YELLOWSTONE COUNTY BOARD OF PLANNING

City of Billings and
Yellowstone County, Montana

AGENDA

MAY 13, 2025 MEETING TIME: 6:00 p.m.
City Council Chambers, 5th Floor
316 N 26th St, Billings MT

NOTICE TO THE PUBLIC

Citizens are invited to:

- Review the Agenda Packet on the City's website at: https://ci.billings.mt.us/117/Agendas-Minutes
- View the meeting live online at Facebook
- Public comment will be taken only during the Public Comment periods as indicated on the agenda and during the Public Hearings, if any are scheduled, under the Regular agenda. Comments may be sent to the Board via email before 12:00 pm on the meeting date. All emails received prior to this time will be entered into the record for the public hearing. Comments may be submitted by:
- Mail: City/County Planning Division PO Box 1178, Billings MT 59103
- Email: plnonline@billingsmt.gov
- NOTICE: All meetings and official activities of the MPO are held in buildings and locations that comply with accessibility standards according to the Americans with Disabilities Act (ADA). A TTY number for the hearing impaired, 406-657-3079, is available upon request. Special arrangements for participation in the public hearings by individuals with hearing, speech, or vision impairment may be made upon request at least three days prior to the hearing. Please notify Brenda Berns, Planning Clerk at bernsb@billingsmt.gov or call 406-247-8610.

1. **CALL TO ORDER - Planning Board President:** Welcome and Introduction of Board Members and Staff.

2. **APPROVAL OF AGENDA* -** including any additions or deletions to agenda. The agenda for a regular meeting will be closed at 5:00 p.m. three (3) working days prior to the date of the meeting.

3. Meeting Minutes of April 8, 2025 & April 22, 2025

   Attachments
   Minutes of April 8, 2025
   Minutes of April 22, 2025

4. **PUBLIC COMMENT PERIOD** -- As required (3 minute maximum per person). *Any member of the public may be heard on any subject that is not on the agenda. The Planning Board will not take any action on these items at this time, but could choose to add an item to the next meeting's agenda for discussion.*
   4a) Comments on items not on agenda and requests to add items to future agendas
   4b) Comments on items on the non-public hearing agenda items

5. **DISCLOSURE OF CONFLICT OF INTEREST:**

6. **DISCLOSURE OF EX PARTE COMMUNICATION:**

7. **OLD BUSINESS** (Agenda items that were not discussed or not completed in a previous meeting or items requiring action).

   a. **PUBLIC HEARINGS/PUBLIC HEARING PARTICIPATION GUIDELINES.** The County Planning Board welcomes public input on matters brought before the Board. To ensure a fair and effective public comment process, we ask that you consider the following guidelines when presenting your comments: Address the Planning Board directly. You must state your name and address before commenting. This is an opportunity to explain how you will be affected by the decision and why that is an important consequence. By state law, the Planning Board must consider only certain criteria when reviewing subdivisions (76-3-608(a), MCA). Please see the attached guidelines for the criterion. Thank you for participating!

8. **NEW BUSINESS:** (Agenda items new to this meeting).

a. Public Hearing and Recommendation. Transportation Alternatives Grant Program. Elyse Monat

Attachments
TA Scoring Criteria
TA Scoring Sheet
City of Billings TA application
Yellowstone County Application

b. Presentation and Board Discussion. Clearwater Estates Subdivision, 2nd Filing. The subdivision creates 69 lots for residential and commercial development. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned CMU1 -- Corridor Mixed Use 1, N2 - Mid-Century Neighborhood Residential, NX1 - Mixed Residential 1, NX2 - Mixed Residential 2.

Attachments
Findings of Fact
Proposed Plat
Draft SIA
Traffic Study

c. Presentation and Board Discussion. 44 West Subdivision. The subdivision creates 62 lots for residential and commercial development. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned NX2 -- Mixed Residential 2 (2 to 8 units) and NX1 Mixed Residential 1 (1 to 4 units).

Attachments
Findings of Fact
Proposed Plat
Draft SIA
Traffic Study

9. **OTHER BUSINESS:**

a. (Standing Item) Long Range Strategic Issues and an overview of future City and County issues and projects.

10. **ADJOURNMENT**

FUTURE AGENDA ITEMS

CITY/COUNTY PLANNING BOARD
City Council Chambers, 5th Floor
316 N 26th St, Billings MT

BILLINGS - YELLOWSTONE COUNTY
MPO
METROPOLITAN PLANNING ORGANIZATION

Public Hearing Participation Guidelines

All meetings and official activities of the MPO are held in buildings and locations that comply with accessibility standards according to the Americans with Disabilities Act (ADA). A TTY number for the hearing impaired, 406-657-3079, is available upon request. Special arrangements for participation in the public hearings by individuals with hearing, speech, or vision impairment may be made upon request at least three days prior to the hearing. Please notify the Planning Division Office, at 406-247-8610.

The County Planning Board welcomes public input on matters brought before the Board. To ensure a fair and effective public comment process, we ask that you consider the following guidelines when presenting your comments: **Address the Planning Board directly. You must state your name and address before commenting**. This is an opportunity to explain how you will be affected by the decision and why that is an important consequence. Be informed of the process and the requirements of the Board. If you are commenting about a subdivision, please limit your comments to the review criteria.

By state law, the Planning Board must consider only certain criteria when reviewing subdivisions (76-3-608(a), MCA). These criteria include: Effect on agriculture and agricultural water user facilities; Effect on local services; Effect on the natural environment; Effect on wildlife and wildlife habitat; Effect on public health and safety.

Provide specific information about why you are concerned about the pending application, how the decision will impact the review criteria listed above, and provide suggestions on how to minimize or eliminate the impact.

Respect the right of others to participate. Wait until the previous speaker has completed their comments before making your own comments. Do not talk over the person commenting or with other people in attendance.

The public hearing is not an opportunity to question or accuse the applicant or their agent. If you have questions of the Board, the applicant or the agent, ask questions directly to the Board during the public hearing portion of the meeting. The Board will respond or request the applicant or agent to respond after the public comment portion of the hearing is closed.

After the public comment portion of the hearing is closed, no further comments are allowed unless you are addressed directly by a Board member.

You should expect the Board to make a balanced recommendation in accordance with its statutory responsibilities. The Board's ability to make reasonable and thoughtful recommendations is dependent on a fair consideration of everyone's interests.

Thank you for participating.

Date:	05/13/2025
Title:	
Presented by:	
Department:	Planning & Community Services
Presentation:	

Information

RECOMMENDATION
MEETING MINUTES: April 8, 2025 & April 22, 2025

BACKGROUND (Consistency with Adopted Plans and Policies, if applicable)

ALTERNATIVES
City Council may:

- Approve; or,
- Not Approve

FISCAL EFFECTS

Attachments

Minutes of April 8, 2025
Minutes of April 22, 2025

CITY/COUNTY PLANNING BOARD

TUESDAY, April 8, 2025 at 6:00pm

	Position	01/14/2025	01/28/2025	02/11/2025	02/25/2025	03/11/2025	03/26/2025	04/08/2025	04/22/2025	05/13/2025	05/28/2025	06/10/2025	06/24/2027	07/08/2025	07/22/2025	08/12/2025	08/26/2025	09/09/2025	09/23/2025	10/14/2025	10/28/2025	11/12/2025	11/26652025	12/09/2025	12/23/2025
Jim Ronquillo	Billings Ward I	1	A	1	1	A	1	1																	
Roger Gravgaard **President**	Billings Ward II	1	1	1	1	1	1	1																	
Dennie Stephenson	Billings Ward III	1	1	1	1	1	1	1																	
John Staley **Vice President**	Billings Ward IV	V	1	1	1	1	1	1																	
David Nordel	Billings Ward V	A	V	V	A	V	A	1																	
Troy Boucher	YC District 1	A	A	A	A	A	A	A																	
Dennis Cook	YC District 2	A	1	1	1	1	1	1																	
Vacant	YC District 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vacant	YC District 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Woody Woods	YC District 5	1	1	1	1	1	1	1																	
Alexis Bonogofsky	YC District 6	1	1	V	1	V	1	1																	
Morgan Tuss	YC District 7	A	A	A	A	A	A	A																	
Vacant	YC Cons. District	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scott Reiter	Ex-Officio SD2	A	A	A	A	A	A	A																	

Please note: “A” stands for excused absence, “1” stands for present, “V” stands for Zoom participation, “C” stands for Canceled

Call the Meeting to Order: President Gravgaard called the meeting to order at 6:00 p.m.

Introduction of Planning Board Members and Planning Department Staff
President Gravgaard called for introductions of the members of the Planning Board and staff.

Attending Staff: Wyeth Friday, Planning & Community Services Director; Anna Vickers, Planning Division Manager; Lora Mattox, Transportation Planning Coordinator; Brenda Berns, Planning Clerk

1. Others in Attendance

2. Approval of Agenda

Motion
Motion made by Board member Staley, seconded by Board member Cook to approve the agenda as submitted. Motion passed unanimously.

3. Approval of Minutes: March 25, 2025

Motion
Motion by Board member Stephenson, seconded by Board member Woods to approve the minutes of March 25, 2025 as submitted. Motion passed unanimously.

4. Public Comment: As required (3 minutes maximum per person). Any member of the public might be heard on any subject that is not on the agenda. The Planning Board will not take any action on these items at this time but could choose to add an item to the next meeting agenda for discussion. There were no comments from the public.

5. Disclosure of Outside (Ex-Parte) Communication – There was none.

6. Disclosure of Conflicts of Interest – There was none.

7. Old Business – There was none.

a. Discussion. Recommendation. 2024-2028 Transportation Improvement Program (TIP) Amendment 2 - Lora Mattox, Transportation Planning Coordinator

Lora Mattox provided an update on the Transportation Improvement Program (TIP) Amendment 2. The TIP serves as the federal budget plan for transportation projects from 2024 to 2028, covering various funding categories such as urban dollars, congestion mitigation, carbon reduction, and transportation alternatives. The amendment process is a routine update that occurs frequently to incorporate new projects and adjust existing ones.

This amendment includes:

- Grand Avenue Reconstruction – Recently discussed and proposed for federal funding.
- King Avenue & 48th Street West Roundabout – Requested by MDT as a highway safety improvement project.
- Southern Riverfront Park Trail – Added as part of the Recreational Trails Program, for which funding was recently secured.

In addition to new projects, the amendment also reflects necessary modifications, including funding adjustments and schedule updates as projects progress. The TIP document must be revised regularly to ensure accuracy, which is why updates occur multiple times each year.

Transit Program Updates
Although Rusty Logan was not present, it was noted that the transit department must also update its portion of the TIP, as it receives significant grant funding. The specific program updates are highlighted in the TIP document attached to the staff report.

Review and Approval Schedule

- The TIP Amendment and Grand Avenue project will be presented to the City Council on Monday.
- The County has already approved both items earlier today.
- The Policy Coordinating Committee is scheduled to review the amendment on April 15th.

Questions

A board member inquired about the process by which a project is elevated to receive federal funding, using King Avenue and 48th Street West as an example. They expressed interest in understanding the criteria and decision-making involved in selecting projects for federal dollars.

Ms. Mattox offered clarification on the process, explaining that projects begin with a planning study, which includes safety assessments such as crash data analysis. If a project scores highly in these evaluations, it may be nominated—typically by the state—for inclusion in the Transportation Improvement Program (TIP), which qualifies it for federal funding.

For state-nominated projects, the Montana Department of Transportation (MDT) submits the proposal to the Metropolitan Planning Organization (MPO), which then incorporates it into the TIP. In contrast, projects nominated by the city—such as Grand Avenue—must first be added to the urban system to be eligible for federal funds. Once included, the nomination is submitted to the State and Highway Commission for final approval.

The discussion then shifted to specific intersections, including Blue Creek Road. The Planning Department noted that intersections must meet strict warrants for improvements, often requiring speed studies or intersection analyses. MDT has conducted speed studies in some locations, but further evaluation may be necessary to determine whether additional improvements are warranted and whether the project could qualify for federal funding in the future.

Motion

Motion made by Board member Stephenson, seconded by Board member Cook to recommend approval of 2024-2028 TIP Amendment 2. Motion passes unanimously.

b. Planning Board Training (Part II) – MPO Designation and Involvement –

Lora Mattox provided an overview of Metropolitan Planning Organizations (MPOs), explaining that an MPO is designated when a community's population exceeds 50,000. Billings, Great Falls, and Missoula were the original MPOs in Montana. After the latest census, Bozeman and the Helena-East Helena area also became MPOs, bringing the state's total to five. While this increase reflects Montana's growing population, it may impact the allocation of planning funds across existing MPOs. However, Billings has not faced funding shortages and has completed projects within its allocated resources.

The discussion covered key aspects of MPO boundaries:

- Urban Boundary: Defines the urbanized area based on census data, slightly different from city limits.
- Planning Boundary: Determines eligibility for federal funding, including urban and congestion mitigation funds.

Currently, the Billings MPO is staffed with a Transportation Planning Coordinator and a Transportation Planner, with plans to add a Multimodal Transportation Planner to support planning efforts for transit and non-motorized transportation.

The urban boundary has been updated, reflecting growth beyond the city limits, which affects eligibility for federal funding sources like urban and Congestion Mitigation and Air Quality (CMAQ) dollars. The update to the planning boundary is ongoing and is the first since 2016. Additionally, growth trends suggest that by the next census, the MPO could expand to include the Billings-Laurel area, prompting adjustments in governance and planning processes.

The transportation planning process is critical for securing federal funding. While some may feel these plans are not actively used, they are frequently updated and referenced. The Long-Range Transportation Plan (LRTP), which spans at least 20 years, is the foundational document that includes traffic modeling and growth projections to identify priority projects. The latest update (2023) identifies over $1 billion in transportation projects, all of which are fiscally constrained, with projected funding availability by 2045.

The approval process for projects involves multiple stages:

1. Technical Advisory Committee (TAC): Provides technical input and recommendations.
2. Governing Bodies Review: City and county officials review recommendations and offer feedback.
3. Policy Coordinating Committee (PCC): The final decision-making body, consisting of key local and state officials, approves the plans.

This multi-step review process can take up to two months, though efforts are underway to streamline it, especially for amendments to the Transportation Improvement Program (TIP).

Key Planning Documents:

- Long-Range Transportation Plan (LRTP): Updated every five years, covering a 20-year outlook.
- Transportation Improvement Program (TIP): Outlines the construction budget for projects.
- Unified Planning Work Program (UPWP): Details staffing and funding for MPO operations and planning efforts.
- Other Plans & Studies: Includes pedestrian and bikeway plans, underpass studies, and public participation efforts.

The Planning Department provided an overview of the various transportation system designations within the Metropolitan Planning Organization (MPO), ranging from national highways to local roads. They shared funding allocations for transportation projects, noting that urban and federal construction funds are distributed annually. A significant portion of recent funding has been allocated to the Billings Bypass project, impacting the ability to fund other city projects.

There was discussion on the long-term financial planning required for major road projects, such as Grand Avenue, which has an estimated cost of $28 million. Given the annual funding levels, it takes several years to accumulate the necessary resources. Past projects such as Bench Boulevard and Skyline Trail were highlighted, and the increasing cost of the Billings Bypass was acknowledged.

The conversation then shifted to the boundaries of the MPO and how they are determined. Urban planning boundaries are primarily set by the Federal Highway Administration and the Census Bureau, with updates occurring every ten years following the census. Adjustments can be made in response to significant growth or development. The Planning Department works with state and federal agencies to ensure the boundaries align with urban expansion and funding eligibility.

Specific areas, such as Blue Creek and Briarwood, were discussed in relation to urban designation and potential future annexation. It was noted that while annexation can occur through city processes, adjustments to the MPO boundary require census-based changes.

The department provided an update on the boundaries of the Metropolitan Planning Organization (MPO), explaining how recent expansions were based on census data. The next census, slated for 2030, could potentially alter the MPO's boundaries, particularly in growing areas such as the West End, which could eventually push the boundary further westward.

A key point of discussion was the potential integration of Laurel into the MPO. While this would not immediately push the population to the threshold for becoming a Transportation Management Area (TMA), it could lead to an increase in federal funding for transportation projects. The integration of Laurel would also bring their projects into the MPO's planning process, which could result in quicker project prioritization for the area.

The meeting then shifted to the MPO’s process for developing its transportation plans.

The Planning Department explained that the board's involvement in these plans is generally limited to reviewing completed documents. However, opportunities for input begin early in the planning process, starting with the Unified Planning Work Program (UPWP), which sets the yearly agenda for transportation planning.

A significant change discussed was the shift in responsibility for managing the MPO's planning process. Following the implementation of the Montana Land Use Planning Act, the MPO will be transitioning from the current Planning Board structure to the Transportation Policy Coordinating Committee. This change will streamline decision-making by moving the responsibility from multiple boards to a more focused, direct governing committee.

The makeup of the new PCC was also discussed. The committee would likely include representatives from the city and county governments, the mayor, public works departments, and other relevant agencies, expanding the number of members from the current configuration. The goal of this restructuring is to ensure a more efficient and collaborative approach to transportation planning.

Subdivision Regulations and Planning Process – Anna Vickers, Planning Division Manager

Anna Vickers opened by outlining the Planning Department's responsibilities, which include both short- and long-term planning efforts such as annexation, zoning, and subdivision reviews, along with broader neighborhood and transportation planning. A newly established Neighborhood Planner position will now focus specifically on neighborhood plans. Transportation planning continues to be coordinated through the Metropolitan Planning Organization (MPO).

Land use planning, she explained, is a layered process that begins well before the review stage. One area the department emphasized was the update to subdivision regulations—particularly those modified after City Council approval, which hadn't been previously reviewed by the group. These updates are intended to streamline development processes and promote consistency, especially in support of affordable housing, an ongoing priority in Billings. The department has even been recognized by peer jurisdictions for its efficiency in managing these processes.

The planning and development process typically begins with a pre-application meeting. Developers present preliminary plans that may involve significant investments in surveys, site layouts, and groundwater assessments. These meetings bring together departments such as fire, engineering, public works, and planning, to collaboratively address issues like parkland dedication, road layout, and site design. This early coordination helps identify and resolve potential challenges upfront.

Among the more notable updates to subdivision regulations is the incorporation of block size standards directly into subdivision design, aligning them with zoning code requirements. Other significant changes include new limitations on cul-de-sacs—restricting them to no more than 20% of total road miles to improve connectivity and emergency access—and a new requirement for streetlights in all residential subdivisions. These lights must not exceed 25 feet in height, and developers must comply with standards for brightness and spacing to enhance safety and reduce crime.

The department also revised standards for road widths. The default width for residential streets is 34 feet, but there is new flexibility to reduce that size under certain conditions.

These exceptions aim to lower upfront development costs while maintaining safety. For example, a 24-foot width may be allowed in golf course areas where on-street parking isn't needed. In low-traffic zones, roads may be narrowed to 31 feet with parking on both sides, assuming emergency access remains intact. For areas with development on only one side, like those next to a drainage ditch, a 29-foot width could suffice with parking on one side only. These adjustments can significantly reduce construction costs, savings that ideally benefit future homeowners.

Board members, however, raised concerns about the potential safety impacts of narrower roads. Examples were cited from the Heights, where on-street parking on narrow roads causes congestion and limits access, especially for larger vehicles. While the intent is to cut costs, the board stressed that public safety must remain a top priority, particularly when considering emergency response capabilities.

The Planning Department responded by emphasizing the importance of balance by reducing unnecessary paving and long-term maintenance costs while preserving safety and functionality. As newly constructed roads fall under the city's long-term maintenance responsibility, minimizing excess asphalt also supports stormwater management and sustainability goals.

Attention then turned to potential regulatory gaps when county developments are later annexed into the city. Differences in standards—such as road widths and sidewalk requirements—can result in expensive upgrades for residents and infrastructure inconsistencies for the city. Historical references were made to the former "donut rule," which once allowed the city to apply its standards within a 3.5-mile radius to prevent these mismatches. Past developments, like those in Blue Creek, continue to present infrastructure challenges due to initial planning under less strict county rules.

The discussion reaffirmed the need for collaborative, forward-looking planning to avoid repeating these issues. Developers must consider that areas built today could be annexed in 15 to 20 years. The goal is to ensure the infrastructure they leave behind is sustainable and safe for the long term. The board shared concerns about past developments where corner-cutting led to narrow roads and inadequate parking—problems still unresolved decades later.

There was agreement that more coordination is needed between city and county planning, especially when annexation is likely. The department pointed to areas like Bell street, where sidewalks are inconsistent and parking enforcement is weak, as examples of the challenges that emerge without unified planning.

Looking ahead, the board emphasized the importance of maintaining dialogue and providing input to influence how regulations evolve. Even though changes ultimately go through legislative processes, feedback from the Planning Board can make a meaningful impact. Past successes—such as integrating sidewalk requirements into zoning rules—were achieved through this collaborative approach.

Finally, the Planning Department reiterated that while it works within existing standards, flexibility is sometimes necessary. Adjustments, like cash-in-lieu options for parkland, are guided by context and available resources. But throughout the planning process, the core mission remains: to balance development needs with long-term public safety, sustainability, and infrastructure integrity.

8. New Business

9. Other Business.

Wyeth Friday, Planning & Community Services Director advised the board of the Open House on the 2-Way Street Conversion on Thursday, April 10, 2025 from 4:00 – 6:00pm.

10. Future Agenda Items

ADJOURNMENT: 7:54 PM

Brenda J Berns, Planning Clerk.

CITY/COUNTY PLANNING BOARD

TUESDAY, April 22, 2025 at 6:00pm

	Position	01/14/2025	01/28/2025	02/11/2025	02/25/2025	03/11/2025	03/26520025	04/082025	04/22/2025	05/13/2025	05/28/2025	06/10/2025	06/24/2027	07/08/2025	07/22/2025	08/12/2025	08/26/2025	09/09/2025	09/23/2025	10/14/2025	10/28/2025	11/12/2025	11/26520025	12/09/2025	12/23/2025
Jim Ronquillo	Billings Ward I	1	A	1	1	A	1	1	1																
Roger Gravgaard **President**	Billings Ward II	1	1	1	1	1	1	1	1																
Dennie Stephenson	Billings Ward III	1	1	1	1	1	1	1	1																
John Staley **Vice President**	Billings Ward IV	V	1	1	1	1	1	1	1																
David Nordel	Billings Ward V	A	V	V	A	V	A	1	V																
Troy Boucher	YC District 1	A	A	A	A	A	A	A	A																
Dennis Cook	YC District 2	A	1	1	1	1	1	1	1																
Vacant	YC District 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vacant	YC District 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Woody Woods	YC District 5	1	1	1	1	1	1	1	A																
Alexis Bonogofsky	YC District 6	1	1	V	1	V	1	1	1																
Morgan Tuss	YC District 7	A	A	A	A	A	A	A	A																
Vacant	YC Cons. District	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scott Reiter	Ex-Officio SD2	A	A	A	A	A	A	A	A																

Please note: “A” stands for excused absence, “1” stands for present, “V” stands for Zoom participation, “C” stands for Canceled

Call the Meeting to Order: President Gravgaard called the meeting to order at 6:00 p.m.

Introduction of Planning Board Members and Planning Department Staff
President Gravgaard called for introductions of the members of the Planning Board and staff.

Attending Staff: Wyeth Friday, Planning & Community Services Director; Anna Vickers, Planning Division Manager; Lora Mattox, Transportation Planning Coordinator; Brenda Berns, Planning Clerk

1. Others in Attendance: Mac Fogelsong, Engineering Department Manager

2. Approval of Agenda

Motion
Motion made by Board member Stephenson, seconded by Board member Bonogofsky to approve the agenda as submitted. Motion passed unanimously.

3. Approval of Minutes: April 8, 2025 Delayed

4. Public Comment: As required (3 minutes maximum per person). Any member of the public might be heard on any subject that is not on the agenda. The Planning Board will not take any action on these items at this time but could choose to add an item to the next meeting agenda for discussion. There were no comments from the public.

5. Disclosure of Outside (Ex-Parte) Communication – There was none.

6. Disclosure of Conflicts of Interest – There was none.

7. Old Business – There was none.

a. Public Hearing and Recommendation. FY25 Unified Planning Work Program (UPWP) Amendment 1- Lora Mattox, Transportation Planning Coordinator

Lora Mattox gave an overview of the background for the Unified Planning Work Program (UPWP).

The UPWP is a key transportation planning document for the Billings metropolitan area. Developed by the Billings Metropolitan Planning Organization (MPO), in coordination with local, state, and federal agencies. The purpose is to outline transportation planning activities and identify planning tasks, funding sources, and study schedules.

Focus areas include roadways, public transit, bicycle and pedestrian infrastructure, and overall transportation system improvements with adherence to federal transportation planning requirements.

The UPWP is amended periodically to reflect changes in project scope, funding allocations, and scheduling, ensuring alignment with evolving priorities.

The FY25 amendment includes updates detailed in Elements 302 and 700, focusing on both project scope and financial adjustments. One key change involves shifting the original plan to issue an RFP for a bike and scooter share program toward a new focus—redirecting resources to conduct an economic analysis of the City's Complete Streets initiatives. This shift follows the MPO's established transportation planning process, which includes public participation and review opportunities. The purpose of the economic analysis is to support data-driven transportation planning, guide investment decisions, and inform policy development, with the goal of creating a more efficient, sustainable, and economically sound transportation network.

Questions

Board member Ronquillo raised a question about the use of electric bikes on sidewalks after observing one in use. Staff acknowledged that electric bikes are an emerging issue and noted that the city currently has no specific regulations in place. Since they are not classified as motorized vehicles, their use is generally unrestricted, which raises concerns—particularly on public lands. Speed may factor into future considerations. While no enforcement or regulatory action has been taken yet, it is recognized as an issue that will need to be addressed.

President Gravgaard opened the public hearing. There were no members of the public, the public hearing was closed.

Motion

Motion made by Board member Staley, seconded by Board member Stephenson to recommend approval of 2024-2028 TIP Amendment. Motion passes unanimously.

New Business:

a Presentation and Board Discussion. Curb Cut Ordinance Amendments – Mac Fogelsong, City Engineer

Mr. Fogelsong reported that the team is reviewing proposed amendments to the city's curb cut ordinance and site development standards. The goal is to align the codes with recent regulatory changes. He noted they are also addressing inconsistencies between traffic study requirements and subdivision regulations.

Mr. Fogelsong stated there were inconsistencies between traffic studies for sites and subdivisions, particularly regarding curb cuts on residential streets, which were previously inflexible. The requirement for site surfacing (paving) was eliminated with Re-Code but has since been reintroduced for site development. Subdivision regulations now serve as the reference point for traffic studies, private street development, and improving flexibility in residential access.

The City retains the authority to limit access along collector and arterial roads. Parking over sidewalks remains prohibited where driveways are shorter than 20 feet.

Administrative relief has been added to address various issues. To ensure consistency between subdivision and site development, traffic accessibility studies now follow the same three-tier structure outlined in the subdivision regulations, with a refresh required for studies older than 10 years. A change was made to clarify that site-specific traffic studies are no longer responsible for pre-existing traffic conditions. There was productive discussion around the frequency and spacing of curb cuts, and a previous zoning conflict regarding curb cut width has been resolved. Concerns related to private streets, such as the costs associated with sidewalks and streetlights, were also addressed.

Questions

The board had a broad discussion on sidewalks, safety, and private streets. Questions were raised about whether sidewalk dimensions are specified, with clarification that standard sizes are already established through subdivision regulations based on street and subdivision type. There was interest in potentially adding restrictions related to sidewalks and streetlights. Concerns about pedestrian safety in neighborhoods without sidewalks were shared, emphasizing the broader implications beyond individual cases. The topic of Crime Prevention Through Environmental Design (CPTED) was introduced and supported. Clarification was also provided that proposed changes would not apply retroactively. The conversation turned to the definition of private streets, highlighting the importance of distinguishing them from driveways and parking lots, with maintenance responsibilities typically falling to homeowners or homeowner associations.

The board engaged in a wide-ranging discussion on the requirements for private streets, weighing whether to simply reference street width or to mandate additional elements such as sidewalks and streetlights. Concerns were raised about consistency and the challenge of maintaining other standards when exceptions are allowed. There was strong sentiment that private streets should match public streets in width, especially for safety and emergency access.

Some members emphasized the need for sidewalks and lighting, citing safety, crime prevention, and long-term neighborhood livability. Personal experiences and examples were shared, including the positive impact of lighting on crime reduction and pedestrian safety. While there was general agreement on the value of sidewalks and streetlights, questions were raised about the costs and who would bear them—developers, homeowners, or through assistance programs.

There was also discussion about enforcement and consistency. Some members noted that developers often find ways around sidewalk requirements, and there was a desire for more uniform application of standards between city and county developments.

The group emphasized the importance of ensuring that materials and designs for private streets adhere to subdivision regulations, with homeowners' associations typically responsible for maintenance. Ultimately, the conversation reflected a shared goal of improving safety and consistency across both public and private developments, while recognizing the practical and financial challenges involved.

Mr. Fogelsong stated the issue will be presented before City Council on May 27, 2025

9. Other Business.

Wyeth Friday, the Planning & Community Services Director expressed appreciation to board member Alexis Bonogofsky for suggesting the inclusion of the Planning Board jurisdiction map. He noted that staff are currently working with the county GIS department to update the map and post it on the website. He also mentioned that Monica Plecker, Yellowstone County Public Works Director, will be attending a future meeting to discuss county parks.

Questions
The board held a general discussion covering legislative updates, bike trail planning, and parkland dedication.

Staff noted that several legislative items are being tracked, including changes to residential parking requirements, such as the removal of mandates for assisted living facilities and daycares. Other proposed legislation involves building heights, agricultural lot development without subdivision review, and new parking standards for accessory dwelling units. These items are currently in the interim phase and will be finalized later. The board also discussed the status of bike trail planning. While a 2017 plan remains in place, an updated version proposed for 2025 was not adopted due to concerns raised about long-term maintenance costs. The city is continuing to work on standardizing development and transportation planning efforts.

Concerns were raised about parkland dedication, with some members noting that developers often choose cash in lieu of providing actual park space. Staff explained that although there are no anticipated changes at the state level, local policies require review of usable park space, and when parkland is dedicated, a funding mechanism such as a parkland district must be established for maintenance. The discussion highlighted the importance of balancing development with community amenities like trails, parks, and infrastructure.

a. (Standing Item) Long Range Strategic Issues and an overview of future City and County issues and projects.

10. Future Agenda Items

ADJOURNMENT: 7:54 PM

Brenda J Berns, Planning Clerk

Planning Board

Date:	05/13/2025
Title:	Public Hearing and Recommendation for Transportation Alternatives Grant Funding
Presented by:	Elyse Monat
Department:	Planning & Community Services
Presentation:	Yes

Information

RECOMMENDATION

Staff recommends the Planning Board review the submitted Transportation Alternatives (TA) applications, conduct a public hearing, consider testimony from the public, and recommend funding for the two received TA applications to the PCC.

BACKGROUND (Consistency with Adopted Plans and Policies, if applicable)

The Transportation Alternatives Program (TA) is a set-aside program from the Surface Transportation Block Grant (STBG) program. Eligible uses of the funds include projects and activities that were previously eligible under the Transportation Alternatives Program under the Moving Ahead for Progress in the 21st Century Act (MAP-21). This includes a variety of pedestrian and bicycle facilities, recreational trails, safe routes to school projects, and other community improvement projects. Billings Metropolitan Planning Organization (MPO) TA Instructions enclosed in this report has details for eligible projects. The Billings MPO has been allocated $1,784,111 in Transportation Alternative Funds in 2025.

The Bipartisan Infrastructure Law (BIL) allows for MPOs to administer their own competitive application process with approval and oversight from the Montana Department of Transportation (MDT).

Projects submitted must meet Federal and State guidelines for eligibility and must identify a local, Federal or State sponsoring agency. Private individuals and organizations may recommend a project if the project is sponsored by the government agency in which the project is located. Examples of a sponsoring agency may include, but are not limited to, City, County, Tribal, etc.

The MPO received two eligible applications for the Transportation Alternatives funds. The applications included:

- City of Billings Safe Routes to School 2025 TA sponsored by the City of Billings
  - Total Project Cost: $1,485,179.04
  - Federal TA Request: $1,285,868.01
  - Local Matching Funds: $199,311.03
- Johnson Lane Sidewalk Connector Project sponsored by Yellowstone County via the Lockwood Pedestrian Safety District
  - Total Project Cost: $296,000.00
  - Federal TA Request: $256,276.80
  - Local Matching Funds: $39,723.20

Together, these two projects request a total of $1,542,144.81 in federal TA funds, which is less than the $1,784,111 in funds the MPO has available. As a result, if the projects rank high enough, both projects could be funded with the available funding.

The Technical Advisory Committee (TAC) is responsible for evaluating and scoring Transportation Alternatives (TA) applications. The scores from TAC will be translated into a list of recommended projects and sent to the Policy Coordinating Committee (PCC) for final decision. While the TAC had not met (meeting on 5/8) by the time this Planning Board memo was due, staff will share the results of the scoring from TAC at the Planning Board meeting.

The MPO will present the list of the recommended projects to the local governing bodies that make up the Policy Coordinating Committee (PCC). The PCC is made up of a representative of the Billings City Council, Yellowstone County Commissioners, Billings-Yellowstone County Planning Board and MDT. Each entity will review the projects recommended by TAC and can either approve the recommendation and forward to PCC or take a different action and forward that onto PCC. PCC will take into consideration each recommendation and make the final decision on which applications to fund.

The following procedure will be used by the MPO and review Committee (TAC) for the scoring and selection of TA projects:

1. At the outset of the scoring process, all applicants will be screened for eligibility by the local TA Coordinator. Projects that do not meet the eligibility requirements will be identified and marked as ineligible. Reason(s) for ineligibility will

be noted and the applicant informed. The ineligible project will not move forward in the scoring process.
2. Individual members of the Committee will score each application independently prior to the selection committee meetings. Scoring will be based on a total of 100 points, 10 points for Project Description, 45 points for Project Benefits and 45 points for Project Risk Analysis. The TA Coordinator will review the scores and provide an average ranking based on individual scores.
3. The Committee will convene as often as necessary to come to a consensus. Each member can adjust their score based on discussion with the Committee.
4. For each application, all final individual member scores will be added together and averaged to arrive at the final total application score.
5. After being scored, applications will be entered into a ranked list and the Committee will develop the final list of selected projects to recommend to PCC. Recommended projects will be selected up to the amount available to the MPO, less any amount the MPO would like to reserve for project cost increases.
6. After the PCC approves, the MPO TA Coordinator will then share the list of the PCC approved TA projects from the MPO to the MDT TA Program Manager for MDT approval and subsequently Transportation Commission approval.

STAKEHOLDERS

MPO staff will share the rankings from the TAC at the Planning Board meeting as TAC had not yet met at the time this memo was due. Ultimately, the traveling public within the MPO Urban Area will all benefit from the TA projects as they will add safety and access for many pedestrians, school students and others to safely navigate the transportation corridors in the MPO area.

ALTERNATIVES

Planning Board may:

- Forward a recommendation of approval of the Transportation Alternatives grant applications to the PCC
- Not forward a recommendation of approval of the Transportation Alternatives grant applications to the PCC
- Forward an alternate funding option for the applications

FISCAL EFFECTS

If both applications are approved, $1,542,144.81 in TA funds will be allocated. TA funds are generally for non-motorized transportation projects, so this would be an appropriate use of these funds.

- $199,311.03 in match for the City of Billings Safe Routes to School 2025 TA project will come from the City's annual Safe Routes to School budget allocation.
- $39,723.20 in matching funds for the Johnson Lane Sidewalk Connector Project will come from the Lockwood Pedestrian Safety District's funds.

Attachments

TA Scoring Criteria
TA Scoring Sheet
City of Billings TA application
Yellowstone County Application

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Transportation Alternative Project Review Criteria and Process

The Technical Advisory Committee (Committee) is responsible for evaluating and scoring Transportation Alternatives (TA) applications. The scores from TAC will be translated into a list of recommended projects.

The MPO will present the list of the recommended projects to the local governing bodies that make up the Policy Coordinating Committee (PCC). The PCC is made up of a representative of the Billings City Council, Yellowstone County Commissioners, Billings-Yellowstone County Planning Board and MDT. Each entity will review the projects recommended by TAC and can either approve that recommendation and forward to PCC or take a different action and forward that onto PCC. PCC will take into consideration each recommendation and make the final decision on which applications to fund.

The following procedure will be used by the MPO and review Committee for the scoring and selection of TA projects:

1. At the outset of the scoring process, all applicants will be screened for eligibility by the local TA Coordinator. Projects that do not meet the eligibility requirements will be identified and marked as ineligible. Reason(s) for ineligibility will be noted and the applicant informed. The ineligible project will not move forward in the scoring process.

2. Individual members of the Committee will score each application independently prior to the selection committee meetings. Scoring will be based on a total of 100 points, 10 points for Project Description, 45 points for Project Benefits and 45 points for Project Risk Analysis. The TA Coordinator will review the scores and provide an average ranking based on individual scores.

3. The Committee will convene as often as necessary to come to a consensus. Each member can adjust their score based on discussion with the Committee.

4. For each application, all final individual member scores will be added together and averaged to arrive at the final total application score.

5. After scored, application will be entered into a ranked list and the Committee will develop the final list of selected projects to recommend to PCC. Recommended projects will be selected up to the amount available to the MPO, less any amount the MPO would like to reserve for project cost increases.

6. After the PCC approves, the MPO TA Coordinator will then share the list of the PCC approved TA projects from the MPO to the MDT TA Program Manager for MDT approval and subsequently Transportation Commission approval.

For Scorer Reference

Billings Metropolitan Planning Organization (MPO)
Transportation Alternatives (TA) Program
2025 Instructions

Instructions:

Completed applications must be received by: **Wednesday, April 9, 2025 – 5:00 pm**

MPO contact for questions: Lora Mattox, TA Coordinator
406-247-8622
mattoxl@billingsmt.gov

Applications must be submitted on the PDF application form provided on the MPO TA Program website https://billingsmt.gov/3095/Transportation-Alternatives-Program .

Submit one (1) electronic version of the application to: mattoxl@billingsmt.gov. Hard copy applications will not be accepted.

The MPO reserves the right to remove a project from further consideration should any of the following occur during the scoring process:

- The project receives a score of less than 20 in either "Project Benefits" or "Project Risk Analysis" sections;
- A fatal flaw is identified. For example: incomplete applications, no project sponsor, project not identified in locally adopted plan or study, lack of maintenance plan, substantial right-of-way, utility or environmental impact, etc.

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Application must be submitted on the PDF application form provided on the MPO TA website.

Below are the instructions for completing TA Applications.

1. <u>Project Name</u>

Provide the name of the project as it is locally known.

2. <u>Local Entity Sponsor (Project Sponsor)</u>

Provide the name of the local entity that is nominating the project as the Project Sponsor (i.e. City, County, Tribal Government, etc.).

3. <u>Project Contact (name, title, address, phone number(s), email</u>

Provide the name, title, address, phone number, and email address of the main point of contact for the Project Sponsor. Please note that the project contact must be an employee or elected official representing the Project Sponsor.

4. <u>Estimated Total Project Cost</u>

Fill out the cost estimate table in the application. Be sure to double check that the numbers add up in each of the rows and columns. Project cost does not affect the scoring of the application, but it is used to determine fundability and compliance with funding distribution. The minimum total cost of the TA project must be at least $250,000. The TA fund will provide up to 86.58% of the total project cost. A local match of at least 13.42% of the total project cost is required. The estimated cost should be as accurate as possible, be developed using industry-accepted project estimating techniques and broken down as follows:

a. Construction (CN) – this is the cost to construct or build the project.

b. Preliminary Engineering (PE) – this is the cost to design the project and either the local entities or MDT's management of the project. PE costs at 35% of Construction has been the average of TA projects and is a good starting point for estimating.

c. Construction Engineering (CE) – this is the cost to inspect and administer the projects while it is being constructed. CE costs at 25% of Construction has been the average of TA projects and is a good starting point for estimating.

d. Right-of-Way (RW) – cost to purchase construction permits, easements, and right-of-way (if applicable).

e. Utility Costs (IC) – cost to relocated utilities (if applicable).
f. Total – total of the above sections.

Example of the methodology used to fill out the cost estimate table:

The MPO recommends starting by estimating the construction cost. This is the estimated construction contract award amount (bid amount) submitted by a contractor (once the project is ready to bid). It is recommended that applicants work with an engineer who has experience in estimating construction cost for the type of project being applied for. ***The more detailed and accurate the cost breakdown estimate is, the better.*** Detailed breakdown of the cost estimate for construction can be attached to the application in the Appendix section.

Below is an example on filling out the cost estimate table to include construction cost estimate, MDT's required indirect cost rate (IDC), contingency, inflation, and local match.

For example, the estimated construction cost of a project is $400,000, this is the amount that would be paid to the contractor to complete construction. It is advised to add a minimum of a 30% contingency. $400,000 x 1.30 (30% contingency) = $520,000. Adding an inflation amount of 4% per year from time of application to anticipated construction can also be added. Then we need to account for the MDT IDC which is currently 11.32%. In addition, when MDT has applicable costs on Local Agency Guidelines (LAG) projects, MDT is required to collect indirect costs associated with project development in the amount of 11.32%. Please take these into account when developing the project budget. So, we take the $520,000 x 1.1132 (IDC rate) = $640,860. An extra (optional) step at this point would be to round up to an even number which effectively will add in extra contingency. So, we will round this up to $650,000.

As described above, to calculate Preliminary and Construction Engineering (PE/CE), a good starting point for PE cost has been 35% of Construction and CE on average has been 25% of Construction. To calculate the PE amount, multiply $650,000 by 0.35 (35% for PE) = $227,500. To calculate the CE amount, multiply $600,000 by 0.25 (25% for CE) = $162,500.

Assuming no RW or IC phases, the last step is to distribute the costs between the TA and local match columns. The TA amount is the Federal Share which is 86.58% of the total cost and the local match is 13.42% of the total cost. To determine the cost split, start by talking the total costs for each phase and multiplying by 0.8658 (86.58%) and then filling in the TA column. Then take the total costs and multiply by 0.1342 (13.42%) to fill in the match column. Round to the nearest dollar. Continue this for each phase of the project and complete the table.

If the sponsoring entity wishes to pay additional funding above the required match, place this amount in the Additional Contribution column.

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5. Project Administration

Please provide information regarding which entity is proposed to administer the project. Is this project going to be administered as a local (LAG) project or are you requesting MDT to administer the project. If requesting MDT administration, please explain.

6. Project Description (10 points)

Describe the overall project. What is being proposed? Why is the project being proposed? How does this project fill a local need? Where is the project located? Maps and photos can be attached and included in the Appendix. Provide as much detail as possible, for example, if a shared-use path is being proposed, include surfacing type, width, slope information, drainage issues, whether curb and gutter is proposed, if pathway is adjacent to a roadway, if so, what is the clearance/distance from the road. Describe if the project will impact driveways, parking lots, roadway ditches, etc.

7. Project Eligibility

Describe how the project is eligible under TA and cite the eligible category. Eligible categories include:

a. Construction, planning, and design of on-road and off-road trail facilities for pedestrians, bicyclists, and other nonmotorized forms of transportation, including sidewalks, bicycle infrastructure, pedestrian and bicycle signals, traffic calming techniques, and transportation projects that achieve compliance with the Americans with Disabilities Act of 1990.

b. Construction, planning, and design of infrastructure-related projects and systems that will provide safe routes for non-drivers, including children, older adults, and individuals with disabilities to access daily needs.

c. Conversion and use of abandoned railroad corridors for trails for pedestrians, bicyclists, or other nonmotorized transportation users.

d. Construction of turnouts, overlooks, and viewing areas in conjunction with nonmotorized facilities.

e. Historic preservation and rehabilitation of historic transportation facilities.

f. Safe Routes to School Projects. Projects must be identified in a locally, adopted Safe Routes to School Plan.

g. Pavement preservation projects of facilities previously funded through the Community Transportation Enhancement or Transportation Alternatives Program.

In addition, discuss the project's consistency with local transportation plans or other locally adopted community plans or studies.

8. <u>Project Benefits (45 points)</u>

Emphasis should be added to the following sections:

a. Safety: Describe how the project improves public safety and how it addresses existing safety concerns. What are the safety benefits of the project?

b. Accessibility: Describe how the project improves the accessibility of the transportation system for all users and meets requirement of the Americans with Disabilities Act (ADA).

Connectivity: Discuss how the project will improve or create linkages/connectivity to bicycle and pedestrian facilities. Include discussions on the proximity to the existing transportation system and how the termini, or ends of the project, are logical and fit within the local system.

9. <u>Risk Analysis (45 points)</u>

This section should represent the Sponsor's understanding of the risks associated with the project, as well as how these risks will be mitigated.

a. Budget: Describe how the construction budget was developed. A thorough and accurate budget is critical to the application and will be scored accordingly. A detailed construction cost estimate can be attached in the Appendix.

b. Matching Funds: A match by the local entity is required for local TA projects. No soft or in-kind matches are permitted; cash match only. The local match is 13.42%. In addition, when MDT has applicable costs on Local Agency Guidelines (LAG) projects, MDT is required to collect indirect costs associated with project development in the amount of 11.32%. Please take these into account when developing the project budget.

State whether or not local matching funds are already in-hand and committed.

c. Project Ownership and Maintenance: The local sponsor is responsible for project maintenance, including projects located within MDT right-of-way. Describe who will be responsible for operation and maintenance of the completed project. What is the plan to ensure maintenance is performed in a timely and adequate manner? Maintenance may include sweeping, snow removal, crack sealing on asphalt surfacing, and other activities necessary for public use and safety. Does the local project sponsor have the equipment, personnel, and maintenance budget necessary accomplish this additional maintenance?

d. Project Right-of-Way and Railroad: Describe the status of right-of-way for the project. Discuss whether the right-of-way is secured and free of conflicts. Are there challenging elements within the right-of-way? Extreme cut, fill or narrow slopes. Additionally, does the project have railroad involvement? Does the project either cross or parallel a railroad corridor? Describe the communication and outreach done with the railroad company. Are they agreeable to the project? Are easements needed and/or secured from the railroad to facilitate the project?

e. Project Utility Impacts: Describe any utility impacts related to the project and the means and methods used to determine the utilities status. Describe if necessary, the utilities that are impacted, what contact was made with the utility owner, discuss the plan for dealing with known and unknown utilities.

10. Appendix

Please limit attachments to only those necessary and relevant. Do not attach plans, links to the plan is acceptable. Relevant items to include in the Appendix: project location maps, on-site photos, drawing/sketches of proposed project (can include cross sections if available), plats or plan that demonstrated project right-of-way/easement widths, detailed cost estimates for construction and other phases and letters of support.

11. Finalize the Application

Please print the application, sign and date and combine application with all attachments and submit via email to Lora Mattox, TA Coordinator at mattoxl@billingsmt.gov .

BILLINGS MPO TRANSPORTATION ALTERNATIVE PROJECT SCORING SHEET

Please review the two applications that have been submitted for the Billings MPO Transportation Alternatives Program. Score based on the criteria listed below.

- Project Description (see Section 5 of TA Instructions for Reference) (0-10 Points)
- Project Benefits (Section 7 of TA Instructions for Reference) (0-45 Points)
- Risk Analysis (Section 8 of TA Instructions for Reference) (0-45 Points)

Score up to maximum points allowed

TA Project Application Name	**Project Description 10 pts**	**Project Benefits 45 pts**	**Risk Analysis 45 pts**	**TOTAL Points**
City of Billings Safe Routes to School 2025 TA				
Johnson Lane Sidewalk Connector Project				

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Billings Metropolitan Planning Organization (MPO)
Transportation Alternatives (TA) Program
2025 Project Application

Review the **instructions** prior to filling out this application for a Capital Improvement Project. Fill in all the sections and do not leave any blank.

1. Project Name: City of Billings Safe Routes to School 2025 TA

2. Project Sponsor: City of Billings

3. Project Contact: Mac Fogelsong, PE

City Engineer, City of Billings, 316 North 26th, 5th Floor, Billings MT 59101

fogelsongm@billingsmt.gov; 406-657-8232

4. Project Cost Estimate

	Total Cost of Phase	Federal/State Funds Share (TA) 86.58%	Local Matching Funds 13.42%	Additional Contribution
Preliminary Engineering (PE)	**$164,929.52**	**$142,795.88**	**$22,133.54**	
PE Local (100%)	**$164,929.52**	**$142,795.88**	**$22,133.54**	
Construction (CN)	**$1,210,296.50**	**$1,047,874.71**	**$162,421.79**	
Construction Engineering (CE)	**$109,953.02**	**$95,197.32**	**$14,755.69**	
CE Local (100%)	**$109,953.02**	**$95,197.32**	**$14,755.69**	
Right-of-Way (RW)	**$0.00**	**$0.00**	**$0.00**	
RW Local	**$0.00**	**$0.00**	**$0.00**	

	Total Cost of Phase	Federal/State Funds Share (TA) 86.58%	Local Matching Funds 13.42%	Additional Contribution
Incidental Construction (Utility involvement) (IC)	**$0.00**	**$0.00**	**$0.00**	
Total	**$1,485,179.04**	**$1,285,868.01**	**$199,311.03**	

As a reminder, the cost split between Federal Share TA and Matching funds is 86.58% Federal Share TA and 13.42% Match

5. Project Administration: Please provide information regarding which entity is proposed to administer the project. Is this project going to be administered as a local (LAG) project or are you requesting MDT to administer the project. If requesting MDT administration, please explain.

The City of Billings will administer the project as a local (LAG) project, through the Engineering Division.

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6. Description of Project (10 points):

The 2025 Safe Routes to School TA application will complete high priority projects from a large list of remaining Safe Routes to school projects totaling about $25,000,000. This funding would accelerate the completion of the projects that are first and foremost safety-based for school children and pedestrians.

Seven project focus areas are proposed that are recommended in the Safe Routes to School Plans, Phase I and Phase II:

- Jackson Street Pedestrian Crossings and Curb Extensions (Bulb-outs)
- Riverside School Zone Improvements
- South Billings Boulevard School Crossing and Pedestrian Refuge Island
- Governors Boulevard Intersection Improvements for Castlerock School
- Central Avenue and 24th Street West--High Visibility Crossing and Leading Pedestrian Interval
- Parkhill Drive and 17th Street--High Visibility Crossing
- Poly Drive and Hoover Avenue Pedestrian Crossing--RRFB and Curb Extensions

These projects are in close proximity and benefit Newman Elementary School, Riverside Middle School, Castlerock Middle School, Mount Olive Lutheran School/Billings West High School, and Rose Park Elementary School.

The project locations were identified in the Safe Routes to School Plans, Phase I and Phase II and are shown in the appendix. A letter of support is provided from School District #2 in the appendix.

The project improvements are substantially surface type improvements, requiring minimal underground excavation and do not require additional right-of-way. These projects will not impact driveways or parking lots or negatively impact existing storm drainage systems.

7. Project Eligibility:

The proposed project is eligible for Transportation Alternatives and strongly meets several categories:

1) Category b. Construction, planning, and design of infrastructure-related projects and systems that provide safe routes for non-drivers, including children, older adults, and individuals with disabilities to access daily needs.
2) Category f. Safe Routes to School Projects. Projects must be identified in a locally, adopted Safe Routes to School Plan.
3) The safe routes to school program under section 1404 of the SAFETEA-LU. A. Infrastructure-related projects.-planning, design, and construction of infrastructure-related projects on any public road or any bicycle or pedestrian pathway or trail in the vicinity of schools that will substantially improve the ability of students to walk and bicycle to school, including sidewalk improvements, traffic calming and speed reduction improvements, pedestrian and bicycle crossing improvements, on-street bicycle facilities, off-street bicycle and pedestrian facilities, secure bicycle parking facilities, and traffic diversion improvements in the vicinity of schools.

The project areas discussed in this application are all recommended projects from the 2021 and 2022 Safe Routes to School Plans, Phase I and II that were locally adopted by the MPO and the Billings City Council.

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8. Project Benefits (45 points):

a. Safety

The project addresses safety concerns raised in the Safe Routes to School Plans, Phase I and Phase II by implementing the recommended projects therein. The project locations utilize tools and design elements that promote safety by improving the physical and visual environment.

The techniques and design elements used to improve safety are the following:

- Creation of a school zone with reduced speed and additional awareness through flashing school zone. The reduced speed and associated signage alerts drivers that there will be students walking and biking in the area.
- Leading Pedestrian Intervals (LPI)—allows pedestrians time to cross the street ahead of traffic, especially turning vehicles, by allowing increased visibility
- Pedestrian Refuge—reduces crossing lengths and allows more visibility of pedestrians. Allows pedestrians to use gaps in traffic by crossing only one direction of traffic. Also creates a visual notice of the crossing and slows traffic speeds by narrowing the traveled way
- Increased level of Striping—High visibility striping at crossings creates improved awareness of crossings
- Curb Extensions (bulb-outs)—Curb extensions shorten pedestrian crossing distances and allow pedestrians to more easily be seen prior to crossing the street
- Rectangular Rapid Flashing Beacons—Makes presence of pedestrian know to drivers

b. Accessibility

The project improves accessibility from an ADA standpoint, but also from accessibility and comfort level of pedestrians and bicyclists, particularly school children going to and from school. Many of the street crossing improvements improve accessibility by adding ADA ramps where none exist today (e.g. Morgan Avenue, Orell Drive, Vaughn Lane, Poly Drive/Hoover Avenue). The benefits of the safety elements discussed in section b. apply to all persons with disabilities as well. All the improvements will be constructed to ADA and PROWAG guidelines.

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c. Connectivity

One of the primary benefits of the project is connectivity through better connecting routes to school. A primary goal of the SRTS is to promote safety within a certain radius of the school –these projects promote connectivity within those spheres used by school-aged children walking and biking to those elementary and middle schools. The proposed project elements clearly make the connections from the student's place of residence to school more direct, safe and noticeable. Inherently, the project elements also improve connections across existing streets for other pedestrians and bicyclists as well.

9. Project Risk Analysis (45 points):

a. Budget

The project budget was developed for each project element and location using recent construction costs at a conceptual planning level through staff experience with costs of Safe Routes to School type improvements. Further, these costs were compared with cost estimates proposed in the Safe Routes to School plans. Contingencies were applied for design and construction unknowns, and inflation of construction costs were added.

A detailed construction cost estimate is provided in the appendix.

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b. Matching Funds

Local matching funds in the amount of 13.42% are proposed by the City Public Works Department and are included in the FY 2026 capital budget that requires approval by City Council in May-June 2025. Historically, these funds are allocated under a specific budget line for Safe Routes to School and have been approved by the City Council.

c. Project Ownership and Maintenance

The City of Billings is responsible for operation and maintenance of the project facilities through annual O&M funds, including sweeping and re-striping faded striping. The City has staff to maintain electrical components of the Leading Pedestrian Interval and Rectangular Rapid Flashing Beacons (RRFBs). The City has the necessary personnel, equipment and budget to maintain these facilities.

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d. Project Right-of-Way and Railroad

The project elements will be constructed within existing right-of-way and there are no anticipated right-of-way needs. There are no significant challenging elements within the right-of-way. None of the project elements are involved with the railroad.

e. Project Utility Impacts

City staff has reviewed the project locations and there are minimal impacts to existing utilities with the proposed improvements. Most of the infrastructure are surface improvements and should not require any utility relocations. Any pedestrian push button poles, RRFB poles, or signs will be placed out of the way of existing utilities. During preliminary design and after surveying of existing utilities, the City will coordinate with various utility companies. At this conceptual stage, there are no apparent, critical utility impacts.

10. Appendix (add attachments): Letter of Support, Project Map, Construction Cost Estimate

March 31, 2025

Mac Fogelsong
City of Billings
316 North 26th Street
Billings, MT 59101

Reference: Letter of Support for 2025 Transportation Alternatives Grant Application.

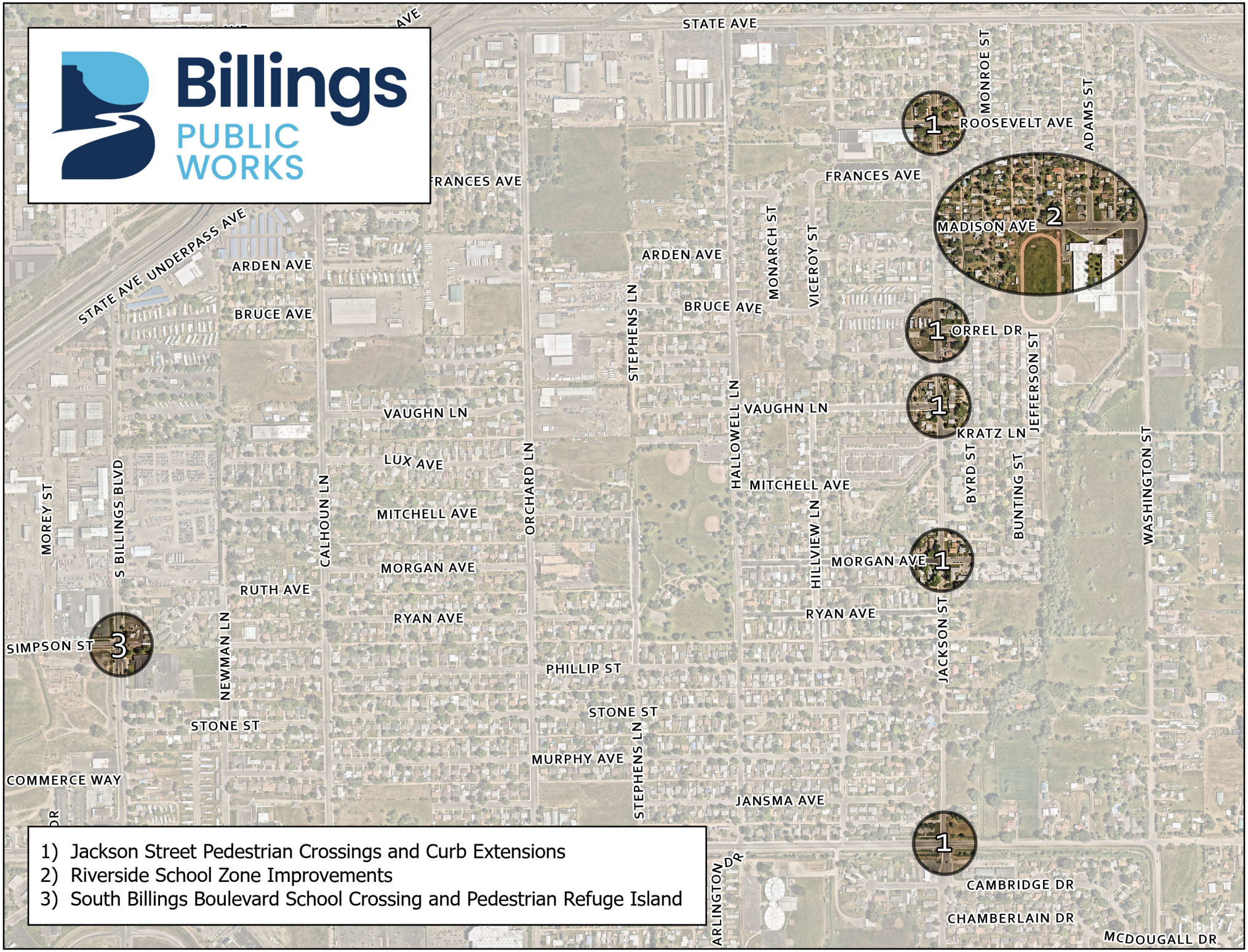
Dear Mac:

School District 2 is pleased to support the City of Billings in its Transportation Alternatives 2025 grant application. The grant application is exclusively focused on Safe Routes to School projects identified and prioritized from the Safe Routes to School Phase I and II plans.

We understand there are about seven main project areas serving elementary and middle schools based on priorities identified in the plans. As you know, we were a partner in developing those Safe Routes to School plans and look forward to seeing these projects implemented to improve the safety of school children getting to and from school.

Sincerely,

Scott Reiter
Executive Director of Facilities
Billings Public Schools
101 10th Street West
Billings, MT 59102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RUTH AVE
RYAN AVE
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JANSMA AVE
CAMBRIDGE DR
CHAMBERLAIN DR
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HALLOWELL LN
HILLVIEW LN
ORCHARD LN
CALHOUN LN
NEWMAN LN
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MOREY ST
BYRD ST
BUNTING ST
JEFFERSON ST
WASHINGTON ST
JACKSON ST
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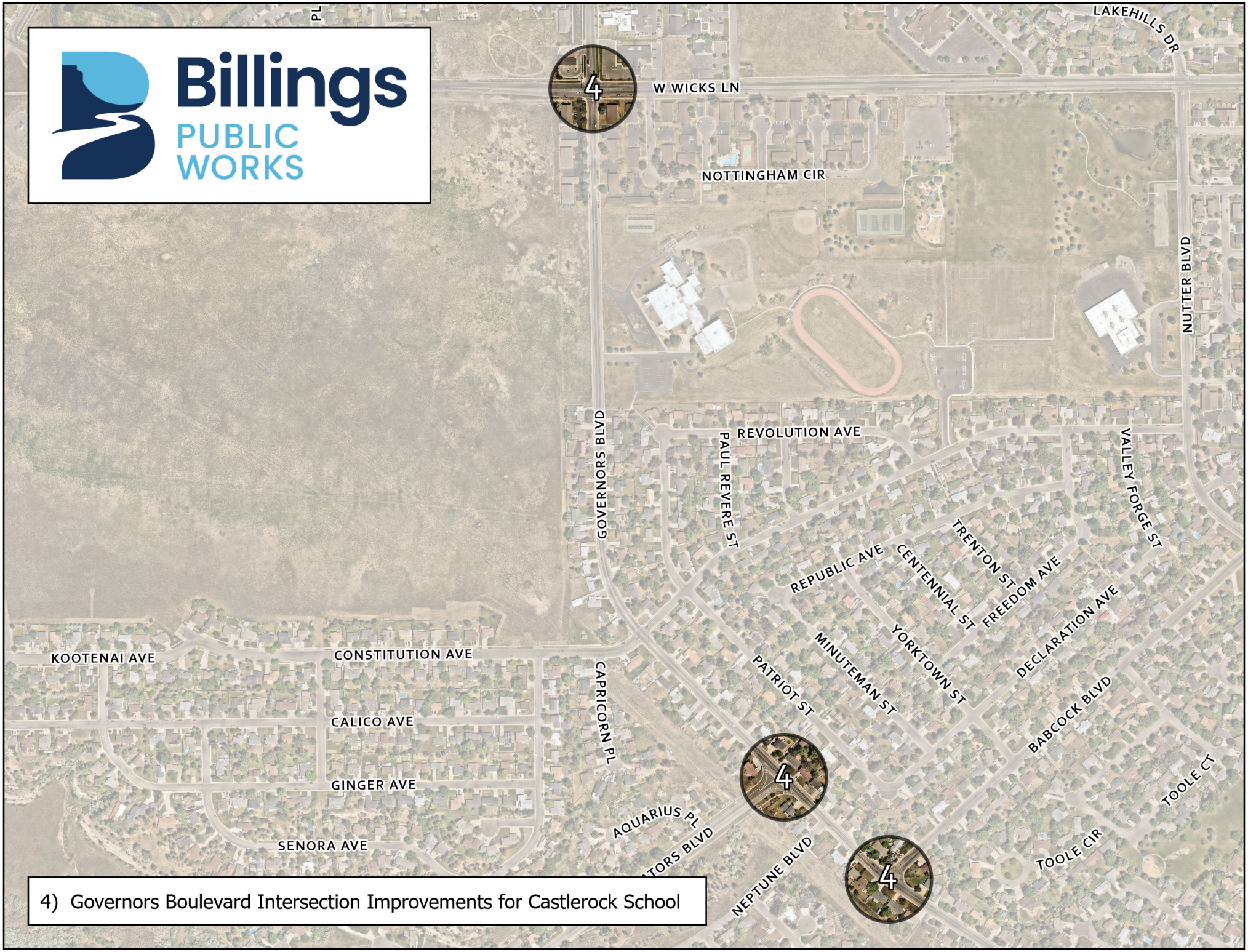
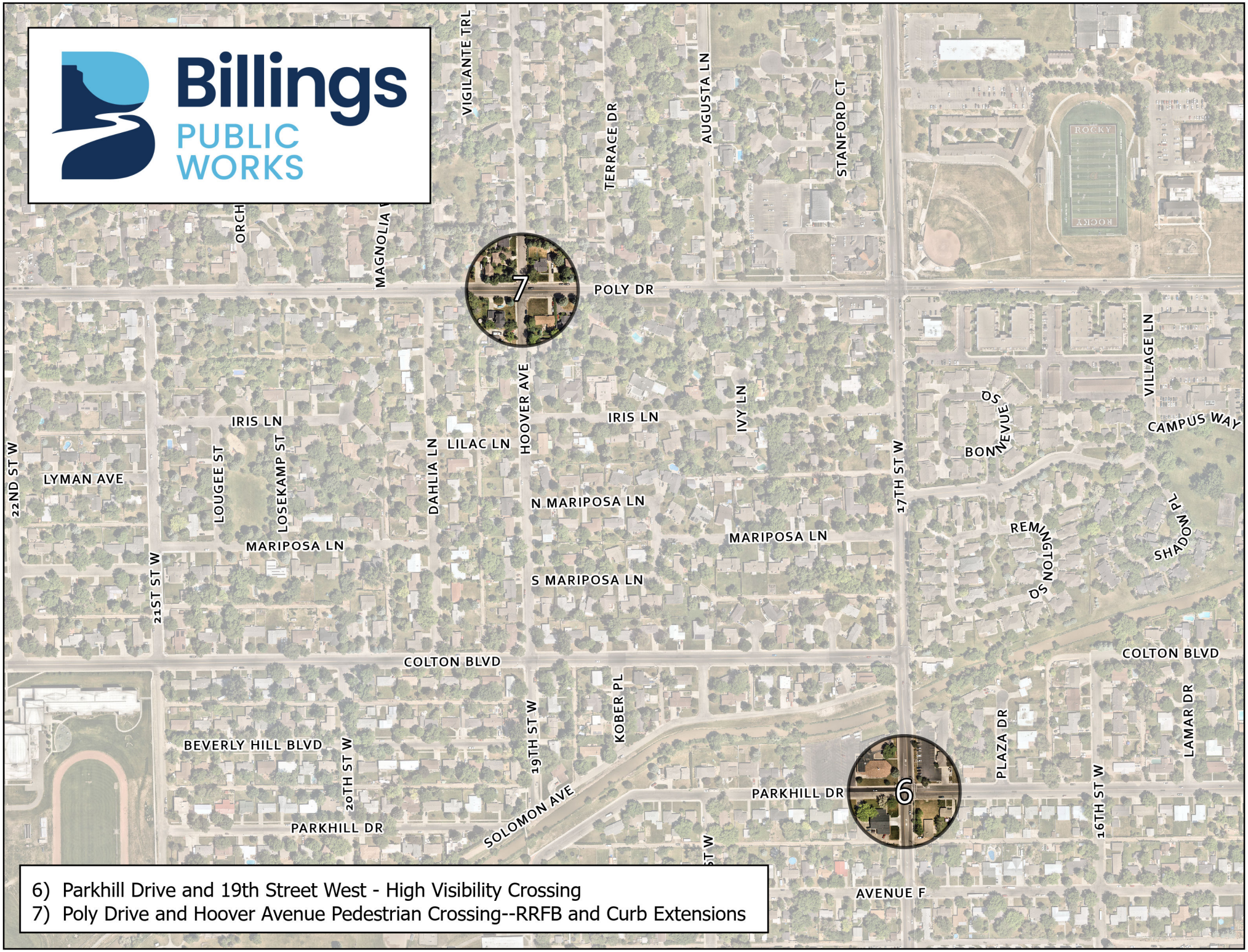
1
2
3
1) Jackson Street Pedestrian Crossings and Curb Extensions
2) Riverside School Zone Improvements
3) South Billings Boulevard School Crossing and Pedestrian Refuge Island



4) Governors Boulevard Intersection Improvements for Castlerock School

5) Central Avenue and 24th Street West--High Visibility Crossing and Leading Pedestrian Interval



6) Parkhill Drive and 19th Street West - High Visibility Crossing
7) Poly Drive and Hoover Avenue Pedestrian Crossing--RRFB and Curb Extensions

TA Grant Application Projects
Summary Of Costs

1. Jackson Street	$317,625.00
2. Riverside School Zone	$283,250.00
3. South Billings Boulevard	$67,100.00
4. Governors Boulevard	$182,050.00
5. Central Ave & 24th Street West	$34,100.00
6. Parkhill Drive and 17th Street West	$23,100.00
7. Poly Drive and Hoover Avenue	$118,450.00
Total Construction Estimate	**$1,025,675.00**
15% Construction Contingency	$153,851.25
Inflation Contingency (3%)	$30,770.25
Total Construction Estimate, with Contingency	**$1,210,296.50**
Engineering Design, Construction Observation, Staking, and Administration (20%)	$242,059.30
MDT Indirect Cost (13.56% of Engineering & Construction Administration)	$32,823.24
Total, Engineering Cost	**$274,882.54**
Total Project Cost	**$1,485,179.04**
Local Match (13.42%)	$199,311.03
Federal Share (86.58%)	$1,285,868.01

	Total Cost of Phase	Federal Share (86.58%)	Local match (13.42%)	Additional Contribution
Preliminary Engineering (PE)	**$164,929.52**	**$142,795.98**	**$22,133.54**	**$0.00**
PE Local (100%)	$164,929.52	$142,795.98	$22,133.54	$0.00
Construction (CN)	**$1,210,296.50**	**$1,047,874.71**	**$162,421.79**	**$0.00**
Construction Engineering (CE)	**$109,953.02**	**$95,197.32**	**$14,755.69**	**$0.00**
CE Local (100%)	$109,953.02	$95,197.32	$14,755.69	$0.00
Right of Way (RW)	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Incidental Construction (Utility Involvement) (IC)	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Total	**$1,485,179.04**	**$1,285,868.01**	**$199,311.03**	**$0.00**

1. Jackson Street

Pedestrian Crossings, High Visibility Crosswalks, Curb Extensions

	Unit	Qty	Unit Cost	Total Cost
General Requirements (Taxes, Bonds, Mob, etc.)	LS	1	$28,875.00	$28,875.00
Construction Traffic Control	LS	1	$15,000.00	$15,000.00
Remove Existing Surface and Utility Features (Per Intersection)	EA	5	$4,000.00	$20,000.00
Curb Extension Including ADA Ramp, Per Corner (Assumes 50 LF New Curb, 200 SF New Concrete, 2 ADA Ramps, and 4 Truncated Dome Panels)	EA	24	$6,500.00	$156,000.00
Storm Drain or Drainage Improvements (Per Intersection)	EA	5	$8,000.00	$40,000.00
Pre-Formed Thermo (White) (Per Crosswalk)	EA	11	$4,000.00	$44,000.00
New Sign(s), Post, and Foundation	EA	22	$625.00	$13,750.00

Construction Estimate - Jackson Street Curb Extensions	$317,625.00

2. Riverside School Zone

Streets Surrounding Riverside Middle School

	Unit	Qty	Unit Cost	Total Cost
General Requirements (Taxes, Bonds, Mob, etc.)	LS	1	$25,750.00	$25,750.00
Construction Traffic Control	LS	1	$15,000.00	$15,000.00
Madison Ave Traffic Calming	LS	1	$50,000.00	$50,000.00
Washington Street Traffic Calming	LS	1	$150,000.00	$150,000.00
School Zone Flasher	EA	4	$7,500.00	$30,000.00
New Sign(s), Post, Foundation	EA	20	$625.00	$12,500.00
Construction Estimate - Riverside Middle School - School Zone				$283,250.00

3. South Billings Boulevard
School Crossing and Pedestrian Refuge Island

	Unit	Qty	Unit Cost	Total Cost
General Requirements (Taxes, Bonds, Mob, etc.)	LS	1	$6,100.00	$6,100.00
Construction Traffic Control	LS	1	$15,000.00	$15,000.00
Remove / Sawcut Existing Surface and Utility Features	LS	1	$5,000.00	$5,000.00
Concrete Median (Pedestrian Refuge Island) (Includes Type A Median Curb, 3-in Median Cap, ADA Ramps, Delineators, Concrete Patching)	LS	1	$30,000.00	$30,000.00
Relocate Existing RRFB Assembly	EA	2	$1,500.00	$3,000.00
Pre-Formed Thermo (White) (Per Crosswalk)	EA	2	$4,000.00	$8,000.00
Construction Estimate - South Billings Boulevard				$67,100.00

4. Governors Boulevard

Intersection Improvements for Castlerock Middle School

	Unit	Qty	Unit Cost	Total Cost
General Requirements (Taxes, Bonds, Mob, etc.)	LS	1	$16,550.00	$16,550.00
Construction Traffic Control	LS	1	$20,000.00	$20,000.00
Remove / Sawcut Existing Surface and Utility Features (Per Intersection)	EA	3	$5,000.00	$15,000.00
Curb and Gutter	LF	900	$30.00	$27,000.00
Asphalt Restoration	SY	800	$50.00	$40,000.00
6-inch Concrete	SF	1,500	$15.00	$22,500.00
4-inch Concrete	SF	1,000	$12.00	$12,000.00
Landscape Restoration	LS	1	$5,000.00	$5,000.00
Pre-Formed Thermo (White) (Per Crosswalk)	EA	4	$6,000.00	$24,000.00
Construction Estimate - Governors Boulevard				$182,050.00

5. Central Ave & 24th Street West

High Visibility Crossing and Leading Pedestrian Interval

	Unit	Qty	Unit Cost	Total Cost
General Requirements (Taxes, Bonds, Mob, etc.)	LS	1	$3,100.00	$3,100.00
Construction Traffic Control	LS	1	$2,000.00	$2,000.00
Obliterate Existing Striping	LS	1	$5,000.00	$5,000.00
Pre-Formed Thermo (White) (Per Crosswalk)	EA	4	$6,000.00	$24,000.00
Construction Estimate - Central Ave & 24th Street West				$34,100.00

6. Parkhill Drive and 17th Street West
Pedestrian Crossing Enhancements

	Unit	Qty	Unit Cost	Total Cost
General Requirements (Taxes, Bonds, Mob, etc.)	LS	1	$2,100.00	$2,100.00
Construction Traffic Control	LS	1	$1,000.00	$1,000.00
Obliterate Existing Striping	LS	1	$4,000.00	$4,000.00
Pre-Formed Thermo (White) (Per Crosswalk)	EA	4	$4,000.00	$16,000.00
Construction Estimate - Parkhill Drive and 17th Street West				$23,100.00

7. Poly Drive and Hoover Avenue
Pedestrian Crossing Enhancements

	Unit	Qty	Unit Cost	Total Cost
General Requirements (Taxes, Bonds, Mob, etc.)	LS	1	$8,950.00	$8,950.00
Construction Traffic Control	LS	1	$5,000.00	$5,000.00
Remove / Sawcut Existing Surface and Utility Features	LS	1	$10,000.00	$10,000.00
Curb and Gutter	LF	300	$30.00	$9,000.00
Asphalt Restoration	SY	200	$50.00	$10,000.00
6-inch Concrete	SF	700	$15.00	$10,500.00
4-inch Concrete	SF	2,000	$12.00	$24,000.00
Landscape Restoration	LS	1	$5,000.00	$5,000.00
Pre-Formed Thermo (White) (Per Crosswalk)	EA	4	$4,000.00	$16,000.00
Intersection Lighting	LS	1	$20,000.00	$20,000.00
Construction Estimate - Poly Drive and Hoover Avenue				$118,450.00

Billings Metropolitan Planning Organization (MPO)
Transportation Alternatives (TA) Program
2025 Project Application

Review the **instructions** prior to filling out this application for a Capital Improvement Project. Fill in all the sections and do not leave any blank.

1. Project Name: JOHNSON LANE SIDEWALK CONNECTOR PROJECT

2. Project Sponsor: YELLOWSTONE COUNTY

3. Project Contact:

ERIN CLAUNCH
SANBELL
1300 N. TRANSTECH WAY
BILLINGS, MT 59102
406-869-3320; eclaunch@sanbell.com

4. Project Cost Estimate

	Total Cost of Phase	Federal/State Funds Share (TA) 86.58%	Local Matching Funds 13.42%	Additional Contribution
Preliminary Engineering (PE)	**$64,750.00**	**$56,060.55**	**$8,689.45**	--
PE MDT (10%)	$6,475.00	$5,606.06	$868.95	--
PE Local (90%)	$58,275.00	$50,454.49	$7,820.50	--
Construction (CN)	**$185,000.00**	**$160,173.00**	**$24,827.00**	--
Construction Engineering (CE)	**$46,250.00**	**$40,043.25**	**$6,206.75**	--
CE MDT (5%)	$2,312.50	$2,002.16	$310.34	--
CE Local (95%)	$43,937.50	$38,041.09	$5,896.41	--
Right-of-Way (RW)	--	--	--	--
RW MDT	--	--	--	--
RW Local	--	--	--	--

	Total Cost of Phase	Federal/State Funds Share (TA) 86.58%	Local Matching Funds 13.42%	Additional Contribution
Incidental Construction (Utility involvement) (IC)	--	--	--	--
Total	--	--	--	--
Total MDT	--	--	--	--
	$296,000.00	**$256,276.80**	**$39,723.20**	**--**

As a reminder, the cost split between Federal Share TA and Matching funds is 86.58% Federal Share TA and 13.42% Match

5. Project Administration: Please provide information regarding which entity is proposed to administer the project. Is this project going to be administered as a local (LAG) project or are you requesting MDT to administer the project. If requesting MDT administration, please explain.

The intent of this project is to be administered by Yellowstone County Public Works through the Local Agency Guidelines. Yellowstone County is currently administering the Old Hardin Road Connector TA Project and is familiar with the processes and requirements. MDT will not be expected to administer this project. Letters of support from both the Yellowstone County Board of County Commissioners and the Lockwood Pedestrian Safety District Board are included in the Appendix.

BILLINGS - YELLOWSTONE COUNTY
MPO
METROPOLITAN PLANNING ORGANIZATION

6. Description of Project (10 points):

Lockwood is a large, unincorporated area under the governance of Yellowstone County with a population of approximately 7,200 people. Johnson Lane is the major north-south principal arterial that runs through the heart of Lockwood and connects the communities two major transportation corridors (Old Hardin Road and Old US Highway 87). As a result, residents have access to Lockwood's main street (Old Hardin Road) and Lockwood High School that resides along Old US Highway 87. Johnson Lane is used as major connecting street for Old Hardin Road and US Highway 87 residents of Lockwood and the surrounding area. Currently, Johnson Lane is a two-lane road with two sections existing sidewalk on the west side of the roadway. It is approximately 2,000 feet from Silverton Street to Old Hardin Road to the north. Currently, the existing sidewalk sections (from Silverton Street to 275 feet north of Rockwood Street and 350 feet of sidewalk in front of Ace Hardware and Treasure State Storage) account for approximately 1,000 feet. Of the remaining 1,000 feet of road without sidewalk, The Montana Department of Transportation has plans to construct sidewalk along the northern section, through their Johson Lane Interchange project. This leaves approximately 500 feet of sidewalk of Johnson Lane from Silverton Street to Old Hardin Road that will be left without sidewalk. This Johnson Lane Sidewalk Connector Project will address two separate gaps in sidewalk facilities between to complete the connection. This TA application will provide the vital portion of sidewalk to be completed and provide safety and connectivity for pedestrians in Lockwood.

The conceptual design of the project is included in the appendix and shows the 6-foot-wide boulevard sidewalk to be constructed in concrete. The intent of the design will maintain all existing driveways and street approaches.

This project was first identified the LPSD's 2023 Non-Motorized Transportation Plan list of Engineering Projects. With completion of this grant project, Johnson Lane will have continuous sidewalk that will connect residents along Johnson Lane to the heart of Lockwood community!

7. Project Eligibility:

The Johnson Lane Sidewalk Connector Project is pivotal to the Lockwood Community as it satisfies multiple categories within the TA guidelines -- specifically Categories A & B (Off-road sidewalk facility and Safe Routes for Non-drivers). The importance of the Johnson Lane Sidewalk Connector Project was determined due to the project being prioritized in the 2023 Lockwood Pedestrian Safety District's Non-Motorized Transportation Plan. Johnson Lane is Lockwood's second busiest road for both vehicular and pedestrian traffic, so this project is critical to separating the two modes of traffic and providing a safe route for pedestrians that are currently being forced to walk in the road's driving paths and unpaved shoulders.

This sidewalk project will provide a facility for pedestrians to travel to and from the intersection of Old Hardin Road and Johnson Lane to the Emerald View Park Subdivision. The intersection offers commercial and convenience store amenities and is a connection to Old Hardin Road pedestrian facilities that serves as a main street for the community and connection to a residences, businesses, and parks.

In addition, the Lockwood Pedestrian Safety District's Non-Motorized Plan has identified a future project as the continuation of this project further to the south to tie into Sunrise Street alignment. This would provide a future Safe Routes to School connection to the Lockwood Elementary, Middle, and High Schools.

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MPO
METROPOLITAN PLANNING ORGANIZATION

8. Project Benefits (45 points):

a. Safety

Johnson Lane exists as a two-lane roadway classified within the Metropolitan Planning Organization's (MPO's) Long Range Transportation Plan (LRTP) as a major collector. An average AADT for Johnson Lane is approximately 3,600 vehicles per day and the posted speed limit is 35 mph. The lack of pedestrian facilities, high traffic volumes, and relatively high speeds creates a safety hazard for pedestrians.

Currently, Johnson Lane has no reported accidents within the project limits. However, the Federal Highway Administration (FHWA) notes that providing sidewalks results in up to an 89% reduction in pedestrian crashes with motor vehicles and suggests that walkways should be part of every new and renovated roadway facility, and every effort should be made to retrofit streets that currently do not have sidewalks. Both FHWA and the Institute of Transportation Engineers (ITE) recommend a minimum width of 5-feet for a sidewalk or walkway, should be continuous along the street, and should be fully accessible to all pedestrians including those in wheelchairs.

b. Accessibility

As detailed in previous sections, there are sidewalk facility's available along Johnson Lane within the project limits. However, these facilities are noncontinuous and do not serve to connect any pedestrian generating land uses. The Johnson Lane Sidewalk Connector project will connect the gaps in the sidewalk and provide a facility that is compliant with both ADA and PROWAG guidelines. This will allow for a continuous, hard-surfaced route that is ADA accessible by all adjacent land uses.

BILLINGS - YELLOWSTONE COUNTY
MPO
METROPOLITAN PLANNING ORGANIZATION

c. Connectivity

One of the primary benefits of the Johnson Lane Sidewalk project is connectivity. As described in the previous sections of this application, there is/will be continuous sidewalk from Emerald View Park Subdivision to the intersection of Old Hardin Road and Johnson Lane. Old Hardin Road is the busiest road in Lockwood and contains a two mile stretch of continuous sidewalk. The Old Hardin Road corridor connects residents, commercial businesses (including multiple gas/convenience stores and the grocery store), Lockwood's popular baseball/softball field complex, and future school safe routes along Piccolo Lane. This project would provide connection along Johnson Lane to the Old Hardin Road sidewalk.

The Lockwood Pedestrian Safety District's Non-Motorized Plan also details the extension of the Johnson Lane Sidewalk project further to the south to the Sunrise Street alignment. A future project along Sunrise Street will be able to connect these two projects to the Lockwood Elementary, Middle, and High Schools. This will create a Safe Routes to School connection for a large contingent of Lockwood School's attendance base.

9. Project Risk Analysis (45 points):

a. Budget

The construction budget for this grant project was developed based on a preliminary/conceptual design of the sidewalk connector project, as commissioned by the Lockwood Pedestrian Safety District. Quantities were estimated for sidewalk area, base gravel, geotextile fabric, excavation areas, and hydroseeding. With the quantities estimated, unit costs for these items were applied based on recent similar projects developed in MDT's database. These numbers were then extrapolated to determine the final construction number. As with standard engineering practice for planning level cost estimates, a contingency was applied to account for unforeseen construction items. The cost estimate was then utilized in Item 4 of this application to determine the overall TA application project cost. A detailed breakdown of this cost estimate is included in the Appendix.

BILLINGS - YELLOWSTONE COUNTY
MPO
METROPOLITAN PLANNING ORGANIZATION

b. Matching Funds

The Lockwood Pedestrian Safety District is a Special Improvement District (SID) that was created by Yellowstone County as allowed under MCA 7-11-1001 through 7-11-1029. A 2014 referendum was presented to voters living within the Lockwood School District, in which they voted 61% to 39% in favor to create the district. Its purpose is to enhance pedestrian safety and provide for alternative means of transportation in the (unincorporated) Lockwood area. Accordingly, the LPSD has an estimated annual revenue of $260,000 per year for use on projects like this one. With Yellowstone County as the sponsor of this project, they are committed to ensuring that the local match is fully secured and in-hand.

c. Project Ownership and Maintenance

As sponsor of this application, Yellowstone County is fully committed, through the LPSD, for operation and maintenance of this project. The LPSD board currently holds contracts with local businesses to remove snow off existing sidewalks within the LPSD boundaries. This grant application project would be included in the snow removal contract. In addition, the LPSD annual budget includes $13,000 for annual maintenance of sidewalks. Through these annual budget items, the LPSD (and thus Yellowstone County) are committed to the ongoing operation and maintenance items for this grant application project.

d. Project Right-of-Way and Railroad

The intent of the design for the Johnson Lane Sidewalk Connector project is to be fully constructed within the public right-of-way along Johnson Lane. As shown in the Right-of-Way Exhibits in the Appendix, there is currently 120 feet of public right-of-way along the project limits that is all free of conflicts. This will allow for adequate construction of the 6-foot sidewalk and boulevard throughout the project.

This project is free of railroad conflicts and no further action is required from a railroad coordination perspective.

e. Project Utility Impacts

For the Johnson Lane Sidewalk Connector project, the only utilities that could potentially be in conflict are overhead power lines within the vicinity of the proposed sidewalk. However, these power poles are located at the back of right-of-way, and the intent of the design is to place the sidewalk where power pole relocation will not be required. Yellowstone Valley Electric Cooperative has been informed about this potential project.

Also in proximity is a water line along the proposed sidewalk alignment. However, water lines are required to be buried greater than 6.5-feet beneath existing ground, and this will not cause conflicts. The water line is owned and operated by the Lockwood Water & Sewer District.

10. Appendix (add attachments): See enclosed attachments.

Yellowstone County

COMMISSIONERS
(406) 256-2701
(406) 256-2777 (FAX)

P.O. Box 35000
Billings, MT 59107-5000
bocc@yellowstonecountymt.gov

April 1, 2025

Lora Mattox
TA Coordinator/Transportation Planner
City of Billings Planning Division
2825 3rd Avenue North, Suite 400
Billings, MT 59101

Re: Transportation Alternatives Program Application
Johnson Lane Sidewalk Project

Dear Ms. Mattox:

The Yellowstone County Board of County Commissioners is in support of the Transportation Alternatives Program grant application for the Johnson Lane Sidewalk project. The project was identified within the Non-Motorized Transportation Plan produced by the Lockwood Pedestrian Safety District (LPSD).

The vision of the LPSD is to build a vibrant community with thriving industrial, commercial, and residential neighborhoods where people of all ages and physical abilities can travel safely and efficiently without the use of an automobile. The project will help accomplish this vision while also aiding in the mission to effectively eliminate fatalities and serious injuries caused by vehicular and pedestrian conflicts throughout the Lockwood area.

For questions regarding this letter of support please contact the Board of County Commissioners, Yellowstone County.

Sincerely,
BOARD OF COUNTY COMMISSIONERS
YELLOWSTONE COUNTY, MONTANA

Mark Morse, Chair

Michael J. Waters, Member

John Ostlund, Member

LOCKWOOD PEDESTRIAN SAFETY DISTRICT

Lockwood Pedestrian Safety District
Advisory Board to Yellowstone County
PO Box 35000
Billings, MT 59107-5000

April 2, 2025

Lora Mattox
TA Coordinator/Transportation Planner
City of Billings Planning Division
2825 3rd Avenue North, Suite 400
Billings, MT 59101

Re: Transportation Alternatives Program Application
Johnson Lane Sidewalk Project

Dear Ms. Mattox:

The Lockwood Pedestrian Safety District Advisory Board is in support of the Transportation Alternatives Program grant application for the Johnson Lane Sidewalk project. The project is on a segment of roadway deemed a high priority by the district's Non-Motorized Transportation Plan. The project completes segments of existing sidewalk to a commercial center of the community for shopping and dining and connects to a residential subdivision.

The mission of the Lockwood Pedestrian Safety District is to effectively eliminate fatalities and serious injuries caused by vehicular and pedestrian conflicts throughout the Lockwood area. Completing the Johnson Lane Sidewalk at the project's location will offer pedestrians a safe way out of the road where steady residential and commercial vehicle traffic on one of Lockwood's busiest roads. As the Lockwood community continues to develop, the safety of neighbors of all ages and abilities is priority to assure an active, healthy lifestyle is responsibly encouraged and experienced.

For more information, please contact Brandy Dangerfield, Lockwood Pedestrian Safety District Advisory Board Chair.

Respectfully,

Brandy Dangerfield
LPSD Advisory Board Secretary
dangerfield.brandy@gmail.com

Travis Smith
LPSD Advisory Board Chair
travis@cd-mt.com

JOHNSON LANE SIDEWALK CONCEPTUAL DESIGN
(SHEET 1 OF 2)

ROCKWOOD ST TO OLD HARDIN RD
WITHIN
YELLOWSTONE COUNTY

NORTH
30 15 0 30 60
SCALE:1" = 30'

PREPARED FOR : YELLOWSTONE COUNTY, MONTANA
PREPARED BY : sanbell

APRIL 2025
BILLINGS, MONTANA

JOHNSON_LANE_PROPOSED.DWG 22113.03 3/31/25 CMH

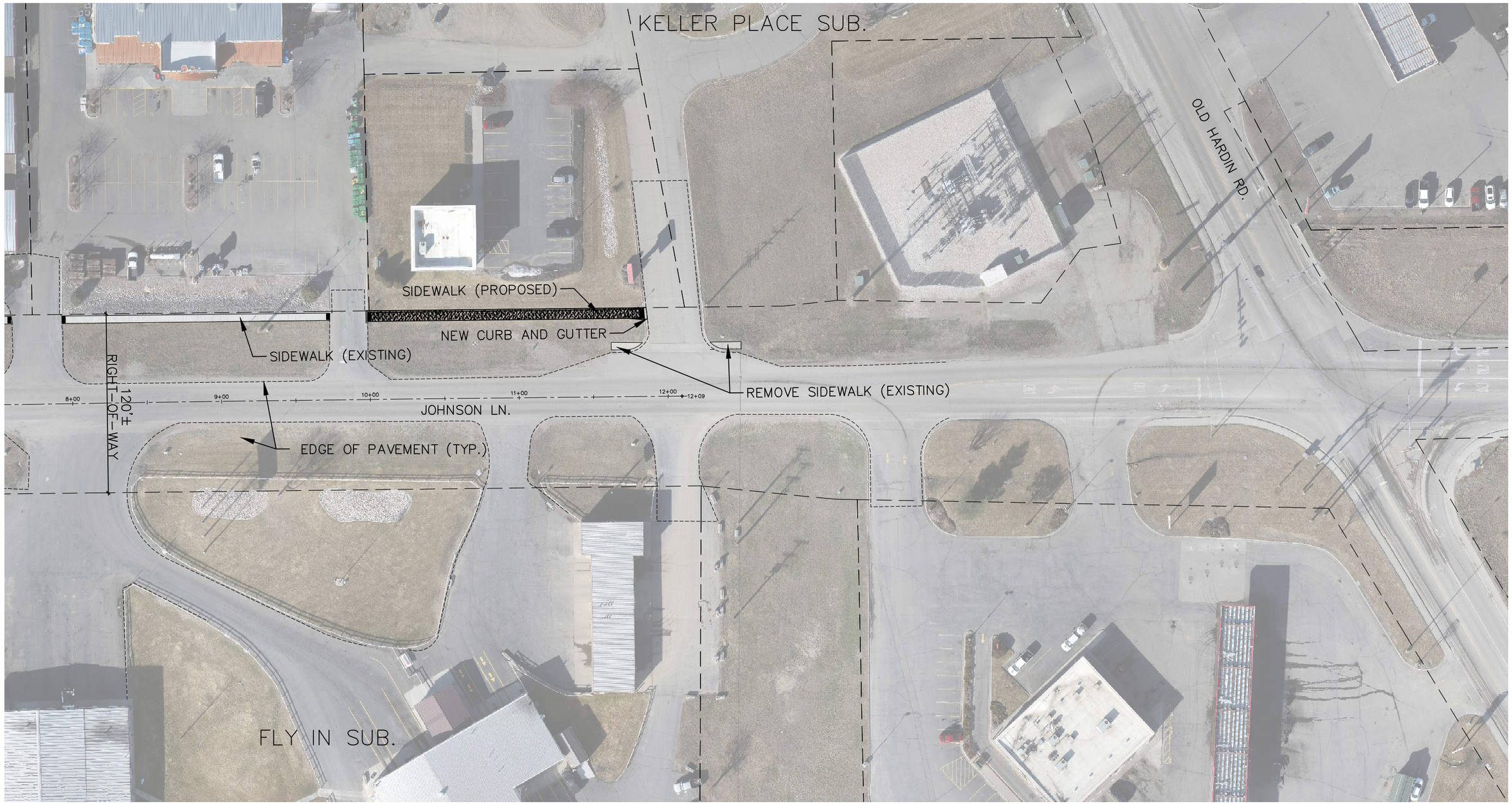
JOHNSON LANE SIDEWALK CONCEPTUAL DESIGN
(SHEET 2 OF 2)

ROCKWOOD ST TO OLD HARDIN RD
WITHIN
YELLOWSTONE COUNTY

NORTH
30 15 0 30 60
SCALE:1" = 30'

PREPARED FOR : YELLOWSTONE COUNTY, MONTANA
PREPARED BY : sanbell

APRIL 2025
BILLINGS, MONTANA



JOHNSON LANE SIDEWALK CONNECTOR COST ESTIMATE				
QUANTITY	DESCRIPTION	UNIT	UNIT PRICE	AMOUNT
2,500	Miscellaneous Work	UNIT	$ 1.00	$ 2,500.00
1	Contractor Survey & Layout	LS	$ 5,000.00	$ 5,000.00
1	Mobilization/Demobilization - 10%	LS	$ 11,000.00	$ 11,000.00
1	Traffic Control	LS	$ 5,000.00	$ 5,000.00
1	Temporary Erosion Control	LS	$ 1,500.00	$ 1,500.00
2,610	Geotextile Fabric	SF	$ 0.50	$ 1,305.00
48	1-1/2" Minus Crushed Base Course	CY	$ 75.00	$ 3,625.00
2,610	6" Sidewalk (6 ft. wide)	SY	$ 20.00	$ 52,200.00
12	Unclassified Excavation	CY	$ 35.00	$ 420.00
30	Truncated Dome Detectable Warning Panel	SF	$ 65.00	$ 1,950.00
1	Clearing & Grubbing	LS	$ 5,000.00	$ 5,000.00
1,305	Hydroseeding	SF	$ 0.50	$ 652.50
145	Over-excavation & Backfill	CY	$ 75.00	$ 10,875.00
3	Removal and Disposal of Small Tree	EA	$ 200.00	$ 600.00
2	Removal and Disposal of Large Tree	EA	$ 2,500.00	$ 5,000.00
50	ADA Ramp-6 foot wide	SF	$ 20.00	$ 1,000.00
5	Street Sign w/ Post	EA	$ 591.33	$ 2,956.65
25	Sawcut Asphalt	LF	$ 8.00	$ 200.00
10	Curb & Gutter Removal	LF	$ 25.00	$ 250.00
15	Concrete Demo and Removal	SY	$ 12.00	$ 180.00
			SUBTOTAL	$ 111,214.15
			30% CONTINGENCY	$ 33,364.25
			SUBTOTAL	$ 144,578.40
			INFLATION 4%/YEAR x 3 YEARS	$ 18,052.64
			SUBTOTAL	$ 162,631.03
			11.32% INDIRECT COST (IDC)	$ 18,409.83
			TOTAL	$ 181,040.86

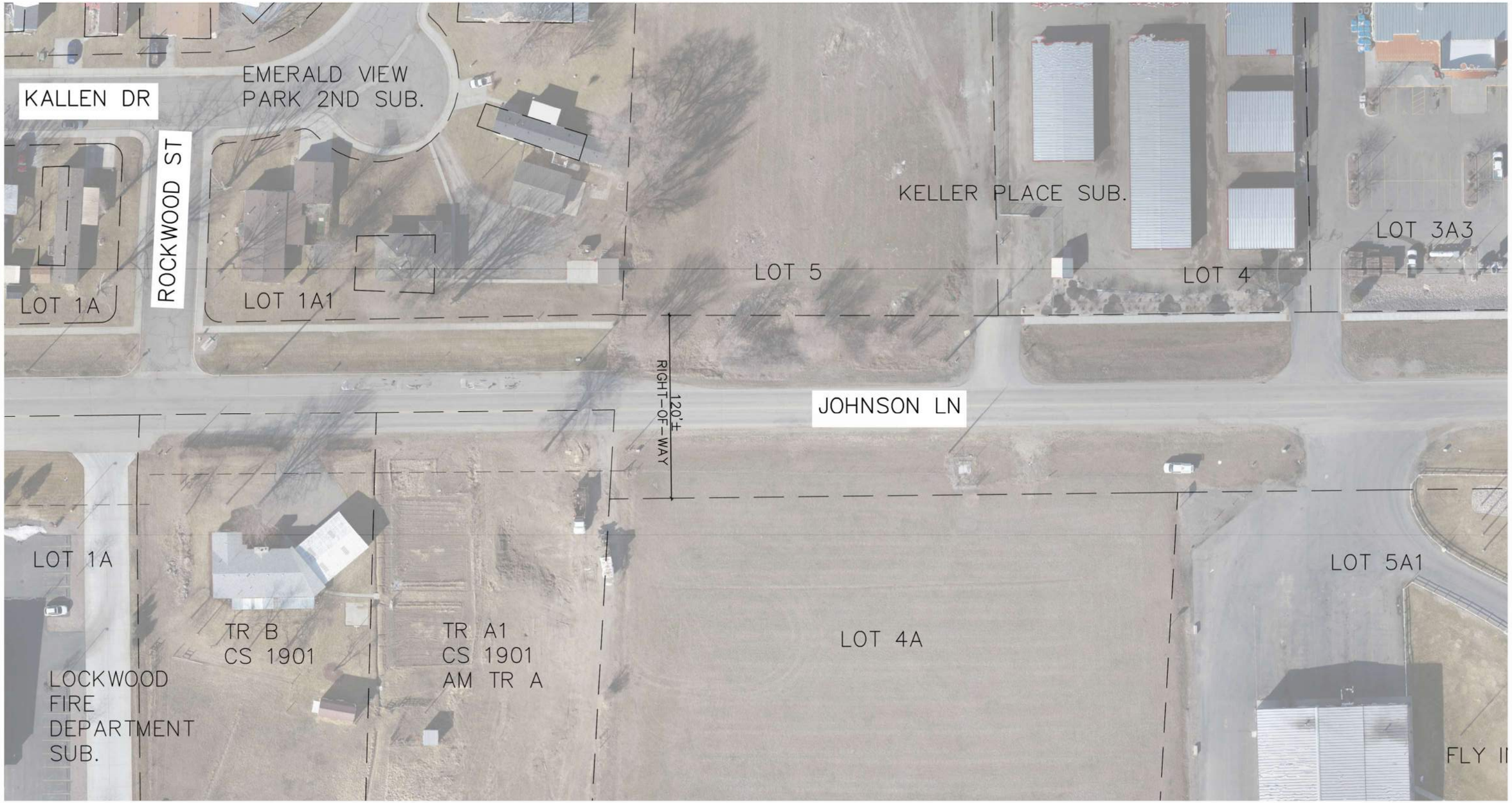
JOHNSON LANE SIDEWALK R/W EXHIBITS
(SHEET 1 OF 2)

ROCKWOOD ST TO OLD HARDIN RD
WITHIN
YELLOWSTONE COUNTY

NORTH
30 15 0 30 60
SCALE:1" = 30'

PREPARED FOR : YELLOWSTONE COUNTY, MONTANA
PREPARED BY : sanbell

APRIL 2025



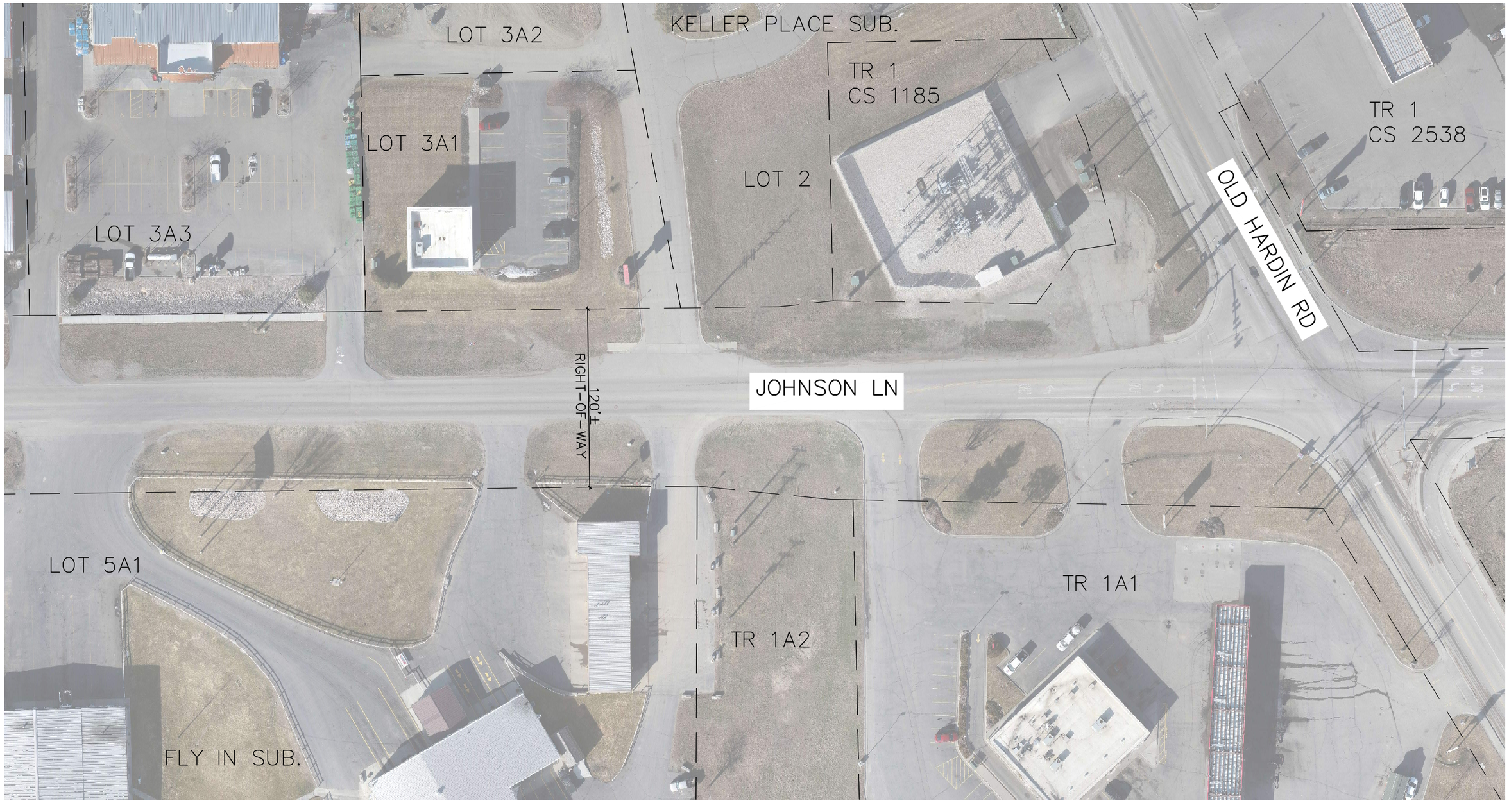
JOHNSON LANE SIDEWALK R/W EXHIBITS
(SHEET 2 OF 2)

ROCKWOOD ST TO OLD HARDIN RD
WITHIN
YELLOWSTONE COUNTY

NORTH
30 15 0 30 60
SCALE:1" = 30'

PREPARED FOR : YELLOWSTONE COUNTY, MONTANA
PREPARED BY : sanbell

APRIL 2025
BILLINGS, MONTANA



Planning Board

Date:	05/13/2025
Title:	Clearwater Estates Subdivision, 2nd Filing - Preliminary major plat
Presented by:	David Green
Department:	Planning & Community Services
Presentation:	Yes

Information

RECOMMENDATION

Staff recommends the Planning Board forward a recommendation to the City Council to conditionally approve the preliminary plat of Clearwater Estates Subdivision, 2nd Filing, and adopt the Findings of Fact as presented in the staff report.

BACKGROUND (Consistency with Adopted Plans and Policies, if applicable)

On April 1, 2025, Performance Engineering applied for preliminary major plat approval for Clearwater Estates Subdivision, 2nd Filing. The proposed subdivision creates 69 lots for residential and commercial development. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned Corridor Mixed Use 1 (CMU1), Mid-Century Neighborhood Residential (N2), Mixed Residential 1 (NX1), Mixed Residential 2 (NX2).

Parkland dedication requirement for this subdivision is 1.67 acres. The applicant is proposing to provide 0.58 acres. The applicant is proposing to provide a cash in lieu contribution for the remaining 1.10 acres of parkland. Planning staff will have a further update on the park proposal at the Plat Review Meeting as the Parks Department provided comment in the review that it preferred a total of 1 acre of private parkland with a smaller cash-in-lieu contribution for the remaining 0.67 acres. There is a benefit of the location of the park land proposed in this subdivision and the adjacent 44 West subdivision being adjacent and therefore being combined for a larger park area. Also, Clearwater Estates plans for additional filings in the future to the south of this filing, so additional combining of park land for a larger space might also be possible. Per these discussions, Planning staff is following up further with Parks, but did not have the added information when this memo was due for the Board agenda.

VARIANCES REQUESTED

No variances from the City Subdivision Regulations have been requested.

PROPOSED CONDITIONS OF APPROVAL

Pursuant to Section 76-3-608(4), MCA, the following conditions are recommended to reasonably minimize potential adverse impacts identified within the Findings of Fact.

1. To meet the requirements of subdivision regulations, prior to final plat approval, the applicant shall provide a break in block length of a minimum 30' wide for Lots 1-16, Block 5. Block design standards shall be in accordance with Table 23-405.1 Required Block Design.

2. To minimize the effects on local services, prior to final plat approval, the applicant shall provide a proportionate share contribution as indicated within the Traffic Impact Study and approved by City of Billings Engineering.

3.To minimize the effects on local service prior to final plat approval, the applicant will coordinate with the USPS to determine what type of deliver system is preferred and to locate and provide the correct amount of space for safely delivering the mail to the residents and businesses.

4. Minor changes may be made in the SIA and final documents, as requested by the Planning, Legal or Public Works Departments to clarify the documents and bring them into the standard acceptable format.

5. The final plat shall comply with all requirements of the City of Billings Subdivision regulations, rules, policies, and resolutions of the City of Billings, and the laws and Administrative Rules of the State of Montana.

PROCEDURAL HISTORY

- Pre-application meeting February 27, 2025
- Preliminary plat application submitted to Planning Division on April 1, 2025
- Departmental review meeting April 17, 2025
- Subdivision resubmittal April 24, 2025
- Planning Board plat review May 13, 2025

- Planning Board public hearing May 28, 2025
- Preliminary plat to City Council June 23, 2025
- 60 working-day preliminary plat review period ends June 26, 2025

PLAT INFORMATION

General location:	South of Central Avenue, and west of Twin Pines Townhomes
Legal Description:	Being Lots 1, 2, and 3 of Clearwater Estates Subdivision
Owner/Subdivider:	Brown Development, LLC
Engineer and Surveyor:	Performance Engineering
Existing Zoning:	CMU1, N2, NX1, NX2
Existing land use:	Agricultural
Proposed land use:	Residential / Commercial
Gross and Net area:	23.43 acres / 20.34 acres
Proposed number of lots:	69
Lot size:	Max: 117,454 square feet / 2.69 acres Min: 7,152 square feet

Parkland requirements: Parkland dedication requirement is 1.67 acres. The applicant is providing 0.58 acres. The applicant is proposing to provide a cash in lieu contribution for the remaining 1.10 acres of parkland.

Traffic Impact Study overview:

This traffic study was done for both 44 West Subdivision and Clearwater Estates Subdivision 2nd Filing. The traffic study was completed for when all filings of the subdivisions are built out.

The site is currently agricultural land. The subdivision's proposed land use will be almost exclusively residential, with 194 single-family detached homes and 262 attached ones. The latter will include duplexes, attached multi-story row houses (townhomes), and "cottage" units that would be smaller units not directly classifiable as apartments. One commercial lot sized to support a 25,000 square-foot building and will be situated at the northwest corner of the site, abutting Central Avenue and Double Haul Lane.

The two subdivisions will pay their proportional share of the costs for each intersection. The split in cost will be based on which subdivision produces the higher percentage of traffic.

The studied intersections are anticipated to operate similarly to existing conditions at the time this subdivision is fully built out.

Exhibit 17. Intersection Cost Participation by Phase

	Phase 1			Phase 2			
Intersection*	AM	PM	Higher	AM	PM	Higher	Total
1. S. 48th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			11.2%			14.4%	25.6%
x $450,000			$50,400			$64,800	$115,200

Parks and Recreation -- Residential subdivisions are required by City of Billings Subdivision Regulations to provide parkland for the residents of the subdivision. This subdivision is required to provide 1.7323 acres of parkland. They are proposing to provide 0.575 acres of land as shown on the proposed subdivision plat. The applicant is proposing to provide a cash-in-lieu contribution for the balance, 1.10 acres. There is a small private park in the subdivision to the east, 44 West Subdivision, that connects directly to the proposed parkland in this subdivision. The applicant has indicated there will be additional parkland dedicated with future filings to the south as this development continues to expand. Comments from the

Parks Department is they would like to see more parkland for the subdivision.

STAKEHOLDERS

There are no stakeholder responses at this time. Stakeholder input will be received at a public hearing scheduled for this subdivision on Wednesday, May 28, 2025.

ALTERNATIVES

In accordance with state law, the City Council has 60 working days to act upon this major preliminary plat. The 60 working day review period for the proposed plat ends on June 26, 2025. State and City subdivision regulations also require that preliminary plats be reviewed using specific criteria, as stated within this report. The City may not unreasonably restrict an owner's ability to develop land if the subdivider provides evidence that any identified adverse effects can be mitigated. Within the 60 working day review period, the City Council is required to:

1. Approve;
2. Conditionally Approve; or
3. Deny the Preliminary Plat

FISCAL EFFECTS

This plat will have no fiscal impact on the City Planning Division.

SUMMARY

One of the purposes of the City's subdivision review process is to identify potential negative effects of property being subdivided. Negative effects that are identified become the subdivider's responsibility to mitigate. Various City departments, private service/utility providers and the affected school district/s, have reviewed this application and provided input on effects and mitigation. The Findings of Fact, which are presented as an attachment, discuss potential negative impacts of the subdivision and conditions of approval are recommended as measures to further mitigate any impacts. In this case, there were found to be minimal impacts from this proposed subdivision.

Attachments

Findings of Fact
Proposed Plat
Draft SIA
Traffic Study

FINDINGS OF FACT

The Planning staff has prepared the Findings of Fact for the preliminary plat of Clearwater Estates Subdivision, 2nd Filing. These findings are based on the preliminary plat application and supplemental documents and address the review criteria required by the Montana Subdivision and Platting Act (76-3-608, MCA) and the Billings Subdivision Regulations (Section 23-303(H), BMCC).

A. What are the effects on agriculture, local services, the natural environment, wildlife, wildlife habitat, and public health, safety and welfare? [MCA 76-3-608 (3) (a) and BMCC 23-302.H.2.]

1. Effect on agriculture and agricultural water user facilities

The subject property has been used for agricultural purposes in the past. The Monad Drain is to the south of this proposed subdivision and is not part of the proposed area to be subdivided. Perimeter ditches and drains shall remain in place and not be altered by the subdivider or subsequent owners. The subdivision should not affect agricultural water users' facilities. With farming activity wildlife habitat has not been maintained. Perimeter ditches are good for birds to hide in as well as deer. But the main body of the land having farm activity on it has left it open without cover.

2. Effect on local services

a. **Utilities** – Water service will be provided by the City of Billings. A 16-inch water mina will be extended along Central Avenue for the proposed subdivision. 12-inch and 8-inch water lines will be provided within the proposed subdivision. The 12-inch line will be installed in Double Haul Lane down to Tippet Trail and along Tippet Trail. 8-inch lines will be installed throughout the majority of the subdivision below Tippet Trail. New individual services will be provided to all the lots, and new fire hydrants will be installed as required by the City Fire Department.

   Sanitary sewer service to Clearwater Estates Subdivision, 2nd Filing will be provided by connecting to the existing 10-inch gravity main running north from the Monad collector. The existing 10-inch gravity main is located in the parkland area in the southeast corner of the Subdivision. 8-inch sanitary sewer mains will be extended throughout the Subdivision.

   The subdivider will install all new water lines and sewer lines in the local streets and individual services for each lot in accordance with design standards, specifications, rules, and regulations of the City of Billings Engineering/Public Works Department and MDEQ. This is outlined in the SIA under the heading VI Utilities.

   Private utility companies will provide services to the subdivision. Any easement required by a private utility company will be coordinated with the subdivider and the utility company.

Stormwater – Stormwater drainage for the public streets is proposed to be provided by curb and gutters that discharge into storm water pipes. Stormwater drainage will discharge east to Lot 5 of Clearwater Estates Subdivision, 1st Filing. A ditch will convey stormwater drainage south to a stormwater detention facility that is located within an off-site area on Tract 3, Certificate of Survey No. 3844. This detention facility will be sized to accept runoff generated from the Clearwater Estates Subdivision, 2nd Filing. The detention facility will discharge into the Monad Drain.

This subdivision shall satisfy the criteria set forth by the *City of Billings Stormwater Management Manual* and will be subject to review and approval by the City Engineering Department. A Stormwater Report will be submitted for review and approval by City Engineering at the time of individual lot development. This is outlined in the SIA under the heading V Storm Drainage

b. **Solid waste** – The City of Billings will provide solid waste collection and disposal. The City's landfill has adequate capacity for this waste.

c. **Streets** – The lots within the subdivision will be served by Central Avenue. The new internal roads, Tippet Trail, Double Haul Lane and Roads B, G, and F. Roads B, G, and F are temporary street names. Final street names are required before final plat. (BMCC Section 23-406 Streets and Roads A 15) Road F will be a private road within the subdivision. The streets will be built to grade with a satisfactory subbase, base course, curb and gutter, and asphalt surface. The design section of said streets shall be submitted to, and approved by, the City Engineer prior to construction.

The sidewalks will be installed by individual lot owners when the lots are developed. All sidewalks will be 5-feet-wide with a 5-foot-wide boulevard behind the curb to the edge of the sidewalk. ADA compliant ramps will be installed by the subdivider at all intersections and the frontage along the parkland.

Block layout is required to have a maximum length and perimeter to them. Blocks of lots begin and end with a street, a 30-foot-wide multi-use trail, or parkland with a trail through it. Lots 1-16, Block 5 exceed block length requirements. In order to meet the requirements of maximum block length the applicant needs to provide a 30 foot wide easement with a multi-use trail or an opening that will include some park area and a trail. **(Condition #1)**

Traffic Impact Study overview:

A traffic accessibility study update has been completed for Clearwater Estates Subdivision, 2nd Filing. All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider's expense.

This traffic study was done for both 44 West Subdivision and Clearwater Estates Subdivision 2nd Filing. The traffic study reflects full build out of all filings of both subdivisions.

The studied intersections are anticipated to operate similarly to existing conditions at the time this subdivision is fully built out.

	Phase 1			**Phase 2**			
Intersection*	**AM**	**PM**	**Higher**	**AM**	**PM**	**Higher**	**Total**
1. S. 48th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			**11.2%**			**14.4%**	**25.6%**
x $450,000			**$50,400**			**$64,800**	**$115,200**

The cash contributions shall be based on the percent of traffic contributions to the intersections based on the total cost of an intersection as determined. The contributions will be made at the time of final plat. **(Condition #2)**

Street lighting is required for this subdivision. In the SIA the applicant has indicated that street lighting will be installed by private contract or SID. A Street Light Maintenance District will be created for operation and maintenance of the lighting at a future date and is included in the waiver of right to protest.

d. **Emergency services** – The Billings Police and Fire Departments will respond to emergencies within the proposed subdivision. The fire station that provides service for this area is Fire Station #7, is located at 1501 54th Street West. The subdivision is located within the ambulance service area of American Medical Response (AMR).

e. **Schools** – School District #2 provides service to students within this subdivision for elementary through high school. Meadowlark for elementary school, Ben Steele for middle school and West for high school. At the time of the writing of this staff report School District #2 had not responded to requests for comments.

f. **Parks and Recreation** – Residential subdivisions are required by City of Billings Subdivision Regulations to provide parkland for the residents of the subdivision. This subdivision is required to provide 1.7323 acres of parkland. They are proposing to provide 0.575 acres of land as shown on the proposed subdivision plat. The applicant is proposing to provide a cash in lieu contribution for the balance, 1.10 acres. There is a small private park in the subdivision to the east, 44 West Subdivision, that connects directly to the proposed parkland in this subdivision. The applicant has indicated there will be additional parkland dedicated with future filings to the south as this development continues to expand.

Comments from the Parks Department are that they would like to see more parkland for the subdivision.

g. **Mail Delivery -** The United States Postal Service will provide postal service to the subdivision. Location of mail delivery boxes will need to be coordinate with the developer and the postal service. **(Condition #3)**

h. **Phasing of Development** - The applicant is not proposing to develop this subdivision in phases.

3. Effect on the natural environment

The subject property is currently vacant with the proposed use of residential development with a small portion of commercial. The property is not located within a floodplain. During development, storm water pollution prevention best management practices are required to be used and monitored to prevent erosion on exposed ground. Overall, the effect on the natural environment should be minimal.

4. Effect on wildlife and wildlife habitat

There are no known endangered or threatened species on the property. There is a paragraph in the SIA that warns future lot owners of the presence of wildlife in the area, which may cause damage to their landscaping. This subdivision should have a minimal effect on wildlife and wildlife habitat.

5. Effect on the public health, safety and welfare

There will be minimal impacts to public health, safety and welfare because of this subdivision.

B. Was an Environmental Assessment required? [(MCA 76-3-616 and BMCC 23-302.H.1.]

The proposed subdivision is exempt from the requirement for an Environmental Assessment pursuant to Section 76-3-616, MCA.

C. Does the subdivision conform to the City of Billings 2016 Growth Policy, the 2014 Transportation Plan, and the Billings Area Bikeway and Trail Master Plan? [BMCC 23-302.H.4.]

1. City of Billings 2016 Growth Policy

The proposed subdivision is consistent with the following goals of the Growth Policy:

Strong Neighborhoods (livable, safe, sociable and resilient neighborhoods): Neighborhoods that are safe and attractive and provide essential services are much desired (p.8).

Home Base (healthy, safe and diverse housing options) Planning and construction of interconnected sidewalks and trails are important to the economy and livability of Billings.

Essential Investments (relating public and private expenditures to public values): Planning and construction of safe and affordable interconnected sidewalks and trails are important to the economy and livability of Billings.

2. 2023 Billings Urban Area Long Range Transportation Plan

The proposed subdivision adheres to the goals and objectives of the 2023 Transportation Plan and preserves the street network and street hierarchy specified in the plan. Central Avenue is identified as an arterial road, it will be widened to the standards of an arterial road.

3. Billings Area Bikeway and Trail Master Plan (BABTMP)

The proposed subdivision is within the Billings Area Bikeways and Trail Master Plan. There are no trails identified within the subdivision. There is a 10-foot-wide bike and pedestrian trail proposed along the south side of Central Avenue. This will be installed by private contract or SIA as outlined in the SIA. No additional improvements of this nature are anticipated.

D. Does the subdivision conform to the Montana Subdivision and Platting Act and to local subdivision regulations? [MCA 76-3-608 (3) (b) and BMCC 23-302.H.3.a.]

The proposed subdivision satisfies the requirements of the Montana Subdivision and Platting Act and the design standards specified in the local subdivision regulations. The subdivider and the local government have complied with the subdivision review and approval procedures set forth in the local and state subdivision regulations.

E. Does the proposed subdivision conform to all requirements of the zoning in effect? [BMCC 23-302.H.3.e.]

The subject property is located within CMU1 – Corridor Mixed Use 1, N2 - Mid-Century Neighborhood Residential, NX1 - Mixed Residential 1, NX2 - Mixed Residential 2. The lot frontages conform to the requirements of these zonings. Other building setbacks and structure specific requirements will be reviewed for compliance at the time of building permit review.

F. Does the proposed plat provide easements for the location and installation of any utilities? [MCA 76-3-608 (3) (c) and BMCC 23-302.H.3.b.]

The subdivider will provided utility easements as requested by private utility companies. Those easements will be shown on the face of the plat.

G. Does the proposed plat provide legal and physical access to each parcel within the subdivision and notation of that access on the plat? [MCA 76-3-608 (3) (d) and BMCC 23-302.H.3.c.]

Legal and physical access is provided to the proposed lots from existing roads and new roads within the proposed subdivision.

CONCLUSIONS OF FINDINGS OF FACT

- The preliminary plat of Clearwater Estates Subdivision, 2nd Filing, does not create any adverse impacts that warrant denial of the subdivision.

- The proposed subdivision conforms to several of the goals and policies of the 2016 Growth Policy and does not conflict with the Transportation or Bikeway/Trail Plans.

- The proposed subdivision complies with state and local subdivision regulations, local zoning, and sanitary requirements and provides legal and physical access to each lot.

- Any potential negative or adverse impacts will be mitigated with the proposed conditions of approval.

RECOMMENDATION

Staff proposes the Planning Board recommends to City Council that the preliminary plat of Clearwater Estates Subdivision, 2nd Filing, be conditionally approved and the Findings of Fact adopted as presented in the staff report.

PRELIMINARY PLAT OF

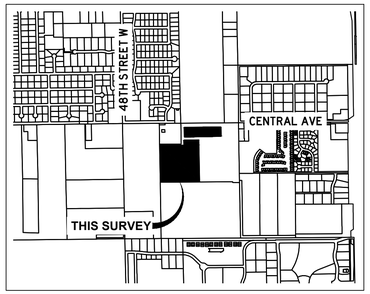
CLEARWATER ESTATES SUBDIVISION, 2ND FILING

BEING LOTS 1, 2, AND 3 OF CLEARWATER ESTATES SUBDIVISION
LOCATED IN THE NW 1/4 OF SECTION 10, TOWNSHIP 01 SOUTH, RANGE 25 EAST, P.M.M., CITY OF BILLINGS, YELLOWSTONE COUNTY, MONTANA

PREPARED FOR : BROWN DEVELOPMENT, LLC

PREPARED BY : PERFORMANCE ENGINEERING, LLC

TOTAL AREA OF SUBDIVISION : ± 23.43 ACRES
APRIL 2025



VICINITY MAP
NOT TO SCALE

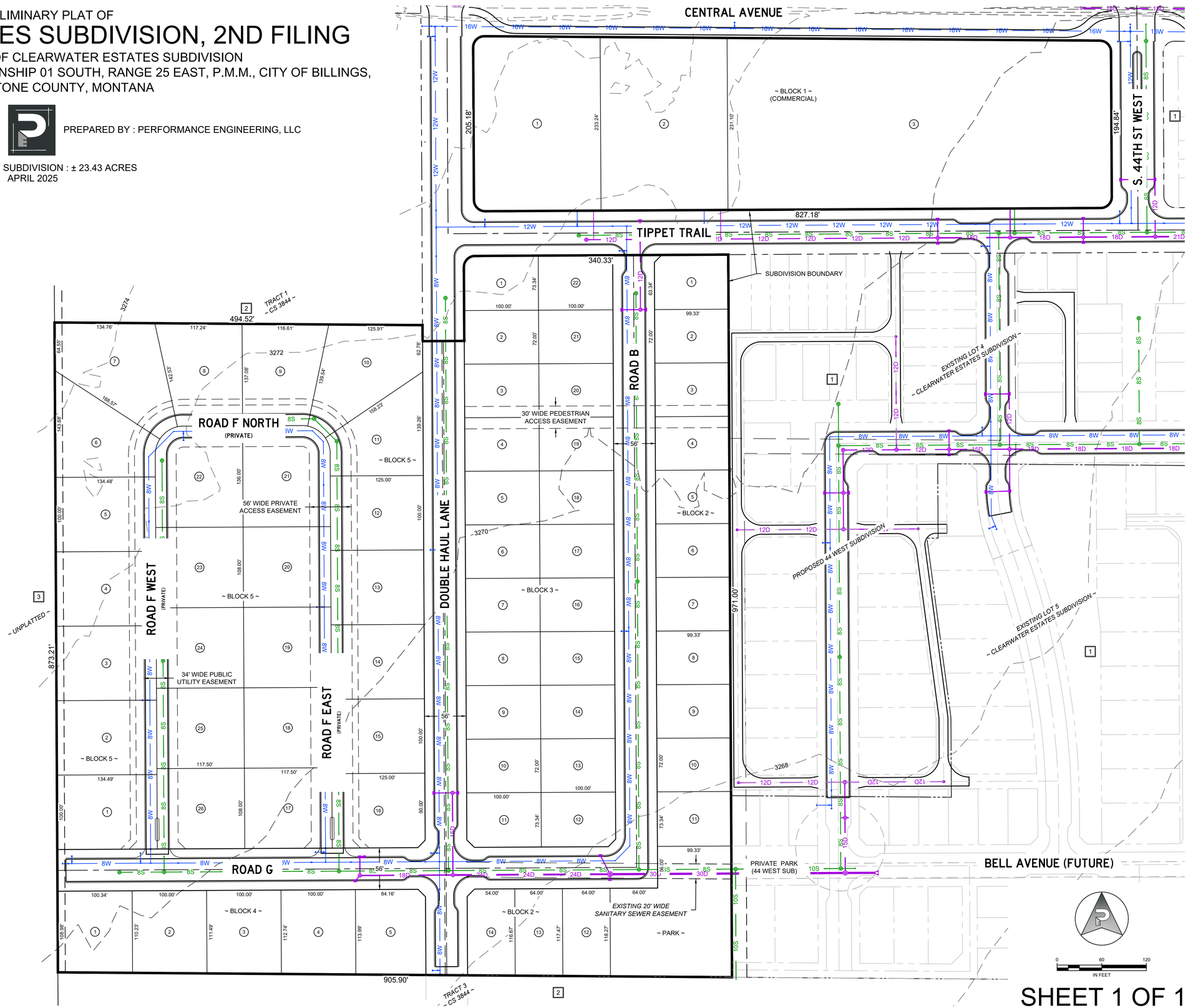
SITE DATA	
GROSS AREA	23.43 ACRES
NET AREA	20.34 ACRES
LOT COUNT	69
MAX. LOT AREA	117,454 SF
MIN. LOT AREA	7,152 SF
ZONING	CMU1, N2, NX1, NX2
PARKLAND DEDICATION	25,047 SF
COMMERCIAL AREA	4.52 ACRES

ADJOINING PROPERTY OWNER INFORMATION

1 BROWN DEVELOPMENT, LLC
745 SOUTH 56TH STREET WEST
BILLINGS, MT 59106

2 BRADLEY W & TAMMY JO HARDT
4620 CENTRAL AVENUE
BILLINGS, MT 59106

3 STALEY FAMILY TRUST
335 SOUTH 48TH STREET WEST
BILLINGS, MT 59106



SHEET 1 OF 1

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SUBDIVISION IMPROVEMENTS AGREEMENT
&WAIVER OF RIGHT TO PROTEST FUTURE SPECIAL IMPROVEMENT DISTRICTS

Clearwater Estates Subdivision, 2nd Filing

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(City of Billings)

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SUBDIVISION IMPROVEMENTS AGREEMENT & WAIVER OF RIGHT TO PROTEST FUTURE SPECIAL IMPROVEMENT DISTRICTS

Clearwater Estates Subdivision, 2nd Filing

This agreement is made and entered into this ____ day of _____, 20__, by and between *Brown Development, LLC*, whose address for the purpose of this agreement is **745 South 56th Street West, Billings, MT 59106**, hereinafter referred to as "Subdivider," and **CITY OF BILLINGS**, Billings, Montana, hereinafter referred to as "City."

WITNESSETH:

WHEREAS, the plat of *Clearwater Estates Subdivision, 2nd Filing*, located in Yellowstone County, Montana was submitted to the Yellowstone County Board of Planning; and

WHEREAS, at a regular meeting conducted on _____ day of _____, 20__, the Board of Planning recommended conditional approval of a preliminary plat of *Clearwater Estates Subdivision, 2nd Filing*; and

WHEREAS, at a regular meeting conducted on _____ day of _____, 20__, the City Council conditionally approved a preliminary plat of *Clearwater Estates Subdivision, 2nd Filing*; and

WHEREAS, a Subdivision Improvements Agreement is required by the City prior to the approval of the final plat.

WHEREAS, the provisions of this agreement shall be effective and applicable to *Clearwater Estates Subdivision, 2nd Filing* upon the filing of the final plat thereof in the office of the Clerk and Recorder of Yellowstone County, Montana. The Subdivision shall comply with all requirements of the City of Billings Subdivision Regulations, the rules, regulations, policies, and resolutions of the City of Billings, and the laws and administrative rules of the State of Montana.

THEREFORE, THE PARTIES TO THIS AGREEMENT, for and in consideration of the mutual promises herein contained and for other good and valuable consideration, do hereby agree as follows:

I. VARIANCES

A. Subdivider has requested, and the City hereby grants, the following variances by City Council from the strict interpretation of the City's Subdivision Regulations (Section 23.1101, BMCC):

1. No variances are requested.

II. PROPERTY CONDITIONS AND INFORMATION FOR LOT PURCHASERS

A. Lot owners will be required to construct that segment of the required sidewalk that fronts their property at the time of lot development. If sidewalk is not constructed within 5 years, the City has the right to construct the sidewalk and assess the property owners.

B. Lot owners should be aware that this subdivision is being built in close proximity to prime deer and antelope habitat and it is likely that homeowners will experience problems with damage to landscaped shrubs, flowers, and gardens. The Montana Fish, Wildlife, and Parks Department does not provide damage assistance unless there is damage to commercial crops and/or a threat to public health and safety.

C. Lot owners should be aware that soil characteristics within the area of this subdivision, as described in the 1972 Yellowstone County Soil Survey, indicate that there could be potential limitations for proposed construction on the lots, which may require a geotechnical survey prior to construction.

D. No water rights have been transferred to the lot owners. Irrigation ditches that exist on the perimeter of this development are for the benefit of other properties. Perimeter ditches and drains shall remain in place and shall not be altered by the Subdivider or subsequent owners.

E. There is attached hereto a Waiver waiving the right to protest the creation of the special improvement district or districts which by this reference is expressly incorporated herein and made as much a part hereof as though fully and completely set forth herein at this point. The Waiver will be filed with the plat, shall run with the land, and shall constitute the guarantee by the Subdivider and property owner or owners of the developments described herein. Said Waiver is effective upon filing and is not conditioned on the completion of the conditions set forth in this Agreement. The Subdivider and owner specifically agree that they are waiving valuable rights and do so voluntarily.

F. The subdivider and subsequent contractors/builders acknowledge that there is a Stormwater Pollution and Prevention Plan (SWPPP) filed with the City and the Montana Department of Environmental Quality (MDEQ). This SWPPP shall be adhered to during all phases of construction and shall be updated as required by MDEQ under the General Permit for Stormwater Discharges Associated with Construction Activity, Chapter 28, BMCC and the Billings Stormwater Management Manual.

G. Individual lot owners should be aware that Best Management Practices for stormwater control shall be required for new construction on lots. Best Management Practices are defined within Section 28-201, BMCC and detailed in the Billings Stormwater Management Manual.

III. TRANSPORTATION

A. Streets

- All internal access roads and site improvements within the subdivision will be in accordance with the City of Billings Site Development Ordinance, City Zoning Ordinance, the Stormwater Management Manual, and other applicable City codes, rules, and regulations.

- Tippet Trail will be 34 feet back of curb to back of curb. The street improvements will be completed by private contract or SID.

- Double Haul Lane will be 44 feet back of curb to back of curb from Central Avenue to Tippet Trail.

- Road B, Road G, and Double Haul Lane south of the intersection with Tippet Trail will provide 34 feet back of curb to back of curb street width within a 56-foot wide right-of-way. The street improvements will be completed by private contract or SID.

- Road F East, Road F North, and Road F West will be located within a private access easement and will be considered a private road. These roads will be 34 feet back of curb to back of curb and will be gated. The street improvements will be completed by private contract.

- A traffic accessibility study has been completed for the *Clearwater Estates Subdivision, 2nd Filing.* All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider's expense. Based on the additional lots created with *Clearwater Estates Subdivision, 2nd Filing,* the percentage of traffic contributions and associated costs to these intersections based on a pro-rata share, as negotiated with City Engineering.

  The cash contributions shall be based on the percent of traffic contributions to the intersections based on the total cost of an intersection as determined by City Engineering for the year in which the contribution is made. These cash contributions for the intersection improvement will be made prior to final plat approval. The percentage contributions are as outline within the Traffic Impact Study for Clearwater Estates Subdivision as submitted with the preliminary plat.

B. Sidewalks

- Individual lot owners will be responsible for the construction of the sidewalks within public right-of-way or easements adjacent to or through their lot at the time of lot construction and shall be included in each building

permit. The Subdivider shall construct or bond for sidewalk adjacent to park areas prior to final plat approval.

- The sidewalk along the west side of Double Haul Lane extending from Central Avenue to the north boundary of Lot 10, Block 5 will be constructed by the Subdivider at the time of road construction. The remaining portions of sidewalk along Double Haul Lane shall be constructed by the adjacent individual lot owners.

- Sidewalks shall be 5-foot wide with a minimum 5-foot boulevard planting strip between the sidewalk and the curb with handicap ramps and aprons installed where necessary. All sidewalks will be constructed by lot owners. Handicap ramps and aprons will be constructed at the time of road construction.

C. Street Lighting

- Street lighting will be installed by private contract or SID. The proposed lighting plan will be reviewed and approved by City of Billings Public Works prior to installation. A Street Light Maintenance District will be created in the future and is included in the waiver of right to protest.

D. Traffic Control Devices

- Street name signs for streets within the subdivision, or located immediately adjacent thereto, shall be furnished and installed in accordance with the specifications of the City of Billings Public Works and Fire Departments.

- No traffic signals are required within this subdivision. Stop signs shall be installed along Double Haul Lane at two (2) intersections, the intersection with Central Avenue and with Road G.

- The Subdivider shall furnish and install all necessary traffic control devices in accordance with the Manual of Uniform Traffic Control Devices and approved by the City of Billings Public Works Department.

E. Access

- Access to the Subdivision will be provided by Central Avenue, Double Haul Lane, Tippet Trail, Road B, Road G, Road F East, Road F North, and Road F West.

F. Billings Area Bikeway and Trail Master Plan

- The Subdivision is within the Billings Area Bikeway and Trail Master Plan. A 10-foot-wide multi-use trail will be constructed along Central Avenue. The trail improvements will be completed by private contract or SID.

G. Public Transit

- MET Transit provides services along Central Avenue with the closest stop at the intersection of Central Avenue and Shiloh Road, approximately 0.5 miles east of the Subdivision. No improvements are required to ensure public transit service.

IV. EMERGENCY SERVICE

Construction of buildings made of combustible materials shall have adequate fire apparatus access roads and water supply (fire hydrants) in place to allow for fire suppression requirements. Prior to the issuance of a building permit for construction using combustible materials (i.e. lumber, plywood, wood trusses, etc.), fire apparatus access roads and water supply requirements shall be provided in accordance with the International Fire Code as adopted by the City of Billings.

At a minimum, the following is required:

- An unobstructed gravel road or gravel road base must be within 150 feet of the furthest portion of a building under construction as measured along the approved route.
- The access roads are required to support fire apparatus vehicle loading (40 tons) during all weather conditions and shall be a minimum of twenty (20) feet wide.
- An operational fire hydrant shall be located within 600 feet of the furthest portion of a residence under construction or within 400 feet of the furthest portion of a commercial building under construction as measured along the access roads to the site.
- The above requirements do not alter or effect the current minimum subdivision requirements for fire apparatus access and water supply.

V. STORM DRAINAGE

All drainage improvements shall comply with the provisions set forth in Chapter 28, BMCC, and the Stormwater Management Manual in place at the time of development. A complete stormwater management plan shall be submitted to the Engineering Division for review and approval at the time of development.

Stormwater drainage will discharge east to Lot 5 or Clearwater Estates Subdivision, 1st Filing. A ditch will convey stormwater drainage south to a stormwater detention facility that is located within an off-site area on Tract 3, Certificate of Survey No. 3844. This detention facility will be sized to accept runoff generated from the *Clearwater Estates Subdivision, 2nd Filing*. The detention facility will discharge into the Monad Drain.

VI. UTILITIES

The Subdivision Improvements Agreement does not constitute an approval for

extension of or connection to water mains and sanitary sewers. The property owner shall make application for extension/connection of water mains and sanitary sewers to the Public Works Department – Engineering Division. The extension/connection of/to water mains and sanitary sewers is subject to the approval of the applications and the conditions of approval. Applications shall be submitted for processing prior to the start of any construction and prior to review and approval of any project plans and specifications.

The Developer/Owner acknowledges that the subdivision shall be subject to the applicable System Development Fees in effect at the time new water and/or sanitary sewer service connections are made.

The design/installation of sanitary sewers and appurtenances, and water mains and appurtenances (fire hydrants, etc.) shall be in accordance with design standards, specifications, rules, regulations of and as approved by the City of Billings Public Works Department, Fire Department and the Montana Department of Environmental Quality.

A. Water

- The Subdivision will be extending a 16-inch water main in Central Avenue. The City will reimburse the Developer for the cost of upsizing the water main from a 12-inch line to a 16-inch line. If requested by the Developer, City staff will forward a Compensation Agreement to City Council for approval of oversizing of the water main in accordance with the City's Rules and Regulations Governing Water and Wastewater Service.
- A 12-inch water main will be installed along Double Haul Lane down to Tippet Trail and along Tippet Trail.
- An 8-inch water main will be installed within Double Haul Lane south of Tippet Trail, Road G, Road B, Road F East, Road F North, and Road F West.
- The water main within Road F East, Road F North, and Road F West will be installed within a public utility easement that is no wider than the road width.

B. Sanitary Sewer

- Sanitary sewer service to *Clearwater Estates Subdivision, 2nd Filing* will be provided by connecting to the existing 10-inch gravity main running north from the Monad collector. The existing 10-inch gravity main is located in the parkland area in the southeast corner of the Subdivision. 8-inch sanitary sewer mains will be extended throughout the Subdivision.
- The sanitary sewer main within Road F East, Road F North, and Road F West will be installed within a public utility easement that is no wider than the road width.

C. Power, Telephone, Gas, and Cable Television

- Private utility facilities currently exist to serve the subdivision. The private utility facilities will be installed within private utility easements included on the plat, as requested by the utility companies.

VII. PARKS/OPEN SPACE

Section 76-3-621 of the Montana Code Annotated covers the park dedication requirement. Paragraph (1) calls for park area to be 11 percent of the land proposed to be subdivided into parcels of one-half acre or smaller. The required Parkland Dedication for the *Clearwater Estates Subdivision, 2nd Filing* is 1.67 acres. Parkland dedications, in the amount of 0.575 acres, are depicted on the face of the plat as PARK. The remaining 1.10 acres of undedicated parkland will be paid as cash in lieu at the time of final plat filing.

VIII. IRRIGATION

No water rights have been transferred to the lot owners. Irrigation ditches that exist on the perimeter of this development are for the benefit of other properties. Perimeter ditches and drains shall remain in place and shall not be altered by the Subdivider or subsequent owners.

IX. SOILS/GEOTECHNICAL STUDY

A soils/geotechnical study has been performed for the subdivision. A copy of this report is included as part of the infrastructure permitting documents and made public record through the Engineering Department. Lot owners and contractors/builders are encouraged to review the report and its recommendations or complete a site-specific geotechnical investigation.

X. PHASING OF IMPROVEMENTS

The Subdivision is not proposed to be constructed in phases.

XI. FINANCIAL GUARANTEES

Except as otherwise provided, Subdivider shall install and construct said required improvements with cash or by utilizing the mechanics of a private contract secured by letters of credit or a letter of commitment to lend funds from a commercial lender, or by SID. All engineering and legal work in connection with such improvements shall be paid by the contracting parties pursuant to said private contract, and the improvements shall be installed as approved by the City Engineer and Utility Department Manager.

XII. LEGAL PROVISIONS APPLYING TO SUBDIVIDER

A. Subdivider agrees to guarantee all public improvements for a period of two (2) years from the date of final acceptance by the City of Billings.

B. The owners of the properties involved in this proposed Subdivision by signature subscribed herein below agree, consent, and shall be bound by the provisions of this Agreement.

C. The covenants, agreements, and all statements in this Agreement run with the land and apply to and shall be binding on the heirs, personal representatives, successors, assigns and transferees of the respective parties.

D. In the event it becomes necessary for either party to this Agreement to retain an attorney to enforce any of the terms or conditions of this Agreement or to give any notice required herein, then the prevailing party or the party giving notice shall be entitled to reasonable attorney fees and costs.

E. Any amendments or modifications of this Agreement or any provisions herein shall be made in writing and executed in the same manner as this original document and shall after execution become a part of this Agreement.

F. Subdivider shall comply with all applicable federal, state, and local statutes, ordinances, and administrative regulations during the performance and discharge of its obligations. Subdivider acknowledges and agrees that nothing contained herein shall relieve or exempt it from such compliance.

IN WITNESS WHEREOF, the parties hereto have set their hands and official seals on the date first above written.

"SUBDIVIDER" *Brown Development, LLC*

By: _____

Title: _____

STATE OF MONTANA)
: ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____, known to me to be the _____ of *Brown Development, LLC*, who executed the foregoing instrument and acknowledged to me that he/she executed the same.

_____
Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

This agreement is hereby approved and accepted by the City of Billings, this ____ day of _____, 20__.

"CITY"
CITY OF BILLINGS
MONTANA

By: _____
Mayor

Attest: _____
City Clerk

STATE OF MONTANA)
: ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____ and _____, known to me to be the Mayor and City Clerk, respectively, of the City of Billings, Montana, whose names are subscribed to the foregoing instrument in such capacity and acknowledged to me that they executed the same on behalf of the City of Billings, Montana.

_____
Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

Waiver of Right to Protest
FUTURE SPECIAL IMPROVEMENTS DISTRICTS

FOR VALUABLE CONSIDERATION, the undersigned, being the Subdivider and all of the owners of the hereinafter described real property, do hereby waive the right to protest the formation of one or more Special Improvement District(s) for a period of no more than twenty years from the recording of this waiver, for street light maintenance and energy, and for the construction of streets, street widening, sidewalks, survey monuments, street name signs, curb and gutter, street lights, driveways, traffic signals, and traffic control devices, parks and park maintenance, trails, sanitary sewer lines, water lines, storm drains (either within or outside the area), and other improvements which the City of Billings may require.

This Waiver and Agreement is independent from all other agreements and is supported by sufficient independent consideration to which the undersigned are parties, and shall run with the land and shall be binding upon the undersigned, their successors and assigns, and the same shall be recorded in the office of the County Clerk and Recorder of Yellowstone County, Montana.

This Waiver is in addition to any other recorded waiver related to the property described herein and is not intended to replace, supersede, or invalidate any such waiver.

The real property hereinabove mentioned is more particularly described as follows:

Clearwater Estates Subdivision, 2nd Filing

Signed and dated this _____ day of _____, 20__.

Brown Development, LLC

By:_____

Title:_____

STATE OF MONTANA)
: ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____, known to me to be the _____ of *Brown Development, LLC*, who executed the foregoing instrument and acknowledged to me that he/she executed the same.

_____
Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

Clearwater Subdivision

Small/squarer photo here

Traffic Accessibility Study

(DRAFT)

Prepared on behalf of:

Performance Engineering

February 2025

Larger/landscape image here – Consider Annafeld cottage view

Traffic Accessibility Study

Prepared for submittal to:

for the project:

Clearwater Subdivision

on behalf of:

Performance Engineering

608 N. 29th Street
Billings, MT 59101

by:

406 Traffic and Transportation Consulting

P.O. Box 249
Bozeman, MT 59771
406.922.7300

(signed stamp here when final)

February 2025

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A: Original Raw Count Data for Intersections

B: Intersection Analysis Software Output

C: Intersection Cost Participation Calculations

1 INTRODUCTION

This report documents the Traffic Accessibility Study (TAS) conducted for the Clearwater Estates subdivision project in northwest Billings. This is a working title for the project. Some parts of the site could be marketed under a different name before final occupancy.

1.1 PROJECT SITE AND STUDY AREA

The overall subdivision site is shown in **Exhibit 1** along with the intersections studied. The existing study intersections were identified during preapplication review with City of Billing staff as:

1. S. 48th Street West at Central Avenue
2. Shiloh Road at Broadwater Avenue
3. Shiloh Road at Central Avenue
4. Shiloh Road at Bell Avenue
5. Shiloh Road at Monad Road

From here forward in the body of this report, existing intersections are generally referred to only by their distinguishing street names (e.g., “Shiloh at Central”) for the sake of brevity. The two new subdivision access points on the south side of Central Avenue have been analyzed for both future scenarios that include project traffic. In this report, these are generally referred to as the West Access and the East Access. The West access has the working name Double Haul Lane and the East Access has the working name S. 44th Street West in part because it is situated approximately halfway between Shiloh Road and S. 48th Street West. The site’s third access will be to existing Bell Avenue, which will be extended west into the site and, while not fully continuous, terminate at the western property edge. The western terminus of Bell will be built to accommodate a future connection to the property west of this site, but no specific street connection has been planned there at the time of this study. The east-west Bell Avenue alignment generally separates the subdivision site into northern and southern parts of similar size.

1.2 LAND USE AND PHASING

The site is currently agricultural land. The subdivision’s proposed land use will be almost exclusively residential, with 194 single-family detached homes and 262 attached ones. The latter will include duplexes, attached multi-story row houses (townhomes), and “cottage” units that would be smaller units not directly classifiable as apartments. One commercial lot sized to support a 25,000 square-foot building will be situated at the northwest corner of the site, abutting Central Avenue and Double Haul Lane.

The project is divided into two logical phases. All 262 of the “attached” type of residential units are included in Phase 1 and are located on the northern part of the site. Phase 1 also includes about one third (66) of the total single-family detached units. Phase 2 includes the commercial parcel and all residential lots on the southern part of the site, which are for the remaining 128 single-family homes.

Because the site is self-contained and generally rural today, the types and locations of specific pathways or other facilities for pedestrians and bicycles have not yet been identified. A brief examination of potential traffic calming needs indicated that the absence of long streets without homes on them will strongly limit the need for such measures. On-street parking is expected to be allowed throughout the site wherever street width is sufficient for it.

Exhibit 2 shows the Clearwater Estates site plan on which the analysis here is based. It includes land use types, streets, alleys, access points, and park parcels.

Exhibit 1. Overall Site Location and Study Intersections

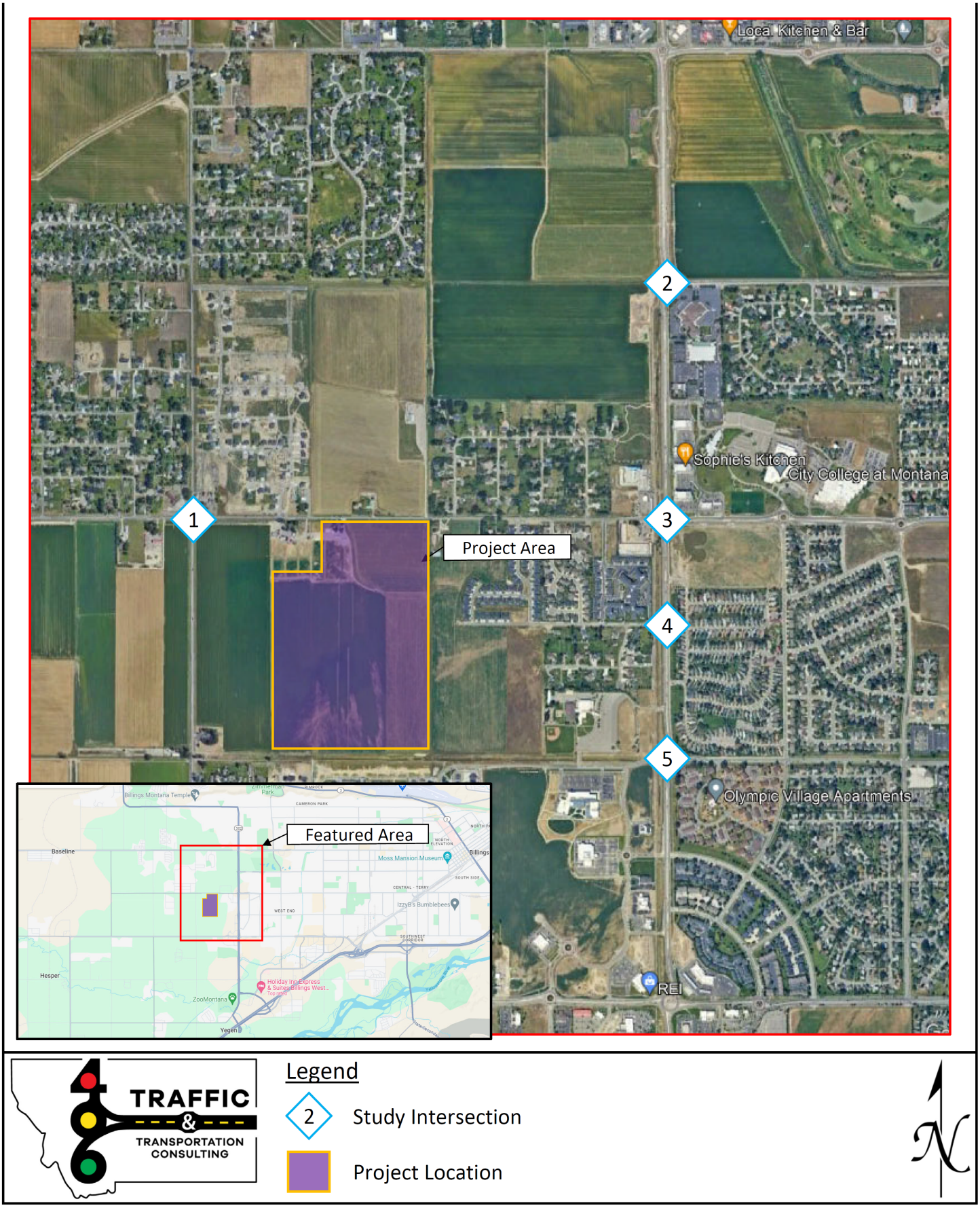


Exhibit 2. Clearwater Estates Subdivision Site Plan

Excerpted from: Performance Engineering drawing provided 1/31/2025

1.3 ANALYSIS METHODS AND REFERENCES

Raw field traffic counts were gathered from other recent traffic study work in the area by Sanbell and provided to the Clearwater applicant team. These raw counts were then adjusted slightly for this TAS based on both (a) recent traffic growth and (b) 2024 City of Billings annualization factors prior to their use in impact analysis.

Trip generation rates, or equations as applicable, are from the Institute of Transportation Engineers (ITE) Trip Generation suite's 11th edition. ITE trip generation data, when aggregated across enough varied sites, produce both simple average rates and best-fit equations, either linear or logarithmic, to help the analyst derive proper estimates for their situation. Equations are generally preferred over rates, especially for larger sites where trip generation per unit of land use can diminish with increasing project size. General ITE guidance calls for the use of the fitted curve equation when the data set for the land use type in question is comprised of studies from 20 or more separate sites and when the equation produces a correlation coefficient (R^2) of 0.75 or higher, with 1.0 being the best possible fit.

Operational performance was analyzed at the study intersections through the use of the industry-standard methods presented in the USDOT's Highway Capacity Manual (HCM), published in its modern form as Transportation Research Board Special Report 209. Synchro Studio 12 was employed as both a data repository and a capacity analysis tool, with reports for each intersection generated using Synchro's application of the assumptions of the HCM's 7th edition, the most recent available at the time of this study.

The HCM methodology for intersection capacity analysis produces delay estimates for each turning movement (or "lane group", when multiple turning movements operate from the same lane). These delay estimates are assigned Level of Service (LOS) grades that range from A (best) to F (worst), as indicated in **Exhibit 3**. It's also important to note that for unsignalized intersections with only side-street Stop sign control, LOS for the intersection is represented by the LOS for the worst lane group. "T" intersections with side-street stop control also fall under this category. All stop-controlled intersections in this study area, including the two new proposed accesses to Central, are "T" intersections, where the approach on the stem of the T, rather than a main street turning movement, contains the worst lane group.

Operations impacts are determined by how peak hour LOS relates to acceptability standards. Billings employs a LOS standard of C or better. When LOS without the project is D or worse, an operations impact is defined when the project would increase delay.

Exhibit 3. LOS Definitions

LOS	Delay, seconds per vehicle
A	0 - 10.0
B	10.1 - 15.0
C	15.1 - 25.0
D	25.1 - 35.0
E	35.1 - 50.0
F	50.1 or more

Source: HCM 7th Edition

2 EXISTING AND BACKGROUND CONDITIONS

2.1 STREETS AND INTERSECTIONS

Shiloh Road, which also carries the designation of MT-302, is a north-south urban principal arterial with two travel lanes in each direction and a speed limit of 45 mph in the study area. Shiloh Road has been a key facilitator of the city's westward expansion, with substantial residential and commercial growth having occurred adjacent to it in recent years. It is characterized by a series of roundabouts at intersections with several of western Billings's east-west arterials and collectors. It also provides access to Interstate 90 via Zoo Drive to the south. A raised median prevents left turns at many two-way stop-controlled intersections, including the one at Bell Avenue. Exclusive left-turn lanes exist at a few select site accesses and local streets. A sidewalk runs along the east side of the road, and a shared-use path called Shiloh Road Trail runs along the west side, much of it separated from the road by a large ditch. There are also two MET Transit bus stops on its east side between the Broadwater and Central roundabouts. These are not considered to be close enough to the project to site to provide meaningful transit access.

Central Avenue is an east-west road that is classified as an urban collector to the west of Shiloh Road and as an urban principal arterial to the east of it. Accordingly, it has one travel lane in each direction to the west of Shiloh, and two travel lanes in each direction to the east of it. It has a speed limit of 45 mph on both sides of Shiloh Road, but it becomes 50 mph to the west of 48th St W. It connects residential neighborhoods to many of western Billings' commercial centers. Central currently has no exclusive turning lanes or parallel multimodal facilities to the west of Shiloh Road.

48th Street W is a north-south local road with one travel lane in each direction. It has a speed limit of 45 mph to the north of Central Avenue and 50 mph to the south of it. It links residences and agricultural properties on the western edges of Billings to the east-west routes that lead into the city, such as Central Avenue and King Avenue. No exclusive turning lanes or multimodal facilities currently exist on 48th in the study area.

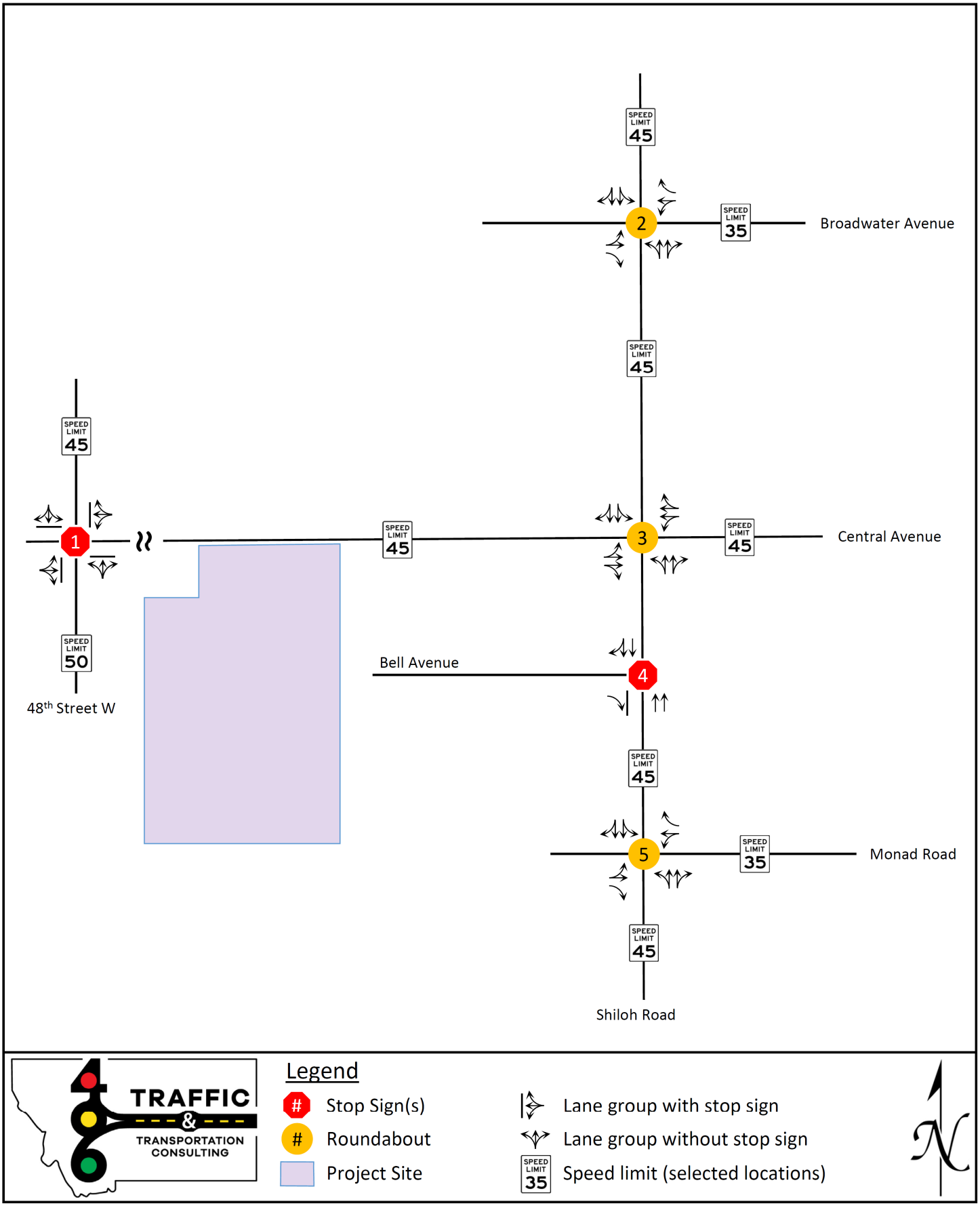
Bell Avenue is an east-west local street with one travel lane in each direction and no posted speed limit. Currently, it provides access to Shiloh Road for a private senior living community and a few other residences. Its eastern terminus is at its intersection with Shiloh Road, where left turns are prohibited. Its western terminus is at a dead-end approximately 2300 ft to the west of this intersection, just past Big Pine Court. While three other streets that intersect Bell Avenue also lead to Central Avenue, these streets traverse private property. As such, Bell Avenue has no outlet for non-residents. The street has no exclusive turning lanes or bike infrastructure, but there is a sidewalk along most of its northern side, starting from the Shiloh Road Trail.

Monad Road is an east-west road that is classified as an urban major collector to the east of Shiloh Road and as a local street to the west of it. West of Shiloh it has one travel lane in each direction, as well as a center left-turn lane. Its speed limit is 35 mph to the east of Shiloh, but it does not have a speed limit posted on the west side. It connects many of western Billings' residential neighborhoods to the industrial areas near the railroad tracks and to north-south routes such as 32nd St W and 24th St W that lead to large commercial centers. It has exclusive right-turn lanes on the east and west legs of the roundabout at Shiloh Road, as well as an exclusive left-turn lane at Henry Chapple Street. To the east of Shiloh Road, there are sidewalks, designated on-street parking, and unprotected bike lanes on both sides of the road. To the west of Shiloh, there is a shared-use path on much of the north side and a sidewalk on much of the south side of the street. There are also two nearby MET Transit bus stops on the south side of the road: one at Henry Chapple Street and the other at Hurdle Circle.

Broadwater Avenue is an east-west urban principal arterial with one travel lane in each direction and a speed limit of 35 mph in the study area. It serves as a link between residential neighborhoods in western Billings, some small commercial centers, and downtown Billings. Its eastern terminus is at its intersection with Division Street, 1st Ave N, and N 36th Street near downtown. Its western terminus is at a roundabout intersection with Shiloh Road. Currently, the roundabout's west leg only connects to two agricultural lots in active use, but the roundabout's infrastructure here has been built out in preparation for potential westward extension of the road. 48th St W also intersects a road called Broadwater Avenue, but this local road segment is currently disconnected from the rest of the arterial network and is only accessible via 48th St W. The arterial Broadwater Avenue has an exclusive westbound right-turn lane at the Shiloh roundabout. There is a shared-use path on the road's north side, and there is a sidewalk on the road's south side extending east.

Intersection traffic control comes in only two forms at the five existing study intersections: two-way stop control (TWSC) and roundabouts. Each leg of the three roundabouts has a crosswalk with a pedestrian refuge in the splitter island. Most of these crosswalks have two solar-powered rectangular rapidly flashing beacons. The intersection of Shiloh Road and Bell Avenue is considered two-way stop-controlled even though only one direction of traffic is stop-controlled. Only four movements are permitted at this intersection: northbound and southbound through movements and southbound and eastbound rights. Shiloh Road's center median prevents all left turns. The intersection of 48th Street and Central Avenue is all-way stop-controlled and is augmented with flashing red beacons facing all four directions. **Exhibit 4** shows traffic control and lane arrangements schematically at each existing intersection as well as posted speed limits on selected road segments.

Exhibit 4. Existing Road and Intersection Basics



2.2 EXISTING TRAFFIC VOLUMES

Existing (2024) annualized volumes were estimated as described earlier in subsection 1.3 and are shown in **Exhibit 5**.

2.3 HISTORIC GROWTH AND BACKGROUND CONDITION TRAFFIC

The “Background Condition” described here is represented by the volumes and intersection performance after several years of traffic growth assumed to occur during the permitting, construction, and initial occupancy of Phase 1. This work is expected to take place in 2025, 2026, and 2027. Allowing for an additional year to ensure full/normal occupancy and for tripmaking behavior by residents to normalize, existing traffic at study intersections was grown to the year 2028. The resulting volumes and operating conditions form the basis for evaluating marginal delay effects of traffic generated by Phase 1 of the Clearwater Estates subdivision.

Phase 2 is currently projected by the applicant team to follow Phase 1 by approximately three years. As such, the study year for Phase 2 traffic is 2031, and traffic was grown in the same way to derive background volumes for that year.

In order to estimate traffic growth without the project, average daily traffic volumes were gathered from selected MDT periodic data collection locations in the study area. The best and most logical data set available was represented by the four legs of the Shiloh intersection at Central. Data were recorded or estimated by MDT annually on each leg dating back at least 20 years. This historical traffic information is shown in the chart in **Exhibit 6**.

Counts from the most recent 10 of these years were used to calculate the average annual growth rate in daily traffic for these four locations in aggregate, which was approximately 3.8% per year. This rate was then applied to the annualized peak hour intersection counts for the Phase 1 and Phase 2 study years. The resulting Background condition traffic volumes are shown for 2028 and 2031 in **Exhibits 7** and **8**, respectively.

Exhibit 5. Existing Traffic Volumes

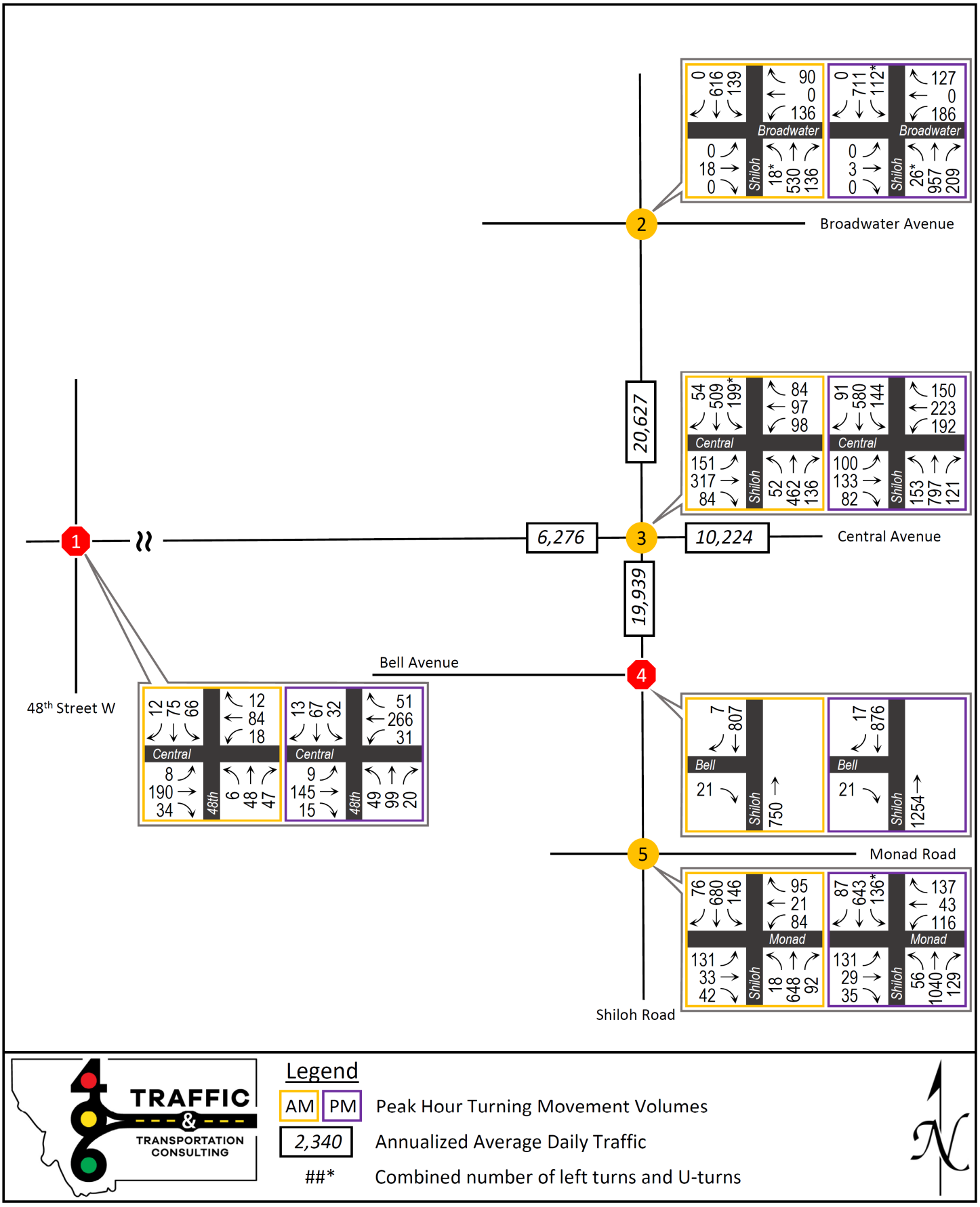


Exhibit 6. Historical Daily Traffic Volumes

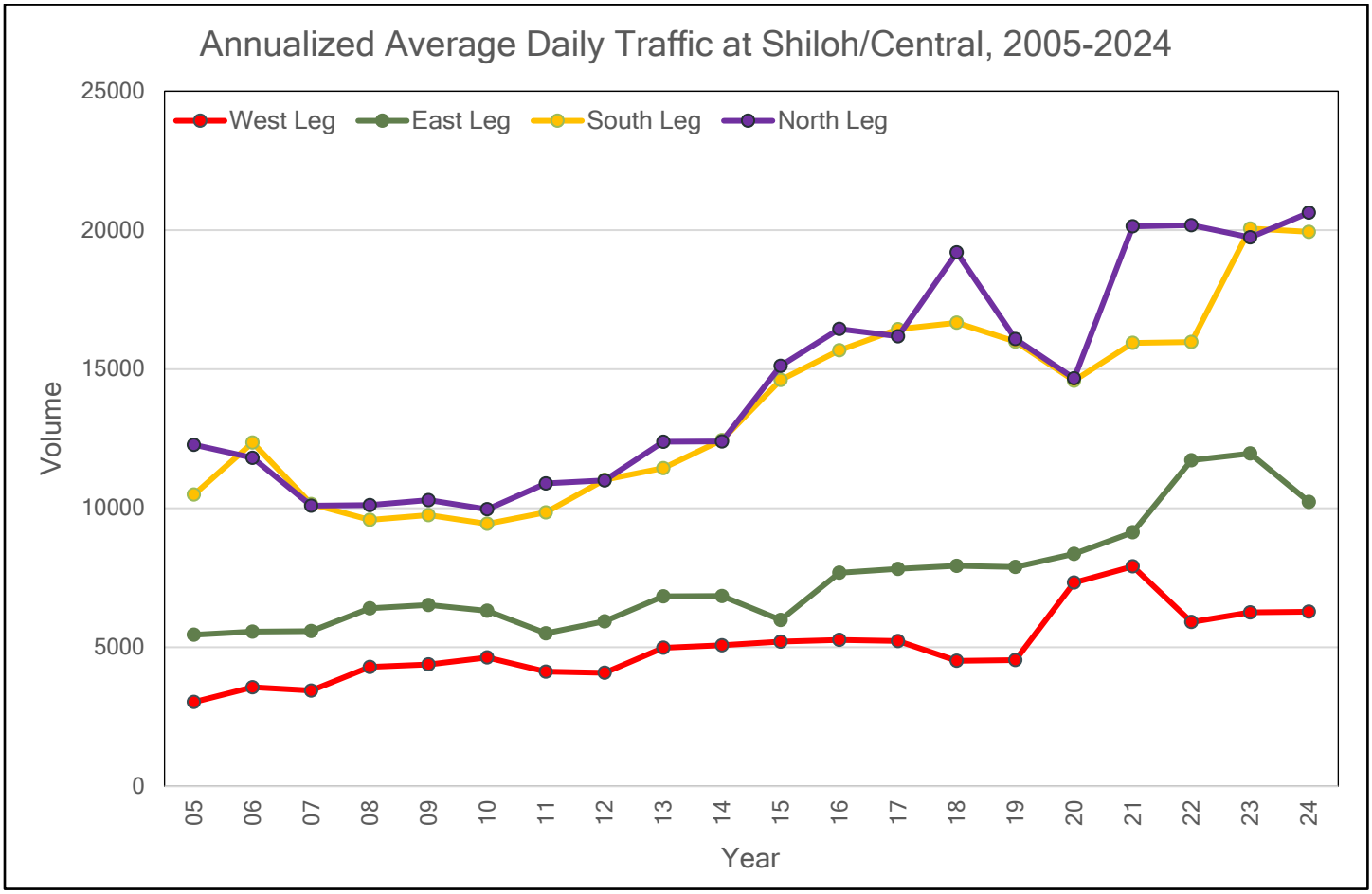


Exhibit 7. 2028 Background Traffic Volumes

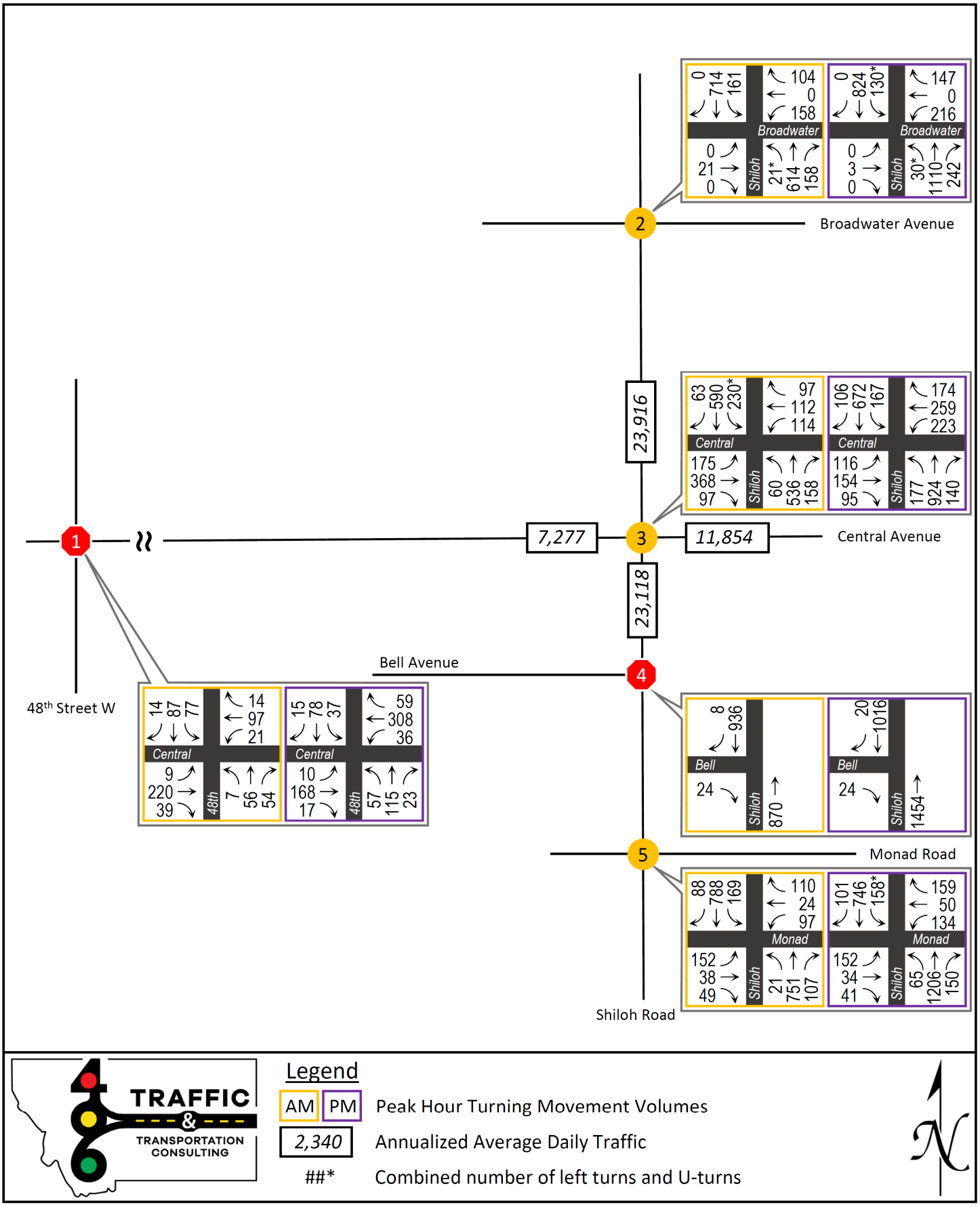
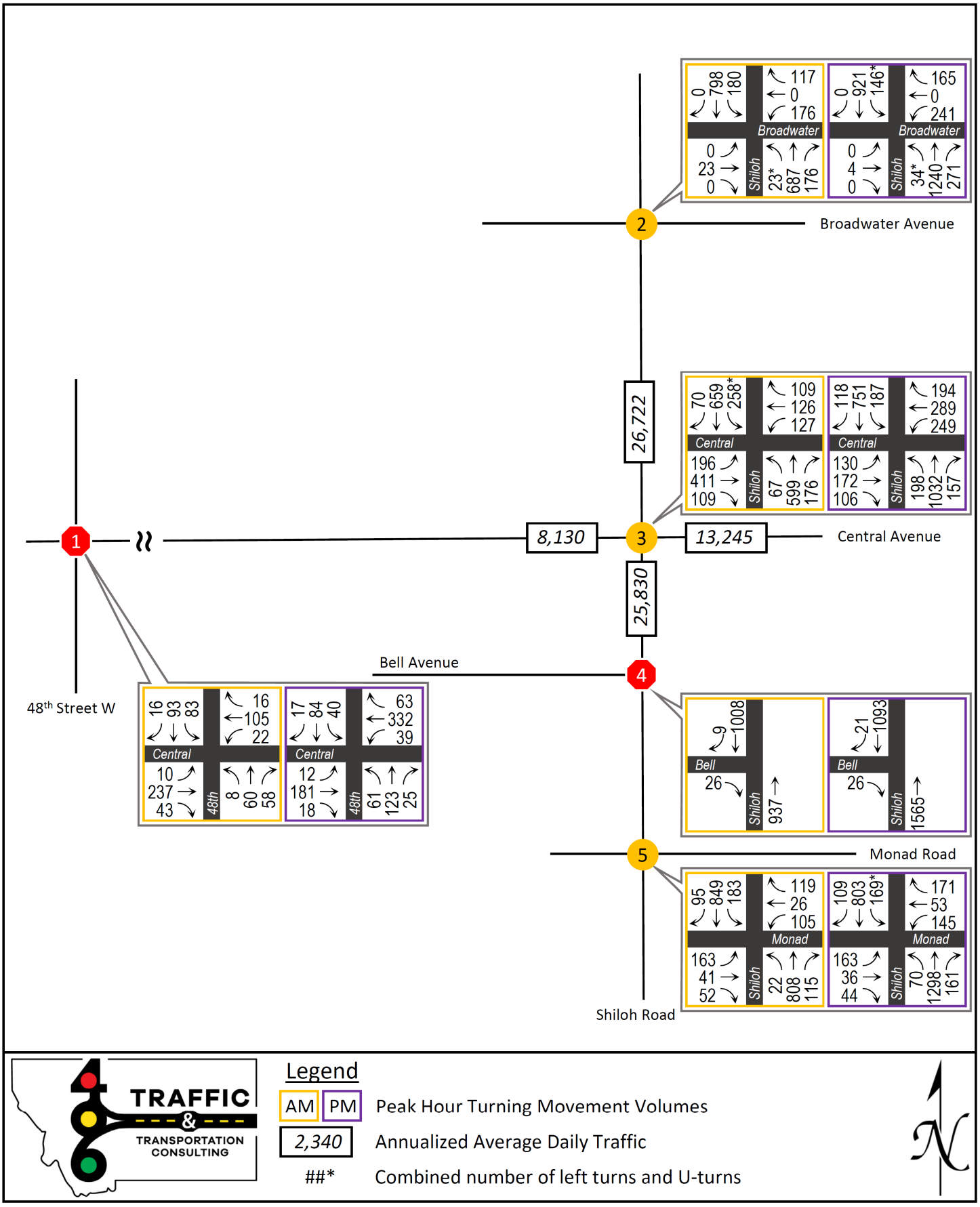


Exhibit 8. 2031 Background Traffic Volumes



2.4 INTERSECTION TRAFFIC OPERATIONS WITHOUT THE PROJECT

The existing and background peak hour intersection Level of Service (LOS) and delay results are shown in **Exhibit 9**. Analysis software results are provided in Appendix B.

Exhibit 9. Existing and Future Background Intersection LOS and Delay

	Intersection	Traffic Control	Peak Hour LOS (delay, in seconds/vehicle)		
			Existing	2028 Background	2031 Background
AM Peak Hour	1. 48th at Central	AWSC	A (9.6)	B (10.6)	B (11.3)
	2. Shiloh at Broadwater	Roundabout	A (6.0)	A (6.9)	A (7.8)
	3. Shiloh at Central	Roundabout	B (11.2)	C (16.2)	D (25.6)
	4. Shiloh at Bell	TWSC*	B (11.8)	B (12.6)	B (13.2)
	5. Shiloh at Monad	Roundabout	A (9.0)	B (11.6)	B (13.7)
PM Peak Hour	1. 48th at Central	AWSC	B (12.7)	C (16.1)	C (20.0)
	2. Shiloh at Broadwater	Roundabout	A (9.1)	B (11.8)	C (15.9)
	3. Shiloh at Central	Roundabout	B (13.6)	C (21.9)	E (40.0)
	4. Shiloh at Bell	TWSC*	B (12.1)	B (13.0)	B (13.6)
	5. Shiloh at Monad	Roundabout	B (10.0)	B (13.7)	C (16.9)

* *Worst lane group is Eastbound at Intersection 4.*

The results in the table indicate that in 2028, all intersections would meet the City's LOS standard of C or better. By 2031, background LOS at the Shiloh/Central roundabout is projected to degrade beyond that standard in both peak hours. Analysis details indicate that in the more severe peak (PM), the longest delays (around 1.5 minutes per vehicle) and queues (13 vehicles, at Synchro's 95th percentile design level) would be for the westbound approach. This background queue would be long enough to block the existing right-in/right-out access for the small mixed-use property on the northwest corner of the intersection, but not to block its ¾ access location farther east on Central.

3 PROJECT TRIP GENERATION AND DISTRIBUTION

3.1 TRIP GENERATION

Trip generation rates, or equations as applicable, are from the Institute of Transportation Engineers (ITE) Trip Generation package's 11th edition. ITE trip generation data, when aggregated across enough varied sites, produce both simple average rates and best-fit equations, either linear or logarithmic, to help the analyst derive proper estimates for their situation. Equations are generally preferred over rates, especially for larger sites where trip generation per unit of land use can diminish with increasing project size.

Clearwater Estates will consist almost entirely of residential land uses. Small park areas within the subdivision are designed and intended for use by residents and their guests, and will be similar to park spaces located in other residential areas around Billings. For that reason, they will not generate external traffic. The strip retail space in Phase 2, programmed for 25,000 square feet, has not had specific tenants or any sub-type(s) of retail use identified, but no drive-through activity is expected.

Three types of adjustments to trip generation were evaluated for this project. First, a discount is sometimes taken to reflect internal capture where multiple uses are present in a single project site. Second, a modal adjustment can be taken if a facility is clearly served by robust high-capacity transit and serves a clientele inclined to use transit to get there, or if the potential land use mix and walk/bike network are likely to lead to nonmotorized trips, either internal or external. Finally, some land uses such as gas stations or coffee shops attract trips that were already using the adjacent or nearby road network by virtue of improved convenience over a similar site that could have been used before. These are called "pass-by" and "diverted-linked" trips. Pass-by trips are those on streets bordering the site, while diverted-linked trips are those that might go slightly out of their way to stop at the establishment on their way to their destination.

The Phase 2 retail parcel is the only part of the site considered for these discounts. Due to its location, small size, and expected similarity to other sites along the Central Avenue corridor, only small discounts of the first two types were assumed here; it is not expected to support a use special enough or large enough to generate pass-by or diverted-linked trip activity. The estimate of combined reduction in vehicle trip use for the retail site due to (a) Clearwater residents' use and (b) nonmotorized trips applied here is 10%. **Exhibit 10** shows trip generation details for both phases of the project.

Exhibit 10. Clearwater Estates Trip Generation

	Daily	AM Peak Hour	PM Peak Hour
Phase 1: Single-Family Detached Housing – X = 66 dwelling units			
ITE Land Use 210 equation	Ln(T)=0.92(X) + 2.68	Ln(T)=0.91(X) + 0.12	T=0.60(X) - 3.93
Peak hour in/out split		*25% / 75%*	*63% / 37%*
Trips	688	51 (13 in / 38 out)	67 (42 in / 25 out)
Phase 1: Single-Family Attached Housing (combined townhome, duplex, and "cottage") – X = 262 dwelling units			
ITE Land Use 215 equation	T=7.62(X) - 50.48	T=0.52(X) - 5.70	T=0.60(X) - 3.93
Peak hour in/out split		*25% / 75%*	*59% / 41%*
Trips	1,946	131 (33 in / 98 out)	153 (90 in / 63 out)
Phase 1 Total Trips	2,634	182 (46 in / 136 out)	221 (133 in / 88 out)
Phase 2: Single-Family Detached Housing – X = 128 dwelling units			
ITE Land Use 210 equation	Ln(T)=0.92(X) + 2.68	Ln(T)=0.91(X) + 0.12	T=0.60(X) - 3.93
Peak hour in/out split		*25% / 75%*	*63% / 37%*
Trips	1,266	93 (23 in / 70 out)	125 (79 in / 46 out)
Phase 2: Strip Retail Plaza – X = 25,000 square feet			
ITE Land Use 822 equation	T=42.2(X) + 229.68	T=2.36(X)	T=6.59(X)
Peak hour in/out split		*60% / 40%*	*50% / 50%*
Gross total trips	1,285	59 (35 in / 24 out)	165 (83 in / 82 out)
Less 10% internal + walk/bike	-128	-6 (4 in / 2 out)	-16 (8 in / 8 out)
Net trips	1,157	53 (31 in / 22 out)	149 (75 in, 74 out)
Combined net trips, both phases:	**5,057**	**328 (101 in / 227 out)**	**494 (286 in / 208 out)**

Source: Equations from ITE Trip Generation, 11th Edition.

3.2 TRIP DISTRIBUTION AND ASSIGNMENT

Trip distribution has been estimated for the streets surrounding the project site in percentages that add to 100%. Farther from the site, traffic eventually disperses in smaller percentages to/from other routes. Because there is no new information regarding a future developer's plan to connect Bell Avenue and/or the similar connection in Phase 2 to the neighborhood to the west, no Clearwater traffic was assumed to use either such connection. Trip distribution and large-scale assignment percentages are shown in **Exhibit 11**. These percentages were assumed to be the same for both phases.

Phase 1 trips reflected as peak hour intersection turning movement volumes and selected daily link volumes are shown in **Exhibit 12**, and the total volumes after Phase 1 implementation and occupancy are shown in **Exhibit 13**. Similarly, new Phase 2 trips and total traffic are shown in **Exhibits 14** and **15**, respectively.

Note that the Shiloh median that blocks all left turns results in some differences in routing of in-out pairs. For example, many residents leaving the site bound for the Shiloh/Monad intersection can turn right at the Shiloh/Bell intersection, but when they return they must go north on Shiloh past Bell, then make a u-turn or left turn at the Shiloh/Central roundabout.

Exhibit 11. Trip Distribution Percentages for New Trips

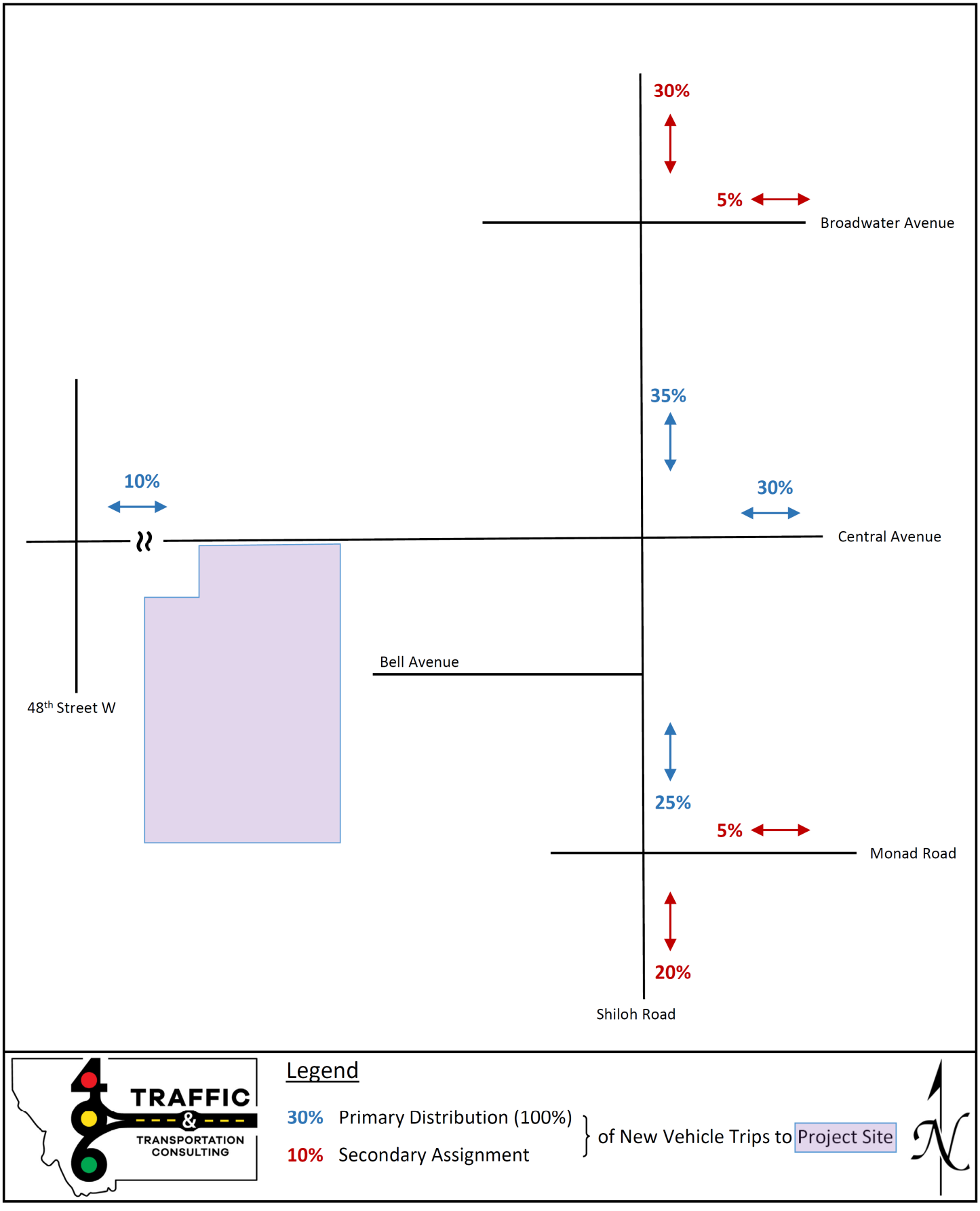


Exhibit 12. Assignment of New Phase 1 Trips

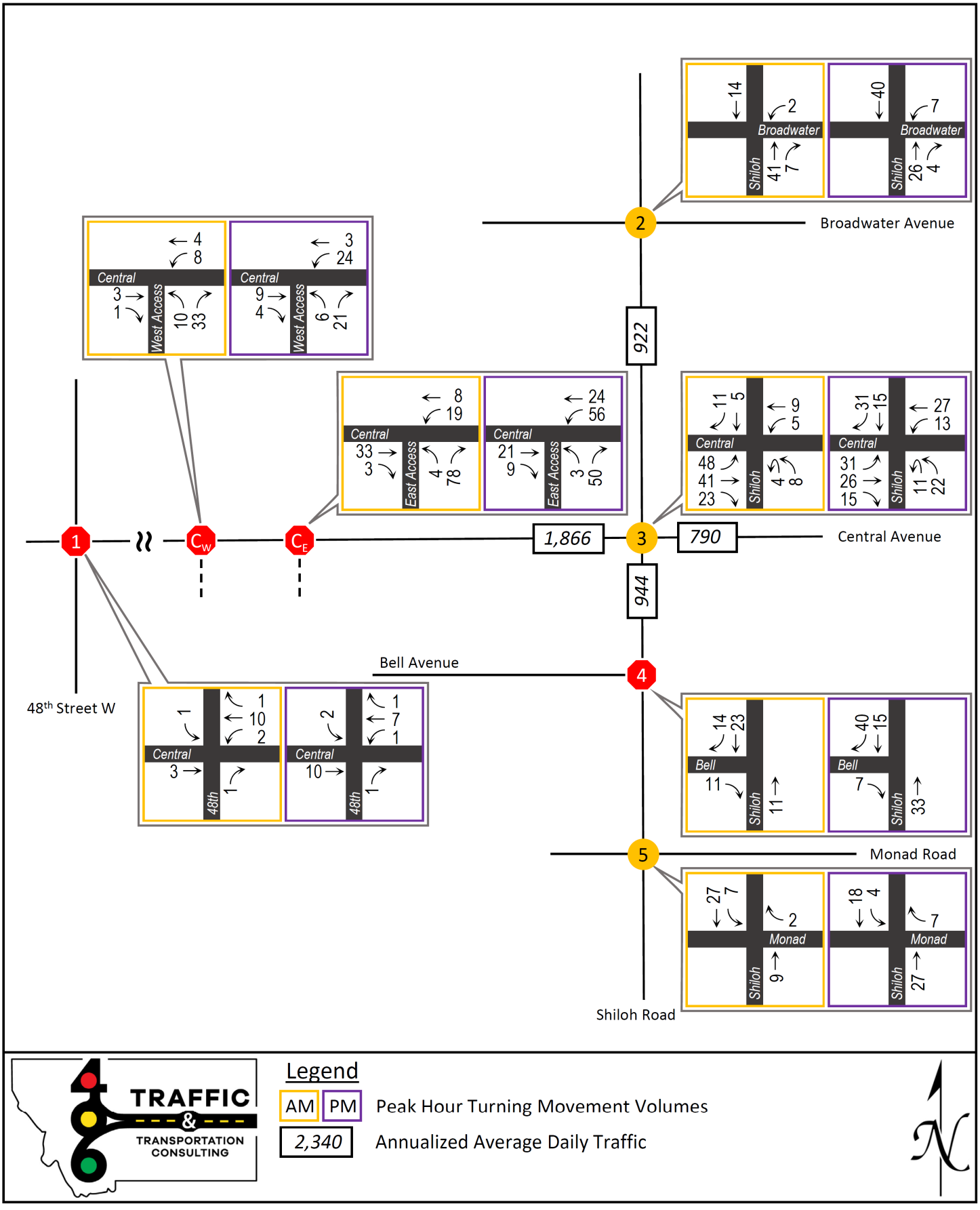


Exhibit 13. 2028 Total Traffic Volumes

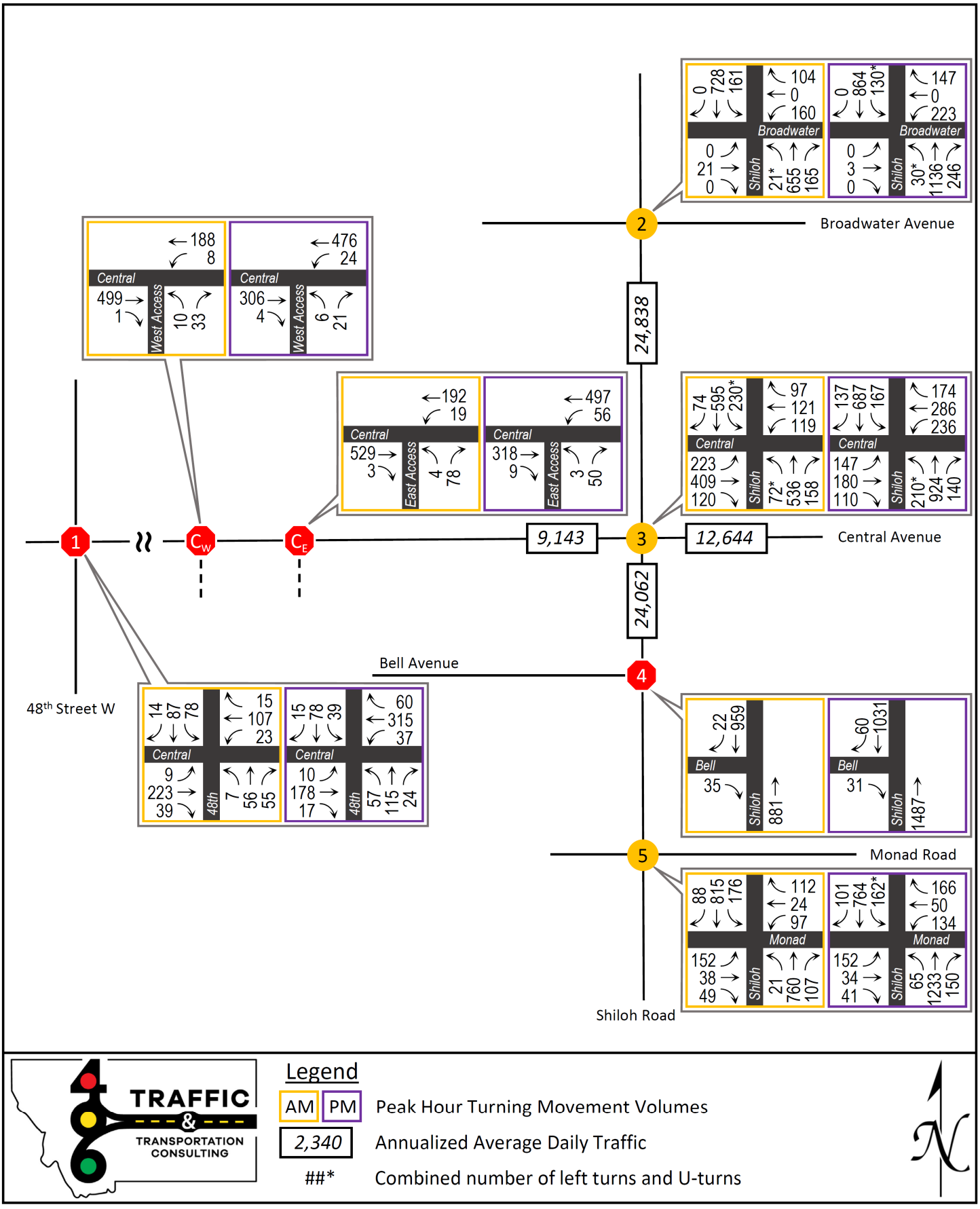


Exhibit 14. Assignment of New Phase 2 Trips

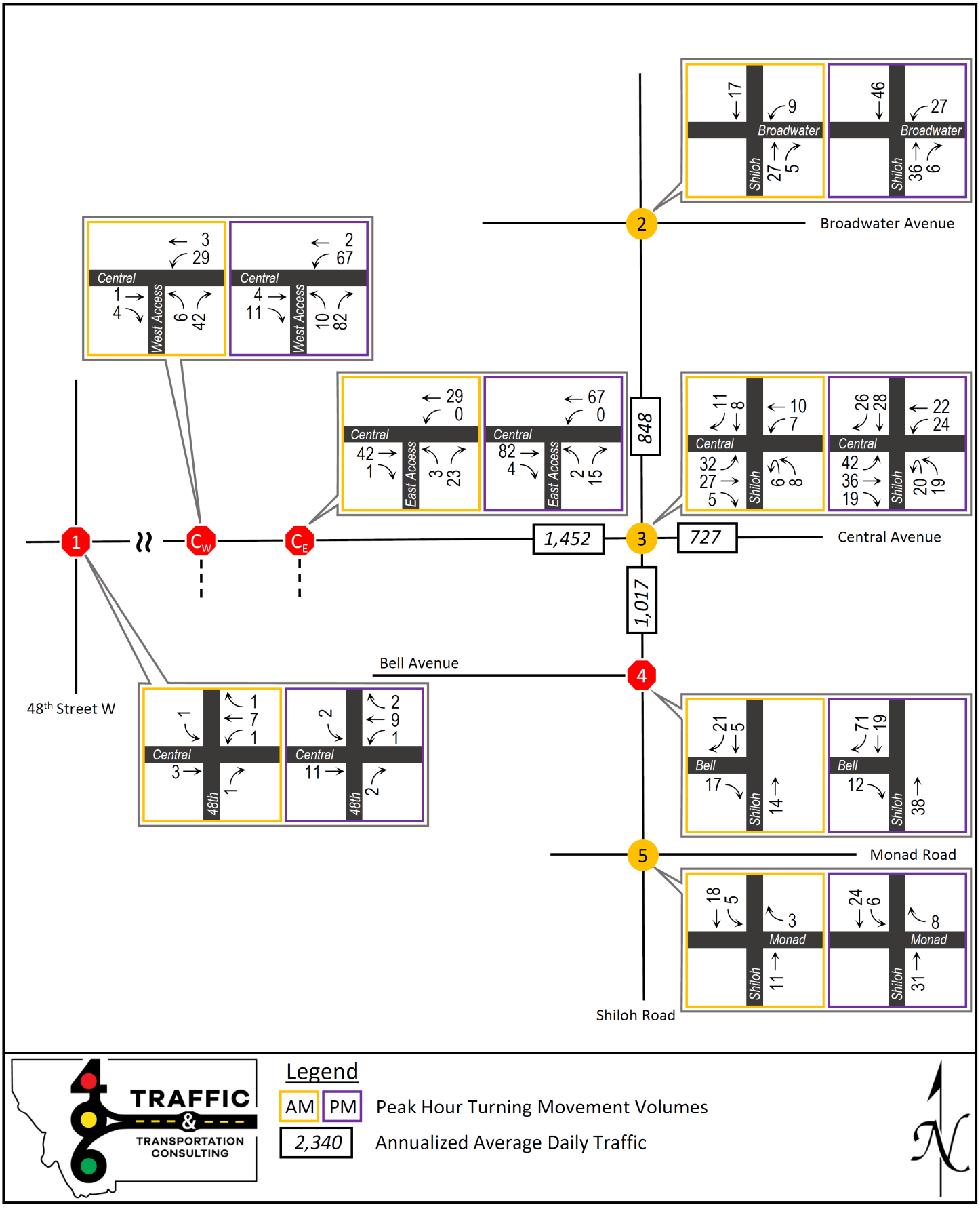
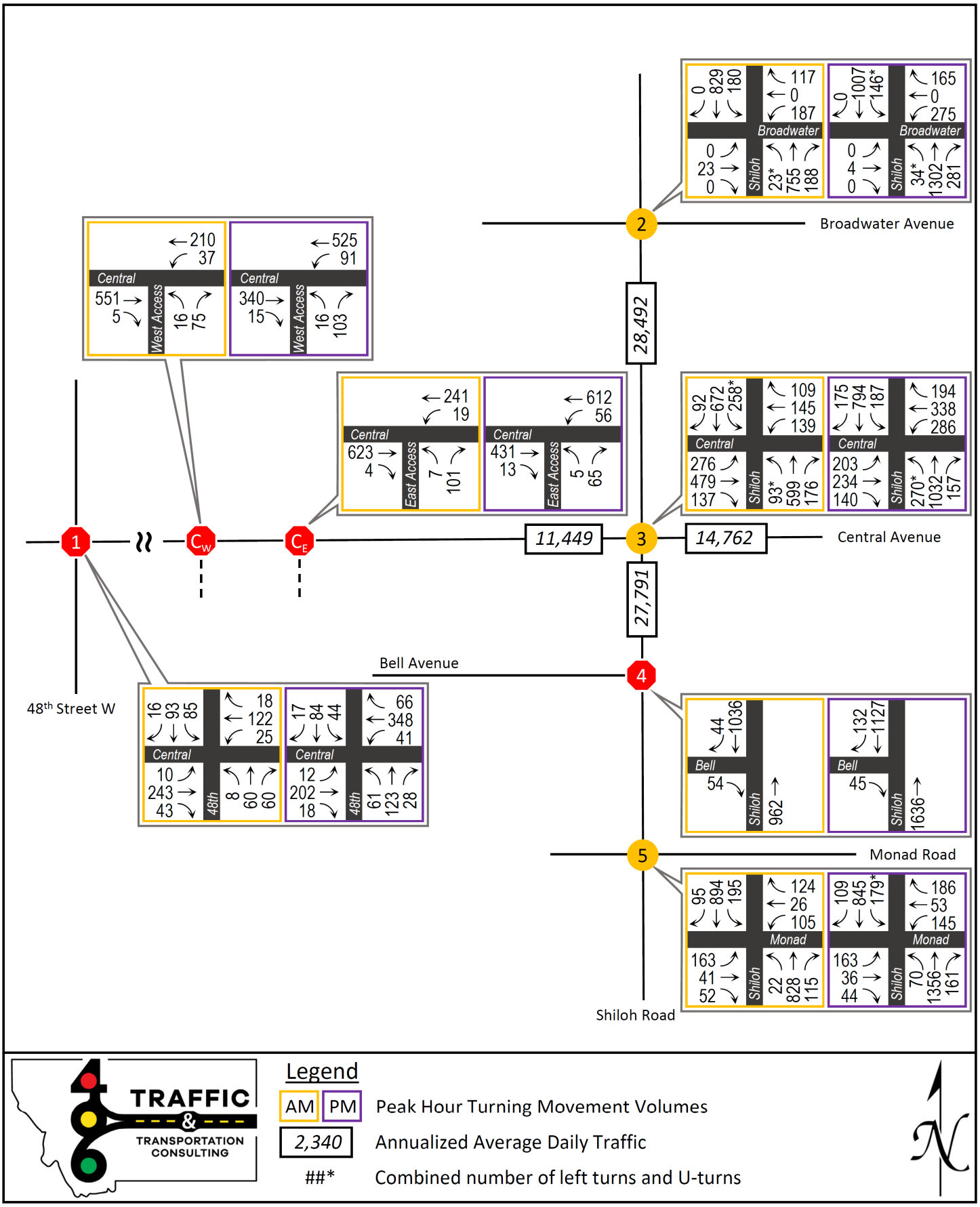


Exhibit 15. 2031 Total Traffic Volumes



4 INTERSECTION CAPACITY ANALYSIS

4.1 PHASE 1

The peak hour intersection Level of Service (LOS) and delay results in 2028 with and without Phase 1 are shown in **Exhibit 15**. Analysis software results are provided in Appendix B.

Exhibit 15. Projected 2028 Intersection LOS and Delay with and without Phase 1

	Intersection	Traffic Control	LOS (delay, in seconds/vehicle) 2028 Background	With Phase 1
AM Peak Hour	1. S. 48th at Central	AWSC	B (10.6)	B (10.8)
	2. Shiloh at Broadwater	Roundabout	A (6.9)	A (7.1)
	3. Shiloh at Central	Roundabout	C (16.2)	C (21.4)
	4. Shiloh at Bell	TWSC*	B (12.6)	B (13.1)
	5. Shiloh at Monad	Roundabout	B (11.6)	B (12.0)
	Central, West Access	TWSC*	-	B (13.5)
	Central, East Access	TWSC*	-	B (14.0)
PM Peak Hour	1. S. 48th at Central	AWSC	C (16.1)	C (17.4)
	2. Shiloh at Broadwater	Roundabout	B (11.8)	B (12.5)
	3. Shiloh at Central	Roundabout	C (21.9)	D (30.5)
	4. Shiloh at Bell	TWSC*	B (13.0)	B (13.6)
	5. Shiloh at Monad	Roundabout	B (13.7)	B (14.3)
	Central, West Access	TWSC*	-	B (12.2)
	Central, East Access	TWSC*	-	B (11.5)

* *Worst lane group is Eastbound at Intersection 4 and Northbound at Intersections 6 and 7.*

Both of the site accesses on Central and the Shiloh/Bell intersection would operate at LOS B in both 2028 peak hours. With respect to the peak hour LOS standard, Clearwater's Phase 1 traffic would only affect Intersection 3, the Shiloh at Central roundabout, and only in the PM peak hour. In this case, delay would increase beyond the LOS C/D threshold (25 seconds per vehicle) as a result of traffic generated by the subdivision. The detailed analysis results indicate that the longest delays (around 1 minute per vehicle) and queues (10 vehicles, at Synchro's 95th percentile design level) would be for the westbound approach. Given the limited range of mitigation options for this 2-lane roundabout and the projected LOS of D, testing of such options was deferred to the Phase 2 scenario, for which operations analysis results are described next.

4.2 PHASE 2

The peak hour intersection Level of Service (LOS) and delay results in 2031 with and without Phase 2 are shown in **Exhibit 16**. Analysis software results are provided in Appendix B.

Exhibit 16. Projected 2031 Intersection LOS and Delay with and without Phase 2

	Intersection	Traffic Control	LOS (delay, in seconds/vehicle) 2031 Background	With Phase 2
AM Peak Hour	1. S. 48th at Central	AWSC	B (11.3)	B (11.6)
	2. Shiloh at Broadwater	Roundabout	A (7.8)	A (8.3)
	3. Shiloh at Central	Roundabout	D (25.6)	F (52.5)
	4. Shiloh at Bell	TWSC*	B (13.2)	B (14.4)
	5. Shiloh at Monad	Roundabout	B (13.7)	B (14.8)
	Central, West Access	TWSC*	-	C (16.0)
	Central, East Access	TWSC*	-	C (17.0)
PM Peak Hour	1. S. 48th at Central	AWSC	C (20.0)	C (23.7)
	2. Shiloh at Broadwater	Roundabout	C (15.9)	C (20.6)
	3. Shiloh at Central	Roundabout	E (40.0)	F (95.7)
	4. Shiloh at Bell	TWSC*	B (13.6)	C (15.4)
	5. Shiloh at Monad	Roundabout	C (16.9)	C (19.1)
	Central, West Access	TWSC*	-	C (15.2)
	Central, East Access	TWSC*	-	B (13.8)

* *Worst lane group is Eastbound at Intersection 4 and Northbound at Intersections 6 and 7.*

As with 2028 conditions, all intersections and both new site accesses would operate within the City's LOS standard of C or better in both peak hours, with the exception of the Shiloh/Central roundabout. There, the additional traffic generated by Clearwater Estates would degrade the already-substandard LOS in both peak hours if no change is made to intersection capacity. In the context of examining intersection delays, it's important to note that the relationship between volume and delay is not linear; intersections operating near, at, or over capacity often have highly elastic delay responses to relatively small changes in volume.

To address future capacity deficiencies, the primary tool at roundabouts is the addition of a channelized right turn bypass lane on the approach(es) with the highest right-turning volume. They require widening and would lengthen pedestrian crossings, as with the addition of a turn lane at any intersection. Installing bypass lanes on the northbound and westbound approaches—that is, to and from the west, where Central is a 4/5-lane facility—would reduce projected PM peak hour average delay for the intersection by 25-30 seconds per vehicle, but LOS would still be F. The AM peak hour LOS would be expected to improve considerably, yet also still have higher delay than in the 2031 Background scenario. Bypass lanes are not logical for Central Avenue to and from the east, where Central currently has only a 2-lane cross section. The applicant team encourages the City to consider prioritizing, to the extent practicable, additional east-west connectivity between Shiloh and 48th with eventual functional extensions of Broadwater and/or Monad as additional land use changes occur along those logical alignments.

The short-term projection of substandard operations at Shiloh/Central, even without traffic from this particular subdivision, echoes similar findings for other major Shiloh roundabouts from recent studies. Some of this current and expected congestion stems from the scarcity of east-west street network connections other than the major arterials that are generally a mile apart. To that end, a secondary, "bigger-picture" part of the overall solution could involve the westward extension of the east-west streets a half-mile north and south of Central (Broadwater and Monad) to help relieve the traffic burden on Grand, Central, and King. Such extensions are outside the scope of Clearwater's mitigation analysis but still bear mentioning for general interest.

5 COST PARTICIPATION

The net new trips identified in this report are subject to examination under the City's cost participation program to the extent that they would travel through studied intersections. Critical traffic shares that drive cost participation are subject to waiver if they fall below 2%, but project trips from both phases are considered together when evaluating such a possibility. Right turns are not considered.

Intersection 4 was excluded from cost participation calculations because (a) Bell Avenue has been designed for local access only, which will keep volumes low, (b) Shiloh Road's access management features are considered permanent such that no traffic control changes are anticipated to be possible within the scope and timeframe of this project, and (c) as a right-in/right-out intersection there are, in effect, no critical pairs.

Exhibit 17 shows the incremental intersection cost participation for the new trips associated with each of the two project phases and the cost share calculation. As shown in the table, none of the four full-movement intersections qualify for the "sub-2%" waiver.

Exhibit 17. Intersection Cost Participation by Phase

	Phase 1			Phase 2			
Intersection*	**AM**	**PM**	**Higher**	**AM**	**PM**	**Higher**	**Total**
1. S. 48th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			**11.2%**			**14.4%**	**25.6%**
x $450,000			**$50,400**			**$64,800**	**$115,200**

For all intersections in both phases, the PM peak hour critical-pair traffic volume would exceed that of the AM peak hour. The calculation summary shown here indicates that $50,400 is associated with Phase 1 traffic and $64,800 is associated with Phase 2. The details of these cost participation calculations are provided in Appendix C.

This concludes the Clearwater Subdivision TAS.

Appendix A: Original Raw Traffic Count Data for Intersections

Study Name **Central and 48th**
Start Date **8/8/2023**
Start Time **7:30 AM**
Type **Road**
Classification **Totals**

	48th Street Southbound				Central Avenue Westbound				48th Street Northbound				Central Avenue Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM																
7:15 AM																
7:30 AM	3	13	19	0	3	27	2	0	18	9	2	0	5	62	1	0
7:45 AM	3	26	21	0	3	24	5	0	9	10	1	0	12	48	1	0
8:00 AM	4	19	12	0	3	17	5	0	10	13	3	0	10	44	2	0
8:15 AM	2	15	13	0	3	14	5	0	8	14	0	0	6	31	4	0
8:30 AM																
8:45 AM																
4:00 PM																
4:15 PM																
4:30 PM																
4:45 PM																
5:00 PM	1	15	6	0	14	70	7	0	7	23	9	0	5	38	1	0
5:15 PM	3	19	12	0	17	60	12	0	5	30	19	0	5	40	2	0
5:30 PM	4	18	5	0	8	69	6	0	6	20	10	0	2	32	4	0
5:45 PM	5	14	8	0	10	60	5	0	1	23	9	0	2	31	2	0

Study Name Shiloh & Broadwater
Start Date 3/7/2024
Start Time 7:00 AM
Type Road
Classification Totals

	Shiloh Road Southbound				Broadwater Avenue Westbound				Shiloh Road Northbound				Eastbound Approach Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	0	111	22	0	17	0	8	0	23	52	0	0	0	1	0	0
7:15 AM	0	147	52	0	21	0	25	0	35	102	0	6	0	3	0	0
7:30 AM	0	182	63	0	18	0	33	0	28	122	0	2	0	4	0	0
7:45 AM	0	170	34	0	23	0	39	0	38	140	0	4	0	4	0	0
8:00 AM	0	131	22	0	26	0	29	0	39	143	0	6	0	6	0	0
8:15 AM	0	139	21	0	24	0	36	0	32	130	0	6	0	4	0	0
8:30 AM	0	133	23	0	18	0	28	0	42	137	0	5	0	3	0	0
8:45 AM	0	150	49	0	18	0	28	0	34	124	0	3	0	4	0	0
4:00 PM	0	143	17	0	33	0	42	0	27	244	0	5	0	2	0	0
4:15 PM	0	151	25	0	20	0	46	0	36	226	0	2	0	0	1	0
4:30 PM	0	151	31	0	21	0	38	0	50	238	2	2	0	0	0	0
4:45 PM	0	177	21	0	24	0	37	0	35	201	1	3	0	0	0	0
5:00 PM	0	169	23	0	40	0	56	0	56	281	0	8	0	3	0	0
5:15 PM	0	193	32	1	44	0	52	0	63	283	4	8	0	0	0	0
5:30 PM	0	179	35	1	20	0	43	0	57	202	1	1	0	0	0	0
5:45 PM	0	160	33	2	20	1	35	0	43	200	0	0	0	0	0	0

Study Name Shiloh & Central
Start Date 3/21/2024
Start Time 7:00 AM
Type Road
Classification Totals

	Shiloh Road Southbound				Central Avenue Westbound				Shiloh Road Northbound				Central Avenue Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	6	74	22	0	7	13	15	0	19	66	9	1	19	51	15	0
7:15 AM	8	118	48	0	7	18	28	0	32	84	14	0	25	90	17	0
7:30 AM	16	128	69	1	18	25	29	0	41	96	15	0	22	112	36	0
7:45 AM	17	135	67	0	26	19	34	0	36	130	19	0	20	91	42	0
8:00 AM	7	116	32	0	29	25	17	0	33	114	10	0	21	76	37	0
8:15 AM	15	135	31	1	12	29	19	0	27	127	9	0	22	41	38	0
8:30 AM	9	98	29	0	15	30	21	0	26	146	10	0	16	30	31	0
8:45 AM	10	102	31	1	20	22	24	0	17	119	20	0	22	40	30	0
4:00 PM	19	127	37	0	23	51	45	0	35	168	24	0	21	29	27	0
4:15 PM	20	100	34	0	35	41	58	0	26	156	45	0	20	39	25	0
4:30 PM	23	127	35	0	38	50	62	0	30	163	47	0	21	26	27	0
4:45 PM	19	153	33	0	41	45	49	0	26	174	41	0	15	36	23	0
5:00 PM	26	152	34	0	38	63	48	0	31	235	32	0	21	46	23	0
5:15 PM	24	154	43	0	35	67	35	0	35	233	35	0	26	26	28	0
5:30 PM	17	142	35	0	40	74	46	0	32	148	35	0	14	32	27	0
5:45 PM	21	148	30	0	31	46	41	0	32	162	26	0	24	22	30	0

Study Name Shiloh & Bell
Start Date 5/18/2023
Start Time 7:00 AM
Type Road
Classification Totals

	Shiloh Road Southbound				n/a Westbound				Shiloh Road Northbound				Bell Avenue Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	1	126		0						103	0	0	1		0	0
7:15 AM	0	186		0						111	0	0	2		0	0
7:30 AM	2	181		0						228	0	0	7		0	0
7:45 AM	2	239		0						213	0	0	7		0	0
8:00 AM	1	184		0						169	0	0	7		0	0
8:15 AM	3	233		0						167	0	0	1		0	0
8:30 AM	2	163		0						180	0	0	3		0	0
8:45 AM	6	174		0						169	0	0	5		0	0
4:00 PM	2	225		0						272	0	0	6		0	0
4:15 PM	4	224		0						262	0	0	3		0	0
4:30 PM	3	212		0						311	0	0	2		0	0
4:45 PM	5	212		0						307	0	0	7		0	0
5:00 PM	4	241		0						357	0	0	8		0	0
5:15 PM	5	243		0						324	0	0	4		0	0
5:30 PM	6	213		0						263	0	0	7		0	0
5:45 PM	6	219		0						254	0	0	2		0	0

Study Name Shiloh & Monad
Start Date 10/24/2023
Start Time 7:00 AM
Type Road
Classification Totals

	Shiloh Road Southbound				Monad Road Westbound				Shiloh Road Northbound				Monad Road Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	6	126	12	0	8	7	12	0	16	67	5	0	10	5	12	0
7:15 AM	12	129	36	0	11	9	15	0	22	113	1	0	13	3	25	0
7:30 AM	9	138	32	0	24	3	22	0	29	175	5	0	17	14	33	0
7:45 AM	16	215	49	0	29	8	21	0	21	190	8	0	12	7	36	0
8:00 AM	23	181	23	0	18	2	22	0	23	142	1	0	9	10	24	0
8:15 AM	26	128	38	0	22	7	17	0	17	123	3	0	2	1	34	0
8:30 AM	12	150	42	5	17	1	15	0	16	111	2	1	5	2	24	0
8:45 AM	10	135	20	0	20	5	9	0	14	109	1	0	10	3	16	0
4:00 PM	16	166	26	0	30	6	21	0	33	210	10	0	12	8	23	0
4:15 PM	15	162	23	0	25	10	20	0	30	203	7	0	6	15	23	0
4:30 PM	21	174	35	0	37	12	29	0	22	233	9	0	8	9	41	0
4:45 PM	18	154	27	1	29	8	32	0	28	236	18	0	6	0	35	0
5:00 PM	16	138	44	0	29	15	27	0	35	277	12	0	9	10	31	0
5:15 PM	30	160	25	0	38	6	25	0	40	266	16	0	11	9	20	0
5:30 PM	19	180	23	0	37	8	34	0	34	183	13	0	9	7	31	0
5:45 PM	24	156	28	0	37	10	16	0	25	176	13	0	11	12	21	0

Appendix B: Intersection Analysis Software Output

Scenario sequence:

Existing

2028 Background

2028 Phase 1

2031 Background

2031 Phase 2

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	190	34	18	84	12	6	48	47	66	75	12
Future Vol, veh/h	8	190	34	18	84	12	6	48	47	66	75	12
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	9	213	38	20	94	13	7	54	53	74	84	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.2	9.1	8.9	9.7
HCM LOS	B	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	43%
Vol Thru, %	48%	82%	74%	49%
Vol Right, %	47%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	101	232	114	153
LT Vol	6	8	18	66
Through Vol	48	190	84	75
RT Vol	47	34	12	12
Lane Flow Rate	113	261	128	172
Geometry Grp	1	1	1	1
Degree of Util (X)	0.154	0.342	0.177	0.24
Departure Headway (Hd)	4.882	4.722	4.983	5.033
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	727	756	713	708
Service Time	2.959	2.783	3.056	3.104
HCM Lane V/C Ratio	0.155	0.345	0.18	0.243
HCM Control Delay, s/veh	8.9	10.2	9.1	9.7
HCM Lane LOS	A	B	A	A
HCM 95th-tile Q	0.5	1.5	0.6	0.9

Intersection	
Intersection Delay, s/veh	6.0
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	19	241	728	803
Demand Flow Rate, veh/h	19	243	742	811
Vehicles Circulating, veh/h	957	594	168	165
Vehicles Exiting, veh/h	19	316	808	672
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.1	6.1	5.9	6.1
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.601	0.399	0.470	0.530	0.470	0.530
Follow-Up Headway, s	1.000	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	3600	1420	1350	1420	1420	1420	1420	1420
B (Slope)	1.151e-3	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	19	0	146	97	349	393	381	430
Cap Entry Lane, veh/h	1196	629	782	857	1219	1219	1222	1222
Entry HV Adj Factor	1.000	1.000	0.993	0.990	0.980	0.981	0.991	0.990
Flow Entry, veh/h	19	0	145	96	342	386	378	426
Cap Entry, veh/h	1196	629	776	848	1194	1196	1211	1210
V/C Ratio	0.016	0.000	0.187	0.113	0.286	0.322	0.312	0.352
Control Delay, s/veh	3.1	5.7	6.6	5.4	5.7	6.0	5.9	6.3
LOS	A	A	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	0	1	1	1	2

Intersection	
Intersection Delay, s/veh	11.2
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	620	310	730	857
Demand Flow Rate, veh/h	632	319	753	866
Vehicles Circulating, veh/h	917	768	762	282
Vehicles Exiting, veh/h	231	747	787	805
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	14.6	7.9	13.7	7.6
Approach LOS	B	A	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	297	335	150	169	354	399	407	459
Cap Entry Lane, veh/h	581	651	666	739	670	743	1041	1117
Entry HV Adj Factor	0.981	0.981	0.971	0.972	0.970	0.970	0.990	0.990
Flow Entry, veh/h	291	329	146	164	343	387	403	454
Cap Entry, veh/h	570	639	647	718	649	721	1031	1106
V/C Ratio	0.511	0.514	0.225	0.229	0.529	0.537	0.391	0.411
Control Delay, s/veh	15.3	14.0	8.3	7.6	14.2	13.3	7.7	7.6
LOS	C	B	A	A	B	B	A	A
95th %tile Queue, veh	3	3	1	1	3	3	2	2

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	21	0	750	807	7
Future Vol, veh/h	0	21	0	750	807	7
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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	24	0	843	907	8

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	457	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	556	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	556	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	11.76	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	556	-	-
HCM Lane V/C Ratio	-	0.042	-	-
HCM Ctrl Dly (s/v)	-	11.8	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.1	-	-

Intersection	
Intersection Delay, s/veh	9.0
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	251	241	924	1100
Demand Flow Rate, veh/h	259	248	933	1111
Vehicles Circulating, veh/h	1119	985	386	151
Vehicles Exiting, veh/h	143	334	992	1082
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.9	9.3	9.2	7.6
Approach LOS	B	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.795	0.205	0.520	0.480	0.471	0.529	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	206	53	129	119	439	494	522	589
Cap Entry Lane, veh/h	482	549	545	615	999	999	1238	1238
Entry HV Adj Factor	0.970	0.962	0.971	0.975	0.989	0.991	0.990	0.990
Flow Entry, veh/h	200	51	125	116	434	490	517	583
Cap Entry, veh/h	468	528	529	599	989	991	1226	1225
V/C Ratio	0.427	0.097	0.236	0.194	0.439	0.494	0.422	0.476
Control Delay, s/veh	15.5	8.0	10.1	8.4	8.7	9.6	7.2	8.0
LOS	C	A	B	A	A	A	A	A
95th %tile Queue, veh	2	0	1	1	2	3	2	3

Intersection	
Intersection Delay, s/veh	12.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	145	15	31	266	51	49	99	20	32	67	13
Future Vol, veh/h	9	145	15	31	266	51	49	99	20	32	67	13
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	10	169	17	36	309	59	57	115	23	37	78	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.8	14.9	11.3	10.5
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	29%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	168	169	348	112
LT Vol	49	9	31	32
Through Vol	99	145	266	67
RT Vol	20	15	51	13
Lane Flow Rate	195	197	405	130
Geometry Grp	1	1	1	1
Degree of Util (X)	0.31	0.298	0.575	0.212
Departure Headway (Hd)	5.721	5.465	5.118	5.852
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	627	656	704	611
Service Time	3.772	3.515	3.159	3.907
HCM Lane V/C Ratio	0.311	0.3	0.575	0.213
HCM Control Delay, s/veh	11.3	10.8	14.9	10.5
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.3	1.2	3.7	0.8

Intersection	
Intersection Delay, s/veh	9.1
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	3	360	1370	946
Demand Flow Rate, veh/h	3	360	1370	955
Vehicles Circulating, veh/h	1169	1130	133	244
Vehicles Exiting, veh/h	30	373	1039	1246
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.9	13.6	9.0	7.6
Approach LOS	A	B	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.594	0.406	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	3	0	214	146	644	726	449	506
Cap Entry Lane, veh/h	461	526	477	543	1258	1258	1137	1137
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991
Flow Entry, veh/h	3	0	214	146	644	726	445	501
Cap Entry, veh/h	461	526	477	543	1258	1258	1126	1127
V/C Ratio	0.007	0.000	0.448	0.269	0.512	0.577	0.395	0.445
Control Delay, s/veh	7.9	6.8	15.8	10.4	8.4	9.6	7.2	8.0
LOS	A	A	C	B	A	A	A	A
95th %tile Queue, veh	0	0	2	1	3	4	2	2

Intersection	
Intersection Delay, s/veh	13.6
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	339	607	1152	877
Demand Flow Rate, veh/h	339	607	1152	886
Vehicles Circulating, veh/h	993	1130	408	611
Vehicles Exiting, veh/h	504	430	924	1126
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	10.3	19.9	12.1	12.6
Approach LOS	B	C	B	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.469	0.531	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	159	180	285	322	541	611	416	470
Cap Entry Lane, veh/h	541	611	477	543	927	1004	769	845
Entry HV Adj Factor	1.002	0.998	1.001	0.999	1.001	0.999	0.991	0.989
Flow Entry, veh/h	159	180	285	322	541	611	412	465
Cap Entry, veh/h	543	609	478	543	928	1003	762	835
V/C Ratio	0.294	0.295	0.597	0.593	0.583	0.609	0.541	0.556
Control Delay, s/veh	10.8	9.8	21.1	18.8	12.1	12.0	12.8	12.4
LOS	B	A	C	C	B	B	B	B
95th %tile Queue, veh	1	1	4	4	4	4	3	3

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	21	0	1254	876	17
Future Vol, veh/h	0	21	0	1254	876	17
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	23	0	1363	952	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	485	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	533	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	533	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.05	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	533	-	-
HCM Lane V/C Ratio	-	0.043	-	-
HCM Ctrl Dly (s/v)	-	12.1	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.1	-	-

Intersection	
Intersection Delay, s/veh	10.0
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	201	305	1263	893
Demand Flow Rate, veh/h	206	305	1263	902
Vehicles Circulating, veh/h	931	1268	310	222
Vehicles Exiting, veh/h	193	305	827	1351
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.8	14.1	11.1	7.1
Approach LOS	A	B	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.538	0.462	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	169	37	164	141	594	669	424	478
Cap Entry Lane, veh/h	573	644	420	483	1071	1071	1160	1160
Entry HV Adj Factor	0.979	0.973	1.000	1.000	0.999	1.001	0.990	0.991
Flow Entry, veh/h	165	36	164	141	594	669	420	473
Cap Entry, veh/h	561	626	420	483	1070	1072	1149	1149
V/C Ratio	0.295	0.057	0.390	0.292	0.555	0.625	0.365	0.412
Control Delay, s/veh	10.6	6.4	15.9	11.9	10.2	11.9	6.8	7.4
LOS	B	A	C	B	B	B	A	A
95th %tile Queue, veh	1	0	2	1	4	5	2	2

Intersection	
Intersection Delay, s/veh	10.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	220	39	21	97	14	7	56	54	77	87	14
Future Vol, veh/h	9	220	39	21	97	14	7	56	54	77	87	14
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	10	247	44	24	109	16	8	63	61	87	98	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	11.6	9.8	9.5	10.6
HCM LOS	B	A	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	43%
Vol Thru, %	48%	82%	73%	49%
Vol Right, %	46%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	117	268	132	178
LT Vol	7	9	21	77
Through Vol	56	220	97	87
RT Vol	54	39	14	14
Lane Flow Rate	131	301	148	200
Geometry Grp	1	1	1	1
Degree of Util (X)	0.191	0.419	0.218	0.297
Departure Headway (Hd)	5.224	5.01	5.3	5.34
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	686	723	678	674
Service Time	3.259	3.01	3.332	3.371
HCM Lane V/C Ratio	0.191	0.416	0.218	0.297
HCM Control Delay, s/veh	9.5	11.6	9.8	10.6
HCM Lane LOS	A	B	A	B
HCM 95th-tile Q	0.7	2.1	0.8	1.2

Intersection	
Intersection Delay, s/veh	6.9
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	22	279	843	931
Demand Flow Rate, veh/h	22	282	859	941
Vehicles Circulating, veh/h	1111	688	195	192
Vehicles Exiting, veh/h	22	366	938	778
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.0	7.1	6.6	7.0
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.603	0.397	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	22	0	170	112	404	455	442	499
Cap Entry Lane, veh/h	486	552	717	791	1189	1189	1192	1192
Entry HV Adj Factor	1.000	1.000	0.988	0.991	0.981	0.982	0.990	0.989
Flow Entry, veh/h	22	0	168	111	396	447	438	494
Cap Entry, veh/h	486	552	708	784	1166	1168	1181	1180
V/C Ratio	0.045	0.000	0.237	0.142	0.340	0.383	0.371	0.418
Control Delay, s/veh	8.0	6.5	7.8	6.1	6.4	6.9	6.7	7.3
LOS	A	A	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	0	2	2	2	2

Intersection	
Intersection Delay, s/veh	16.2
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	719	363	847	992
Demand Flow Rate, veh/h	733	374	872	1003
Vehicles Circulating, veh/h	1063	890	883	331
Vehicles Exiting, veh/h	271	865	913	933
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	23.2	9.8	21.1	9.2
Approach LOS	C	A	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.471	0.529	0.471	0.529	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	345	388	176	198	410	462	471	532
Cap Entry Lane, veh/h	508	575	595	666	599	670	996	1072
Entry HV Adj Factor	0.979	0.982	0.970	0.972	0.971	0.972	0.990	0.989
Flow Entry, veh/h	338	381	171	193	398	449	466	526
Cap Entry, veh/h	497	565	577	648	582	651	986	1060
V/C Ratio	0.680	0.674	0.296	0.297	0.684	0.689	0.473	0.496
Control Delay, s/veh	24.6	21.9	10.3	9.4	22.0	20.3	9.3	9.2
LOS	C	C	B	A	C	C	A	A
95th %tile Queue, veh	5	5	1	1	5	5	3	3

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	24	0	870	936	8
Future Vol, veh/h	0	24	0	870	936	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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	27	0	978	1052	9

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	530	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	498	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	498	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.63	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	498	-	-
HCM Lane V/C Ratio	-	0.054	-	-
HCM Ctrl Dly (s/v)	-	12.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	11.6
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	291	281	1072	1274
Demand Flow Rate, veh/h	300	290	1082	1287
Vehicles Circulating, veh/h	1301	1142	446	178
Vehicles Exiting, veh/h	164	386	1155	1254
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	21.1	11.9	11.8	9.1
Approach LOS	C	B	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.793	0.207	0.524	0.476	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	238	62	152	138	509	573	605	682
Cap Entry Lane, veh/h	408	470	472	538	946	946	1208	1208
Entry HV Adj Factor	0.969	0.968	0.968	0.971	0.990	0.991	0.990	0.990
Flow Entry, veh/h	231	60	147	134	504	568	599	675
Cap Entry, veh/h	395	455	457	522	937	938	1196	1196
V/C Ratio	0.583	0.132	0.322	0.257	0.538	0.606	0.501	0.565
Control Delay, s/veh	24.0	9.8	13.2	10.5	10.9	12.6	8.5	9.7
LOS	C	A	B	B	B	B	A	A
95th %tile Queue, veh	4	0	1	1	3	4	3	4

Intersection	
Intersection Delay, s/veh	16.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	168	17	36	308	59	57	115	23	37	78	15
Future Vol, veh/h	10	168	17	36	308	59	57	115	23	37	78	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	12	195	20	42	358	69	66	134	27	43	91	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.5	20.6	13.1	11.8
HCM LOS	B	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	28%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	195	195	403	130
LT Vol	57	10	36	37
Through Vol	115	168	308	78
RT Vol	23	17	59	15
Lane Flow Rate	227	227	469	151
Geometry Grp	1	1	1	1
Degree of Util (X)	0.386	0.376	0.706	0.269
Departure Headway (Hd)	6.244	5.964	5.425	6.413
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	580	608	661	562
Service Time	4.244	3.964	3.516	4.427
HCM Lane V/C Ratio	0.391	0.373	0.71	0.269
HCM Control Delay, s/veh	13.1	12.5	20.6	11.8
HCM Lane LOS	B	B	C	B
HCM 95th-tile Q	1.8	1.7	5.8	1.1

Intersection	
Intersection Delay, s/veh	11.8
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	3	417	1588	1096
Demand Flow Rate, veh/h	3	417	1588	1106
Vehicles Circulating, veh/h	1354	1310	153	282
Vehicles Exiting, veh/h	34	431	1204	1445
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.4	20.5	11.3	9.2
Approach LOS	A	C	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.595	0.405	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	3	0	248	169	746	842	520	586
Cap Entry Lane, veh/h	388	449	405	466	1236	1236	1099	1099
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991
Flow Entry, veh/h	3	0	248	169	746	842	515	581
Cap Entry, veh/h	388	449	405	466	1236	1235	1088	1089
V/C Ratio	0.008	0.000	0.613	0.362	0.604	0.681	0.473	0.533
Control Delay, s/veh	9.4	8.0	25.1	13.9	10.3	12.3	8.6	9.7
LOS	A	A	D	B	B	B	A	A
95th %tile Queue, veh	0	0	4	2	4	6	3	3

Intersection	
Intersection Delay, s/veh	21.9
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	393	705	1335	1017
Demand Flow Rate, veh/h	393	705	1335	1027
Vehicles Circulating, veh/h	1152	1309	473	708
Vehicles Exiting, veh/h	583	499	1072	1306
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.7	39.1	17.6	18.7
Approach LOS	B	E	C	C

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.471	0.529	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	185	208	331	374	627	708	483	544
Cap Entry Lane, veh/h	468	533	405	467	874	950	704	778
Entry HV Adj Factor	0.998	1.001	1.001	0.999	1.001	0.999	0.989	0.991
Flow Entry, veh/h	185	208	331	374	627	708	478	539
Cap Entry, veh/h	467	534	405	466	874	949	696	771
V/C Ratio	0.395	0.390	0.817	0.801	0.718	0.745	0.686	0.699
Control Delay, s/veh	14.6	12.9	42.3	36.2	17.4	17.7	19.1	18.3
LOS	B	B	E	E	C	C	C	C
95th %tile Queue, veh	2	2	7	7	6	7	5	6

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	24	0	1454	1016	20
Future Vol, veh/h	0	24	0	1454	1016	20
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	26	0	1580	1104	22

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	563	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	475	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	475	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.03	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	475	-	-
HCM Lane V/C Ratio	-	0.055	-	-
HCM Ctrl Dly (s/v)	-	13	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	234	354	1465	1036
Demand Flow Rate, veh/h	239	354	1465	1047
Vehicles Circulating, veh/h	1080	1470	361	257
Vehicles Exiting, veh/h	224	356	958	1567
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	12.8	21.0	15.8	8.4
Approach LOS	B	C	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.537	0.463	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	196	43	190	164	689	776	492	555
Cap Entry Lane, veh/h	500	567	349	407	1022	1022	1124	1124
Entry HV Adj Factor	0.981	0.977	1.000	1.000	0.999	1.001	0.990	0.990
Flow Entry, veh/h	192	42	190	164	689	776	487	549
Cap Entry, veh/h	490	554	349	407	1022	1023	1113	1112
V/C Ratio	0.392	0.076	0.544	0.403	0.674	0.759	0.438	0.494
Control Delay, s/veh	14.0	7.4	24.7	16.7	13.8	17.4	7.9	8.8
LOS	B	A	C	C	B	C	A	A
95th %tile Queue, veh	2	0	3	2	5	8	2	3

Intersection	
Intersection Delay, s/veh	10.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	223	39	23	107	15	7	56	55	78	87	14
Future Vol, veh/h	9	223	39	23	107	15	7	56	55	78	87	14
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	10	251	44	26	120	17	8	63	62	88	98	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	11.8	10.1	9.6	10.8
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	44%
Vol Thru, %	47%	82%	74%	49%
Vol Right, %	47%	14%	10%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	118	271	145	179
LT Vol	7	9	23	78
Through Vol	56	223	107	87
RT Vol	55	39	15	14
Lane Flow Rate	133	304	163	201
Geometry Grp	1	1	1	1
Degree of Util (X)	0.195	0.427	0.241	0.302
Departure Headway (Hd)	5.284	5.054	5.325	5.4
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	679	716	674	666
Service Time	3.322	3.054	3.361	3.435
HCM Lane V/C Ratio	0.196	0.425	0.242	0.302
HCM Control Delay, s/veh	9.6	11.8	10.1	10.8
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.7	2.1	0.9	1.3

Intersection	
Intersection Delay, s/veh	7.1
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	22	281	895	945
Demand Flow Rate, veh/h	22	284	913	955
Vehicles Circulating, veh/h	1127	733	195	194
Vehicles Exiting, veh/h	22	375	954	823
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.1	7.5	6.9	7.1
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.606	0.394	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	22	0	172	112	429	484	449	506
Cap Entry Lane, veh/h	479	545	688	762	1189	1189	1190	1190
Entry HV Adj Factor	1.000	1.000	0.988	0.991	0.981	0.980	0.989	0.990
Flow Entry, veh/h	22	0	170	111	421	474	444	501
Cap Entry, veh/h	479	545	680	755	1166	1166	1178	1178
V/C Ratio	0.046	0.000	0.250	0.147	0.361	0.407	0.377	0.425
Control Delay, s/veh	8.1	6.6	8.3	6.3	6.6	7.2	6.8	7.4
LOS	A	A	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	1	2	2	2	2

Intersection	
Intersection Delay, s/veh	21.4
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	846	377	861	1007
Demand Flow Rate, veh/h	863	388	886	1018
Vehicles Circulating, veh/h	1075	959	986	359
Vehicles Exiting, veh/h	302	913	952	988
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	33.5	10.9	28.0	9.7
Approach LOS	D	B	D	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.469	0.531	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	406	457	182	206	416	470	478	540
Cap Entry Lane, veh/h	502	569	559	628	545	614	970	1047
Entry HV Adj Factor	0.979	0.981	0.974	0.970	0.973	0.971	0.990	0.989
Flow Entry, veh/h	398	448	177	200	405	456	473	534
Cap Entry, veh/h	492	559	544	610	530	596	961	1035
V/C Ratio	0.809	0.803	0.326	0.328	0.763	0.765	0.493	0.516
Control Delay, s/veh	35.5	31.6	11.4	10.4	29.2	26.8	9.8	9.7
LOS	E	D	B	B	D	D	A	A
95th %tile Queue, veh	8	8	1	1	7	7	3	3

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	35	0	881	959	22
Future Vol, veh/h	0	35	0	881	959	22
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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	39	0	990	1078	25

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	551	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	483	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	483	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.11	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	483	-	-
HCM Lane V/C Ratio	-	0.081	-	-
HCM Ctrl Dly (s/v)	-	13.1	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.3	-	-

Intersection	
Intersection Delay, s/veh	12.0
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	291	284	1083	1316
Demand Flow Rate, veh/h	300	293	1093	1329
Vehicles Circulating, veh/h	1343	1153	455	178
Vehicles Exiting, veh/h	164	395	1188	1268
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	22.8	12.1	12.1	9.4
Approach LOS	C	B	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.793	0.207	0.519	0.481	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	238	62	152	141	514	579	625	704
Cap Entry Lane, veh/h	392	453	467	533	939	939	1208	1208
Entry HV Adj Factor	0.969	0.968	0.968	0.972	0.990	0.991	0.990	0.991
Flow Entry, veh/h	231	60	147	137	509	574	619	698
Cap Entry, veh/h	380	439	452	518	929	930	1195	1197
V/C Ratio	0.606	0.137	0.325	0.265	0.548	0.617	0.518	0.583
Control Delay, s/veh	26.1	10.2	13.4	10.8	11.2	13.0	8.8	10.0
LOS	D	B	B	B	B	B	A	B
95th %tile Queue, veh	4	0	1	1	3	4	3	4

Intersection	
Int Delay, s/veh	0.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	499	1	8	188	10	33
Future Vol, veh/h	499	1	8	188	10	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	561	1	9	211	11	37

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	562	0	790	561
Stage 1	-	-	-	-	561	-
Stage 2	-	-	-	-	229	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1010	-	359	527
Stage 1	-	-	-	-	571	-
Stage 2	-	-	-	-	809	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1010	-	355	527
Mov Cap-2 Maneuver	-	-	-	-	355	-
Stage 1	-	-	-	-	571	-
Stage 2	-	-	-	-	801	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.35	13.46
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	474	-	-	73	-
HCM Lane V/C Ratio	0.102	-	-	0.009	-
HCM Ctrl Dly (s/v)	13.5	-	-	8.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection	
Int Delay, s/veh	1.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	529	3	19	192	4	78
Future Vol, veh/h	529	3	19	192	4	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	594	3	21	216	4	88

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	598	0	854	596
Stage 1	-	-	-	-	596	-
Stage 2	-	-	-	-	258	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	979	-	329	504
Stage 1	-	-	-	-	550	-
Stage 2	-	-	-	-	785	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	979	-	321	504
Mov Cap-2 Maneuver	-	-	-	-	321	-
Stage 1	-	-	-	-	550	-
Stage 2	-	-	-	-	765	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.79	14.04
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	490	-	-	162	-
HCM Lane V/C Ratio	0.188	-	-	0.022	-
HCM Ctrl Dly (s/v)	14	-	-	8.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.7	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	17.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	178	17	37	315	60	57	115	24	39	78	15
Future Vol, veh/h	10	178	17	37	315	60	57	115	24	39	78	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	12	207	20	43	366	70	66	134	28	45	91	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	13	23	13.6	12.1
HCM LOS	B	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	30%
Vol Thru, %	59%	87%	76%	59%
Vol Right, %	12%	8%	15%	11%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	196	205	412	132
LT Vol	57	10	37	39
Through Vol	115	178	315	78
RT Vol	24	17	60	15
Lane Flow Rate	228	238	479	153
Geometry Grp	1	1	1	1
Degree of Util (X)	0.4	0.399	0.744	0.278
Departure Headway (Hd)	6.32	6.019	5.592	6.518
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	570	598	652	549
Service Time	4.369	4.065	3.592	4.572
HCM Lane V/C Ratio	0.4	0.398	0.735	0.279
HCM Control Delay, s/veh	13.6	13	23	12.1
HCM Lane LOS	B	B	C	B
HCM 95th-tile Q	1.9	1.9	6.6	1.1

Intersection	
Intersection Delay, s/veh	12.5
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	3	425	1623	1142
Demand Flow Rate, veh/h	3	425	1623	1153
Vehicles Circulating, veh/h	1409	1340	153	290
Vehicles Exiting, veh/h	34	436	1259	1475
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.9	22.5	11.7	9.7
Approach LOS	A	C	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.602	0.398	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	3	0	256	169	763	860	542	611
Cap Entry Lane, veh/h	369	429	394	455	1236	1236	1091	1091
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991
Flow Entry, veh/h	3	0	256	169	763	860	537	605
Cap Entry, veh/h	369	429	394	455	1235	1236	1080	1080
V/C Ratio	0.008	0.000	0.651	0.372	0.618	0.696	0.497	0.560
Control Delay, s/veh	9.9	8.4	27.9	14.4	10.6	12.8	9.1	10.3
LOS	A	A	D	B	B	B	A	B
95th %tile Queue, veh	0	0	4	2	5	6	3	4

Intersection	
Intersection Delay, s/veh	30.5
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	470	762	1371	1066
Demand Flow Rate, veh/h	470	762	1371	1076
Vehicles Circulating, veh/h	1182	1378	534	801
Vehicles Exiting, veh/h	695	527	1118	1339
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	16.5	60.3	22.1	26.1
Approach LOS	C	F	C	D

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	221	249	358	404	644	727	506	570
Cap Entry Lane, veh/h	455	520	380	440	826	902	646	719
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.001	0.999	0.990	0.991
Flow Entry, veh/h	221	249	358	404	644	727	501	565
Cap Entry, veh/h	455	520	380	440	826	901	639	712
V/C Ratio	0.486	0.479	0.942	0.918	0.780	0.806	0.783	0.793
Control Delay, s/veh	17.6	15.5	65.8	55.3	21.8	22.3	26.8	25.5
LOS	C	C	F	F	C	C	D	D
95th %tile Queue, veh	3	3	10	10	8	9	8	8

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	31	0	1487	1031	60
Future Vol, veh/h	0	31	0	1487	1031	60
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	34	0	1616	1121	65

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	593	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	454	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	454	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.57	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	454	-	-
HCM Lane V/C Ratio	-	0.074	-	-
HCM Ctrl Dly (s/v)	-	13.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	14.3
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	234	361	1493	1059
Demand Flow Rate, veh/h	239	361	1493	1070
Vehicles Circulating, veh/h	1103	1498	365	257
Vehicles Exiting, veh/h	224	360	977	1602
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.2	22.1	16.6	8.6
Approach LOS	B	C	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.526	0.474	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	196	43	190	171	702	791	503	567
Cap Entry Lane, veh/h	489	556	340	397	1019	1019	1124	1124
Entry HV Adj Factor	0.981	0.977	1.000	1.000	1.000	1.000	0.990	0.990
Flow Entry, veh/h	192	42	190	171	702	791	498	561
Cap Entry, veh/h	480	543	340	397	1018	1019	1112	1113
V/C Ratio	0.401	0.077	0.558	0.430	0.689	0.776	0.448	0.504
Control Delay, s/veh	14.4	7.6	26.0	17.9	14.4	18.5	8.1	9.0
LOS	B	A	D	C	B	C	A	A
95th %tile Queue, veh	2	0	3	2	6	8	2	3

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	306	4	24	476	6	21
Future Vol, veh/h	306	4	24	476	6	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	344	4	27	535	7	24

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	348	0	935	346
Stage 1	-	-	-	-	346	-
Stage 2	-	-	-	-	589	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1211	-	295	697
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	555	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1211	-	285	697
Mov Cap-2 Maneuver	-	-	-	-	285	-
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	537	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.39	12.24
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	528	-	-	86	-
HCM Lane V/C Ratio	0.057	-	-	0.022	-
HCM Ctrl Dly (s/v)	12.2	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	318	9	56	497	3	50
Future Vol, veh/h	318	9	56	497	3	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	357	10	63	558	3	56

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	367	0	1047	362
Stage 1	-	-	-	-	362	-
Stage 2	-	-	-	-	684	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1191	-	253	682
Stage 1	-	-	-	-	704	-
Stage 2	-	-	-	-	501	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1191	-	233	682
Mov Cap-2 Maneuver	-	-	-	-	233	-
Stage 1	-	-	-	-	704	-
Stage 2	-	-	-	-	463	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.83	11.48
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	615	-	-	182	-
HCM Lane V/C Ratio	0.097	-	-	0.053	-
HCM Ctrl Dly (s/v)	11.5	-	-	8.2	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.2	-

Intersection	
Intersection Delay, s/veh	11.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	237	43	22	105	16	8	60	58	83	93	16
Future Vol, veh/h	10	237	43	22	105	16	8	60	58	83	93	16
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	11	266	48	25	118	18	9	67	65	93	104	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.5	10.2	9.9	11.2
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	15%	43%
Vol Thru, %	48%	82%	73%	48%
Vol Right, %	46%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	126	290	143	192
LT Vol	8	10	22	83
Through Vol	60	237	105	93
RT Vol	58	43	16	16
Lane Flow Rate	142	326	161	216
Geometry Grp	1	1	1	1
Degree of Util (X)	0.212	0.462	0.243	0.329
Departure Headway (Hd)	5.392	5.106	5.446	5.485
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	664	704	659	656
Service Time	3.434	3.14	3.486	3.523
HCM Lane V/C Ratio	0.214	0.463	0.244	0.329
HCM Control Delay, s/veh	9.9	12.5	10.2	11.2
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.8	2.4	0.9	1.4

Intersection	
Intersection Delay, s/veh	7.8
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	24	311	942	1040
Demand Flow Rate, veh/h	24	314	961	1050
Vehicles Circulating, veh/h	1239	770	217	213
Vehicles Exiting, veh/h	24	408	1046	871
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.1	8.1	7.4	7.9
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.602	0.398	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	24	0	189	125	452	509	494	556
Cap Entry Lane, veh/h	432	495	665	738	1166	1166	1170	1170
Entry HV Adj Factor	1.000	1.000	0.989	0.992	0.980	0.981	0.989	0.991
Flow Entry, veh/h	24	0	187	124	443	499	489	551
Cap Entry, veh/h	432	495	658	732	1142	1144	1157	1159
V/C Ratio	0.056	0.000	0.284	0.169	0.388	0.437	0.422	0.475
Control Delay, s/veh	9.1	7.3	9.1	6.8	7.1	7.7	7.5	8.3
LOS	A	A	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	1	2	2	2	3

Intersection	
Intersection Delay, s/veh	25.6
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	804	407	946	1109
Demand Flow Rate, veh/h	819	419	974	1120
Vehicles Circulating, veh/h	1187	994	988	370
Vehicles Exiting, veh/h	303	968	1018	1043
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	40.7	11.9	35.8	11.0
Approach LOS	E	B	E	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	385	434	197	222	458	516	526	594
Cap Entry Lane, veh/h	453	518	541	610	544	613	960	1037
Entry HV Adj Factor	0.981	0.982	0.970	0.971	0.971	0.971	0.991	0.989
Flow Entry, veh/h	378	426	191	216	445	501	521	588
Cap Entry, veh/h	444	508	525	592	528	596	951	1026
V/C Ratio	0.850	0.838	0.364	0.364	0.842	0.842	0.548	0.573
Control Delay, s/veh	43.7	38.1	12.6	11.3	37.5	34.3	11.0	11.0
LOS	E	E	B	B	E	D	B	B
95th %tile Queue, veh	8	9	2	2	9	9	3	4

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	26	0	937	1008	9
Future Vol, veh/h	0	26	0	937	1008	9
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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	29	0	1053	1133	10

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	571	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	469	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	469	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.19	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	469	-	-
HCM Lane V/C Ratio	-	0.062	-	-
HCM Ctrl Dly (s/v)	-	13.2	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	312	305	1152	1374
Demand Flow Rate, veh/h	321	314	1163	1387
Vehicles Circulating, veh/h	1402	1227	481	192
Vehicles Exiting, veh/h	177	417	1242	1349
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	28.4	13.8	13.9	10.2
Approach LOS	D	B	B	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.798	0.202	0.525	0.475	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	256	65	165	149	547	616	652	735
Cap Entry Lane, veh/h	372	431	437	500	917	917	1192	1192
Entry HV Adj Factor	0.971	0.969	0.970	0.973	0.990	0.991	0.990	0.991
Flow Entry, veh/h	249	63	160	145	542	611	646	728
Cap Entry, veh/h	361	418	423	487	907	909	1181	1181
V/C Ratio	0.689	0.151	0.378	0.298	0.597	0.672	0.547	0.616
Control Delay, s/veh	32.8	10.9	15.5	12.0	12.6	15.0	9.4	10.9
LOS	D	B	C	B	B	C	A	B
95th %tile Queue, veh	5	1	2	1	4	5	3	4

Intersection	
Intersection Delay, s/veh	20
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	181	18	39	332	63	61	123	25	40	84	17
Future Vol, veh/h	12	181	18	39	332	63	61	123	25	40	84	17
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	14	210	21	45	386	73	71	143	29	47	98	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	13.9	28	14.6	12.8
HCM LOS	B	D	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	6%	9%	28%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	209	211	434	141
LT Vol	61	12	39	40
Through Vol	123	181	332	84
RT Vol	25	18	63	17
Lane Flow Rate	243	245	505	164
Geometry Grp	1	1	1	1
Degree of Util (X)	0.44	0.425	0.802	0.307
Departure Headway (Hd)	6.523	6.243	5.722	6.74
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	552	574	631	531
Service Time	4.576	4.298	3.765	4.799
HCM Lane V/C Ratio	0.44	0.427	0.8	0.309
HCM Control Delay, s/veh	14.6	13.9	28	12.8
HCM Lane LOS	B	B	D	B
HCM 95th-tile Q	2.2	2.1	8	1.3

Intersection	
Intersection Delay, s/veh	15.9
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	5	467	1775	1227
Demand Flow Rate, veh/h	5	467	1775	1240
Vehicles Circulating, veh/h	1517	1464	175	316
Vehicles Exiting, veh/h	39	486	1347	1615
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	11.0	33.3	14.6	11.1
Approach LOS	B	D	B	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.593	0.407	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	5	0	277	190	834	941	583	657
Cap Entry Lane, veh/h	334	391	351	409	1211	1211	1065	1065
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.990
Flow Entry, veh/h	5	0	277	190	834	941	577	651
Cap Entry, veh/h	334	391	351	409	1211	1211	1054	1055
V/C Ratio	0.015	0.000	0.789	0.464	0.689	0.777	0.547	0.617
Control Delay, s/veh	11.0	9.2	43.5	18.5	12.7	16.3	10.2	11.8
LOS	B	A	E	C	B	C	B	B
95th %tile Queue, veh	0	0	7	2	6	8	3	4

Intersection	
Intersection Delay, s/veh	40.0
Intersection LOS	E

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	439	788	1492	1136
Demand Flow Rate, veh/h	439	788	1492	1147
Vehicles Circulating, veh/h	1287	1463	528	792
Vehicles Exiting, veh/h	652	557	1198	1459
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	18.2	89.6	27.8	30.2
Approach LOS	C	F	D	D

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.469	0.531	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	206	233	370	418	701	791	539	608
Cap Entry Lane, veh/h	413	475	351	409	831	907	651	724
Entry HV Adj Factor	1.002	0.999	1.001	0.999	1.000	1.000	0.991	0.990
Flow Entry, veh/h	206	233	370	418	701	791	534	602
Cap Entry, veh/h	414	475	352	409	831	906	645	717
V/C Ratio	0.499	0.490	1.053	1.021	0.844	0.873	0.827	0.839
Control Delay, s/veh	19.5	17.1	97.8	82.3	27.1	28.5	30.8	29.7
LOS	C	C	F	F	D	D	D	D
95th %tile Queue, veh	3	3	13	13	10	11	9	9

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	26	0	1565	1093	21
Future Vol, veh/h	0	26	0	1565	1093	21
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	28	0	1701	1188	23

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	605	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	445	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	445	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.63	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	445	-	-
HCM Lane V/C Ratio	-	0.063	-	-
HCM Ctrl Dly (s/v)	-	13.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	16.9
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	250	380	1576	1114
Demand Flow Rate, veh/h	255	380	1576	1125
Vehicles Circulating, veh/h	1161	1581	385	276
Vehicles Exiting, veh/h	240	380	1031	1685
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	15.0	27.5	20.0	9.3
Approach LOS	B	D	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.537	0.463	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	209	46	204	176	741	835	529	596
Cap Entry Lane, veh/h	464	529	315	370	1000	1000	1105	1105
Entry HV Adj Factor	0.982	0.978	1.000	1.000	1.000	1.000	0.990	0.990
Flow Entry, veh/h	205	45	204	176	741	835	523	590
Cap Entry, veh/h	456	518	315	370	1000	1001	1093	1094
V/C Ratio	0.450	0.087	0.647	0.475	0.741	0.835	0.479	0.540
Control Delay, s/veh	16.5	8.0	33.4	20.6	16.8	22.9	8.7	9.8
LOS	C	A	D	C	C	C	A	A
95th %tile Queue, veh	2	0	4	2	7	10	3	3

Intersection	
Intersection Delay, s/veh	11.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	243	43	25	122	18	8	60	60	85	93	16
Future Vol, veh/h	10	243	43	25	122	18	8	60	60	85	93	16
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	11	273	48	28	137	20	9	67	67	96	104	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.9	10.7	10.1	11.5
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	15%	44%
Vol Thru, %	47%	82%	74%	48%
Vol Right, %	47%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	128	296	165	194
LT Vol	8	10	25	85
Through Vol	60	243	122	93
RT Vol	60	43	18	16
Lane Flow Rate	144	333	185	218
Geometry Grp	1	1	1	1
Degree of Util (X)	0.22	0.479	0.283	0.339
Departure Headway (Hd)	5.501	5.181	5.497	5.594
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	650	695	653	641
Service Time	3.552	3.222	3.545	3.641
HCM Lane V/C Ratio	0.222	0.479	0.283	0.34
HCM Control Delay, s/veh	10.1	12.9	10.7	11.5
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	0.8	2.6	1.2	1.5

Intersection	
Intersection Delay, s/veh	8.3
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	24	323	1027	1073
Demand Flow Rate, veh/h	24	326	1047	1084
Vehicles Circulating, veh/h	1285	843	217	225
Vehicles Exiting, veh/h	24	421	1092	944
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.5	9.1	8.0	8.3
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.617	0.383	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	24	0	201	125	492	555	509	575
Cap Entry Lane, veh/h	414	476	622	694	1166	1166	1157	1157
Entry HV Adj Factor	1.000	1.000	0.990	0.992	0.981	0.981	0.991	0.989
Flow Entry, veh/h	24	0	199	124	483	544	504	569
Cap Entry, veh/h	414	476	615	688	1143	1143	1147	1145
V/C Ratio	0.058	0.000	0.323	0.180	0.422	0.476	0.440	0.497
Control Delay, s/veh	9.5	7.6	10.2	7.3	7.5	8.4	7.8	8.7
LOS	A	A	B	A	A	A	A	A
95th %tile Queue, veh	0	0	1	1	2	3	2	3

Intersection	
Intersection Delay, s/veh	52.5
Intersection LOS	F

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1002	441	975	1148
Demand Flow Rate, veh/h	1022	455	1004	1160
Vehicles Circulating, veh/h	1217	1116	1158	436
Vehicles Exiting, veh/h	379	1046	1081	1135
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	95.2	14.9	72.5	12.9
Approach LOS	F	B	F	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	480	542	214	241	472	532	545	615
Cap Entry Lane, veh/h	441	505	484	550	465	531	904	980
Entry HV Adj Factor	0.981	0.980	0.969	0.970	0.971	0.971	0.990	0.990
Flow Entry, veh/h	471	531	207	234	458	517	540	609
Cap Entry, veh/h	432	495	468	533	452	515	895	970
V/C Ratio	1.089	1.074	0.443	0.438	1.015	1.003	0.603	0.627
Control Delay, s/veh	100.4	90.5	15.9	14.1	76.7	68.7	12.9	12.9
LOS	F	F	C	B	F	F	B	B
95th %tile Queue, veh	16	17	2	2	14	14	4	5

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	54	0	962	1036	44
Future Vol, veh/h	0	54	0	962	1036	44
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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	61	0	1081	1164	49

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	607	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	445	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	445	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	14.37	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	445	-	-
HCM Lane V/C Ratio	-	0.136	-	-
HCM Ctrl Dly (s/v)	-	14.4	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.5	-	-

Intersection	
Intersection Delay, s/veh	14.8
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	312	311	1177	1444
Demand Flow Rate, veh/h	321	321	1188	1458
Vehicles Circulating, veh/h	1473	1252	496	192
Vehicles Exiting, veh/h	177	432	1298	1381
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	33.4	14.4	14.9	10.9
Approach LOS	D	B	B	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.798	0.202	0.514	0.486	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	256	65	165	156	558	630	685	773
Cap Entry Lane, veh/h	348	406	427	490	904	904	1192	1192
Entry HV Adj Factor	0.971	0.969	0.970	0.968	0.991	0.990	0.991	0.990
Flow Entry, veh/h	249	63	160	151	553	624	679	765
Cap Entry, veh/h	338	393	414	474	896	895	1182	1181
V/C Ratio	0.735	0.160	0.387	0.318	0.617	0.697	0.574	0.648
Control Delay, s/veh	38.9	11.7	16.0	12.7	13.3	16.2	9.9	11.7
LOS	E	B	C	B	B	C	A	B
95th %tile Queue, veh	6	1	2	1	4	6	4	5

Intersection	
Int Delay, s/veh	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	551	5	37	210	16	75
Future Vol, veh/h	551	5	37	210	16	75
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	619	6	42	236	18	84

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	625	0	941	622
Stage 1	-	-	-	-	622	-
Stage 2	-	-	-	-	319	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	957	-	292	487
Stage 1	-	-	-	-	535	-
Stage 2	-	-	-	-	737	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	957	-	278	487
Mov Cap-2 Maneuver	-	-	-	-	278	-
Stage 1	-	-	-	-	535	-
Stage 2	-	-	-	-	700	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.34	15.97
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	430	-	-	270	-
HCM Lane V/C Ratio	0.238	-	-	0.043	-
HCM Ctrl Dly (s/v)	16	-	-	8.9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.9	-	-	0.1	-

Intersection	
Int Delay, s/veh	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	622	4	19	240	7	101
Future Vol, veh/h	622	4	19	240	7	101
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	699	4	21	270	8	113

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	703	0	1013	701
Stage 1	-	-	-	-	701	-
Stage 2	-	-	-	-	312	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	894	-	265	439
Stage 1	-	-	-	-	492	-
Stage 2	-	-	-	-	742	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	894	-	257	439
Mov Cap-2 Maneuver	-	-	-	-	257	-
Stage 1	-	-	-	-	492	-
Stage 2	-	-	-	-	721	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.67	17.04
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	419	-	-	132	-
HCM Lane V/C Ratio	0.289	-	-	0.024	-
HCM Ctrl Dly (s/v)	17	-	-	9.1	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.2	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	23.7
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	202	18	41	348	66	61	123	28	44	84	17
Future Vol, veh/h	12	202	18	41	348	66	61	123	28	44	84	17
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	14	235	21	48	405	77	71	143	33	51	98	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	15.3	35.1	15.5	13.5
HCM LOS	C	E	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	30%
Vol Thru, %	58%	87%	76%	58%
Vol Right, %	13%	8%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	212	232	455	145
LT Vol	61	12	41	44
Through Vol	123	202	348	84
RT Vol	28	18	66	17
Lane Flow Rate	247	270	529	169
Geometry Grp	1	1	1	1
Degree of Util (X)	0.462	0.48	0.863	0.328
Departure Headway (Hd)	6.747	6.41	5.87	6.995
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	532	558	614	511
Service Time	4.82	4.483	3.926	5.075
HCM Lane V/C Ratio	0.464	0.484	0.862	0.331
HCM Control Delay, s/veh	15.5	15.3	35.1	13.5
HCM Lane LOS	C	C	E	B
HCM 95th-tile Q	2.4	2.6	9.8	1.4

Intersection	
Intersection Delay, s/veh	20.6
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	5	506	1859	1325
Demand Flow Rate, veh/h	5	506	1859	1339
Vehicles Circulating, veh/h	1655	1536	175	355
Vehicles Exiting, veh/h	39	498	1485	1687
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	12.5	55.5	16.3	13.3
Approach LOS	B	F	C	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.625	0.375	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	5	0	316	190	874	985	629	710
Cap Entry Lane, veh/h	295	348	329	385	1211	1211	1028	1028
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.989
Flow Entry, veh/h	5	0	316	190	874	985	623	702
Cap Entry, veh/h	295	348	329	385	1211	1211	1018	1017
V/C Ratio	0.017	0.000	0.962	0.494	0.722	0.813	0.612	0.691
Control Delay, s/veh	12.5	10.4	76.5	20.6	13.9	18.4	12.0	14.5
LOS	B	B	F	C	B	C	B	B
95th %tile Queue, veh	0	0	10	3	7	10	4	6

Intersection	
Intersection Delay, s/veh	95.7
Intersection LOS	F

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	621	897	1569	1243
Demand Flow Rate, veh/h	621	897	1569	1256
Vehicles Circulating, veh/h	1374	1618	673	978
Vehicles Exiting, veh/h	860	624	1322	1537
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	35.0	208.7	62.8	85.8
Approach LOS	D	F	F	F

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	292	329	422	475	737	832	590	666
Cap Entry Lane, veh/h	381	442	305	359	727	801	549	618
Entry HV Adj Factor	1.000	1.000	0.999	1.001	1.001	0.999	0.991	0.990
Flow Entry, veh/h	292	329	422	475	737	832	584	659
Cap Entry, veh/h	381	442	304	359	727	801	544	612
V/C Ratio	0.766	0.745	1.385	1.324	1.014	1.038	1.075	1.077
Control Delay, s/veh	38.2	32.1	225.4	194.0	60.7	64.7	87.4	84.4
LOS	E	D	F	F	F	F	F	F
95th %tile Queue, veh	6	6	22	22	17	20	18	19

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	45	0	1636	1127	132
Future Vol, veh/h	0	45	0	1636	1127	132
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	49	0	1778	1225	143

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	684	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	396	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	396	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	15.38	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	396	-	-
HCM Lane V/C Ratio	-	0.124	-	-
HCM Ctrl Dly (s/v)	-	15.4	-	-
HCM Lane LOS	-	C	-	-
HCM 95th %tile Q(veh)	-	0.4	-	-

Intersection	
Intersection Delay, s/veh	19.1
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	250	396	1636	1168
Demand Flow Rate, veh/h	255	396	1636	1180
Vehicles Circulating, veh/h	1216	1641	396	276
Vehicles Exiting, veh/h	240	391	1075	1761
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	16.2	31.5	23.2	9.7
Approach LOS	C	D	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.515	0.485	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	209	46	204	192	769	867	555	625
Cap Entry Lane, veh/h	441	505	298	352	990	990	1105	1105
Entry HV Adj Factor	0.982	0.978	1.000	1.000	1.000	1.000	0.989	0.991
Flow Entry, veh/h	205	45	204	192	769	867	549	619
Cap Entry, veh/h	433	494	298	352	990	990	1093	1094
V/C Ratio	0.474	0.091	0.684	0.546	0.776	0.875	0.502	0.566
Control Delay, s/veh	17.9	8.5	38.0	24.6	18.9	27.1	9.1	10.3
LOS	C	A	E	C	C	D	A	B
95th %tile Queue, veh	2	0	5	3	8	12	3	4

Intersection	
Int Delay, s/veh	2.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	340	15	91	525	16	103
Future Vol, veh/h	340	15	91	525	16	103
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	382	17	102	590	18	116

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	399	0	1185	390
Stage 1	-	-	-	-	390	-
Stage 2	-	-	-	-	794	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1160	-	209	658
Stage 1	-	-	-	-	684	-
Stage 2	-	-	-	-	445	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1160	-	181	658
Mov Cap-2 Maneuver	-	-	-	-	181	-
Stage 1	-	-	-	-	684	-
Stage 2	-	-	-	-	387	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.24	15.19
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	486	-	-	266	-
HCM Lane V/C Ratio	0.275	-	-	0.088	-
HCM Ctrl Dly (s/v)	15.2	-	-	8.4	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.1	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	430	13	56	611	5	65
Future Vol, veh/h	430	13	56	611	5	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	483	15	63	687	6	73

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	498	0	1303	490
Stage 1	-	-	-	-	490	-
Stage 2	-	-	-	-	812	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1066	-	177	578
Stage 1	-	-	-	-	616	-
Stage 2	-	-	-	-	436	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1066	-	160	578
Mov Cap-2 Maneuver	-	-	-	-	160	-
Stage 1	-	-	-	-	616	-
Stage 2	-	-	-	-	395	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.72	13.81
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	487	-	-	151	-
HCM Lane V/C Ratio	0.161	-	-	0.059	-
HCM Ctrl Dly (s/v)	13.8	-	-	8.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0.2	-

Appendix C: Intersection Cost Participation Calculations

City of Billings Cost Participation Worksheet: Clearwater Phase 1

Whether a movement pair is critical is based on Phase 1 site-generated traffic, as shown in Exhibit 12 of the report.

1: Central at 48th

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	3	3	**10**	**10**
WB L	1	2	2	**1**	**1**
WB T	1	**10**	**10**	7	7
EB L	1	No project traffic			
NB T	1	No project traffic			
SB L	1	**1**	**1**	**2**	**2**
SB T	1	No project traffic			
NB L	1				
Project **Critical** Lane Volume			**11**		**13**
Critical Lane Capacity			1200		1200
% Increase			0.9%		1.1%
Max % Increase			1.1%		

2: Shiloh at Broadwater

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	**2**	**2**	**7**	**7**
WB T	1	No project traffic			
EB L	1				
NB T	2	**41**	**21**	26	13
SB L	1	No project traffic			
SB T	2	14	7	**40**	**20**
NB L	1	No project traffic			
Project **Critical** Lane Volume			**23**		**27**
Critical Lane Capacity			1200		1200
% Increase			1.9%		2.3%
Max % Increase			2.3%		

3: Shiloh at Central

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	2	41	21	26	13
WB L	1	5	5	13	13
WB T	2	**9**	**5**	**27**	**14**
EB L	1	**48**	**48**	**31**	**31**
NB T	2	No project traffic			
SB L	1				
SB T	2	**5**	**3**	**15**	**8**
NB L	1	**8**	**8**	**22**	**22**
Project **Critical** Lane Volume			**64**		**75**
Critical Lane Capacity			1200		1200
% Increase			5.3%		6.3%
Max % Increase			6.3%		

5: Shiloh at Monad

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1				
WB T	1				
EB L	1				
NB T	2	9	5	**27**	**14**
SB L	1	7	7	**4**	**4**
SB T	2	**27**	**14**	18	9
NB L	1	No project traffic			
Project **Critical** Lane Volume			**14**		**18**
Critical Lane Capacity			1200		1200
% Increase			1.2%		1.5%
Max % Increase			1.5%		

City of Billings Cost Participation Worksheet: Clearwater Phase 2

Whether a movement pair is critical is based on Phase 2 site-generated traffic, as shown in Exhibit 14 of the report.

1: Central at 48th

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	3	3	**11**	**11**
WB L	1	1	1	**1**	**1**
WB T	1	**7**	**7**	9	9
EB L	1	No project traffic			
NB T	1	No project traffic			
SB L	1	**1**	**1**	**2**	**2**
SB T	1	No project traffic			
NB L	1				
Project **Critical** Lane Volume			**8**		**14**
Critical Lane Capacity			1200		1200
% Increase			0.7%		1.2%
Max % Increase			1.2%		

2: Shiloh at Broadwater

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	**9**	**9**	**27**	**27**
WB T	1	No project traffic			
EB L	1				
NB T	2	**27**	**14**	36	18
SB L	1	No project traffic			
SB T	2	17	9	**46**	**23**
NB L	1	No project traffic			
Project **Critical** Lane Volume			**23**		**50**
Critical Lane Capacity			1200		1200
% Increase			1.9%		4.2%
Max % Increase			4.2%		

3: Shiloh at Central

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	2	27	14	36	18
WB L	1	7	7	24	24
WB T	2	**10**	**5**	**22**	**11**
EB L	1	**32**	**32**	**42**	**42**
NB T	2	No project traffic			
SB L	1				
SB T	2	**8**	**4**	**28**	**14**
NB L	1	**8**	**8**	**19**	**19**
Project **Critical** Lane Volume			**49**		**86**
Critical Lane Capacity			1200		1200
% Increase			4.1%		7.2%
Max % Increase			7.2%		

5: Shiloh at Monad

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1				
WB T	1				
EB L	1				
NB T	2	**11**	**6**	**31**	**16**
SB L	1	**5**	**5**	**6**	**6**
SB T	2	18	9	24	12
NB L	1	No project traffic			
Project **Critical** Lane Volume			**11**		**22**
Critical Lane Capacity			1200		1200
% Increase			0.9%		1.8%
Max % Increase			1.8%		

Planning Board

Date:	05/13/2025
Title:	44 West Subdivision - Preliminary Major Plat
Presented by:	David Green
Department:	Planning & Community Services
Presentation:	Yes

Information

RECOMMENDATION

Staff recommends the Planning Board recommend to City Council that the preliminary plat of 44 West Subdivision be conditionally approved and the Findings of Fact adopted as presented in the staff report.

BACKGROUND (Consistency with Adopted Plans and Policies, if applicable)

On April 1, 2025, Performance Engineering applied for preliminary minor plat approval for 44 West Subdivision. The proposed subdivision creates 62 lots for residential and commercial development. The proposed commercial area is 0.89 acres. The subject property is generally located south of Central Avenue, and west of Twin Pines Townhomes. The property is zoned NX2 -- Mixed Residential 2 (2 to 8 units) and NX1 Mixed Residential 1 (1 to 4 units).

VARIANCES REQUESTED

No variances from the City Subdivision Regulations have been requested.

PROPOSED CONDITIONS OF APPROVAL

Pursuant to Section 76-3-608(4), MCA, the following conditions are recommended to reasonably minimize potential adverse impacts identified within the Findings of Fact.

1. To minimize the effects on local service, prior to final plat approval, the applicant will coordinate with the USPS to determine what type of deliver system is preferred and to locate and provide the correct amount of space for safely delivering the mail to the residents and businesses.

2. To minimize the effects on local service, prior to final plat approval, the applicant shall provide a proportionate share contribution as indicated within the Traffic Impact Study and approved by City of Billings Engineering.

3. Minor changes may be made in the SIA and final documents, as requested by the Planning, Legal or Public Works Departments to clarify the documents and bring them into the standard acceptable format.

4. The final plat shall comply with all requirements of the City of Billings Subdivision regulations, rules, policies, and resolutions of the City of Billings, and the laws and Administrative Rules of the State of Montana.

PROCEDURAL HISTORY

- Pre-application meeting January 23, 2025
- Preliminary plat application submitted to Planning Division on April 1, 2025
- Departmental review meeting April 17, 2025
- Subdivision resubmittal April 24, 2025
- Planning Board plat review May 13, 2025
- Planning Board public hearing May 28, 2025
- Preliminary plat to City Council June 23, 2025
- 60 working-day preliminary plat review period ends June 26, 2025

PLAT INFORMATION

General location:	South of Central Avenue, and west of Twin Pines Townhomes
Legal Description:	Being Lots 4 and 5 of Clearwater Estates Subdivision
Owner/Subdivider:	McCall Development, Inc.
Engineer and Surveyor:	Performance Engineering
Existing Zoning:	NX2 and NX1

Existing land use: Agricultural

Proposed land use: Residential / Commercial

Gross and Net area: 22.67 acres / 20.01 acres

Proposed number of lots: 62

Lot size: Max: 354,171 square feet / 8.13 acres
Min: 1,910 square feet

Parkland requirements: Parkland dedication requirement is 0.46 acres. The applicant is proposing to provide 0.50 acres of parkland.

TRAFFIC IMPACT STUDY OVERVIEW

This traffic study was done for both 44 West Subdivision and Clearwater Estates Subdivision, 2nd Filing. The traffic study is for when all filings of the subdivisions are built out.
The site is currently agricultural land. The subdivision's proposed land use will be almost exclusively residential, with 194 single-family detached homes and 262 attached ones. The latter will include duplexes, attached multi-story row houses (townhomes), and "cottage" units that would be smaller units not directly classifiable as apartments.

The studied intersections are anticipated to operate similarly to existing conditions at the time this subdivision is fully built out.

Exhibit 17. Intersection Cost Participation by Phase

	Phase 1			Phase 2			
Intersection*	AM	PM	Higher	AM	PM	Higher	Total
1. S. 48th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			11.2%			14.4%	25.6%
x $450,000			$50,400			$64,800	$115,200

PARKLAND OVERVIEW:
This subdivision is required to provide 0.46 acres of parkland. The applicant will be providing 0.50 acres of private parkland for this subdivision. The parkland will be maintained by the Homeowner Association. The Parks Department responded that it approved of the parkland being proposed for this subdivision.

STAKEHOLDERS

There are no stakeholder responses at this time. Stakeholder input will be received at a public hearing scheduled for this subdivision on May 28th.

ALTERNATIVES

In accordance with state law, the City Council has 60 working days to act upon this major preliminary plat. The 60 working day review period for the proposed plat ends on June 26, 2025. State and City subdivision regulations also require that preliminary plats be reviewed using specific criteria, as stated within this report. The City may not unreasonably restrict an owner's ability to develop land if the subdivider provides evidence that any identified adverse effects can be mitigated. Within the 60 working day review period, the City Council is required to:
1. Approve;
2. Conditionally Approve; or
3. Deny the Preliminary Plat

FISCAL EFFECTS

This plat will have no fiscal impacts on the City Planning Division.

SUMMARY

One of the purposes of the City's subdivision review process is to identify potential negative effects of property being subdivided. Negative effects that are identified become the subdivider's responsibility to mitigate. Various City

departments, private service/utility providers and the affected school district/s, have reviewed this application and provided input on effects and mitigation. The Findings of Fact, which are presented as an attachment, discuss potential negative impacts of the subdivision and conditions of approval are recommended as measures to further mitigate any impacts. In this case, there were found to be minimal impacts from this proposed subdivision.

Attachments

Findings of Fact
Proposed Plat
Draft SIA
Traffic Study

FINDINGS OF FACT

The Planning staff has prepared the Findings of Fact for the preliminary plat of 44 West Subdivision. These findings are based on the preliminary plat application and supplemental documents and address the review criteria required by the Montana Subdivision and Platting Act (76-3-608, MCA) and the Billings Subdivision Regulations (Section 23-303(H), BMCC).

A. What are the effects on agriculture, local services, the natural environment, wildlife, wildlife habitat, and public health, safety and welfare? [MCA 76-3-608 (3) (a) and BMCC 23-302.H.2.]

1. Effect on agriculture and agricultural water user facilities

The subject property has been used for agricultural purposes in the past. The Monad Drain is to the south of this proposed subdivision and is not part of the proposed area to be subdivided. Perimeter ditches and drains shall remain in place and not be altered by the subdivider or subsequent owners. The subdivision should not affect agricultural water users' facilities. With farming activity wildlife habitat has not been maintained. Perimeter areas are good for birds to hide in and smaller ungulates, such as deer.

2. Effect on local services

a. **Utilities** – Water service will be provided by the City of Billings. A 16-inch water mina will be extended along Central Avenue for the proposed subdivision. 12-inch and 8-inch water lines will be provided within the proposed subdivision. 12-inch in the northern area and 8-inch throughout the majority of the subdivision. New individual services will be provided to all the lots, and new fire hydrants will be installed as required by the City Fire Department.

   Sanitary sewer service to the subdivision will be by an existing 10-inch sanitary sewer main located within the alleyway along the western boundary at the south end of the Subdivision. The Subdivider is responsible for extending an 8-inch gravity sewer main to Central Avenue via South 44th Street West to allow for future connections to the north of the Subdivision. Sewer lines within the subdivision shall be no smaller than 8-inches in diameter.

   The subdivider will install all new water lines and sewer lines in the local streets and individual services for each lot in accordance with design standards, specifications, rules, and regulations of the City of Billings Engineering/Public Works Department and MDEQ. This is outlined in the SIA under the heading VI Utilities.

   Private Utilities will be provided from existing facilities to the subdivision. The private utilities will be installed within the Carriage Lane right-of-way and by easements included on the plat, as requested by the utility companies, to provide routes to the Carriage Lanes.

   Stormwater – The storm drainage system for 44 West Subdivision, will consist of a curb and gutter surface collection and curb inlets that drain into storm drainage piping, as well as surface conveyance. The Subdivision will be allowed to discharge stormwater into the

Monad Drain as part of its stormwater management strategy. A complete stormwater management plan shall be submitted to the Engineering Division for review and approval at the time of development. This is outlined in the SIA under the heading V. Storm Drainge.

All drainage improvements shall satisfy the criteria set forth by the *City of Billings Stormwater Management Manual* and will be subject to review and approval by the City Engineering Department.

b. **Solid Waste** – The City of Billings will provide solid waste collection and disposal. The City's landfill has adequate capacity for this waste.

c. **Streets** – All internal streets within the subdivision shall be built to grade with a satisfactory subbase, base course, curb and gutter, and asphalt surface. All public roads will be built to provide a 34-foot back-to-back curb street width.

All internal streets and carriage lanes will be built according to the standards of the City of Billings Public Works Department. Street improvements are included in the Waiver of Right to Protest Future Special Improvement Districts.

The sidewalks will be installed by the respective lot owners on a lot-by-lot basis, as lots develop. Sidewalks along the street frontage shall be minimum 5-foot-wide and separated with a boulevard width not less than five feet. The developer will also install all ADA required ramps at the intersections within the proposed subdivision. The developer shall construct the 5-foot-wide boulevard sidewalk adjacent to private parks. This information is all in the SIA under the heading Transportation.

Traffic Impact Study overview:

A traffic accessibility study update has been completed for 44 West Subdivision. All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider's expense.

This traffic study was done for both 44 West Subdivision and Clearwater Estates Subdivision 2nd Filing. The traffic study was for when all filings of the subdivisions is built out.

The studied intersections are anticipated to operate similarly to existing conditions at the time this subdivision is fully built out.

	Phase 1			Phase 2			
Intersection*	**AM**	**PM**	**Higher**	**AM**	**PM**	**Higher**	**Total**
1. S. 48th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			**11.2%**			**14.4%**	**25.6%**
x $450,000			**$50,400**			**$64,800**	**$115,200**

The cash contributions shall be based on the percent of traffic contributions to the intersections based on the total cost of an intersection as determined. The contributions will be made at the time of final plat. **(Condition #2)**

Street lighting is required for this subdivision. In the SIA the applicant has indicated that street lighting will be installed by private contract or SID. A Street Light Maintenance District will be created for operation and maintenance of the lighting at a future date and is included in the waiver of right to protest.

d. **Emergency Services** – The Billings Police and Fire Departments will respond to emergencies within the proposed subdivision. The fire station that provides service for this area is Fire Station #7, is located at 1501 54th Street West. The subdivision is located within the ambulance service area of American Medical Response (AMR).

e. **Schools** – School District #2 provides service to students within this subdivision for elementary through high school. Meadowlark for elementary school, Ben Steele for middle school and West for high school. At the time of the writing of this staff report School District #2 had not responded to requests for comments.

f. **Parks and Recreation** – This subdivision is required to provide 0.46 acres of parkland. The applicant will be providing 0.50 acres of private parkland for this subdivision. The parkland will be maintained by the Homeowner Association. The Parks Department responded that they approved of the proposed parkland for the subdivision.

g. **Mail Delivery -** The developer shall coordinate with the United States Postal Service to determine the preferred type and location of mail delivery system for this subdivision. **(Condition #1)**

h. **Phasing of Development** – This subdivision will not be developed in phases.

3. Effect on the natural environment

The subject property is currently vacant with the proposed use of residential development with a small portion of commercial. The property is not located within a floodplain. During development, storm water pollution prevention best management practices are required to be used and monitored to prevent erosion on exposed ground. Overall, the effect on the natural environment should be minimal.

4. Effect on wildlife and wildlife habitat

There are no known endangered or threatened species on the property. There is a paragraph in the SIA that warns future lot owners of the presence of deer in the area, which may cause damage to their landscaping. This subdivision should have a minimal effect on wildlife and wildlife habitat.

5. Effect on public health, safety and welfare

There will be no significant impacts to public health, safety and welfare because of this subdivision.

B. Was an Environmental Assessment required? [(MCA 76-3-616 and BMCC 23-302.H.1.]

The proposed subdivision is exempt from the requirement for an Environmental Assessment pursuant to Section 76-3-616, MCA.

C. Does the subdivision conform to the City of Billings 2016 Growth Policy, the 2014 Transportation Plan, and the Billings Area Bikeway and Trail Master Plan? [BMCC 23-302.H.4.]

1. City of Billings 2016 Growth Policy

The proposed subdivision is consistent with the following goals of the Growth Policy:

> **Strong Neighborhoods (livable, safe, sociable and resilient neighborhoods):** Neighborhoods that are safe and attractive and provide essential services are much desired.
>
> **Home Base (healthy, safe and diverse housing options):** Planning and construction of interconnected sidewalks and trails are important to the economy and livability of Billings.
>
> **Essential Investments (relating public and private expenditures to public values)**: Planning and construction of safe and affordable interconnected sidewalks and trails are important to the economy and livability of Billings.
>
> Developed parks that provide recreation and active living opportunities are desirable for an attractive and healthy community.

3. 2023 Billings Urban Area Long Range Transportation Plan

The proposed subdivision adheres to the goals and objectives of the 2023 Transportation Plan and preserves the street network and street hierarchy specified in the plan.

4. Billings Area Bikeway and Trail Master Plan (BABTMP)

The proposed subdivision is within the Billings Area Bikeways and Trail Master Plan. There are no trails identified within the subdivision. There is a 10-foot-wide bike and pedestrian trail proposed along the south side of Central Avenue. This will be installed by private contract or SIA as outlined in the SIA. No additional improvements of this nature are anticipated.

D. Does the subdivision conform to the Montana Subdivision and Platting Act and to local subdivision regulations? [MCA 76-3-608 (3) (b) and BMCC 23-302.H.3.a.]

The proposed subdivision satisfies the requirements of the Montana Subdivision and Platting Act, and the design standards specified in the local subdivision regulations. The subdivider and the local government have complied with the subdivision review and approval procedures set forth in the local and state subdivision regulations.

E. Does the proposed subdivision conform to all requirements of the zoning in effect? [BMCC 23-302.H.3.e.]

The subject property is located within NX2 – Mixed Residential 2 (2 to 8 units) and NX1 Mixed Residential 1 (1 to 4 units). The lot frontages conform to the requirements of this zone. Other building setbacks and structure specific requirements will be reviewed for compliance at the time of building permit review.

F. Does the proposed plat provide easements for the location and installation of any utilities? [MCA 76-3-608 (3) (c) and BMCC 23-302.H.3.b.]

The subdivider will provide utility easements as requested by private utility companies on the face of the plat.

G. Does the proposed plat provide legal and physical access to each parcel within the subdivision and notation of that access on the plat? [MCA 76-3-608 (3) (d) and BMCC 23-302.H.3.c.]

Legal and physical access to the subdivision will be provided by Central Avenue, South 44th Street West and Tippet Trail. Carriage Lane access is also provided to residential lots within the subdivision.

CONCLUSIONS OF FINDINGS OF FACT

- The preliminary plat of 44 West Subdivision does not create any adverse impacts that warrant denial of the subdivision.

- The proposed subdivision conforms to several of the goals and policies of the 2016 Growth Policy and does not conflict with the Transportation or Bikeway/Trail Plans.

- The proposed subdivision complies with state and local subdivision regulations, local zoning, and sanitary requirements and provides legal and physical access to each lot.

- Any potential negative or adverse impacts will be mitigated with the proposed conditions of approval.

RECOMMENDATION

Staff proposes the Planning Board recommends to City Council that the preliminary plat of 44 West Subdivision, be conditionally approved and the Findings of Fact adopted as presented in the staff report.

PE STANDARD.CTB

4/1/2025 9:07:52 AM

PRELIMINARY PLAT OF

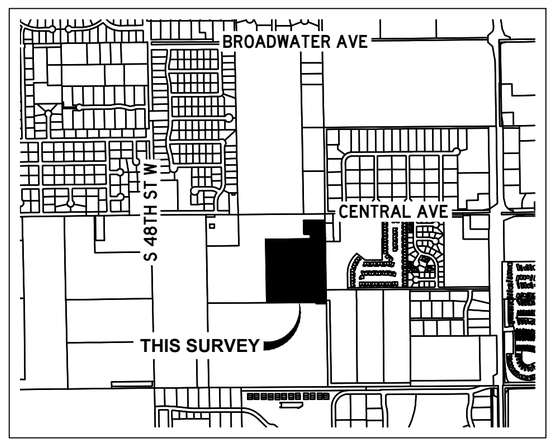
44 WEST SUBDIVISION

BEING LOTS 4 AND 5 OF CLEARWATER ESTATES SUBDIVISION
LOCATED IN THE NW 1/4 OF SECTION 10, TOWNSHIP 01 SOUTH, RANGE 25 EAST, P.M.M., CITY OF BILLINGS, YELLOWSTONE COUNTY, MONTANA

PREPARED FOR : MCCALL DEVELOPMENT, INC.

PREPARED BY : PERFORMANCE ENGINEERING, LLC

TOTAL AREA OF SUBDIVISION : ± 22.67 ACRES
APRIL 2025



VICINITY MAP
NOT TO SCALE

SITE DATA	
GROSS AREA	22.67 AC
NET AREA	20.01 AC
LOT COUNT	62
MAX. LOT AREA	354,171 SF
MIN. LOT AREA	1,910 SF
ZONING	CMU1, NMU, NX1, NX2, P1
PARKLAND DED.	21,904 SF
COMMERICAL AREA	0.89 AC

ADJOINING PROPERTY OWNER INFORMATION:

1 BROWN DEVELOPMENT, LLC
745 S 56TH STREET WEST
BILLINGS, MT 59106

2 DONNA MARIE, KARIN ELLEN, & DIANA LYNNE BARBER
PO BOX 121
HOGELAND, MT 59529

3 BRADLEY W HARDT
4620 CENTRAL AVENUE
BILLINGS, MT 59106

4 BRYAN KARL LEITZ
4420 CENTRAL AVENUE
BILLINGS, MT 59106

5 EDWARD L HOFMANN JR
4246 CENTRAL AVENUE
BILLINGS, MT 59106

6 JANET B BERGMAN REVOCABLE TRUST
1322 BROADWATER AVENUE
BILLINGS, MT 59102

7 DORN/LOWE, LLC
PO BOX 81524
BILLINGS, MT 59108

8 BRADLEY W & TAMMY JO HARDT
4620 CENTRAL AVENUE
BILLINGS, MT 59106

SHEET 1 OF 1

Z:\Brown\2022-067 Clearwater Sub\CAD\DWG\Plats\44th Street Sub\22-067 McCall Prelim Plat.dwg

SUBDIVISION IMPROVEMENTS AGREEMENT
&WAIVER OF RIGHT TO PROTEST FUTURE SPECIAL IMPROVEMENT DISTRICTS

44 West Subdivision

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(City of Billings)

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SUBDIVISION IMPROVEMENTS AGREEMENT & WAIVER OF RIGHT TO PROTEST FUTURE SPECIAL IMPROVEMENT DISTRICTS

44 West Subdivision

This agreement is made and entered into this ____ day of _____, 20__, by and between *44 West Development, LLC*, whose address for the purpose of this agreement is **1536 Mullowney Lane, Suite 100; Billings, Montana 59101**, hereinafter referred to as "Subdivider," and **CITY OF BILLINGS**, Billings, Montana, hereinafter referred to as "City."

WITNESSETH:

WHEREAS, the plat of *44 West Subdivision*, located in Yellowstone County, Montana was submitted to the Yellowstone County Board of Planning; and

WHEREAS, at a regular meeting conducted on _____ day of _____, 20__, the Board of Planning recommended conditional approval of a preliminary plat of *44 West Subdivision*; and

WHEREAS, at a regular meeting conducted on _____ day of _____, 20__, the City Council conditionally approved a preliminary plat of *44 West Subdivision*; and

WHEREAS, a Subdivision Improvements Agreement is required by the City prior to the approval of the final plat.

WHEREAS, the provisions of this agreement shall be effective and applicable to *44 West Subdivision* upon the filing of the final plat thereof in the office of the Clerk and Recorder of Yellowstone County, Montana. The Subdivision shall comply with all requirements of the City of Billings Subdivision Regulations, the rules, regulations, policies, and resolutions of the City of Billings, and the laws and administrative rules of the State of Montana.

THEREFORE, THE PARTIES TO THIS AGREEMENT, for and in consideration of the mutual promises herein contained and for other good and valuable consideration, do hereby agree as follows:

I. VARIANCES

A. Subdivider has requested, and the City hereby grants, the following variances by City Council from the strict interpretation of the City's Subdivision Regulations (Section 23.1101, BMCC):

1. No variances are requested.

II. PROPERTY CONDITIONS AND INFORMATION FOR LOT PURCHASERS

A. Lot owners will be required to construct that segment of the required sidewalk that fronts their property at the time of lot development. If sidewalk is not constructed within 5 years, the City has the right to construct the sidewalk and assess the property owners.

B. Lot owners should be aware that this subdivision is being built in close proximity to prime deer and antelope habitat and it is likely that homeowners will experience problems with damage to landscaped shrubs, flowers, and gardens. The Montana Fish, Wildlife, and Parks Department does not provide damage assistance unless there is damage to commercial crops and/or a threat to public health and safety.

C. Lot owners should be aware that soil characteristics within the area of this subdivision, as described in the 1972 Yellowstone County Soil Survey, indicate that there could be potential limitations for proposed construction on the lots, which may require a geotechnical survey prior to construction.

D. No water rights have been transferred to the lot owners. Irrigation ditches that exist on the perimeter of this development are for the benefit of other properties. Perimeter ditches and drains shall remain in place and shall not be altered by the Subdivider or subsequent owners.

E. There is attached hereto a Waiver waiving the right to protest the creation of the special improvement district or districts which by this reference is expressly incorporated herein and made as much a part hereof as though fully and completely set forth herein at this point. The Waiver will be filed with the plat, shall run with the land, and shall constitute the guarantee by the Subdivider and property owner or owners of the developments described herein. Said Waiver is effective upon filing and is not conditioned on the completion of the conditions set forth in this Agreement. The Subdivider and owner specifically agree that they are waiving valuable rights and do so voluntarily.

F. The subdivider and subsequent contractors/builders acknowledge that there is a Stormwater Pollution and Prevention Plan (SWPPP) filed with the City and the Montana Department of Environmental Quality (MDEQ). This SWPPP shall be adhered to during all phases of construction and shall be updated as required by MDEQ under the General Permit for Stormwater Discharges Associated with Construction Activity, Chapter 28, BMCC and the Billings Stormwater Management Manual.

G. Individual lot owners should be aware that Best Management Practices for stormwater control shall be required for new construction on lots. Best Management Practices are defined within Section 28-201, BMCC and detailed in the Billings Stormwater Management Manual.

III. TRANSPORTATION

A. Streets

- All internal access roads and site improvements within the subdivision will be in accordance with the City of Billings Site Development Ordinance, City Zoning Ordinance, the Stormwater Management Manual, and other applicable City codes, rules, and regulations.

- Tippet Trail will be 34 feet back of curb to back of curb. The street improvements will be completed by private contract or SID.

- South 44th Street West will be 48 feet back of curb to back of curb to the intersection with Tippet Trail. The street improvements will be completed by private contract or SID.

- All internal streets to provide a 34-foot back of curb to back of curb street width. The street improvements will be completed by private contract or SID

- A traffic accessibility study has been completed for the *44 West Subdivision.* All required intersection improvement contributions identified therein shall be completed by the Subdivider at the Subdivider's expense. Based on the additional lots created with 44 West Subdivision, the percentage of traffic contributions and associated costs to these intersections based on a pro-rata share, as negotiated with City Engineering.

  The cash contributions shall be based on the percent of traffic contributions to the intersections based on the total cost of an intersection as determined by City Engineering for the year in which the contribution is made. These cash contributions for the intersection improvement will be made prior to final plat approval. The percentage contributions are as outline within the Traffic Impact Study for Clearwater Estates Subdivision as submitted with the preliminary plat.

B. Carriage Lanes

- All carriage lanes within the subdivision shall be built to grade with a satisfactory subbase, base course, and asphalt surface or concrete surface. All carriage lane approaches constructed with asphalt shall be replaced with concrete by the Subdivider at the time when home construction is complete. In the event asphalt approaches within the subdivision are not replace with concrete within three years of the date of recording of the final plat, the City may construct the concrete approaches and assess the Subdivider for the costs associated with the approach construction. Carriage Lane pavement widths shall be 12 feet. No trees are allowed to

be planted in Carriage Lane rights-of-way. In addition, no shrubs taller than two (2) feet are allowed to be planted in Carriage Lane rights-of-way.

C. Sidewalks

- Individual lot owners will be responsible for the construction of the sidewalks within public right-of-way or easements adjacent to or through their lot at the time of lot construction and shall be included in each building permit. The Subdivider shall construct sidewalk adjacent to private parks at the time of private park development.

- Sidewalks shall be 5-foot wide with a minimum 5-foot boulevard planting strip between the sidewalk and the curb with handicap ramps and aprons installed where necessary.

D. Street Lighting

- Street lighting will be installed by private contract or SID. A Street Light Maintenance District will be created in the future and is included in the waiver of right to protest.

E. Traffic Control Devices

- Street name signs for streets within the subdivision, or located immediately adjacent thereto, shall be furnished and installed in accordance with the specifications of the City of Billings Public Works and Fire Departments.

- No traffic signals are required within this subdivision. Stop signs shall be installed at the intersection of South 44th Street West and Central Avenue.

- The Subdivider shall furnish and install all necessary traffic control devices in accordance with the Manual of Uniform Traffic Control Devices and approved by the City of Billings Public Works Department.

F. Access

- Access to the Subdivision will be provided by Central Avenue, South 44th Street West, Tippet Trail, Wildrye Road, Bluestem Lane, and Junegrass Avenue. Carriage Lane access is also provided to all residential lots within the subdivision.

G. Billings Area Bikeway and Trail Master Plan

- The Subdivision is within the Billings Area Bikeway and Trail Master Plan. A 10-foot-wide multi-use trail will be constructed along Central Avenue. The trail improvements will be completed by private contract or SID.

H. Public Transit

- MET Transit provides services along Central Avenue with the closest stop at the intersection of Central Avenue and Shiloh Road, approximately 0.5 miles east of the Subdivision. No improvements are required to ensure public transit service.

IV. EMERGENCY SERVICE

Construction of buildings made of combustible materials shall have adequate fire apparatus access roads and water supply (fire hydrants) in place to allow for fire suppression requirements. Prior to the issuance of a building permit for construction using combustible materials (i.e. lumber, plywood, wood trusses, etc.), fire apparatus access roads and water supply requirements shall be provided in accordance with the International Fire Code as adopted by the City of Billings.

At a minimum, the following is required:

- An unobstructed gravel road or gravel road base must be within 150 feet of the furthest portion of a building under construction as measured along the approved route.
- The access roads are required to support fire apparatus vehicle loading (40 tons) during all weather conditions and shall be a minimum of twenty (20) feet wide.
- An operational fire hydrant shall be located within 600 feet of the furthest portion of a residence under construction or within 400 feet of the furthest portion of a commercial building under construction as measured along the access roads to the site.
- The above requirements do not alter or effect the current minimum subdivision requirements for fire apparatus access and water supply.

V. STORM DRAINAGE

All drainage improvements shall comply with the provisions set forth in Chapter 28, BMCC, and the Stormwater Management Manual in place at the time of development. The Subdivision will be allowed to discharge stormwater into the Monad Drain as part of its stormwater management strategy. A complete stormwater management plan shall be submitted to the Engineering Division for review and approval at the time of development.

VI. UTILITIES

The Subdivision Improvements Agreement does not constitute an approval for extension of or connection to water mains and sanitary sewers. The property owner shall make application for extension/connection of water mains and sanitary sewers to the Public Works Department – Engineering Division. The extension/connection of/to water mains and sanitary sewers is subject to the approval of the applications and the conditions of approval. Applications shall be submitted for processing prior to the start of any construction and prior to review and approval of any project plans and specifications.

The Developer/Owner acknowledges that the subdivision shall be subject to the applicable System Development Fees in effect at the time new water and/or sanitary sewer service connections are made.

The design/installation of sanitary sewers and appurtenances, and water mains and appurtenances (fire hydrants, etc.) shall be in accordance with design standards, specifications, rules, regulations of and as approved by the City of Billings Public Works Department, Fire Department and the Montana Department of Environmental Quality.

A. Water

- The Subdivision will be extending a 16-inch water main along Central Avenue. The City will reimburse the Subdivider for the cost of upsizing the water main from a 12-inch line to a 16-inch line. If requested by the Subdivider, City staff will forward a Compensation Agreement to City Council for approval of oversizing of the water main in accordance with the City's Rules and Regulations Governing Water and Wastewater Service.
- A 12-inch water main will be installed along South 44th Street West and Tippet Trail.
- An 8-inch water main will be installed within Wildrye Road, Bluestem Lane, and Junegrass Avenue.

B. Sanitary Sewer

- The Subdivision will be served by an existing 10-inch sanitary sewer main located within the alleyway along the western boundary at the south end of the Subdivision. The Subdivider is responsible for extending an 8-inch gravity sewer main to Central Avenue via South 44th Street West to allow for future connections to the north of the Subdivision.
- Gravity sewer mains no less than 8 inches in diameter will be extended throughout the Subdivision. Mains shall be sized to accommodate future growth inside and outside of the Subdivision.

C. Power, Telephone, Gas, and Cable Television

- Private utility facilities currently exist to serve the subdivision. The private utility facilities will be installed within Carriage Lane right-of-way and by easements included on the plat, as requested by the utility companies, to provide routes to the Carriage Lanes.

VII. PARKS/OPEN SPACE

Section 76-3-621 of the Montana Code Annotated covers the park dedication requirement. Paragraph (1) calls for park area to be 11 percent of the land proposed to be subdivided into parcels of one-half acre or smaller. The required Parkland Dedication for the *44 West Subdivision* is 0.46 acres. Parkland dedications, in the amount of 0.50 acres, are depicted on the face of the plat as PRIVATE PARK.

Parks will be privately owned and maintained by a Private HOA created by the Subdivider.

VIII. POSTAL DELIVERY

The Subdivider shall provide centralized delivery boxes with sufficient pullout to accommodate a mail carrier vehicle. The location of the boxes shall be reviewed and approved by the United States Postal Service.

IX. IRRIGATION

No water rights have been transferred to the lot owners. Irrigation ditches that exist on the perimeter of this development are for the benefit of other properties. Perimeter ditches and drains shall remain in place and shall not be altered by the Subdivider or subsequent owners.

X. SOILS/GEOTECHNICAL STUDY

A soils/geotechnical study has been performed for the subdivision. A copy of this report is included as part of the infrastructure permitting documents and made public record through the Engineering Department. Lot owners and contractors/builders are encouraged to review the report and its recommendations or complete a site-specific geotechnical investigation.

XI. PHASING OF IMPROVEMENTS

The Subdivision is not proposed to be constructed in phases.

XII. FINANCIAL GUARANTEES

Except as otherwise provided, Subdivider shall install and construct said required improvements with cash or by utilizing the mechanics of a private contract secured by letters of credit or a letter of commitment to lend funds from a commercial lender, or by SID. All engineering and legal work in connection with such improvements shall be paid by the contracting parties pursuant to said private contract, and the improvements shall be installed as approved by the City Engineer and Utility Department Manager.

XIII. LEGAL PROVISIONS APPLYING TO SUBDIVIDER

A. Subdivider agrees to guarantee all public improvements for a period of two (2) years from the date of final acceptance by the City of Billings.

B. The owners of the properties involved in this proposed Subdivision by signature subscribed herein below agree, consent, and shall be bound by the provisions of this Agreement.

C. The covenants, agreements, and all statements in this Agreement run with the land and apply to and shall be binding on the heirs, personal representatives, successors, assigns and transferees of the respective parties.

D. In the event it becomes necessary for either party to this Agreement to retain an attorney to enforce any of the terms or conditions of this Agreement or to give any notice required herein, then the prevailing party or the party giving notice shall be entitled to reasonable attorney fees and costs.

E. Any amendments or modifications of this Agreement or any provisions herein shall be made in writing and executed in the same manner as this original document and shall after execution become a part of this Agreement.

F. Subdivider shall comply with all applicable federal, state, and local statutes, ordinances, and administrative regulations during the performance and discharge of its obligations. Subdivider acknowledges and agrees that nothing contained herein shall relieve or exempt it from such compliance.

IN WITNESS WHEREOF, the parties hereto have set their hands and official seals on the date first above written.

"SUBDIVIDER" *44 West Development, LLC*

By: _____

Title: _____

STATE OF MONTANA)
: ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____, known to me to be the _____ of *44 West Development, LLC*, who executed the foregoing instrument and acknowledged to me that he/she executed the same.

_____
Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

This agreement is hereby approved and accepted by the City of Billings, this ____ day of _____, 20__.

"CITY"
CITY OF BILLINGS
MONTANA

By: _____
Mayor

Attest: _____
City Clerk

STATE OF MONTANA)
: ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____ and _____, known to me to be the Mayor and City Clerk, respectively, of the City of Billings, Montana, whose names are subscribed to the foregoing instrument in such capacity and acknowledged to me that they executed the same on behalf of the City of Billings, Montana.

_____
Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

Waiver of Right to Protest
FUTURE SPECIAL IMPROVEMENTS DISTRICTS

FOR VALUABLE CONSIDERATION, the undersigned, being the Subdivider and all of the owners of the hereinafter described real property, do hereby waive the right to protest the formation of one or more Special Improvement District(s) for a period of no more than twenty years from the recording of this waiver, for street light maintenance and energy, and for the construction of streets, street widening, sidewalks, survey monuments, street name signs, curb and gutter, street lights, driveways, traffic signals, and traffic control devices, parks and park maintenance, trails, sanitary sewer lines, water lines, storm drains (either within or outside the area), and other improvements which the City of Billings may require.

This Waiver and Agreement is independent from all other agreements and is supported by sufficient independent consideration to which the undersigned are parties, and shall run with the land and shall be binding upon the undersigned, their successors and assigns, and the same shall be recorded in the office of the County Clerk and Recorder of Yellowstone County, Montana.

This Waiver is in addition to any other recorded waiver related to the property described herein and is not intended to replace, supersede, or invalidate any such waiver.

The real property hereinabove mentioned is more particularly described as follows:

44 West Subdivision

Signed and dated this _____ day of _____, 20__.

44 West Development, LLC

By:_____

Title:_____

STATE OF MONTANA)
: ss
County of Yellowstone)

On this ____ day of _____, 20__, before me, a Notary Public in and for the State of Montana, personally appeared _____, known to me to be the _____ of *44 West Development, LLC*, who executed the foregoing instrument and acknowledged to me that he/she executed the same.

_____
Notary Public in and for the State of Montana
Printed Name: _____
Residing at: _____
My commission expires: _____

Clearwater Subdivision

Small/squarer photo here

Traffic Accessibility Study

(DRAFT)

Prepared on behalf of:

Performance Engineering

February 2025

Larger/landscape image here – Consider Annafeld cottage view

Traffic Accessibility Study

Prepared for submittal to:

for the project:

Clearwater Subdivision

on behalf of:

Performance Engineering

608 N. 29th Street
Billings, MT 59101

by:

406 Traffic and Transportation Consulting

P.O. Box 249
Bozeman, MT 59771
406.922.7300

(signed stamp here when final)

February 2025

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1 INTRODUCTION

This report documents the Traffic Accessibility Study (TAS) conducted for the Clearwater Estates subdivision project in northwest Billings. This is a working title for the project. Some parts of the site could be marketed under a different name before final occupancy.

1.1 PROJECT SITE AND STUDY AREA

The overall subdivision site is shown in **Exhibit 1** along with the intersections studied. The existing study intersections were identified during preapplication review with City of Billing staff as:

1. S. 48th Street West at Central Avenue
2. Shiloh Road at Broadwater Avenue
3. Shiloh Road at Central Avenue
4. Shiloh Road at Bell Avenue
5. Shiloh Road at Monad Road

From here forward in the body of this report, existing intersections are generally referred to only by their distinguishing street names (e.g., “Shiloh at Central”) for the sake of brevity. The two new subdivision access points on the south side of Central Avenue have been analyzed for both future scenarios that include project traffic. In this report, these are generally referred to as the West Access and the East Access. The West access has the working name Double Haul Lane and the East Access has the working name S. 44th Street West in part because it is situated approximately halfway between Shiloh Road and S. 48th Street West. The site’s third access will be to existing Bell Avenue, which will be extended west into the site and, while not fully continuous, terminate at the western property edge. The western terminus of Bell will be built to accommodate a future connection to the property west of this site, but no specific street connection has been planned there at the time of this study. The east-west Bell Avenue alignment generally separates the subdivision site into northern and southern parts of similar size.

1.2 LAND USE AND PHASING

The site is currently agricultural land. The subdivision’s proposed land use will be almost exclusively residential, with 194 single-family detached homes and 262 attached ones. The latter will include duplexes, attached multi-story row houses (townhomes), and “cottage” units that would be smaller units not directly classifiable as apartments. One commercial lot sized to support a 25,000 square-foot building will be situated at the northwest corner of the site, abutting Central Avenue and Double Haul Lane.

The project is divided into two logical phases. All 262 of the “attached” type of residential units are included in Phase 1 and are located on the northern part of the site. Phase 1 also includes about one third (66) of the total single-family detached units. Phase 2 includes the commercial parcel and all residential lots on the southern part of the site, which are for the remaining 128 single-family homes.

Because the site is self-contained and generally rural today, the types and locations of specific pathways or other facilities for pedestrians and bicycles have not yet been identified. A brief examination of potential traffic calming needs indicated that the absence of long streets without homes on them will strongly limit the need for such measures. On-street parking is expected to be allowed throughout the site wherever street width is sufficient for it.

Exhibit 2 shows the Clearwater Estates site plan on which the analysis here is based. It includes land use types, streets, alleys, access points, and park parcels.

Exhibit 1. Overall Site Location and Study Intersections

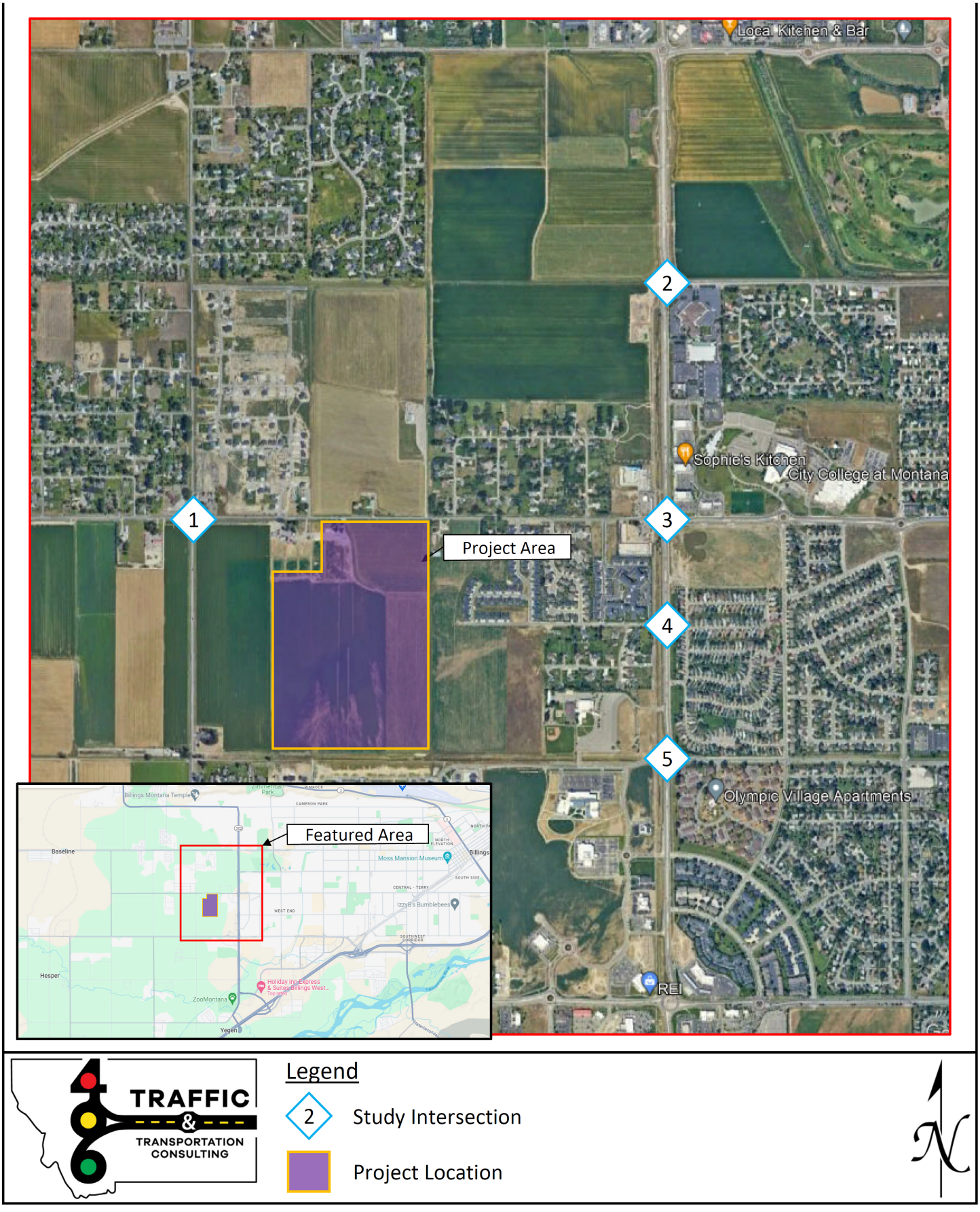


Exhibit 2. Clearwater Estates Subdivision Site Plan

Excerpted from: Performance Engineering drawing provided 1/31/2025

1.3 ANALYSIS METHODS AND REFERENCES

Raw field traffic counts were gathered from other recent traffic study work in the area by Sanbell and provided to the Clearwater applicant team. These raw counts were then adjusted slightly for this TAS based on both (a) recent traffic growth and (b) 2024 City of Billings annualization factors prior to their use in impact analysis.

Trip generation rates, or equations as applicable, are from the Institute of Transportation Engineers (ITE) Trip Generation suite's 11th edition. ITE trip generation data, when aggregated across enough varied sites, produce both simple average rates and best-fit equations, either linear or logarithmic, to help the analyst derive proper estimates for their situation. Equations are generally preferred over rates, especially for larger sites where trip generation per unit of land use can diminish with increasing project size. General ITE guidance calls for the use of the fitted curve equation when the data set for the land use type in question is comprised of studies from 20 or more separate sites and when the equation produces a correlation coefficient (R^2) of 0.75 or higher, with 1.0 being the best possible fit.

Operational performance was analyzed at the study intersections through the use of the industry-standard methods presented in the USDOT's Highway Capacity Manual (HCM), published in its modern form as Transportation Research Board Special Report 209. Synchro Studio 12 was employed as both a data repository and a capacity analysis tool, with reports for each intersection generated using Synchro's application of the assumptions of the HCM's 7th edition, the most recent available at the time of this study.

The HCM methodology for intersection capacity analysis produces delay estimates for each turning movement (or "lane group", when multiple turning movements operate from the same lane). These delay estimates are assigned Level of Service (LOS) grades that range from A (best) to F (worst), as indicated in **Exhibit 3**. It's also important to note that for unsignalized intersections with only side-street Stop sign control, LOS for the intersection is represented by the LOS for the worst lane group. "T" intersections with side-street stop control also fall under this category. All stop-controlled intersections in this study area, including the two new proposed accesses to Central, are "T" intersections, where the approach on the stem of the T, rather than a main street turning movement, contains the worst lane group.

Operations impacts are determined by how peak hour LOS relates to acceptability standards. Billings employs a LOS standard of C or better. When LOS without the project is D or worse, an operations impact is defined when the project would increase delay.

Exhibit 3. LOS Definitions

LOS	Delay, seconds per vehicle
A	0 - 10.0
B	10.1 - 15.0
C	15.1 - 25.0
D	25.1 - 35.0
E	35.1 - 50.0
F	50.1 or more

Source: HCM 7th Edition

2 EXISTING AND BACKGROUND CONDITIONS

2.1 STREETS AND INTERSECTIONS

Shiloh Road, which also carries the designation of MT-302, is a north-south urban principal arterial with two travel lanes in each direction and a speed limit of 45 mph in the study area. Shiloh Road has been a key facilitator of the city's westward expansion, with substantial residential and commercial growth having occurred adjacent to it in recent years. It is characterized by a series of roundabouts at intersections with several of western Billings's east-west arterials and collectors. It also provides access to Interstate 90 via Zoo Drive to the south. A raised median prevents left turns at many two-way stop-controlled intersections, including the one at Bell Avenue. Exclusive left-turn lanes exist at a few select site accesses and local streets. A sidewalk runs along the east side of the road, and a shared-use path called Shiloh Road Trail runs along the west side, much of it separated from the road by a large ditch. There are also two MET Transit bus stops on its east side between the Broadwater and Central roundabouts. These are not considered to be close enough to the project to site to provide meaningful transit access.

Central Avenue is an east-west road that is classified as an urban collector to the west of Shiloh Road and as an urban principal arterial to the east of it. Accordingly, it has one travel lane in each direction to the west of Shiloh, and two travel lanes in each direction to the east of it. It has a speed limit of 45 mph on both sides of Shiloh Road, but it becomes 50 mph to the west of 48th St W. It connects residential neighborhoods to many of western Billings' commercial centers. Central currently has no exclusive turning lanes or parallel multimodal facilities to the west of Shiloh Road.

48th Street W is a north-south local road with one travel lane in each direction. It has a speed limit of 45 mph to the north of Central Avenue and 50 mph to the south of it. It links residences and agricultural properties on the western edges of Billings to the east-west routes that lead into the city, such as Central Avenue and King Avenue. No exclusive turning lanes or multimodal facilities currently exist on 48th in the study area.

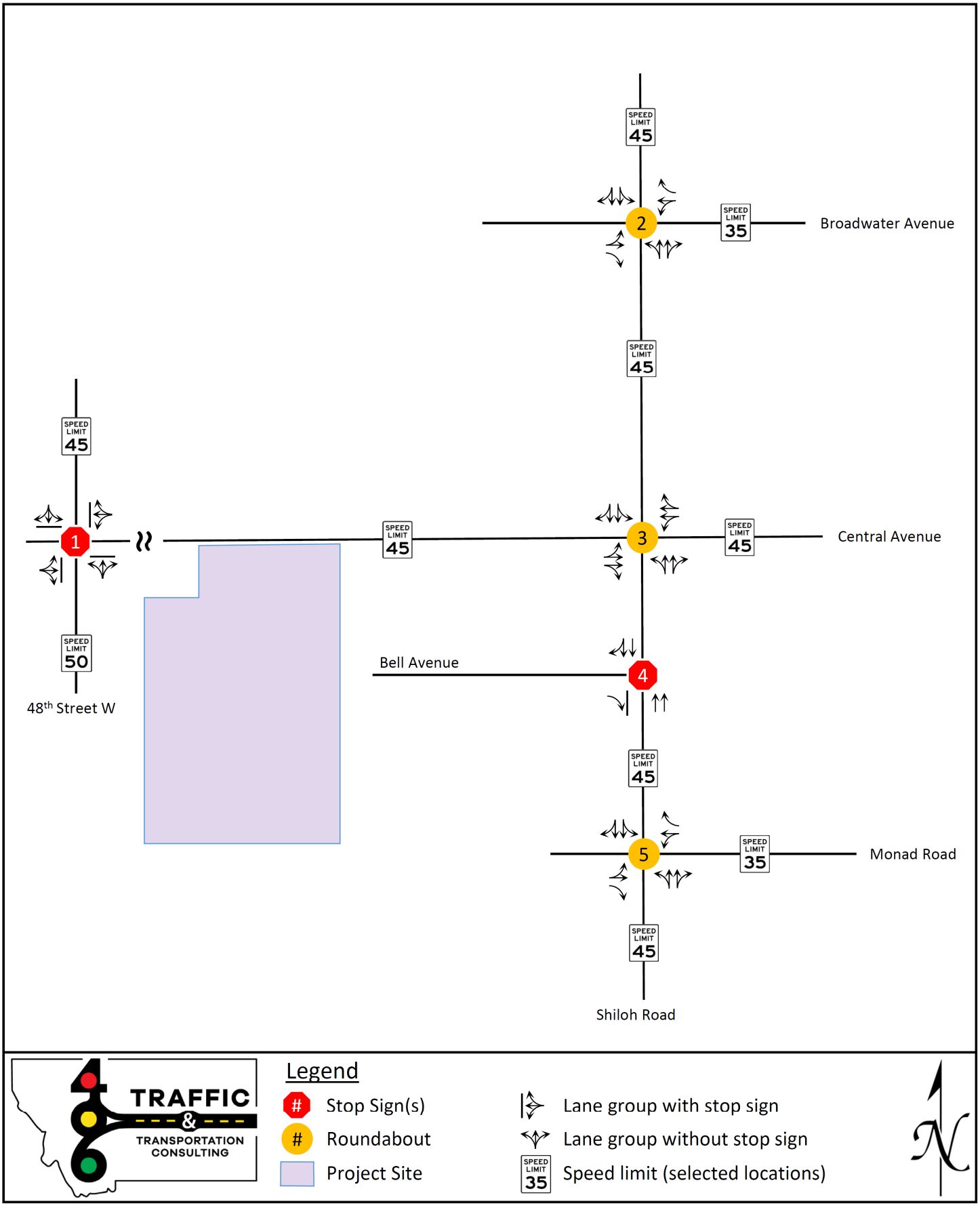
Bell Avenue is an east-west local street with one travel lane in each direction and no posted speed limit. Currently, it provides access to Shiloh Road for a private senior living community and a few other residences. Its eastern terminus is at its intersection with Shiloh Road, where left turns are prohibited. Its western terminus is at a dead-end approximately 2300 ft to the west of this intersection, just past Big Pine Court. While three other streets that intersect Bell Avenue also lead to Central Avenue, these streets traverse private property. As such, Bell Avenue has no outlet for non-residents. The street has no exclusive turning lanes or bike infrastructure, but there is a sidewalk along most of its northern side, starting from the Shiloh Road Trail.

Monad Road is an east-west road that is classified as an urban major collector to the east of Shiloh Road and as a local street to the west of it. West of Shiloh it has one travel lane in each direction, as well as a center left-turn lane. Its speed limit is 35 mph to the east of Shiloh, but it does not have a speed limit posted on the west side. It connects many of western Billings' residential neighborhoods to the industrial areas near the railroad tracks and to north-south routes such as 32nd St W and 24th St W that lead to large commercial centers. It has exclusive right-turn lanes on the east and west legs of the roundabout at Shiloh Road, as well as an exclusive left-turn lane at Henry Chapple Street. To the east of Shiloh Road, there are sidewalks, designated on-street parking, and unprotected bike lanes on both sides of the road. To the west of Shiloh, there is a shared-use path on much of the north side and a sidewalk on much of the south side of the street. There are also two nearby MET Transit bus stops on the south side of the road: one at Henry Chapple Street and the other at Hurdle Circle.

Broadwater Avenue is an east-west urban principal arterial with one travel lane in each direction and a speed limit of 35 mph in the study area. It serves as a link between residential neighborhoods in western Billings, some small commercial centers, and downtown Billings. Its eastern terminus is at its intersection with Division Street, 1st Ave N, and N 36th Street near downtown. Its western terminus is at a roundabout intersection with Shiloh Road. Currently, the roundabout's west leg only connects to two agricultural lots in active use, but the roundabout's infrastructure here has been built out in preparation for potential westward extension of the road. 48th St W also intersects a road called Broadwater Avenue, but this local road segment is currently disconnected from the rest of the arterial network and is only accessible via 48th St W. The arterial Broadwater Avenue has an exclusive westbound right-turn lane at the Shiloh roundabout. There is a shared-use path on the road's north side, and there is a sidewalk on the road's south side extending east.

Intersection traffic control comes in only two forms at the five existing study intersections: two-way stop control (TWSC) and roundabouts. Each leg of the three roundabouts has a crosswalk with a pedestrian refuge in the splitter island. Most of these crosswalks have two solar-powered rectangular rapidly flashing beacons. The intersection of Shiloh Road and Bell Avenue is considered two-way stop-controlled even though only one direction of traffic is stop-controlled. Only four movements are permitted at this intersection: northbound and southbound through movements and southbound and eastbound rights. Shiloh Road's center median prevents all left turns. The intersection of 48th Street and Central Avenue is all-way stop-controlled and is augmented with flashing red beacons facing all four directions. **Exhibit 4** shows traffic control and lane arrangements schematically at each existing intersection as well as posted speed limits on selected road segments.

Exhibit 4. Existing Road and Intersection Basics



2.2 EXISTING TRAFFIC VOLUMES

Existing (2024) annualized volumes were estimated as described earlier in subsection 1.3 and are shown in **Exhibit 5**.

2.3 HISTORIC GROWTH AND BACKGROUND CONDITION TRAFFIC

The “Background Condition” described here is represented by the volumes and intersection performance after several years of traffic growth assumed to occur during the permitting, construction, and initial occupancy of Phase 1. This work is expected to take place in 2025, 2026, and 2027. Allowing for an additional year to ensure full/normal occupancy and for tripmaking behavior by residents to normalize, existing traffic at study intersections was grown to the year 2028. The resulting volumes and operating conditions form the basis for evaluating marginal delay effects of traffic generated by Phase 1 of the Clearwater Estates subdivision.

Phase 2 is currently projected by the applicant team to follow Phase 1 by approximately three years. As such, the study year for Phase 2 traffic is 2031, and traffic was grown in the same way to derive background volumes for that year.

In order to estimate traffic growth without the project, average daily traffic volumes were gathered from selected MDT periodic data collection locations in the study area. The best and most logical data set available was represented by the four legs of the Shiloh intersection at Central. Data were recorded or estimated by MDT annually on each leg dating back at least 20 years. This historical traffic information is shown in the chart in **Exhibit 6**.

Counts from the most recent 10 of these years were used to calculate the average annual growth rate in daily traffic for these four locations in aggregate, which was approximately 3.8% per year. This rate was then applied to the annualized peak hour intersection counts for the Phase 1 and Phase 2 study years. The resulting Background condition traffic volumes are shown for 2028 and 2031 in **Exhibits 7** and **8**, respectively.

Exhibit 5. Existing Traffic Volumes

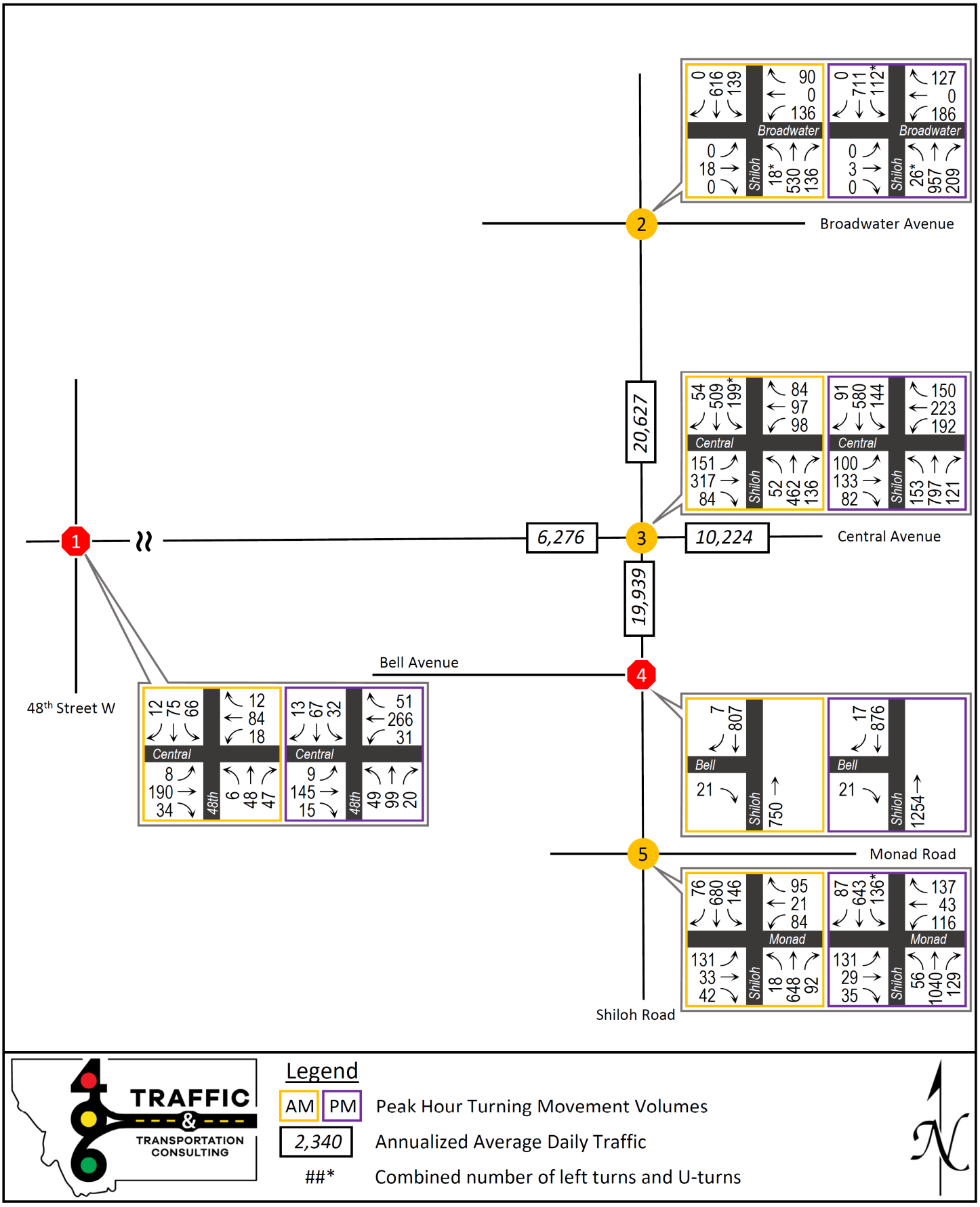


Exhibit 6. Historical Daily Traffic Volumes

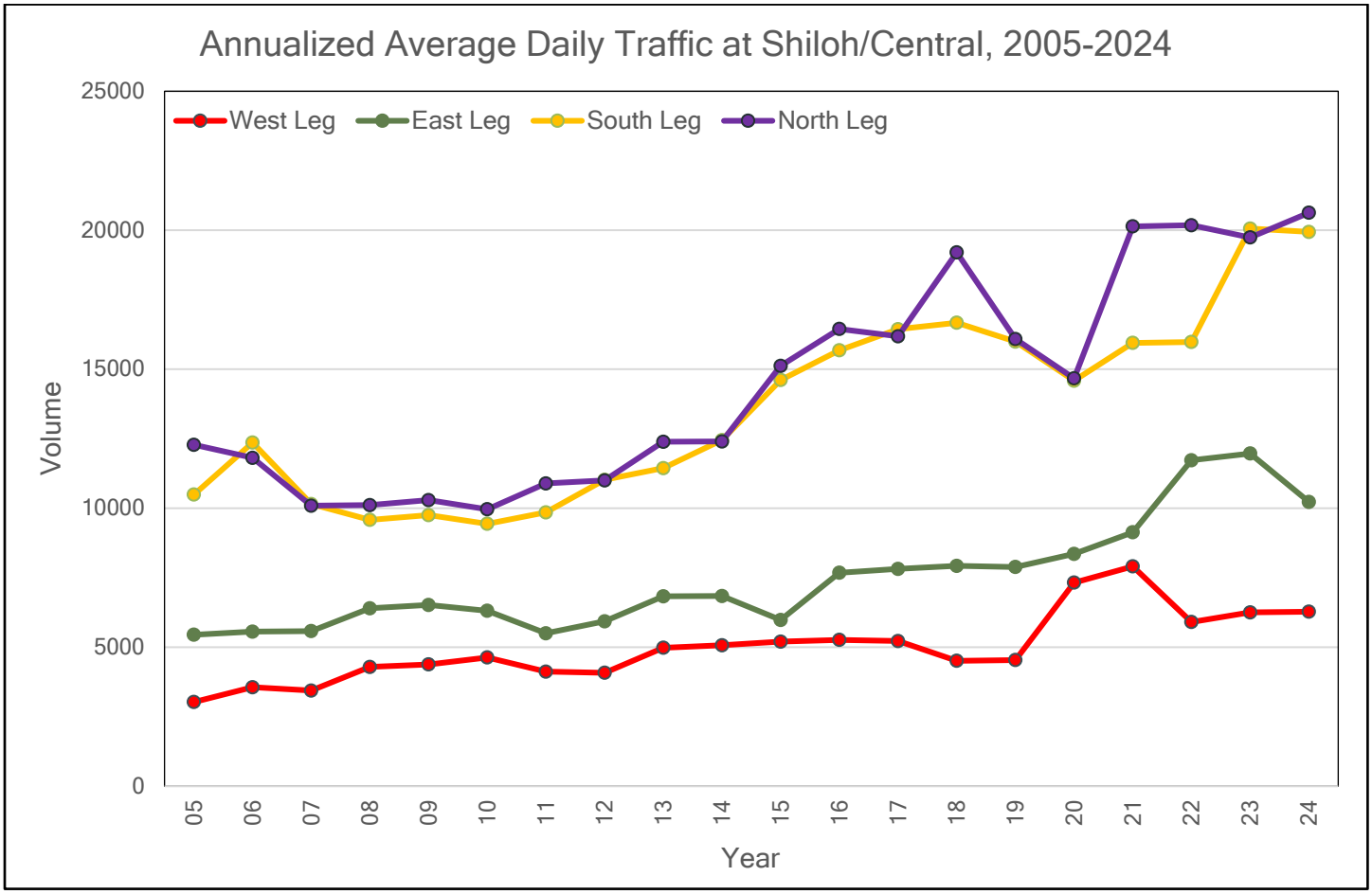


Exhibit 7. 2028 Background Traffic Volumes

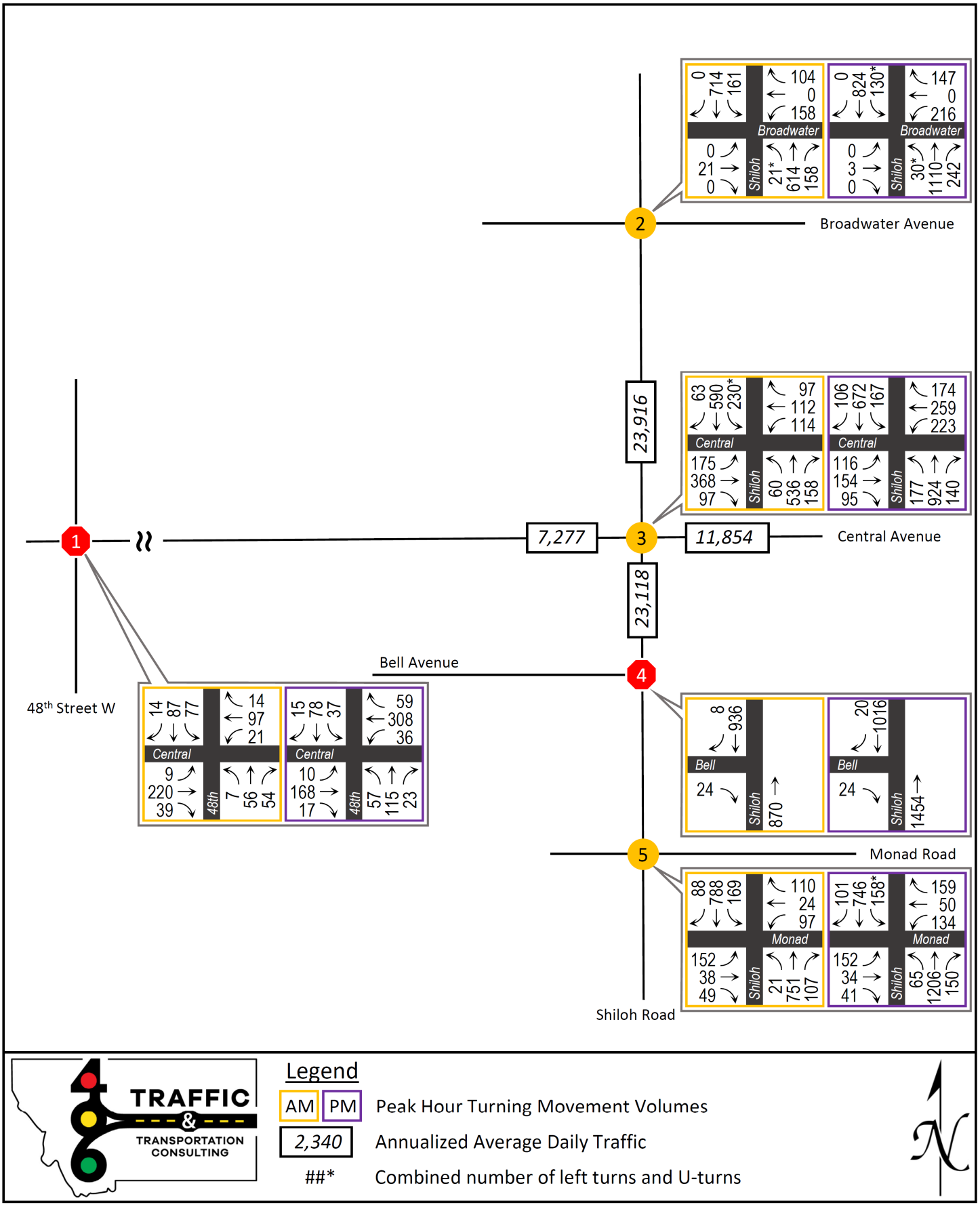
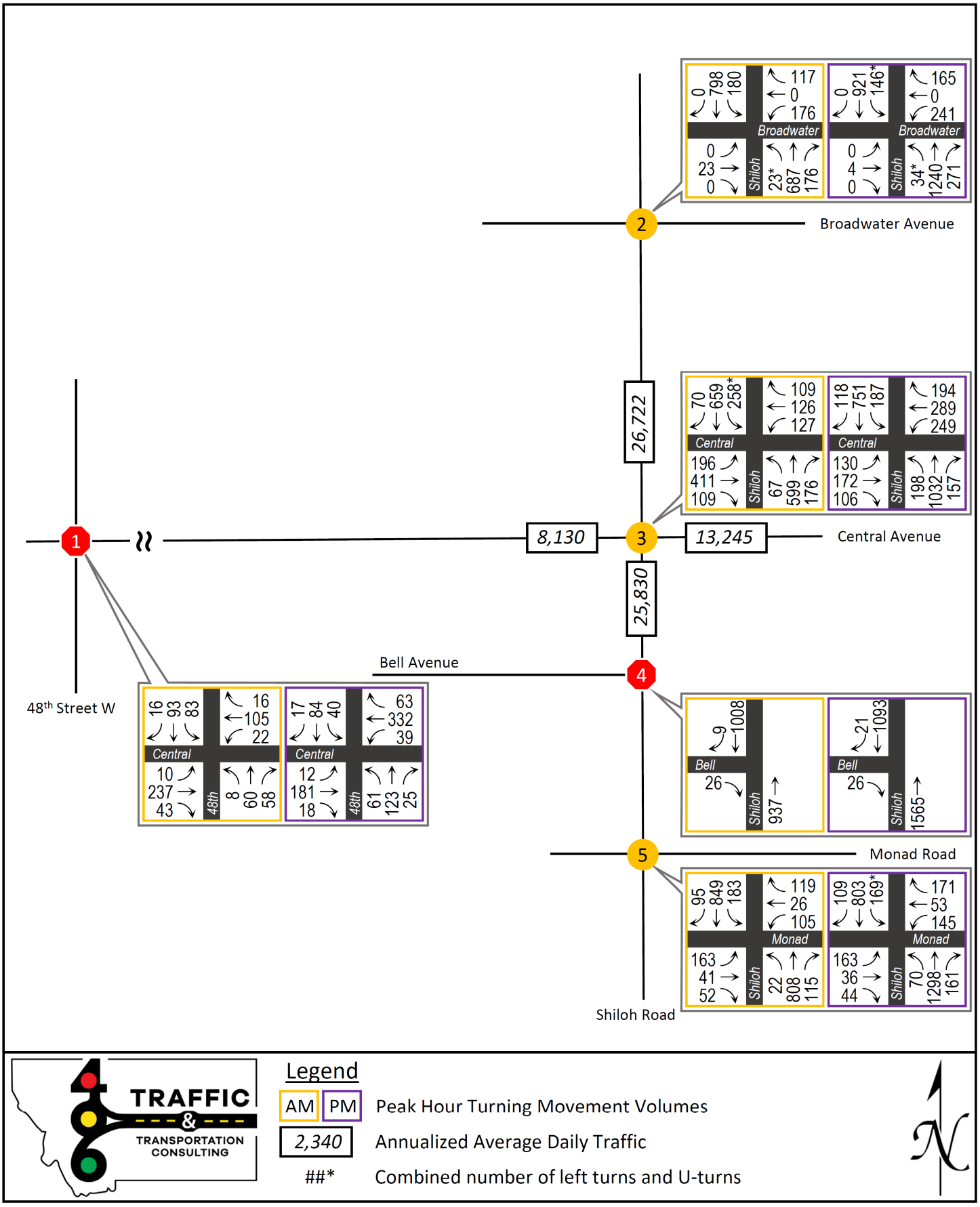


Exhibit 8. 2031 Background Traffic Volumes



2.4 INTERSECTION TRAFFIC OPERATIONS WITHOUT THE PROJECT

The existing and background peak hour intersection Level of Service (LOS) and delay results are shown in **Exhibit 9**. Analysis software results are provided in Appendix B.

Exhibit 9. Existing and Future Background Intersection LOS and Delay

	Intersection	Traffic Control	Peak Hour LOS (delay, in seconds/vehicle)		
			Existing	2028 Background	2031 Background
AM Peak Hour	1. 48th at Central	AWSC	A (9.6)	B (10.6)	B (11.3)
	2. Shiloh at Broadwater	Roundabout	A (6.0)	A (6.9)	A (7.8)
	3. Shiloh at Central	Roundabout	B (11.2)	C (16.2)	D (25.6)
	4. Shiloh at Bell	TWSC*	B (11.8)	B (12.6)	B (13.2)
	5. Shiloh at Monad	Roundabout	A (9.0)	B (11.6)	B (13.7)
PM Peak Hour	1. 48th at Central	AWSC	B (12.7)	C (16.1)	C (20.0)
	2. Shiloh at Broadwater	Roundabout	A (9.1)	B (11.8)	C (15.9)
	3. Shiloh at Central	Roundabout	B (13.6)	C (21.9)	E (40.0)
	4. Shiloh at Bell	TWSC*	B (12.1)	B (13.0)	B (13.6)
	5. Shiloh at Monad	Roundabout	B (10.0)	B (13.7)	C (16.9)

* *Worst lane group is Eastbound at Intersection 4.*

The results in the table indicate that in 2028, all intersections would meet the City's LOS standard of C or better. By 2031, background LOS at the Shiloh/Central roundabout is projected to degrade beyond that standard in both peak hours. Analysis details indicate that in the more severe peak (PM), the longest delays (around 1.5 minutes per vehicle) and queues (13 vehicles, at Synchro's 95th percentile design level) would be for the westbound approach. This background queue would be long enough to block the existing right-in/right-out access for the small mixed-use property on the northwest corner of the intersection, but not to block its ¾ access location farther east on Central.

3 PROJECT TRIP GENERATION AND DISTRIBUTION

3.1 TRIP GENERATION

Trip generation rates, or equations as applicable, are from the Institute of Transportation Engineers (ITE) Trip Generation package's 11th edition. ITE trip generation data, when aggregated across enough varied sites, produce both simple average rates and best-fit equations, either linear or logarithmic, to help the analyst derive proper estimates for their situation. Equations are generally preferred over rates, especially for larger sites where trip generation per unit of land use can diminish with increasing project size.

Clearwater Estates will consist almost entirely of residential land uses. Small park areas within the subdivision are designed and intended for use by residents and their guests, and will be similar to park spaces located in other residential areas around Billings. For that reason, they will not generate external traffic. The strip retail space in Phase 2, programmed for 25,000 square feet, has not had specific tenants or any sub-type(s) of retail use identified, but no drive-through activity is expected.

Three types of adjustments to trip generation were evaluated for this project. First, a discount is sometimes taken to reflect internal capture where multiple uses are present in a single project site. Second, a modal adjustment can be taken if a facility is clearly served by robust high-capacity transit and serves a clientele inclined to use transit to get there, or if the potential land use mix and walk/bike network are likely to lead to nonmotorized trips, either internal or external. Finally, some land uses such as gas stations or coffee shops attract trips that were already using the adjacent or nearby road network by virtue of improved convenience over a similar site that could have been used before. These are called "pass-by" and "diverted-linked" trips. Pass-by trips are those on streets bordering the site, while diverted-linked trips are those that might go slightly out of their way to stop at the establishment on their way to their destination.

The Phase 2 retail parcel is the only part of the site considered for these discounts. Due to its location, small size, and expected similarity to other sites along the Central Avenue corridor, only small discounts of the first two types were assumed here; it is not expected to support a use special enough or large enough to generate pass-by or diverted-linked trip activity. The estimate of combined reduction in vehicle trip use for the retail site due to (a) Clearwater residents' use and (b) nonmotorized trips applied here is 10%. **Exhibit 10** shows trip generation details for both phases of the project.

Exhibit 10. Clearwater Estates Trip Generation

	Daily	AM Peak Hour	PM Peak Hour
Phase 1: Single-Family Detached Housing – X = 66 dwelling units			
ITE Land Use 210 equation	Ln(T)=0.92(X) + 2.68	Ln(T)=0.91(X) + 0.12	T=0.60(X) - 3.93
Peak hour in/out split		*25% / 75%*	*63% / 37%*
Trips	688	51 (13 in / 38 out)	67 (42 in / 25 out)
Phase 1: Single-Family Attached Housing (combined townhome, duplex, and "cottage") – X = 262 dwelling units			
ITE Land Use 215 equation	T=7.62(X) - 50.48	T=0.52(X) - 5.70	T=0.60(X) - 3.93
Peak hour in/out split		*25% / 75%*	*59% / 41%*
Trips	1,946	131 (33 in / 98 out)	153 (90 in / 63 out)
Phase 1 Total Trips	2,634	182 (46 in / 136 out)	221 (133 in / 88 out)
Phase 2: Single-Family Detached Housing – X = 128 dwelling units			
ITE Land Use 210 equation	Ln(T)=0.92(X) + 2.68	Ln(T)=0.91(X) + 0.12	T=0.60(X) - 3.93
Peak hour in/out split		*25% / 75%*	*63% / 37%*
Trips	1,266	93 (23 in / 70 out)	125 (79 in / 46 out)
Phase 2: Strip Retail Plaza – X = 25,000 square feet			
ITE Land Use 822 equation	T=42.2(X) + 229.68	T=2.36(X)	T=6.59(X)
Peak hour in/out split		*60% / 40%*	*50% / 50%*
Gross total trips	1,285	59 (35 in / 24 out)	165 (83 in / 82 out)
Less 10% internal + walk/bike	-128	-6 (4 in / 2 out)	-16 (8 in / 8 out)
Net trips	1,157	53 (31 in / 22 out)	149 (75 in, 74 out)
Combined net trips, both phases:	**5,057**	**328 (101 in / 227 out)**	**494 (286 in / 208 out)**

Source: Equations from ITE Trip Generation, 11th Edition.

3.2 TRIP DISTRIBUTION AND ASSIGNMENT

Trip distribution has been estimated for the streets surrounding the project site in percentages that add to 100%. Farther from the site, traffic eventually disperses in smaller percentages to/from other routes. Because there is no new information regarding a future developer's plan to connect Bell Avenue and/or the similar connection in Phase 2 to the neighborhood to the west, no Clearwater traffic was assumed to use either such connection. Trip distribution and large-scale assignment percentages are shown in **Exhibit 11**. These percentages were assumed to be the same for both phases.

Phase 1 trips reflected as peak hour intersection turning movement volumes and selected daily link volumes are shown in **Exhibit 12**, and the total volumes after Phase 1 implementation and occupancy are shown in **Exhibit 13**. Similarly, new Phase 2 trips and total traffic are shown in **Exhibits 14** and **15**, respectively.

Note that the Shiloh median that blocks all left turns results in some differences in routing of in-out pairs. For example, many residents leaving the site bound for the Shiloh/Monad intersection can turn right at the Shiloh/Bell intersection, but when they return they must go north on Shiloh past Bell, then make a u-turn or left turn at the Shiloh/Central roundabout.

Exhibit 11. Trip Distribution Percentages for New Trips

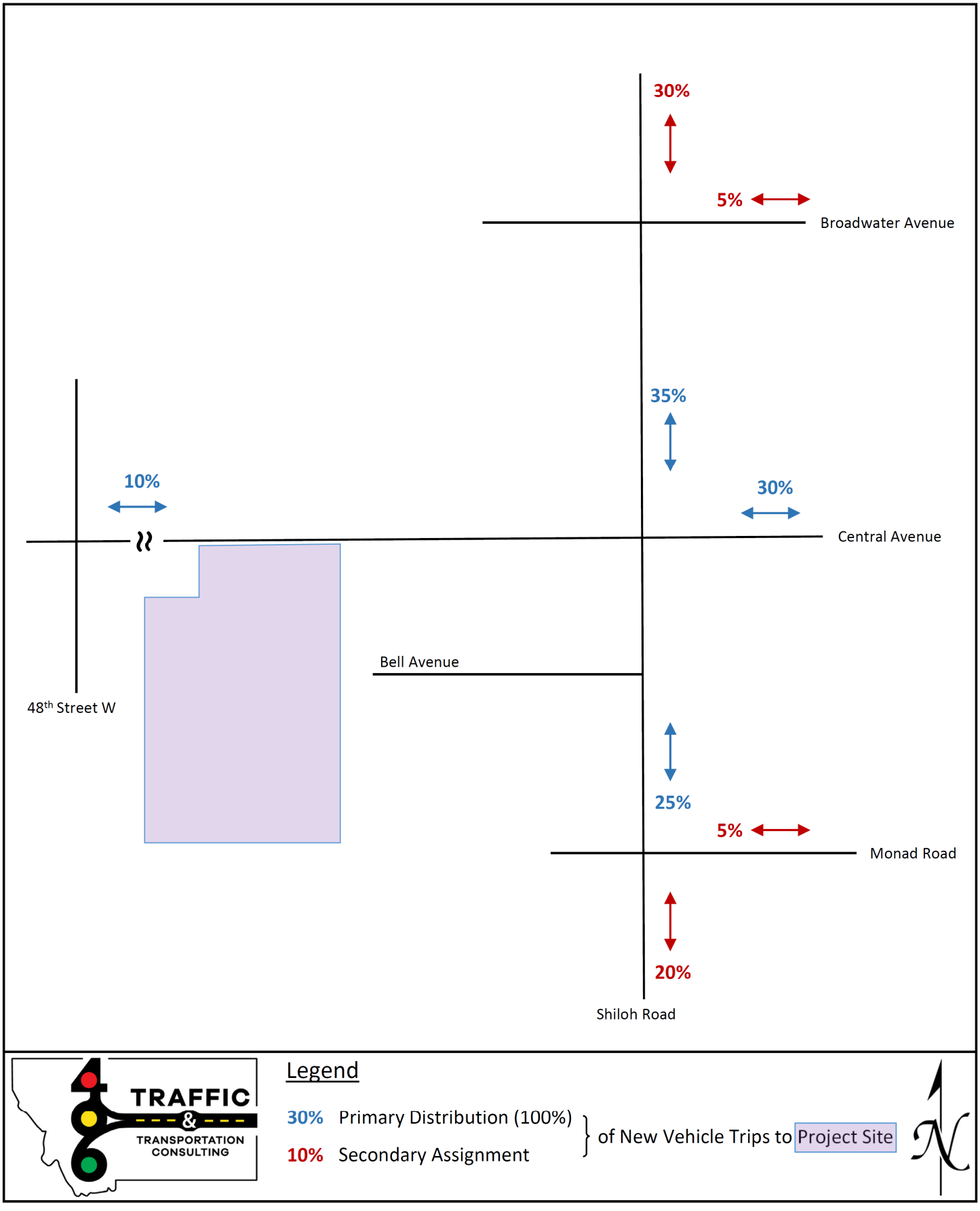


Exhibit 12. Assignment of New Phase 1 Trips

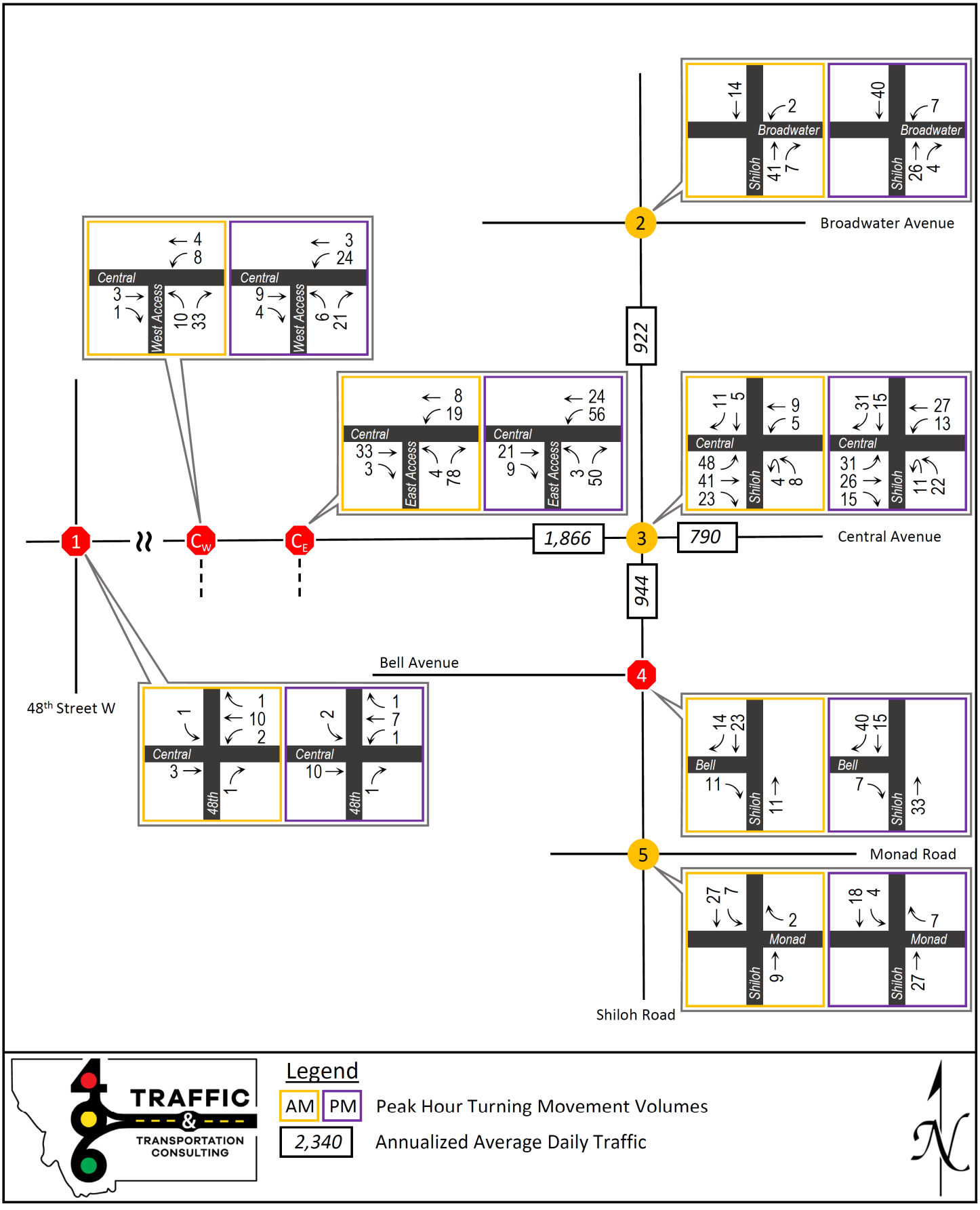


Exhibit 13. 2028 Total Traffic Volumes

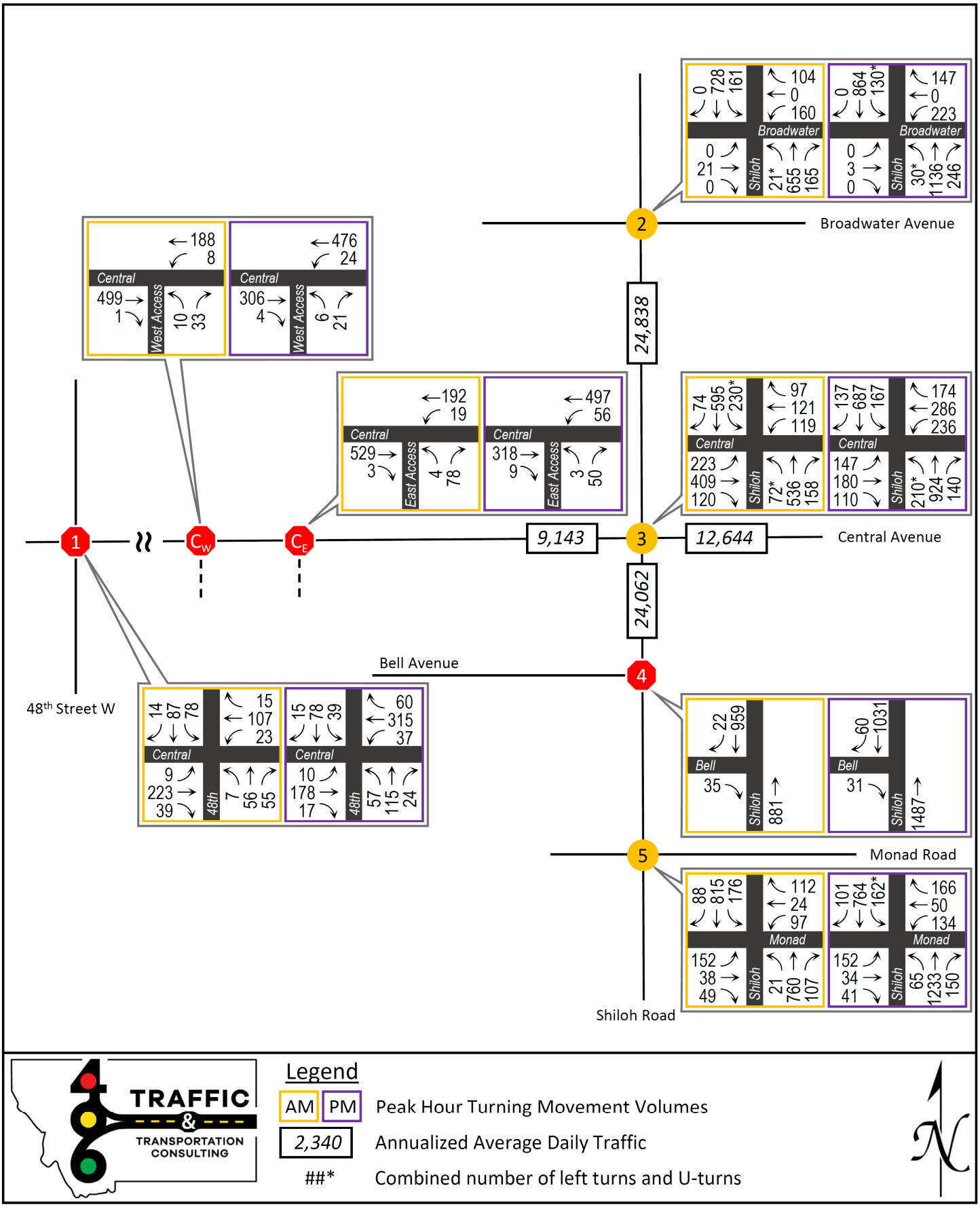


Exhibit 14. Assignment of New Phase 2 Trips

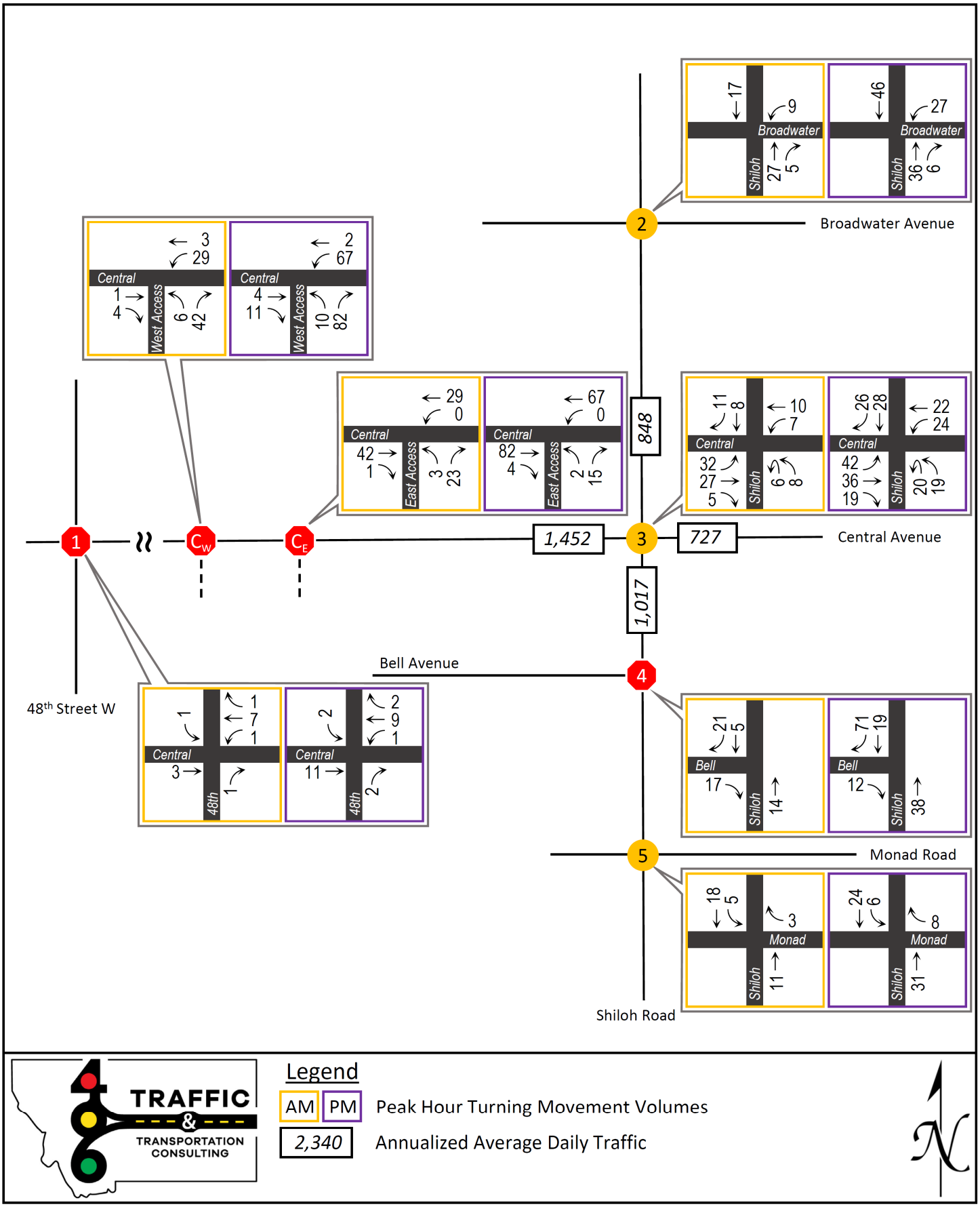
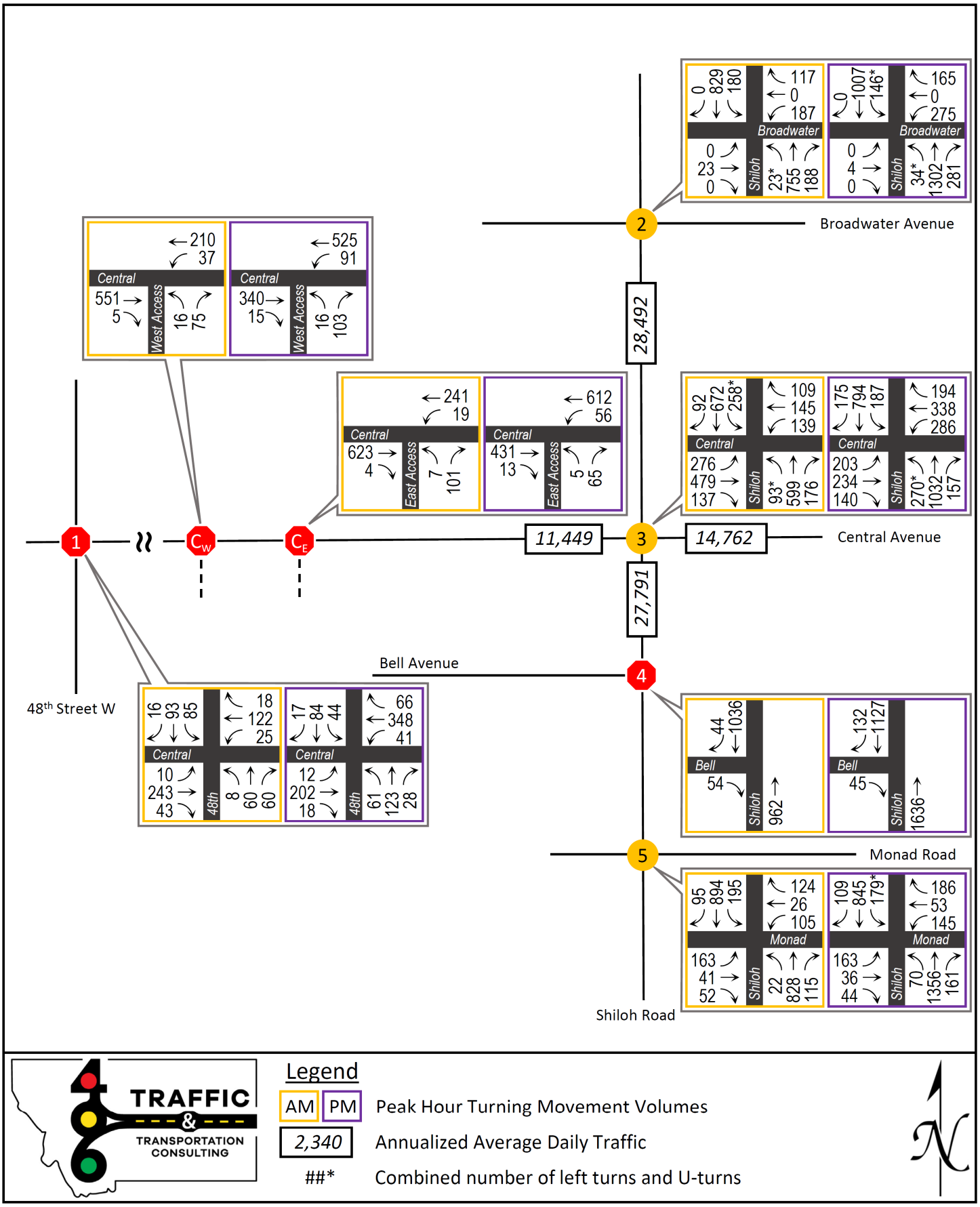


Exhibit 15. 2031 Total Traffic Volumes



4 INTERSECTION CAPACITY ANALYSIS

4.1 PHASE 1

The peak hour intersection Level of Service (LOS) and delay results in 2028 with and without Phase 1 are shown in **Exhibit 15**. Analysis software results are provided in Appendix B.

Exhibit 15. Projected 2028 Intersection LOS and Delay with and without Phase 1

	Intersection	Traffic Control	LOS (delay, in seconds/vehicle) 2028 Background	With Phase 1
AM Peak Hour	1. S. 48th at Central	AWSC	B (10.6)	B (10.8)
	2. Shiloh at Broadwater	Roundabout	A (6.9)	A (7.1)
	3. Shiloh at Central	Roundabout	C (16.2)	C (21.4)
	4. Shiloh at Bell	TWSC*	B (12.6)	B (13.1)
	5. Shiloh at Monad	Roundabout	B (11.6)	B (12.0)
	Central, West Access	TWSC*	-	B (13.5)
	Central, East Access	TWSC*	-	B (14.0)
PM Peak Hour	1. S. 48th at Central	AWSC	C (16.1)	C (17.4)
	2. Shiloh at Broadwater	Roundabout	B (11.8)	B (12.5)
	3. Shiloh at Central	Roundabout	C (21.9)	D (30.5)
	4. Shiloh at Bell	TWSC*	B (13.0)	B (13.6)
	5. Shiloh at Monad	Roundabout	B (13.7)	B (14.3)
	Central, West Access	TWSC*	-	B (12.2)
	Central, East Access	TWSC*	-	B (11.5)

* *Worst lane group is Eastbound at Intersection 4 and Northbound at Intersections 6 and 7.*

Both of the site accesses on Central and the Shiloh/Bell intersection would operate at LOS B in both 2028 peak hours. With respect to the peak hour LOS standard, Clearwater's Phase 1 traffic would only affect Intersection 3, the Shiloh at Central roundabout, and only in the PM peak hour. In this case, delay would increase beyond the LOS C/D threshold (25 seconds per vehicle) as a result of traffic generated by the subdivision. The detailed analysis results indicate that the longest delays (around 1 minute per vehicle) and queues (10 vehicles, at Synchro's 95th percentile design level) would be for the westbound approach. Given the limited range of mitigation options for this 2-lane roundabout and the projected LOS of D, testing of such options was deferred to the Phase 2 scenario, for which operations analysis results are described next.

4.2 PHASE 2

The peak hour intersection Level of Service (LOS) and delay results in 2031 with and without Phase 2 are shown in **Exhibit 16**. Analysis software results are provided in Appendix B.

Exhibit 16. Projected 2031 Intersection LOS and Delay with and without Phase 2

	Intersection	Traffic Control	LOS (delay, in seconds/vehicle) 2031 Background	With Phase 2
AM Peak Hour	1. S. 48th at Central	AWSC	B (11.3)	B (11.6)
	2. Shiloh at Broadwater	Roundabout	A (7.8)	A (8.3)
	3. Shiloh at Central	Roundabout	D (25.6)	F (52.5)
	4. Shiloh at Bell	TWSC*	B (13.2)	B (14.4)
	5. Shiloh at Monad	Roundabout	B (13.7)	B (14.8)
	Central, West Access	TWSC*	-	C (16.0)
	Central, East Access	TWSC*	-	C (17.0)
PM Peak Hour	1. S. 48th at Central	AWSC	C (20.0)	C (23.7)
	2. Shiloh at Broadwater	Roundabout	C (15.9)	C (20.6)
	3. Shiloh at Central	Roundabout	E (40.0)	F (95.7)
	4. Shiloh at Bell	TWSC*	B (13.6)	C (15.4)
	5. Shiloh at Monad	Roundabout	C (16.9)	C (19.1)
	Central, West Access	TWSC*	-	C (15.2)
	Central, East Access	TWSC*	-	B (13.8)

* *Worst lane group is Eastbound at Intersection 4 and Northbound at Intersections 6 and 7.*

As with 2028 conditions, all intersections and both new site accesses would operate within the City's LOS standard of C or better in both peak hours, with the exception of the Shiloh/Central roundabout. There, the additional traffic generated by Clearwater Estates would degrade the already-substandard LOS in both peak hours if no change is made to intersection capacity. In the context of examining intersection delays, it's important to note that the relationship between volume and delay is not linear; intersections operating near, at, or over capacity often have highly elastic delay responses to relatively small changes in volume.

To address future capacity deficiencies, the primary tool at roundabouts is the addition of a channelized right turn bypass lane on the approach(es) with the highest right-turning volume. They require widening and would lengthen pedestrian crossings, as with the addition of a turn lane at any intersection. Installing bypass lanes on the northbound and westbound approaches—that is, to and from the west, where Central is a 4/5-lane facility—would reduce projected PM peak hour average delay for the intersection by 25-30 seconds per vehicle, but LOS would still be F. The AM peak hour LOS would be expected to improve considerably, yet also still have higher delay than in the 2031 Background scenario. Bypass lanes are not logical for Central Avenue to and from the east, where Central currently has only a 2-lane cross section. The applicant team encourages the City to consider prioritizing, to the extent practicable, additional east-west connectivity between Shiloh and 48th with eventual functional extensions of Broadwater and/or Monad as additional land use changes occur along those logical alignments.

The short-term projection of substandard operations at Shiloh/Central, even without traffic from this particular subdivision, echoes similar findings for other major Shiloh roundabouts from recent studies. Some of this current and expected congestion stems from the scarcity of east-west street network connections other than the major arterials that are generally a mile apart. To that end, a secondary, "bigger-picture" part of the overall solution could involve the westward extension of the east-west streets a half-mile north and south of Central (Broadwater and Monad) to help relieve the traffic burden on Grand, Central, and King. Such extensions are outside the scope of Clearwater's mitigation analysis but still bear mentioning for general interest.

5 COST PARTICIPATION

The net new trips identified in this report are subject to examination under the City's cost participation program to the extent that they would travel through studied intersections. Critical traffic shares that drive cost participation are subject to waiver if they fall below 2%, but project trips from both phases are considered together when evaluating such a possibility. Right turns are not considered.

Intersection 4 was excluded from cost participation calculations because (a) Bell Avenue has been designed for local access only, which will keep volumes low, (b) Shiloh Road's access management features are considered permanent such that no traffic control changes are anticipated to be possible within the scope and timeframe of this project, and (c) as a right-in/right-out intersection there are, in effect, no critical pairs.

Exhibit 17 shows the incremental intersection cost participation for the new trips associated with each of the two project phases and the cost share calculation. As shown in the table, none of the four full-movement intersections qualify for the "sub-2%" waiver.

Exhibit 17. Intersection Cost Participation by Phase

	Phase 1			Phase 2			
Intersection*	**AM**	**PM**	**Higher**	**AM**	**PM**	**Higher**	**Total**
1. S. 48th at Central	0.9%	1.1%	1.1%	0.7%	1.2%	1.2%	2.3%
2. Shiloh at Broadwater	1.9%	2.3%	2.3%	1.9%	4.2%	4.2%	6.5%
3. Shiloh at Central	5.3%	6.3%	6.3%	4.1%	7.2%	7.2%	13.5%
5. Shiloh at Monad	1.2%	1.5%	1.5%	0.9%	1.8%	1.8%	3.3%
Total Participation:			**11.2%**			**14.4%**	**25.6%**
x $450,000			**$50,400**			**$64,800**	**$115,200**

For all intersections in both phases, the PM peak hour critical-pair traffic volume would exceed that of the AM peak hour. The calculation summary shown here indicates that $50,400 is associated with Phase 1 traffic and $64,800 is associated with Phase 2. The details of these cost participation calculations are provided in Appendix C.

This concludes the Clearwater Subdivision TAS.

Appendix A: Original Raw Traffic Count Data for Intersections

Study Name **Central and 48th**
Start Date **8/8/2023**
Start Time **7:30 AM**
Type **Road**
Classification **Totals**

	48th Street Southbound				Central Avenue Westbound				48th Street Northbound				Central Avenue Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM																
7:15 AM																
7:30 AM	3	13	19	0	3	27	2	0	18	9	2	0	5	62	1	0
7:45 AM	3	26	21	0	3	24	5	0	9	10	1	0	12	48	1	0
8:00 AM	4	19	12	0	3	17	5	0	10	13	3	0	10	44	2	0
8:15 AM	2	15	13	0	3	14	5	0	8	14	0	0	6	31	4	0
8:30 AM																
8:45 AM																
4:00 PM																
4:15 PM																
4:30 PM																
4:45 PM																
5:00 PM	1	15	6	0	14	70	7	0	7	23	9	0	5	38	1	0
5:15 PM	3	19	12	0	17	60	12	0	5	30	19	0	5	40	2	0
5:30 PM	4	18	5	0	8	69	6	0	6	20	10	0	2	32	4	0
5:45 PM	5	14	8	0	10	60	5	0	1	23	9	0	2	31	2	0

Study Name Shiloh & Broadwater
Start Date 3/7/2024
Start Time 7:00 AM
Type Road
Classification Totals

	Shiloh Road Southbound				Broadwater Avenue Westbound				Shiloh Road Northbound				Eastbound Approach Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	0	111	22	0	17	0	8	0	23	52	0	0	0	1	0	0
7:15 AM	0	147	52	0	21	0	25	0	35	102	0	6	0	3	0	0
7:30 AM	0	182	63	0	18	0	33	0	28	122	0	2	0	4	0	0
7:45 AM	0	170	34	0	23	0	39	0	38	140	0	4	0	4	0	0
8:00 AM	0	131	22	0	26	0	29	0	39	143	0	6	0	6	0	0
8:15 AM	0	139	21	0	24	0	36	0	32	130	0	6	0	4	0	0
8:30 AM	0	133	23	0	18	0	28	0	42	137	0	5	0	3	0	0
8:45 AM	0	150	49	0	18	0	28	0	34	124	0	3	0	4	0	0
4:00 PM	0	143	17	0	33	0	42	0	27	244	0	5	0	2	0	0
4:15 PM	0	151	25	0	20	0	46	0	36	226	0	2	0	0	1	0
4:30 PM	0	151	31	0	21	0	38	0	50	238	2	2	0	0	0	0
4:45 PM	0	177	21	0	24	0	37	0	35	201	1	3	0	0	0	0
5:00 PM	0	169	23	0	40	0	56	0	56	281	0	8	0	3	0	0
5:15 PM	0	193	32	1	44	0	52	0	63	283	4	8	0	0	0	0
5:30 PM	0	179	35	1	20	0	43	0	57	202	1	1	0	0	0	0
5:45 PM	0	160	33	2	20	1	35	0	43	200	0	0	0	0	0	0

Study Name Shiloh & Central
Start Date 3/21/2024
Start Time 7:00 AM
Type Road
Classification Totals

	Shiloh Road Southbound				Central Avenue Westbound				Shiloh Road Northbound				Central Avenue Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	6	74	22	0	7	13	15	0	19	66	9	1	19	51	15	0
7:15 AM	8	118	48	0	7	18	28	0	32	84	14	0	25	90	17	0
7:30 AM	16	128	69	1	18	25	29	0	41	96	15	0	22	112	36	0
7:45 AM	17	135	67	0	26	19	34	0	36	130	19	0	20	91	42	0
8:00 AM	7	116	32	0	29	25	17	0	33	114	10	0	21	76	37	0
8:15 AM	15	135	31	1	12	29	19	0	27	127	9	0	22	41	38	0
8:30 AM	9	98	29	0	15	30	21	0	26	146	10	0	16	30	31	0
8:45 AM	10	102	31	1	20	22	24	0	17	119	20	0	22	40	30	0
4:00 PM	19	127	37	0	23	51	45	0	35	168	24	0	21	29	27	0
4:15 PM	20	100	34	0	35	41	58	0	26	156	45	0	20	39	25	0
4:30 PM	23	127	35	0	38	50	62	0	30	163	47	0	21	26	27	0
4:45 PM	19	153	33	0	41	45	49	0	26	174	41	0	15	36	23	0
5:00 PM	26	152	34	0	38	63	48	0	31	235	32	0	21	46	23	0
5:15 PM	24	154	43	0	35	67	35	0	35	233	35	0	26	26	28	0
5:30 PM	17	142	35	0	40	74	46	0	32	148	35	0	14	32	27	0
5:45 PM	21	148	30	0	31	46	41	0	32	162	26	0	24	22	30	0

Study Name Shiloh & Bell
Start Date 5/18/2023
Start Time 7:00 AM
Type Road
Classification Totals

	Shiloh Road Southbound				n/a Westbound				Shiloh Road Northbound				Bell Avenue Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	1	126		0						103	0	0	1		0	0
7:15 AM	0	186		0						111	0	0	2		0	0
7:30 AM	2	181		0						228	0	0	7		0	0
7:45 AM	2	239		0						213	0	0	7		0	0
8:00 AM	1	184		0						169	0	0	7		0	0
8:15 AM	3	233		0						167	0	0	1		0	0
8:30 AM	2	163		0						180	0	0	3		0	0
8:45 AM	6	174		0						169	0	0	5		0	0
4:00 PM	2	225		0						272	0	0	6		0	0
4:15 PM	4	224		0						262	0	0	3		0	0
4:30 PM	3	212		0						311	0	0	2		0	0
4:45 PM	5	212		0						307	0	0	7		0	0
5:00 PM	4	241		0						357	0	0	8		0	0
5:15 PM	5	243		0						324	0	0	4		0	0
5:30 PM	6	213		0						263	0	0	7		0	0
5:45 PM	6	219		0						254	0	0	2		0	0

Study Name Shiloh & Monad
Start Date 10/24/2023
Start Time 7:00 AM
Type Road
Classification Totals

	Shiloh Road Southbound				Monad Road Westbound				Shiloh Road Northbound				Monad Road Eastbound			
Start Time	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U	Right	Thru	Left	U
7:00 AM	6	126	12	0	8	7	12	0	16	67	5	0	10	5	12	0
7:15 AM	12	129	36	0	11	9	15	0	22	113	1	0	13	3	25	0
7:30 AM	9	138	32	0	24	3	22	0	29	175	5	0	17	14	33	0
7:45 AM	16	215	49	0	29	8	21	0	21	190	8	0	12	7	36	0
8:00 AM	23	181	23	0	18	2	22	0	23	142	1	0	9	10	24	0
8:15 AM	26	128	38	0	22	7	17	0	17	123	3	0	2	1	34	0
8:30 AM	12	150	42	5	17	1	15	0	16	111	2	1	5	2	24	0
8:45 AM	10	135	20	0	20	5	9	0	14	109	1	0	10	3	16	0
4:00 PM	16	166	26	0	30	6	21	0	33	210	10	0	12	8	23	0
4:15 PM	15	162	23	0	25	10	20	0	30	203	7	0	6	15	23	0
4:30 PM	21	174	35	0	37	12	29	0	22	233	9	0	8	9	41	0
4:45 PM	18	154	27	1	29	8	32	0	28	236	18	0	6	0	35	0
5:00 PM	16	138	44	0	29	15	27	0	35	277	12	0	9	10	31	0
5:15 PM	30	160	25	0	38	6	25	0	40	266	16	0	11	9	20	0
5:30 PM	19	180	23	0	37	8	34	0	34	183	13	0	9	7	31	0
5:45 PM	24	156	28	0	37	10	16	0	25	176	13	0	11	12	21	0

Appendix B: Intersection Analysis Software Output

Scenario sequence:

Existing

2028 Background

2028 Phase 1

2031 Background

2031 Phase 2

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	190	34	18	84	12	6	48	47	66	75	12
Future Vol, veh/h	8	190	34	18	84	12	6	48	47	66	75	12
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	9	213	38	20	94	13	7	54	53	74	84	13
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.2	9.1	8.9	9.7
HCM LOS	B	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	43%
Vol Thru, %	48%	82%	74%	49%
Vol Right, %	47%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	101	232	114	153
LT Vol	6	8	18	66
Through Vol	48	190	84	75
RT Vol	47	34	12	12
Lane Flow Rate	113	261	128	172
Geometry Grp	1	1	1	1
Degree of Util (X)	0.154	0.342	0.177	0.24
Departure Headway (Hd)	4.882	4.722	4.983	5.033
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	727	756	713	708
Service Time	2.959	2.783	3.056	3.104
HCM Lane V/C Ratio	0.155	0.345	0.18	0.243
HCM Control Delay, s/veh	8.9	10.2	9.1	9.7
HCM Lane LOS	A	B	A	A
HCM 95th-tile Q	0.5	1.5	0.6	0.9

Intersection	
Intersection Delay, s/veh	6.0
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	19	241	728	803
Demand Flow Rate, veh/h	19	243	742	811
Vehicles Circulating, veh/h	957	594	168	165
Vehicles Exiting, veh/h	19	316	808	672
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.1	6.1	5.9	6.1
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.601	0.399	0.470	0.530	0.470	0.530
Follow-Up Headway, s	1.000	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	3600	1420	1350	1420	1420	1420	1420	1420
B (Slope)	1.151e-3	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	19	0	146	97	349	393	381	430
Cap Entry Lane, veh/h	1196	629	782	857	1219	1219	1222	1222
Entry HV Adj Factor	1.000	1.000	0.993	0.990	0.980	0.981	0.991	0.990
Flow Entry, veh/h	19	0	145	96	342	386	378	426
Cap Entry, veh/h	1196	629	776	848	1194	1196	1211	1210
V/C Ratio	0.016	0.000	0.187	0.113	0.286	0.322	0.312	0.352
Control Delay, s/veh	3.1	5.7	6.6	5.4	5.7	6.0	5.9	6.3
LOS	A	A	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	0	1	1	1	2

Intersection	
Intersection Delay, s/veh	11.2
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	620	310	730	857
Demand Flow Rate, veh/h	632	319	753	866
Vehicles Circulating, veh/h	917	768	762	282
Vehicles Exiting, veh/h	231	747	787	805
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	14.6	7.9	13.7	7.6
Approach LOS	B	A	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	297	335	150	169	354	399	407	459
Cap Entry Lane, veh/h	581	651	666	739	670	743	1041	1117
Entry HV Adj Factor	0.981	0.981	0.971	0.972	0.970	0.970	0.990	0.990
Flow Entry, veh/h	291	329	146	164	343	387	403	454
Cap Entry, veh/h	570	639	647	718	649	721	1031	1106
V/C Ratio	0.511	0.514	0.225	0.229	0.529	0.537	0.391	0.411
Control Delay, s/veh	15.3	14.0	8.3	7.6	14.2	13.3	7.7	7.6
LOS	C	B	A	A	B	B	A	A
95th %tile Queue, veh	3	3	1	1	3	3	2	2

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	21	0	750	807	7
Future Vol, veh/h	0	21	0	750	807	7
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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	24	0	843	907	8

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	457	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	556	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	556	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	11.76	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	556	-	-
HCM Lane V/C Ratio	-	0.042	-	-
HCM Ctrl Dly (s/v)	-	11.8	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.1	-	-

Intersection	
Intersection Delay, s/veh	9.0
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	251	241	924	1100
Demand Flow Rate, veh/h	259	248	933	1111
Vehicles Circulating, veh/h	1119	985	386	151
Vehicles Exiting, veh/h	143	334	992	1082
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.9	9.3	9.2	7.6
Approach LOS	B	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.795	0.205	0.520	0.480	0.471	0.529	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	206	53	129	119	439	494	522	589
Cap Entry Lane, veh/h	482	549	545	615	999	999	1238	1238
Entry HV Adj Factor	0.970	0.962	0.971	0.975	0.989	0.991	0.990	0.990
Flow Entry, veh/h	200	51	125	116	434	490	517	583
Cap Entry, veh/h	468	528	529	599	989	991	1226	1225
V/C Ratio	0.427	0.097	0.236	0.194	0.439	0.494	0.422	0.476
Control Delay, s/veh	15.5	8.0	10.1	8.4	8.7	9.6	7.2	8.0
LOS	C	A	B	A	A	A	A	A
95th %tile Queue, veh	2	0	1	1	2	3	2	3

Intersection	
Intersection Delay, s/veh	12.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	145	15	31	266	51	49	99	20	32	67	13
Future Vol, veh/h	9	145	15	31	266	51	49	99	20	32	67	13
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	10	169	17	36	309	59	57	115	23	37	78	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	10.8	14.9	11.3	10.5
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	29%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	168	169	348	112
LT Vol	49	9	31	32
Through Vol	99	145	266	67
RT Vol	20	15	51	13
Lane Flow Rate	195	197	405	130
Geometry Grp	1	1	1	1
Degree of Util (X)	0.31	0.298	0.575	0.212
Departure Headway (Hd)	5.721	5.465	5.118	5.852
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	627	656	704	611
Service Time	3.772	3.515	3.159	3.907
HCM Lane V/C Ratio	0.311	0.3	0.575	0.213
HCM Control Delay, s/veh	11.3	10.8	14.9	10.5
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.3	1.2	3.7	0.8

Intersection	
Intersection Delay, s/veh	9.1
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	3	360	1370	946
Demand Flow Rate, veh/h	3	360	1370	955
Vehicles Circulating, veh/h	1169	1130	133	244
Vehicles Exiting, veh/h	30	373	1039	1246
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	7.9	13.6	9.0	7.6
Approach LOS	A	B	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.594	0.406	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	3	0	214	146	644	726	449	506
Cap Entry Lane, veh/h	461	526	477	543	1258	1258	1137	1137
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991
Flow Entry, veh/h	3	0	214	146	644	726	445	501
Cap Entry, veh/h	461	526	477	543	1258	1258	1126	1127
V/C Ratio	0.007	0.000	0.448	0.269	0.512	0.577	0.395	0.445
Control Delay, s/veh	7.9	6.8	15.8	10.4	8.4	9.6	7.2	8.0
LOS	A	A	C	B	A	A	A	A
95th %tile Queue, veh	0	0	2	1	3	4	2	2

Intersection	
Intersection Delay, s/veh	13.6
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	339	607	1152	877
Demand Flow Rate, veh/h	339	607	1152	886
Vehicles Circulating, veh/h	993	1130	408	611
Vehicles Exiting, veh/h	504	430	924	1126
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	10.3	19.9	12.1	12.6
Approach LOS	B	C	B	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.469	0.531	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	159	180	285	322	541	611	416	470
Cap Entry Lane, veh/h	541	611	477	543	927	1004	769	845
Entry HV Adj Factor	1.002	0.998	1.001	0.999	1.001	0.999	0.991	0.989
Flow Entry, veh/h	159	180	285	322	541	611	412	465
Cap Entry, veh/h	543	609	478	543	928	1003	762	835
V/C Ratio	0.294	0.295	0.597	0.593	0.583	0.609	0.541	0.556
Control Delay, s/veh	10.8	9.8	21.1	18.8	12.1	12.0	12.8	12.4
LOS	B	A	C	C	B	B	B	B
95th %tile Queue, veh	1	1	4	4	4	4	3	3

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	21	0	1254	876	17
Future Vol, veh/h	0	21	0	1254	876	17
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	23	0	1363	952	18

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	485	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	533	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	533	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.05	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	533	-	-
HCM Lane V/C Ratio	-	0.043	-	-
HCM Ctrl Dly (s/v)	-	12.1	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.1	-	-

Intersection	
Intersection Delay, s/veh	10.0
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	201	305	1263	893
Demand Flow Rate, veh/h	206	305	1263	902
Vehicles Circulating, veh/h	931	1268	310	222
Vehicles Exiting, veh/h	193	305	827	1351
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.8	14.1	11.1	7.1
Approach LOS	A	B	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.538	0.462	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	169	37	164	141	594	669	424	478
Cap Entry Lane, veh/h	573	644	420	483	1071	1071	1160	1160
Entry HV Adj Factor	0.979	0.973	1.000	1.000	0.999	1.001	0.990	0.991
Flow Entry, veh/h	165	36	164	141	594	669	420	473
Cap Entry, veh/h	561	626	420	483	1070	1072	1149	1149
V/C Ratio	0.295	0.057	0.390	0.292	0.555	0.625	0.365	0.412
Control Delay, s/veh	10.6	6.4	15.9	11.9	10.2	11.9	6.8	7.4
LOS	B	A	C	B	B	B	A	A
95th %tile Queue, veh	1	0	2	1	4	5	2	2

Intersection	
Intersection Delay, s/veh	10.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	220	39	21	97	14	7	56	54	77	87	14
Future Vol, veh/h	9	220	39	21	97	14	7	56	54	77	87	14
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	10	247	44	24	109	16	8	63	61	87	98	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	11.6	9.8	9.5	10.6
HCM LOS	B	A	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	43%
Vol Thru, %	48%	82%	73%	49%
Vol Right, %	46%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	117	268	132	178
LT Vol	7	9	21	77
Through Vol	56	220	97	87
RT Vol	54	39	14	14
Lane Flow Rate	131	301	148	200
Geometry Grp	1	1	1	1
Degree of Util (X)	0.191	0.419	0.218	0.297
Departure Headway (Hd)	5.224	5.01	5.3	5.34
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	686	723	678	674
Service Time	3.259	3.01	3.332	3.371
HCM Lane V/C Ratio	0.191	0.416	0.218	0.297
HCM Control Delay, s/veh	9.5	11.6	9.8	10.6
HCM Lane LOS	A	B	A	B
HCM 95th-tile Q	0.7	2.1	0.8	1.2

Intersection	
Intersection Delay, s/veh	6.9
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	22	279	843	931
Demand Flow Rate, veh/h	22	282	859	941
Vehicles Circulating, veh/h	1111	688	195	192
Vehicles Exiting, veh/h	22	366	938	778
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.0	7.1	6.6	7.0
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.603	0.397	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	22	0	170	112	404	455	442	499
Cap Entry Lane, veh/h	486	552	717	791	1189	1189	1192	1192
Entry HV Adj Factor	1.000	1.000	0.988	0.991	0.981	0.982	0.990	0.989
Flow Entry, veh/h	22	0	168	111	396	447	438	494
Cap Entry, veh/h	486	552	708	784	1166	1168	1181	1180
V/C Ratio	0.045	0.000	0.237	0.142	0.340	0.383	0.371	0.418
Control Delay, s/veh	8.0	6.5	7.8	6.1	6.4	6.9	6.7	7.3
LOS	A	A	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	0	2	2	2	2

Intersection	
Intersection Delay, s/veh	16.2
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	719	363	847	992
Demand Flow Rate, veh/h	733	374	872	1003
Vehicles Circulating, veh/h	1063	890	883	331
Vehicles Exiting, veh/h	271	865	913	933
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	23.2	9.8	21.1	9.2
Approach LOS	C	A	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.471	0.529	0.471	0.529	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	345	388	176	198	410	462	471	532
Cap Entry Lane, veh/h	508	575	595	666	599	670	996	1072
Entry HV Adj Factor	0.979	0.982	0.970	0.972	0.971	0.972	0.990	0.989
Flow Entry, veh/h	338	381	171	193	398	449	466	526
Cap Entry, veh/h	497	565	577	648	582	651	986	1060
V/C Ratio	0.680	0.674	0.296	0.297	0.684	0.689	0.473	0.496
Control Delay, s/veh	24.6	21.9	10.3	9.4	22.0	20.3	9.3	9.2
LOS	C	C	B	A	C	C	A	A
95th %tile Queue, veh	5	5	1	1	5	5	3	3

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	24	0	870	936	8
Future Vol, veh/h	0	24	0	870	936	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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	27	0	978	1052	9

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	530	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	498	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	498	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.63	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	498	-	-
HCM Lane V/C Ratio	-	0.054	-	-
HCM Ctrl Dly (s/v)	-	12.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	11.6
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	291	281	1072	1274
Demand Flow Rate, veh/h	300	290	1082	1287
Vehicles Circulating, veh/h	1301	1142	446	178
Vehicles Exiting, veh/h	164	386	1155	1254
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	21.1	11.9	11.8	9.1
Approach LOS	C	B	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.793	0.207	0.524	0.476	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	238	62	152	138	509	573	605	682
Cap Entry Lane, veh/h	408	470	472	538	946	946	1208	1208
Entry HV Adj Factor	0.969	0.968	0.968	0.971	0.990	0.991	0.990	0.990
Flow Entry, veh/h	231	60	147	134	504	568	599	675
Cap Entry, veh/h	395	455	457	522	937	938	1196	1196
V/C Ratio	0.583	0.132	0.322	0.257	0.538	0.606	0.501	0.565
Control Delay, s/veh	24.0	9.8	13.2	10.5	10.9	12.6	8.5	9.7
LOS	C	A	B	B	B	B	A	A
95th %tile Queue, veh	4	0	1	1	3	4	3	4

Intersection	
Intersection Delay, s/veh	16.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	168	17	36	308	59	57	115	23	37	78	15
Future Vol, veh/h	10	168	17	36	308	59	57	115	23	37	78	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	12	195	20	42	358	69	66	134	27	43	91	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.5	20.6	13.1	11.8
HCM LOS	B	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	28%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	195	195	403	130
LT Vol	57	10	36	37
Through Vol	115	168	308	78
RT Vol	23	17	59	15
Lane Flow Rate	227	227	469	151
Geometry Grp	1	1	1	1
Degree of Util (X)	0.386	0.376	0.706	0.269
Departure Headway (Hd)	6.244	5.964	5.425	6.413
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	580	608	661	562
Service Time	4.244	3.964	3.516	4.427
HCM Lane V/C Ratio	0.391	0.373	0.71	0.269
HCM Control Delay, s/veh	13.1	12.5	20.6	11.8
HCM Lane LOS	B	B	C	B
HCM 95th-tile Q	1.8	1.7	5.8	1.1

Intersection	
Intersection Delay, s/veh	11.8
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	3	417	1588	1096
Demand Flow Rate, veh/h	3	417	1588	1106
Vehicles Circulating, veh/h	1354	1310	153	282
Vehicles Exiting, veh/h	34	431	1204	1445
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.4	20.5	11.3	9.2
Approach LOS	A	C	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.595	0.405	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	3	0	248	169	746	842	520	586
Cap Entry Lane, veh/h	388	449	405	466	1236	1236	1099	1099
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991
Flow Entry, veh/h	3	0	248	169	746	842	515	581
Cap Entry, veh/h	388	449	405	466	1236	1235	1088	1089
V/C Ratio	0.008	0.000	0.613	0.362	0.604	0.681	0.473	0.533
Control Delay, s/veh	9.4	8.0	25.1	13.9	10.3	12.3	8.6	9.7
LOS	A	A	D	B	B	B	A	A
95th %tile Queue, veh	0	0	4	2	4	6	3	3

Intersection	
Intersection Delay, s/veh	21.9
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	393	705	1335	1017
Demand Flow Rate, veh/h	393	705	1335	1027
Vehicles Circulating, veh/h	1152	1309	473	708
Vehicles Exiting, veh/h	583	499	1072	1306
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.7	39.1	17.6	18.7
Approach LOS	B	E	C	C

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.471	0.529	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	185	208	331	374	627	708	483	544
Cap Entry Lane, veh/h	468	533	405	467	874	950	704	778
Entry HV Adj Factor	0.998	1.001	1.001	0.999	1.001	0.999	0.989	0.991
Flow Entry, veh/h	185	208	331	374	627	708	478	539
Cap Entry, veh/h	467	534	405	466	874	949	696	771
V/C Ratio	0.395	0.390	0.817	0.801	0.718	0.745	0.686	0.699
Control Delay, s/veh	14.6	12.9	42.3	36.2	17.4	17.7	19.1	18.3
LOS	B	B	E	E	C	C	C	C
95th %tile Queue, veh	2	2	7	7	6	7	5	6

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	24	0	1454	1016	20
Future Vol, veh/h	0	24	0	1454	1016	20
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	26	0	1580	1104	22

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	563	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	475	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	475	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.03	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	475	-	-
HCM Lane V/C Ratio	-	0.055	-	-
HCM Ctrl Dly (s/v)	-	13	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	234	354	1465	1036
Demand Flow Rate, veh/h	239	354	1465	1047
Vehicles Circulating, veh/h	1080	1470	361	257
Vehicles Exiting, veh/h	224	356	958	1567
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	12.8	21.0	15.8	8.4
Approach LOS	B	C	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.537	0.463	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	196	43	190	164	689	776	492	555
Cap Entry Lane, veh/h	500	567	349	407	1022	1022	1124	1124
Entry HV Adj Factor	0.981	0.977	1.000	1.000	0.999	1.001	0.990	0.990
Flow Entry, veh/h	192	42	190	164	689	776	487	549
Cap Entry, veh/h	490	554	349	407	1022	1023	1113	1112
V/C Ratio	0.392	0.076	0.544	0.403	0.674	0.759	0.438	0.494
Control Delay, s/veh	14.0	7.4	24.7	16.7	13.8	17.4	7.9	8.8
LOS	B	A	C	C	B	C	A	A
95th %tile Queue, veh	2	0	3	2	5	8	2	3

Intersection	
Intersection Delay, s/veh	10.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	223	39	23	107	15	7	56	55	78	87	14
Future Vol, veh/h	9	223	39	23	107	15	7	56	55	78	87	14
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	10	251	44	26	120	17	8	63	62	88	98	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	11.8	10.1	9.6	10.8
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	16%	44%
Vol Thru, %	47%	82%	74%	49%
Vol Right, %	47%	14%	10%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	118	271	145	179
LT Vol	7	9	23	78
Through Vol	56	223	107	87
RT Vol	55	39	15	14
Lane Flow Rate	133	304	163	201
Geometry Grp	1	1	1	1
Degree of Util (X)	0.195	0.427	0.241	0.302
Departure Headway (Hd)	5.284	5.054	5.325	5.4
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	679	716	674	666
Service Time	3.322	3.054	3.361	3.435
HCM Lane V/C Ratio	0.196	0.425	0.242	0.302
HCM Control Delay, s/veh	9.6	11.8	10.1	10.8
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.7	2.1	0.9	1.3

Intersection	
Intersection Delay, s/veh	7.1
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	22	281	895	945
Demand Flow Rate, veh/h	22	284	913	955
Vehicles Circulating, veh/h	1127	733	195	194
Vehicles Exiting, veh/h	22	375	954	823
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.1	7.5	6.9	7.1
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.606	0.394	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	22	0	172	112	429	484	449	506
Cap Entry Lane, veh/h	479	545	688	762	1189	1189	1190	1190
Entry HV Adj Factor	1.000	1.000	0.988	0.991	0.981	0.980	0.989	0.990
Flow Entry, veh/h	22	0	170	111	421	474	444	501
Cap Entry, veh/h	479	545	680	755	1166	1166	1178	1178
V/C Ratio	0.046	0.000	0.250	0.147	0.361	0.407	0.377	0.425
Control Delay, s/veh	8.1	6.6	8.3	6.3	6.6	7.2	6.8	7.4
LOS	A	A	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	1	2	2	2	2

Intersection	
Intersection Delay, s/veh	21.4
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	846	377	861	1007
Demand Flow Rate, veh/h	863	388	886	1018
Vehicles Circulating, veh/h	1075	959	986	359
Vehicles Exiting, veh/h	302	913	952	988
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	33.5	10.9	28.0	9.7
Approach LOS	D	B	D	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.469	0.531	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	406	457	182	206	416	470	478	540
Cap Entry Lane, veh/h	502	569	559	628	545	614	970	1047
Entry HV Adj Factor	0.979	0.981	0.974	0.970	0.973	0.971	0.990	0.989
Flow Entry, veh/h	398	448	177	200	405	456	473	534
Cap Entry, veh/h	492	559	544	610	530	596	961	1035
V/C Ratio	0.809	0.803	0.326	0.328	0.763	0.765	0.493	0.516
Control Delay, s/veh	35.5	31.6	11.4	10.4	29.2	26.8	9.8	9.7
LOS	E	D	B	B	D	D	A	A
95th %tile Queue, veh	8	8	1	1	7	7	3	3

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	35	0	881	959	22
Future Vol, veh/h	0	35	0	881	959	22
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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	39	0	990	1078	25

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	551	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	483	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	483	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.11	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	483	-	-
HCM Lane V/C Ratio	-	0.081	-	-
HCM Ctrl Dly (s/v)	-	13.1	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.3	-	-

Intersection	
Intersection Delay, s/veh	12.0
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	291	284	1083	1316
Demand Flow Rate, veh/h	300	293	1093	1329
Vehicles Circulating, veh/h	1343	1153	455	178
Vehicles Exiting, veh/h	164	395	1188	1268
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	22.8	12.1	12.1	9.4
Approach LOS	C	B	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.793	0.207	0.519	0.481	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	238	62	152	141	514	579	625	704
Cap Entry Lane, veh/h	392	453	467	533	939	939	1208	1208
Entry HV Adj Factor	0.969	0.968	0.968	0.972	0.990	0.991	0.990	0.991
Flow Entry, veh/h	231	60	147	137	509	574	619	698
Cap Entry, veh/h	380	439	452	518	929	930	1195	1197
V/C Ratio	0.606	0.137	0.325	0.265	0.548	0.617	0.518	0.583
Control Delay, s/veh	26.1	10.2	13.4	10.8	11.2	13.0	8.8	10.0
LOS	D	B	B	B	B	B	A	B
95th %tile Queue, veh	4	0	1	1	3	4	3	4

Intersection	
Int Delay, s/veh	0.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	499	1	8	188	10	33
Future Vol, veh/h	499	1	8	188	10	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	561	1	9	211	11	37

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	562	0	790	561
Stage 1	-	-	-	-	561	-
Stage 2	-	-	-	-	229	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1010	-	359	527
Stage 1	-	-	-	-	571	-
Stage 2	-	-	-	-	809	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1010	-	355	527
Mov Cap-2 Maneuver	-	-	-	-	355	-
Stage 1	-	-	-	-	571	-
Stage 2	-	-	-	-	801	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.35	13.46
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	474	-	-	73	-
HCM Lane V/C Ratio	0.102	-	-	0.009	-
HCM Ctrl Dly (s/v)	13.5	-	-	8.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0	-

Intersection	
Int Delay, s/veh	1.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	529	3	19	192	4	78
Future Vol, veh/h	529	3	19	192	4	78
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	594	3	21	216	4	88

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	598	0	854	596
Stage 1	-	-	-	-	596	-
Stage 2	-	-	-	-	258	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	979	-	329	504
Stage 1	-	-	-	-	550	-
Stage 2	-	-	-	-	785	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	979	-	321	504
Mov Cap-2 Maneuver	-	-	-	-	321	-
Stage 1	-	-	-	-	550	-
Stage 2	-	-	-	-	765	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.79	14.04
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	490	-	-	162	-
HCM Lane V/C Ratio	0.188	-	-	0.022	-
HCM Ctrl Dly (s/v)	14	-	-	8.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.7	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	17.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	178	17	37	315	60	57	115	24	39	78	15
Future Vol, veh/h	10	178	17	37	315	60	57	115	24	39	78	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	12	207	20	43	366	70	66	134	28	45	91	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	13	23	13.6	12.1
HCM LOS	B	C	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	30%
Vol Thru, %	59%	87%	76%	59%
Vol Right, %	12%	8%	15%	11%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	196	205	412	132
LT Vol	57	10	37	39
Through Vol	115	178	315	78
RT Vol	24	17	60	15
Lane Flow Rate	228	238	479	153
Geometry Grp	1	1	1	1
Degree of Util (X)	0.4	0.399	0.744	0.278
Departure Headway (Hd)	6.32	6.019	5.592	6.518
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	570	598	652	549
Service Time	4.369	4.065	3.592	4.572
HCM Lane V/C Ratio	0.4	0.398	0.735	0.279
HCM Control Delay, s/veh	13.6	13	23	12.1
HCM Lane LOS	B	B	C	B
HCM 95th-tile Q	1.9	1.9	6.6	1.1

Intersection	
Intersection Delay, s/veh	12.5
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	3	425	1623	1142
Demand Flow Rate, veh/h	3	425	1623	1153
Vehicles Circulating, veh/h	1409	1340	153	290
Vehicles Exiting, veh/h	34	436	1259	1475
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.9	22.5	11.7	9.7
Approach LOS	A	C	B	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.602	0.398	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	3	0	256	169	763	860	542	611
Cap Entry Lane, veh/h	369	429	394	455	1236	1236	1091	1091
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.991
Flow Entry, veh/h	3	0	256	169	763	860	537	605
Cap Entry, veh/h	369	429	394	455	1235	1236	1080	1080
V/C Ratio	0.008	0.000	0.651	0.372	0.618	0.696	0.497	0.560
Control Delay, s/veh	9.9	8.4	27.9	14.4	10.6	12.8	9.1	10.3
LOS	A	A	D	B	B	B	A	B
95th %tile Queue, veh	0	0	4	2	5	6	3	4

Intersection	
Intersection Delay, s/veh	30.5
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	470	762	1371	1066
Demand Flow Rate, veh/h	470	762	1371	1076
Vehicles Circulating, veh/h	1182	1378	534	801
Vehicles Exiting, veh/h	695	527	1118	1339
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	16.5	60.3	22.1	26.1
Approach LOS	C	F	C	D

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	221	249	358	404	644	727	506	570
Cap Entry Lane, veh/h	455	520	380	440	826	902	646	719
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.001	0.999	0.990	0.991
Flow Entry, veh/h	221	249	358	404	644	727	501	565
Cap Entry, veh/h	455	520	380	440	826	901	639	712
V/C Ratio	0.486	0.479	0.942	0.918	0.780	0.806	0.783	0.793
Control Delay, s/veh	17.6	15.5	65.8	55.3	21.8	22.3	26.8	25.5
LOS	C	C	F	F	C	C	D	D
95th %tile Queue, veh	3	3	10	10	8	9	8	8

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	31	0	1487	1031	60
Future Vol, veh/h	0	31	0	1487	1031	60
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	34	0	1616	1121	65

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	593	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	454	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	454	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.57	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	454	-	-
HCM Lane V/C Ratio	-	0.074	-	-
HCM Ctrl Dly (s/v)	-	13.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	14.3
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	234	361	1493	1059
Demand Flow Rate, veh/h	239	361	1493	1070
Vehicles Circulating, veh/h	1103	1498	365	257
Vehicles Exiting, veh/h	224	360	977	1602
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	13.2	22.1	16.6	8.6
Approach LOS	B	C	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.526	0.474	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	196	43	190	171	702	791	503	567
Cap Entry Lane, veh/h	489	556	340	397	1019	1019	1124	1124
Entry HV Adj Factor	0.981	0.977	1.000	1.000	1.000	1.000	0.990	0.990
Flow Entry, veh/h	192	42	190	171	702	791	498	561
Cap Entry, veh/h	480	543	340	397	1018	1019	1112	1113
V/C Ratio	0.401	0.077	0.558	0.430	0.689	0.776	0.448	0.504
Control Delay, s/veh	14.4	7.6	26.0	17.9	14.4	18.5	8.1	9.0
LOS	B	A	D	C	B	C	A	A
95th %tile Queue, veh	2	0	3	2	6	8	2	3

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	306	4	24	476	6	21
Future Vol, veh/h	306	4	24	476	6	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	344	4	27	535	7	24

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	348	0	935	346
Stage 1	-	-	-	-	346	-
Stage 2	-	-	-	-	589	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1211	-	295	697
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	555	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1211	-	285	697
Mov Cap-2 Maneuver	-	-	-	-	285	-
Stage 1	-	-	-	-	716	-
Stage 2	-	-	-	-	537	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.39	12.24
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	528	-	-	86	-
HCM Lane V/C Ratio	0.057	-	-	0.022	-
HCM Ctrl Dly (s/v)	12.2	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	318	9	56	497	3	50
Future Vol, veh/h	318	9	56	497	3	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	357	10	63	558	3	56

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	367	0	1047	362
Stage 1	-	-	-	-	362	-
Stage 2	-	-	-	-	684	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1191	-	253	682
Stage 1	-	-	-	-	704	-
Stage 2	-	-	-	-	501	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1191	-	233	682
Mov Cap-2 Maneuver	-	-	-	-	233	-
Stage 1	-	-	-	-	704	-
Stage 2	-	-	-	-	463	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.83	11.48
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	615	-	-	182	-
HCM Lane V/C Ratio	0.097	-	-	0.053	-
HCM Ctrl Dly (s/v)	11.5	-	-	8.2	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.2	-

Intersection	
Intersection Delay, s/veh	11.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	237	43	22	105	16	8	60	58	83	93	16
Future Vol, veh/h	10	237	43	22	105	16	8	60	58	83	93	16
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	11	266	48	25	118	18	9	67	65	93	104	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.5	10.2	9.9	11.2
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	15%	43%
Vol Thru, %	48%	82%	73%	48%
Vol Right, %	46%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	126	290	143	192
LT Vol	8	10	22	83
Through Vol	60	237	105	93
RT Vol	58	43	16	16
Lane Flow Rate	142	326	161	216
Geometry Grp	1	1	1	1
Degree of Util (X)	0.212	0.462	0.243	0.329
Departure Headway (Hd)	5.392	5.106	5.446	5.485
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	664	704	659	656
Service Time	3.434	3.14	3.486	3.523
HCM Lane V/C Ratio	0.214	0.463	0.244	0.329
HCM Control Delay, s/veh	9.9	12.5	10.2	11.2
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.8	2.4	0.9	1.4

Intersection	
Intersection Delay, s/veh	7.8
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	24	311	942	1040
Demand Flow Rate, veh/h	24	314	961	1050
Vehicles Circulating, veh/h	1239	770	217	213
Vehicles Exiting, veh/h	24	408	1046	871
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.1	8.1	7.4	7.9
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.602	0.398	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	24	0	189	125	452	509	494	556
Cap Entry Lane, veh/h	432	495	665	738	1166	1166	1170	1170
Entry HV Adj Factor	1.000	1.000	0.989	0.992	0.980	0.981	0.989	0.991
Flow Entry, veh/h	24	0	187	124	443	499	489	551
Cap Entry, veh/h	432	495	658	732	1142	1144	1157	1159
V/C Ratio	0.056	0.000	0.284	0.169	0.388	0.437	0.422	0.475
Control Delay, s/veh	9.1	7.3	9.1	6.8	7.1	7.7	7.5	8.3
LOS	A	A	A	A	A	A	A	A
95th %tile Queue, veh	0	0	1	1	2	2	2	3

Intersection	
Intersection Delay, s/veh	25.6
Intersection LOS	D

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	804	407	946	1109
Demand Flow Rate, veh/h	819	419	974	1120
Vehicles Circulating, veh/h	1187	994	988	370
Vehicles Exiting, veh/h	303	968	1018	1043
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	40.7	11.9	35.8	11.0
Approach LOS	E	B	E	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	385	434	197	222	458	516	526	594
Cap Entry Lane, veh/h	453	518	541	610	544	613	960	1037
Entry HV Adj Factor	0.981	0.982	0.970	0.971	0.971	0.971	0.991	0.989
Flow Entry, veh/h	378	426	191	216	445	501	521	588
Cap Entry, veh/h	444	508	525	592	528	596	951	1026
V/C Ratio	0.850	0.838	0.364	0.364	0.842	0.842	0.548	0.573
Control Delay, s/veh	43.7	38.1	12.6	11.3	37.5	34.3	11.0	11.0
LOS	E	E	B	B	E	D	B	B
95th %tile Queue, veh	8	9	2	2	9	9	3	4

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	26	0	937	1008	9
Future Vol, veh/h	0	26	0	937	1008	9
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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	29	0	1053	1133	10

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	571	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	469	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	469	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.19	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	469	-	-
HCM Lane V/C Ratio	-	0.062	-	-
HCM Ctrl Dly (s/v)	-	13.2	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	312	305	1152	1374
Demand Flow Rate, veh/h	321	314	1163	1387
Vehicles Circulating, veh/h	1402	1227	481	192
Vehicles Exiting, veh/h	177	417	1242	1349
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	28.4	13.8	13.9	10.2
Approach LOS	D	B	B	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.798	0.202	0.525	0.475	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	256	65	165	149	547	616	652	735
Cap Entry Lane, veh/h	372	431	437	500	917	917	1192	1192
Entry HV Adj Factor	0.971	0.969	0.970	0.973	0.990	0.991	0.990	0.991
Flow Entry, veh/h	249	63	160	145	542	611	646	728
Cap Entry, veh/h	361	418	423	487	907	909	1181	1181
V/C Ratio	0.689	0.151	0.378	0.298	0.597	0.672	0.547	0.616
Control Delay, s/veh	32.8	10.9	15.5	12.0	12.6	15.0	9.4	10.9
LOS	D	B	C	B	B	C	A	B
95th %tile Queue, veh	5	1	2	1	4	5	3	4

Intersection	
Intersection Delay, s/veh	20
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	181	18	39	332	63	61	123	25	40	84	17
Future Vol, veh/h	12	181	18	39	332	63	61	123	25	40	84	17
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	14	210	21	45	386	73	71	143	29	47	98	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	13.9	28	14.6	12.8
HCM LOS	B	D	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	6%	9%	28%
Vol Thru, %	59%	86%	76%	60%
Vol Right, %	12%	9%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	209	211	434	141
LT Vol	61	12	39	40
Through Vol	123	181	332	84
RT Vol	25	18	63	17
Lane Flow Rate	243	245	505	164
Geometry Grp	1	1	1	1
Degree of Util (X)	0.44	0.425	0.802	0.307
Departure Headway (Hd)	6.523	6.243	5.722	6.74
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	552	574	631	531
Service Time	4.576	4.298	3.765	4.799
HCM Lane V/C Ratio	0.44	0.427	0.8	0.309
HCM Control Delay, s/veh	14.6	13.9	28	12.8
HCM Lane LOS	B	B	D	B
HCM 95th-tile Q	2.2	2.1	8	1.3

Intersection	
Intersection Delay, s/veh	15.9
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	5	467	1775	1227
Demand Flow Rate, veh/h	5	467	1775	1240
Vehicles Circulating, veh/h	1517	1464	175	316
Vehicles Exiting, veh/h	39	486	1347	1615
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	11.0	33.3	14.6	11.1
Approach LOS	B	D	B	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.593	0.407	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	5	0	277	190	834	941	583	657
Cap Entry Lane, veh/h	334	391	351	409	1211	1211	1065	1065
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.990
Flow Entry, veh/h	5	0	277	190	834	941	577	651
Cap Entry, veh/h	334	391	351	409	1211	1211	1054	1055
V/C Ratio	0.015	0.000	0.789	0.464	0.689	0.777	0.547	0.617
Control Delay, s/veh	11.0	9.2	43.5	18.5	12.7	16.3	10.2	11.8
LOS	B	A	E	C	B	C	B	B
95th %tile Queue, veh	0	0	7	2	6	8	3	4

Intersection	
Intersection Delay, s/veh	40.0
Intersection LOS	E

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	439	788	1492	1136
Demand Flow Rate, veh/h	439	788	1492	1147
Vehicles Circulating, veh/h	1287	1463	528	792
Vehicles Exiting, veh/h	652	557	1198	1459
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	18.2	89.6	27.8	30.2
Approach LOS	C	F	D	D

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.469	0.531	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	206	233	370	418	701	791	539	608
Cap Entry Lane, veh/h	413	475	351	409	831	907	651	724
Entry HV Adj Factor	1.002	0.999	1.001	0.999	1.000	1.000	0.991	0.990
Flow Entry, veh/h	206	233	370	418	701	791	534	602
Cap Entry, veh/h	414	475	352	409	831	906	645	717
V/C Ratio	0.499	0.490	1.053	1.021	0.844	0.873	0.827	0.839
Control Delay, s/veh	19.5	17.1	97.8	82.3	27.1	28.5	30.8	29.7
LOS	C	C	F	F	D	D	D	D
95th %tile Queue, veh	3	3	13	13	10	11	9	9

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	26	0	1565	1093	21
Future Vol, veh/h	0	26	0	1565	1093	21
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	28	0	1701	1188	23

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	605	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	445	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	445	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.63	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	445	-	-
HCM Lane V/C Ratio	-	0.063	-	-
HCM Ctrl Dly (s/v)	-	13.6	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.2	-	-

Intersection	
Intersection Delay, s/veh	16.9
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	250	380	1576	1114
Demand Flow Rate, veh/h	255	380	1576	1125
Vehicles Circulating, veh/h	1161	1581	385	276
Vehicles Exiting, veh/h	240	380	1031	1685
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	15.0	27.5	20.0	9.3
Approach LOS	B	D	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.537	0.463	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	209	46	204	176	741	835	529	596
Cap Entry Lane, veh/h	464	529	315	370	1000	1000	1105	1105
Entry HV Adj Factor	0.982	0.978	1.000	1.000	1.000	1.000	0.990	0.990
Flow Entry, veh/h	205	45	204	176	741	835	523	590
Cap Entry, veh/h	456	518	315	370	1000	1001	1093	1094
V/C Ratio	0.450	0.087	0.647	0.475	0.741	0.835	0.479	0.540
Control Delay, s/veh	16.5	8.0	33.4	20.6	16.8	22.9	8.7	9.8
LOS	C	A	D	C	C	C	A	A
95th %tile Queue, veh	2	0	4	2	7	10	3	3

Intersection	
Intersection Delay, s/veh	11.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	243	43	25	122	18	8	60	60	85	93	16
Future Vol, veh/h	10	243	43	25	122	18	8	60	60	85	93	16
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	5	5	5	5	5	5	1	1	1
Mvmt Flow	11	273	48	28	137	20	9	67	67	96	104	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	12.9	10.7	10.1	11.5
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	6%	3%	15%	44%
Vol Thru, %	47%	82%	74%	48%
Vol Right, %	47%	15%	11%	8%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	128	296	165	194
LT Vol	8	10	25	85
Through Vol	60	243	122	93
RT Vol	60	43	18	16
Lane Flow Rate	144	333	185	218
Geometry Grp	1	1	1	1
Degree of Util (X)	0.22	0.479	0.283	0.339
Departure Headway (Hd)	5.501	5.181	5.497	5.594
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	650	695	653	641
Service Time	3.552	3.222	3.545	3.641
HCM Lane V/C Ratio	0.222	0.479	0.283	0.34
HCM Control Delay, s/veh	10.1	12.9	10.7	11.5
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	0.8	2.6	1.2	1.5

Intersection	
Intersection Delay, s/veh	8.3
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	24	323	1027	1073
Demand Flow Rate, veh/h	24	326	1047	1084
Vehicles Circulating, veh/h	1285	843	217	225
Vehicles Exiting, veh/h	24	421	1092	944
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	9.5	9.1	8.0	8.3
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.617	0.383	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	24	0	201	125	492	555	509	575
Cap Entry Lane, veh/h	414	476	622	694	1166	1166	1157	1157
Entry HV Adj Factor	1.000	1.000	0.990	0.992	0.981	0.981	0.991	0.989
Flow Entry, veh/h	24	0	199	124	483	544	504	569
Cap Entry, veh/h	414	476	615	688	1143	1143	1147	1145
V/C Ratio	0.058	0.000	0.323	0.180	0.422	0.476	0.440	0.497
Control Delay, s/veh	9.5	7.6	10.2	7.3	7.5	8.4	7.8	8.7
LOS	A	A	B	A	A	A	A	A
95th %tile Queue, veh	0	0	1	1	2	3	2	3

Intersection	
Intersection Delay, s/veh	52.5
Intersection LOS	F

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	1002	441	975	1148
Demand Flow Rate, veh/h	1022	455	1004	1160
Vehicles Circulating, veh/h	1217	1116	1158	436
Vehicles Exiting, veh/h	379	1046	1081	1135
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	95.2	14.9	72.5	12.9
Approach LOS	F	B	F	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	480	542	214	241	472	532	545	615
Cap Entry Lane, veh/h	441	505	484	550	465	531	904	980
Entry HV Adj Factor	0.981	0.980	0.969	0.970	0.971	0.971	0.990	0.990
Flow Entry, veh/h	471	531	207	234	458	517	540	609
Cap Entry, veh/h	432	495	468	533	452	515	895	970
V/C Ratio	1.089	1.074	0.443	0.438	1.015	1.003	0.603	0.627
Control Delay, s/veh	100.4	90.5	15.9	14.1	76.7	68.7	12.9	12.9
LOS	F	F	C	B	F	F	B	B
95th %tile Queue, veh	16	17	2	2	14	14	4	5

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	54	0	962	1036	44
Future Vol, veh/h	0	54	0	962	1036	44
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	89	89	89	89	89	89
Heavy Vehicles, %	0	0	4	4	2	2
Mvmt Flow	0	61	0	1081	1164	49

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	607	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	445	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	445	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	14.37	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	445	-	-
HCM Lane V/C Ratio	-	0.136	-	-
HCM Ctrl Dly (s/v)	-	14.4	-	-
HCM Lane LOS	-	B	-	-
HCM 95th %tile Q(veh)	-	0.5	-	-

Intersection	
Intersection Delay, s/veh	14.8
Intersection LOS	B

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	312	311	1177	1444
Demand Flow Rate, veh/h	321	321	1188	1458
Vehicles Circulating, veh/h	1473	1252	496	192
Vehicles Exiting, veh/h	177	432	1298	1381
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	33.4	14.4	14.9	10.9
Approach LOS	D	B	B	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.798	0.202	0.514	0.486	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	256	65	165	156	558	630	685	773
Cap Entry Lane, veh/h	348	406	427	490	904	904	1192	1192
Entry HV Adj Factor	0.971	0.969	0.970	0.968	0.991	0.990	0.991	0.990
Flow Entry, veh/h	249	63	160	151	553	624	679	765
Cap Entry, veh/h	338	393	414	474	896	895	1182	1181
V/C Ratio	0.735	0.160	0.387	0.318	0.617	0.697	0.574	0.648
Control Delay, s/veh	38.9	11.7	16.0	12.7	13.3	16.2	9.9	11.7
LOS	E	B	C	B	B	C	A	B
95th %tile Queue, veh	6	1	2	1	4	6	4	5

Intersection	
Int Delay, s/veh	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	551	5	37	210	16	75
Future Vol, veh/h	551	5	37	210	16	75
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	619	6	42	236	18	84

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	625	0	941	622
Stage 1	-	-	-	-	622	-
Stage 2	-	-	-	-	319	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	957	-	292	487
Stage 1	-	-	-	-	535	-
Stage 2	-	-	-	-	737	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	957	-	278	487
Mov Cap-2 Maneuver	-	-	-	-	278	-
Stage 1	-	-	-	-	535	-
Stage 2	-	-	-	-	700	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.34	15.97
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	430	-	-	270	-
HCM Lane V/C Ratio	0.238	-	-	0.043	-
HCM Ctrl Dly (s/v)	16	-	-	8.9	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.9	-	-	0.1	-

Intersection	
Int Delay, s/veh	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	622	4	19	240	7	101
Future Vol, veh/h	622	4	19	240	7	101
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	699	4	21	270	8	113

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	703	0	1013	701
Stage 1	-	-	-	-	701	-
Stage 2	-	-	-	-	312	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	894	-	265	439
Stage 1	-	-	-	-	492	-
Stage 2	-	-	-	-	742	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	894	-	257	439
Mov Cap-2 Maneuver	-	-	-	-	257	-
Stage 1	-	-	-	-	492	-
Stage 2	-	-	-	-	721	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.67	17.04
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	419	-	-	132	-
HCM Lane V/C Ratio	0.289	-	-	0.024	-
HCM Ctrl Dly (s/v)	17	-	-	9.1	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.2	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	23.7
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	202	18	41	348	66	61	123	28	44	84	17
Future Vol, veh/h	12	202	18	41	348	66	61	123	28	44	84	17
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	2	2	2	1	1	1	0	0	0	0	0	0
Mvmt Flow	14	235	21	48	405	77	71	143	33	51	98	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay, s/veh	15.3	35.1	15.5	13.5
HCM LOS	C	E	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	5%	9%	30%
Vol Thru, %	58%	87%	76%	58%
Vol Right, %	13%	8%	15%	12%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	212	232	455	145
LT Vol	61	12	41	44
Through Vol	123	202	348	84
RT Vol	28	18	66	17
Lane Flow Rate	247	270	529	169
Geometry Grp	1	1	1	1
Degree of Util (X)	0.462	0.48	0.863	0.328
Departure Headway (Hd)	6.747	6.41	5.87	6.995
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	532	558	614	511
Service Time	4.82	4.483	3.926	5.075
HCM Lane V/C Ratio	0.464	0.484	0.862	0.331
HCM Control Delay, s/veh	15.5	15.3	35.1	13.5
HCM Lane LOS	C	C	E	B
HCM 95th-tile Q	2.4	2.6	9.8	1.4

Intersection	
Intersection Delay, s/veh	20.6
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	5	506	1859	1325
Demand Flow Rate, veh/h	5	506	1859	1339
Vehicles Circulating, veh/h	1655	1536	175	355
Vehicles Exiting, veh/h	39	498	1485	1687
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	12.5	55.5	16.3	13.3
Approach LOS	B	F	C	B

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	1.000	0.000	0.625	0.375	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	5	0	316	190	874	985	629	710
Cap Entry Lane, veh/h	295	348	329	385	1211	1211	1028	1028
Entry HV Adj Factor	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.989
Flow Entry, veh/h	5	0	316	190	874	985	623	702
Cap Entry, veh/h	295	348	329	385	1211	1211	1018	1017
V/C Ratio	0.017	0.000	0.962	0.494	0.722	0.813	0.612	0.691
Control Delay, s/veh	12.5	10.4	76.5	20.6	13.9	18.4	12.0	14.5
LOS	B	B	F	C	B	C	B	B
95th %tile Queue, veh	0	0	10	3	7	10	4	6

Intersection	
Intersection Delay, s/veh	95.7
Intersection LOS	F

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	621	897	1569	1243
Demand Flow Rate, veh/h	621	897	1569	1256
Vehicles Circulating, veh/h	1374	1618	673	978
Vehicles Exiting, veh/h	860	624	1322	1537
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	35.0	208.7	62.8	85.8
Approach LOS	D	F	F	F

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	TR	LT	TR	LT	TR	LT	TR
Assumed Moves	LT	TR	LT	TR	LT	TR	LT	TR
RT Channelized								
Lane Util	0.470	0.530	0.470	0.530	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.667	2.535	2.667	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.645	4.328	4.645	4.328
A (Intercept)	1350	1420	1350	1420	1350	1420	1350	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.199e-4	8.501e-4
Entry Flow, veh/h	292	329	422	475	737	832	590	666
Cap Entry Lane, veh/h	381	442	305	359	727	801	549	618
Entry HV Adj Factor	1.000	1.000	0.999	1.001	1.001	0.999	0.991	0.990
Flow Entry, veh/h	292	329	422	475	737	832	584	659
Cap Entry, veh/h	381	442	304	359	727	801	544	612
V/C Ratio	0.766	0.745	1.385	1.324	1.014	1.038	1.075	1.077
Control Delay, s/veh	38.2	32.1	225.4	194.0	60.7	64.7	87.4	84.4
LOS	E	D	F	F	F	F	F	F
95th %tile Queue, veh	6	6	22	22	17	20	18	19

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	0	45	0	1636	1127	132
Future Vol, veh/h	0	45	0	1636	1127	132
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	92	92	92	92
Heavy Vehicles, %	0	0	0	0	2	2
Mvmt Flow	0	49	0	1778	1225	143

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	684	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.9	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.3	-	-	-	-
Pot Cap-1 Maneuver	0	396	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	396	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	15.38	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	396	-	-
HCM Lane V/C Ratio	-	0.124	-	-
HCM Ctrl Dly (s/v)	-	15.4	-	-
HCM Lane LOS	-	C	-	-
HCM 95th %tile Q(veh)	-	0.4	-	-

Intersection	
Intersection Delay, s/veh	19.1
Intersection LOS	C

Approach	EB	WB	NB	SB
Entry Lanes	2	2	2	2
Conflicting Circle Lanes	2	2	1	1
Adj Approach Flow, veh/h	250	396	1636	1168
Demand Flow Rate, veh/h	255	396	1636	1180
Vehicles Circulating, veh/h	1216	1641	396	276
Vehicles Exiting, veh/h	240	391	1075	1761
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	16.2	31.5	23.2	9.7
Approach LOS	C	D	C	A

Lane	Left	Right	Left	Right	Left	Right	Left	Right
Designated Moves	LT	R	LT	R	LT	TR	LT	TR
Assumed Moves	LT	R	LT	R	LT	TR	LT	TR
RT Channelized								
Lane Util	0.820	0.180	0.515	0.485	0.470	0.530	0.470	0.530
Follow-Up Headway, s	2.667	2.535	2.667	2.535	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.645	4.328	4.544	4.544	4.544	4.544
A (Intercept)	1350	1420	1350	1420	1420	1420	1420	1420
B (Slope)	9.199e-4	8.501e-4	9.199e-4	8.501e-4	9.101e-4	9.101e-4	9.101e-4	9.101e-4
Entry Flow, veh/h	209	46	204	192	769	867	555	625
Cap Entry Lane, veh/h	441	505	298	352	990	990	1105	1105
Entry HV Adj Factor	0.982	0.978	1.000	1.000	1.000	1.000	0.989	0.991
Flow Entry, veh/h	205	45	204	192	769	867	549	619
Cap Entry, veh/h	433	494	298	352	990	990	1093	1094
V/C Ratio	0.474	0.091	0.684	0.546	0.776	0.875	0.502	0.566
Control Delay, s/veh	17.9	8.5	38.0	24.6	18.9	27.1	9.1	10.3
LOS	C	A	E	C	C	D	A	B
95th %tile Queue, veh	2	0	5	3	8	12	3	4

Intersection	
Int Delay, s/veh	2.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	340	15	91	525	16	103
Future Vol, veh/h	340	15	91	525	16	103
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	382	17	102	590	18	116

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	399	0	1185	390
Stage 1	-	-	-	-	390	-
Stage 2	-	-	-	-	794	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1160	-	209	658
Stage 1	-	-	-	-	684	-
Stage 2	-	-	-	-	445	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1160	-	181	658
Mov Cap-2 Maneuver	-	-	-	-	181	-
Stage 1	-	-	-	-	684	-
Stage 2	-	-	-	-	387	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	1.24	15.19
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	486	-	-	266	-
HCM Lane V/C Ratio	0.275	-	-	0.088	-
HCM Ctrl Dly (s/v)	15.2	-	-	8.4	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	1.1	-	-	0.3	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	430	13	56	611	5	65
Future Vol, veh/h	430	13	56	611	5	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	483	15	63	687	6	73

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	498	0	1303	490
Stage 1	-	-	-	-	490	-
Stage 2	-	-	-	-	812	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1066	-	177	578
Stage 1	-	-	-	-	616	-
Stage 2	-	-	-	-	436	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1066	-	160	578
Mov Cap-2 Maneuver	-	-	-	-	160	-
Stage 1	-	-	-	-	616	-
Stage 2	-	-	-	-	395	-

Approach	EB	WB	NB
HCM Ctrl Dly, s/v	0	0.72	13.81
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	487	-	-	151	-
HCM Lane V/C Ratio	0.161	-	-	0.059	-
HCM Ctrl Dly (s/v)	13.8	-	-	8.6	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.6	-	-	0.2	-

Appendix C: Intersection Cost Participation Calculations

City of Billings Cost Participation Worksheet: Clearwater Phase 1

Whether a movement pair is critical is based on Phase 1 site-generated traffic, as shown in Exhibit 12 of the report.

1: Central at 48th

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	3	3	**10**	**10**
WB L	1	2	2	**1**	**1**
WB T	1	**10**	**10**	7	7
EB L	1	No project traffic			
NB T	1	No project traffic			
SB L	1	**1**	**1**	**2**	**2**
SB T	1	No project traffic			
NB L	1				
Project **Critical** Lane Volume			**11**		**13**
Critical Lane Capacity			1200		1200
% Increase			0.9%		1.1%
Max % Increase			1.1%		

2: Shiloh at Broadwater

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	**2**	**2**	**7**	**7**
WB T	1	No project traffic			
EB L	1				
NB T	2	**41**	**21**	26	13
SB L	1	No project traffic			
SB T	2	14	7	**40**	**20**
NB L	1	No project traffic			
Project **Critical** Lane Volume			**23**		**27**
Critical Lane Capacity			1200		1200
% Increase			1.9%		2.3%
Max % Increase			2.3%		

3: Shiloh at Central

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	2	41	21	26	13
WB L	1	5	5	13	13
WB T	2	**9**	**5**	**27**	**14**
EB L	1	**48**	**48**	**31**	**31**
NB T	2	No project traffic			
SB L	1				
SB T	2	**5**	**3**	**15**	**8**
NB L	1	**8**	**8**	**22**	**22**
Project **Critical** Lane Volume			**64**		**75**
Critical Lane Capacity			1200		1200
% Increase			5.3%		6.3%
Max % Increase			6.3%		

5: Shiloh at Monad

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1				
WB T	1				
EB L	1				
NB T	2	9	5	**27**	**14**
SB L	1	7	7	**4**	**4**
SB T	2	**27**	**14**	18	9
NB L	1	No project traffic			
Project **Critical** Lane Volume			**14**		**18**
Critical Lane Capacity			1200		1200
% Increase			1.2%		1.5%
Max % Increase			1.5%		

City of Billings Cost Participation Worksheet: Clearwater Phase 2

Whether a movement pair is critical is based on Phase 2 site-generated traffic, as shown in Exhibit 14 of the report.

1: Central at 48th

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	3	3	**11**	**11**
WB L	1	1	1	**1**	**1**
WB T	1	**7**	**7**	9	9
EB L	1	No project traffic			
NB T	1	No project traffic			
SB L	1	**1**	**1**	**2**	**2**
SB T	1	No project traffic			
NB L	1				
Project **Critical** Lane Volume			**8**		**14**
Critical Lane Capacity			1200		1200
% Increase			0.7%		1.2%
Max % Increase			1.2%		

2: Shiloh at Broadwater

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1	**9**	**9**	**27**	**27**
WB T	1	No project traffic			
EB L	1				
NB T	2	**27**	**14**	36	18
SB L	1	No project traffic			
SB T	2	17	9	**46**	**23**
NB L	1	No project traffic			
Project **Critical** Lane Volume			**23**		**50**
Critical Lane Capacity			1200		1200
% Increase			1.9%		4.2%
Max % Increase			4.2%		

3: Shiloh at Central

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	2	27	14	36	18
WB L	1	7	7	24	24
WB T	2	**10**	**5**	**22**	**11**
EB L	1	**32**	**32**	**42**	**42**
NB T	2	No project traffic			
SB L	1				
SB T	2	**8**	**4**	**28**	**14**
NB L	1	**8**	**8**	**19**	**19**
Project **Critical** Lane Volume			**49**		**86**
Critical Lane Capacity			1200		1200
% Increase			4.1%		7.2%
Max % Increase			7.2%		

5: Shiloh at Monad

Lane Group		AM Peak Hour		PM Peak Hour	
(**critical**)	Lanes	Vproject	Per Lane	Vproject	Per Lane
EB T	1	No project traffic			
WB L	1				
WB T	1				
EB L	1				
NB T	2	**11**	**6**	**31**	**16**
SB L	1	**5**	**5**	**6**	**6**
SB T	2	18	9	24	12
NB L	1	No project traffic			
Project **Critical** Lane Volume			**11**		**22**
Critical Lane Capacity			1200		1200
% Increase			0.9%		1.8%
Max % Increase			1.8%		