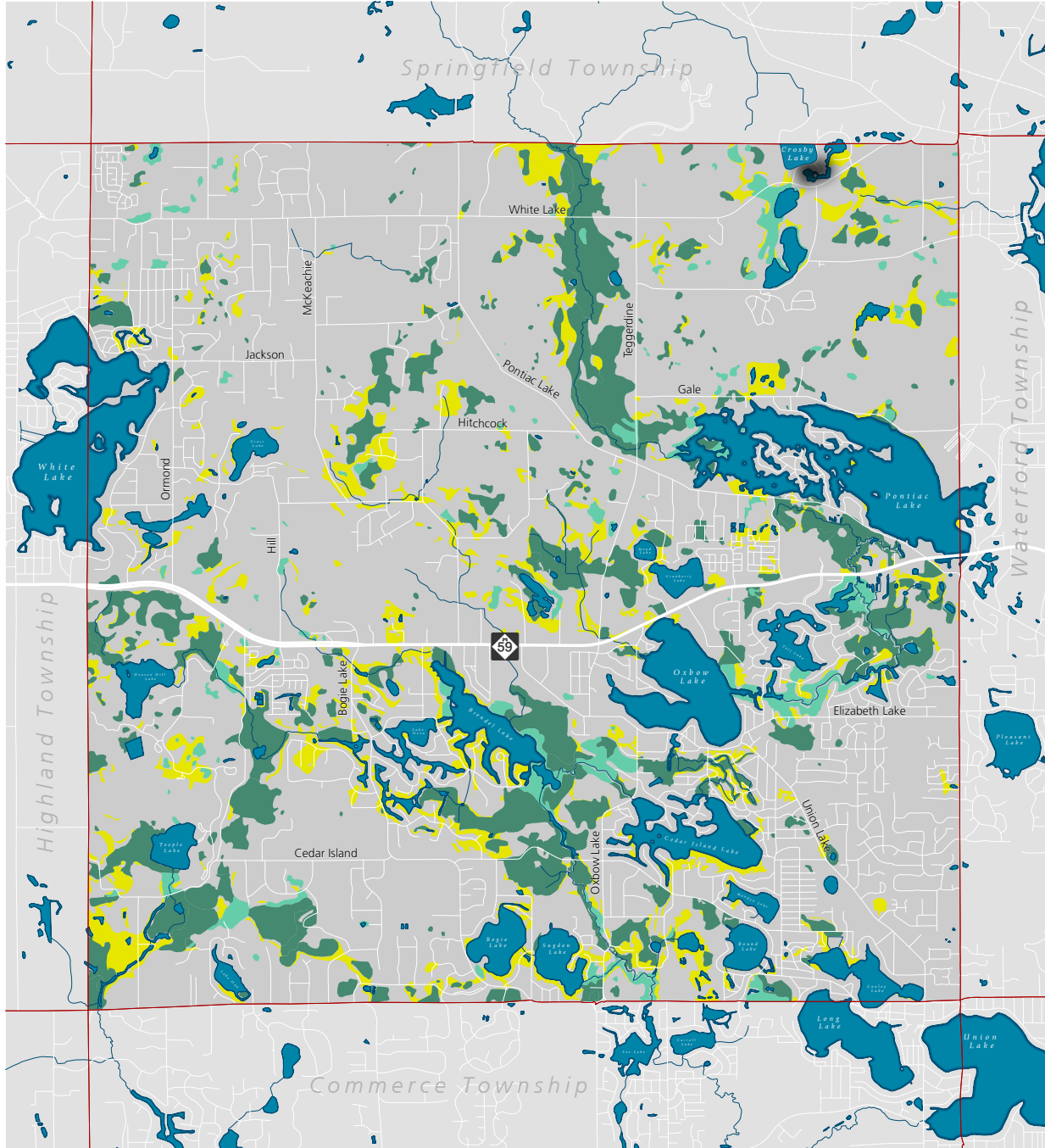
Low impact development (LID) is a broad term for a set of practices that imitate natural processes to allow stormwater to infiltrate the ground as opposed to channeling it toward water bodies. The table titled “Green Infrastructure Methods” (p. 37) shows several examples of landscaping and low impact development practices that can be encouraged in White Lake Township. The Township should encourage green infrastructure placement during the site plan review process and/or planned development process.



Bloomer Park



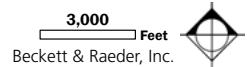
# Map 06: Wetlands



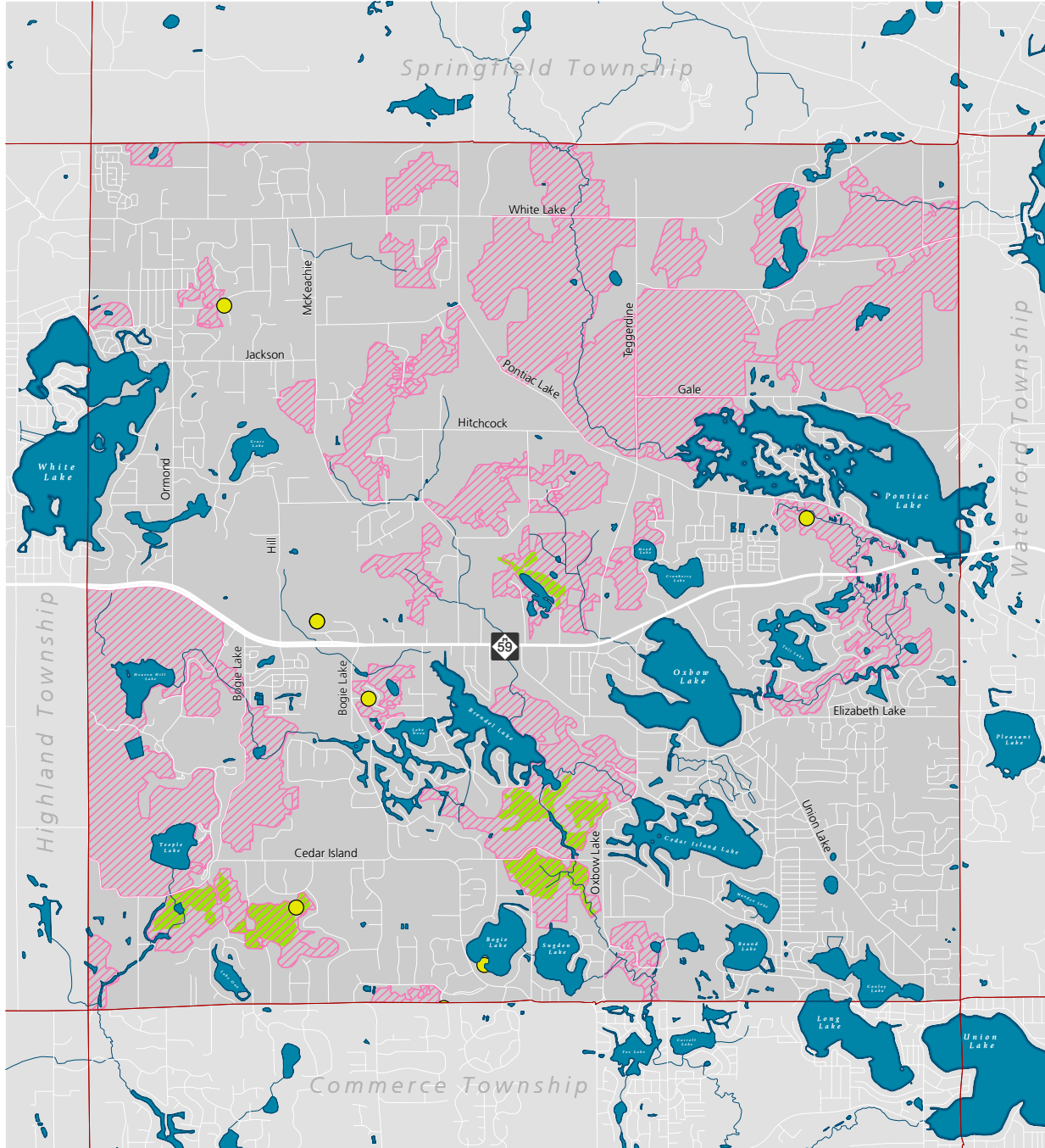
## Wetlands

Sources: Michigan Open Data Portal, Oakland County, White Lake Township

- Emergent Wetland
- Forested Wetland
- Restorative Wetland



Map 07: Potential Conservation Areas



### Potential Natural Areas

Sources: Michigan Open Data Portal, Oakland County, White Lake Township

- Existing Conservation Easement
- ▨ Potential Natural Area
- ▨ High Quality Habitat

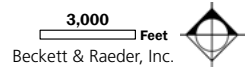






Table 08: Green Infrastructure Methods

Method	Description	Example
Rainwater Harvesting	Systems that collect and store rainwater for later use.	
Rain Gardens	Shallow, vegetated gardens that collect and absorb runoff from streets, sidewalks, and roofs.	
Planter Boxes	Boxes along sidewalks, streets, or parking lots that collect and absorb rainwater; they can be designed with a notch to allow additional stormwater to flow in, as with rain gardens. These also serve as streetscaping elements.	
Bioswales	Linear and vegetated channels, typically adjacent to a road or parking lot, that slow, retain, and filter stormwater.	
Permeable Pavement	Pavement that absorbs, filters, and stores rainwater, like these pavers.	
Green Roofs	Vegetated roofs that absorb and filter rainwater.	
Tree Canopy	Trees reduce and slow stormwater flow.	

Source: United States Environmental Protection Agency



## Figure 13: Natural Features & Open Space: Key Takeaways and Recommendations

### Woodlands & Tree Canopy should be protected.

- » Existing trees can be “credited” to a development’s landscaping requirements to encourage tree preservation and must be replaced if damaged during the process.

### Development around Water Features (Floodplains, Wetlands, Groundwater Recharge Areas) should be regulated.

- » The Township should encourage the protection of wetlands and the installation of green infrastructure measures along the FEMA flood zones.
- » The Township can designate the areas around the floodplain as conservation areas to limit development and impervious surfaces.
- » The Township can also regulate lakefront development by mandating greenbelts with native vegetation as a buffer zone between the setback and the water’s edge to reduce flooding impacts.
- » Development should be regulated such that no potential pollutant sources, like heavy industry, are located within the wellhead protection area.
- » Development that deposits, fills, dredges, removes, drains, or constructs on a wetland must receive a permit from EGLE.

### Conservation Areas should be protected.

- » The location of these high-quality natural lands should be considered whenever development takes place within the community.
- » The Township can provide information about voluntary conservation easements to residents, especially those living in the designated areas on the map.

### Green Infrastructure Measures should be promoted.

- » The Township should encourage green infrastructure placement during the site plan review process and/or planned development process.



Meadow along Cedar Island Road

## Sources

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# Housing

Providing quality housing opportunities that cater to the needs and preferences of residents across demographic and income groups is vital to building thriving communities. According to the MI New Economy plan, Michigan faces an acute housing shortage—worse than the national average for both owners and renters.<sup>1</sup> Home construction has not returned to pre-Great Recession levels compounding the effects of a housing shortage. In Michigan, it is predicted by 2045 there will be a shortage of 150,000 units.<sup>2</sup> On top of that, the COVID-19 pandemic disrupted the economy, pushing the Michigan housing market into a state of precarity as labor and materials became increasingly expensive.

The undersupply of housing benefits existing homeowners and disadvantages newcomers to the market. For existing homeowners, there is increased demand and competition for their homes, which drives up the prices. Homeowners can leverage equity gained from rising home prices to purchase their next home. However, because so few new units have been built, many homeowners are facing difficulties finding new units. For newcomers to the market, skyrocketing housing prices are out of reach for moderate- and low-income earners, such as young professionals or single-income households. As a result, these households stay in their rentals longer or have to pay more for older homes that were once attainable to lower-income households. The bottleneck caused by a lack of available homes for purchase leaves more people in the rental market, and rents increase as a result of increased competition, leaving renters less opportunity to save for a down payment on a home. Many households are in less-than-ideal housing situations when it comes to finding the price, type, and location that fits their lifestyle.

In response to this housing crisis, the Michigan State Housing Development Authority's (MSHDA) Statewide Housing Plan set a calculated target of

adding 75,000+ new or rehabilitated units over the next five years.<sup>3</sup> This target can only be realized if every community in Michigan proactively expands its housing stock and housing diversity. To this end, this section of the Plan summarizes the housing characteristics in the Township, presents community preferences, and outlines housing strategies.

## REGIONAL CONTEXT

Housing supply is a regional issue as it is part of a larger ecosystem of people, land use, natural and built environments, transportation networks, and economic markets. Housing trends constantly change and evolve in response to local and regional socio-economic shifts. Therefore, where relevant, the existing condition of housing in White Lake Township is compared to nearby Oakland County communities to guide housing goals and recommendations in this Plan.

## DEMOGRAPHIC TRENDS IMPACTING HOUSING

Demographic trends influence housing; therefore, it is essential to monitor the population and the community's preferences to predict future trends in housing and strategize housing supply appropriately. The Township's local and regional demographic trends are discussed in detail in Chapter 2, titled "Demographics," but trends impacting the housing market are listed below:

- » Households in White Lake Township are becoming smaller (average household size of 2.68 in 2010 to 2.6 in 2020) and as a result, the total households in the Township grew by 9% between 2010 and 2020.
- » White Lake Township's population is aging. Mature households (35-54 years) continue to remain the largest age cohort (26%) while the percentage of empty nesters and seniors, with niche housing requirements, increased to roughly 18% in 2020.

- » Roughly 15% of the Township’s population and almost 40% of seniors have a disability and will require support facilities including mobility assistance, accessible living facilities, and specialized healthcare services.
- » The percentage of individuals in poverty has increased to 8.8% in 2020, and an estimated 28% of households fall under the ALICE threshold. Providing affordable housing and economic opportunities will be key in ensuring these households can navigate their way out of poverty.

## CHARACTERISTICS OF HOUSING IN WHITE LAKE TOWNSHIP

### Housing Units

The total housing units in White Lake Township increased by roughly 4% to an estimated 12,519 in 2020. Given households increased by 9% in the same period, the growth of housing units has been relatively slow, indicating a mismatch between the changing household structure and the existing housing stock in the Township. The pace of growth is comparable to the County (2.9%); however, almost all surrounding communities, except Waterford Township, witnessed a greater increase in housing units than the Township. Given the population in these communities also grew faster than the Township, the higher growth rate of housing units is expected.

Of the 12,519 housing units, 95.8% are occupied units and the remaining 4.2% are vacant; the vacancy rate dropped from the estimated 8.8% in 2010 and is lower than the County (6%). While

low vacancy rates are desirable, rates as low as 4% are one indication of a housing shortage. The term vacancy includes units for sale, seasonal housing units, and migrant-worker housing. Therefore, while the unit may be “vacant,” it may not be available for a household to purchase or occupy. About 175 units are vacant, seasonal, recreational, or are occasionally used.<sup>4</sup>

### Age of Housing Stock

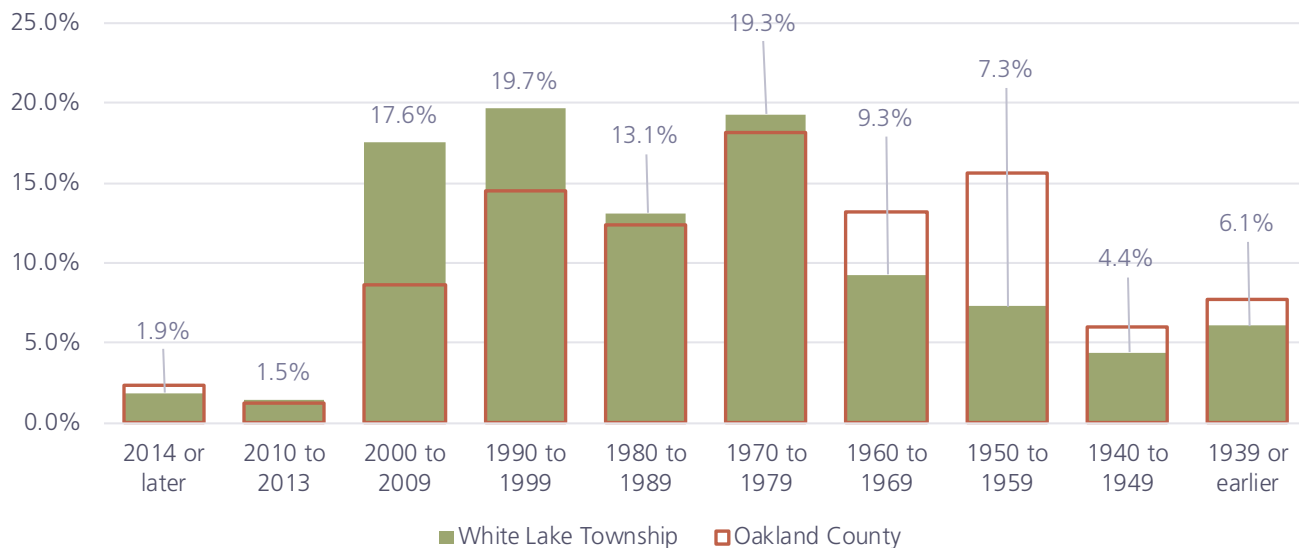
The housing stock in White Lake Township is aging. Over a quarter of the housing stock is close to 50 years old, and only 4% of units have been built in the last decade. A large proportion of existing units were built between 1990-1999 which corresponds to the population boom the Township witnessed during that period (25%). The slow rate of new builds in the Township is consistent with the trend in Oakland County and most surrounding cities and is a contributing factor to the housing shortage in the region.<sup>5</sup> The market is still recovering from the aftermath of the Great Recession which halted development for several years, but in many places, including White Lake Township, it has not caught up fast enough. Without an influx of new units, the average age of homes will increase. Older homes, depending on their level of maintenance or architectural charm, can either add to the Township’s appeal or detract from it. When kept up, they are historic assets. On the other hand, families might find them harder to maintain and feel that they lack modern, convenient amenities.

**Table 09: Total Housing Units: White Lake Township & Other Communities (2010–2020)**

	2010	2020	Change
White Lake Twp	12,045	12,519	3.9%
Commerce Twp	15,292	17,096	11.8%
Highland Twp	7,677	8,048	4.8%
Lyon Twp	5,197	7,537	45.0%
Orion Twp	13,648	15,896	16.5%
Springfield Twp	5,264	5,620	6.8%
Waterford Twp	31,766	32,564	2.5%
Oakland County	526,693	542,094	2.9%

Source: U.S. Census Bureau ACS Five-Year Estimates (2010, 2020)

Figure 14: Age of Housing Stock: White Lake Township &amp; Oakland County (2010-2020)



Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

Table 10: Housing Sale Inventory, White Lake Township (May 2022-May 2023)

Housing Typology	Units Sold
Detached Single-family Residential	430
Attached Single-family Residential	55
Multi-family Residential	1
<b>Total Residential</b>	<b>486</b>
Undeveloped Parcels	30

Source: Debby DeHart, Real Estate One.

## Homeownership in White Lake Township

A high percentage of owner-occupied units is generally perceived as a healthy market characteristic. In 2020, owner-occupied units accounted for 85.9% of the occupied households in White Lake Township, slightly lower than the homeownership rate in 2010 (89.5%), but higher than the County (71.2%).<sup>6</sup> The Township has a very low homeowner vacancy rate of 0.9%, indicative of a competitive homeownership market where demand outpaces supply.<sup>7</sup>

### Housing Sale Inventory

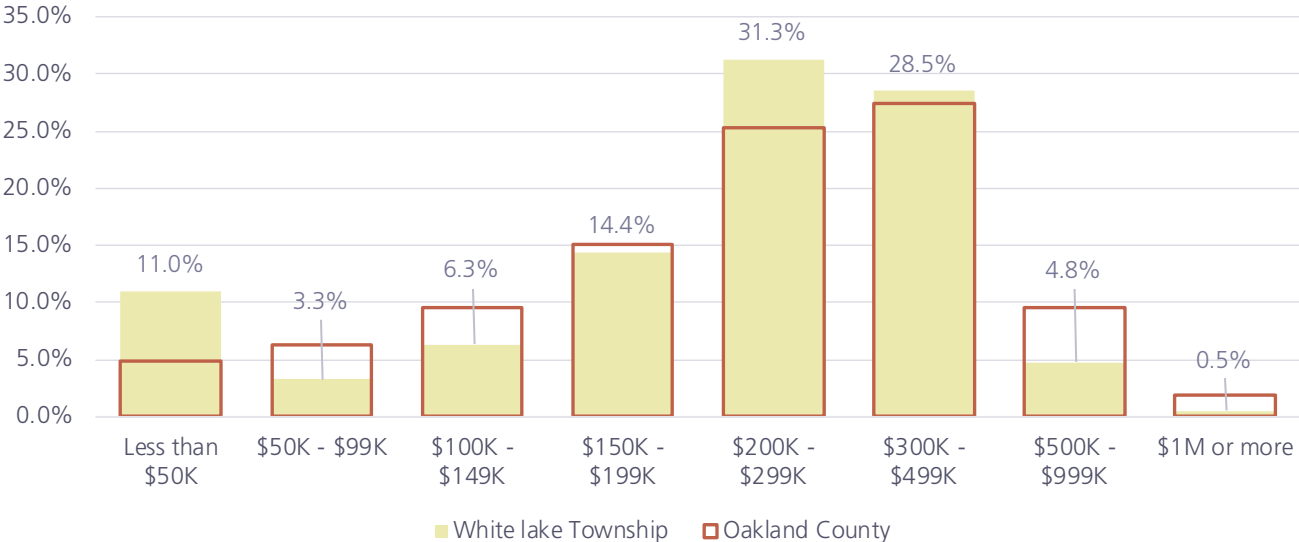
The table titled “Housing Sale Inventory, White Lake Township (May 2022–May 2023)” lists data on the number of residential units sold in White Lake Township between May 2022–May 2023. Of the 486 total residential units sold in the Township,

430 were detached single-family units and 55 were attached single-family units; one multi-family unit was sold during the same period. In addition, 30 undeveloped parcels of land were sold, which may be used towards new residential developments.

### Home Value

The shortage of units available for sale is likely why median home values increased to \$247,200 in 2020 from \$210,700 in 2010. The median home value in the Township is lower than the County (\$252,800) but higher than the State of Michigan (\$154,900).<sup>8</sup> Since demand drives home value, the higher the demand, the more homes are valued. In a tight market, when a housing unit becomes available, the bidding process can inflate the home’s value, resulting in people paying above-average price for the home. While this benefits existing residents because it increases the price of their homes, it

Figure 15: Housing Value (2020)



Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

makes it challenging for households attempting to enter the market.

The figure “Housing Value (2020)” illustrates the majority of homes (31.3%) in the Township are valued between \$200,000-\$299,999 and 28.5% are valued between \$300,000-\$499,999. Housing sales data indicated a total of 430 homes were sold in the Township between May 2022 and May 2023, and the average sale price was \$357,089.<sup>9</sup> Only about 5% of homes have price points between \$500K and \$1M. The Township also has a relatively smaller percentage of homes in the lower price range (\$50K–\$150K) creating a challenge for households seeking to buy “starter homes” and enter the market. Around 11% of the homes are priced at less than \$50,000. Given that 14% of vacant homes are sold but not occupied, these homes are likely blighted and uninhabitable.<sup>10</sup>

*Housing Costs & Affordability*

Homeowner costs are measured using the “Selected Monthly Owner Costs” (SMOC) metric, which includes a mortgage payment as well as insurance and other housing-related expenses. The median SMOC in White Lake Township in 2020 was estimated at \$1,666, slightly lower than the County (\$1,676). Among homeowners, roughly 82% live in an affordable unit and 16% live in an unaffordable unit. Given the rising poverty rates in the Township, producing affordable housing will be a key step in assisting these households to navigate their way out of financial distress.

**Defining Housing Affordability**

**Affordable:** Households spend <30% of income on housing costs.

**Unaffordable:** Households spend 30% - 50% of income on housing costs.

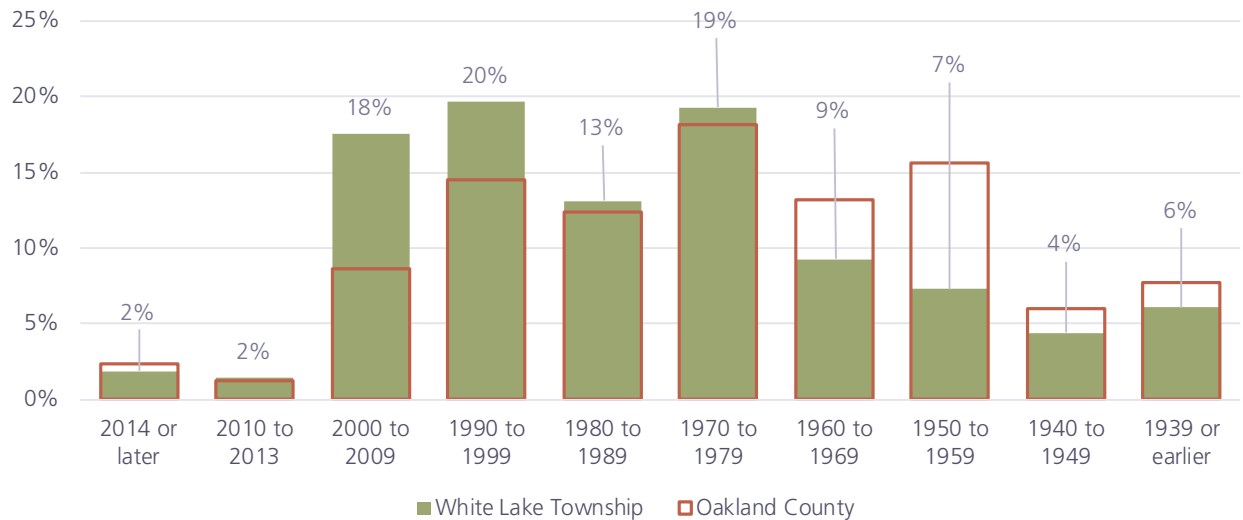
**Severely Unaffordable:** Households spend >50% of income on housing costs.

Source: U.S. Department of Housing and Urban Development (HUD)

**Renting in White Lake Township**

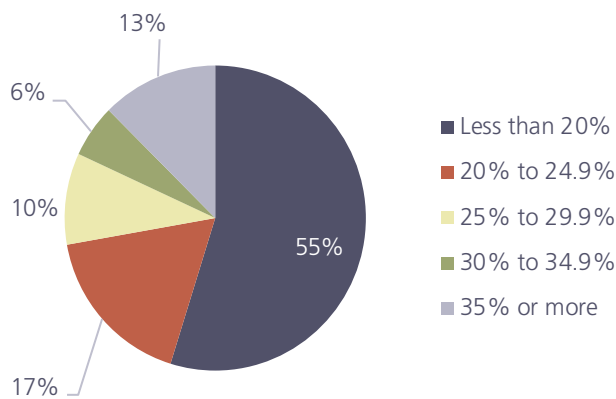
Renting is becoming an increasingly popular option among young households, empty nesters, and seniors. Considering an overall scarcity of units available for sale in White Lake Township, especially in the lower price range (\$50K– \$150K), home ownership is out of reach for low- and moderate-income households, and as a result, they must rent. In 2020, renter-occupied units account for 14.1% of the occupied households in White Lake Township, higher than in 2010 (10.5%), but lower than the County (28.8%).<sup>11</sup> The rental vacancy rate in the Township is 2.5%. The average household size of rental households is 2.05, lower than that of homeowners (2.69).

Figure 16: Age of Housing Stock: White Lake Township & Oakland County (2010–2020)



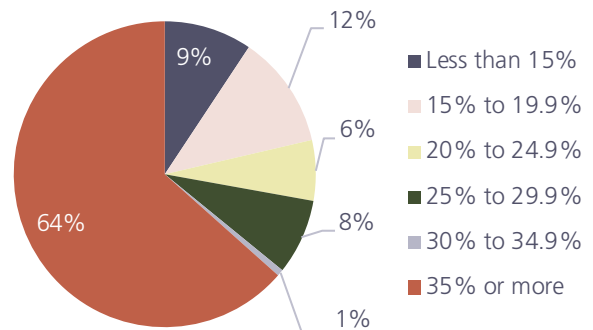
Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

Figure 17: Homeowner Affordability (2020)



Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

Figure 18: Renter Affordability (2020)



Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

**Gross Rent**

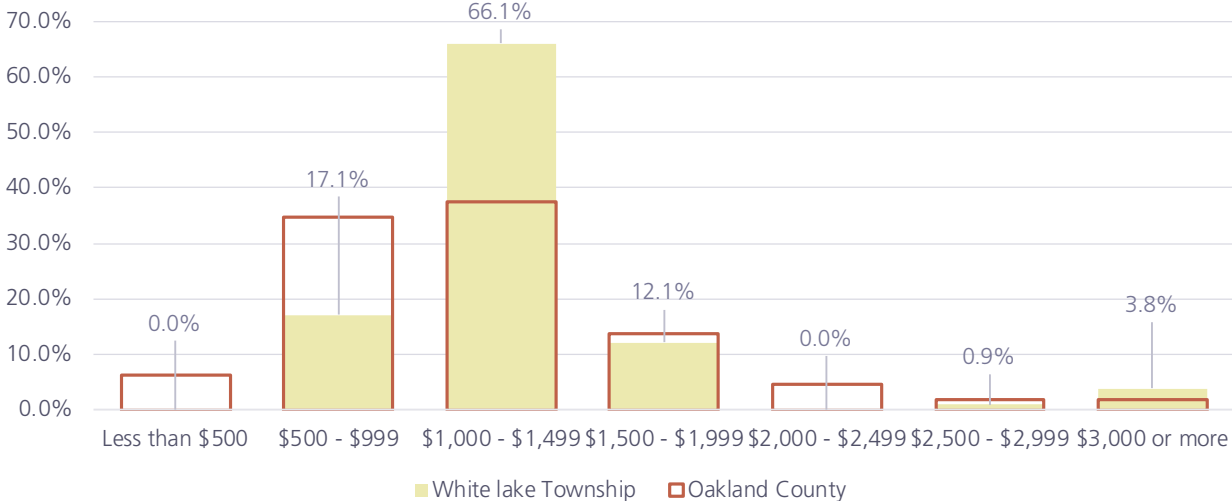
Between 2010–2020 the median gross rent in the Township jumped to \$1,192 from \$884. The gross rent in the Township is slightly higher than the County (\$1,100) but substantially higher than the State of Michigan (\$871).<sup>12</sup> The figure titled “Monthly Rent (2020)” (p. 45) illustrates roughly two-thirds of the renters in the Township pay a gross rent between \$1,000–\$1,499 monthly. About 17% pay less than \$1,000 and 12% pay gross rents between \$1,500–\$1,999. The County has a greater availability of units (34.6%) with rents in the \$500–\$999 than the Township (17.1%).

The table titled “Household Income in The Past 12 Months by Monthly Gross Rent (2020)” presents

the ratio of household income by gross monthly rent. The table shows that some of the lowest rents (less than \$600) in the Township are borne by households with an income between \$10,000 and \$49,999. However, the table also shows the highest percentage of renters (81%) paying the highest rents in the Township (\$2,000 or more) are households with an income between \$35,000–\$49,999, suggesting many renter households may be housing cost burdened. The ratio of renter households paying the median rent range in the Township (\$1,000–\$1,499) is also concentrated among households earning \$10,000–\$34,999, reiterating that many households are paying rents considered unaffordable based on the affordability standards defined by the Department of Housing and Urban Development (HUD).



Figure 19: Monthly Rent: White Lake Township & Oakland County (2020)



Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

Table 11: Household Income in the Past 12 Months by Monthly Gross Rent (2020)

	Less than \$10,000	\$10,000 to \$19,999	\$20,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$74,999	\$75,000 to \$99,999	\$100,000 or more
\$500 to \$599	0%	32%	32%	36%	0%	0%	0%
\$600 to \$699	0%	0%	0%	37%	37%	0%	26%
\$700 to \$799	0%	9%	16%	0%	75%	0%	0%
\$800 to \$899	0%	16%	58%	5%	20%	0%	0%
\$900 to \$999	0%	32%	24%	8%	19%	17%	0%
\$1,000 to \$1,249	6%	9%	55%	2%	10%	11%	6%
\$1,250 to \$1,499	0%	46%	18%	2%	23%	6%	4%
\$1,500 to \$1,999	9%	9%	32%	0%	0%	6%	45%
\$2,000 or more	0%	0%	0%	81%	10%	3%	6%
No cash rent	18%	22%	9%	22%	0%	20%	9%

Note: The table above is read horizontally; all rows add up to 100%, showing the ratio of household income by gross monthly rent.

Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

**Housing Costs & Affordability**

As noted above, the table titled “Household Income in The Past 12 Months by Monthly Gross Rent (2020)” highlights affordability concerns among the renter households in the Township. A sizable 64% of renters live in units unaffordable for their household income, while only 36% live in affordable units. The low- and moderate-income households in White Lake Township are disproportionately disadvantaged when considering rental affordability. These renters are in a challenging situation because they are priced

out of homeownership and are living in rental units and still paying unaffordable rents.

**Housing Diversity**

Housing diversity is an important tool to address the housing shortage and affordability in White Lake Township. The changing demographics of the Township require a variety of housing typologies at different price points to ensure housing access. Consistent with the County and regional trends, the existing housing stock in the Township is

homogeneous with 77.1% detached single-family dwelling units. Of the remaining units, 3.2% were attached single-family dwelling units, 0.6% were duplexes, 7.6% were multi-dwelling units, and 12% were mobile homes. Additionally, nearly a quarter of housing units have four or more bedrooms. With the average household sizes decreasing, the demand for large-footprint homes will likely decrease in the Township.<sup>13</sup> However, of the 76 new builds authorized in the Township in 2022, 85% were detached single-family dwelling units, signifying recent home construction is not aligned with the shifting housing preferences of demographic trends.<sup>14</sup> Concentration in the Township’s housing stock of predominantly one housing typology is a major factor driving up unaffordability levels in the Township. For instance, empty nesters who wish to downsize, working households with limited discretionary income, couples without children, or young adults moving out of their parent’s homes, may prefer smaller but affordable units. A shortage of such options will push residents, and potential future residents, to seek desired housing outside of the Township or drive demand for those units in the Township. Furthermore, because the neighboring townships have less to offer in terms of housing diversity, it could push them out of the region.

### COMMUNITY HOUSING PREFERENCES

The takeaways from the responses in the housing section of the Master Plan community survey are summarized below and represent consensus on

housing preferences and challenges in the Township, and are instrumental in tailoring housing solutions and recommendations to meet the needs of the White Lake Township community.

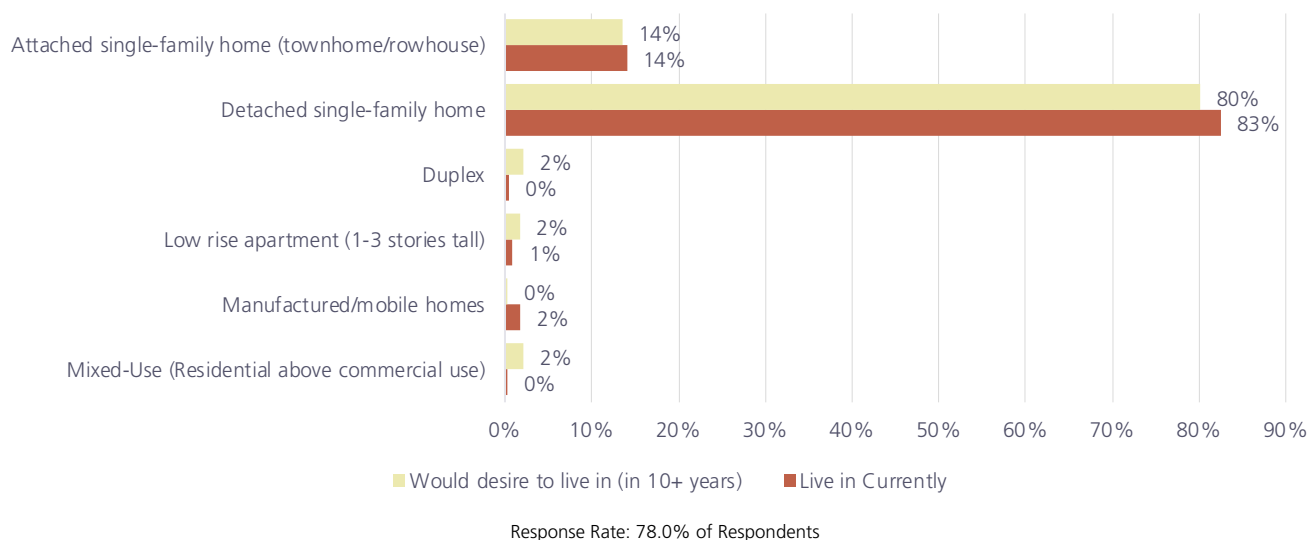
*What type of housing do you LIVE IN CURRENTLY and what type would you like to LIVE IN 10 YEARS FROM NOW? (Please select all options that apply)*

The majority of respondents currently live in either detached single-family homes (83%) or attached single-family homes (14%); only 3% of all respondents live in other multi-family housing units. Future preferences of respondents are also concentrated only between the two typologies of single-family homes, attached (80%) and detached (14%), indicating most respondents are not seeking diverse housing typologies in the Township. It is important to ensure housing needs are met in the community. A small percentage of respondents (6%) indicate a desire to live in multi-family housing units such as duplexes (2%), low-rise apartments (2%) and mixed uses units (2%) 10 years from now. A more detailed analysis of housing preferences by age indicated additional trends. First, of the 2% of respondents who wish to live in duplexes, over 50% are seniors (65 years and above). Second, the desire to live in low-rise apartments was most prominent for young professionals and families (25-34 years), empty nesters (55-64 years), and seniors. And third, among those who wish to live in mixed-use residential units in the future (2% of the total), 36% are young professionals and families, while the remaining vary in age from 35-seniors.



Single-family home

Figure 20: Current Housing Type and Future Preferences



*What is the size of your current housing unit, and what size of housing unit do you require to fulfill your housing needs in the future? (Please select one for each column)*

Almost one half of the respondents (46%) live in mid-size homes between 1,000-2,000 square feet and over a third of respondents (38%) live in homes with an area between 2,000-3,000 square feet. About 10% live in larger homes with an area of 3,000 to 4,000 square feet or above while only 5% of respondents live in smaller units ranging between 500-1,000 square feet. Reviewing the future housing needs of respondents, a higher percentage of respondents indicate a desire to live in homes with an area of 1,000-2,000 square feet in the future than where they currently live. One possibility for this demand may be a lack of availability of sufficient units of 1,000-2,000 square feet in area, suggesting that the current housing needs of some respondents are not being met. Alternatively, as housing composition changes, it is likely that the future housing needs will change, creating a future demand for homes in the 1,000-2,000 square feet category. Irrespective of the reason, respondents indicate a need to increase the housing stock of homes 1,000-2,000 square feet in the Township. Similarly, respondents also indicate a demand for smaller homes, 500-1,000 square feet in the Township.

The table titled "Current Housing Size and Future Preferences by Age" (p. 48) filters the current housing size and future needs by age of the respondent. The table demonstrates that a larger percentage

of seniors who currently live in larger homes will be interested in downsizing to smaller homes 500-1,000 or 1,000-2,000 square feet in the area. As the population of the Township is aging, the Township can expect the demand for small to mid-size homes to grow. However, those aged 25-34 years indicate a desire for the larger footprint (3,000-5,000 square feet) likely to house their growing families.

*What is your housing tenure status?*

About 95% of respondents are homeowners, 2% are renters, and 2% are not financially responsible for their housing costs. The majority of respondents who are not responsible for their housing costs are young adults and professionals aged 18-34 years, and the largest percentage of renters (29%) belong to the 25-34 years cohort hinting at a housing affordability concern for specifically the low- and moderate-income households in the Township.

*How strongly do you agree with the following statement: "With my household income, I feel the housing options in White Lake Township are financially attainable."*

Respondents demonstrated varied levels of agreement on housing attainability in the Township indicating a need to diversify housing to reach the various income cohorts in the Township. While across age groups, over half the respondents are able to access housing catered to their household income, many either disagree or strongly disagreed to the above statement, suggesting they are housing-cost burdened. Those aged 18-24 years, potentially

Figure 21: Current Housing Size and Future Preferences

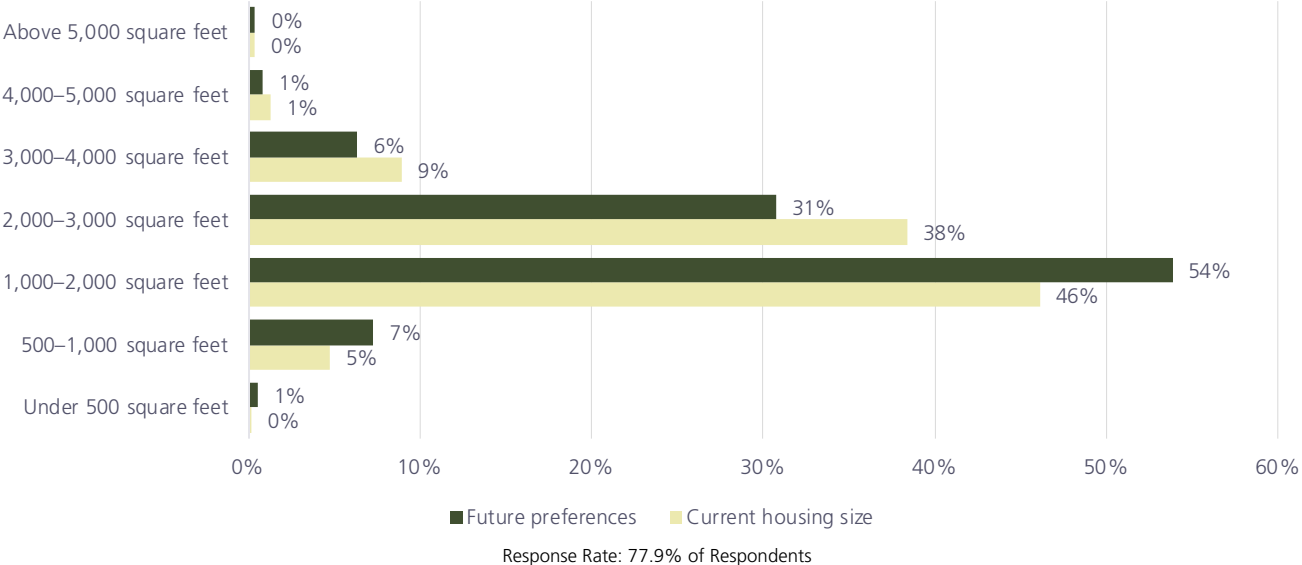


Table 12: Current Housing Size and Future Preferences by Age

Size of Unit	Current Housing Size						Future Needs					
	18-24	25-34	35-44	45-54	55-64	65+	18-24	25-34	35-44	45-54	55-64	65+
Under 500 Sq.Ft.	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	1%
500–1,000 Sq.Ft.	25%	9%	6%	2%	5%	1%	9%	7%	2%	5%	9%	12%
1,000–2,000 Sq.Ft.	42%	52%	42%	46%	44%	50%	73%	34%	43%	59%	59%	62%
2,000–3,000 Sq.Ft.	8%	31%	41%	39%	38%	41%	18%	43%	46%	25%	24%	23%
3,000–4,000 Sq.Ft.	25%	6%	7%	11%	11%	6%	0%	14%	9%	9%	5%	2%
4,000–5,000 Sq.Ft.	0%	1%	3%	0%	1%	1%	0%	3%	0%	1%	1%	0%
Above 5,000 Sq.Ft.	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%	1%	0%

Note: The table above is read vertically; all columns add up to 100% showing the distribution of housing needs within each age cohort.

including those still in school or beginning their careers, indicated strongest disagreement, likely due to a lack of smaller starter or low- to mid-end rental units.

*How much longer do you anticipate living in your current home?*

The percentage of respondents aged 25-34 years indicate varied timelines in their current homes, indicating they will move out as they transition

through various stages of life. Among those aged 35-44 years, the majority (34%) anticipate living in their current homes over the next twenty years, likely homeowners who have children in a nearby school district. Preferences vary among those aged 45 years and above. This is likely due to some anticipating they will downsize after their children leave the nest or for retirement, while others are already in the housing of their choice and intend to age in place.

Figure 22: Housing Tenure Status by Age of Respondents

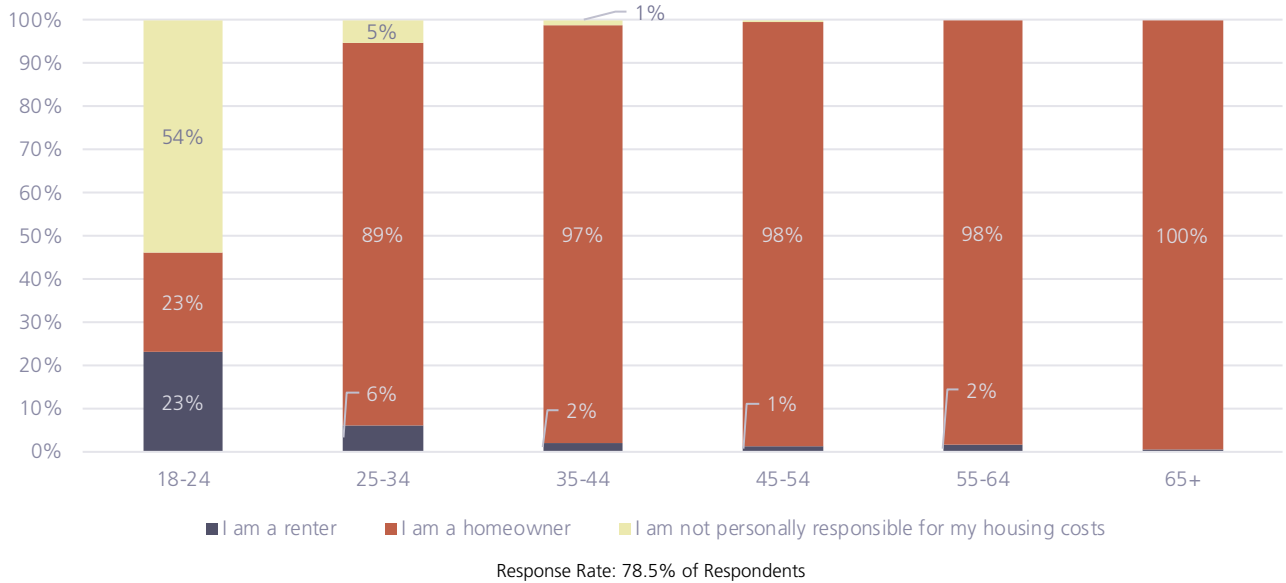
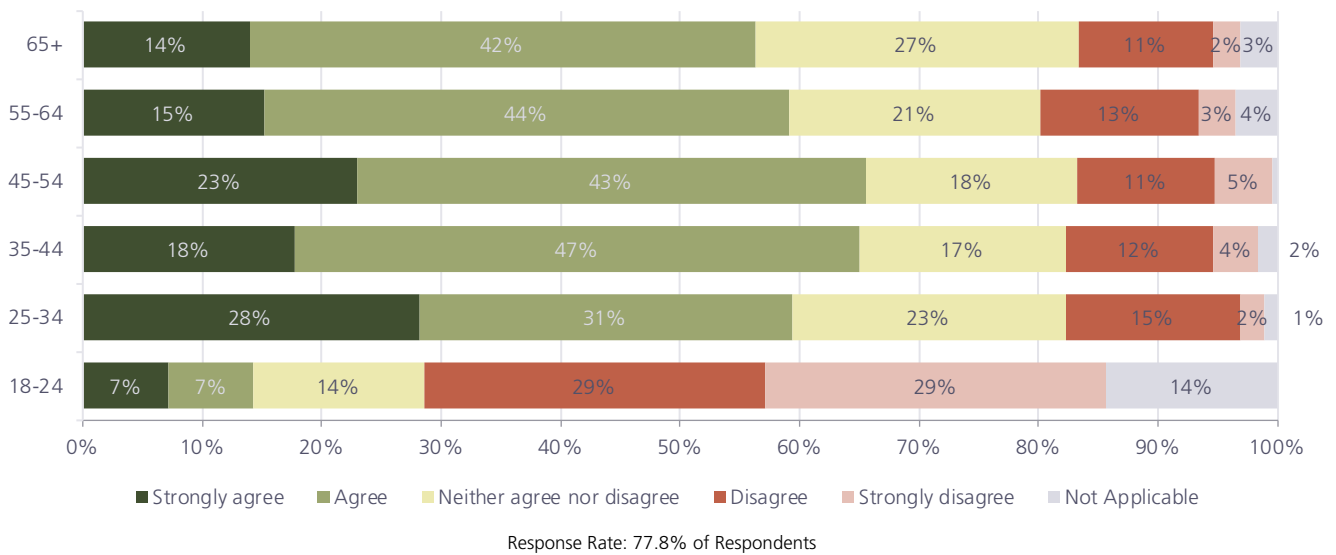


Figure 23: Housing Attainability by Age of Respondents



## HOUSING STRATEGIES

### Missing Middle

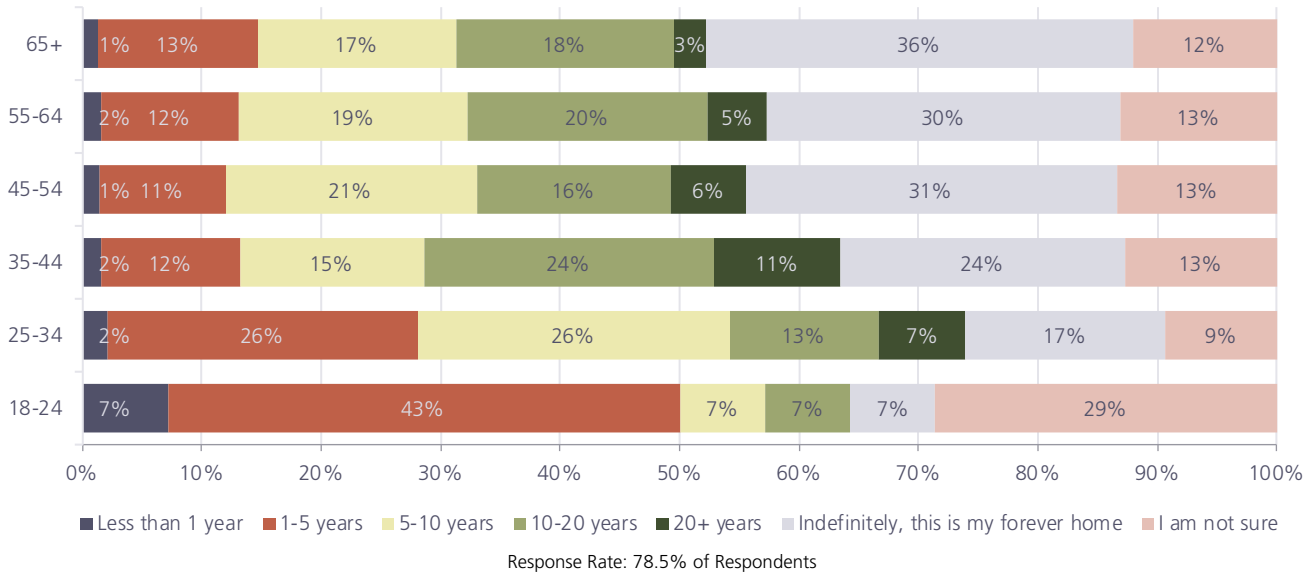
There is still a wide range of housing options between single-family dwelling units and multi-dwelling unit apartment complexes that remain unexplored in White Lake Township. In housing terms, the Township needs to expand “Missing Middle” housing, a term that refers to housing similar in size to single-family structures, but instead are either clustered or have multiple units.<sup>15</sup> Missing Middle housing typologies: Duplex, Triplex, Quadplex, Bungalow Courts, Multiplex, Live/Work units, weave density and diversity into the fabric of

traditional single-family residential neighborhoods. Typically, when smaller units are built on reduced lot areas, they generally have lower purchasing prices and maintenance costs.

Among the different missing middle typologies, Accessory Dwelling Units (ADUs) are an effective way to diversify the existing housing stock and offer low impact increases to density. Colloquially referred to as “in-law units” or “granny flats”, they are smaller units located in the rear areas of a residential parcel, subordinate to the principal structure, that can be used to house family members or to be rented to a nonfamily member. ADUs add new units compatible with the existing neighborhood composition that



Figure 24: Duration in Current Home



are not supplied by the private housing development market. The lower costs may be passed on to the tenants to provide more affordable housing options for young adults, the elderly, or residents in transition to homeownership, all of which are important goals for the Township. Attached ADUs are currently permitted in the Township; however, limitations with septic fields and connecting to septic systems limits their widespread applicability in the Township.

### Build To Rent

Housing markets often tend to focus on ownership, and while ownership tenure is vital for overall economic well-being, renting is an option due to housing costs and inventory shortage associated with homeownership. Additionally, demographic groups such as young adults, empty nesters, and

seniors may prefer to rent due to the convenience and flexibility it offers. With this demand for rental units, developers are building to rent in Southeast Michigan, spread over an array of housing typologies, and the units can be more spacious than apartments and include shared amenities.<sup>16</sup> Based on existing and approved projects, there is an adequate supply of rental units to serve Township residents.

### Rehabilitate Blighted Properties

As of 2020, 77 units under ownership tenure are unoccupied and are valued below \$50,000.<sup>17</sup> These units are likely blighted and uninhabitable, and a potential threat to deteriorating the quality of the neighborhood and lowering property values. Rehabilitating or retrofitting such properties will not only funnel more units into the housing market

Figure 25: Missing Middle Housing



to address the supply issues, but will also produce units at lower prices than new builds to cater to the low- and middle-income groups pursuing homeownership. Oakland County provides federal Community Development Block Grants (CDBG) funding to communities for revitalization projects. The program strengthens neighborhoods by supporting local revitalization, home improvement and public services for senior citizens, low-income persons and families, disadvantaged youth, and disabled residents throughout most of Oakland County.<sup>18</sup> The map titled “CDBG Area-Wide Benefits: White Lake Township” (p. 52) denotes areas of the Township eligible for the CDBG funding from Oakland County. Detailed information can be found on [Oakland County’s Community & Home Improvement Division website](#).

### Zoning Reform<sup>19</sup>

Zoning determines where housing will be built, what types of units are allowed, how the housing might look, and when it might be approved. As the Township’s legally binding document, the language can be removed or added to allow a range of housing types. Provisions can be modified to make conversions, infill, and redevelopment possible.

### *Rezone for Mixed-Use/Multi-Family in Commercial Districts*

Existing commercial districts and corridors can be great locations to accommodate more housing. Zoning for mixed-use districts along commercial corridors, is one of the easiest ways to support higher-density residential uses adjacent to, but outside of, less compact neighborhoods. The majority of the M-59 corridor is zoned planned business which does not permit any residential development. There are opportunities for residential development behind many of the commercial frontages on the corridor.

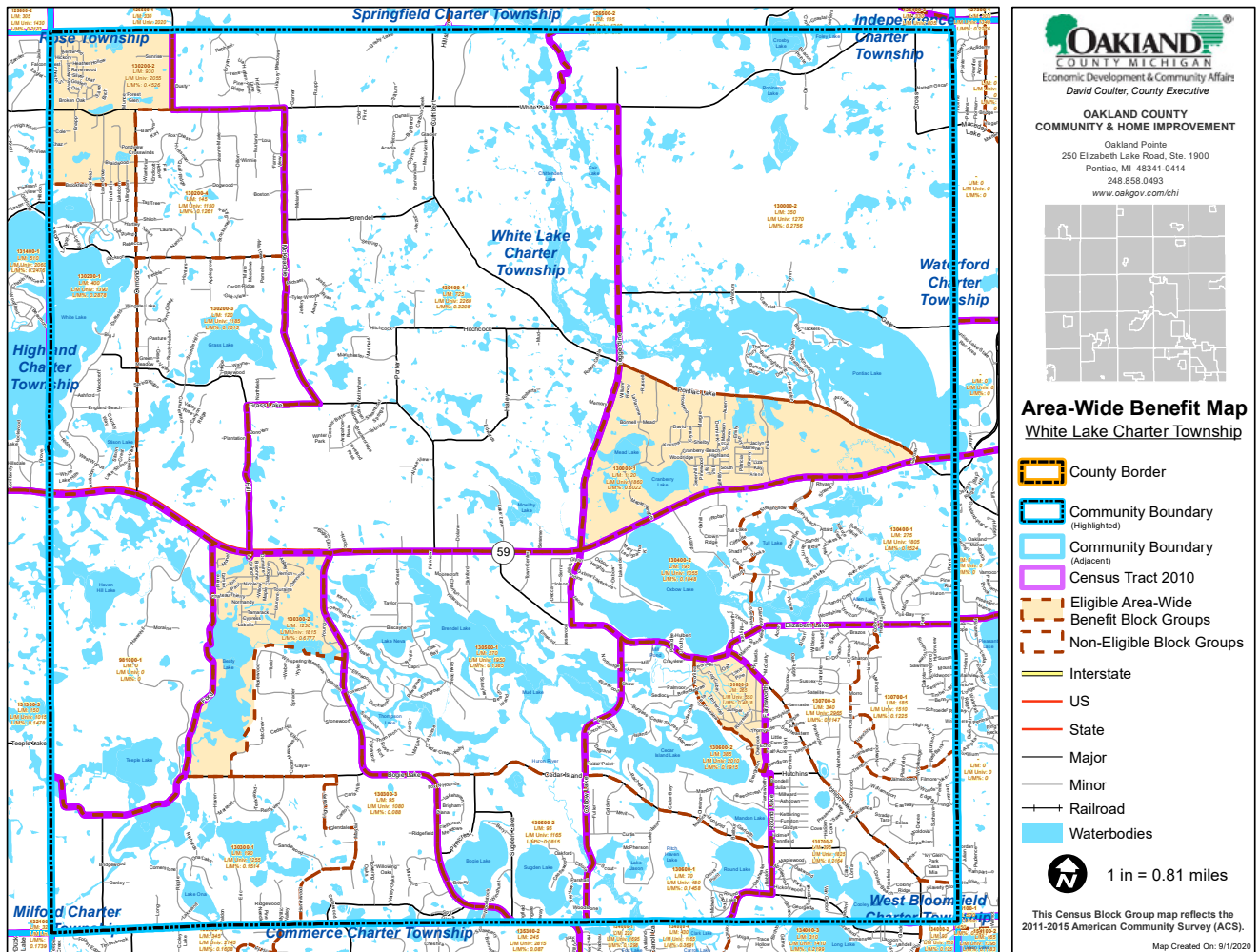
### *Minimum Lot Width, Area, and Setback Requirements*

Lot width and area requirements set the minimum standard for the size of the property. These two standards combined with setback requirements are often the primary criteria that establish whether a lot is buildable and impose restrictions on choice and cost of development. White Lake Township’s lot width, area, and setbacks are well written to permit a range of residential housing sizes and styles and are well scaled to the intent of each residential zoning district.



Single-family residence

### Map 08: CDBG Area-Wide Benefits: White Lake Township



Source: Oakland County's Community & Home Improvement Division



Small lot single-family



Figure 26: Key Housing Strategies

### Missing Middle Housing

Missing Middle housing typologies: Duplex, Triplex, Quadplex, Bungalow Courts, Multiplex, Live/Work units, weave density and diversity into the fabric of traditional single-family residential neighborhoods.

### Rehabilitate Blighted Properties

Rehabilitating or retrofitting blighted properties will not only funnel more units into the housing market to address the supply issues but will also produce units at lower prices than new builds to cater to the low- and middle-income groups pursuing homeownership.

### Zoning Reform

As the Township's legally binding document, language in the Zoning Ordinance can be removed or added to allow a range of housing types.

- » Rezone for Mixed-Use/Multi-Family in Commercial Districts.
- » Minimum Lot Width, Area, and Setback Requirements.



Large lot single-family

## Sources

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Lakefront home

# Transportation & Mobility

Transportation networks are the physical links that define mobility and connectivity in a community. Roads, public transit, sidewalks, and other non-motorized paths allow residents to move between home, work, places to socialize, and other everyday destinations. Transportation infrastructure also enables regional connectivity, facilitating the exchange of products and services with other economic markets. Typically, housing, businesses, and amenities tend to concentrate along well-connected road networks, thereby establishing transportation infrastructure as a fundamental element of land use planning.

The Township's 2012 Master Plan recognized the importance of broadening transportation choices, improving pedestrian connectivity to public and commercial areas, and promoting a public transportation system to increase the mobility of the elderly and physically disabled. However, transportation and the supporting infrastructure in the Township continues to be auto-oriented. This section inventories the transportation systems in White Lake Township and identifies how existing infrastructure can be adapted to support diverse mobility options. The findings from the analyses and community input session will help guide the Township on major transportation infrastructure advancements and policy decisions.

## ROAD NETWORK

White Lake Township has 231.5 miles of roads within its boundary.<sup>1</sup> The Township is bisected by State Highway M-59 that runs east-west through the Township. The M-59 thoroughfare continues west to connect the Township with US-23, which runs north to Flint and south to Brighton and Ann Arbor, and continues east through metro Detroit to find a terminus at Chesterfield and Harrison Townships. Interstate 75 (I-75), which runs north to Flint and south to Detroit, can be accessed about three miles northeast. Collectively, the M-59 thoroughfare and

the proximity to freeway interchanges and highways offer convenient regional connectivity, making White Lake Township an accessible residential community.

## Road Classification and Traffic Volumes

The National Functional Classification (NFC) is a hierarchical system developed by the Federal Highway Administration (FHWA) and used by the Michigan Department of Transportation (MDOT) to determine federal funding allocation for roads. Roads are categorized based on mobility, trip distance, speed limit, and traffic volume. The higher the road classification, the greater the funding. Roads in White Lake Township fall into one of the following classifications: Major Arterial, Minor Arterial, Major Collector, and Local Roads. The map titled "National Functional Classification" (p. 58) represents the Township's road network based on the NFC system. MDOT also calculates the average daily number of vehicles that travel on roadways throughout the year, a metric termed "Average Annual Daily Traffic" or AADT. The numbers on the NFC map represent the estimated 2019 AADT counts in White Lake Township. MDOT recommends the continued use of 2019 AADT numbers since the most recent data was skewed due to the COVID-19 pandemic.

### *Major Arterials*

The east-west connector in the Township, M-59 (locally referred to as Highland Road) and the east-southeast peripheral road, Williams Lake Road, are the two major arterial roads. M-59 continues west to merge with US-23, connecting the Township to the major cities and employment hubs in the region: Flint to the north and Ann Arbor to the south, making the western segment of M-59 the busiest road in the Township with an AADT of nearly 30,980. With an AADT of 27,920, the eastern segment of M-59 is equally busy as it offers connections to the Oakland County International Airport and Metro Detroit. Williams Lake Road is the eastern boundary



## National Functional Classification

**Major Arterials:** Carry long-distance high-speed traffic and offer connectivity to other interstate highways. White Lake Township has 11.5 miles of major arterials.

**Minor Arterials:** Provide service for trips of moderate length, serve smaller geographic areas, and offer connectivity to other major arterials. White Lake Township has 18.1 miles of minor arterials.

**Major Collectors:** Gather and funnel traffic from local roads to the arterial network; these provide access to properties but tend to be longer in length, have lower connecting driveway densities, have higher speed limits, are spaced at greater intervals, and may have more travel lanes than minor collectors. White Lake Township has 16.4 miles of major collectors.

**Local Roads:** Provide access to properties. White Lake Township has 185.6 miles of local roads.

Source: Federal Highway Administration (U.S. Department of Transportation)

of the Township, which meets Cooley Lake Road to the south and, in turn, connects the Township to the “Four Towns” area with Commerce, Waterford, and West Bloomfield Townships. Williams Lake Road extends northeast to merge with Dixie Highway (M-24). A small segment of Cooley Lake Road, east of Union Lake Road, generates a high volume of traffic (AADT of 29,189) in the southeast corner of the Township, due to the connectivity it offers to the cities and employment centers south of the Township.

M-59 is under jurisdiction of MDOT, and the Township has limited control over any infrastructure decisions. Since Highland Recreation Area is accessed off M-59 and many commercial uses in the Township are concentrated along M-59, any decisions made by MDOT regarding road improvements will directly impact pedestrian safety, walkability, and the overall character along the corridor. MDOT’S Five-Year Transportation Program for 2023 to 2027 includes plans to rehabilitate M-59, or Highland Road, for the segment between Milford Road and Pontiac Lake Road in White Lake. Construction

and physical improvements are planned to begin in 2026. In addition to the rehabilitations planned for this stretch, six other segments of M-59 within the bounds of Oakland County will receive repairs and be reconstructed beginning in 2027.<sup>2</sup>

### *Minor Arterials and Major Collectors*

There are five minor arterial roads in White Lake Township: Elizabeth Lake Road, Union Lake Road, and Bogie Lake Road branch south from M-59/ Highland Road while Ormond Road branches north to meet another minor arterial, White Lake Road. The vehicle counts on Bogie Lake Road range from approximately 10,620 to 10,740; the volume of traffic is higher closer to the Huron Valley Schools campus. Elizabeth Lake Road and Union Lake Road are widely used (AADT of about 10,330 and 7,560, respectively) as the connectors between M-59 and the denser residential developments in the southeast quadrant of the Township. With an AADT of 9,345, White Lake Road is another major east-west connector in the Township, which runs parallel to M-59 and continues northeast to merge with Dixie Highway.

White Lake Township has several major collector roads including Teggerdine Road, Pontiac Lake Road, Oxbow Lake Road, and a segment of Cooley Lake Road. The segment of Cooley Lake Road, west of Union Lake Road, receives an AADT of 9,600, making it the busiest major collector in the Township. Teggerdine Road and Oxbow Lake Road are the primary north-south connectors in the Township with an annual daily average of about 7,700 vehicles. Pontiac Lake Road, leading to M-59, connects the northern portion of the Township to Waterford Township. The minor arterials and the major collectors are maintained by Oakland County and any infrastructure improvements along these roads require coordination with the Road Commission for Oakland County (RCOC).

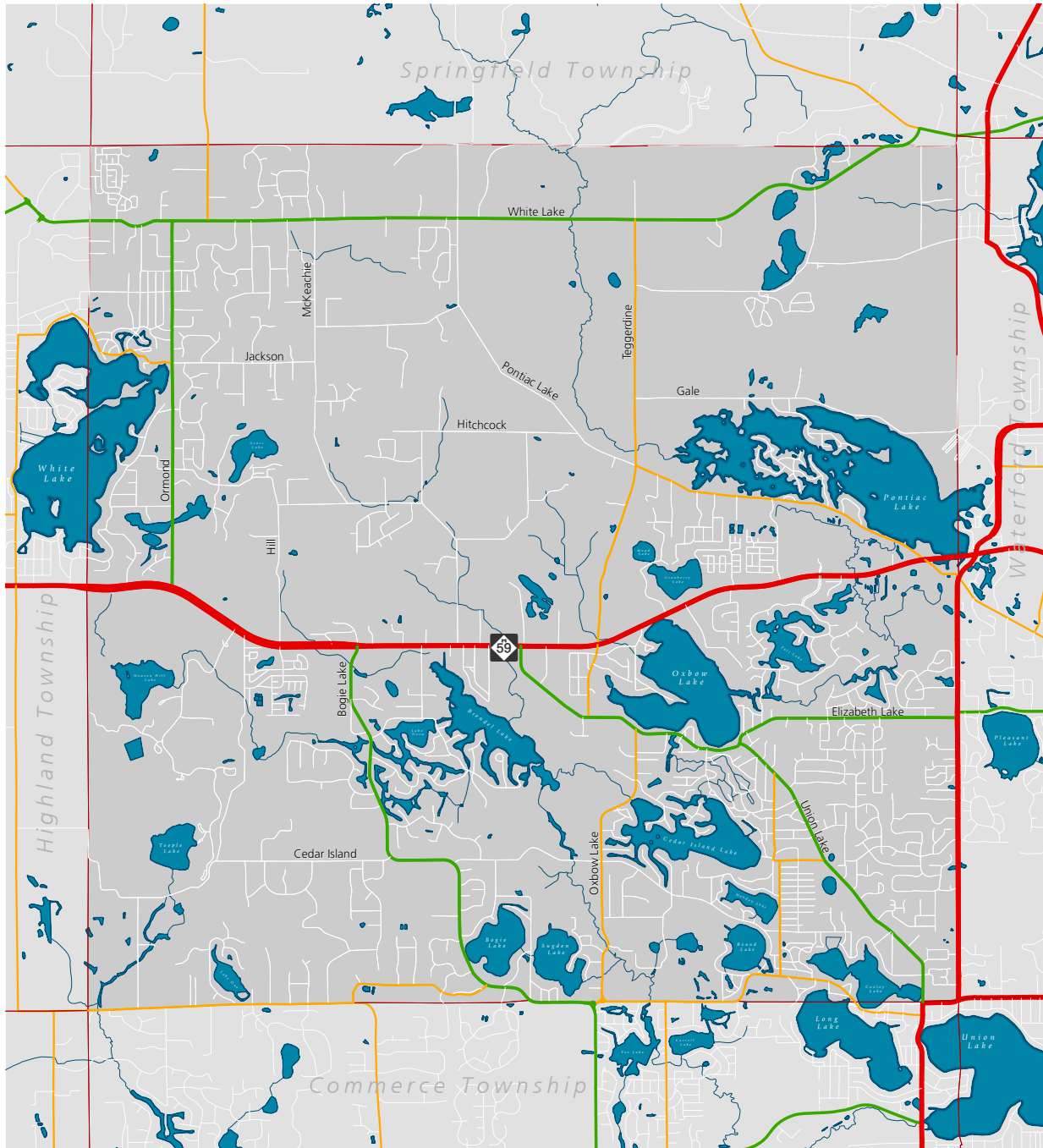
### *Local Roads*

Local roads offer connectivity to residential neighborhoods and other public spaces in the Township. Local roads cover the largest area compared to the other roads but are not eligible for any federal funding.

## Commuter Traffic

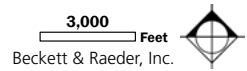
White Lake Township is primarily residential in character, with almost 96% of its residents

# Map 09: National Functional Classification



## National Functional Classification

Sources: Michigan Open Data Portal, Oakland County, White Lake Township, MDOT



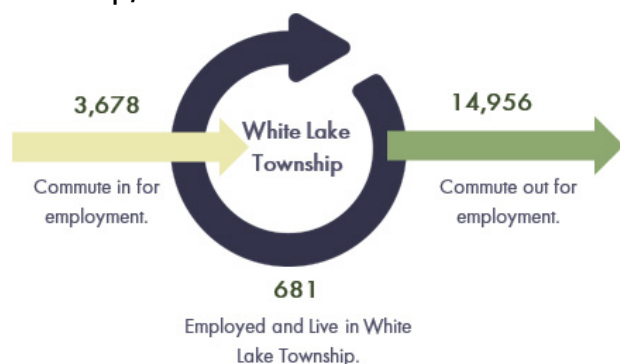
- Major Arterial
- Minor Arterial
- Major Collector
- Local Roads
- ## 2019 Average Annual Daily Traffic (AADT)

commuting outside of the Township to their place of employment.<sup>3</sup> About 61% of Township residents are employed within Oakland County and 17% commute to Wayne County for employment.<sup>4</sup> Most residents commute either south or southeast to the employment hubs of Detroit (4.7%), Farmington Hills (4.5%), Troy (4.3%), or Southfield (4.2%).<sup>5</sup> All four cities can be accessed via the segment of M-59 east of Teggerdine Road, likely causing congestion along this major throughfare during peak hours in the morning and evening, which can impact the length of daily commutes and safety. Those commuting to the Township for employment also primarily access the Township via M-59 from the west, establishing this stretch of the state highway as an important corridor.<sup>6</sup> The segment of Cooley Lake Road west of Union Lake Road receives high traffic counts (AADT 9,600) as it contains a strip mall and offers connectivity to the cities of Farmington Hills, Novi, and Livonia, making it a bottleneck for traffic.

## Road Quality

The Transportation Asset Management Council (TAMC) conducts a visual survey called the

**Figure 27: Commute Patterns, White Lake Township, 2019**



Source: OnTheMap, United States Census Bureau

Pavement Surface Evaluation and Rating (PASER) to evaluate conditions of roads. This survey uses a scale of 1-10 to rate roads and categorize them as good, fair, or poor, as represented in the map titled "PASER Ratings 2022" (p. 60). The map depicts a vast majority of the major roads in the Township are in fair (indicated in yellow) or poor (indicated in red) condition; only a handful of road segments are in good condition (indicated in green). While Michigan's extreme weather exacerbates regular wear and tear, deteriorating road conditions can impede daily commutes and safety.

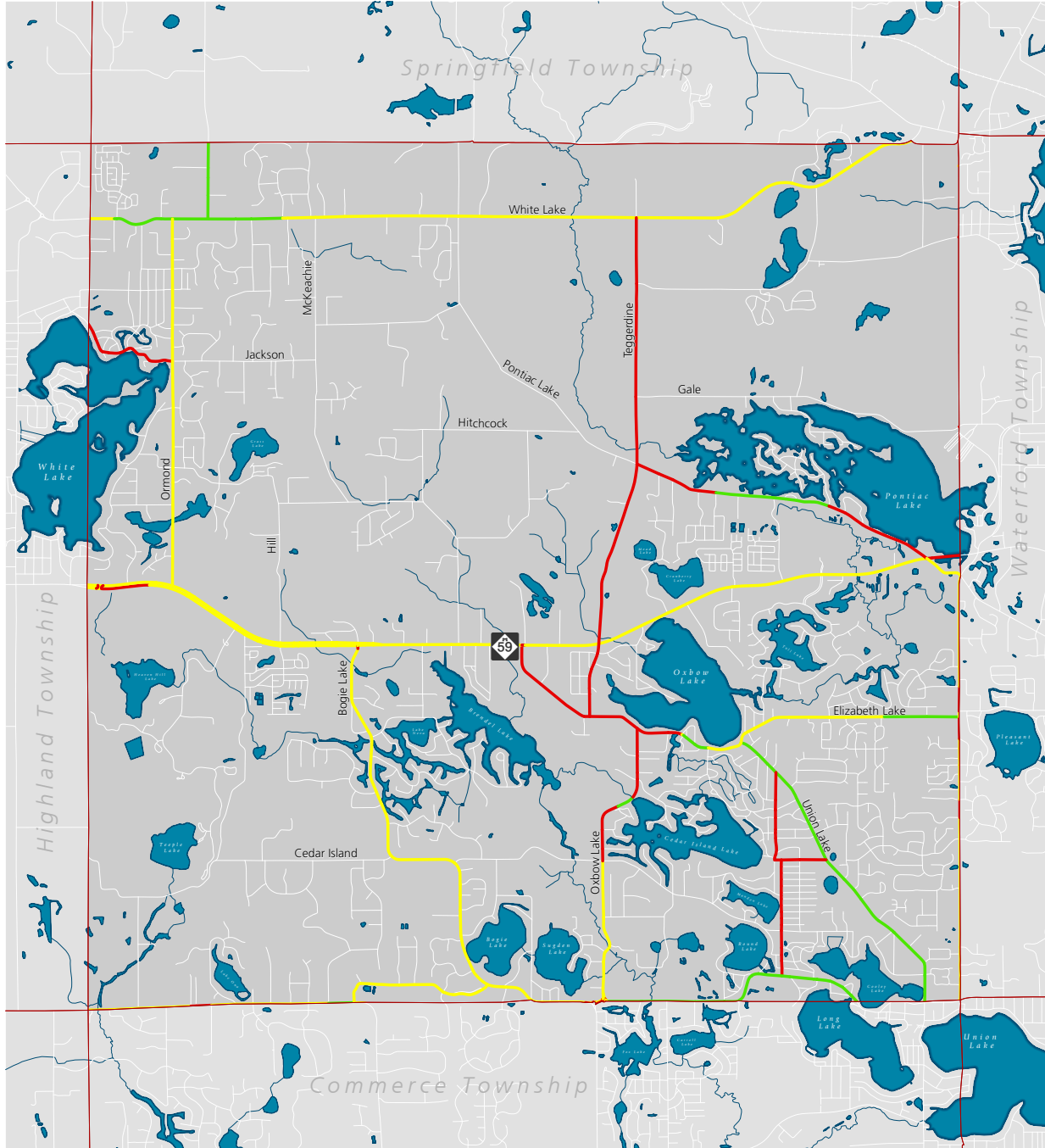
The Township's major arterials, M-59 and Williams Lake Road, are in "fair" condition. Given both roads are gateways into the Township and receive high volumes of daily commuters, improving the quality of these roads is imperative. As noted in the previous section, improvements and maintenance along M-59 are managed by MDOT. In addition to the rehabilitation projects MDOT has planned for 2026 and 2027 along M-59, SEMCOG has proposed \$53.8 million in pavement improvements along M-59 between Milford Road and Pontiac Lake Road in 2026 under the Transportation Improvement Program (TIP), which includes projects recommended by MDOT for state-owned transportation assets in the SEMCOG region.<sup>7</sup>

The quality of pavements along the minor arterial roads, Elizabeth Lake Road, Union Lake Road, Bogie Lake Road, Ormond Road, and White Lake Road, varies from good to poor; only Union Lake Road, short segments of Elizabeth Lake Road, and White Lake Road are in "good" condition. Particularly concerning is the western segment of Elizabeth Lake Road that connects with M-59. This intersection provides direct access to the residential development in the southeast portion of the Township. The RCOG completed a \$2.3 million project, to address concerns regarding road quality and safety along Elizabeth Lake Road. The improvements include:<sup>8</sup>

- » Conversion of the three-way Elizabeth Lake Road/Teggerdine Road intersection, controlled by stop signs, to a single-lane roundabout.
- » Conversion of the three-way Elizabeth Lake Road/Oxbow Lake Road intersection, controlled by stop signs, to a compact roundabout.
- » Repaving of roads in the vicinity of the roundabouts with asphalt.
- » Installation of curbs and gutters, sidewalks, Americans with Disabilities Act (ADA)-compliant pedestrian crosswalks, and street lighting at the roundabouts.
- » Improvements to storm sewers and drainage.
- » Utility relocation.
- » Milling and paving Elizabeth Lake Road between the roundabouts with the addition of four-foot road shoulders.



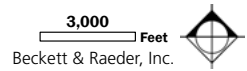
Map 10: The Pavement Surface Evaluation and Rating (PASER)



### PASER Ratings 2022

Sources: Michigan Open Data Portal, Oakland County, White Lake Township

- Good
- Fair
- Poor



Many of the major collector roads in the Township are in “poor” condition. The quality of pavement that covers the entire stretch of road along the major north-south connectors in the Township, Teggerdine Road and Oxbow Lake Road via Elizabeth Lake Road, are in poor condition. In addition to offering north-south connectivity, Oxbow Lake Road provides access to Oxbow Elementary School, furthering the urgency to invest in infrastructure improvements along this stretch. Segments of Pontiac Lake Road leading to Teggerdine Road and M-59 are also of poor quality.

**Road Safety**

The existing road infrastructure in White Lake Township is impacted by the geography of the lakes as the road system is not organized into rectilinear grids, but rather large swooping stretches with disjointed intersections and connections in response to the existing lakes and wetlands. While accidents can occur at any segment of a road, 31% of Michigan’s fatal crashes in 2021 occurred at intersections, emphasizing the importance of designing safe road intersections.<sup>9</sup> Additionally, as highlighted in the Road Quality section above, the poor quality of pavement along some of the Township’s major thoroughfares further exacerbates the safety of commuters. The map titled “Crashes, 2021” (p. 62) uses 2021 crash data from the Michigan Traffic Crash Facts (MTCF) website to identify unsafe intersections and road segments in White Lake Township.

A total of 568 crashes occurred in the Township in 2021, of which a majority occurred along M-59, especially at intersections with north-south arterials or collector roads. The “Crashes 2021” map (p. 62) shows several crashes along White Lake Road in the

northern half of the Township, but the southern half witnessed a significantly higher number of crashes along Williams Lake Road, Bogie Lake Road, Elizabeth Lake Road, Union Lake Road, and Oxbow Lake Road likely due to blind spots created by curvilinear geography of roads in response to several lakes and natural features. The highest concentration of crashes occurred at the following intersections:

- » M-59 and Ormond Road
- » M-59 and Bogie Lake Road
- » M-59 and Teggerdine Road
- » M-59 and Fisk Road
- » M-59 and Pontiac Lake Road

While there were no fatalities caused by crashes in 2021, the table below titled “Injury Caused by Crashes” shows of the 568 total crashes in the Township, 9.7% may have involved injuries, 8.1% may have resulted in minor injuries, and 1.6% may have caused serious injuries. Two accidents involving pedestrians were categorized as “Suspected Serious Injury” while two involving bicyclists were categorized as “Suspected Minor Injury.”

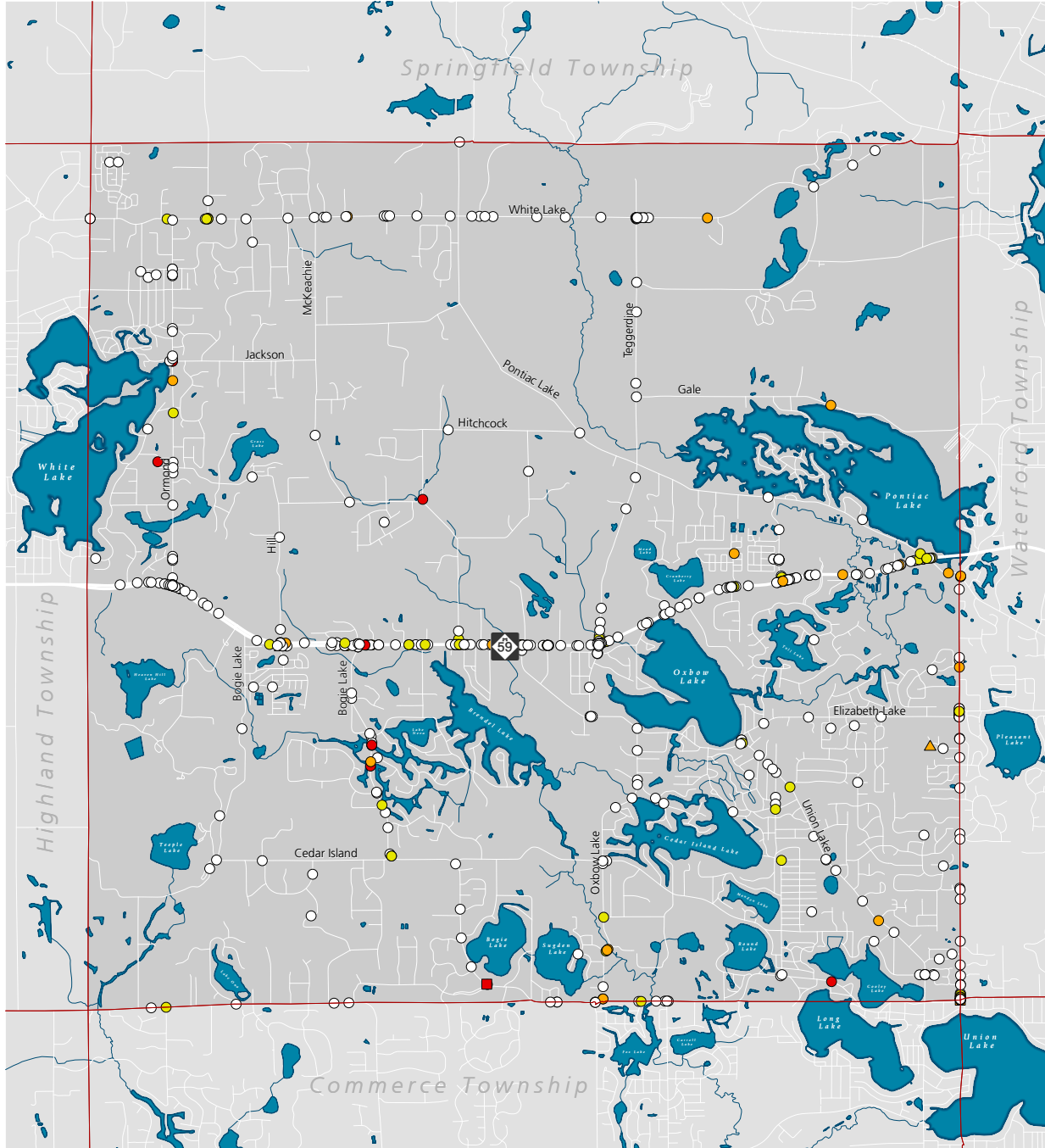
Given the volume and intensity of crashes in 2021, improving road safety measures and addressing problematic intersections should be important priorities for the Township. Proposed improvements along M-59 and between Milford Road and Pontiac Lake Road may address some safety concerns. The construction of roundabouts at the intersections of Elizabeth Lake Road and Teggerdine Road, and Elizabeth Lake Road and Oxbow Lake Road, will improve safety in the southern portion of the Township.<sup>10</sup>

**Table 13: Injury Caused by Crashes in 2021**

Injury Type	Number of Crashes	Percentage of Total
Fatal Injury	0	0.0%
No Injury	458	80.6%
Possible Injury	55	9.7%
Suspected Minor Injury	46	8.1%
Suspected Serious Injury	9	1.6%
<b>Totals</b>	<b>568</b>	<b>100%</b>

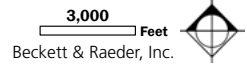
Source: Michigan Traffic Crash Facts

Map 11: Crashes 2021



### Crashes 2021

Sources: Michigan Open Data Portal, Oakland County, White Lake Township, MTCF



#### Type of Crash

- ▲ Pedestrian Involved
- Cyclist Involved
- No Pedestrian or Cyclist

#### Severity

- No Injury
- Possible Injury
- Minor Injury
- Major Injury

# MULTI-MODAL TRANSPORTATION INFRASTRUCTURE AND COMPLETE STREETS

Transportation advocates have increased public awareness of how streets in the United States are overwhelmingly oriented toward automobile travel. As an alternative to single-use roads, advocates have pushed for "Complete Streets," a movement that calls for multimodal transportation by designing streets for automobiles, pedestrians, bicyclists, and public transit users of all ages and abilities. From simple additions or modifications to full-fledged infrastructure revamps, complete street elements may be scaled based on the needs and budget of individual communities.

## Non-Motorized Pathways

The existing pedestrian system is as expected in an area that relies heavily on the automobile as the primary source of transportation: currently, it contains several disconnected sidewalks/pathways. Though about 91% of Township residents primarily use automobiles (cars, trucks, or vans) to commute

to work, integrating and increasing non-motorized trails and pathways was recognized as a "high priority" by 32% of survey respondents.<sup>11</sup> To this end, the Parks and Recreation Committee developed a plan for Township-wide system of pathways; the renovation of the M-59 pathway is an essential element of this plan as it will connect future north-south pathways to residential land use in the Township. The 2024–2029 CIP shows \$6 million for the renovation of the pathway along M-59, spread over three phases, as a combination of funds from the Township and partner organizations.<sup>12</sup> The CIP also includes \$7 million worth of pathway construction along Union Lake Road and Bogie Lake Road.<sup>13</sup> In addition to pathways along the major thoroughfares, the Township has also planned for the development of the "ITC Corridor Four Seasons Trail" which would provide a link between Pontiac Lake State Recreation Area and Highland State Recreation Area, via the M-59 trailway.<sup>14</sup> This route is included in the Oakland County Greenways Plan and includes state and regional financial participation. Construction of the trailway is expected to occur over three phases. Furthermore, the Huron-Clinton

**Complete Streets**

Complete street elements the Township can focus on include sidewalks, bicycle lanes, safe crossings, street lighting, and street landscaping.



Sidewalks



Bicycle Routes



Safe Crossings



Street Landscaping



Street Lighting



Metroparks have begun a project to connect the five metroparks with non-motorized pathways. The initial phase of the project is complete, and two of the proposed segments under consideration are in White Lake Township.<sup>15</sup>

### Signed Bicycle Route<sup>16</sup>

A signed bicycle route is a low-volume roadway designated for cyclist use, which typically connects dense residential areas to municipal facilities such as the Township Hall, library, schools, churches, retail uses, and the like. There is not a dedicated lane within the roadway for bicycle use. Rather, bicyclists share the road with vehicles and are guided to their destination by “bicycle route” signs along the shoulder.

### Bicycle Lane<sup>17</sup>

Bicycle lanes are dedicated portions of the roadway designed, striped, and signed to accommodate bicyclists. There are several thoroughfares in White Lake Township that could be designed to accommodate bicycle lanes, including Bogie Lake Road, Elizabeth Lake Road, Teggerdine Road, Union Lake Road, Ormond Road, White Lake Road, and paved portions of Pontiac Lake Road and Fisk Road.

### Shared-Use Path<sup>18</sup>

Shared-use paths are routes that accommodate two-way “traffic” of non-motorized and pedestrian uses within a single right-of-way separated from the roadway. Frequently, these trails are developed within an easement part of a utility corridor or within an abandoned railroad corridor. Shared-use paths can accommodate a wider spectrum of users than either the signed bicycle routes or bicycle lanes. Shared-use paths are typically wider and separated from motorized traffic, making it safer for walkers, runners, in-line skaters, and bicyclists. Often these trails are used during the winter months for cross-country skiing and snow shoeing. Therefore, the design of this trail system (width, materials, grade, etc.) is critical to accommodate all potential users. In White Lake Township, proposed pathways along M-59 and the ITC corridor are classified as shared-use paths.

The Township should continually aim to integrate trails, sidewalks, and bicycle routes that connect parks and open spaces, recreational facilities, residential neighborhoods, schools, and commercial

uses to achieve improved multi-modal access and usability in the community. In addition to the complete street elements identified previously, the Township should be mindful of the following goals as it works to integrate shared-use pathways among existing roads and transportation infrastructure:

- » GOAL 1: Maintain and improve existing pathway segments.
- » GOAL 2: Construct new pathway segments and establish connections between existing segments.
- » GOAL 3: Plan connections to Oakland County Trail System.
- » GOAL 4: Non-motorized access to parks.
- » GOAL 5: Non-motorized access to a future central gathering place.
- » GOAL 6: Individual connectors between neighborhoods and Township parks.

The Township can also explore the adoption of a Complete Streets Ordinance, requiring all new roads or improvements to existing roads to consider the inclusion of Complete Street elements.

## PUBLIC TRANSPORTATION

Access to quality public transportation at affordable rates and regular frequency enables mobility for people of all age groups and income. Oakland County coordinates with various regional transportation organizations to provide public transportation in White Lake Township and other communities across the County. In November 2022, Oakland County residents approved the Oakland County Public Transportation millage. This voter-approved 10-year, 0.95 millage is dedicated to maintaining and expanding public transit services throughout Oakland County.<sup>19</sup> Following are the public transportation options available to White Lake Township residents.

### Suburban Mobility Authority for Regional Transportation (SMART)<sup>20</sup>

The Suburban Mobility Authority for Regional Transportation (SMART) is southeast Michigan’s regional bus system which provides a variety of transit services in Oakland County. White Lake Township is currently not serviced by SMART; however, in 2023, SMART considered creating a new fixed route service



from Auburn Hills through Pontiac that continues west through Waterford Township and a portion of White Lake Township.

### Western Oakland Transportation Authority (WOTA)<sup>21</sup>

The Western Oakland Transportation Authority (WOTA) has been providing paratransit (dial-a-ride) transportation services since 2020 to qualifying residents of Highland Township, Walled Lake, Waterford Township, and White Lake Township.

WOTA accommodates trips to work, medical appointments, shopping, banking, civic events, entertainment venues, and social activities within the driving boundary. Eligible riders include seniors over 55, adults with disabilities, and veterans, along with companion riders. In 2023, WOTA undertook efforts to extend the hours of service, reduce the cost per stop, include low-income residents as eligible riders, purchase additional ADA-compliant minivans, and expand the geography of the service area.

Figure 28: Transportation & Mobility: Ongoing & Proposed Transportation Improvements

#### Major Arterials

- » MDOT'S Five-Year Transportation Program for 2023 to 2027 includes plans to rehabilitate M-59, or Highland Road, for the segment that stretches between Milford Road and Pontiac Lake Road; construction and physical improvements are planned to begin in 2026.
- » Six other segments of M-59 within the bounds of Oakland County will receive repairs and be reconstructed beginning in 2027.

#### Road Quality

- » SEMCOG has proposed \$53.8 million in pavement improvements along M-59 between Milford Road and Pontiac Lake Road in 2026, under the Transportation Improvement Program (TIP) which includes projects recommended by MDOT for state-owned transportation assets in the SEMCOG region.
- » The RCOG completed a \$2.3 million project to address concerns regarding road quality and safety along Elizabeth Lake Road.

#### Road Safety

- » The construction of roundabouts at the intersections of Elizabeth Lake Road and Teggerdine Road and Elizabeth Lake Road and Oxbow Lake Road will improve safety in the southern portion of the Township.

#### Complete Streets

- » In addition to the several non-motorized and multi-modal infrastructure measures, the Township can also explore the adoption of a Complete Streets Ordinance, requiring all new roads or improvements to existing roads to consider the inclusion of Complete Street elements.

## Sources

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Sidewalk in commercial development



# Community Facilities

A primary function of local government is to provide services and amenities like public safety, infrastructure, and recreational opportunities to its residents. In many cases, the provision and quality of these services and amenities are a draw to the municipality and may also be cited as the reason current residents chose to live in the area.

These sentiments ring true for many residents of White Lake Township. Results from the community survey indicate 56% of respondents consider the Township's recreation options to be one of White Lake Township's best characteristics. Another 39% held the same perspective about the quality of schools that serve the Township, 11% about the quality of municipal services, and 4% about access to healthcare services, all of which comprise essential municipal facilities and services that impact residents on a daily basis. On the other hand, when asked about the largest challenges to face White Lake Township within the next 10 years, 18% of respondents expressed concern about the maintenance of public infrastructure, representing the 6th most commonly held concern in the coming decade. These sentiments may be indicative of the need to service these systems in the coming years.

This chapter inventories the facilities and services available to residents of White Lake Township, including public utilities and services, municipal facilities, public safety services, parks and recreation spaces and facilities, educational services and facilities, and healthcare facilities to support medical needs.

## PUBLIC UTILITIES & SERVICES

### Water and Sewer

#### *Water System*

The water system includes about 55 miles of water main lines that range in size from 4 to 16 inches in diameter; 15 pressure control valves; approximately 1,000 gate valves; nearly 700 fire hydrants and hydrant valves; 2 elevated water storage tanks that each hold

1 million gallons of water; 5 water treatment plants; and 9 water supply wells. Major improvements to the Township's water system took place in 2019 and 2020 at the Twin Lakes II and Hillview well houses. While the condition of the system varies, it is primarily assessed as being in "good to excellent" condition and typically experiences moderate to heavy use on a regular basis.<sup>1</sup>

The Township's Department of Public Services (DPS) is managed by the DPS Director and seeks to provide safe drinking water and fire protection to all citizens of the Township. The Department has provided water to Township residents since 1980; currently, more than 2,100 water accounts are in use.<sup>2</sup> The Department offers numerous services that include, but are not limited to, the following:<sup>3</sup>

- » Repairing and maintaining water mains and related structures, such as towers, pumps, treatment facilities, fire hydrants, water shut-off valves, and generators.
- » Flushing fire hydrants in the Spring and Fall.
- » Replacing water meters and updating them to work in an automated billing system.
- » Marking underground water utility locations.
- » Managing subdivision irrigation meters.
- » Investigating water service line leaks.
- » Answering customer inquiries regarding rusty or cloudy water, low water pressure, water location, billing, and fees.
- » Complying with public health standards and guidance.

#### *Sanitary Sewer System*

The sanitary sewer system serves approximately 4,500 residents. The sewer mains of this system were primarily constructed in 1999 with additional

improvements and extensions taking place later, including the most recent update in 2012. The Sanitary Sewer System contains approximately 20 miles of gravity sewer mains, 22 miles of pressured mains, and 10 pumping stations. The wastewater flow of the Township is discharged into Commerce Township's collection system and conveyed to the Commerce Township Wastewater Treatment Plant for treatment. Currently, the Sanitary Sewer System is in "good to excellent" condition and experiences light to moderate use on a regular basis.<sup>4</sup>

The Township's sanitary sewer system is managed by the DPS. This Department holds numerous responsibilities that advance its mission to provide quality and efficient services to all users while simultaneously protecting and enhancing the Huron and Clinton River Watersheds. The Department's responsibilities include, but are not limited to, the following:<sup>5</sup>

- » Managing and sharing storm and sanitary sewer locations and easement information.
- » Continually developing, maintaining, and reviewing the Sanitary Sewer Master Plan.
- » Calculating and sharing sewer connection, extension, and capacity estimates.
- » Developing Special Assessment Districts (SADs) for sewer and water systems.
- » Performing program, project, and asset management, design assistance, and systemic fiscal responsibility.
- » Overseeing invasive species management programs, including the West Nile Virus (Mosquito) Control Program.
- » Hosting public education and outreach efforts.
- » Assessing the quality of surface and groundwater.

In the event of an emergency, the Department of Public Services provides around-the-clock maintenance of the Township's sewer system through an agreement with the Oakland County Water Resources Commissioner's Office.

White Lake Township utilizes two types of infrastructure to transport wastewater through the municipal pipe system to appropriate treatment facilities: the conventional gravity sewer system and the pressure sewer system. Gravitational methods

of wastewater transport use underground, sloping pipe systems that enable gravitational movement toward treatment facilities while pressure sewers break down waste in a pumping station before transporting it through smaller, airtight pipes toward treatment centers.<sup>6</sup> Though pressure sewers require energy to break down wastewater, the construction of pressure system pipelines is less intensive and can be placed closer to the ground level. Because gravity sewer systems are reliant on sloping pipelines, their placement is often much deeper underground.

The map titled "Sanitary Sewer Master Plan" (p. 70) illustrates upcoming plans to maintain, adjust, and expand the Township's sewer system. The current pressure system primarily runs east-west through the center of the Township and around Pontiac, Oxbow, Bogie, and Sugden Lakes. Plans for the pressure system's expansion would extend pressure mains and sanitary pressure structures to the land surrounding Cedar Island Lake, Brendel Lake, and Grass Lake to cover more of the Township's southern and northwest areas. The Township's existing gravity system covers less area than the pressure system. Notably further from the Township's bodies of water than the pressure systems, expansion plans for the gravity system would cover much of White Lake Township's southeast corner and also provide greater connection to the northwest area with additional gravity main lines and sanitary structures that follow Highland Road and Hill Road. Plans for expansion of the system should be carefully considered and done in accordance with the Future Land Use Plan. Water and sewer systems allow for higher-density development and can be used as a tool to control and direct growth and density. Areas designated as higher density on the Future Land Use Plan should be prioritized for water and sewer expansion (if they are not already served). Areas designated as low density on the Future Land Use plan should not be candidates for the expansion of the system.

## Electric and Gas Utilities

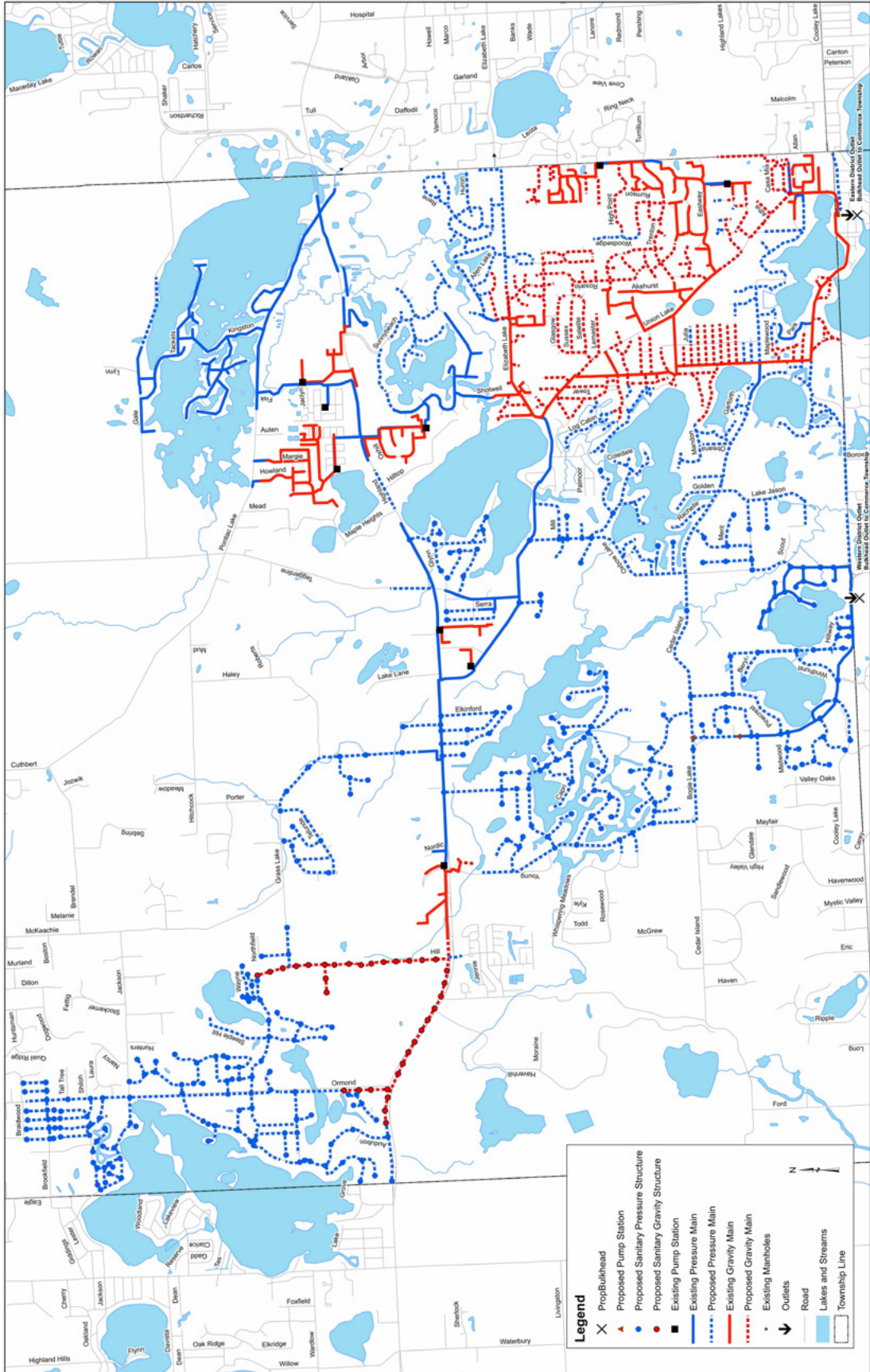
Electricity in White Lake Township is provided by DTE, while natural gas is provided by Consumers Energy. A transmission line passes through White Lake Township, and there is a gas/oil well located in the western-central portion of the Township.<sup>7</sup>

## Broadband and Cell Service

Residents of White Lake Township can access home internet services through numerous providers.



# Map 12: Sanitary Sewer Master Plan



Map 12: Sanitary Sewer Master Plan

White Lake Township

Scale: 0 = 875 = 1,750 = 3,500 = 7,000 Feet

Sheet 1 of 1

17810

Johnston & Anderson

11/20/2013

Source: White Lake Township Community Development Department

Though T-Mobile 5G Home and Xfinity Cable are the most common, Frontier, Mercury Broadband, HughesNet, and Viasat round out the options available to Township residents, with download speeds that range from 25 Mbps to 120 Mbps. Cellular internet service is offered through Verizon, AT&T, Xfinity Mobile, T-Mobile, Mint Mobile, and Visible. AT&T provides 5G connection while the other five providers offer 4G LTE.<sup>8</sup>

In 2022, Oakland County and the Southeast Michigan Council of Governments (SEMCOG) helped secure funding for a project enacted by Connected Michigan to assess and better understand uneven internet access and coverage as it pertains to rural communities in Oakland, Macomb, and Wayne counties. This project ultimately intends to increase broadband access based on findings uncovered through various phases of the study, including a survey distributed to update coverage maps for the state. With evidence backed by data, Connected Michigan has plans to use their findings to apply for federal funding to improve broadband access by investing in infrastructure that benefits homes, businesses, and public spaces alike.<sup>9</sup>

### Road Maintenance

In White Lake Township, road maintenance responsibilities are split between the Road Commission for Oakland County (RCOC) and the Michigan Department of Transportation (MDOT). A road's classification determines which entity is responsible for maintenance and improvements; for example, M-59 falls under the jurisdiction of MDOT because it is a state highway and classified as one of the Township's major arterials.

## MUNICIPAL FACILITIES

### White Lake Township Hall

White Lake Township Hall was built in 1949 and received its last major improvement in 1996. The Hall houses the offices and operations of the Supervisor, Clerk, and Treasurer, all elected officials of the Township. It also houses the offices of the Assessing, Building, and Planning departments for the Township. The Hall has been assessed as being in "fair" condition, and it is used heavily by both employees and community members as the site of numerous meetings.<sup>10</sup> All board, commission, and committee meetings are held in the Township Annex.

In 2020, the White Lake Township Board of Trustees passed a motion to move forward with plans to construct a new Township Civic Center that will include a new township hall and public safety building for the Township's Police Station and Fire Station #1.<sup>11</sup> Informed by resident input, the Board envisions this new construction to creatively incorporate and connect municipal, recreational, and commercial uses in one place. The Township's purchase of the 57-acre former Brendel Lake Campground will be incorporated into the Civic Center's creation as the land is developed into Stanley Park. The park will include an expanded trail system, pavilion for community events, picnic areas, and a variety of other amenities to be enjoyed throughout the year.<sup>12</sup> The Township's 2024-2029 Capital Improvement Plan includes constructing a new Township Civic Center in lieu of completing renovations to the existing Township Hall. Construction will be financed through grants, the Improvement Revolving Fund, and the issuance of bonds to complete the project.

## PUBLIC SAFETY

### Police

The White Lake Township Police Department provides police services to the Township. In addition to responding to calls, the Department offers community resources and services to the Township to bolster civic responsibility, involvement, and safety. These community-based services include the following:

- » **Neurodiverse Citizen Program:** This program provides an opportunity for the Township's Police Department to connect and interact with neurodiverse citizens on an individualized, appropriate, and helpful basis. Residents have the opportunity to provide voluntary information to the Department about special circumstances and the best way to approach neurodiverse individuals when responders are notified of a situation. This information and guidance are used to assess unique circumstances from a mental health perspective with the individual's best interests in mind.<sup>13</sup>
- » **Senior Welfare Contact Program:** This program was implemented with the intent to reduce the criminal victimization of the elderly by creating channels of communication between senior citizens and the Township's Police Department. Individuals enrolled in this program will be contacted by a representative

from the Department on a monthly basis to address concerns or problems within the community, generally check on their well-being, and connect them to senior services available at the local and national levels.<sup>14</sup>

- » **T.E.A.M. (Teaching, Educating, and Mentoring):** In 2018, the T.E.A.M. curriculum replaced DARE and is taught to 5th and 7th grade students in the Township over the course of 10 weeks. Topics include vaping, alcohol, drugs, gun safety, school violence, bullying, the court system, and internet safety. Additionally, T.E.A.M. program officials coordinate with the White Lake Police Foundation to offer events to participating students, including an annual golf outing, Youth Police Academy, a 5k Run event, and more.<sup>15</sup>
- » **Community Emergency Response Team (CERT):** The program educates volunteers about disaster preparedness through training sessions focused on basic disaster response skills in the event of fires, small-scale search and rescue, team organization, and medical operations. To complete the program, CERT volunteers must complete seven core training classes.<sup>16</sup>
- » **Citizens Academy:** The Citizens Academy is a 30-hour block of instruction designed to give the public a knowledge of the Police Department, Fire Department and Township personnel and policies. It consists of a series of classes, held once each week for two to three hours. The instruction is comprehensive, covering a different area of the Police Department, Fire Department and Township each week. Officers, Firefighters, and Township Board members assigned to that particular division conduct each instructional block.<sup>17</sup>

## Fire Department

The White Lake Township Fire Department (WLTFD) seeks to protect life and property through fire rescue and emergency medical services. Since its founding in 1948, the Department has transitioned from a volunteer department to a department of career and part-time firefighters. White Lake Township is covered 24 hours a day, 7 days a week by career fire department personnel with emergency assistance from part-time staff members as needed.<sup>18</sup> In addition to fire suppression and rescue needs, the WLTFD may also respond to the following: utility problems (including downed or arching power lines and natural gas leaks), smoke and odor investigations, motor vehicle accidents, medical emergencies, mutual aid, and citizen assists.

Beyond its primary responsibilities, the White Lake Township Fire Department stays involved with the community through numerous events and public education opportunities. The Citizens Academy and Youth Fire Academy are both intended to provide participants with hands-on experience by exposing them to some elements of the Department's responsibilities and work. The Citizens Academy offers one class a week over the course of 11 weeks and is open to any individual over the age of 21 who works or lives in the Township. The Youth Fire Academy is a week-long program that takes place in the summer months and is open to 7th and 8th-grade students. In addition to each academy experience, the Fire Department educates the public with classes on CPR and basic first aid and through appointments with families to ensure their child car seat setup is proper and safe.

## Emergency Medical Services

Star EMS provides emergency and non-emergency services to communities throughout Oakland County, including White Lake Township. The dispatch center is staffed 24 hours a day with Emergency Medical Dispatchers who have been trained to give first aid assistance to each 911 caller and, when necessary, to provide a prompt ambulance response to emergencies requiring medical assistance and transportation. Star EMS also provides trusted non-emergency ambulance services to transport individuals to area hospitals, extended care facilities, nursing homes, dialysis clinics, doctor offices, and private residences.<sup>19</sup>

## PARKS & RECREATION

Parks, recreation spaces, nature preserves, and subsequent programming opportunities are important to provide in White Lake Township. In addition to the six parks managed and operated by the Township, recreation facilities are located on school properties, properties managed by the State, Metropark system, Oakland County, and private properties with activities like skiing and golf.<sup>20</sup>

The park and recreation facilities under the purview of the Township include a wide variety of offerings to ensure patrons of all ages and abilities can participate in recreational opportunities. In White Lake Township, these facilities include neighborhood parks that offer play areas for children near their homes with fields that fulfill the needs of sports teams for both children and adults. Community-wide parks provide



a destination for the broader community by offering a variety of activities and facilities, including trails, sports fields, and playground equipment.<sup>21</sup> In White Lake Township, recreation planning is intended to be participatory and to elicit insights from a large portion of the Township’s population. The Parks and Recreation Committee, Planning Commission, and Township Board are collectively responsible for planning through the master planning and parks and recreation planning processes. As the legislative body, the Township Board retains the utmost authority for recreation planning and budgeting.<sup>22</sup> The White Lake Township 2023-2027 Parks & Recreation Plan can be accessed on the Township’s website.

## EDUCATION

### Schools

Within the boundaries of White Lake Township, students are served by one of five school districts:

- » Clarkston Community Schools.
- » Holly Area Schools.
- » Huron Valley Schools.
- » Walled Lake Community School District.
- » Waterford Community Schools.

St. Patrick, a parochial school, is also located in the Township and serves students in Pre-K through 8th grade. Each of the Township’s districts and schools boast opportunities for early childhood learning prior to beginning elementary school as well as numerous programs and facilities dedicated to enrichment, recreation, and extracurricular activities.

### Museums and Libraries

#### Museum

The White Lake Historical Society provides an outlet for Township residents to participate in a mutual appreciation of White Lake’s history. The Society seeks to “preserve, advance, and disseminate” information about the Township’s history through the collection, arrangement, preservation, and restoration of numerous historic materials, including physical sites, as well as various written documents.

The White Lake Historical Society operates a museum to further its mission and educate visitors of all ages. The museum consists of the 1855 Kelley-Fisk Farm

state historic site, the Greek Revival farmhouse and outbuildings, including barn, pig, and hen houses, two corn cribs, a garage, and a privy.<sup>23</sup> The site also includes the 1876 Thompson One-Room School which was dismantled in 1995, moved from its original location on the Thompson Farm in 2004 and rebuilt.<sup>24</sup> Currently, the museum is available for visitation during special events or by appointment.

#### The White Lake Library

Since its establishment in 1975, the White Lake Library has had four different locations. First in the White Lake Community Hall, second Brooks Elementary, third to a building on Highland Road, and fourth, as of 2019, to a 28,000-square foot facility on Elizabeth Lake Road.<sup>25</sup> The demand for additional space corresponded with an increase in the Township’s population and, along with voter approval of a new space, speaks to the importance of the Library as a community asset for both long-term residents and newcomers to the community. In 2022 there were a total of 47,608 visits to the library. While the Library’s 87,618 items in its collection are certainly a point of attraction for visitors, it also offers a robust variety of online resources: eBooks; audiobooks; special collections; seeds that are free to plant and grow; numerous programs for kids, teens, and adults; and various events throughout the year. Program offerings range from musical events, movie nights, reading circles, arts and craft opportunities, book clubs, and yoga.

The White Lake Library is primarily funded through Township property taxes. In August 2022, Township voters approved a renewed millage rate of 0.5 mill to support library operations for the next 8 years.<sup>26</sup> The Library’s non-property tax revenue comes from state aid, fines, donations, and interest accrued from investments.

## HEALTHCARE & MEDICAL RESOURCES

### Healthcare Services

A range of healthcare services through numerous facilities are located within the boundaries of the Township. White Lake Family Medicine provides services for several separate areas of focus: family medicine, including pediatric services for infants, toddlers, children, and teens; urgent care; addiction treatment; behavioral and mental health treatments and services; COVID-19 testing; allergy testing; medical weight loss and nutritional services; sports

physicals; personalized treatment for substance abuse; and women's health services.<sup>27</sup>

For individuals who seek and would benefit from assisted living facilities, the Neighborhoods of White Lake, Independence Village, and New Hope are located within the Township.

Springfield Urgent Care provides flexibility in meeting the healthcare needs of White Lake residents of all ages. Open from 9am to 9pm every day of the week, including weekends, Springfield Urgent Care bridges the gap between primary physician care and emergency room treatment by offering services that fulfill urgent, non-emergency medical needs.<sup>28</sup>

## Hospitals

While there is not a hospital located within the boundaries of White Lake Township, there are seven hospitals located within 15 miles. Of these seven hospitals, the Detroit Medical Center Huron Valley-Sinai Hospital is less than five miles from White Lake Township.<sup>29</sup>

**Figure 29: Community Facilities: Key Takeaways**

### **There are several projects underway in White Lake Township.**

- » The Civic Center project, which includes the new Township Hall and Public Safety Building, has been in the works for several years and will be the result of many visionary planning efforts.
- » The Township has been working on the future vision of sewer and water infrastructure and where it should be developed in the future.
- » Phase 1 development of Stanley Park is nearing completion.

### **There are a host of services and facilities available to Township residents including:**

- » Water and sanitary sewer infrastructure.
- » Electric and gas utilities.
- » Broadband and cell services.
- » Road maintenance.
- » Public safety (police, fire, emergency medical services).
- » Parks and recreation facilities.
- » Public schools and healthcare facilities.

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# Economic Development

## REGIONAL CONTEXT

Economies are a web of relationships that span local, national, and global geographies. While municipalities have influence over economic development, they are beholden to laws, policies, and trends outside of their control that can have a negative or positive impact on local success. Due to its dependence on a larger system, economic development strategies are best conceived of and implemented with partners to strengthen the network and opportunities in which they operate.

Southeast Michigan is comprised of seven counties, including Oakland County. The Southeast Michigan Council of Governments, or SEMCOG, created a Comprehensive Economic Development Strategy for the region to reach economic success through strategies that emphasize collaboration, current conditions, and opportunities for growth and development.<sup>1</sup> By focusing on the three pillars of economic development (place, business, and talent), SEMCOG and the region endeavor to meet a vision of economic prosperity by ensuring communities have access to the following:

- » Unique places that offer various housing choices for a large and diverse population.
- » An educated and trained workforce that supports a multi-sector economy and provides opportunities for all.
- » Healthy and clean lakes, streams, and air, as well as connected systems of trails, parks, and natural areas that support recreational and cultural amenities.
- » Safe, efficient, and coordinated infrastructure systems that embrace advances in technology and focus on access for all.
- » Effective local government and engaged citizenry.

In local government, economic development is correlated to developing land to accommodate its “highest and best use.” When land is used according to the analysis conducted in this Master Plan, the region’s need for housing, commercial, recreational, or industrial uses can be optimized for job creation, housing that is affordable for the workforce, or creating tourist destinations. This section will explore the region’s major employment sectors, partnerships, and opportunities for development/redevelopment.

## EMPLOYMENT INVENTORY

White Lake Township’s rate of labor participation is reflective of employment patterns. Of the Township’s population aged 16 years and older, 64.7% participate in the labor force. While Oakland County’s rate of labor force participation is slightly higher at 66.2%, White Lake exceeds workforce participation not only in Michigan but the United States as well. As seen in the table (p.77) titled “Labor Force Participation (2020),” White Lake Township has experienced a lower unemployment rate than Oakland County, State of Michigan, and the United States; conversely, the Township has the highest percentage of households collecting social security income (39.3%) compared to other scales of observation. White Lake Township also has the highest rate of self-employment when compared to Oakland County and the State.

For residents of White Lake that are employed, the U.S. Census records the sectors of employment that residents participate in, regardless of where Township residents go to work. With the rise of remote work options, it is possible for residents of White Lake to work in sectors headquartered outside of the region; it is also possible for residents of White Lake to commute to places of work located outside of the Township or County on a hybrid or daily basis.

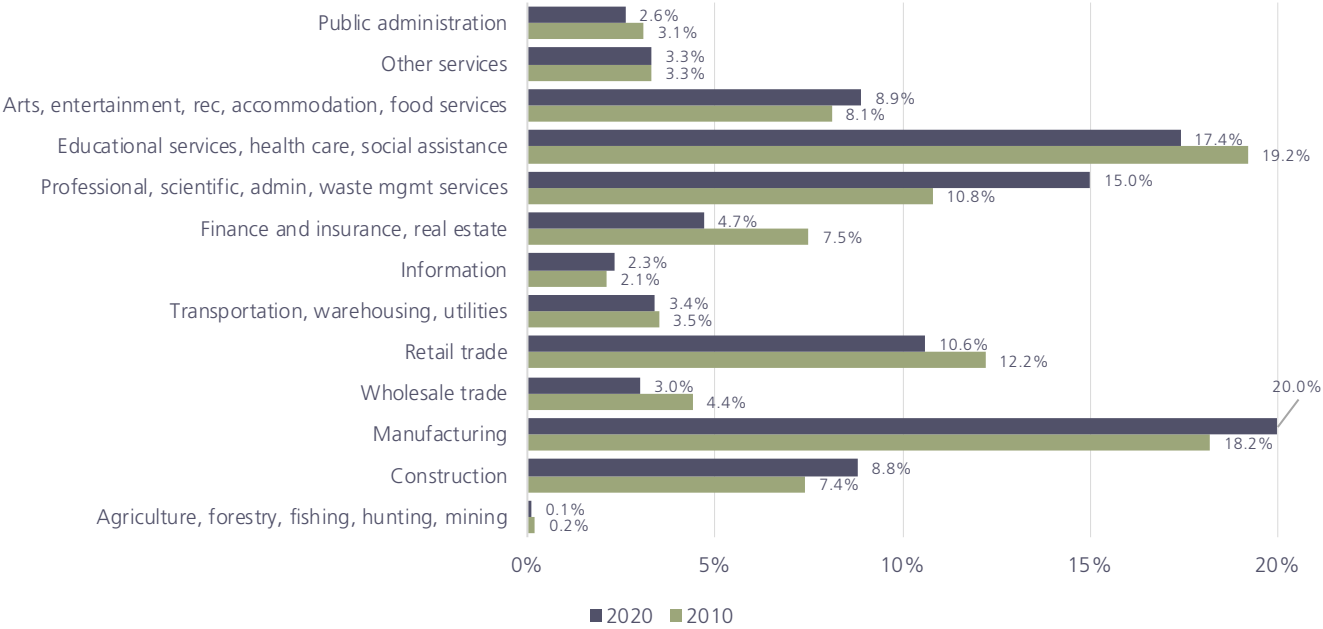
The most prominent sectors of employment for White Lake residents in 2020 (not necessarily

Table 14: Labor Force Participation (2020)

	White Lake Township	Oakland County	Michigan	United States
Labor Force Participation	64.7%	66.2%	61.5%	63.4%
Self-Employment Rate	5.6%	4.8%	5.0%	5.9%
Social Security Income	39.3%	30.9%	34.9%	31.4%
Unemployment Rate	4.6%	4.7%	6.0%	5.4%

Source: U.S. Census Bureau ACS Five-Year Estimates (2020)

Figure 30: Industry Employment Over Time (2010-2020)



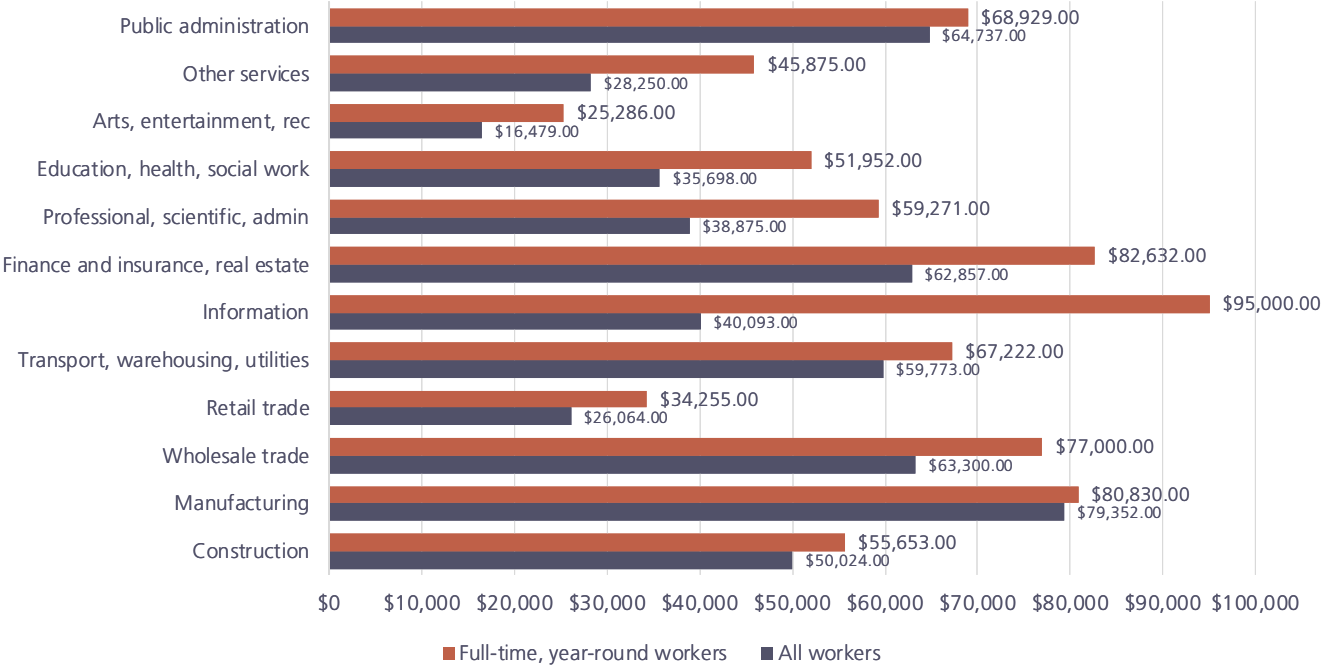
Source: U.S. Census Bureau ACS Five-Year Estimates (2010, 2020)

located within the Township) include: manufacturing (20%); educational services, health care, and social assistance (17.4%); and professional, scientific, administrative, and waste management services (15%). These sectors represent a little over half of all employers for residents of the Township. From 2010 to 2020, these three sectors have largely maintained the same prominence within White Lake Township. In 2010, retail trade included 12.2% of all White Lake workers, surpassing past levels of employment for those working in professional, scientific, administrative, and waste management services which was 10.8% that year. In 2020, workforce participation in retail services dropped slightly to 10.6% of the Township’s working population, representing the fourth most prominent sector of employment.

Median annual earnings vary across industries of employment, especially when distinguishing between all workers, whether seasonal part-time or year-round full-time participation in the workforce. In 2020, the median annual income for all workers in the Township was \$42,948, nearly \$20,000 less than the median income of full-time workers who are employed on a year-round basis and earn an average of \$60,794 annually.

Median incomes in the manufacturing sector did not vary greatly between different types of employment, likely indicating most employees in the industry work on a full-time basis. Additionally, manufacturing income is approximately \$80,000 annually, the highest for all workers and the third greatest for full-time, year-round workers, which bodes well for the Township as the greatest portion of residents

Figure 31: Median Annual Earnings by Industry (2020)



Source: United States Census Bureau ACS 5-Year Estimates (2020)

are employed in this sector. The two other most prevalent sectors of employment have median annual incomes notably less than manufacturing. Full-time, year-round employees of: educational services, health care, and social assistance; and professional, scientific, administrative, and waste management services earn \$51,952 and \$59,271, respectively.

**SECTOR ANALYSIS**

Products often go through multiple stages of manufacturing, processing, distribution, and sales before they get to the consumer. All of these stages are important economic links and form the broader economy. IMPLAN, an input-output economic modeling tool, was used to illustrate interdependence between industries and sectors in White Lake Township. IMPLAN data is sourced from various governmental agencies including the Bureau of Economic Analysis, Census Bureau, and Internal Revenue Service. IMPLAN models upstream economic activity, or the activities and labor that take place on the supply side of production. This includes the resources, supply, and manufacturing of goods and services. IMPLAN does not model sales, use, and disposal activity, also known as downstream economic activity. IMPLAN models several elements

of economic output, including labor income, intermediate output, and value added. The elements discussed in this section are described below.

- » “Value Added” represents the contribution to the gross domestic product.
- » “Total Economic Output” is the combined value of labor income, value added, and intermediate outputs.

While nearly 96% of Township residents commute to places of employment located outside of White Lake and these patterns of commuter and employment can render the Township a “bedroom community”, the following analyses will investigate employment opportunities within the Township. Prominent economic trends and the Township’s more prevalent industries impact the experience of living in and being a patron of businesses across the Township. Later analyses will focus on the economic impacts of COVID-19, which are place-based and felt by all residents of the Township, regardless of their place of employment.

Of the 546 industries modeled by IMPLAN, 181 are active in White Lake Township. By looking at each industry’s change in economic output, amount of economic output, and concentration in the

Table 15: Economic Base

Industry Categorization	Description	Location Quotient	2018-2019 Economic Output
Growth Industry	Industries that have a strong presence in the region and are expanding.	LQ > 1	Positive Change
Emerging Industry	Industries that are expanding but have yet to establish a strong presence.	LQ < 1	Positive Change
Mature Industry	Industries that have been a specialty for the region but are declining.	LQ > 1	Negative Change
Declining Industry	Industries with a small presence and declining economic activity.	LQ < 1	Negative Change

Source: IMPLAN, 2019

Township between 2018 and 2019, the industries are each categorized as mature, growing, emerging, or declining. These categorizations are determined by the industry's location quotient, a statistical metric that measures a region's industrial specialization compared to a larger geography, typically the state or nation. Location quotients (or LQs) greater than one indicate that industry contributes to a greater share of that community's economic activity. The table titled "Economic Base" shows how industries are categorized based on their location quotient and change in economic output.

The table titled "Growth and Decline Spectrum" (p. 80) provides an overview of the Township's economy based on trends in industry presence and growth. In White Lake, negative economic changes

have slightly exceeded positive gains. While the employment and total economic output of declining industries have the smallest presence of any of the four economic base categorizations, the Township's mature industries have the highest amount of economic output and employ the greatest number of workers. These trends indicate declining industries are likely to continue to diminish, but the prevalence of mature industries reduces the likelihood they will lose their stronghold in the Township. It is worth noting mature industries can easily become categorized as growth industries if and/or when their economic output increases over the course of observed years. Despite the presence of declining industries, emerging and growth industries illustrate economic promise; the greatest number of Township industries are categorized as emerging, and growth industries rival mature industries in the number of workers that are employed in the sector.

- » 49.0% of workers in White Lake Township are employed in growth or emerging industries.
- » Growth and emerging industries produce about 45.6% of the Township's total economic output while mature industries alone produce 42.9% of all economic output.
- » 51.4% of all businesses saw a positive change in economic output between 2018 and 2019.

Regardless of an industry's classification as growth, emerging, mature, or declining, economic contributions take place at all stages of development. The table titled "Top Industry Trends" compiles the top five industries under each stage based on their

### Industry Categorization

**Declining:** industries that have a small presence and declining economic activity; negative change.

**Emerging:** industries that are expanding but have yet to establish a strong presence; trending towards positive change.

**Growth:** industries with a strong regional presence that are expanding; positive change.

**Mature:** industries that have been a specialty for the region but are now declining; trending towards negative change.

Source: IMPLAN



Table 16: Growth and Decline Spectrum

Stage	Industry Count	Economic Output, 2019		Employment, 2019	
		Number	Dollars	Percent of Total	Count
Declining	63	\$95,492,419.08	11.50%	692	11.31%
Emerging	74	\$158,237,389.13	19.06%	863	14.11%
Growth	19	\$220,425,192.58	26.55%	2,122	34.86%
Mature	25	\$356,035,977.88	42.89%	2,441	39.90%
<b>Total</b>	<b>181</b>	<b>\$830,190,978.67</b>	<b>100%</b>	<b>6,118</b>	<b>100%</b>

Source: IMPLAN, 2019

Table 17: Top Industry Trends

Top Industries	Growth Industries	Emerging Industries	Mature Industries	Declining Industries
#1	Retail – building material and garden equipment and supplies store \$57.73 M	Other real estate \$36.36 M	Tenant-occupied housing \$130.66 M	Insurance agencies, brokerages, and related activities \$15.51 M
#2	Construction of other new residential structures \$29.38 M	Monetary authorities and depository credit intermediation \$17.08 M	Retail – general merchandise stores \$61.67 M	Full-service restaurants \$12.91 M
#3	Retail – motor vehicle and parts dealers \$22.98 M	Insurance carriers (except direct life) \$14.68 M	Limited-service restaurants \$29.63 M	Legal services \$9.89 M
#4	Retail – food and beverage stores \$16.65 M	Architectural, engineering, and related services \$12.12 M	Construction of new single-family residential structures \$29.51 M	Wholesale – motor vehicle and motor vehicle parts and supplies \$6.30 M
#5	Nursing and community care facilities \$14.75 M	Retail – non-store retailers \$10.66 M	Drilling oil and gas wells \$13.31 M	Religious organizations \$6.18 M

Source: IMPLAN, 2019

economic output for 2019. The Township's highest producing growth industries follow themes of various retail spaces, construction and building, and nursing and community care. As is expected from the preliminary base sector analysis, the top five mature industries exhibit high totals of economic activity. As these areas are regional specialties that

have exhibited evidence of decline between 2018 and 2019, investing in these industries may increase the likelihood they will observe economic growth in the present and shift to the growth categorization.

The emerging industries with the highest economic outputs echo trends present across Oakland County and complement the Township's most profitable

growth and mature industries. Other real estate and architectural, engineering, and related services are both necessary for construction and development services as well as housing and residences at large. Investing in this area is likely to benefit growth, emerging, and mature industries alike and further bolster economic growth and regional specialization for each.

**LARGEST SECTORS**

This section analyzes industries by their regional advantage, economic output, and number of employees to inventory the Township’s strengths and areas for improvement.

**Regional Advantage**

A base sector analysis was performed to identify industries in White Lake Township that are the largest exporters of goods and services as well as the industries that typically import goods and services. Exporting industries are important to identify because they inform the base of a municipality’s economy. Exporting sectors draw money into the region across a broad geographical area, indicating which industries provide a competitive advantage for the region. The location quotient is used to pinpoint the Township’s major exporters in comparison to the presence of each industry in a broader geographic setting; location quotients greater than one indicate the presence of an exporting industry. The greater the location quotient, the more that industry exports and/or specializes in goods and services compared to a broader, national context.

As shown in the table titled “Top Five Export Industries in White Lake Township (2019),” manufacturing, drilling, and mining industries are a specialty for the Township. White Lake Township’s top 20 export industries predominantly reflect sectors that serve permanent residents with a focus on residential construction, housing, general retail, recreation and amusement, and a variety of child and healthcare services. Further, the Township’s top 20 export industries account for about 47% of its total economic activity, indicating these regional specialties are making productive contributions to the entire economy. Of the top five export industries, three exhibited positive growth between 2018 and 2019. The two mature industries of “drilling oil and gas wells” and “jewelry and silverware manufacturing” exhibited declines of 31% and 8%, respectively, between both years.

**Biggest Employers**

The biggest employers in White Lake Township are determined by the number of employees in each industry. In 2019, four of the Township’s five most prominent sectors of employment were categorized as mature industries. These industries also broadly fell into two primary categories: retail/restaurant service or housing/housing construction. The table titled “Top Five Employers in White Lake Township (2019)” details the most prevalent employers of the Township. These employers comprise 36.1% of the Township’s total employment.

In 2019, the average employee compensation for all of the top five industries by employment was less than

**Table 18: Top Five Export Industries in White Lake Township (2019)**

Export Industry	Location Quotient	Total Economic Output (millions)	Employment	Stage
Concrete pipe manufacturing	45.59	\$6.51 M	18	Growth
Drilling oil and gas wells	41.59	\$13.31 M	61	Mature
Jewelry and silverware manufacturing	12.24	\$4.71 M	22	Mature
Iron ore mining	8.01	\$3.71 M	17	Growth
Retail-building material and garden equipment and supplies stores	7.05	\$57.73 M	433	Growth

Source: IMPLAN, 2019

**Table 19: Top Five Employers in White Lake Township (2019)**

Industry	Employment	Economic Output (millions)	Average Employee Compensation	Stage
Retail-general merchandise stores	784	\$61.67 M	\$33,412.89	Mature
Retail-building material and garden equipment and supplies stores	433	\$57.73 M	\$52,252.49	Growth
Limited-service restaurants	405	\$29.63 M	\$21,248.69	Mature
Tenant-occupied housing	355	\$130.66 M	\$59,133.77	Mature
Construction of new single-family residential structures	229	\$29.51 M	\$75,706.81	Mature

Source: IMPLAN, 2019

the Township's average annual income (\$85,384) for the same year. Beyond the Township's average annual income, the Asset Limited, Income Constrained, and Employed (ALICE) suggested survival and stability budgets provide greater context for whether these compensation figures are appropriate for employees in these sectors. A "survival budget" accounts for all necessary expenditures related to housing, food, transportation, childcare, etc. A "stability budget" estimates expenditures in these same essential categories while also incorporating a savings category and accounting for higher costs that contribute to greater financial stability over time.

Three of the Township's five largest employers provide average employee compensation that fulfills suggested survival budgets for single- and two-adult households. However, only one industry meets the survival budget threshold for a family of four. The stability budget suggestions are further out of reach as three industries are near or surpass the budget for a single adult, and only one industry offers stability for a household of two adults. Limited-service restaurant employee compensation does not satisfy any suggested budgeting parameters; while

a greater portion of employees in this industry may be employed on a seasonal and/or part-time basis, compensation in this industry is not sufficient to support even a single adult. Moreover, positions with predominantly part-time or seasonal employers are unlikely to include benefits, putting employees in a precarious situation should they have an accident and are not covered by an employer's insurance plan.

### Greatest Economic Output

The table titled "Top Five Largest Industries in White Lake Township by Economic Output (2019)" highlights the five industries that had the largest economic output in 2019. Tenant-occupied housing had the highest economic output in the Township, totaling over \$130 million. Notably, both retail-based industries, tenant-occupied housing, and limited-service restaurants also made up four of the Township's top five employers, illustrating the relationship between the prevalence of each industry in terms of employment and total output. The output of tenant-occupied housing and other real estate (which include leasing, appraisal services, and financing) contribute to the strength of the

**Table 20: ALICE Budget**

	Single Adult	Two Adults	Two Adults, Two Children
ALICE Survival Budget	\$31,344	\$45,588	\$66,252
ALICE Stability Budget	\$54,792	\$76,836	\$133,872

Source: ALICE United, 2021

Table 21: Top Five Largest Industries in White Lake Township by Economic Output (2019)

Industry	Total Economic Output (millions)	Intermediate Outputs (millions)	Value Added (millions)	Labor Income (millions)	Employment
Tenant-occupied housing	\$130.66M	\$15.91M	\$114.75M	\$15.21M	355
Retail – general merchandise stores	\$61.67M	\$23.01M	\$38.66M	\$26.08M	784
Retail – building material and garden equipment and supplies stores	\$57.73M	\$16.30M	\$41.43M	\$22.91M	433
Other real estate	\$36.36M	\$18.51M	\$17.85M	\$7.27M	158
Limited-service restaurants	\$29.63M	\$16.58M	\$13.05M	\$8.64M	405

Source: IMPLAN, 2019

housing and real estate industry in Oakland County as a whole. One third of Michigan's total economic output from the real estate industry originates from Oakland County.

## COVID IMPACTS

While White Lake Township has shown signs of bouncing back from the economic impacts of COVID-19, the pandemic has had a lasting effect on the Township's overall economy. Using a similar economic base analysis for the years 2019 and 2021, the IMPLAN model helps explain the recovery

process for the Township's industries in comparison to industry activity across all of Michigan. In 2021, the Township's economic output was about \$22 million dollars less than its output prior to the pandemic (\$808,486,039.84 in 2021 vs. \$830,190,978.67 in 2019).

The table titled "COVID Impacts" (p. 83) details the distribution of industry growth between 2019 and 2021, stating how industries have grown or declined over this period of time and to what extent these changes have taken place in comparison to

Table 22: COVID Impacts

Industry Status	Description	No. of Industries	% of Total	Example Sector
Decline and Underperform	Industry declined after COVID to a greater extent than it did across Michigan	73	40%	Broadwoven fabric mills; concrete pipe manufacturing; household laundry equipment manufacturing; lawn and garden equipment manufacturing.
Decline but Outperform	Industry declined after COVID but to a lesser extent than it did across Michigan	11	6%	Air transportation; computer related services, including facilities management; metal mining services; paperboard mills.
Increase and Outperform	Industry increased after COVID to a greater extent than it did across Michigan	61	34%	Local government passenger transit; maintenance and repair construction of nonresidential structures; retail-nonstore retailers; wholesale-grocery and related product wholesalers.
Increase but Underperform	Industry increased after COVID but to a lesser extent than it did across Michigan	36	20%	Environmental and other technical consulting services; home health care services; iron ore mining; retail-gasoline stores.

Source: IMPLAN, 2019

Michigan. A total of 97 industries of the Township increased their economic activity over these two years, exceeding the number of industries that exhibited an economic decrease in activity (84 industries). However, the greatest portion of industries (40%) fall in the category of “decline and underperform”, meaning the economic activity of these industries in White Lake declined over these two years and to a greater extent than they did across the rest of the State. The second most prominent category of industries are those in the category of “increase and outperform”, meaning economic activity for 34% of the Township’s businesses increased between 2019 and 2021 to a greater extent than the State.

### DEVELOPMENT OPPORTUNITIES

Analysis of the Township’s economic position, prominent industries, employment patterns, and barriers to growth can be considered alongside community engagement results to determine the “highest and best” use of available land. Determining the highest and best use of parcels prime for development or redevelopment matches these spaces with the land uses and businesses in highest demand within the community. However, due to the size, shape, and surroundings of each parcel, sites may not be suitable for the most requested types of uses.

#### Community Insights

The White Lake Township community survey assessed resident perceptions of the local economy, including their preferences regarding commercial developments and how their economic needs fit in with other Township goals and priorities such as the preservation of natural and open spaces. It is worth emphasizing “undesirable commercial development” ranked fourth out of 11 options for respondents to identify the top three challenges facing the Township over the next decade. To address the prospect of appropriate commercial development, respondents overwhelmingly supported approaching commercial development through the revitalization of former commercial buildings that have become vacant and/or retrofitting strip malls to support new commercial

activities. The preference for these approaches aligns with respondent concerns about the potential loss of open and/or natural spaces as new commercial areas are developed. Furthermore, revitalizing vacant spaces presents the opportunity to utilize existing sites instead of developing new ones. Increased traffic was also a prominent concern in the discussion of additional commercial development.

When asked about the types of retail establishments respondents would like to see in the Township, food and beverage stores and restaurant and drinking establishments received the greatest support as uses respondents would patronize on a daily or weekly basis. Respondents specifically expressed support for the Township’s development of additional restaurants and bars, farm-to-table eating establishments, family-friendly restaurants, cafes, and breweries, with each eating and drinking option receiving support from 50% or more of all survey takers.

#### Redevelopment Sites

On August 17, 2023 the Planning Commission hosted a workshop to gather public input on five sites of possible redevelopment. The workshop was held between 5 p.m. and 7 p.m. in the Township Annex, and approximately 100 members of the public attended.

The central aim of the workshop was to begin a conversation among residents about the potential of five sites selected for consideration by the Planning Commission. Though some sites identified for this workshop are currently vacant, two sites were part of the Township’s Master Plan update in 2012. Concepts for future development and use at both sites were developed during the last planning process, and both concepts were presented again during the workshop. The other three sites provided blank slates for residents to share their ideas based on the site surroundings as well as general desires for development in the area. The full results from the workshop can be found in the appendix. The Planning Commission picked three of the sites as prime redevelopment opportunities for evaluation in this Master Plan.



**PONTIAC LAKE GATEWAY**

<b>Purpose</b>	<p>The redevelopment concept envisions the area as a key and welcoming gateway into the community. At the northern intersection of Pontiac Lake Road and Highland Road/M-59 is a two-story mixed-use concept with frontage along the roads and the lake, with parking located in the middle. The mixed-use concept includes restaurants, retail, and residential on the second floor. This area is intended to be walkable and integrated into the shoreline of Pontiac Lake. People can access this area via foot, bike, car, or boat. Boaters can dock along the boardwalk and walk to restaurants or shops. Along Highland Road/M-59 is traditional commercial development but an emphasis is placed on fronting buildings on M-59 and locating parking in the rear. There are limited curb cuts and the properties are served by access roads at the rear. At the western edge of the gateway is a cluster of townhomes. The northern end of the gateway is maintained as undeveloped open space.</p>	
<b>Regulated Uses</b>	<p><b>Non-Residential</b></p> <ul style="list-style-type: none"> <li>» Low-scale local retail along M-59</li> <li>» Restaurants, local dining with no drive-thru's</li> <li>» Office and professional services</li> <li>» Boat docks, no launches</li> </ul>	<p><b>Residential / Open Space</b></p> <ul style="list-style-type: none"> <li>» Townhomes, Owner Occupied</li> <li>» Upper Story Residential</li> <li>» Lakefront Open Space</li> </ul>
<b>Built Form</b>	<p><b>Building Height:</b> Residential - No more than two stories, or 30 feet above grade. Mixed-use buildings no more than three stories, or 42 feet above grade.</p> <p><b>Parking:</b> In the rear of the buildings; minimal ingress-egress on M-59</p> <p><b>Road Frontage:</b> Setbacks from ROW is 25 feet to allow for a landscape zone with street trees and an 8' to 10' pedestrian sidewalk.</p> <p><b>Exterior Building Materials:</b> Primarily high-quality, durable, low-maintenance material, such as masonry, stone, brick, glass, or equivalent materials. All buildings should be completed on all sides with acceptable finishing materials. Materials such as vinyl, aluminum, and other metal siding should be avoided. Metal and portable buildings should be prohibited.</p> <p><b>Design:</b> Architectural design should be consistent with pedestrian-oriented development with a minimum of 10-foot-wide sidewalks to allow for outdoor dining and seating.</p>	

**Figure 32: Conceptual Rendering – Pontiac Lake Gateway**

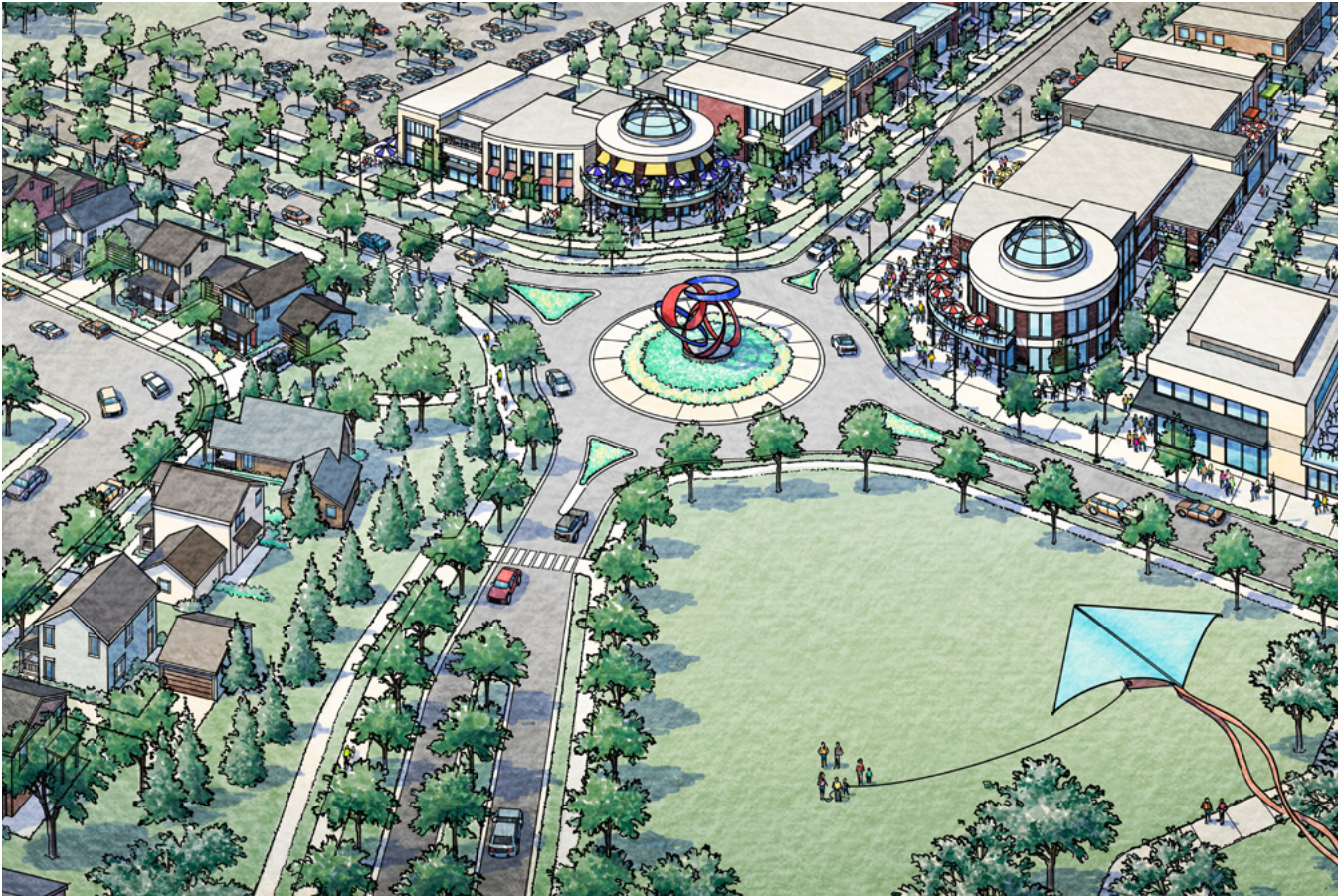




LAKES TOWN CENTER

<p><b>Purpose</b></p>	<p>Small scale mixed-use development that provides a transition between the regional shopping center east of Elizabeth Lake Road and the single-family development to the west along Elkinford Drive. Retail uses would be internalized within the development surrounded by single family residential.</p>	
<p><b>Regulated Uses</b></p>	<p><b>Non-Residential</b></p> <ul style="list-style-type: none"> <li>» Assisted Living Facilities</li> <li>» Local/Regional Retail; small scale</li> <li>» Child and Family Care Facilities</li> <li>» Independent and Congregate Care Facilities</li> </ul>	<p><b>Residential / Open Space</b></p> <ul style="list-style-type: none"> <li>» Single Family - Detached and Attached</li> <li>» Upper Story Residential</li> <li>» Duplexes</li> <li>» Home Occupations</li> </ul>
<p><b>Built Form</b></p>	<p><b>Building Height:</b> Residential -No more than two and one-half stories, or 35 feet above grade. Mixed-use Buildings - three stories, or 42 feet above grade.</p> <p><b>Road Frontage:</b> Setback along Highland Road would be 40 feet with no ingress/egress. Ingress/egress would be from Elizabeth Lake Road.</p> <p><b>Building Type:</b> Small scale, retail and restaurant clustered in a walkable Village concept that allows for outdoor dining, events, and possible farmers market. Traditional single family neighborhoods would surround the retail. Upper story residential would be encouraged.</p>	

Figure 33: Conceptual Rendering – Lakes Town Center





**CEDAR ISLAND ROAD AND BOGIE LAKE ROAD**

<p><b>Purpose</b></p>	<p>This redevelopment site is located in the southern part of the Township and is in close proximity to three primary/secondary schools (Lakewood Elementary School, White Lake Middle School, and Lakeland High School) as well as the Brentwood Golf Club and Banquet Center. This site's location on Bogie Lake Road provides a direct connection to M-59, making it accessible from across the Township.</p> <p>The redevelopment concept envisions this area as a community anchor in the southwest section of the Township. The main entrance to the site is along Cedar Island Road, near the intersection of Bogie Lake Road. Development would include single-family detached and attached dwellings with adequate area reserved for outdoor recreation for both active and passive activities.</p>	
<p><b>Regulated Uses</b></p>	<p><b>Non-Residential</b></p> <ul style="list-style-type: none"> <li>» Local Business with no drive-thru's focused only on the southeast corner</li> </ul>	<p><b>Residential / Open Space</b></p> <ul style="list-style-type: none"> <li>» Single Family; Attached and Detached</li> <li>» Active and Passive Recreation Areas</li> <li>» Home Occupations</li> </ul>
<p><b>Built Form</b></p>	<p><b>Building Height:</b> No more than two and one-half stories, or 35 feet above grade.</p> <p><b>Road Frontage:</b> Setbacks from Bogie Lake Road would allow for a landscape zone with street trees and a shared pathway. The setback line for residential single-family homes would be 35 feet from the ROW. Access points on Bogie Lake Road and Cedar Island Road would serve an internalized street network, in order to reduce traffic.</p> <p><b>Building Type:</b> Traditional single family neighborhoods. Residential densities along Bogie Lake Road would be one dwelling per acre. Internal residential development could be higher if developed adjacent to the recreation open space.</p>	

Figure 34: Conceptual Rendering – Cedar Island and Bogie Lake Roads



### Placemaking

Building a sense of place starts with defining borders, a core, hubs of activity, and landmarks in the public realm so that passers-by understand where the district begins and ends. Place, by definition, should be distinct enough for people to immediately distinguish it from other neighborhoods or districts.

Placemaking’s main charge is to create desirable places with a focus on physical improvements. As so much of the economy is impacted by activity that takes place outside of the Township, the focus on investing in beauty through landscaping, amenities, art, and events helps to create a distinguishable place that entices residents and tourists to visit. Public investment signals to developers the Township is ready and willing to support business establishments, simultaneously setting the tone for how they should

fit in the community. It takes the coordination of public and private dollars to create a place that people want to be. Placemaking’s connection to economic development is straightforward. One study found that people are 50% more likely to spend time in spaces with creative placemaking.<sup>2</sup> Related to this, people will also be more likely to recommend this place and spend more money there.

Within White Lake Township, the majority of placemaking efforts prioritize natural features, parks, and recreational spaces as a testament to the Township’s commitment to natural space preservation.

#### Stanley Park

Located on Elizabeth Lake Road just southeast of the Civic Center, Stanley Park provides beach access to Brendel Lake as well as a system of trails. Stanley

**Table 23: Proposed Corridor Improvement Authority Projects**

Project	Description	Timeline
Branding	A branding process creates a distinct identity to be established for the district and the Township. The CIA will promote the area as a community center and area of regional appeal and business attraction. Branding the district will also set the themes of other visual improvements, gateway signage, marketing, and wayfinding.	2024 – 2025
Entryway and wayfinding signage	Include wayfinding that would direct visitors within the district to the Town Center, Gateway District, parks, community buildings, and other points of interest.	2027 – 2029
Streetscape improvements	Includes enhancements to the streetscaping, landscaping, public art, seasonal displays, and other design elements. Provide a visual connection between M-59 and other corridors.	2030 – 2032
Pathway extensions and improvements	Improve non-motorized transportation throughout the district. Connect M-59 with residential, commercial, and recreational areas. Complete the Township Triangle Trail to connect the Town Center and Library to M-59 and Teggerdine Road.	2028 – 2035
Traffic safety improvements	Build intersection capacity and additional safety improvements throughout the district. Add safe pedestrian and non-motorized crossings.	2025 – 2035
Enhanced transit stops and transit-oriented development	In conjunction with the expansion of WOTA along M-59, enhance transit stops with cover and seating. Promote transit-oriented development.	2028 – 2035
Sewer extensions	Expand sanitary sewer to underserved and unserved areas of the district.	2028 – 2034
Water extension/system improvements	Expand water service to underserved and unserved areas of the district.	2028 – 2034
Property/easement acquisition	Potentially acquire property through fee simple or by easement.	2025 – 2035

Source: White Lake Township Corridor Improvement Authority Development Plan and Tax Increment Financing Plan



Park and its placemaking efforts are unique in that the Township's 5-Year Recreation Plan for 2023-2027 focused on redevelopment plans for the park to improve facilities while also maintaining and preserving its natural features.

### *Corridor Improvement Authority*

The White Lake Township Corridor Improvement Authority (CIA) aims to promote private development and redevelopment, highlighting the Township's position as a "Four Seasons Playground" and offering world-class recreational opportunities for residents and visitors alike. The Authority's focus is on the Highland Road corridor with the intention to promote the area's natural amenities, non-motorized connectivity, and nodes of retail, dining, entertainment, and lodging to round out the corridor experience.

In 2023, the CIA recommended the Township Board adopt a development plan and tax increment financing (TIF) plan. The plan outlines a TIF funding mechanism which captures increases in tax revenue from properties in the CIA which are not taxed at a higher rate; the TIF diverts a portion of future revenues to the CIA. Between 2024 and 2043, the TIF is estimated to capture \$12,273,133.

For CIA programs and projects, redevelopment encompasses the physical, economic, and social elements of place. Projects the CIA has proposed include branding and marketing efforts, wayfinding signage, streetscape improvements (including beautification efforts and area branding), along with various improvements to traffic flow, non-motorized connections, and transit-oriented development.<sup>3</sup>

### **Brownfield Redevelopment Resources<sup>4</sup>**

Redevelopment and revitalization, and, in many cases, the implementation of these projects would

involve brownfield protocols. White Lake Township does not have their own Brownfield Redevelopment Authority (BRA) but can partner with Oakland County through the Oakland County Brownfield Redevelopment Authority (OCBRA). The OCBRA can assist and coordinate with the State of Michigan Department of Environment, Great Lakes and Energy (EGLE) along with the Michigan Economic Development Corporation (MEDC), as needed, in an effort to prepare designated brownfields for redevelopment.

### **Future Study Areas**

There are a few areas within the Township that could warrant future planning studies for potential development. The two most prominent of these areas include 1) the intersection of Elizabeth Lake Road and Union Lake Road, and 2) the area at Cooley Lake Road and Round Lake Road. Each of these areas has opportunity for improvement and might take advantage of several of the available economic development partnerships and resources.

## **ECONOMIC DEVELOPMENT PARTNERSHIPS**

As forces both inside and outside of White Lake play a role in the Township's overall economic health, the Township itself is not solely responsible for its continued development and economic prosperity. As part of a network, White Lake will have to cooperate with agencies and organizations that have a larger scope of operation and connections to resources such as funding, expertise, talent, and program management. Economic partnerships could include cross promotion, regularly scheduled meetings, joint projects, and other opportunities for mutual support as needed. On the following page is an inventory of local and regional partners to support the Township's economic development.



Commercial Development



Table 24: Economic Development Partners

Project	Description
Advantage Oakland	Oakland County's economic development department, connecting jurisdictions across the County to resources to support businesses with capital acquisition, workforce development, entrepreneurial endeavors, and more. <sup>5</sup>
Community Foundation for Southeast Michigan-New Economy Initiative	The New Economy Initiative is a special project of the Community Foundation for Southeast Michigan committed to regional economic development to encourage further investment. The initiative focuses on supporting service providers by providing technical assistance through business planning, providing capital to new and growing businesses, and connecting businesses to each other and their community. <sup>6</sup>
Oakland Chamber Network	Oakland Chamber Network seeks to cultivate a collaborative business environment across the region where member chambers can access resources that support each individual chamber's mission.
Lakes Area Chamber of Commerce	The regional chamber for western Oakland County that serves the communities of Commerce, Walled Lake, Waterford, White Lake, Wixom, Wolverine Lake, and the Union Lake Business District has been serving them since 1950. With approximately 400 members, the Chamber represents a diversified group of businesses, drives economic progress, and facilitates valuable connections through networking and other initiatives. <sup>7</sup>
Southeast Michigan Council of Governments	The Southeast Michigan Council of Governments (SEMCOG) supports local planning by providing technical services, data analysis, and intergovernmental resources. SEMCOG's technical assistance in the region's economic development covers many facets, including a recently published report titled Increasing Shared Prosperity for a Resilient Economy (semcog.org).

Figure 35: Economic Development: Key Takeaways

In 2020, 20% of all White Lake Township residents worked in manufacturing industries. Manufacturing and educational services, health care, and social assistance industries have been the most common employers for Township residents from 2010 to 2020 – 37.4% of all Township residents were employed in either sector in both 2010 and 2020.

In 2019, the Township's "mature" industries (regional specialties with decreasing economic output) dominated White Lake's economic output and portion of workers employed. On the other hand, "growth" industries (regional specialties with increasing economic output) have the second greatest presence in the Township.

Retail, real estate, construction, housing, and service restaurants are among the Township's most prominent industries in terms of exports, economic output, and employment.

Though the Township's economic output in 2021 was about \$22 million less than outputs before the COVID-19 pandemic in 2019, trends of economic recovery across the Township are promising as 54% of all industries have increased their economic output since the pandemic began; however, 74% of all industries are underperforming economically in comparison to industry trends across the State, regardless of whether they have experienced financial growth or decline.

## Sources

- 1 SEMCOG, Increasing Shared Prosperity for a Resilient Economy, <https://maps.semcog.org/sharedprosperity/>.
- 2 Real Estate News, New Research Reveals the Impact of Creative Placemaking, 2016, <https://storeys.com/new-research-reveals-the-impact-of-creative-placemaking/>.
- 3 White Lake Township Corridor Improvement Authority Board, Agenda, <https://mccmeetings.blob.core.usgovcloudapi.net/whitelakmi-pubu/MEET-Packet-197320c748a24e679194674cc23a15f8.pdf>
- 4 Oakland County, Brownfield Program, <https://www.oakgov.com/community/community-development/brownfield-initiative>.
- 5 Oakland County, Business Development, <https://www.oakgov.com/business/business-development>.
- 6 Community Foundation for Southeast Michigan, New Economy Initiative, <https://cfsem.org/initiative/new-economy-initiative/>.
- 7 Lakes Area Chamber of Commerce, <https://lakesareachamber.com/> .



Agri-business

# Land Use

Land use is a foundational piece of community planning as the land area of any community is fixed in size. Planning and designating zones of land for predetermined uses is imperative to ensuring all community needs and desires are met. The identity of a community is also often tied to its land use patterns. White Lake Township is unique in offering a mix of rural and suburban lifestyles as demonstrated through land use patterns. On one hand, the Township carries forward its rich agrarian history through a combination of agricultural and rural residential land uses. But, on the other hand, regional population growth and the Township's proximity to several urbanized municipalities in the metro Detroit area attract denser residential and commercial land uses. Ensuring development does not infringe on the Township's abundant natural resources and recreational land uses is a priority for the community. This chapter inventories existing land use patterns in the Township to identify areas for preservation and areas suitable for development. This chapter combined with community input lays the foundation for establishing a robust future land use strategy in White Lake Township.

## EXISTING LAND USE

White Lake Township's current pattern of land use is represented in the map (p. 93) titled "Existing Land Use." Land use in the Township has been determined, to a large degree, by the M-59 thoroughfare which runs east to west and divides the Township in half. The northern half of the Township exhibits a rural setting with agricultural and large-lot-residential land uses, whereas denser residential land uses (that range from single-family dwellings on smaller lots to multiple-family dwellings) are the dominant land use in the southern half. Barring a few parcels, almost all commercial development in the Township is concentrated along M-59. Additionally, land reserved for recreation or conservation purposes account for a large percentage of the Township,

through the Pontiac Lake State Recreation Area in the northeast, and Highland State Recreation Area in the southwest quadrants of the Township. Utilizing data from Oakland County, land parcels in White Lake Township are divided into the following categories:

- » Agricultural.
- » Commercial/Office.
- » Industrial.
- » Public/Institutional.
- » Recreation/Conservation.
- » Residential.
- » Transportation/Utility/Communication.
- » Vacant.

The table titled "Existing Land Use" (p. 94) charts the acreage and the total percentage of the Township area under each land use classification.

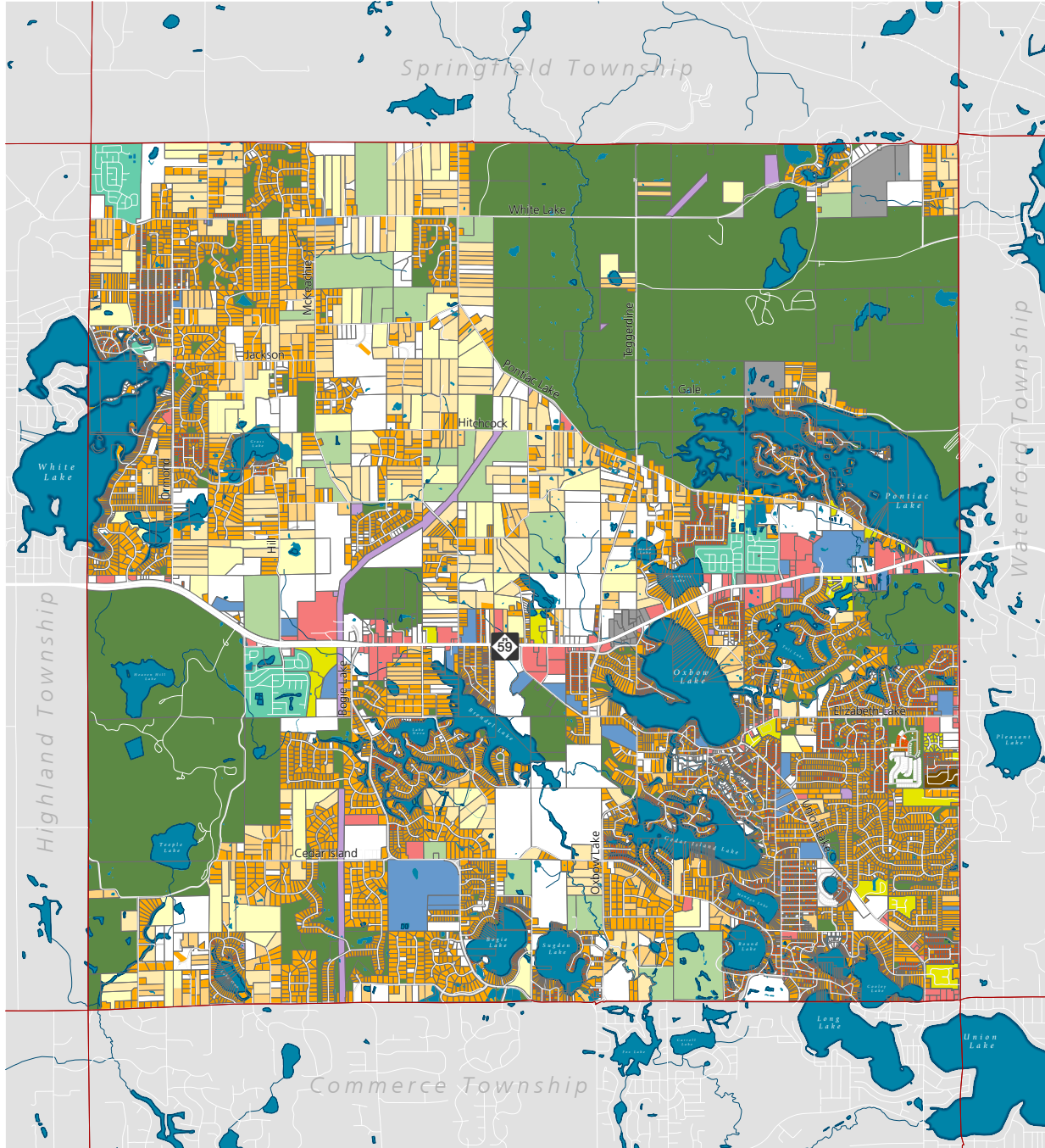
## Residential Land Use

Residential use is the largest land use category in White Lake Township and accounts for roughly 8,990 acres, or 46.3% of the Township area. Lot sizes and density vary throughout the Township; rural residential uses with larger lots (2.5 acres and above) are predominant north of M-59 while denser residential development with smaller lots (less than 2.5 acres) and multifamily units are common south of M-59. Due to the geography around the lakes, land use around the lakes tends to be concentrated with smaller lots as shown in the map (p. 93) titled "Existing Land Use."

Land use along the boundaries, especially in the southeast quadrant bordering Waterford Township and Commerce Township, exhibits intense residential development. It is likely the connectivity

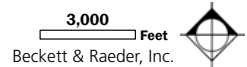


Map 13: Existing Land Use



## Existing Land Use, 2020

Sources: Michigan Open Data Portal, Oakland County, White Lake Township



<span style="display:inline-block; width:15px; height:15px; background-color:#90EE90; border:1px solid black;"></span> Agriculture	<span style="display:inline-block; width:15px; height:15px; background-color:#FFFF00; border:1px solid black;"></span> Multiple-Family Residential	<span style="display:inline-block; width:15px; height:15px; background-color:#FFDAB9; border:1px solid black;"></span> 2.5 - 5 acres
<span style="display:inline-block; width:15px; height:15px; background-color:#6AA84F; border:1px solid black;"></span> Recreation/Conservation	<span style="display:inline-block; width:15px; height:15px; background-color:#40E0D0; border:1px solid black;"></span> Mobile Home Park	<span style="display:inline-block; width:15px; height:15px; background-color:#FFA500; border:1px solid black;"></span> 1 - 2.5 acres
<span style="display:inline-block; width:15px; height:15px; background-color:#4682B4; border:1px solid black;"></span> Public/Institutional	<span style="display:inline-block; width:15px; height:15px; background-color:#FFFFFF; border:1px solid black;"></span> Vacant	<span style="display:inline-block; width:15px; height:15px; background-color:#FF8C00; border:1px solid black;"></span> 14,000 - 43,559 sq. ft.
<span style="display:inline-block; width:15px; height:15px; background-color:#9932CC; border:1px solid black;"></span> Transportation/Utility	<span style="display:inline-block; width:15px; height:15px; background-color:#FFD700; border:1px solid black;"></span> Single-Family Residential	<span style="display:inline-block; width:15px; height:15px; background-color:#FF4500; border:1px solid black;"></span> 8,000 - 13,999 sq. ft.
<span style="display:inline-block; width:15px; height:15px; background-color:#FF6347; border:1px solid black;"></span> Commercial/Office	<span style="display:inline-block; width:15px; height:15px; background-color:#FFFFE0; border:1px solid black;"></span> >10 acres	<span style="display:inline-block; width:15px; height:15px; background-color:#8B4513; border:1px solid black;"></span> <8,000 sq. ft.
<span style="display:inline-block; width:15px; height:15px; background-color:#808080; border:1px solid black;"></span> Industrial	<span style="display:inline-block; width:15px; height:15px; background-color:#FFDAB9; border:1px solid black;"></span> 5 - 10 acres	<span style="display:inline-block; width:15px; height:15px; background-color:#654321; border:1px solid black;"></span> Multiple units per parcel

Table 25: Existing Land Use

Existing Land Use	Number of Acres	Percentage of Total
<b>Residential</b>	<b>8,989.9</b>	<b>46.3%</b>
Single Family, 14,000 to 43,559 Sq.Ft.	2,365.1	12.2%
Single Family, 1 to 2.5 Acres	2,137.8	11.0%
Single Family, 5 to 10 acres	1,197.8	6.2%
Single Family, 2.5 to 5 acres	984.3	5.1%
Single Family, greater than 10 acres	962.7	4.9%
Single Family, 8,000 to 13,999 Sq.Ft.	657.7	3.4%
Mobile Home Park	338.9	1.7%
Multiple Family	185.2	1.0%
Single Family, less than 8,000 Sq.Ft.	143.1	0.7%
Single Family, more than 1 unit / parcel	17.3	0.1%
<b>Recreation/Conservation</b>	<b>6,131.5</b>	<b>31.5%</b>
<b>Vacant</b>	<b>2,455.7</b>	<b>12.6%</b>
<b>Agricultural</b>	<b>791.4</b>	<b>4.1%</b>
<b>Commercial/Office</b>	<b>392.8</b>	<b>2.0%</b>
<b>Public/Institutional</b>	<b>366.3</b>	<b>1.9%</b>
<b>Industrial</b>	<b>165.0</b>	<b>0.8%</b>
<b>Transportation/Utility/Communication</b>	<b>157.4</b>	<b>0.8%</b>
<b>Total</b>	<b>19,450.0</b>	<b>100%</b>

Source: Oakland County

offered via M-59 to the other major cities and employment centers in the metro Detroit area, as well as regional trends of population growth from the rapidly urbanizing municipalities of Waterford and Commerce Townships, increase the demand for development in the southeast quadrant of the Township. As urbanizing municipalities begin to encounter unmet demand for housing, utilities, services, and so on, the tendency to seek residence in nearby localities (and accept longer commutes) increases. Managing development in tandem with available (and future) infrastructure will be crucial to ensure sustainable growth in this part of the Township. The majority of larger residential parcels in the Township are concentrated in the center, north of M-59, shielded from development pressure from the neighboring municipalities. Given these parcels are in proximity to agrarian uses, and roughly 45% of survey respondents indicated a rural atmosphere with plenty of open space was the main characteristic that attracted them to move to their current area

of residence, preserving the existing lot sizes and density will be a priority for the Township. Future residential development in the Township should be targeted in select areas of the Township with access to water and sewer infrastructure, preferably south of M-59, while development north of M-59 should be strictly regulated to preserve agricultural land and the rural character of the Township.

### Recreation/Conservation Land Use

Parcels under the recreation/conservation land use account for 6,131.5 acres, or 31.5% of the Township area. Most of the land under this classification is within the Pontiac Lake State Recreation Area in the northeast and Highland State Recreation Area in the southwest quadrant of the Township. Other areas under this classification include areas like Indian Springs Metropark, which is included in the metropark system and operated by the Huron-Clinton Metropolitan Authority. Additionally,



White Lake Oaks Golf Course occupies a small area immediately south of M-59 and also falls under this classification. Other parcels in this land use classification are scattered around the Township, including neighborhood parks and open spaces. The southeast quadrant of the Township which has the highest density of residential development in the Township contains a lower percentage of recreation/conservation land use compared to other areas of the Township. While residents in this area can access other recreation facilities in the Township, encouraging development of neighborhood parks amidst dense residential areas will be critical to ensuring the community's recreation and open space needs are met, further ensuring access to such facilities while protecting existing lakes and natural features.

As the Township plans for and begins to develop additional parks and outdoor recreational spaces, designing the space to incorporate green infrastructure features provides an opportunity to address the infrastructural needs of White Lake alongside recreational outlets. Promoting minimal development to any extent possible can ensure both access to, and preservation of, natural resources. Green infrastructure, such as rain gardens and bioswales, can further mitigate the impacts of any paved surfaces on stormwater by slowing, cleaning, and cooling it before entering green spaces or preservation areas. Recreation- and conservation-oriented land uses are themselves considered green infrastructure that can justify the highest and best use of land in such a way that it is enjoyed, yet largely undisturbed, by residents and visitors.<sup>1</sup>

### Agricultural Land Use

The identity of White Lake Township is influenced by its agricultural history and its rural character. However, only about 790 acres or 4.1% of the Township's total land area is currently used for agriculture. Almost all agricultural land is located in the central parts of the Township, with the majority situated north of M-59. Only a few parcels of agricultural land are located in the southeast quadrant of the Township. Since 2009, agricultural land in the Township has increased from 2.9% to 4.1% of the total Township area.<sup>2</sup>

Though agricultural land use in the Township has increased, protecting existing farmland from development is crucial. Agricultural land is primarily protected through zoning. In addition to the "Agricultural" zoning district, many parcels in the Township fall under the "Suburban Farm" district

which allows for a combination of specific agrarian and residential uses of land.<sup>3,4</sup> While this may prove effective to encourage agrarian uses and preserve the rural character of the Township with large lot sizes, it limits the area available for smaller single-family homes, duplexes, and other such housing typologies. This leads to pressure for increasing residential development, and, subsequently, risks eventual infringement of farmland. One potential strategy to balance farmland preservation and the increasing demand for residential development is to continue to strictly regulate uses in the Agricultural and Suburban Farm districts. By focusing residential development to existing residential areas and adjacent vacant land it alleviates development pressure on suburban and farmland. Essentially, the strategy encourages higher density development in a smaller area rather than lower density development over a broad area. Another strategy for preserving farmland is the Farmland and Open Space Preservation Program (PA 116), a voluntary agreement between a landowner and the State of Michigan in which the landowners receive tax benefits and exemptions in exchange for preserving their land for agriculture or open space.<sup>5</sup>

### Commercial/Office Land Use

Commercial land uses in White Lake Township are concentrated in the center of the Township along the M-59 thoroughfare. Some commercial parcels in the Township are scattered between residential land uses south of M-59, and a few are situated in the southeast corner adjoining Commerce and Waterford Townships. While restricting commercial development to the Township's major thoroughfare helps retain the rural and residential character of the Township, residents are likely dependent on the automobile to go to work, run errands, or visit businesses. Although the Township can regulate larger commercial/office uses and big-box stores along M-59, residents may benefit from additional neighborhood-scale stores such as small grocers or produce stores, especially in the denser residential neighborhoods in the southeast quadrant of the Township. Creating commercial pockets/nodes also encourages foot traffic for local businesses and reclaims the streets from catering solely to automobiles.

### Public/Institutional Land Use

Parcels under the public/institutional land use classification typically serve public interest by

permitting uses such as schools, religious buildings, institutional buildings, Township offices, and so on. This land use accounts for roughly 366 acres or 2% of the Township area, and these parcels are usually exempt from property taxation. Most of this land use is situated south of M-59 including the Huron Valley Schools campus, Dublin Elementary School, and Houghton Elementary School properties.

### Industrial Land Use

Industrial land is predominately used for manufacturing or processing materials or articles and includes accessory uses such as storage areas and warehousing. Only 165 acres amounting to 0.8% of the total Township area fall under the industrial land use classification. Some industrial parcels are located north of M-59 and east of Teggerdine Road, mostly comprised of automobile services and related uses. Two larger parcels are located in the northeast corner of the Township. An important consideration for industrial land use is the proximity to natural features; given most industrial parcels are located near lakes or recreation/conservation land, it is crucial to implement stringent development standards through the zoning ordinance to ensure adequate setbacks and buffers are provided from natural features.

### Transportation/Utility/Communication Land Use

Areas predominately used for vehicular transportation, public utilities, or establishing

communication towers and other related public infrastructure fall under this land use category and account for 150 acres and 0.8% of the total Township area.

### Vacant

Vacant parcels are unimproved areas that do not have a specific land use classification. Roughly 2,456 acres, or 12.6% of the Township area is vacant. While vacant parcels are distributed across White Lake, most are found in the central and western portions of the Township, often adjacent to residential uses. These parcels offer the opportunity to expand land uses to cater to the needs of the community. While vacant land areas may not have a committed use, their presence may contribute to the agrarian nature of the Township. However, unlike the land designated for Agricultural or Suburban Farm uses, these areas may provide an avenue to meet the increasing demand for housing and subsequent residential uses to prevent the conversion of traditionally agricultural uses. As shown in the table titled "Zoning of Vacant Land, 2023" (p. 97), the majority of the land classified as vacant is zoned agriculture (Agricultural or Suburban Farm). Following agriculture, land zoned for residential accounts for roughly 22% of all vacant land. Finally, commercially zoned vacant land accounts for roughly 18% all of vacant land in the Township. Industrially zoned vacant land is less than 1% of the total vacant land.



Agricultural land

Table 26: Zoning of Vacant Land, 2023

Zoning	Percent of Vacant Land
<b>Agriculture</b>	<b>59.60%</b>
AG: Agricultural	36.39%
SF: Suburban Farm	23.21%
<b>Residential</b>	<b>21.75%</b>
R1-A: Single Family	4.99%
R1-B: Single Family	0.96%
R1-C: Single Family	5.75%
R1-D: Single Family	6.31%
RM-1: Attached Single Family	1.03%
RM-2: Multiple Family	2.71%
<b>Commercial</b>	<b>17.75%</b>
LB: Local Business	1.49%
GB: General Business	3.01%
NBO: Neighborhood Office	0.17%
ROP: Research Office Park	0.11%
PD: Planned Development	9.79%
PB: Planned Business	3.18%
<b>Industrial</b>	<b>0.77%</b>
LM: Light Manufacturing	0.77%

Source: Oakland County &amp; White Lake Township



Vacant land

Figure 36: Key Land Use Strategies

### Residential Land Use

- » Preserving the existing lot sizes and density will be a priority for the Township.
- » Future residential development should be targeted in select areas of the Township with access to water and sewer infrastructure, preferably south of M-59, while development north of M-59 should be strictly regulated to preserve agricultural land and the rural character of the Township.

### Recreation/Conservation Land Use

- » Encouraging development of neighborhood parks amidst dense residential areas will be critical to ensuring the community's recreation and open space needs are met.

### Agricultural Land Use

- » The Township should continue to strictly regulate uses in the Agricultural and Suburban Farm districts.
- » Another strategy for preserving farmland is the Farmland and Open Space Preservation Program (PA 116), a voluntary agreement between a landowner and the State of Michigan in which the landowners receive tax benefits and exemptions in exchange for preserving their land for agriculture or open space.

### Industrial Land Use

- » It is crucial to implement stringent development standards for industrial land through the zoning ordinance to ensure adequate setbacks and buffers are provided from natural features.

## Sources

- 1 SEMCOG, Green Infrastructure Vision for Southeast Michigan, 2014, <https://www.semco.org/desktopmodules/SEMCOG.Publications/GetFile.ashx?filename=GreenInfrastructureVisionForSoutheastMichiganMarch2014.pdf>.
- 2 White Lake Township, White Lake Township Master Plan for Land Use 2010–2011, 2011, [https://www.whitelaketwp.com/sites/default/files/fileattachments/planning/page/3681/complete\\_wl\\_mp\\_update\\_document\\_2012.pdf](https://www.whitelaketwp.com/sites/default/files/fileattachments/planning/page/3681/complete_wl_mp_update_document_2012.pdf).
- 3 White Lake Township Zoning Map, [https://www.whitelaketwp.com/sites/default/files/fileattachments/planning/page/23353/wlt\\_zoning\\_map\\_update\\_20221010\\_updated\\_again\\_5.4.2023.pdf](https://www.whitelaketwp.com/sites/default/files/fileattachments/planning/page/23353/wlt_zoning_map_update_20221010_updated_again_5.4.2023.pdf).
- 4 White Lake Township Zoning Ordinance, [https://www.whitelaketwp.com/sites/default/files/fileattachments/planning/page/2311/2022\\_01\\_27\\_white\\_lake\\_clearzoning\\_ordinance\\_security\\_on.pdf](https://www.whitelaketwp.com/sites/default/files/fileattachments/planning/page/2311/2022_01_27_white_lake_clearzoning_ordinance_security_on.pdf).
- 5 “Farmland Preservation”, Michigan Department of Agriculture and Rural Development, [https://www.michigan.gov/mdard/0,4610,7-125-1599\\_2558---,00.html](https://www.michigan.gov/mdard/0,4610,7-125-1599_2558---,00.html).





Commercial development



# Goals & Implementation

Good planning uses data and community preferences to shape a preferred course of action. In this section, findings from previous chapters of the Master Plan and community engagements are used to build an Action Plan of strategies. This Action Plan is intended to advance White Lake Township toward its goals by providing guidance for future planning efforts.

The following vision from the 2012 Master Plan was shared through the community survey at the start of the master planning process:

**“Strive for a sustainable White Lake Township that balances the community’s economic, environmental, and social needs. Promote the identity of White Lake Township as a small country town with big city**

**amenities by protecting and preserving natural features, encouraging redevelopment of obsolete properties, and directing growth and development to a central community core.”**

When asked if this vision still aligned with their vision of White Lake, 77% of respondents stated it did. The 2012 vision is carried forward with this Master Plan. In addition to the 2012 vision, the following 10 goals were identified and shared through the community survey at the start of the master planning process. The survey asked respondents to select their top three goals; the results are detailed in the table titled “Goal Survey Results”.

**Table 27: Goal Survey Results**

Goal	All Survey Respondents	White Lake Residents
Preserve and protect natural features including wetlands, floodplains, lakes, woodlands, and other natural features.	69%	69%
Maintain the small-town rural character of existing single family residential areas.	49%	49%
Provide adequate infrastructure that preserves and protects White Lake Township’s natural features.	46%	46%
Address the community’s needs for efficient and safe multi-modal access (walking, biking, auto).	31%	32%
Enhance the quality of life and make the community more appealing by providing a variety of recreational facilities.	26%	26%
Provide goods and services that meet the current and future needs of Township residents.	22%	22%
Address the community’s needs for sewer and water systems.	20%	20%
Provide efficient public services that adequately and safely support the existing and future population of White Lake Township.	17%	17%
Encourage high tech, research, and light industrial developments to improve the tax base and provide job opportunities.	7%	7%
Provide a variety of housing opportunities.	3%	3%

Based on community feedback, the goals were revised to the following:

A. Invest in infrastructure and implement appropriate regulations and policy measures to preserve and protect natural features, including wetlands, floodplains, lakes, woodlands, and other natural features.

B. Enhance the quality of life and make the community more appealing by providing a variety of recreational facilities.

C. Maintain the small-town rural character of existing single-family residential areas while

pursuing opportunities to meet the Township's housing needs.

D. Address the community's needs for efficient and safe multi-modal transportation (walking, biking, automobile, etc).

E. Support businesses providing goods and services, and implement infrastructural upgrades to meet current and future needs of Township residents.

F. Improve the Township's tax base and provide job opportunities by encouraging beneficial development/redevelopment projects.

**Table 28: Action Plan**

Action Item	Applicable Goal(s)	Timeframe
Retain residents between the ages of 25 and 34 by responding to demand for more housing units, including affordable housing options.	C, E	Medium term
Support an increasing senior population by assessing and responding to the demand for additional assisted living facilities, nursing homes, and appropriate healthcare facilities.	C, E	Medium term
Accommodate the needs of the Township's disabled population by enforcing ADA compliant design.	E	Ongoing
Recognize the economic hardship that faces households earning below the ALICE threshold by encouraging affordable housing and economic opportunities.	E, F	Short term
Encourage protection of wetlands and installation of green infrastructure along FEMA zones to mitigate harm caused by flooding.	A	Short term
Designate areas around floodplain as conservation areas to limit development and impervious surfaces.	A, B	Short term
Regulate lakefront development by mandating greenbelts with native vegetation in a buffer zone between the setback and the water's edge to reduce flooding impacts.	A	Medium term
Provide information about voluntary conservation easements to residents, especially those living in environmentally-sensitive areas.	A	Short term
Encourage green infrastructure placement during the site plan review process and/or planned development process.	A	Ongoing
Preserve natural and open spaces by pursuing commercial development in vacant buildings and/or retrofitting strip malls to support new commercial activities.	A, B	Medium term
Increase housing supply to meet demand for residences in the Township.	C	Medium term
Ensure aging housing stock receives appropriate maintenance and renovation to promote its habitability to the greatest extent and to avoid deterioration and demolition.	C, E	Medium term

Action Item	Applicable Goal(s)	Timeframe
Address increasing housing costs and the limited availability of starter homes valued between \$150k and \$250k by increasing the Township's supply of housing to match the demand.	C	Medium term
Accommodate future community housing preferences by matching the size and types of housing construction to needs. For example, while single-family homes remain the most prominent preference for Township residents, support attached single-family structures (such as duplexes).	C	Short term
Pursue CDBG funds to support the revitalization of housing units that are deteriorating and/or uninhabitable in order to put them back into the housing market.	C, E	Ongoing
Rezone commercial districts and corridors to allow for mixed-use developments.	C, F	Ongoing
Support commercial development by revitalizing buildings that have become vacant and/or retrofitting strip malls to support new commercial activities.	F	Medium term
Ensure redevelopment plans align with community-guided ideas at Pontiac Lake Gateway, Cedar Island and Bogie Lake Roads, and around Lakes Town Center.	F	Long term
Support efforts of the Corridor Improvement Authority to promote a sense of place, connectivity, and various activities in commercial corridors across the Township.	E, F	Ongoing
Implement traffic calming techniques along Cooley Lake Road and M-59 (east of Teggerdine Road) to ease commuter congestion en route to outside communities.	D	Ongoing
Address the volume of crashes that take place at intersections along M-59 by improving road safety measures and implementing biking and pedestrian infrastructure.	D	Ongoing
Educate and share information with Township residents about implementation plans for non-motorized infrastructure that includes a signed bicycle route, bicycle lanes, and shared-use paths.	D	Ongoing
Educate and share information with Township residents about public transportation options, including upcoming changes in operation.	D, E	Ongoing

## FUTURE LAND USE

The Future Land Use Map (FLUM) (p. 104) identifies preferred future land uses in the Township. It is a general framework, a land-use visualization of intended future uses, that guide land use and policy decisions within the Township over the next 10-20

years. It should drive changes to the Zoning Ordinance and inform development review decisions. In the FLUM, preferred locations for future development types are displayed, allowing the community to identify where certain land uses should expand or contract without committing to it by law.

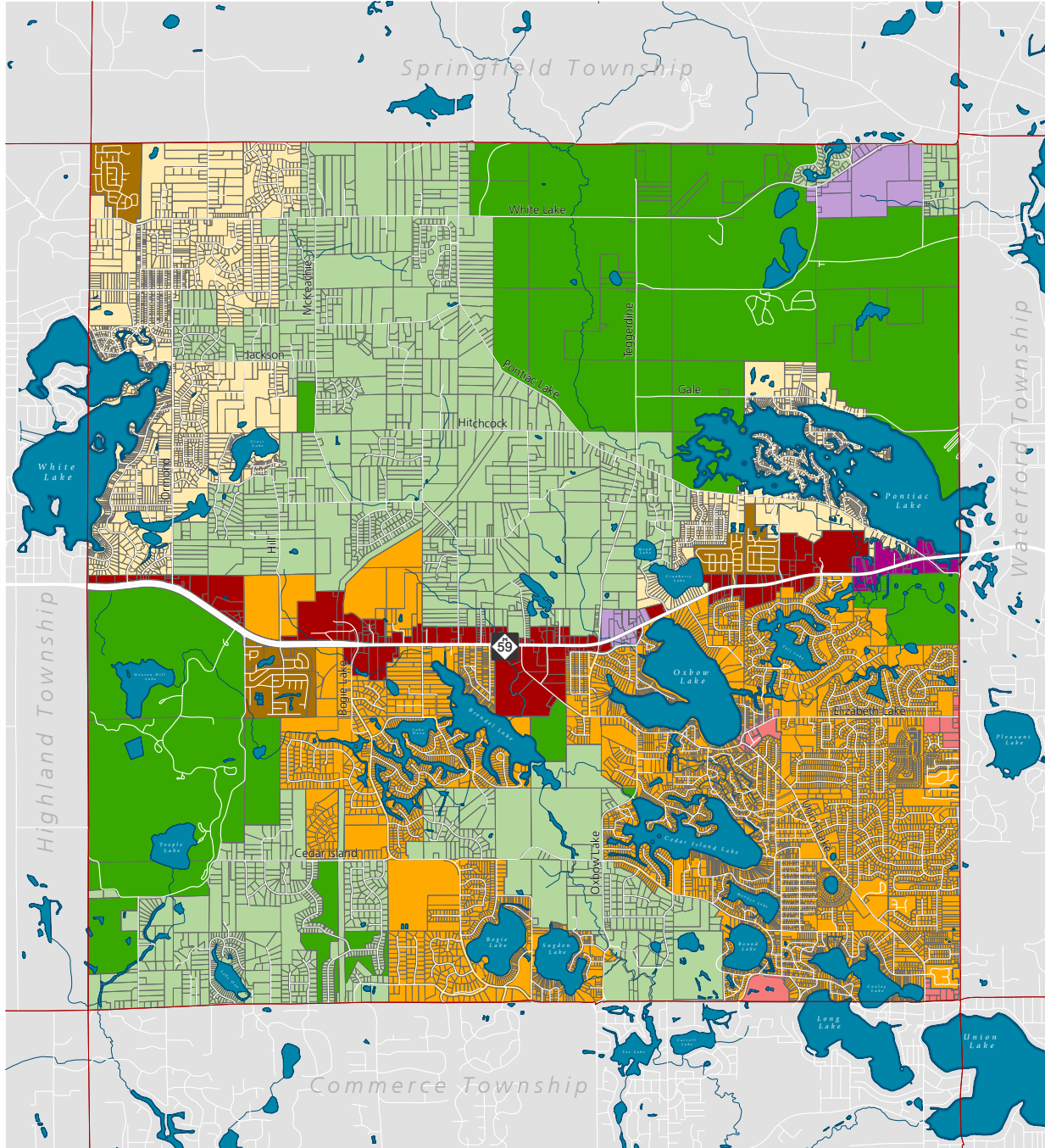
Table 29: Future Land Use and Zoning

Future Land Use	Description	Examples of Use*	Residential Density (DU/Acre)	Corresponding Zoning District(s)
<b>Recreation/ Open Space</b>	Large recreation spaces including the Highland State Recreation Area, White Lakes Oaks Golf Course, Pontiac Lake State Recreation Area, and Township parks.	Parks, golf courses, ski resorts, conservation areas	N/A	ROS
<b>Agriculture/ Rural Residential</b>	Maintains agricultural land and rural living through large lots and limited residential development. Subdivision residential development is discouraged.	Large-lot single family, agriculture, farm-stands, cider mills	0.2	AG, SF
<b>Suburban Residential</b>	Provides large lot, low density residences with open space preservation in residential subdivisions. Residential lots tend to be smaller than those in the Agriculture/Rural Residential future land use classification.	Large-lot single family, parks, churches, public facilities or institutions (e.g., schools)	0.5 – 3.0	R1-A, R1-B
<b>Neighborhood Residential</b>	Maintains existing neighborhoods and provides for denser residential development in places where there is infrastructure to support the density and ensuring density is within context of the surrounding neighborhood.	Small-lot single family, duplexes, multi-family, parks, convalescent or nursing homes	2.0 – 8.0	R1-C, R1-D, RM-1, RM-2, PD
<b>Manufactured Residential</b>	Includes existing manufactured housing developments.	Manufactured housing	3.0 – 6.0	MHP
<b>Neighborhood Commercial</b>	Provides neighborhood scale commercial establishments that have daily goods and services for residents. Creates centers of neighborhood life, encouraging a mix of compatible retail, service, office, and residential uses in a walkable environment.	Professional services/office, personal care, restaurants, mixed-use	6.0 – 10.0; varies based on development	LB, RB, NB-O, NMU
<b>Commercial Corridor</b>	Provides regional goods and services to residents and non-residents. Includes large box stores and drive thrus.	Large grocery, outlet, mixed-use, restaurants	Varies based on development	PB, GB, LB, PD, TC, NMU
<b>Pontiac Lake Gateway</b>	Creates a welcoming gateway offering a mix of local and regional goods and services. Uniform development and design standards create a defined sense of place.	Professional services, multi-family, personal care, restaurants, entertainment	Varies based on development	PG, GB, RM-1, RM-2
<b>Production/ Technology</b>	Serves community's need for research facilities and light industrial opportunities.	Light manufacturing	N/A	LM, ROP

\* Not an exhaustive list of uses.

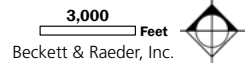


Map 14: Future Land Use Map



### Future Land Use Framework

Sources: Michigan Open Data Portal, Oakland County, White Lake Township



- Recreation / Open Space
- Agriculture / Rural Residential
- Suburban Residential
- Neighborhood Residential
- Manufactured Residential
- Neighborhood Commercial
- Commercial Corridor
- Pontiac Lake Gateway
- Production / Technology



Agri-business

# Appendix

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Appendix A: Survey Results Summary (pg. 108)  
Appendix B: Redevelopment Workshop Summary (pg. 131)  
Appendix C: Master Plan Open House Results (pg. 142)



# SURVEY RESULTS SUMMARY

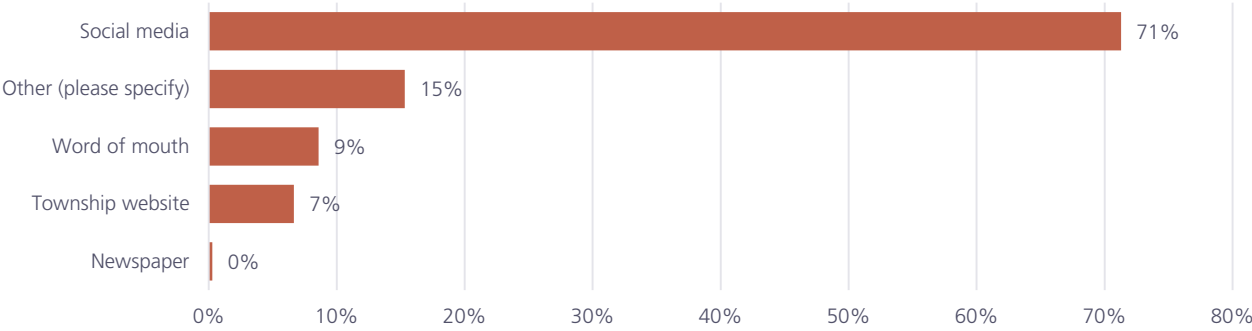
The White Lake Township Master Plan Survey was designed to garner the community’s vision for the future of the Township and gauge current perspectives and future preferences and priorities regarding the quality of life, housing, local economy, recreation, and natural features. The survey was hosted on an online platform—SurveyMonkey—and extensively promoted through postcards and flyers, social media platforms, local newspapers, newsletters, email, a poster at the White Lake Township Hall, and the Township’s website. Paper copies of the survey were available at the Township Hall for those who could not access the online platform. A total of 1,411 people participated in the survey between February and March 2023 with a completion rate of 70%.

## INTRODUCTORY QUESTIONS

Question 1. How did you hear about the survey? (Please select all options that apply)

Social media was the most common way the survey reached people; about 71% respondents indicated they heard about the survey on social media. Word of mouth and the Township website reached 9% and 7% of the respondents respectively. The remaining 15% of respondents heard about the survey through other mediums including email, neighborhood / subdivision newsletters, and Homeowners Associations (HOAs).

### Survey Outreach



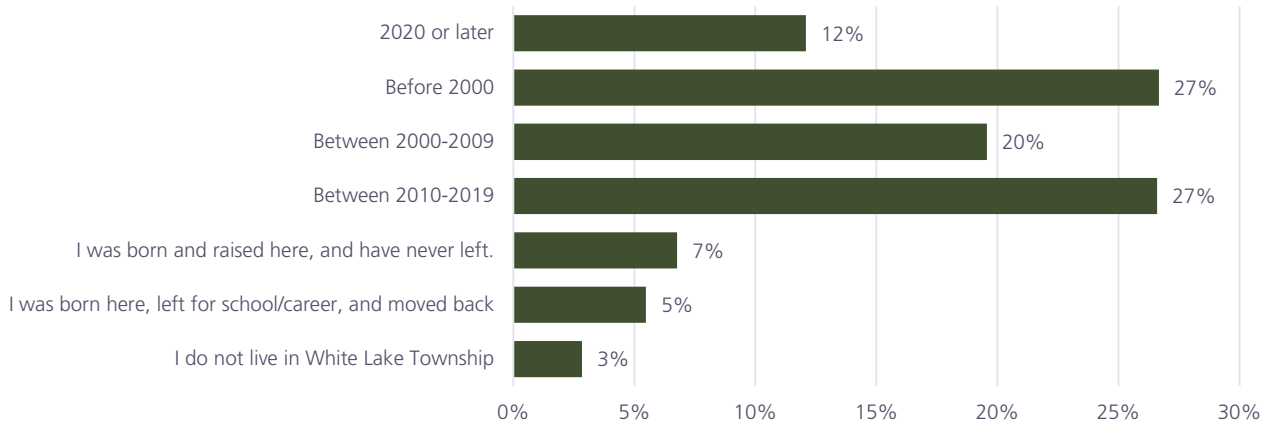
[Response Rate: 99.0% of Respondents]

Question 2. What year did you move to White Lake Township?

Respondents lived in the Township over a range of years, indicating the survey captured preferences of both recent and long-term residents. Roughly a third of respondents (34%) have lived in the Township for over 20 years and 5% of residents were born in the Township and returned after pursuing higher education / a career. About 20% of survey takers moved to the Township between 2000–2009, 27% between 2010–2019, and more recently 12% moved to the Township in or after 2020. The remaining 3% of respondents were not Township residents.



### Year Respondents Moved to the Township



[Response Rate: 99.6% of Respondents; percentages may not add up to 100% due to rounding errors]

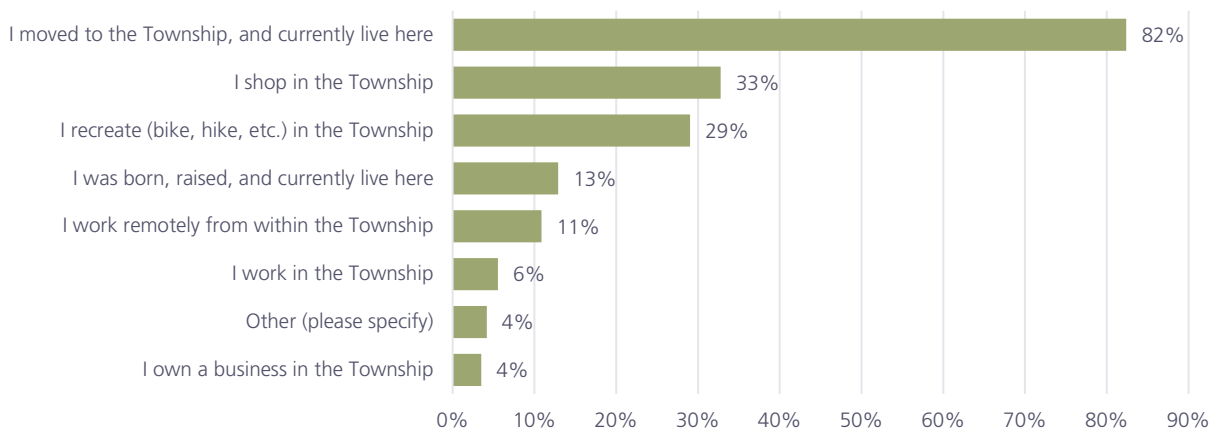
### QUALITY OF LIFE

The responses in this section help comprehend the community’s perception regarding the quality of life in the Township and identify aspects of the Township they believe need to be improved.

Question 3. What is your connection to White Lake Township? (Please select all options that apply)

A vast majority of respondents (82%) were residents who moved into the Township, while 13% were residents who were born and raised in the Township. Around one-third of respondents (33%) shopped in the Township and nearly 30% used recreational opportunities in the Township such as biking / hiking. In regard to employment, 11% worked remotely within the Township, 6% worked in the Township, and 4% of respondents were local business owners. Among the remaining 4% who chose the “other” option, respondents commonly owned seasonal lakeside properties, had children attending the local schools, or had family in the Township.

### Respondents’ Connection to the Township



[Response Rate: 86.9% of Respondents]

Question 4. In one word or phrase, what is a defining characteristic of White Lake Township?

The most common words used to describe White Lake Township were “Beautiful”, “Community”, “Friendly”, “Home”, “Lake”, “Nature”, “Peaceful”, and “Rural”.

#### Defining Characteristics of the Township



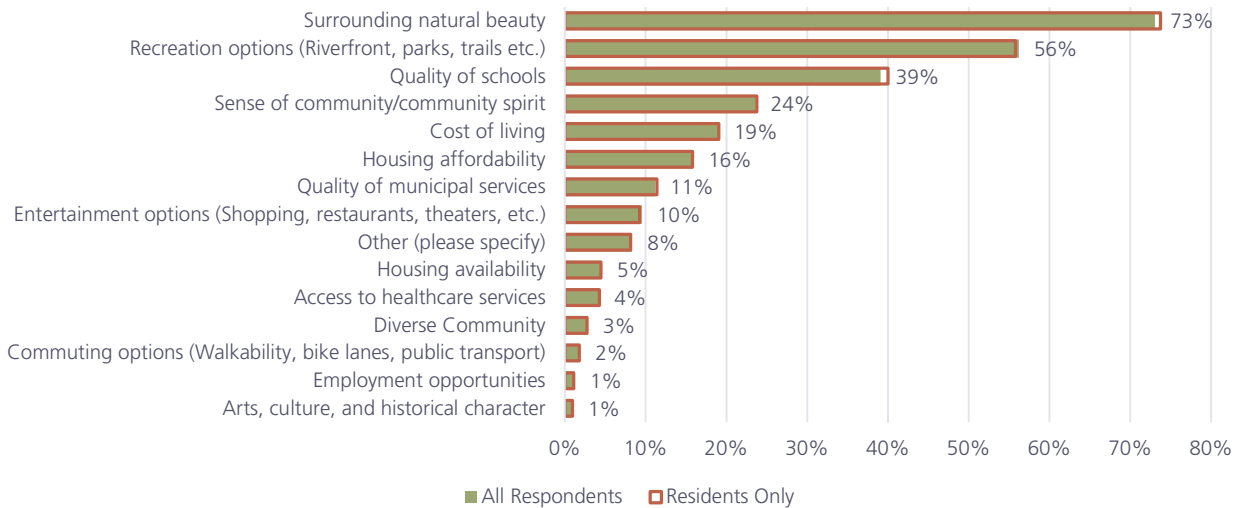
[Response Rate: 64.4% of Respondents]

Question 5. What are the THREE best characteristics of the Township? (Please select at most three options)

True to the Township’s motto as the “Four Seasons Playground,” a majority of respondents (73%) indicated surrounding natural beauty was the best characteristic of the Township. Recreation options and quality of schools were identified as the second and third best characteristics by 56% and 39% of respondents, respectively.

To understand what residents valued most in the Township, the responses to this question were filtered based on respondents who selected either “I moved to the Township, and currently live here” or “I was born, raised, and currently live here” as a response to their connection to the Township in question 3. Among those who responded to this question (87% of total respondents), 95% identified as residents. Residents also identified surrounding natural beauty (74%), recreation options (56%), and quality of schools (40%) as the best characteristics of the Township. Commuting options (2%), employment opportunities (1%), and arts, culture, and historic character (1%) were the characteristics rated the lowest by all respondents and residents alike.

### Best characteristics of the Township

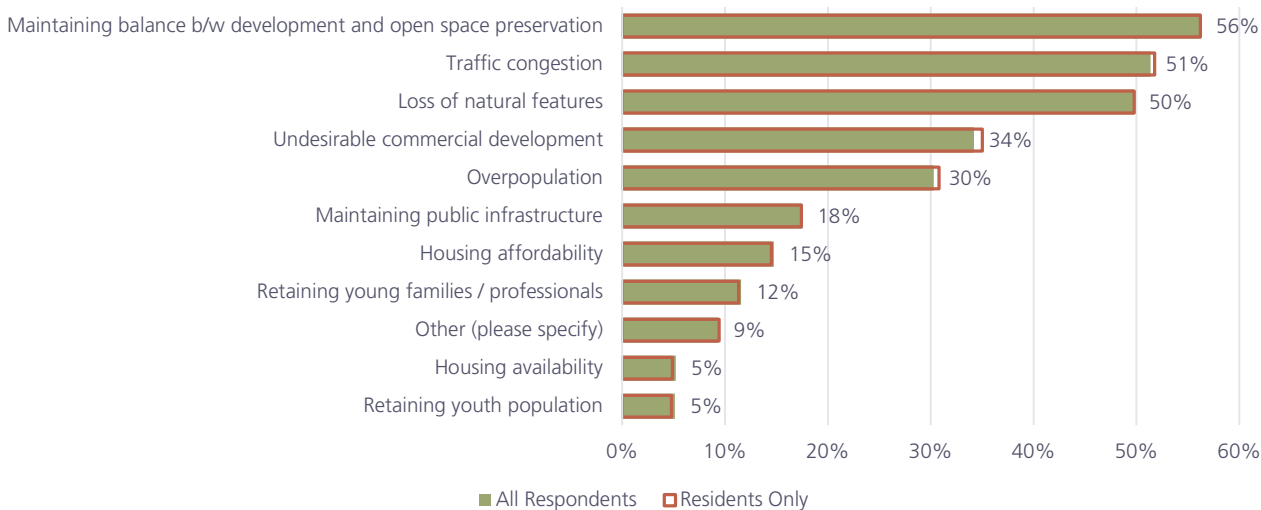


[Response Rate: 87.0% of Respondents, % labels above are all respondents]

### Question 6. What are the THREE biggest challenges the Township faces over the next 10 years? (Please select at most three options)

The coexistence of both rural and urban characteristics may be a challenge in White Lake Township. Therefore, over half of all respondents (56%) indicated maintaining a balance between development and open space preservation would be the biggest challenge for the Township over the next 10 years. Traffic congestion and loss of natural features were other major challenges identified by roughly half of the respondents.

### Biggest challenges the Township faces over the next 10 years.



[Response Rate: 87.0% of Respondents, % labels above are all respondents]

Filtering responses, residents also identified maintaining a balance between development and open space preservation (56%), traffic congestion (52%), and loss of natural features (50%) as the three biggest challenges for the Township over the next decade. Some other common challenges identified by 9% of respondents included poor quality of roads and public infrastructure, lack of pedestrian connectivity and bike lanes, and lack of destinations / downtown.

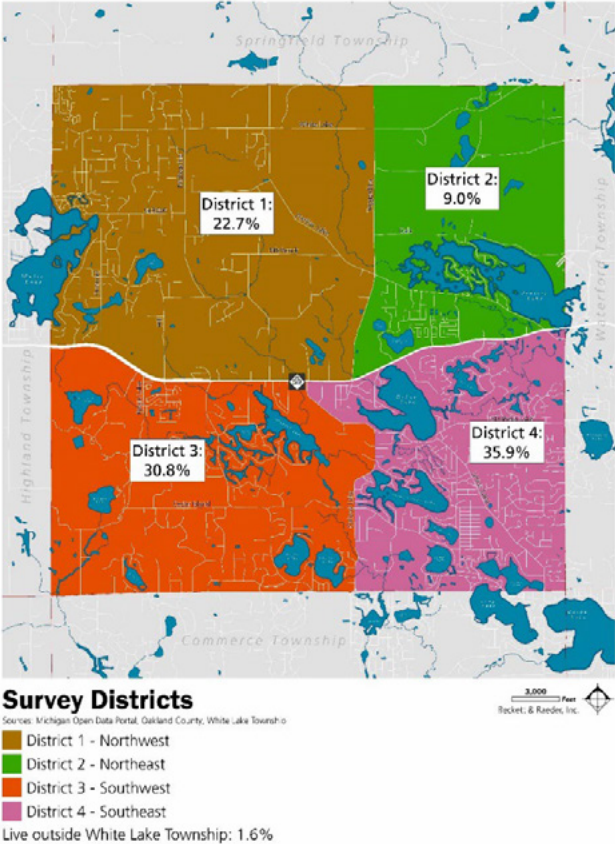
## HOUSING

The responses in this section of the questionnaire help perceive the respondents' current and future preferences and needs regarding housing and residential land use in the Township.

Question 7. Which area of the Township do you live in? (Please use the map below as a reference or use this link to search your address)

Most of the respondents (35.9%) lived in District 4, followed by 30.8% who lived in District 3; combined, two-thirds of respondents live south of M-59. Roughly 22% of respondents live in District 1, 9% live in District 2, and the remaining 1.6% were not Township residents. Roughly 22% of respondents did not answer this question. In subsequent questions, where this question was used as a filter to categorize responses by district, it is important to acknowledge the lower response rate to this question may skew the analysis.

### Percentage of Respondents by Survey District



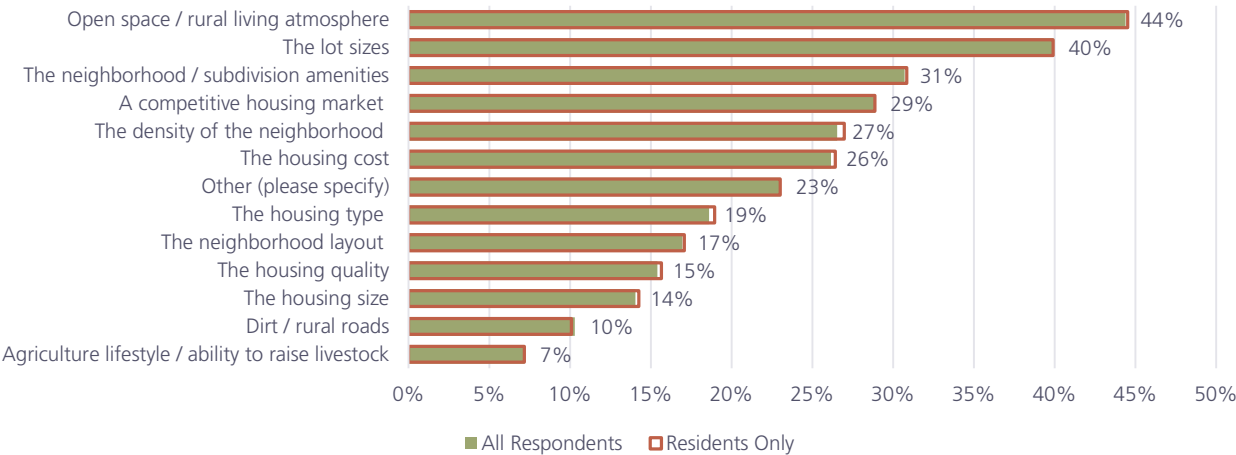
[Response Rate: 78.2% of Respondents, % labels above are all respondents]



Question 8. What characteristics of the area that you live in attracted you to move there? (Please select all options that apply)

Most respondents (44%) indicated a rural atmosphere with plenty of open space was the main characteristic that attracted them to move to their current area of residence. Many (40%) also noted the lot sizes as a reason and almost a third of respondents (31%) valued the amenities such as parks and common spaces in their neighborhood / subdivisions. When residents noted the rural aesthetic as a valuable characteristic, it appears to be limited to the open space that accompanies rural residential land use; the rural roads or the agriculture lifestyle were not aspects of the rural character respondents found attractive. Among some other responses, a vast majority of respondents also noted the lakes and access to the lakes as important characteristics of their neighborhood.

**Characteristics that Attracted Respondents to their Area of Residence**



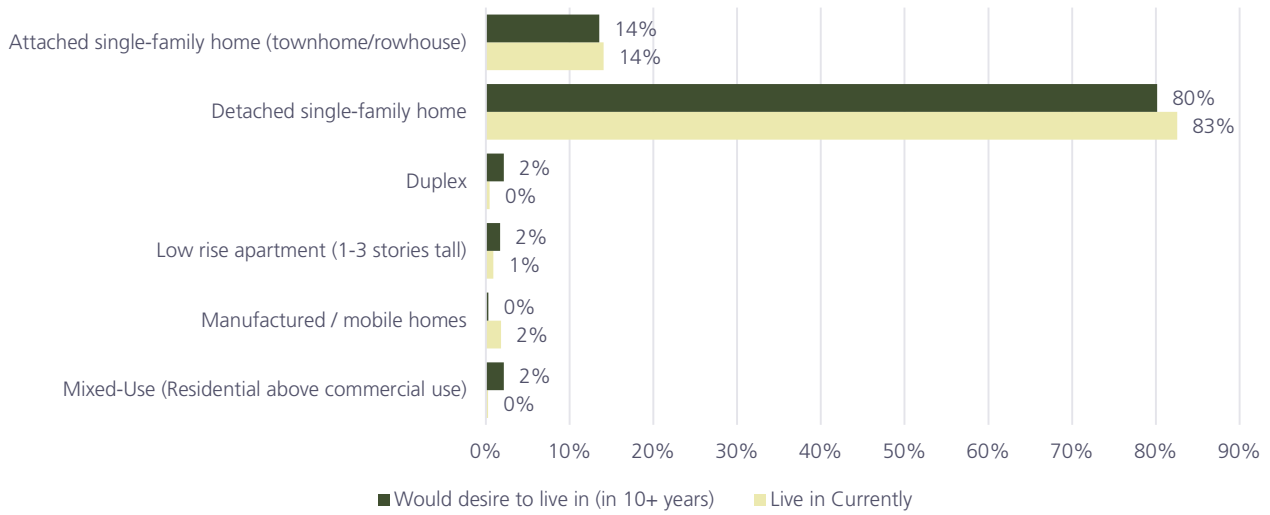
[Response Rate: 77.7% of Respondents, % labels above are all respondents]

Question 9. What type of housing do you LIVE IN CURRENTLY and what type would you like to LIVE IN 10 YEARS FROM NOW? (Please select all options that apply)

The majority of respondents currently lived in either detached single-family homes (83%) or attached single-family homes house (14%); only 3% of all respondents lived in other multi-family housing units. Future preferences of respondents were also concentrated only between the two typologies of single-family homes, attached (80%) and detached (14%), indicating most respondents were not seeking different housing typologies in the Township. A small percentage of respondents (6%) indicate a desire to live in duplexes (2%), and other multi-family housing units such as low-rise apartments (2%) and mixed use units (2%) ten years from now. A more detailed analysis of housing preferences by age, indicated the following:

- » Of the 2% respondents who wish to live in duplexes, over 50% seniors (65 years and above)
- » Young professionals and families (25-34 years), empty nesters (55-64 years), and seniors indicated a desire to live in low-rise apartments.
- » Among those who wish to live in mixed use residential units in the future (2% of the total), 36% are young professionals and families, while the remaining vary in age from 35-year-olds to seniors.

### Current Housing Type and Future Preferences

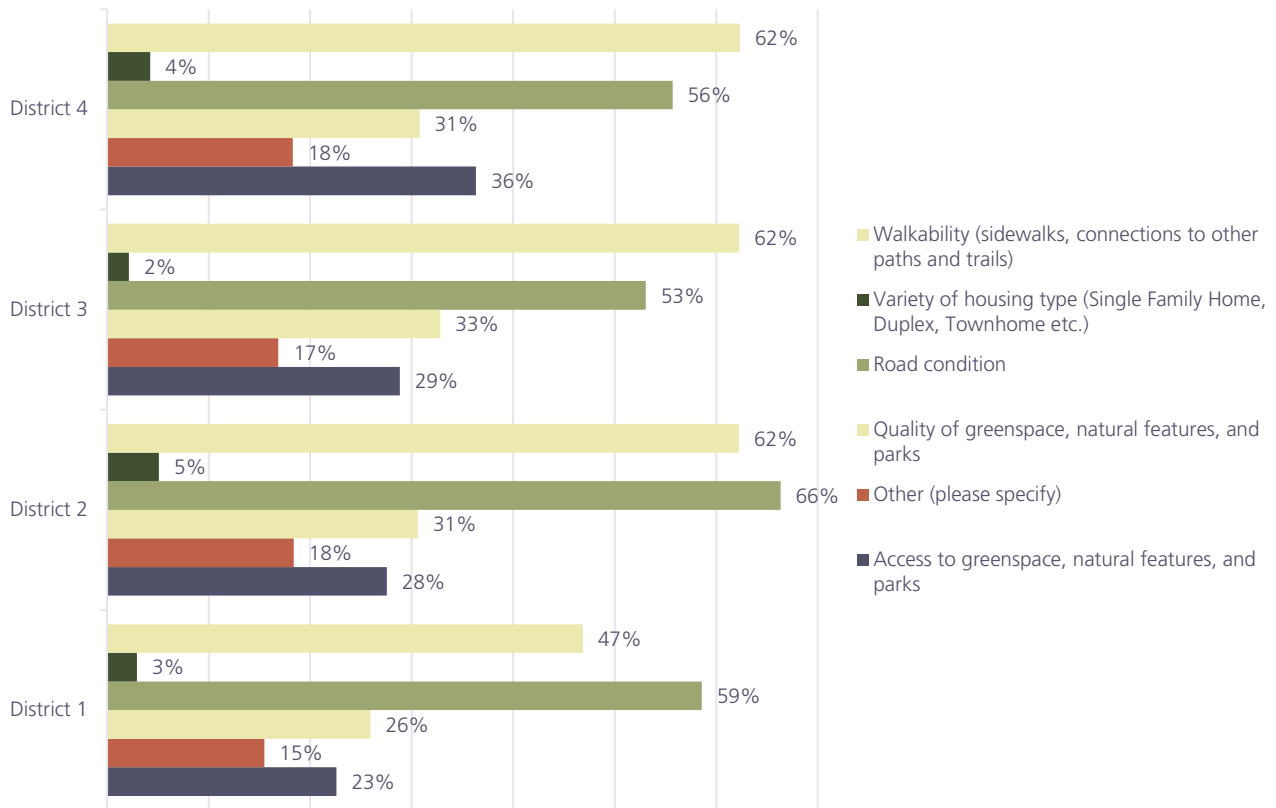


[Response Rate: 78.0% of Respondents]

Question 10. What are the characteristics of the area that you live in that could be used for improvement? (Please select all options that apply)

Walkability—the quality of sidewalks, connectivity of sidewalks and trails—was identified by roughly 60% of respondents from all four districts as a major characteristic that needs to be improved. Following walkability, over one half of respondents in Districts 1, 3, and 4, and two-thirds (66%) in District 2, noted roads required improvements. Respondents from Districts 1, 2, and 3 rated improvements related to the **quality** of greenspace, natural features, and parks slightly higher than **access** to greenspace, natural features, and parks. Conversely, in District 4, respondents rated access higher than quality. About 5% and 4% of respondents in Districts 2 and 4 suggested improving housing diversity. Among the various “other” responses, some common characteristics included improving/expanding sewer and water infrastructure, reducing traffic congestion, and increasing restaurants/destinations.

### Improvement Priorities by District



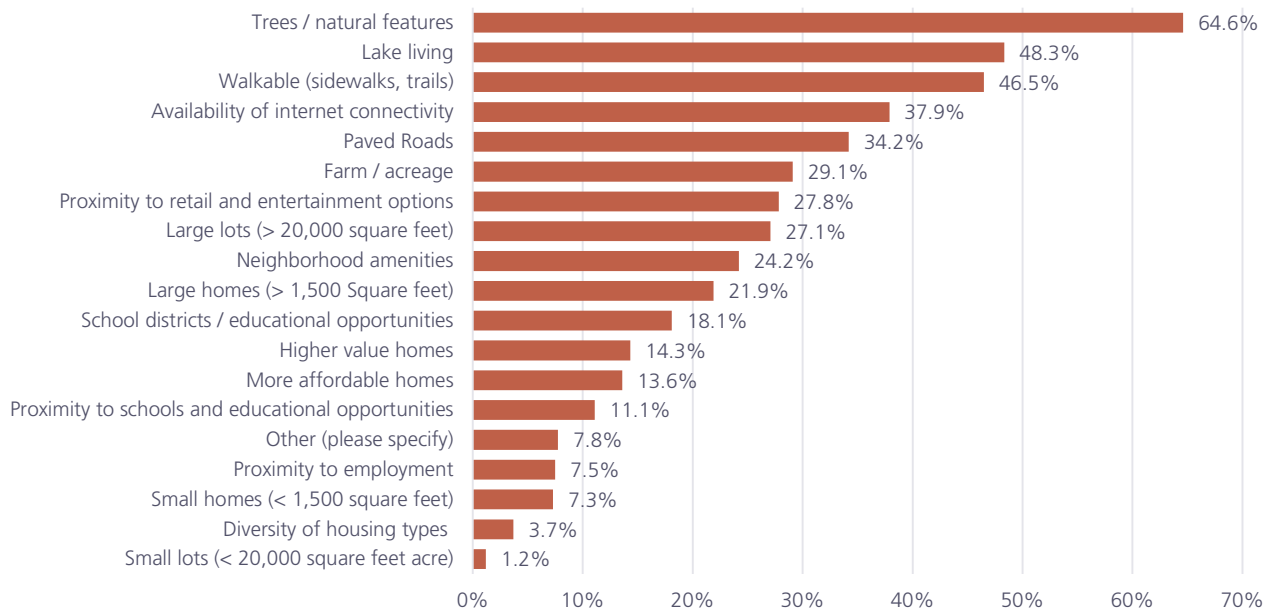
[Response Rate: 75.1% of Respondents, % labels above are all respondents]

Question 11. What are the characteristics of an area you would like to live in, in the future? (Please select all options that apply)

Overall, respondents chose trees and natural features (65%), lake living (48%), and walkability (46%) as the top three characteristics of an area they would like to live in, in the future.

Filtering responses by age of respondents, the top three priorities for all cohorts aged 25 years and above mirrored that of the entire group, in the same order. Young adults (18-24 years) also identified trees and natural features (86%) as the top characteristic of an area they would live in the future; however, deviating from the rest of the cohorts, they preferred an area with affordable homes (71%) and availability of internet connectivity (64%) over other characteristics.

### Characteristics of an Area Respondents Would Live in, in the Future.

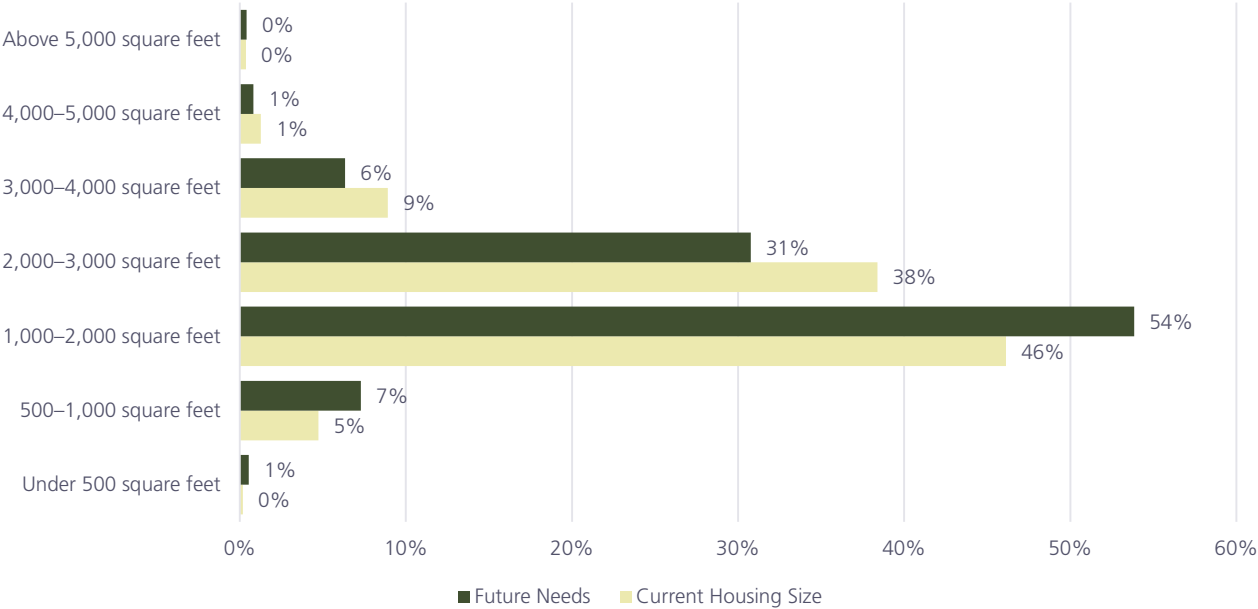


[Response Rate: 76.7% of Respondents]

Question 12. What is the size of your current housing unit, and what size of housing unit do you require to fulfill your housing needs in the future? (Please select one for each column)

Almost one-half of the respondents (46%) lived in homes between 1,000–2,000 square feet and over a third of respondents (38%) lived in homes with an area between 2,000–3,000 square feet. About 10% lived in larger homes with an area of 3,000 to 4,000 square feet or above while only 5% of respondents lived in units 500-1,000 square feet in size. Reviewing the future housing needs of respondents, a higher percentage of respondents indicate a desire to live in homes with an area of 1,000–2,000 square feet in the future than those housed presently. One possibility for this demand may be a lack of units 1,000–2,000 square feet in area, suggesting the current housing needs of some respondents were not being met. Alternatively, as housing composition changes, it is likely the future housing needs will change, creating a future demand for homes in the 1,000–2,000 square feet category. Irrespective of the reason, respondents indicated a need to increase the housing stock of homes 1,000–2,000 square feet in the Township. Similarly, respondents also indicated a demand for smaller homes, 500-1,000 square feet in the Township.

### Current Housing Size and Future Preferences



[Response Rate: 77.9% of Respondents]



The table titled “Current Housing Size and Future Preferences by Age” filtered the current housing size and future needs by age of the respondent. The table demonstrates a larger percentage of seniors who currently lived in larger homes will be interested in downsizing to smaller homes 500-1,000 or 1,000–2,000 square feet in the area. As the population of the Township ages, the Township can expect the demand for small to mid-size homes to grow. Those aged 25-34 years indicated a desire for the larger format of homes (3,000–5,000) likely a future need to house growing families.

**Current Housing Size and Future Preferences by Age**

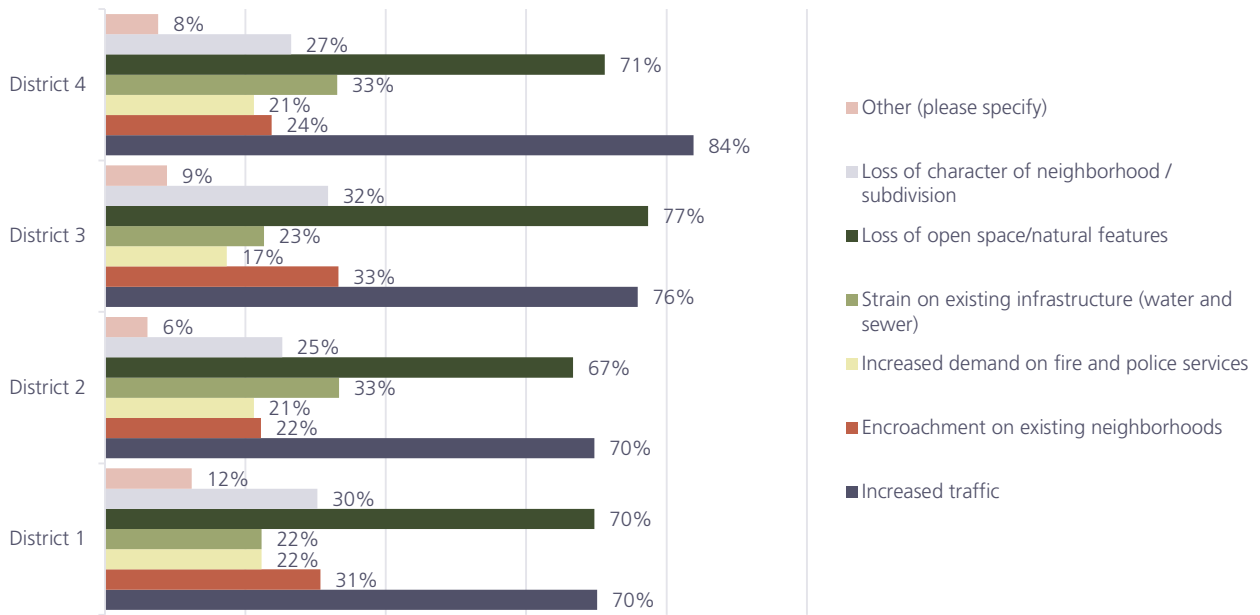
Size of Unit	Current Housing Size						Future Needs					
	18-24	25-34	35-44	45-54	55-64	65+	18-24	25-34	35-44	45-54	55-64	65+
Under 500 Sq.Ft.	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	1%	1%
500–1,000 Sq.Ft.	25%	9%	6%	2%	5%	1%	9%	7%	2%	5%	9%	12%
1,000–2,000 Sq.Ft.	42%	52%	42%	46%	44%	50%	73%	34%	43%	59%	59%	62%
2,000–3,000 Sq.Ft.	8%	31%	41%	39%	38%	41%	18%	43%	46%	25%	24%	23%
3,000–4,000 Sq.Ft.	25%	6%	7%	11%	11%	6%	0%	14%	9%	9%	5%	2%
4,000–5,000 Sq.Ft.	0%	1%	3%	0%	1%	1%	0%	3%	0%	1%	1%	0%
Above 5,000 Sq.Ft.	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%	1%	0%

Note: The table above is read vertically, all columns add up to 100% showing the distribution of housing needs within each age cohort.

Question 13. What are your top THREE biggest concerns about increased residential development in the Township? (Please select at most three options)

Traffic congestion as a result of increased residential development was the biggest overall concern for over 70% of respondents from all districts. Almost 70% of respondents were also concerned about the loss of open space and natural features resulting from increasing residential development in the Township, but those from District 3 rated this as their biggest concern.

### Concerns about Increased Residential Development by District



[Response Rate: 78.5% of Respondents]

Respondents from Districts 1 and 3 rated the encroachment on existing neighborhoods as the third biggest concern while those from Districts 2 and 4 expressed concerns about the loss of the character of their neighborhood / subdivision due to new development.

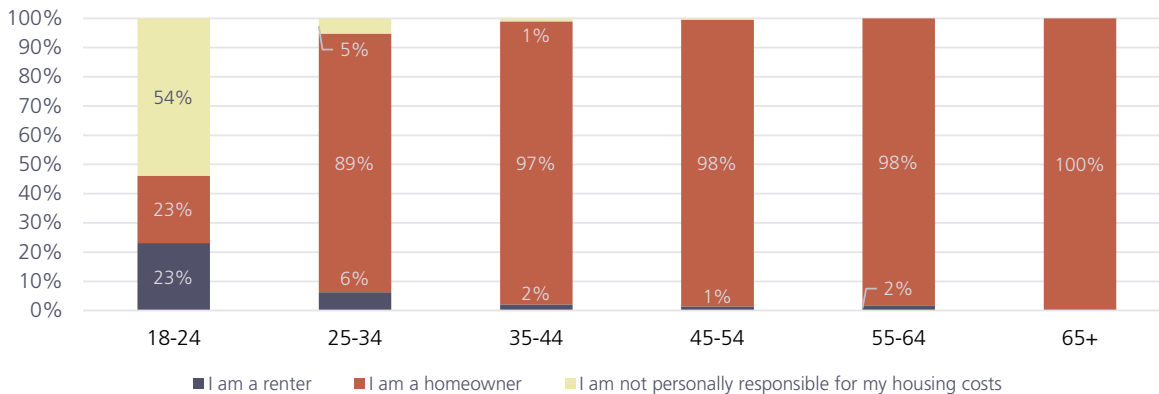
Question 14. Of the two options below, which is your preferred approach to directing new residential development?

Of the 73.8% who responded to this question, a majority of respondents (57%) supported low density development anywhere in the Township with minimal loss of open space and natural features; the remaining 43% support slightly higher density development south of M-59 while prioritizing preservation of open space and natural features north of M-59.

Question 15. What is your housing tenure status?

About 95% of respondents were homeowners, 2% were renters, and 2% were not financially responsible for their housing costs. The majority of respondents who were not responsible for their housing costs were young adults and professionals aged 18–34 years, and the largest percentage of renters (29%) also belong to the 25–34 years cohort.

### Housing Tenure Status by Age of Respondents

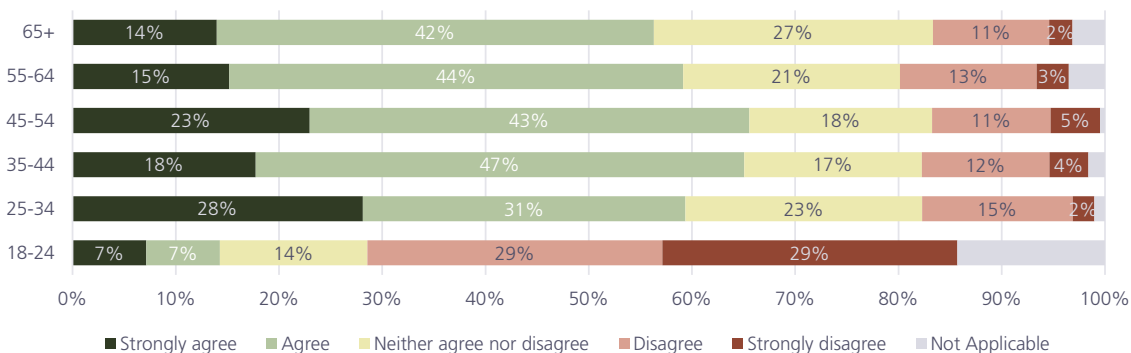


[Response Rate: 78.5% of Respondents]

Question 16. How strongly do you agree with the following statement "With my household income, I feel the housing options in White Lake Township are financially attainable."?

Respondents demonstrated varied levels of agreement on housing attainability in the Township indicating a need to diversify housing to reach the various income cohorts in the Township. While across age groups, over half the respondents were able to access housing catered to their housing income, a minority either disagreed or strongly disagreed to the above statement. Those aged 18–24 years, potentially including those still in school or beginning their careers, indicated strongest disagreement.

### Housing Attainability by Age of Respondents

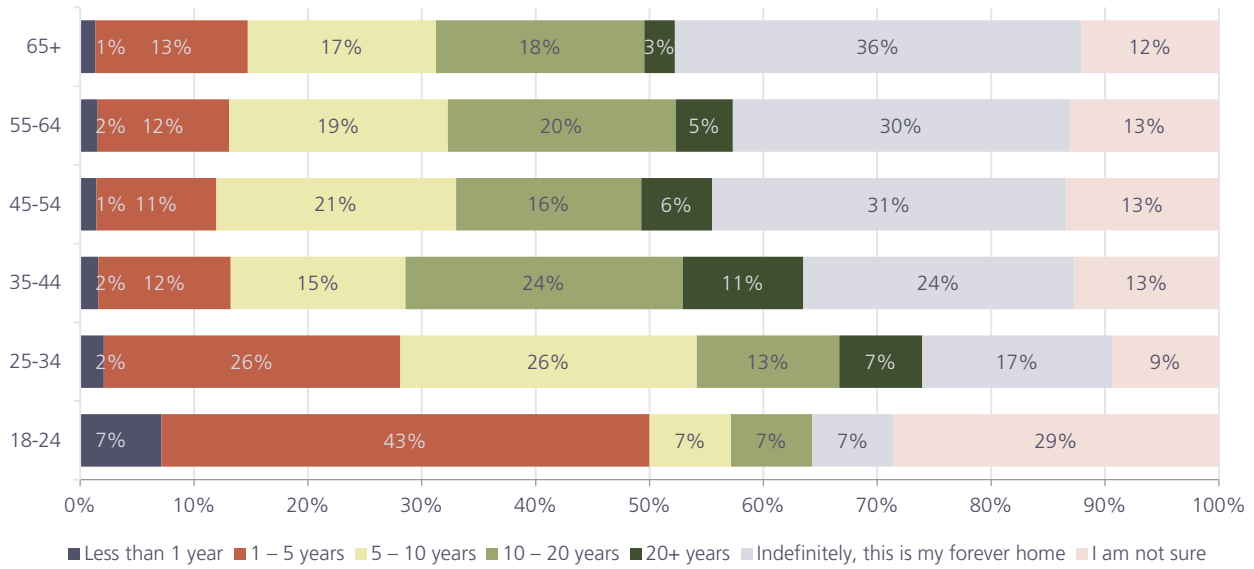


[Response Rate: 77.8% of Respondents]

Question 17. How much longer do you anticipate living in your current home?

The percentage of respondents aged 25–34 years indicated varied intentions of residing in their current homes, suggesting they would move as they transitioned through various stages of life. Among those aged 35–44 years, the majority (34%) anticipated living in their current homes over the next twenty years, likely homeowners with children in school. Preferences varied among those aged 45 years and above.

### Duration in Current Home



[Response Rate: 78.5% of Respondents; percentages may not add up to 100% due to rounding errors]

### FUTURE HOUSING PLANS

#### Question 18. Why are you planning on moving?

Responses varied depending on the age and income level of respondents as identified in the prior questions. Younger renters were interested in pursuing homeownership; middle-aged respondents planned to move to accommodate growing families; and most empty nesters and seniors planned to downsize from their current homes into smaller homes that were easier to maintain both financially and physically.

## LOCAL ECONOMY

The responses in this section of the questionnaire help perceive the respondents' current and future preferences and needs concerning the local economy and commercial land use in the Township.

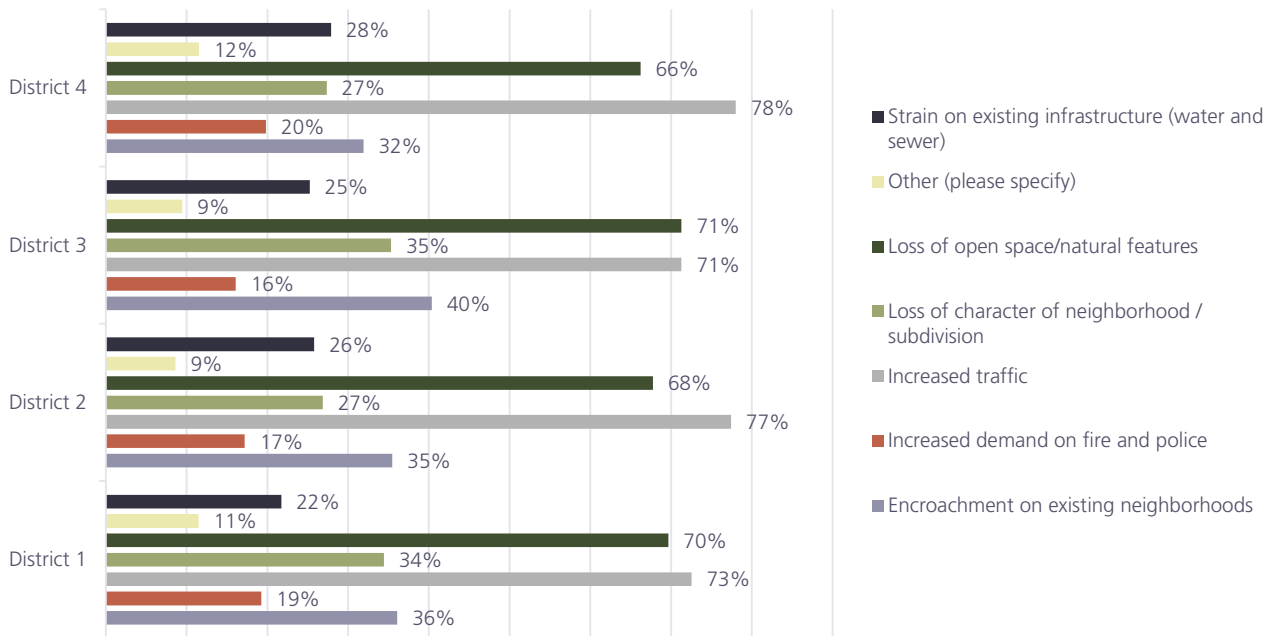
Question 19. Of the two options below, which is your preferred approach to directing new commercial development?

Of the 72.7% who responded to this question, 92% favored reuse of former commercial buildings now vacant or retrofitting of strip malls both of which will preserve existing open space and natural features; only 8% of respondents favored encouraging new low-density development along M-59 on vacant undeveloped land even with minimal threat to open space and natural features.

Question 20. What are your top THREE biggest concerns about increased commercial development in the Township? (Please select at most three options)

Increased traffic as a result of increased commercial development was the biggest overall concern for roughly 75% of respondents from all districts. Approximately 70% of respondents from all districts were also concerned about the loss of open space and natural features resulting from increasing commercial development in the Township. Around a third of respondents from all four districts showed consensus that encroachment on existing neighborhoods was the third biggest concern.

### Concerns about Increased Commercial Development by District



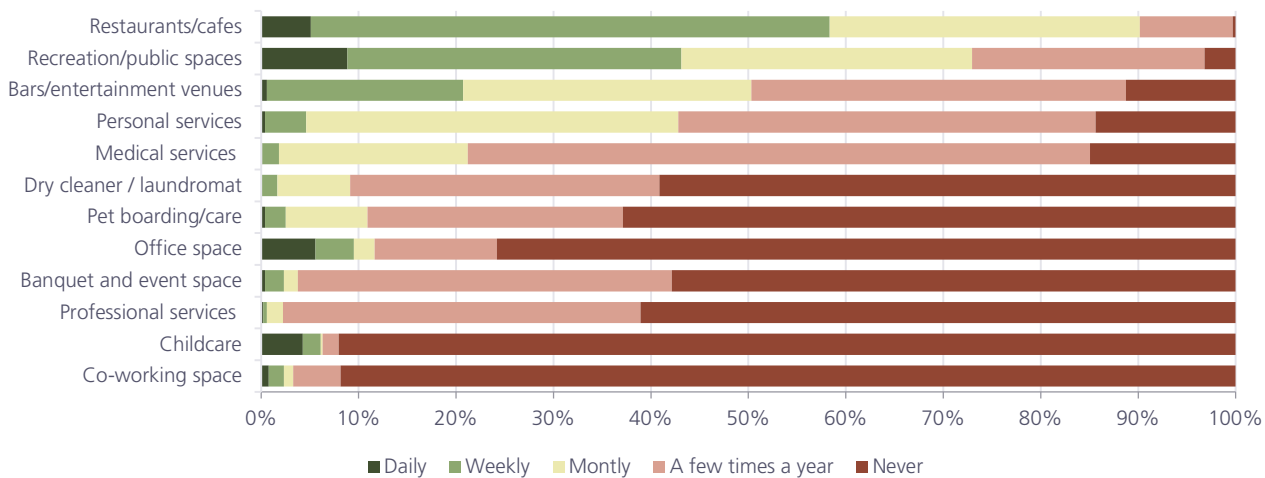
[Response Rate: 74.1% of Respondents]



Question 21. How often do you frequent the following types of businesses/locations on average?

The majority of daily visits to businesses or locations by respondents included recreation spaces (9%), followed by office spaces (6%), restaurants or café (5%), and childcare (4%). On a weekly basis, respondents frequented restaurants and cafes (53%), recreation and public spaces (34%), and bars and entertainment venues (20%). Many respondents visited bars and entertainment venues (30%) and personal services such as salons and spas (38%), in addition to restaurants and recreation facilities monthly. Overall, co-working spaces (92%) and childcare (92%) were least visited locations overall.

**Visits to Businesses / Locations**

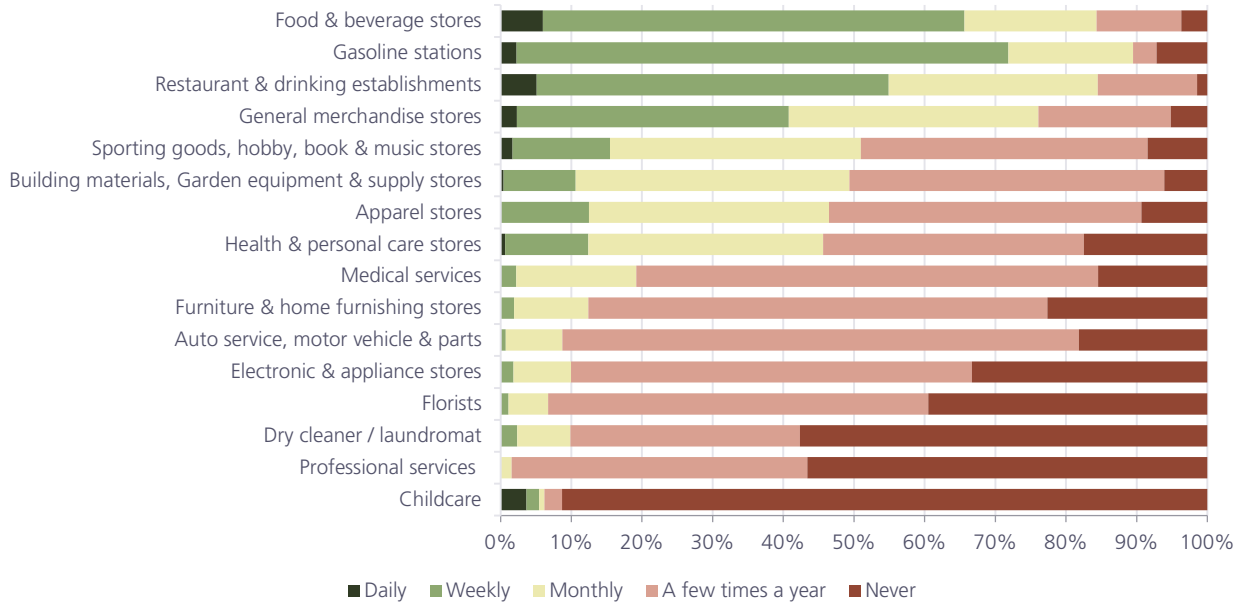


[Response Rate: 73.9% of Respondents]

Question 22. What type of retail would you like to see in the Township and how often would you frequent each storefront on average?

Many respondents indicated a high demand to frequent gasoline stations (70%), food and beverage stores (60%), restaurants and drinking establishments (50%), and general merchandise stores (38%) on a weekly basis. Respondents also showed interest in visiting apparel stores (34%), building materials and garden equipment stores (39%), and health and personal care stores (33%) every month. Close to three-quarters (73%) indicated a demand for automotive service establishments and 65% would visit furniture and home furnishing stores and medical services a few times a year. Many respondents expressed a lack of interest / need for childcare and professional services space in the Township.

### Visits to Retail Establishments

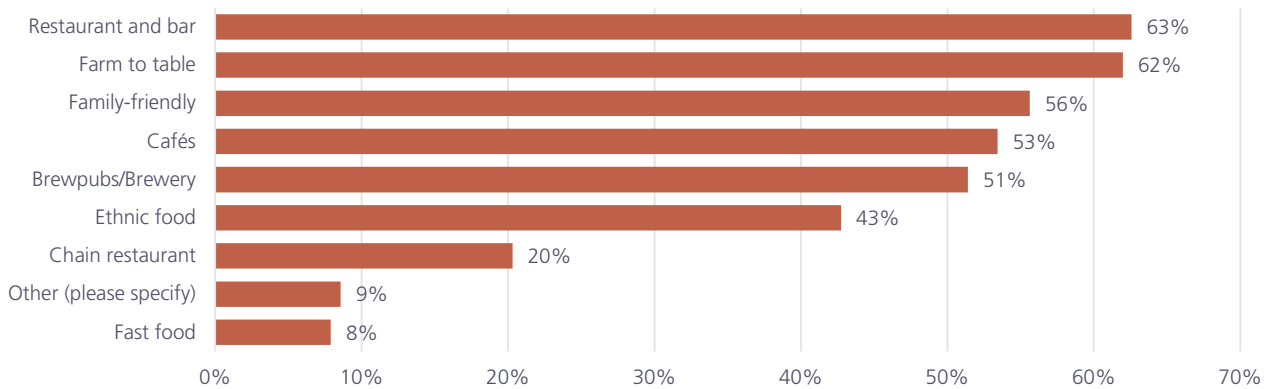


[Response Rate: 73.1% of Respondents]

Question 23. What type of eating and drinking establishments would you like to see in the Township? (Please select all options that apply)

A majority of respondents (63%) reiterated a strong desire to see more restaurants and bars in the Township. Considering the past or present ties many respondents had/have with farming and agriculture in the Township, and parts of the Township continue to preserve farmlands, many respondents expressed interest in supporting farm to table establishments. Roughly half the respondents also wish to encourage family-friendly eating and drinking establishments (56%), cafes (53%), and breweries (51%). Survey takers were least interested in encouraging fast-food or chain restaurants in the Township.

### Eating and Drinking Establishments Preferences

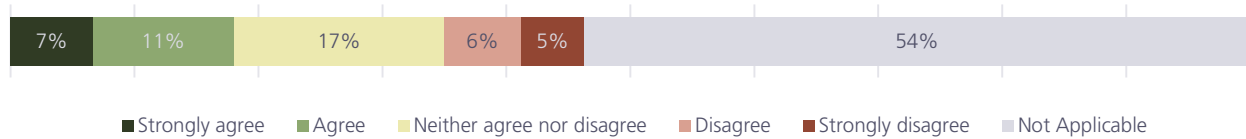


[Response Rate: 73.6% of Respondents]

Question 24. To what extent do you agree with the following statement, "I would like to start or expand a business in the Township, but I'm unaware of resources that could help me do that."

Only one-half of respondents were interested to start or expand a business in the Township; 17% either strongly agreed or agreed they were aware of resources to help establish/expand businesses; another 17% were neutral; while 11% were unaware of the resources.

### Business Resources Outreach Satisfaction Scale



[Response Rate: 73.5% of Respondents]

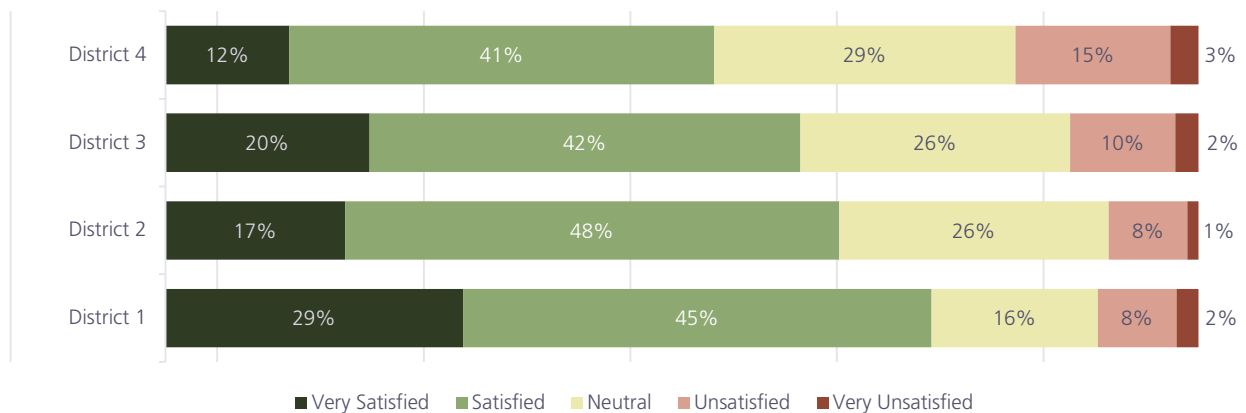
## RECREATION

The responses in this section of the questionnaire help perceive the respondents' perception of recreational opportunities in the Township.

Question 25. How satisfied are you with the parks and other recreation offerings in the Township?

As the "Four Seasons Playground," a majority of respondents in all four districts were either very satisfied or satisfied with the parks and recreational opportunities offered in the Township. Many respondents reported a neutral perception, while respondents from Districts 3 and 4 indicated the highest level of dissatisfaction. As noted in Question 7, given only 78% of respondents noted their survey district, a district-wide analysis may slightly skew the results.

### Satisfaction with Parks and Recreation Offerings



[Response Rate: 73.5% of Respondents]

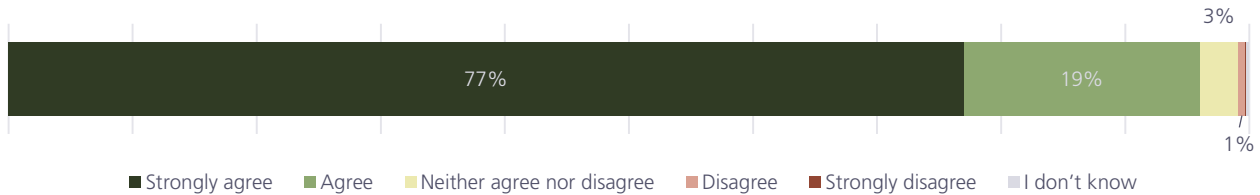
## NATURAL FEATURES

The responses in this section of the questionnaire help comprehend the importance of natural features to the survey respondents.

Question 26. To what extent do you agree with the following statement: "Natural features are an asset to White Lake Township."?

Throughout the survey, most of the respondents demonstrated a strong motivation to preserve the open space and natural features in the Township; consistently, 77% "strongly agree" and 19% "agree" natural features were an asset to White Lake Township.

### Level of Agreement that Natural Features are Assets to the Township

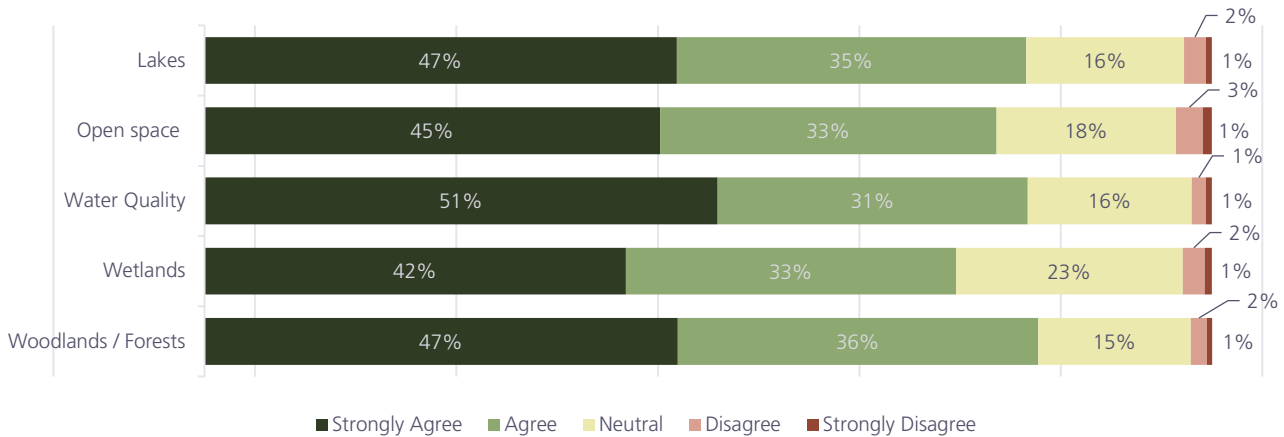


[Response Rate: 71.7% of Respondents]

Question 27. To what degree do you agree with the following statement: "The Township's natural features (listed below) could be better protected/preserved."?

Roughly 80 of respondents indicated the Township's natural features including lakes, open space, water quality, wetlands, and forests can be better protected/preserved. A majority (82%) of respondents indicated the water quality in the Township could be better preserved.

### Level of Agreement that Natural Features Could be Better Protected/Preserved



[Response Rate: 71.8% of Respondents; percentages may not add up to 100% due to rounding errors]

## VISION FOR WHITE LAKE TOWNSHIP

This section uses community input to establish a vision for White Lake Township which is subsequently used to determine the priorities and goals in the implementation section of the Master Plan.

Question 28. Please select your top THREE goals for the future of White Lake Township. (Please select at most three options)

The majority of all respondents and residents alike (69%) identified preserving and protecting natural features as the top goal for the future of the Township. Subsequently, respondents ranked maintaining the small-town rural character of residential areas (49%) and providing adequate infrastructure while protecting natural features (46%) as the second and third priority goal; the preferences of residents align with that of all respondents.

### Rating of Goals

Goals	All Respondents	Residents Only
Preserve and protect natural features including wetlands, floodplains, lakes, woodlands, and other natural features	69%	69%
Maintain the small-town rural character of existing single family residential areas	49%	49%
Provide adequate infrastructure that preserves and protects White Lake Township's natural features	46%	46%
Address the community's needs for efficient and safe multi-modal access (walking, biking, auto)	31%	32%
Enhance the quality of life and make the community more appealing by providing a variety of recreational facilities	26%	26%
Provide goods and services that meet the current and future needs of Township residents	22%	22%
Address the community's needs for sewer and water systems	20%	20%
Provide efficient public services that adequately and safely support the existing and future population of White Lake Township	17%	17%
Encourage high tech, research, and light industrial developments to improve the tax base and provide job opportunities	7%	7%
Provide a variety of housing opportunities	3%	3%

[Response Rate: 71.7% of Respondents]



Question 29. The 2012 Master Plan specified the following vision for White Lake Township: "Strive for a sustainable White Lake Township that balances the community's economic, environmental, and social needs. Promote the identity of White Lake Township as a small country town with big city amenities by protecting and preserving natural features, encouraging redevelopment of obsolete properties, and directing growth and development to a central community core." Does this vision align with your view of White Lake Township?

Majority of respondents (77%) either strongly agreed or agreed the vision statement of the 2012 Master Plan aligned with their view of White Lake Township; and 14% neither agree nor disagree. Roughly 10% of the respondents disagreed or strongly disagreed with the specified vision statement. Filtering responses by residents, no difference was observed between responses of residents compared to that of all respondents.

Question 30. If you were neutral or disagreed with the 2012 statement, what is your vision for White Lake Township?

Some common themes identified by respondents as their vision for the Township included:

- » "Big city" amenities are not appropriate for the Township.
- » Preserve and protect natural features.
- » Protect the lakes and preserve water quality.
- » Maintain small-town / rural character.
- » Create walkable neighborhoods with pedestrian amenities.
- » Maintain quality of roads and infrastructure.
- » Develop recreation programming for all ages.
- » Control development / growth.
- » Add restaurants and destinations.
- » Address blighted properties.
- » Create a community!

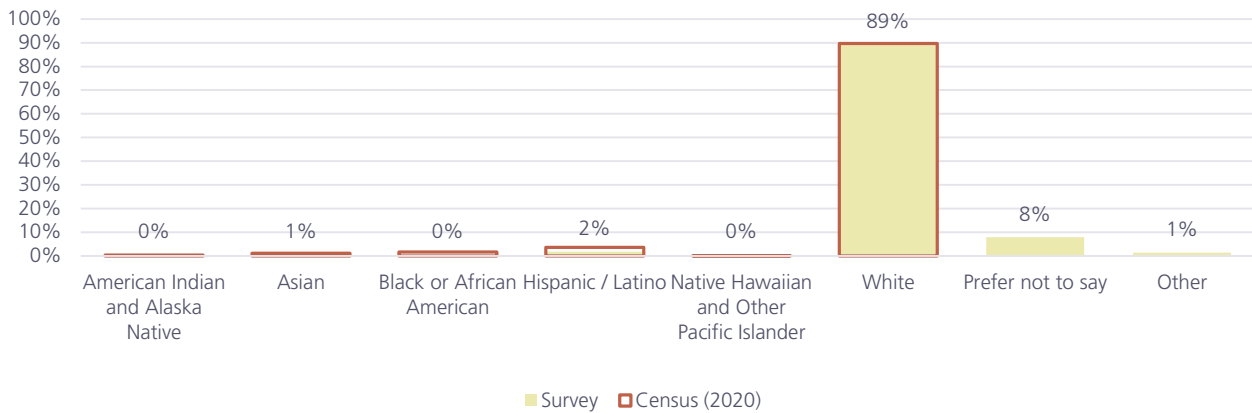
## DEMOGRAPHICS

The following demographic questions in the survey were optional and included solely with the intent of ensuring the survey was representative of the community.

Question 31. How would you identify yourself? (Please select all options that apply)

The majority of respondents (89%) identified as White; given 90% of the Township population identified as White in the 2020 Census, the survey was fairly racially representative of the population.

### Racial / Ethnic Identity of Respondents

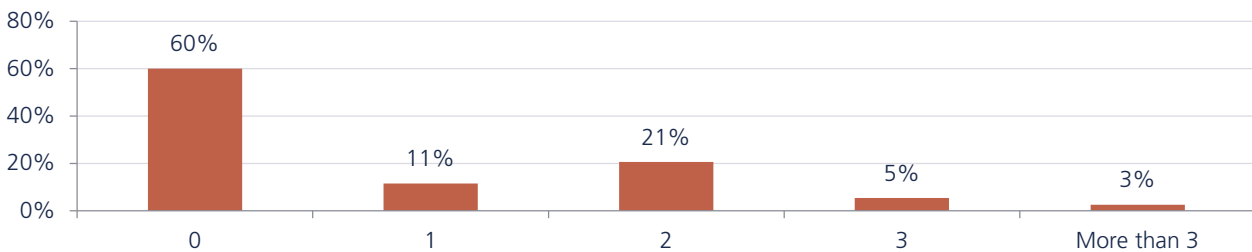


[Response Rate: 70.2% of Respondents; percentages may not add up to 100% due to rounding errors]

Question 32. How many members of your household are under the age of 18?

The majority of respondents (60%) had no members under the age of 18 years in their household and the remaining 40% had at least one member under the age of 18 years. The 2020 American Community Survey, indicated 30% of White Lake Township’s population had at least one member under 18 years of age in a household, indicating respondents with children were slightly over-represented in the survey.

### Number of Household Members Under 18 Years

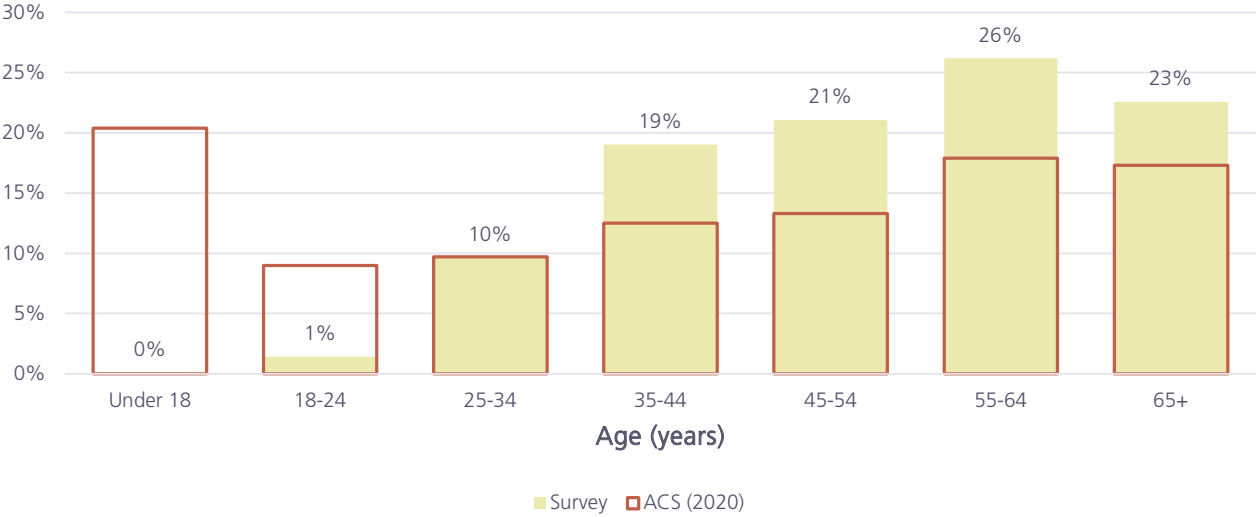


[Response Rate: 70.6% of Respondents]

Question 33. What age group do you fall into?

Respondents from all age cohorts were represented in the survey, except those under 18 years. Given children and youth were not the target audience for this survey, the under-representation is expected. Comparing the age of respondents to the 2020 American Community Survey estimates, young adults 18-24 years were under-represented while all other cohorts were over-represented.

Age of Respondents



[Response Rate: 70.4% of Respondents]

# REDEVELOPMENT WORKSHOP RESULTS

## INTRODUCTION

On August 17, 2023 the Planning Commission hosted a workshop to gather public input on five sites of possible redevelopment. The workshop was held between 5pm and 7pm in the Township Annex, and approximately 100 members of the public attended.

The central aim of the workshop was to begin a conversation among residents about the future potential at five sites selected for consideration by the Planning Commission. Though some sites identified for this workshop are currently vacant, two sites were a part of the Township's Master Plan update in 2012. Concepts for future development and use at both sites were developed during the last planning process, and both concepts were presented again during the workshop. The other three sites provided blank slates for residents to share their ideas based on the site surroundings as well as general desires for development in the area.

Results from the workshop provide a framework for future plans of redevelopment as they come to fruition. By providing the opportunity for residents to identify uses they would support at each site and to share feedback, suggestions, and concerns, all five sites are currently accompanied by a vision of use and development that will be the basis of any changes. This report details the results of community input provided for all five sites, analysis of trends, and preliminary recommendations for a more complete development concept to be explored in the future.

## REDEVELOPMENT SITES

The redevelopment workshop asked attendees to share their perspectives on five potential sites of redevelopment. These sites fell into one of two categories described below, and attendees engaged with each redevelopment site based on the category.

### Existing Redevelopment Concepts

The following two concepts were developed during the 2012 update to the Master Plan. At the workshop, attendees used sticky dots to indicate whether they supported the existing concept rendering. Attendees were also asked to write thoughts and suggestions on sticky notes to identify the specific components of the concept they supported as well as other components they felt were missing or were not appropriate for the site.

- » Pontiac Lake Gateway Concept Plan
- » Elizabeth Lake Road and Union Lake Road Concept Plan

### New Uses and Redevelopments

The following three sites represent vacant tracts of land that present the opportunity to be developed in ways that accommodate specific needs and desires as identified by the Township. These three sites were strategically chosen from across the southern half of the Township to ensure the predominantly agricultural uses north of M-59 are preserved. At the workshop, each site was accompanied by six to eight potential use options that attendees were asked to indicate their support of with sticky dots.

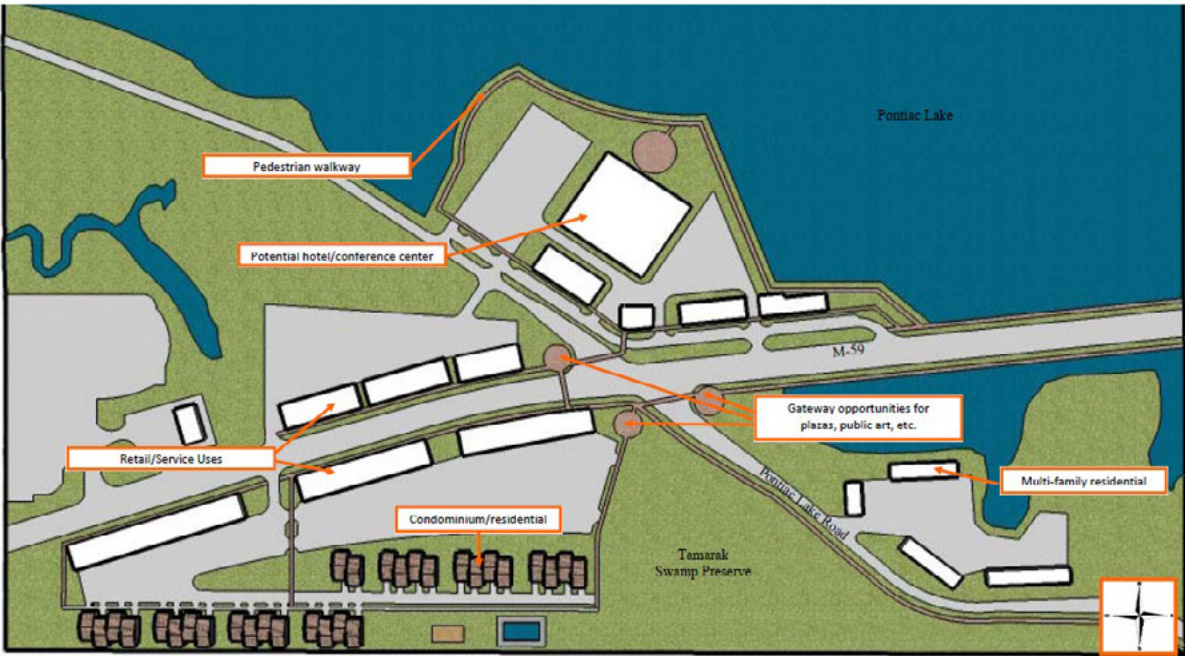
- » Round Lake Road and Cedar Island Road
- » Cedar Island Road and Bogie Lake Road
- » Civic Center/Lakes Town Center (M-59 and Elizabeth Lake Road)

## WORKSHOP RESULTS

### Pontiac Lake Gateway Concept Plan

The Pontiac Lake Gateway concept plan was developed during the 2012 update to the Master Plan. Pontiac Lake Gateway offers an opportunity to showcase White Lake Township at its only major entry from the east by enhancing lake views, removing blighted structures, and improving connectivity for pedestrians. The 2012 concept proposed retail and service uses, multi-family residential, plazas and spaces for public art, a hotel and/or conference center, and a pedestrian walkway.

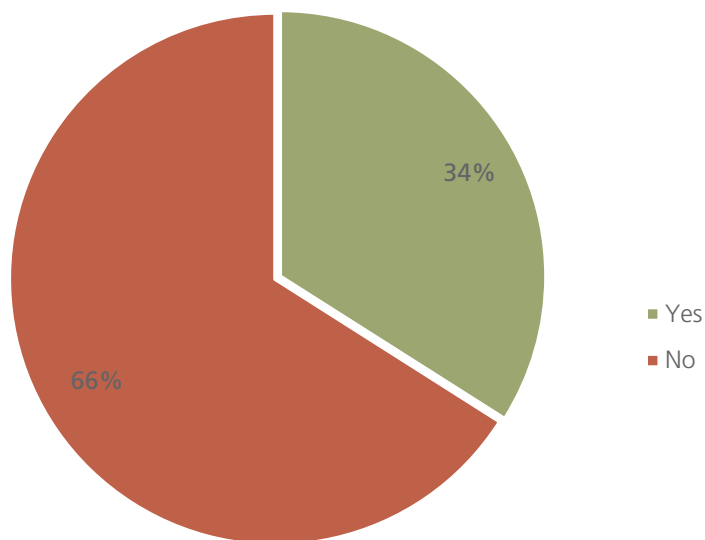
Pontiac Lake Gateway Concept Plan





When asked to indicate whether the current redevelopment concept aligned with their vision, about two thirds of workshop attendees shared it did not (as seen in Figure 1):

Figure 1: “Does the Pontiac Lake Gateway concept plan align with your view of the future of this site?”



Comments, suggestions, and concerns about this concept were provided by attendees on sticky notes and are summarized below. While just 6% of all comments suggested this concept should be rethought in its entirety, all other suggestions coalesce around a few themes that should be the focus of any revisions to the existing concept to align with the vision of the community.

- » **Support for the concept** as a way to utilize the lake setting, create a community space, and remove deteriorating structures.
- » **Support for the pedestrian walkway.** Respondents shared they would support a biking/walking path around Pontiac Lake.
- » **Support for the development of restaurant/bars along the waterfront.** Attendees specified they would like to see a nice, affordable restaurant in the area and also suggested the area provide boat docks.
- » **Opposition to multi-family residences.** This was the most common takeaway from the concept with about 37% of all comments sharing this sentiment.
- » **Opposition to the hotel and conference center.** While there is evidence of some support for this development, attendees expressed they would prefer uses specific to the well-being and use of permanent residents rather than visitors.
- » **Some opposition to retail.** While some responses expressed their support for retail and shopping as a complement to restaurants, bars, and other dining areas, others shared concerns about M-59 traffic as a challenge to utilizing these retail spaces, as well as a preference to keep the Township’s retail in the M-59 and Elizabeth Lake Road area.

## Results

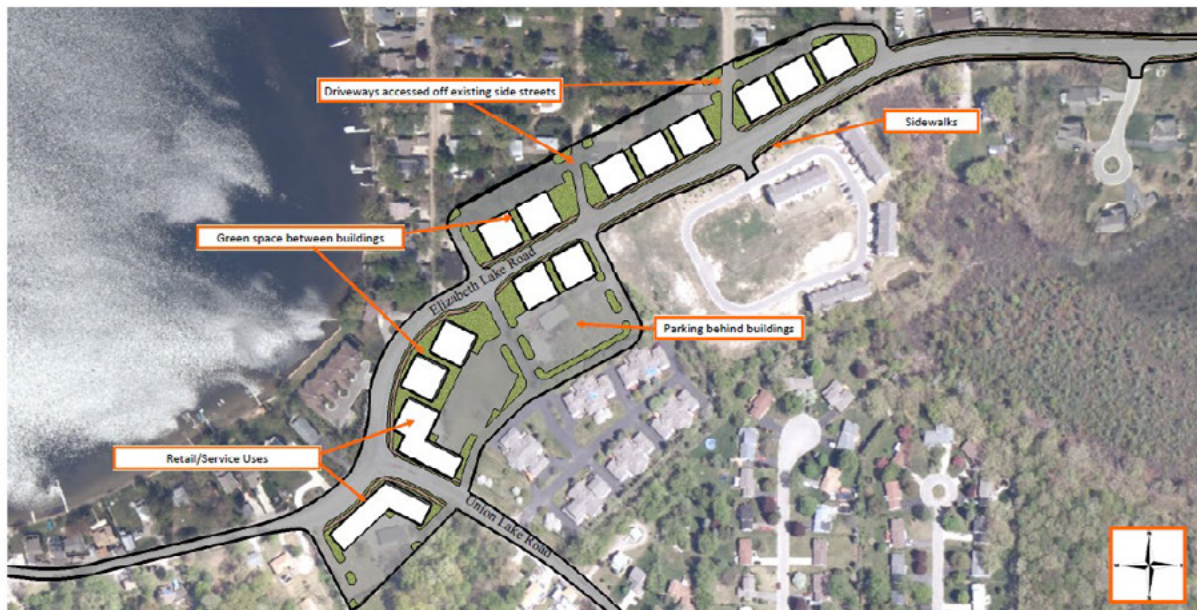
The Township should consider revising this concept in the following ways:

- » Prioritize the development of restaurants over the hotel and conference center.
- » Incorporate residential uses through mixed-use developments. While the proposed multi-family residential structures may not be the best fit for the site, there may be an opportunity to provide some residential units alongside retail with mixed-use development.

### Elizabeth Lake Road and Union Lake Road Concept Plan

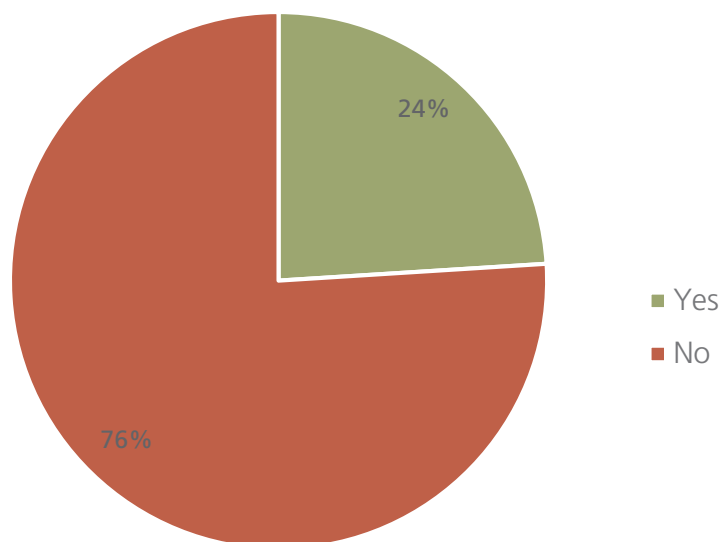
The Elizabeth Lake Road and Union Lake Road concept plan was developed during the 2012 update to the Master Plan. The site would benefit from investment to rehabilitate existing buildings or facilitate new construction. Additionally, the existing residential uses would likely support neighborhood retail. Other benefits of revitalization include the removal of blighted buildings, an improved appearance, uses that align with the largely residential character of the area, improved views of Oxbow Lake, and the opportunity to link the commercial area with nearby residential neighborhoods. The 2012 concept proposed retail and service uses connected by sidewalks that incorporate green spaces between buildings.

### Elizabeth Lake Road and Union Lake Road Concept Plan



When asked to indicate whether the current redevelopment concept aligned with their vision, just over three fourths of workshop attendees shared that it did not (as seen in Figure 2 below):

**Figure 2: “Does the Elizabeth Lake Road/Union Lake Road concept plan align with your view of the future of this site?”**



Comments, suggestions, and concerns about this concept were provided by attendees on sticky notes and are summarized below.

- » **Support for walkable design and incorporation of green spaces.** This concept plan was praised for the way it prioritized walkability, sidewalks, and green spaces in a retail-oriented area. Some suggestions included adding more sidewalks and ensuring green spaces comprise a large portion of the site.
- » **Support for mixed-use developments and uses that complement adjacent neighborhoods.** Though new residential developments are not currently proposed for this redevelopment concept, some attendees suggested incorporating residences among retail sites through mixed-use buildings.
- » **Concerns about locating retail uses in this area of the Township.** Some attendees shared current levels of traffic from surrounding neighborhoods may pose a challenge to successfully locating retail in this area. The residential nature of the site also poses a challenge to getting residents from other parts of the Township to the district.
- » **Opposition to developing this site.** About 30% of all comments did not support the development of this site and instead favored keeping and maintaining it as green space.

## Results

Revisions to this concept plan should center around scaling back the extent of proposed retail-oriented development. Proposed retail may support the needs of surrounding residents and can be catered to neighborhood-specific uses. Additionally, the greatest, most favorable assets of this site present an opportunity for adjusted development to expand green spaces and promote walkability as primary attractors to the area rather than secondary features.

### Round Lake Road

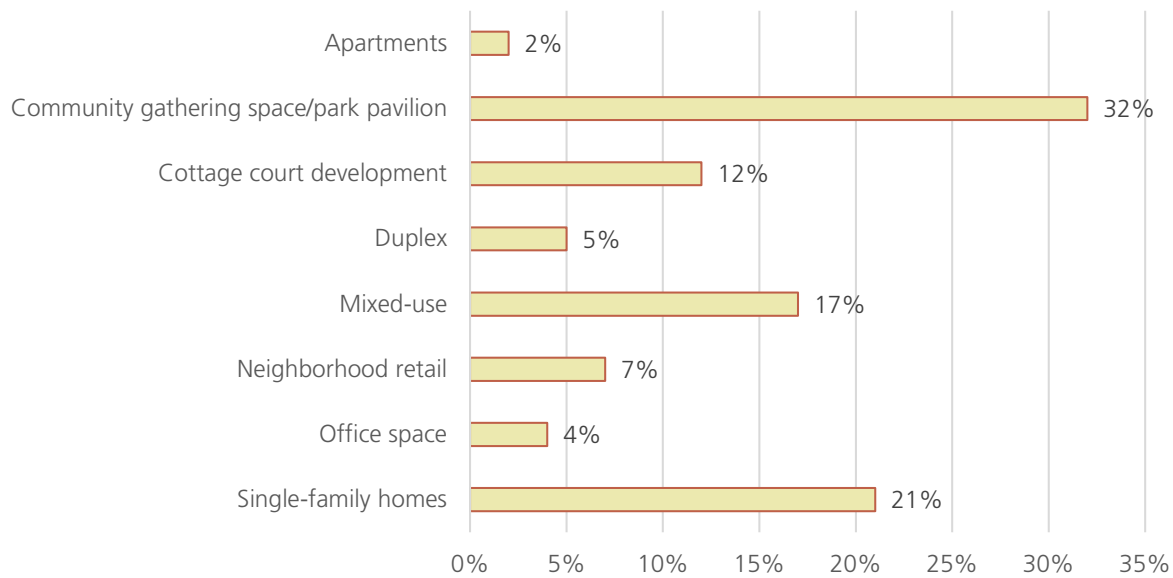
This redevelopment site is in the southeastern part of the Township. The surrounding area is primarily residential; apart from a few service agencies, there is no immediate access to any commercial area.



During the redevelopment workshop, attendees were asked to indicate which uses they would support should this site become developed. These thoughts are compiled in Figure 3.



Figure 3: Favorable Uses for Round Lake Road



Along with indicating the uses they would support at this site, a few attendees also left comments to provide context to their responses. Some comments expressed a general need for more affordable housing in the Township; others shared retail uses would not fit and contribute to traffic congestion because of the residential nature of the area; and others shared a preference to keep the Township’s green areas to avoid overdevelopment.

### Results

The most common preferences for this site’s redevelopment present an opportunity to develop additional dwellings compatible with an outdoor community gathering space or pavilion, the option that received the most support. A cottage court development naturally lends itself to community gathering spaces as the front and/or back yards of the development are typically shared, naturally creating community space. Mixed-use developments have the opportunity to incorporate commercial uses in support of the largely residential character that currently exists in the area, while also providing additional residential units.



### Cedar Island Road and Bogie Lake Road

This redevelopment site is located in the southern part of the Township and is in close proximity to three primary/secondary schools (Lakewood Elementary School, White Lake Middle School, and Lakeland High School) as well as the Brentwood Golf Club and Banquet Center. This site's location on Bogie Lake Road provides a direct connection to M-59, making it largely accessible from across the Township.



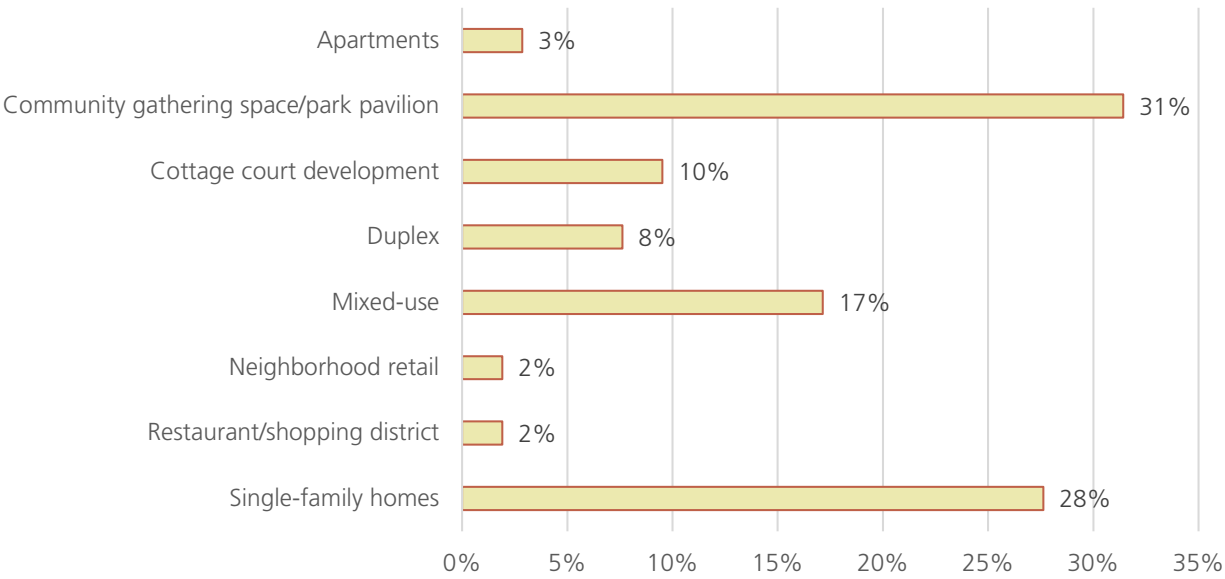
### Redevelopment Site: Cedar Island Rd

Sources: Michigan Open Data Portal, Oakland County, White Lake Township



During the redevelopment workshop, attendees were asked to indicate which uses they would support should this site become developed. These ideas are compiled in Figure 4.

**Figure 4: Favorable Uses for Cedar Island Road & Bogie Lake Road**



Along with indicating the uses they would support at this site, a few attendees also left comments to provide context to their responses or to offer additional suggestions. The most common sentiment from these insights was a hesitancy to develop this site at all. These commenters shared their affinity for existing green space, concerns about school-based traffic and the general danger of roads in the area, and general opposition to development. Soccer fields were proposed as a potential use which received the second most support from commenters.

### Results

The two most common responses that support the development of single-family homes and a community gathering space/pavilion complement each other and provide a feasible vision for development that aligns with the area’s current landscape of schools and neighborhoods. Developing homes near the schools presents a wise pattern of development that enables much needed access for families with school aged children. This, alongside a formal community space, park, and/or outdoor pavilion, presents an opportunity for utilization by a wide range of users, such as students, families, and nearby residents. While less aligned with the two most popular choices, the support for mixed-used development in this area also provides a complementary use to nearby schools as the activity in the area is likely to support new businesses.

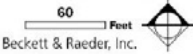
### Civic Center/Lakes Town Center (M-59 and Elizabeth Lake Road)

This redevelopment site is located in the center of the Township at the southwest corner of Highland Road (M-59) and Elizabeth Lake Road, which contributes to its accessibility from across White Lake. The lot is just yards away from the proposed Civic Center and across Elizabeth Lake Road from Lakes Town Center. Amid this access to public institutions, shopping, and dining, recreational spaces like Hawley Park and Stanley Park are in close proximity as well.



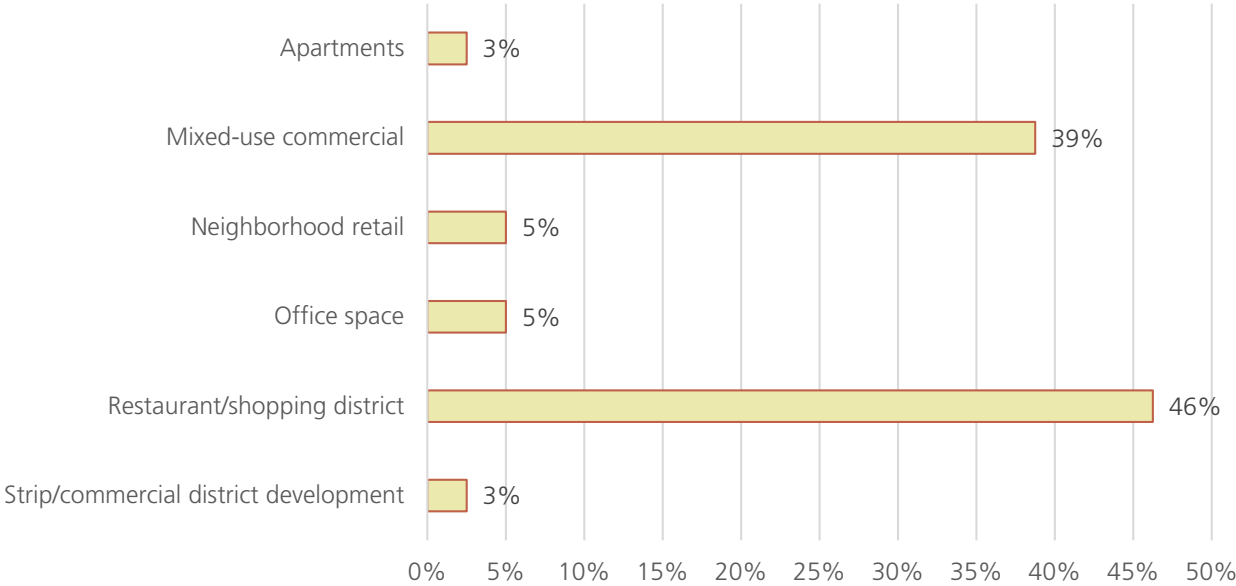
### Redevelopment Site: Civic Center

Sources: Michigan Open Data Portal, Oakland County, White Lake Township



During the redevelopment workshop, attendees were asked to indicate which uses they would support should this site become developed. These thoughts are compiled in Figure 5.

**Figure 5: Favorable Uses Adjacent to the Civic Center/Lakes Town Center**



Along with indicating the uses they would support at this site, a few attendees also left comments to provide context to their responses or to offer additional suggestions. The majority of respondents expressed their opposition to developing the site or adding more storefronts to the Township. Some respondents shared uses offering restaurants, dining opportunities, and/or shopping areas should have character and follow an appealing aesthetic form. Finally, a suggestion for a farmers’ market with fresh fruit and vegetables received support, though not initially presented.

**Results**

The two most popular uses for this site complement each other well. Developing a restaurant and shopping district to support community entertainment and commercial interests is compatible with mixed-use developments that incorporate residential units in commercial buildings. The site’s location across from Lakes Town Center provides a natural expansion with similar uses that emphasize leisure and entertainment.



# MASTER PLAN OPEN HOUSE RESULTS

## INTRODUCTION

On December 7<sup>th</sup>, 2023, the Planning Commission hosted an open house during a regularly scheduled meeting to gather public input on three aspects of the White Lake Township Master Plan: three sites of potential redevelopment, the Master Plan's action plan, and the proposed Future Land Use Map (FLUM) and Future Land Use categories. At the time of the open house, the Township's Master Plan had recently entered 63-day review, meaning a complete draft of the 2024 Master Plan was available on the Township's website for public review and comment. Approximately 100 members of the public were in attendance.

The rest of this report will summarize results gathered from the open house on each of the three areas. Feedback provided at the open house offers guidance on the most actionable aspects of the 2024 Master Plan.

- Comments on the potential three redevelopment sites provided a nuanced perspective on the community input that was initially used to conceptualize developments at each place and support a process of community feedback used to ensure continued alignment with community-based visions.
- Observations of the Future Land Use framework (map and categorizations) allow for the reconsideration of proposed future uses alongside their applicability to the culture of the Township in both the present and future.
- Residential preferences related to the proposed action plan provide the opportunity to hone actions to the ones that are most needed.

## REDEVELOPMENT SITES

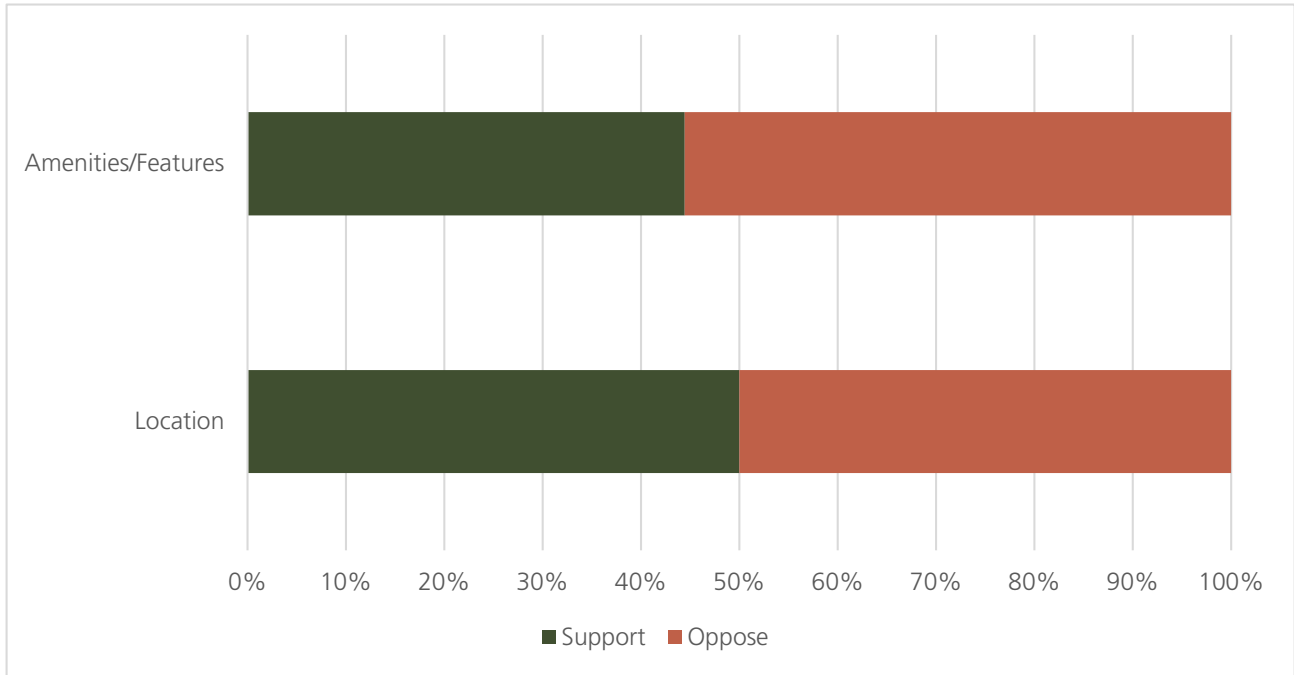
The three potential redevelopment sites presented to the public for review were conceptualized based on feedback gathered at a redevelopment workshop held by the White Lake Township Planning Commission in August of 2023. Included with each site was a rendering, a brief description of the uses the site would include, and a series of questions to gauge sentiments related to the site's location, amenities and features, and the likelihood of whether attendees would engage with each component of the site (if at all). The following section details the results of community input and feedback for each site.

### Pontiac Lake Gateway

Open house attendees were asked to provide feedback on the Pontiac Lake Gateway property based on the site's location as well as the amenities and features proposed to be included with the development. Of the three redevelopment sites, Pontiac Lake Gateway received the most support from Township residents. The location of the redevelopment site was supported by 50% of all respondents (and opposed by the other 50%). The site's amenities and features had similarly even rates of support and opposition with about 44% in support of the proposal and 56% in opposition.



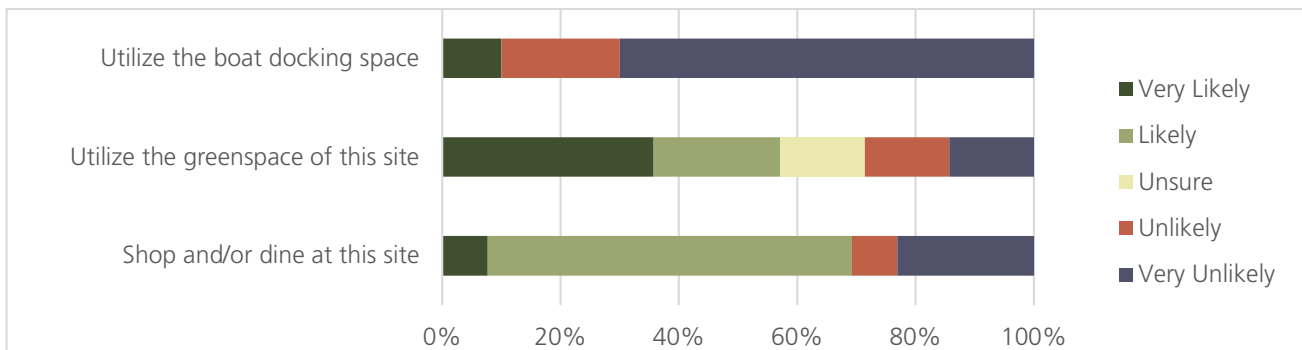
### Location and Amenity Approval for Pontiac Lake Gateway



In addition to indicating their general support for or opposition to these aspects of the redevelopment site, open house attendees were asked to further elaborate on their views by sharing specific comments about the site’s location and amenities. In general, these comments provided additional suggestions for the site (such as a waterfront restaurant, boat rentals, and fishing areas with handicap access) as well as overall support for the vision of the redevelopment, especially in comparison to the current use of the site. Other comments stated that the waterway was already too congested and therefore needed to be protected.

The final activity to gather feedback on the Pontiac Lake Gateway property asked open house attendees to indicate their likelihood of engaging with the site in several ways based on the proposed amenities. More than 50% of all respondents (69% and 57%, respectively) indicated they would be “likely” or “very likely” to “shop and/or dine” and “utilize the greenspace” of the site. While 90% of respondents stated they were “unlikely” or “very unlikely” to use the boat docking space proposed for the site, this is likely a function of which residents of the Township own a boat that does not already have a designated docking space.

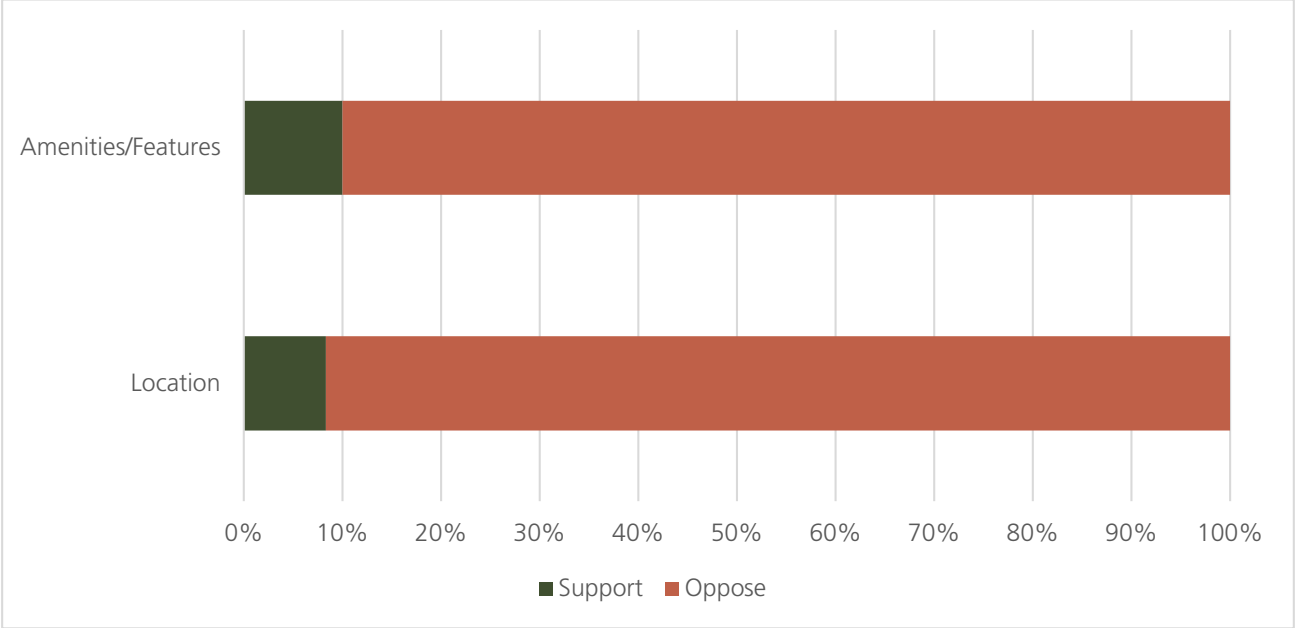
### Likelihood to Engage with Site Amenities



### Lakes Town Center

Open house attendees were asked to provide feedback on the Lakes Town Center property based on the site’s location as well as the amenities and features proposed to be included with the development. The location of the redevelopment site was supported by just over 8% of all respondents, and the site’s amenities had similar rates of support with 10% of participating attendees indicating their support for proposed features.

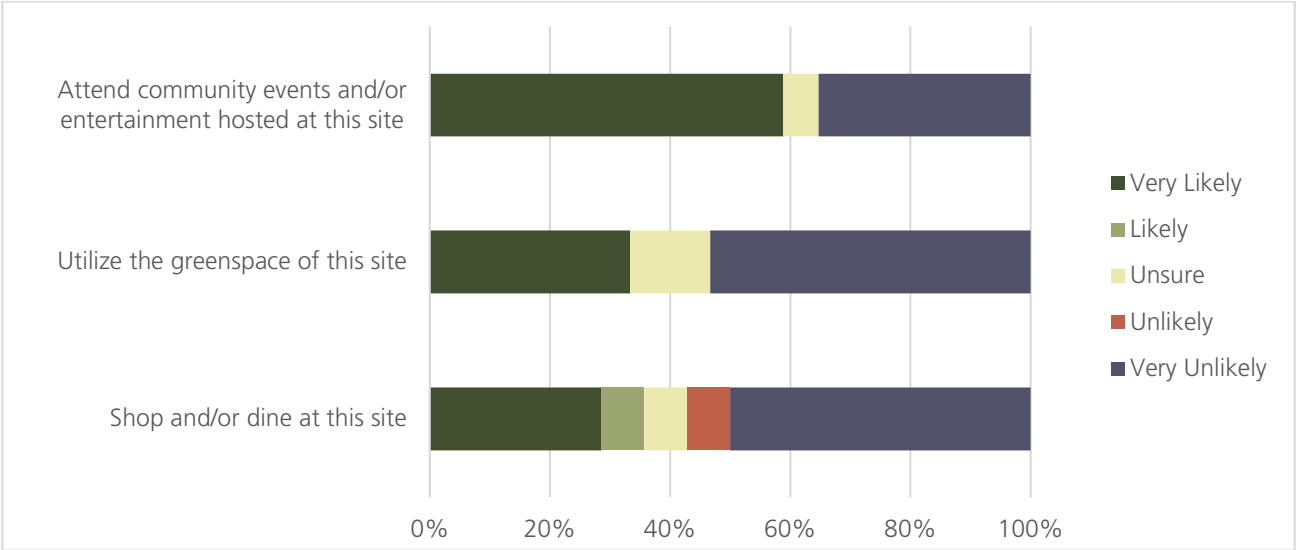
#### Location and Amenity Approval for Lakes Town Center



In addition to indicating their general support for or opposition to these aspects of the redevelopment site, open house attendees were asked to further elaborate on their views by sharing specific comments about the site’s location and amenities. The location of this redevelopment site presented concerns to some attendees related to existing levels of traffic congestion in the area as well as anticipated impacts on Brendel Lake in terms of light and noise pollution. More generally, concerns about the Township’s capacity to support new businesses were presented here along with the suggestion to utilize vacant buildings before developing new ones. Many comments about the proposed amenities and features of the site emphasized a desire to promote a farm stand, farmer’s market, and/or craft market to honor past uses common to the area. Other comments focused on the needs of the Township’s senior citizens, stating a senior living facility may provide benefits to residents based on its proximity to the library and greenspace as well as parking accommodations that serve the needs of this population.

The final activity to gather feedback on Lakes Town Center asked open house attendees to indicate their likelihood of engaging with the site in several ways based on the proposed amenities. Nearly 59% of all respondents indicated they were “very likely” to attend community events/entertainment hosted at the site. Further, about 30% of all respondents indicated they would also be very likely to utilize the site’s greenspace and to shop and/or dine at the development – however, about 53% and 57% (respectively) indicated they would be “unlikely” or “very unlikely” to partake in the same activities.

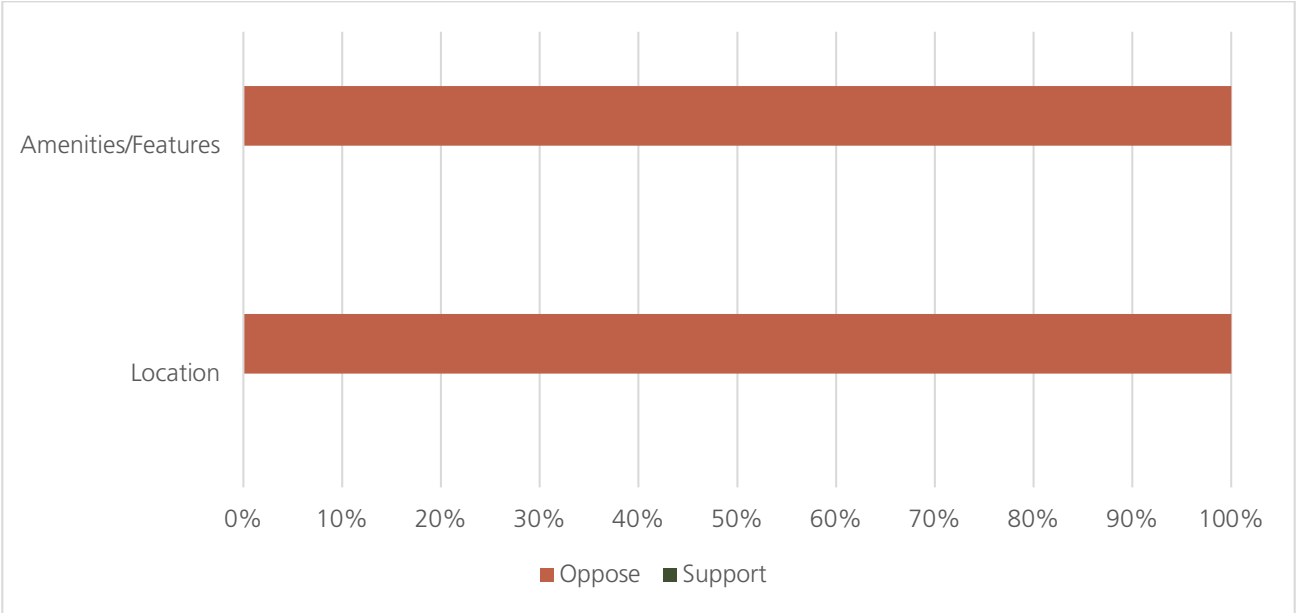
### Likelihood to Engage with Site Amenities



### Cedar Island Road and Bogie Lake Road

Open house attendees were asked to provide feedback on the west intersection of Cedar Island Road and Bogie Lake Road site based on the site’s location as well as the amenities and features proposed to be included with the development. Of the three redevelopment sites, the Cedar Island Road and Bogie Lake Road received the least amount of support from Township residents – virtually 100% of all open house attendees opposed both the site’s location and its proposed amenities and features.

### Location and Amenity Approval for Cedar Island Road and Bogie Lake Road

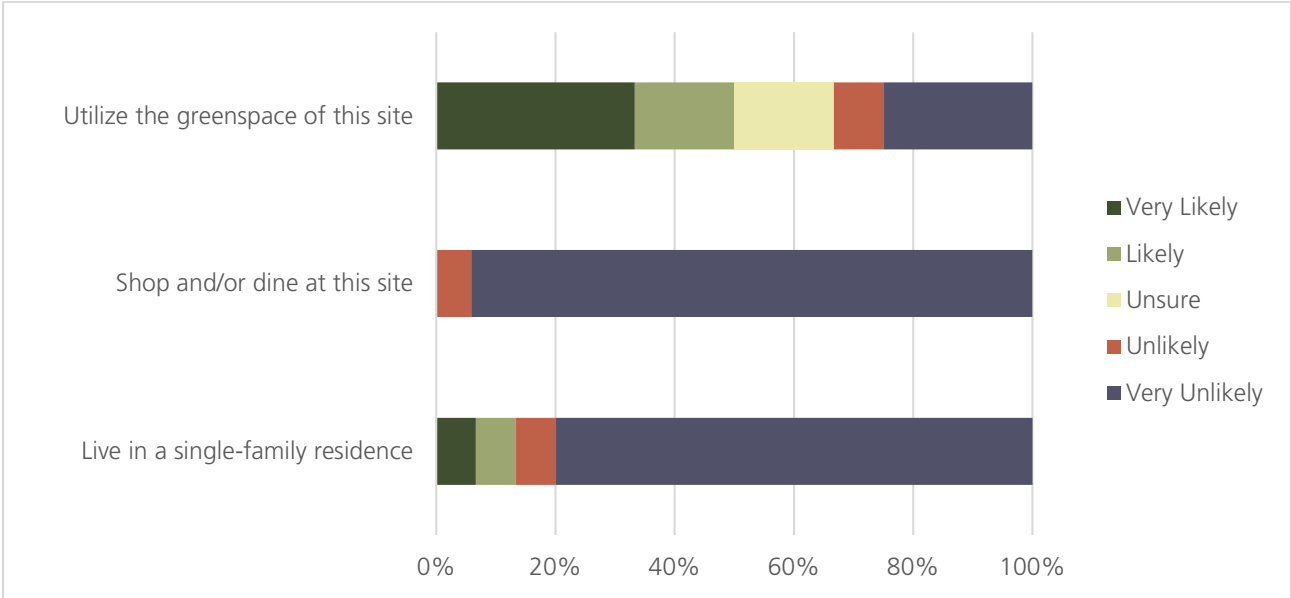


In addition to indicating their general support for or opposition to these aspects of the redevelopment site, open house attendees were asked to further elaborate on their views by sharing specific comments about the site’s location and amenities. The location of this redevelopment site presented two primary concerns related to the types of residential housing the site might offer and to the impact

of both residential and commercial traffic in the area. Respondents voiced their opposition to rental housing units as well as residential units of mixed-use developments, instead supporting single-family homes on 1-acre lots. Existing traffic on Bogie Lake Road was cited as a specific hindrance to this redevelopment site, as was its proximity to three schools that do not have capacity for more students and that, in themselves, contribute to traffic during the school year. However, one comment emphasized the benefits of promoting walkability to and from the schools with additional residential developments in the redevelopment. Comments about the site’s features and amenities reiterated general opposition to apartments, commercial buildings, and mixed-use developments, again citing concerns with traffic and congestion as the primary drivers for these stances. One attendee suggested the site’s land be sold to schools for them to use as a recreation space, or to be developed privately as an indoor recreation center.

The final activity to gather feedback on the Cedar Island Road and Bogie Lake Road property asked open house attendees to indicate their likelihood of engaging with the site in several ways based on the proposed amenities. About 50% of all respondents indicated they were “likely” or “very likely” to utilize the site’s greenspace, and about 13% shared they would be open to living in a single-family residential unit on the site. However, 100% of all respondents indicated they were “unlikely” or “very unlikely” to shop and/or dine at the site while the majority of respondents (about 87%) also indicated their unlikelihood to live on the site in a single-family residence.

**Likelihood to Engage with Site Amenities**



**FUTURE LAND USE MAP**

Community input for the Future Land Use Map (FLUM) was centered around opportunities to improve clarity in the descriptions of each categorization while also checking to see whether any proposed categorizations seemed misplaced on the FLUM.

In general, public input for this activity emphasized the appreciation residents have for the Township as a community that is not overly focused on commercial or business development. One respondent shared the commercial future land use designations seemed “overly inflated” and expressed the

concern the Township does not have the residents (workers and patrons) to support such an emphasis.

When asked whether the FLU framework (map and categorizations) was expected to support or hinder current or future plans within the Township, five attendees indicated their plans were “supported” while four indicated plans were “hindered.” Here, a comment from one attendee again emphasized their appreciation for the current feel of the Township as opposed to a “city feel with lots of business development.”

## ACTION PLAN

As a culmination of the Master Planning process, 23 actions items were identified as priorities for White Lake Township. Each item is directly informed by the Master Plan’s findings, including community input and public opinion. At the open house, attendees were instructed to indicate the three action items of the action plan they believed to be of greatest importance for the Township to pursue and/or prioritize in the near future. The results of this activity are described below.

### Highest Priorities

The five most popular action items emphasize the preservation of open spaces and natural areas through several approaches that limit or redirect development to specific parts of the Township while also prioritizing strategies intended to protect environmentally sensitive areas.

1. Preserve natural and open spaces by pursuing commercial development in vacant buildings and/or retrofitting strip malls to support new commercial activities. **11 votes**
2. Encourage protection of wetlands and installation of green infrastructure along FEMA zones to mitigate harm caused by flooding. **10 votes**
3. Designate areas around floodplain as conservation areas to limit development and impervious surfaces. **10 votes**
4. Regulate lakefront development by mandating greenbelts with native vegetation in a buffer zone between the setback and the water’s edge to reduce flooding impacts. **8 votes**
5. Support commercial development by revitalizing buildings that have become vacant and/or retrofitting strip malls to support new commercial activities. **8 votes**

### Moderate Support

The following action items received some level of support from open house attendees and each garnered between one and six votes from White Lake residents. Among the most popular items in this category are those that emphasize transportation and mobility across the Township through non-motorized infrastructure, general safety on behalf of drivers, walkers, and pedestrians, and traffic calming measures to ease congestion across the Township.

1. Educate and share information with Township residents about implementation plans for non-motorized infrastructure that includes a signed bicycle route, bicycle lanes, and shared-use paths. **6 votes**
2. Address the volume of crashes that take place at intersections along M-59 by improving road safety measures and implementing biking and pedestrian infrastructure. **5 votes**
3. Implement traffic calming techniques along Cooley Lake Road and M-59 (east of Teggerdine Road) to ease commuter congestion in route to outside communities. **4 votes**



4. Encourage green infrastructure placement during the site plan review process and/or planned development process. *4 votes*
5. Ensure redevelopment plans align with community-guided ideas at Pontiac Lake Gateway, Cedar Island and Bogie Lake Roads, and around Lakes Town Center. *3 votes*
6. Provide information about voluntary conservation easements to residents, especially those living in environmentally sensitive areas. *3 votes*
7. Retain residents between the ages of 25 and 34 by responding to demand for more housing units, including affordable housing options. *3 votes*
8. Address increasing housing costs and the limited availability of starter homes valued between \$150k and \$250k by increasing the Township's supply of housing to match the demand. *2 votes*
9. Pursue CDBG funds to support the revitalization of housing units that are deteriorating and/or uninhabitable in order to put them back into the housing market. *2 votes*
10. Accommodate the needs of the Township's disabled population by enforcing ADA compliant design. *1 vote*
11. Recognize the economic hardship that faces households earning below the ALICE threshold by encouraging affordable housing and economic opportunities. *1 vote*
12. Ensure aging housing stock receives appropriate maintenance and renovation to promote its habitability to the greatest extent and to avoid deterioration and demolition. *1 vote*
13. Rezone commercial districts and corridors to allow for mixed-use developments. *1 vote*
14. Educate and share information with Township residents about public transportation options, including upcoming changes in operation. *1 vote*

### Not Supported

The following four items did not receive support from any open house attendees. It is important to acknowledge while these areas of focus may be considered lower priorities than previous items, input from attendees of the open house may not fully represent opinions from all residents of the Township.

- Support an increasing senior population by assessing and responding to demand for additional assisted living facilities, nursing homes, and appropriate healthcare facilities.
- Increase housing supply to meet demand for residence in the Township.
- Accommodate future community housing preferences by matching the size and types of housing construction to needs. For example: while single-family homes remain the most prominent preference for Township residents, attached single-family structures (such as duplexes) can also be supported.
- Support the efforts of the Corridor Improvement Authority to promote a sense of place, connectivity, and various activities in commercial corridors across the Township.

# WHITE LAKE TOWNSHIP NOTICE OF PUBLIC HEARING

Item B.

Notice is hereby given of a public hearing by the White Lake Township Planning Commission on **Thursday, April 4, 2024 at 6:30 p.m.** at the Township Annex, 7527 Highland Road, White Lake, Michigan 48383. The purpose of the hearing is to receive comments from interested persons on a proposal by the Planning Commission to adopt an updated Master Plan for White Lake Township pursuant to Act 33 of 2008, the Michigan Planning Enabling Act.

The updated White Lake Township Master Plan includes text, charts, tables, graphs, illustrations and maps that describe the Planning Commission's proposal for the long-range future development of the community.

The Master Plan is a long-range policy proposal for land use that helps guide the township officials when making difficult development decisions. The Master Plan is not a zoning map and does not change the zoning of individual properties.

Persons interested are requested to be present. Pertinent information relative to the Master Plan is on file at the Community Development Department and may be examined at any time during regular business hours of 8:00 a.m. to 5:00 p.m. Persons interested may visit the Community Development Department, contact the Community Development Department by telephone at 248-698-3300, ext. 5, or attend the Public Hearing on the date specified. An electronic version can be viewed at *whitelaketwp.com*. Written comments are also welcome at 7525 Highland Road, White Lake, MI 48383. Individuals with disabilities requiring auxiliary aids or services should contact the Clerk's Office at 248-698-6300 x7 at least 5 days before the hearing.

Sean O'Neil, AICP  
Community Development Director

396

CHARTER TOWNSHIP OF WHITE LAKE  
OAKLAND COUNTY, MICHIGAN

RESOLUTION OF ADOPTION  
CHARTER TOWNSHIP OF WHITE LAKE MASTER PLAN

WHEREAS, Public Act 33 of 2008, known as the Michigan Planning Enabling Act (“MPEA”) authorizes municipal planning commissions to prepare a "master plan" pertinent to the future development of the municipality; and

WHEREAS, the Charter Township of White Lake has retained a professional planning consultant to assist the Planning Commission with the preparation of the master plan; and

WHEREAS, the Planning Commission has prepared a master plan for the municipality to update and replace its previous community master plan; and

WHEREAS, the Planning Commission approved by motion recommending that the Township Board authorize the distribution of the draft master plan pursuant to the Michigan Planning Enabling Act (MPEA); and

WHEREAS, the Township Board authorized the distribution of the draft Community Master Plan to the general public and the various entities as required by the MPEA, for review and comment purposes; and

WHEREAS, on April 4, 2024, the Charter Township of White Lake Planning Commission convened a public hearing to solicit public input on the plan.

NOW, THEREFORE BE IT RESOLVED, that the Charter Township of White Planning Commission hereby adopts the 2024 Master Plan, along with its text, maps, charts, graphs, and other supporting materials contained in the Plan.

BE IT FURTHER ORDERED that an approved copy of the Master Plan shall be submitted to Oakland County, SEMCOG, and the Planning Commissions of Commerce Township, West Bloomfield Township, Waterford Township, Highland Township, Rose Township, Springfield Township, Milford Township, and Independence Township.

CERTIFICATE

I hereby certify the foregoing resolution was approved by a majority of the members of the Planning Commission by a roll call vote at a regular meeting of the Charter Township of White Lake Planning Commission held on April 4, 2024, in compliance with the Open Meetings Act.

Motion by: \_\_\_\_\_

Second by: \_\_\_\_\_

Votes: Yeas \_\_\_\_\_ Nay \_\_\_\_\_ Abstain \_\_\_\_\_

Resolution declared adopted this 4<sup>th</sup> day of April, 2024.

\_\_\_\_\_  
Debby DeHart  
Planning Commission Secretary

\_\_\_\_\_  
Date

**WHITE LAKE TOWNSHIP**  
***COMMUNITY DEVELOPMENT DEPARTMENT***

**DATE:** March 21, 2024

**TO:** Joe Seward, Chairperson  
Planning Commission

**FROM:** Sean O’Neil, Community Development Director

**SUBJECT:** Amendments to Zoning Ordinance No. 58

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Please find attached, the proposed amendments to Zoning Ordinance No. 58. The amendments span many different sections of the ordinance and are largely meant to clean up and clarify the language. For the purpose of organization, each proposed amendment is listed out in numbered “Parts” as you move through the document. Our goal is always to clearly convey regulations and eliminate possible confusion. Most of these changes are minor in nature.

I have included a “red lined” version of the proposed amendments. They are a bit easier to review and compare. The Planning Commission will be holding a public hearing, to consider these amendments, on April 4<sup>th</sup>. If you have any questions, or require additional information, please do not hesitate to contact the office.

Thank you.

**CHARTER TOWNSHIP OF WHITE LAKE  
COUNTY OF OAKLAND  
AMENDMENT \_\_\_\_\_ TO ZONING ORDINANCE**

**AN ORDINANCE TO AMEND THE ZONING ORDINANCE OF THE CHARTER TOWNSHIP OF WHITE LAKE BY AMENDING ARTICLE 2.0 DEFINITIONS, ARTICLE 3.0 ZONING DISTRICTS, ARTICLE 4.0 USE STANDARDS, ARTICLE 5.0 SITE STANDARDS, ARTICLE 6.0 DEVELOPMENT PROCEDURES, AND ARTICLE 7 ADMINISTRATION, APPEALS, AND ENFORCEMENT, ONLY AS PROVIDED FOR HEREIN.**

**NOW HEREBY** the Charter Township of White Lake ordains the following amendments to the White Lake Charter Township Zoning Ordinance:

**PART 1: Amend Article 2.0, Definitions, Section 2.2, Definitions by modifying the following definition as shown below:**

ACREAGE PARCEL. Any **single-family residential** parcel of land in White Lake Township which ~~parcel~~ is not located in or part of a recorded plat: **or condominium subdivision.**

**PART 2: Amend Article 2.0, Definitions, Section 2.2, Definitions by adding the following definition as shown below:**

**ALLEY.** A public or private way which affords only a secondary means of access to abutting property and not intended for general traffic circulation.

**PART 3: Amend Article 2.0, Definitions, Section 2.2, Definitions by modifying the following definition as shown below:**

LOT AREA. The total horizontal area within the lot lines, as defined, of a lot. **With the exception of lots zoned AG (Agricultural), SF (Suburban Farms), and R1-A (Single-Family Residential),** the lot area of any lot, zoning lot or parcel of land shall also be interpreted to be exclusive of any land in a public or private road right-of-way or easement.

**PART 4: Amend Article 2.0, Definitions, Section 2.2, Definitions by adding the following definition as shown below:**

**ORDINARY HIGH-WATER MARK.** The line between upland and bottomland which persists through successive changes in water levels, below which the presence and action of the water is so common or recurrent that the character of the land is marked distinctly from the upland and is apparent in the soil itself, the configuration of the surface of the soil and the vegetation. On an inland lake which has a level established by law, it means the high established level. Where water returns to its natural level as the result of the permanent removal or abandonment of a dam, it means the natural ordinary high-water mark.



**PART 5: Amend Article 2.0, Definitions, Section 2.2, Definitions by modifying the following definition as shown below:**

**PARKING SPACE.** An area ~~ten feet by twenty feet (9' x 18')~~ for parking of each automobile or motor vehicle, being exclusive of necessary drives, aisles, entrances or exits, and being fully accessible for the storage or parking of permitted vehicles.

**PART 6: Amend Article 2.0, Definitions, Section 2.2, Definitions by adding the following definition as shown below:**

**RIGHT-OF-WAY.** A strip of land acquired by reservation, dedication, prescription, or condemnation and intended to be occupied by a street, pathway/sidewalk/trail, water line, sanitary sewer, and/or other public utilities or facilities.

**PART 7: Amend Article 2.0, Definitions, Section 2.2, Definitions by modifying the following definition as shown below:**

**SETBACK.** ~~The minimum horizontal distance between the front of the building, excluding steps and unenclosed porches, and the front street or right of way line.~~ **The minimum distance by which any building or structure must be separated from a street right-of-way or lot line.**

**PART 8: Amend Article 2.0, Definitions, Section 2.2, Definitions by modifying the following definition as shown below:**

1. **Above-the-Roof Sign.** A sign ~~projecting beyond or above the roof or parapet or that is erected, constructed or maintained upon the roof or parapet of a building~~ **that is mounted on, applied to, or otherwise structurally supported by the roof of a building (other than the fascia portion of a mansard roof).**

**PART 9: Amend Article 2.0, Definitions, Section 2.2, Definitions by modifying the following definition as shown below:**

23. **Wall Sign.** A sign attached to, or placed flat against, the exterior wall or surface of any building, no portion of which projects more than twelve (12) inches from the wall. **No wall sign shall be erected to extend above the top of the wall to which it is attached.**

**PART 10: Amend Article 2.0, Definitions, Section 2.2, Definitions by adding the following definition to "SIGN" as shown below:**

25. **Parapet Sign.** A sign attached to that portion of a building's exterior wall that projects above the roofline of a building.

**PART 11: Amend Article 3.0, Zoning Districts, Section 3.1.1, Agricultural District by modifying the district name as shown below:**

~~Agricultural District.~~ **Rural Residential District.**

**PART 12: Amend Article 3.0, Zoning Districts, Section 3.1.1, Agricultural District, Subsection 3.1.1.A by modifying the Intent statement as shown below:**

The ~~Agricultural~~ **Rural Residential** District is established as a district in which the principal use of land is for ~~farming, dairying, forestry operations and other agricultural activities.~~ **agricultural use and single-family detached dwellings on acreage parcels.** The intent of this article is to protect land needed for agricultural pursuits from encroachment by untimely and unplanned residential, commercial or industrial development.

**PART 13: Amend Article 3.0, Zoning Districts, Section 3.1.1, Agricultural District, Subsection 3.1.1.C.iv to read as follows:**

iv. Temporary uses within a building §7.20

**PART 14: Amend Article 3.0, Section 3.1.2, Suburban Farms by modifying the district name as shown below:**

~~Suburban Farms District.~~ **Suburban Estates District.**

**PART 15: Amend Article 3.0, Zoning Districts, Section 3.1.2, Suburban Farms, Subsection 3.1.2.A by modifying the Intent statement as shown below:**

The Suburban ~~Farms~~ **Estates** District is created to establish areas of the Township for single family residences in a rural environment characterized by low densities and significant open spaces.

**PART 16: Amend Article 3.0, Zoning Districts, Section 3.1.2, Suburban Farms, Subsection 3.1.2.F, Development Standards, by modifying the maximum lot coverage as shown below:**

~~20%.~~ **30%.**

**PART 17: Amend Article 3.0, Zoning Districts, Section 3.1.3, R1-A Single Family Residential, Subsection 3.1.3.E, Development Standards, by modifying the maximum lot coverage as shown below:**

~~20%.~~ **30%.**

**PART 18: Amend Article 3.0, Zoning Districts, Section 3.1.4, R1-B Single Family Residential, Subsection 3.1.4.E, Development Standards, by modifying the maximum lot coverage as shown below:**

~~20%.~~ 25% for lots served by a private septic system.  
30% for lots served by public sanitary sewer.

**PART 19: Amend Article 3.0, Zoning Districts, Section 3.1.5, R1-C Single Family Residential, Subsection 3.1.5.E, Development Standards by modifying the maximum lot coverage as shown below:**

~~20%.~~ 25% for lots served by a private septic system.  
30% for lots served by public sanitary sewer.

**PART 20: Amend Article 3.0, Zoning Districts, Section 3.1.6, R1-D Single Family Residential, Subsection 3.1.6.E by modifying the maximum lot coverage as shown below:**

~~20%.~~ 25% for lots served by a private septic system.  
30% for lots served by public sanitary sewer.

**PART 21: Amend Article 3.0, Zoning Districts, Section 3.1.12, Local Business District, Subsection 3.1.12.C, Special Land Uses, to add the following section as Paragraph 3.1.12.C.vii:**

vii. Entertainment and/or outdoor dining associated with a restaurant §4.18

**PART 22: Amend Article 3.0, Zoning Districts, Section 3.1.14, Restricted Business District, Subsection 3.1.14.C, Special Land Uses, to add the following section as Paragraph 3.1.14.C.xviii:**

xviii. Entertainment and/or outdoor dining associated with a restaurant §4.18

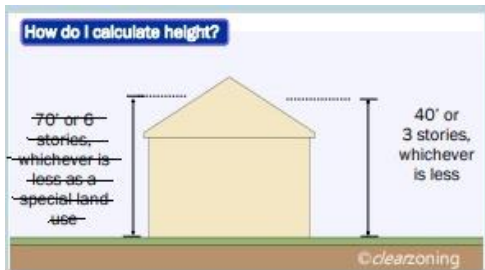
**PART 23: Amend Article 3.0, Zoning Districts, Section 3.1.18, Pontiac Lake Gateway District, Subsection 3.1.18.C.v, Special Land Uses, to read as follows:**

v. ~~Hotels over three stories~~ §4.33

**PART 24: Amend Article 3.0, Zoning Districts, Section 3.1.18, Pontiac Lake Gateway District, Subsection 3.1.18.D, Development Standards, by modifying the maximum building height as shown below:**

~~70 feet or 6 stories, whichever is less as a special land use~~  
40 feet or 3 stories, whichever is less

**PART 25: Amend Article 3.0, Zoning Districts, Section 3.1.18, Pontiac Lake Gateway District, Subsection 3.1.18.D, Development Standards, by modifying the maximum building height illustration as shown below:**



**PART 26: Amend Article 3.0, Zoning Districts, Section 3.1.18, Pontiac Lake Gateway District, Subsection 3.1.18.D, Development Standards, by modifying the minimum floor height as shown below:**

First/ground floor: ~~14~~ 10 feet  
Upper floors: ~~10~~ 9 feet

**PART 27: Amend Article 3.0, Zoning Districts, Section 3.11, Notes to District Standards, Subsection 3.11.A to read as follows:**

- A. Minimum lot area, with the exception of lots zoned AG (Agricultural), SF (Suburban Farms), and R1-A (Single-Family Residential), shall not include any right of way or easement for a public road, private road, or access easement. Calculations for determining maximum density and the number of lots permitted shall be based upon net buildable land area (areas such as regulated wetlands, flood plains and open water bodies, areas devoted to storm water retention/ detention, or other, similar areas of the site that are not available for the use and enjoyment of the residents of a site, shall not be included in calculations for determining maximum density and number of lots permitted).

**PART 28: Amend Article 3.0, Zoning Districts, Section 3.11, Notes to District Standards, Subsection 3.11.F to strike and replace the regulation as shown below:**

~~If at least 60% of the dwelling units on one side of a block have a narrower front setback than the ordinance standard, the minimum front yard setback for new dwelling units shall be the average front yard setback of the existing dwellings on the same side of the block.~~  
Garage sales, rummage sales, yard sales, estate sales, and similar activities may be conducted for no longer than three days and no more than twice per calendar year on the same property.

**PART 29: Amend Article 3.0, Zoning Districts, Section 3.11, Notes to District Standards, Subsection 3.11.W to strike and replace the regulation as shown below:**

~~A maximum 30% lot coverage may be approved administratively by the Director of the Community Development Department or his/ her designee on existing lots of record where all of the following criteria are present:~~

- ~~i. The lot has sanitary sewer service, and~~
- ~~ii. Storm water collected from the roof of the home and garage is directed to a storm drain, retention or detention basin, lake or other body of water, and~~
- ~~iii. The proposed building development complies with all setback requirements of the appropriate zoning district, unless a variance has been approved by the Zoning Board of Appeals.~~

**A modular home may be approved if all of the following criteria are present:**

- A. The dwelling shall be attached to a permanent foundation. The foundation shall be constructed in accordance with the state construction code, and attachment of the dwelling to the foundation shall meet all applicable building codes and other state and federal regulations.**
- B. The dwelling shall not have exposed wheels, towing mechanism, undercarriage, or chassis.**
- C. The dwelling shall be certified by the manufacturer or builder to be:
 
  - a. Designed only for erection or installation on a site-built permanent foundation;**
  - b. Not designed to be moved once so erected or installed;**
  - c. Designed and manufactured to comply with the state construction code, as adopted by the Township;**
  - d. Not intended to be used other than on a site-built permanent foundation.****

**PART 30: Amend Article 3.0, Zoning Districts, Section 3.11, Notes to District Standards, to add the following as Subsection 3.11.Y:**

**No mechanical units, including heating, ventilation, and air conditioning (HVAC) systems and generators, shall be placed in the front yard or closer than five (5) feet to any side yard lot line or rear yard lot line.**



**PART 31: Amend Article 4.0, Use Standards, Section 4.18, Eating Establishments with Entertainment and/or Outdoor Dining, to amend the first paragraph to read as follows:**

Eating establishments with entertainment and/ or outdoor dining may be permitted in the **LB (Local Business) district, RB (Restricted Business) district, GB (General Business) district, and PB (Planned Business) district**, subject to the following:

**PART 32: Amend Article 4.0, Use Standards, Section 4.21, Government Offices and Township Buildings and Uses Without Service or Storage Yards, to add the following section as 4.21.D:**

**D. Governmental drive-thrus shall be allowed as an accessory use under this section.**

**PART 33: Amend Article 4.0, Use Standards, Section 4.33, Motels and Hotels, to amend the first paragraph to read as follows:**

Motels and hotels may be permitted ~~in the RB (Restricted Business) district~~ subject to the following conditions:

**PART 34: Amend Article 5.0, Site Standards, Section 5.11, Off-Street Parking, Subsection 5.11.M by modifying the table of the amount of required off-street parking as follows:**

5.11.M-~~Minimum~~ **Maximum** Requirements for Off-Street Parking  
(note to Planning Commission only, not ordinance text: this is the table title)

~~Minimum~~-**Maximum** Required Number of Parking Spaces  
(note to Planning Commission only, not ordinance text: this is the second column title)

**PART 35: Amend Article 5.0, Site Standards, Section 5.11, Off-Street Parking, Subsection 5.11.M by adding a footnote to the table of the amount of required off-street parking as follows:**

<sup>1</sup>Unless otherwise specified in this Ordinance, at least 75% of the maximum required number of parking spaces shall be provided.

**PART 36: Amend Article 5.0, Site Standards, Section 5.11, Off-Street Parking, Subsection 5.11.M.i.e to read as follows:**

Each stacking space in the drive-through lane shall be nine (9) feet wide by ~~twenty~~ **eighteen** (~~20~~**18**) feet long.

**PART 37: Amend Article 5.0, Site Standards, Section 5.11, Off-Street Parking, Subsection 5.11.Q.xvi to read as follows:**

Parking space length may be reduced by ~~two~~ **one** (~~2~~**1**) ~~feet~~ **foot** where the space abuts a raised sidewalk.

**PART 38: Amend Article 5.0, Site Standards, Section 5.11, Off-Street Parking, Subsection 5.11.Q.xviii to read as follows:**

Concrete curbing and gutter shall be provided at the end of all parking areas and stalls. Curb and gutter shall not be counted towards required drive aisle width and parking stall length and width.

**PART 39: Amend Article 6.0, Development Procedures, Section 6.8, Site Plan Review and Approval, Subsection 6.8.I to read as follows:**

I. Approval Valid for ~~One (1)~~ Two (2) Years

Upon approval of a final site plan by the Planning Commission ~~and approval of a final engineering plan~~, a building permit shall be requested by the applicant within ~~twelve (12)~~ twenty-four (24) months or the site plan shall be declared invalid. The Planning Commission may grant a twelve (12) month extension based upon confirmation by the Director of the Community Development Department or his/her designee that there have been no Ordinance changes affecting the site plan since the time of original approval. Upon receipt of a building permit, reasonable construction shall be commenced within six (6) months, and shall be completed within twenty-four (24) months, or the site plan and building permit shall be declared to be invalid, unless the applicant requests an extension.

**PART 40: Amend Article 6.0, Development Procedures, Section 6.11, Procedures for Review and Approval of All Special Land Uses, Subsection 6.11.A to read as follows:**

A. Approval. If the Planning Commission determines that the particular special land use(s) should be allowed, it shall endorse its approval thereof on the written application and clearly set forth in a special land use permit the particular use(s) which have been allowed and applicable conditions. Thereafter, the enforcing officer may issue a building permit in conformity with the particular special land use so approved. In all cases where a particular special land use has been granted as provided herein, application for a building permit in pursuance thereof must be made and received by the Township not later than ~~one (1)~~ two (2) years thereafter, or such approval shall automatically be revoked, provided, however, the Planning Commission or Township Board may grant an extension thereof for good cause shown under such terms and conditions and for such period of time not exceeding one (1) year as it shall determine to be necessary and appropriate. If granted concurrently, the duration of final site plan approval and special land use approval shall be the same.



# NOTICE OF PUBLIC HEARING CHARTER TOWNSHIP OF WHITE LAKE

Item C.

Notice is hereby given that the Charter Township of White Lake Planning Commission will hold a public hearing on Thursday, April 4, 2024 at 6:30 p.m., or shortly thereafter, at the White Lake Township Annex, 7527 Highland Road, White Lake, MI 48383. The purpose of the hearing is to receive public comments on amendments to several sections of the Charter Township of White Lake Zoning Ordinance 58. The Sections proposed for amendment, and brief summary, are as follows:

**Article 2.0 (Definitions)** – Amend and/or create definitions Section 2.2

**Article 3.0 (Zoning Districts)** – Amend and/or create the following Sections of Article 3.0 to revise the district name, intent statement, maximum lot coverage, special land uses, maximum building height, minimum floor height, and notes to district standards:

- Section 3.1.1 – Agricultural District
- Section 3.1.2 – Suburban Farms
- Section 3.1.3 – R1-A Single Family Residential
- Section 3.1.4 – R1-B Single Family Residential
- Section 3.1.5 – R1-C Single Family Residential
- Section 3.1.6 – R1-D Single Family Residential
- Section 3.1.12 – Local Business District
- Section 3.1.14 – Restricted Business District
- Section 3.1.18 – Pontiac Lake Gateway District
- Section 3.11 – Notes to District Standards

**Article 4.0 (Use Standards)** – Amend and/or create the following Sections of Article 4.0 and to revise the districts in which uses are permitted:

- Section 4.18 – Eating Establishments with Entertainment and/or Outdoor Dining
- Section 4.21 – Government Offices and Township Buildings and Uses Without Service or Storage Yards
- Section 4.33 – Motels and Hotels

**Article 5.0 (Site Standards)** – Amend and/or create the following Section of Article 5.0 and to revise the standards and requirements:

- Section 5.11 – Off-Street Parking

**Article 6.0 (Development Procedures)** – Amend and/or create the following Section of Article 6.0 and to revise the standards and requirements:

- Section 6.8 – Site Plan Review and Approval
- Section 6.11 – Procedures for Review and Approval of All Special Land Uses

**Article 7.0 (Administration, Appeals, and Enforcement)** – Amend and/or create the following Section of Article 7.0 and to revise the standards and requirements:

- Section 7.39 – Approval Periods

A complete copy of the proposed amendments may be examined at the White Lake Township Community Development Department, 7525 Highland Road, White Lake, MI, 48383, prior to the public hearing during the Township's regular business hours; Monday through Friday, 8:00 a.m. through 5:00 p.m. (excluding holidays). The above amendments can also be reviewed on our website at [www.whitelaketwp.com](http://www.whitelaketwp.com). Written comments may be sent to the Planning Commission at the above address prior to the hearing. Oral comments will be taken during the public hearing. Please contact the Community Development Department at (248) 698-3300 ext. 163 with any questions. Persons with disabilities who will need special accommodations the night of the meeting may contact the Clerk of the Commission at least 5 days before the hearing.

408

Sean O'Neil, AICP  
Community Development Director

# WHITE LAKE TOWNSHIP PLANNING COMMISSION

## REPORT OF THE COMMUNITY DEVELOPMENT DEPARTMENT

**TO:** Planning Commission

**FROM:** Sean O'Neil, AICP, Community Development Director  
Justin Quagliata, Staff Planner

**DATE:** March 25, 2024

**RE:** New Hope Planned Development Agreement Amendment

Rumi Shahzad, on behalf of New Hope White Lake, submitted a letter dated March 12, 2024 requesting an amendment to the Planned Development Agreement (PDA). Section 7.4 of the PDA allows the Agreement to be modified by written agreement of the Township and Owner. New Hope, located on a 21.57-acre parcel at 450 S. Williams Lake Road (on the west side of Williams Lake Road, south of Elizabeth Lake Road), is a 93,541 square foot single-story assisted living and memory care facility. A 2,621 square foot office building is located southeast of the main building. The property is zoned PD (Planned Development). The Planning Commission granted final site plan approval on July 16, 2020 and the Township Board approved the PDA on July 21, 2020. A Certificate of Occupancy was granted on December 15, 2022.

New Hope would like to rent its office building to a certified nursing aide (CNA) training program provider. No new construction would be involved with this request. Staff concludes the 70 existing parking spaces on the property are adequate to serve the likely minor increase in the number of vehicle trips to the site resulting from the proposed use.

The Applicant has not yet submitted the PDA amendment. The Planning Commission could recommend approval of the PDA amendment to allow the proposed use, conditioned on staff and consultants' administrative review of the agreement.

### **Planning Commission Options / Recommendation**

The Planning Commission has the option to recommend approval, approval with modifications, or denial of the PDA amendment to the Township Board. **Staff recommends approval of the PDA amendment subject to administrative review.**

### **Attachment:**

1. Letter from Rumi Shahzad requesting amendment dated March 12, 2024.





Planning Commission  
White Lake Township  
7525 Highland Rd  
White Lake, MI 48383

March 12, 2024

Dear Planning Commission members,

I am writing this note to request a change to the Planned Development Agreement between Township of White Lake and New Hope White Lake, LLC (NHWL).

As you know, talent acquisition and retention is a key to running a successful business. This is even more critical for Senior Living Providers. NHWL has identified a top CNA training Program to bring to White Lake. NHWL would like to rent out the 2,621 square foot separate office building, which was used as a model during construction, to a Certified Nursing Aide (CNA) Training Program. Doug and Stephanie Sokol have been running a CNA Training Program in Grand Blanc over the past 5 years. They have been recognized by Hospitals and Nursing Homes as one of the leading CNA Training Programs in Michigan. Please note that no new construction would be involved with this request, the existing building will be used for training CNA candidates.

The CNA Training Program would enable the White Lake, Waterford and neighboring area residents to get training from a top provider. It will also enable New Hope White Lake to recruit strong candidates that successfully complete the program and utilize the services for ongoing training of our existing employees as well.

Please let me know should you have any questions.

A handwritten signature in black ink, appearing to read "Khurram Rumi Shahzad", with a horizontal line extending to the right.

Khurram Rumi Shahzad  
Managing Director,  
New Hope White Lake,  
450 S. Williams Lake Rd,  
White Lake, MI 48386

# WHITE LAKE TOWNSHIP PLANNING COMMISSION

## REPORT OF THE COMMUNITY DEVELOPMENT DEPARTMENT

**TO:** Planning Commission

**FROM:** Sean O'Neil, AICP, Community Development Director  
Justin Quagliata, Staff Planner

**DATE:** March 26, 2024

**RE:** Walmart outdoor seasonal sales

---

Walmart submitted a temporary use permit application dated March 8, 2024 requesting to place a garden center corral (for mulch and other large garden items) in the parking lot until September 5, 2024. Walmart is located on a 13.11-acre parcel at 9190 Highland Road (on the north side of Highland Road, east of Fisk Road) and zoned PB (Planned Business). Paragraph 2(q) of the White Lake Marketplace Planned Business District Development (PBD) Agreement allows Walmart to petition the Planning Commission for permission to conduct outdoor seasonal sales (this includes displaying merchandise outdoors). In determining the size and location of such area, the PBD Agreement requires the Planning Commission to ensure Walmart takes into account the parking ratio for the overall shopping center must not fall below 4.5 cars for each 1,000 square feet of gross leasable area of the shopping center, not including parking spaces which may be within any such outdoor seasonal sales area.

The plan provided by the Applicant shows the garden center corral in the west portion of the parking lot along Fisk Road. When the PBD Agreement was amended in 2009, Birchler Arroyo, the Township's then Planning Consultant, provided a review letter (dated October 8, 2008) stating, in regard to seasonal outdoor sales areas, the Planning Commission could provide conditions of approval for such areas, including their location, duration, and possibly the type of merchandise permitted. The Consultant further stated overstock of merchandise such as mulch, stone, topsoil, fertilizer, etc. should not be permitted to be stored in a designated seasonal sales area.

Walmart did not submit a parking calculation to confirm compliance with the PBD Agreement. It is also unclear if there would be overstock of merchandise in the outdoor sales area. Based on Walmart's past practices associated with this particular use (the Planning Commission granted approval of this use for a two-year period on March 15, 2018), there do not appear to be conflicts with barrier-free parking and vehicular access.

### **Planning Commission Options / Recommendation**

The Planning Commission has the option to approve, approve with conditions, or deny the request to place a garden center corral in the parking lot. **Staff recommends approval of the request subject to the following conditions:**

- **Walmart shall obtain a temporary use permit from the Building Division.**
- **The outdoor seasonal sales area is subject to inspection and approval by the Fire Marshal.**
- **Activity associated with the outdoor seasonal sales shall be limited to April 5 through September 5, with site cleanup to be completed by September 15.**
- **No additional signage, other than directional signage in the parking lot, associated with the outdoor seasonal sales shall be permitted.**
- **The approval shall expire on April 4, 2026.**

#### **Attachments:**

1. Temporary use permit application, dated March 8, 2024.
2. Notice of PBD Agreement Amendment, recorded August 7, 2009.
3. PBD Agreement Amendment, dated July 10, 2009.
4. Minutes of the March 15, 2018 Planning Commission meeting.

RECEIVED

MAR 08 2024

BUILDING DEPARTMENT



White Lake Township Building Department  
7525 Highland Road • White Lake, MI 48383 • (248) 698-3300 Ext 2 • [www.whitelaketwp.com](http://www.whitelaketwp.com)

TEMPORARY USE PERMIT

Owner's Address: Walmart  
9190 E. Highland Rd.  
Whitelake, MI, 48386

Owner's Permission: Ray Tyler

Location of Temporary Use: parking lot  
"Garden Center Corral"

Start Date: March 20th, 2024  
End Date: September 5th, 2024

Type of use requested: To have a "Corral"  
for mulch and other  
large garden items

Applicant's Name: Racheal Stack / Mona Sevic  
Applicant's Phone Number: 248-698-9601

Applicant Signature: Mona Sevic

- \*\* Applicant is to provide a copy of photo ID.
- \*\* Attach a site plan/plot plan showing parking, tent size and location, portable restroom, etc.

Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

Walmart

Main Doors

Garden Doors

Patio

Entrance

Parking Lot

Handicap

Trees & Shrubs

Cart Rail?

mana  
ese

Black & Brown  
& Red Scotts  
mulch

Black & Brown  
Red Scotts  
Rubber mulch

Black  
mulch

Black  
mulch

Red  
mulch

Red  
mulch

Brown  
mulch

Brown  
mulch

~~Black~~  
Rubber

Brown

Red  
mulch

← Fisk Rd →

Mona Sevic  
517-899-4241

Walmart

9190

E. Highland  
Whitlake, MI

48386

248-698-1111

Item B.



RECEIVED  
OAKLAND COUNTY  
REGISTER OF DEEDS  
2009 AUG -7 AM 10:28

143180  
LIBER 41394 PAGE 273  
\$22.00 MISC RECORDING  
\$4.00 REMONUMENTATION  
08/07/2009 11:10:19 A.M. RECEIPT# 65315



PAID RECORDED - OAKLAND COUNTY  
RUTH JOHNSON, CLERK/REGISTER OF DEEDS

**NOTICE OF PLANNED BUSINESS DEVELOPMENT AGREEMENT**

Gregory K. Need, being duly sworn, states as follows:

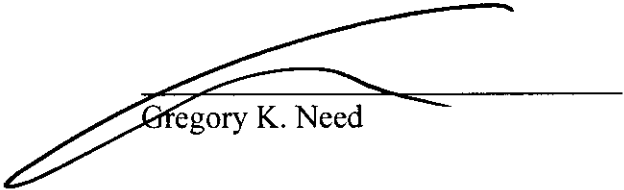
1. He is the attorney for White Lake Township ("Township"), Oakland County, Michigan.
2. On June 26, 1998, the Township and Ramco-Gershenson Properties, L.P. ("Ramco-Gershenson") entered into a Planned Business District Development Agreement, which covers the property described on Exhibit A, attached hereto and by reference made a part hereof (tax parcel numbers 12-14-476-015((part), 12-14-476-009 and 12-14-476-007)).
3. On July 10, 2009, Pontiac Mall Limited Partnership ("Pontiac Mall"), as successor-in-interest to Ramco-Gershenson, Wal-Mart Real Estate Business Trust ("Wal-Mart") and the Township executed an Amendment to White Lake Marketplace Planned Business District Development Agreement, which covers the property described on Exhibit B, attached hereto and by reference made a part hereof (tax parcel number 12-14-476-015).
4. The Planned Business Development Agreement contains provisions regarding development of the property.

~~XXXX~~

SP  
R


O.K. - MH

5. A copy of the Agreement is available for inspection at the office of the Township, 7525 Highland Road, White Lake, Michigan 48383, during regular business hours.

  
Gregory K. Need

STATE OF MICHIGAN    )  
                                  ) ss  
COUNTY OF OAKLAND    )

Subscribed and sworn to before me  
on August 4, 2009.

  
Michelle M. Simmons, Notary Public  
Oakland County, Michigan  
My commission expires: October 11, 2011

Drafted by and when recorded return to:

Gregory K. Need, Esq.  
Adkison, Need & Allen, P.L.L.C.  
39533 Woodward Avenue, Suite 210  
Bloomfield Hills, MI 48304

*m:\white lake township\walmart\notice of pbd agr.doc*

**LEGEND**

- S.I. SET IRON (W/CAP #37281)
- F.I. FOUND IRON
- F.P. FOUND PIPE

0 150' 300' 600'



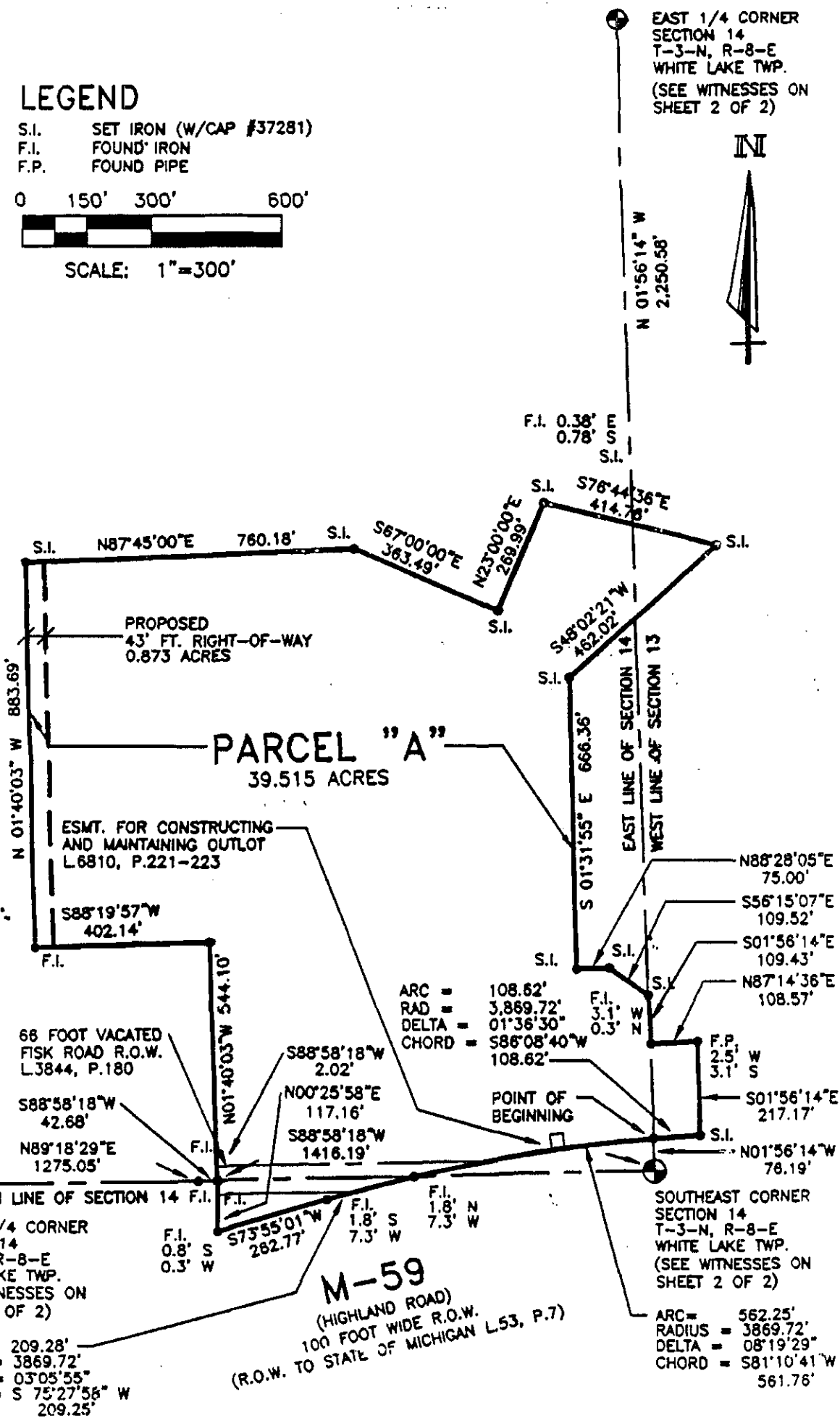
SCALE: 1"=300'

EAST 1/4 CORNER  
SECTION 14  
T-3-N, R-8-E  
WHITE LAKE TWP.  
(SEE WITNESSES ON  
SHEET 2 OF 2)

N



FISK ROAD  
(66 FOOT WIDE)



**CERTIFICATE OF SURVEY**

PART OF THE SW 1/4 OF SECTION 13 & THE SE 1/4 OF SECTION 14  
AND PART OF NE 1/4 OF SECTION 23, T-3-N, R-8-E  
WHITE LAKE TOWNSHIP, OAKLAND COUNTY, MICHIGAN

<b>Giffels-Webster Engineers Inc.</b> ENGINEERS-SURVEYORS-PLANNERS 407 E. FORT STREET SUITE 600, DETROIT MICHIGAN 48226 (313) 962-4442	DATE: 4/28/98	CK'D. BY: JD	DATE: 4/98	SCALE: 1"=300'
	DRAWN: SW	JD	4/98	SHEET: 1 OF 2
	DESIGN: JD	LL	4/98	<b>GWE</b> 14753
	SECTION: 13,14,23	T-3-N R-8-E		

MAY 04 1998

data/acad/14753/sketches/sk14

**LEGAL DESCRIPTION  
PARCEL "A"**

PART OF THE NE 1/4 OF SECTION 23 & PART OF THE SW 1/4 OF SECTION 13 & PART OF THE SE 1/4 OF SECTION 14, T-3-N, R-8-E, WHITE LAKE TOWNSHIP, OAKLAND COUNTY, MICHIGAN, BEING MORE PARTICULARLY DESCRIBED AS: COMMENCING AT THE SE CORNER OF SECTION 14, T-3-N, R-8-E; THENCE N 01°56'14" W, 76.19 FEET ALONG THE EAST LINE OF SAID SECTION 14 TO A POINT ON THE NORTH RIGHT-OF-WAY LINE OF M-59 (100 FEET WIDE), SAID POINT ALSO BEING THE POINT OF BEGINNING; THENCE THE FOLLOWING THREE COURSES ALONG SAID NORTH RIGHT-OF-WAY LINE: (1) ALONG A CURVE TO THE LEFT 562.25 FEET, SAID CURVE HAVING A RADIUS OF 3,869.72 FEET, CENTRAL ANGLE OF 08°19'29" AND A LONG CHORD BEARING OF S 81°10'41" W, 581.78 FEET TO A POINT ON THE SOUTH LINE OF SAID SECTION 14 AND (2) CONTINUING ALONG A CURVE TO THE LEFT 209.28 FEET, SAID CURVE HAVING A RADIUS OF 3,869.72 FEET, CENTRAL ANGLE OF 03°05'55" AND A LONG CHORD BEARING OF S 75°27'58" W, 209.25 FEET, AND (3) S 73°55'01" W, 262.77 FEET; THENCE N 00°25'58" E, 117.16 FEET TO A POINT ON THE SOUTH LINE OF SAID SECTION 14; THENCE S 88°58'18" W, 2.02 FEET ALONG SAID SOUTH LINE; THENCE N 01°40'03" W, 544.10 FEET; THENCE S 88°19'57" W, 402.14 FEET TO A POINT IN FISK ROAD; THENCE N 01°40'03" W, 883.69 FEET ALONG SAID FISK ROAD; THENCE N 87°45'00" E, 760.18 FEET; THENCE S 67°00'00" E, 363.49 FEET; THENCE N 23°00'00" E, 269.99 FEET; THENCE S 76°44'36" E, 414.76 FEET; THENCE S 48°02'21" W, 462.02 FEET; THENCE S 01°31'55" E, 666.36 FEET; THENCE N 88°28'05" E, 75.00 FEET; THENCE S 56°15'07" E, 109.52 FEET TO A POINT ON THE EAST LINE OF SAID SECTION 14; THENCE S 01°56'14" E, 109.43 FEET ALONG SAID EAST LINE; THENCE N 87°14'36" E, 108.57 FEET; THENCE S 01°56'14" E, 217.17 FEET TO A POINT ON THE NORTH RIGHT-OF-WAY LINE OF M-59 (100 FEET WIDE); THENCE ALONG SAID NORTH RIGHT-OF-WAY LINE ALONG A CURVE TO THE LEFT 108.62 FEET, SAID CURVE HAVING A RADIUS OF 3,869.72 FEET, CENTRAL ANGLE OF 01°36'30" AND A LONG CHORD BEARING OF S 86°05'40" W, 108.62 FEET TO THE POINT OF BEGINNING AND CONTAINING 39.515 GROSS ACRES 38.642 NET ACRES.

SUBJECT TO THE RIGHTS OF THE PUBLIC IN FISK ROAD AND M-59.  
ALSO SUBJECT TO ANY EASEMENTS, RESTRICTIONS OF RIGHT-OF-WAY, RECORDED OR OTHERWISE.

**WITNESSES**

12-14-476-007 SEX  
12-14-476-011 - SW Sec 13, SE Sec 14  
PT 12-14-476-015 SEX  
12-14-476-009 - SW Sec 13, SE Sec 14  
12-14-476-010 - SE Sec 14, NE Sec 23  
12-14-476-013 - SE  
12-14-476-012 - SE

SOUTHEAST CORNER OF SECTION 14, T-3-N, R-8-E  
FOUND 1/2" IRON IN MONUMENT BOX WITH R.C.O.C. CAP

DUE NORTH 81.28 FEET 4" CONCRETE MONUMENT  
N 57° E 193.34 FEET CUT CROSS SOUTHWEST BOLT OF CHURCH SIGN  
S 36° E 172.31 FEET NORTH FACE OF 10" PINE TAG #33138  
S 47° W 45.93 FEET NORTHWEST FACE OF UTILITY POLE TAG #33138

SOUTH 1/4 CORNER OF SECTION 14, T-3-N, R-8-E  
FOUND CONCRETE MONUMENT WITH R.C.O.C. CAP #33138

N 45° W 29.55 FEET SOUTHWEST FACE OF 10" MAPLE TAG #33138  
N 03° E 9.96 FEET EAST FACE OF 10" THORNAPPLE TAG #33138  
N 88° E 1.45 FEET NORTH FACE OF UTILITY POLE TAG #33138  
S 45° E 69.68 FEET WEST FACE OF UTILITY POLE TAG #33138

EAST 1/4 CORNER OF SECTION 14, T-3-N, R-8-E  
FOUND AXLE SHAFT WITH R.C.O.C. CAP #33138

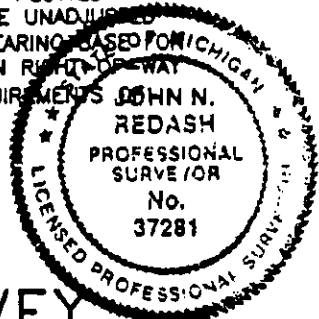
S 45° E 23.49 FEET NORTHEAST FACE OF TWIN 12" BOXELDER TAG #33138  
S 65° W 50.14 FEET NORTH FACE OF 4" ELM TAG #33138  
N 03° W 2.66 FEET SOUTHWEST FACE OF TWIN 36" BOXELDER TAG #33138  
N 03° E 2.93 FEET NORTHEAST FACE OF TWIN 36" BOXELDER TAG #33138

CENTER OF SECTION 14, T-3-N, R-8-E  
1" FOUND PINCH PIPE

N 04° E 53.85 FEET WEST FACE OF 8" APPLE NAIL & TAG #13903  
S 15° E 18.24 FEET NORTH FACE OF 12" CHERRY NAIL & TAG #13904  
S 20° W 10.06 FEET NORTH FACE OF 6" ELM NAIL & TAG #13901  
N 85° W 70.36 FEET NORTH FACE OF 4" PINE NAIL & TAG #13902

I HEREBY CERTIFY THAT I HAVE SURVEYED AND MAPPED THE LAND HEREON PLOTTED AND DESCRIBED APRIL 15, 1998 AND THAT THE RATIO OF CLOSURE OF THE UNADJUSTED FIELD OBSERVATIONS OF SUCH SURVEY WAS 1 IN 45332 AND THAT THE BEARING BASED ON MICHIGAN DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY PLAN SHEET #266, PROJECT NUMBER 63-45; AND THAT ALL OF THE REQUIREMENTS OF P.A. 132, 1970, AS AMENDED, HAVE BEEN COMPLIED WITH.

*John N. Redash*  
JOHN N. REDASH P.S. #37281



MAY 04 1998

**CERTIFICATE OF SURVEY**

PART OF THE SW 1/4 OF SECTION 13 & THE SE 1/4 OF SECTION 14  
AND PART OF NE 1/4 OF SECTION 23, T-3-N, R-8-E  
WHITE LAKE TOWNSHIP, OAKLAND COUNTY, MICHIGAN

<b>Giffels-Webster Engineers Inc.</b> ENGINEERS-SURVEYORS-PLANNERS 407 E. FORT STREET SUITE 600, DETROIT MICHIGAN 48226 (313) 962-4442	DATE: 4/28/98	CK'D. BY: JD	DATE: 4/98	SCALE: 1"=300'
	DRAWN: SW	JD	4/98	SHEET: 2 OF 2
	DESIGN: JD	LL	4/98	<b>GWE</b> 14753
	SECTION: 13,14,23	T-3-N R-8-E		

duta/acad/14753/sketches/sk14

## Legal Description for Wal-Mart Property

A part of the southeast 1/4 of Section 14, Town 3 North, Range 8 East, White Lake Township, Oakland County, Michigan, more particularly described as:

Commencing at the southeast corner of a said Section 14; thence North  $01^{\circ}56'14''$  West, 76.19 feet along the east line of Section 14 to a point on the northerly right of way line of M-59 – Highland Road, (100 feet wide);

thence along said right of way line on a curve to the right with an arc length of 108.62 feet; having a radius of 3,869.72 feet, with a delta angle of  $01^{\circ}36'30''$  and having a chord bearing of North  $86^{\circ}08'40''$  East, 108.62 feet;

thence North  $01^{\circ}56'14''$  West, 217.17 feet;

thence South  $87^{\circ}14'36''$  West, 108.57 feet to a point on the east line of said Section 14;

thence North  $01^{\circ}56'14''$  West, 109.43 feet along said line;

thence North  $56^{\circ}15'07''$  West, 109.52 feet;

thence South  $88^{\circ}28'05''$  West, 75.00 feet;

thence North  $01^{\circ}31'55''$  West, 293.04;

thence South  $88^{\circ}19'57''$  West, 266.13 feet,

thence South  $01^{\circ}40'03''$  East, 206.13 feet,

thence South  $88^{\circ}19'57''$  West, 345.00 feet to the **Point of Beginning** for the following described tract of land;

thence South  $88^{\circ}19'57''$  West, 596.50 feet;

thence North  $01^{\circ}40'03''$  West, 884.12 feet;

thence South  $87^{\circ}45'00''$  West, 10.00 feet;

thence North  $01^{\circ}40'03''$  West, 113.64 feet;

thence North  $87^{\circ}45'00''$  East, 653.20 feet;

thence South  $02^{\circ}15'00''$  East, 113.63 feet;

thence South  $87^{\circ}45'00''$  West, 107.94 feet;

thence South  $01^{\circ}40'03''$  East, 545.08 feet;

thence North  $88^{\circ}19'57''$  East, 60.11 feet;

thence South  $01^{\circ}40'03''$  East, 344.49 feet to the **Point of Beginning**, containing 13.101 acres (570695 sq. ft.).

Part of Parcel No. 12-14-476-005 and all of Parcel No. 12-14-476-006

12-14-476-015



White Lake, MI  
Store No. 2700-02

**AMENDMENT TO WHITE LAKE MARKETPLACE  
PLANNED BUSINESS DISTRICT DEVELOPMENT AGREEMENT**

This Amendment to White Lake Marketplace Planned Business District Development Agreement (this "Amendment") is made this 10th day of July, 2009, by and among the **CHARTER TOWNSHIP OF WHITE LAKE**, whose address is 7525 Highland Road, White Lake Township, Michigan 48383 ("Township"), **PONTIAC MALL LIMITED PARTNERSHIP**, a Michigan limited partnership as successor-in-interest to **RAMCO-GERSHENSON PROPERTIES, L.P.**, a Delaware limited partnership, with a mailing address of 31500 Northwestern Highway, Suite 100, Farmington Hills, Michigan 48334 ("Developer") and **WAL-MART REAL ESTATE BUSINESS TRUST**, a Delaware statutory trust, whose address is 2001 S.E. 10th Street, Bentonville, Arkansas 72716-0550 ("Wal-Mart").

**RECITALS**

A. Developer and the Township entered into that certain White Lake Marketplace Planned Business District Development Agreement dated June 26, 1998 (the "Agreement").

B. Wal-Mart intends to expand its current building located on property owned by Wal-Mart as described in **Exhibit A** attached hereto and made a part hereof (the "Wal-Mart Parcel") and within the White Lake Marketplace Shopping Center pursuant to those certain Final Site Plans and construction related plans, prepared by CESO, Inc., dated August 13, 2008 and final Elevations prepared by Raymond Harris Architects ("RHA"), dated July 14, 2008 and final Sign Plan prepared by RHA, dated July 17, 2008 and last revised May 29, 2009 as all of such plans were approved by the Township in connection with Wal-Mart's expansion.

C. The Township desires to ensure that the Wal-Mart expansion that is the subject of this Amendment is developed and used in accordance with Township approved development plans and applicable laws and regulations.

NOW THEREFORE, for good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, the parties agree as follows:

1. Paragraph 2(q) of the Agreement is hereby deleted in its entirety and replaced with the following:

Although the approved Site Plan does not provide an area where Wal-Mart will have the right to conduct outdoor seasonal sales, Wal-Mart shall have the absolute right to petition the Township (through its Planning Commission) for the right to conduct such sales in a specified area within the Wal-Mart Parcel, and the Township (through its Planning Commission) shall reasonably consider any such request in accordance with the Township Zoning Ordinance, provided that, in determining the size and location of such area, Wal-Mart takes into account that the parking ratio for the overall shopping center must not fall below 4.5 cars for each 1,000 square feet of gross leasable area of the shopping center, not including parking spaces which may be within any such outdoor seasonal sales area. Wal-Mart shall be required to utilize the same application and approval process set out above in the event that Wal-Mart desires to lease or license any portion of its parking lot for a kiosk or other similar use.

2. Paragraph 2(u) is hereby amended to add the following language:

Other than as provided for herein, except for a four week period of time surrounding the national holidays of Christmas and Thanksgiving (i.e. two weeks before the date and two weeks after), and except for a two week period of time surrounding certain other national holidays which shall include Easter, Memorial Day, the 4th of July and Labor Day (i.e. one week before the date and one week after), Wal-Mart shall not permit the storage of roll-off shipping containers or other storage containers or trailers behind the Wal-Mart building outside of the loading dock areas for longer than twenty-four (24) consecutive hours. Said limitation does not apply to containers or trailers within the loading dock areas. No more than four (4) roll-off shipping containers or other storage containers or trailers (in addition to any such containers or trailers within the loading dock areas) shall be permitted behind the Wal-Mart building at any one time, and such roll-off shipping containers or other storage containers or trailers not within the loading dock areas shall be limited to the designated areas as depicted on the attached **Exhibit B**. Wal-Mart shall not permit running refrigeration containers or running refrigeration trailers to be stored behind the Wal-Mart building at any time (except within the loading dock areas). Said containers shall not block the access/truck drive located behind the Wal-Mart building, and in the event said containers damage any common area within the White Lake Marketplace Shopping Center, Wal-Mart shall promptly repair and/or restore (at its sole cost) such area to the same or better condition as which existed immediately prior to such damage.

3. The following Paragraph 2(x) is hereby added to the Agreement:

If requested to do so by the Township, Wal-Mart shall install signs within the parking area on the Wal-Mart Parcel stating that the parking of recreational vehicles and buses on the Wal-Mart Parcel on an overnight basis is prohibited. Wal-Mart store representatives shall also reference such prohibition to any parties inquiring regarding overnight parking of recreational vehicles and buses.



Notwithstanding the foregoing, the parties acknowledge that Wal-Mart shall have no responsibility to enforce or police this prohibition.

4. The following Paragraph 2(y) is hereby added to the Agreement:

Wal-Mart shall maintain all landscaping on the Wal-Mart Parcel, and shall replace any dead or dying landscaping on the Wal-Mart Parcel, consistent with its obligation to do so pursuant to the Township Code of Ordinances.

5. The sign plan for the Wal-Mart development is hereby amended, as reflected within the attached **Exhibit C**.

6. In recognition of the fact that certain lot combinations and/or consolidations necessary for the expansion of the Wal-Mart store may not be complete at the time construction commences, construction on or across any lot line or boundary between the parcels that are to be combined or consolidated shall be permitted consistent with the approved site plans, without regard to any set back requirements in the Township Code of Ordinances that would otherwise apply to any such lot lines or boundary lines. Such lot combinations and/or consolidations shall be complete before a certificate of occupancy is issued.

7. The parties hereto acknowledge and agree that, as between Pontiac, Wal-Mart and Home Depot U.S.A., Inc., this Amendment is not intended to and does not amend, modify or circumvent the terms and conditions of that certain Easement With Covenants and Restrictions Affecting Land dated June 26, 1998 and recorded in Liber 18772, Page 13, Oakland County, Michigan Register of Deeds, as amended by that certain First Amendment to Easement With Covenants and Restrictions Affecting Land dated and recorded on or around the date hereof (as amended, the "ECR"), including but not limited to the parking ratio requirements set forth in the ECR.

[Rest of this page intentionally left blank. Signatures start on next page.]

IN WITNESS WHEREOF, the parties have executed this Amendment as of the date set out on the first page of this Amendment.

CHARTER TOWNSHIP OF WHITE LAKE

By: Mike Kowall  
Mike Kowall

Its: \_\_\_\_\_  
Supervisor  
and

By: Terrence Lilley  
Terrence Lilley

Its: \_\_\_\_\_  
Clerk

STATE OF Mich)  
  )SS:  
COUNTY OF OAKLAND)

Before me, the undersigned, a Notary Public, in and for said County and State, on this 30 day of June, 2009 personally appeared Mike Kowall, the Supervisor and Terrence Lilley the clerk of the Charter Township of White Lake, and acknowledged the execution of the foregoing for and on behalf of said Township.

Dena M. Potter  
Notary Public,  
OAKLAND County, \_\_\_\_\_  
Acting in OAKLAND County  
My Commission Expires: 12-5-13

[Signatures continue on following pages]

DENA M. POTTER  
Notary Public, Oakland County, MI  
My Commission Expires Dec. 5, 2013  
Acting in the County of OAKLAND, MI

**PONTIAC MALL LIMITED PARTNERSHIP**, a Michigan limited partnership and successor-in-interest to **Ramco-Gershenson Properties, L.P.**

By: White Lake Holdings, Inc.,  
a Michigan corporation

Its: General Partner

By: [Signature]

Name: Bruce Gershenson

Its: Vice President

STATE OF MICHIGAN )  
 )SS:  
COUNTY OF OAKLAND )

Before me, the undersigned, a Notary Public, in and for said County and State, on this 25<sup>th</sup> day of June, 2009 personally appeared Bruce Gershenson, the Vice President of White Lake Holdings, Inc., a Michigan corporation, the general partner of Pontiac Mall Limited Partnership, a Michigan limited partnership, and acknowledged the execution of the foregoing for and on behalf of said limited partnership.

[Signature]  
\_\_\_\_\_  
Kelly Friesz Notary Public,  
Oakland County, Michigan  
Acting in \_\_\_\_\_ County  
My Commission Expires: 8/21/2015

[Signatures continue on following page]



**WAL-MART REAL ESTATE  
BUSINESS TRUST,**  
a Delaware statutory trust

By: J. Chris Callaway  
J. Chris Callaway  
Regional Vice President, Design and Real Estate

STATE OF ARKANSAS    )  
  )SS:  
COUNTY OF BENTON    )

Before me, the undersigned, a Notary Public, in and for said County and State, on this 9<sup>th</sup> day of July, 2009 personally appeared J. Chris Callaway, Regional Vice President, Design and Real Estate for Wal-Mart Real Estate Business Trust, a Delaware statutory trust, and acknowledged the execution of the foregoing for and on behalf of said trust.



Michelle L. Tagliavore  
Notary Public,  
Benton County, ARKANSAS  
Acting in Benton County  
My Commission Expires: 5-20-2015

Approved and Consented to:

HOME DEPOT U.S.A., INC.,  
a Delaware corporation

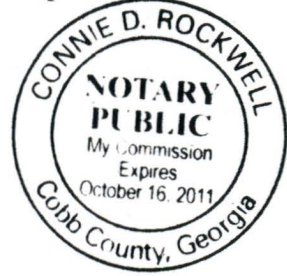
By: [Signature]

Its: Brett Soloway - Counsel

STATE OF Georgia )  
  )SS:  
COUNTY OF Cobb )

Before me, the undersigned, a Notary Public, in and for said County and State, on this 30 day of June, 2009 personally appeared Brett Soloway, the Counsel of Home Depot U.S.A., Inc. a Delaware corporation, and acknowledged the execution of the foregoing for and on behalf of said corporation.

Notary Public, Connie D. Rockwell  
Cobb County, Georgia  
Acting in Cobb County  
My Commission Expires:



Drafted by, and when recorded, please return to:

Dawda, Mann, Mulcahy & Sadler, PLC  
Attn. Dana Kreis Glencer  
39533 Woodward Avenue, Suite 200  
Bloomfield Hills, Michigan 48304

**MORTGAGEE'S CONSENT TO AMENDMENT**

The undersigned, Wells Fargo Bank National Association as Trustee for the registered holders of PNC Mortgage Acceptance Corp. Commercial Mortgage Pass-Through Certificates Series 2001-C1, whose Master Servicer is Midland Loan Services, Inc., being a mortgagee of certain property that is the subject of the Agreement by virtue of a Mortgage, dated as of January 29, 2001, and recorded on February 2, 2001 in Liber 22289, Page 798, Oakland County, Michigan register of deeds, hereby consents to this Amendment to White Lake Marketplace Planned Business District Development Agreement.

Wells Fargo Bank National Association as Trustee for the registered holders of PNC Mortgage Acceptance Corp. Commercial Mortgage Pass-Through Certificates Series 2001-C1

By and through its Master Servicer and Attorney in Fact  
Midland Loan Services, Inc.

By: BJH

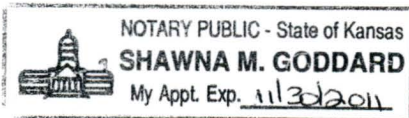
Print Name: Bradley J. Hauge

Its: EVP

Date: 7/22, 2009

STATE OF KANSAS            )  
  )SS:  
COUNTY OF JOHNSON    )

Before me, the undersigned, a Notary Public, in and for said County and State, on this 2nd day of July, 2009 personally appeared Bradley J. Hauge the Sr. Vice President of Midland Loan Services Inc., a Delaware Corp., and acknowledged the execution of the foregoing for and on behalf of said corporation.



[Signature]

Notary Public,

Johnson County,

Kansas

Acting in Johnson County

My Commission Expires: 11/30/2011

175  
176 Mr. Seward questioned how they would designate or mark out access to the lake between lots 60-61. Mr.  
177 Pisaki stated this could be done with signs. Mr. Seward noted that he had the same set up and over time  
178 those two lots became their property. It was a great set up, but created arguments. They could put  
179 posts or a fence down those property lines so it can easily be delineated. Also he feels the southern lots  
180 will feel separated from the pond/lake and it might discourage them from using the lake, which is  
181 gorgeous. A gazebo or gathering place would be awesome.

182  
183 Mr. O'Neil stated this developer came before the commission this evening with a concept looking for  
184 feedback. Accessibility to the lake is a common theme and they could perhaps eliminate a few lots to  
185 access the lake. They want to make this workable.

186  
187 Additional Commissioner Comments:

188  
189 Mr. Ruggles feels this is a decent plan in general and he doesn't have issues. He suggested maybe  
190 making the park on the west bigger and lose a few lots.

191  
192 Ms. Grubb would like to see more frontage on the pond on lot 60.

193  
194 Mr. Fine encouraged the applicant to move forward with this development.

195  
196 Mr. Seward suggested having access for the northern lots on the north end of the road and creating a  
197 gathering space. The area should be accessible and more open for a visual aspect.

198  
199 Mr. O'Neil indicated he would meet with the applicant again to see what they can do to address these  
200 issues.

201  
202 **b. Walmart, Temporary Use Permit for outdoor seasonal sales**

203  
204 Mr. O'Neil indicated that per the approved Planned Business Development Agreement, Walmart has the  
205 right to petition the Planning Commission for approval of a Temporary Use Permit for outdoor seasonal  
206 sales from April-October each year. The administrative denial was issued due to the fact that only the  
207 Planning Commission can approve this request.

208  
209 Mr. O'Neil continued that they are proposing to keep all materials on the westerly property line near the  
210 Garden Center. There is thick vegetation along the sidewalk and what they would store would not be  
211 obtrusive to the neighbors across the street. He would recommend that the first few spaces remain open  
212 and product not to exceed past the parking spots, as the fire lane must remain open. He appreciates  
213 them moving it to this area and feels it is a better location. One possible condition would be to limit the  
214 height of the pallets to 5 ft.

215  
216 Sean Bolen of Walmart stated that the main reason for requesting outdoor storage in this area is that  
217 customers are asking for more variety and convenience when it comes to mulch. The new store manager  
218 agreed to give this a try. He agrees with the suggestion of leaving a few parking spaces open to allow for  
219 loading. This is a low traffic area, both lanes will be open and they will only occupy the space designated.  
220 There is an access gate where customers can go out without having to go all the way around.

221  
222 The new Store Manager, Nicole, stated they have not done this in previous years and it would be a nice  
223 benefit for the customers.

224  
225 Mr. O'Neil asked how far back would they need to go in order to provide this convenience. Mr. Bolen  
226 stated there are emergency exits and trucks unload in the back. They will need 10-12 spaces maximum  
227 and anticipate 6 spaces for pallets of dirt and mulch with a few spaces for trees and shrubs. Racks of  
228 flowers will be against the building and will not intrude into the fire lane. There are two roll-up doors for  
229 ventilation purposes only.

230  
231 Mr. Ruggles stated that this is straight forward and Home Depot does this as well. Home Depot was one  
232 of the first PB's in the township and these stipulations were not put into their development, but we want to  
233 continue this in the future.



234  
235 Ms. Grubb thinks this is a good idea and maybe they can discourage parking in that area. Mr. Bolen  
236 stated it would be the place where cars can stop and load.

237  
238 Mr. Anderson did not like all the front outdoor storage in previous years. It was an eyesore and created  
239 traffic problems. With regard to loading and unloading, he feels someone will have to park in the  
240 ingress/egress to do that. This may create a problem with flow and traffic. He suggested the 5 empty  
241 spaces be designated for loading and unloading. Nicole and Mr. Bolen felt this was a good idea.

242  
243 Mr. Anderson questioned how many bags of mulch each pallet would hold. Mr. Bolen responded that  
244 each pallet is 4x5 ft. and would hold roughly 50 bags of mulch, and be less than 5 ft. high. There will still  
245 be mulch available in the store, but this request is for bulk purchase as a convenience for the customer.  
246 Mr. Anderson asked how they would secure this area at night. Mr. Bolen stated there is an overnight  
247 team who will monitor the area.

248  
249 Mr. Fine thinks this is a great idea and will be good for their business. He would like to see signage in  
250 that area for safety purposes.

251  
252 Ms. Grubb asked if Christmas trees would be included in this and Mr. Bolen responded that they would  
253 not.

254  
255 Parking directly west of the westerly fencing – MOTION – one pallet 5ft. max.

256  
257 **Mr. Fine moved to approve the Walmart Temporary Use Permit for Outdoor Seasonal Sales of**  
258 **mulch and other items in the westerly area, and having space where they can see from the Garden**  
259 **Center gates, from April 1-September 30 for a 2-year period and storage is restricted to**  
260 **immediately west of the Garden Center. Ms. Carlock supported and the MOTION CARRIED with a**  
261 **roll call vote: Ruggles – yes; Grubb – yes; Anderson – yes; Fine – yes; Carlock – yes; Seward –**  
262 **yes. (6 yes votes)**

263  
264 **Liaison's Report:**

265  
266 Mr. Ruggles reported that Officer Jessica Snow was presented with her third life-saving award; the  
267 Township has applied for the Michigan Natural Resources Grant to acquire property at the Brendel Lake  
268 camp ground. If the township is successful, the state will fund 74%. They are working on a purchase  
269 price and we'll know by December if it's awarded, with the funding coming next year. There was a large  
270 turnout and residents asked if the township would allow docks/boats. Mr. Kowall assured them there  
271 would not be any motorized vehicles allowed; regarding the Preliminary Site Plan for Aspen Meadows,  
272 the Planning Commission wanted a community impact statement, but the Township Board decided they  
273 didn't need it; 4 Corners requested a designation as a Brownfield development. There is more  
274 contamination on site, not in the corner, but in middle of property where all the utilities are. The  
275 development is at a standstill right now and the developer is also looking for tax abatement.

276  
277 Ms. Grubb reported that the Parks & Rec has not met since the last meeting. Also, there will be a  
278 millage in November to vote for.

279  
280 Ms. Dehart was not present to give a report. The next ZBA meeting March 22.

281  
282 **Director's Report:**

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284 Mr. O'Neil added to Mr. Ruggles report that two rezonings were finalized with a second reading. He  
285 expects projects coming in. And lastly, there will not be a meeting on April 5.

286  
287 **Communications:**

288  
289 **Next meeting dates:**

- 290  
291  
292
- Regular Meeting – April 5, 2018 (cancelled)
  - Regular Meeting – April 19, 2018 (public hearing, Anderson cannot attend)