Erie Police Station

Traffic Impact Study

Prepared for:

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I. INTRODUCTION

The Town of Erie is proposing to expand an existing police station located on the southwest corner of County Line Road and Telleen Avenue. **Figure 1** shows the location of the site and **Figure 2** shows the proposed site plan. The facility currently houses a police station as well as Town judicial functions. As part of the police function expansion, the judicial operations will be relocated to another Town facility.

The station currently takes access onto Tellen Avenue as well as onto County Line Road, and no changes in access are planned. However, some of the parking will be within a secure area and the County Line Road access will be gated, likely otherwise reducing its use. The available public (open) parking will be located at the Telleen Avenue access which will likely lead to the Telleen Avenue being used more so than the County Line Road access.

The purpose of this study is to assess the transportation impacts onto the surrounding roadway network related to this expansion, with a focus on peak hour traffic impacts. This report contains information on:

- Existing traffic conditions
- Vehicle-trips associated with the expansion
- Short-term (year 2028) and Long-term (year 2045) traffic impact
- Recommended roadway and intersection improvements

The Denver Regional Council of Governments (DRCOG) regional travel demand model was among the resources used in preparing this study with respect to traffic forecasts. Other nearby TIS documents aided in informing this study. The Town's TIS assumptions form was completed and approved by Town staff, which is provided in **Appendix A.**

This study was prepared per the Town's Traffic Impact Study Guidelines. Study area intersections, and their movements, were the focus of this effort and included:

- Tellen Avenue/Site Access
- County Line Road/Site Access
- County Line Road/Telleen Avenue

Five traffic scenarios are analyzed in this report including:

- Existing Traffic
- Short-term (2028) Background Traffic
- Short-term (2028) Total Traffic (which includes development traffic)
- Long-term (2045) Background Traffic
- Long-term (2045) Total Traffic (which includes trips associated with the facility being full)

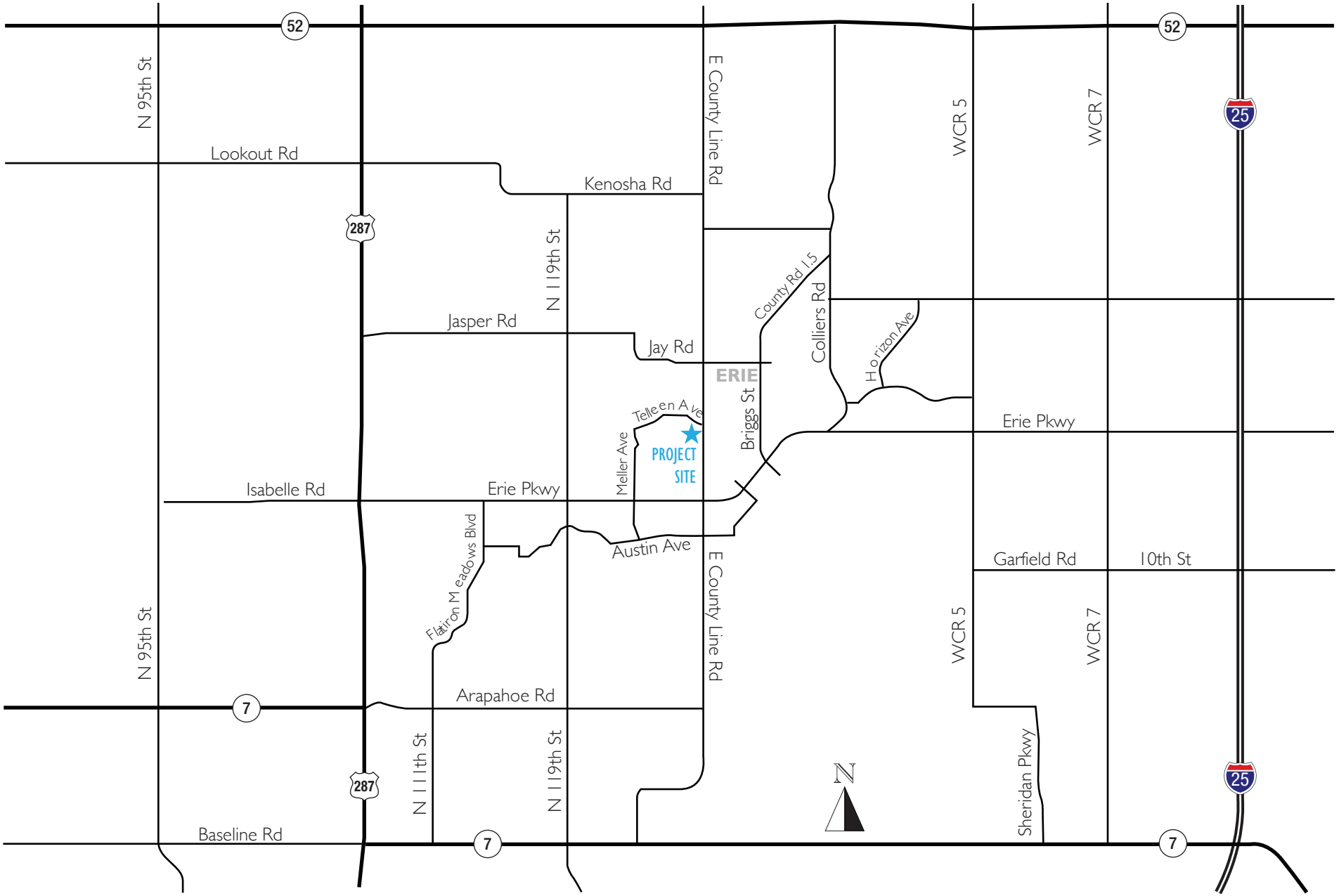

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Figure 1

Vicinity Map

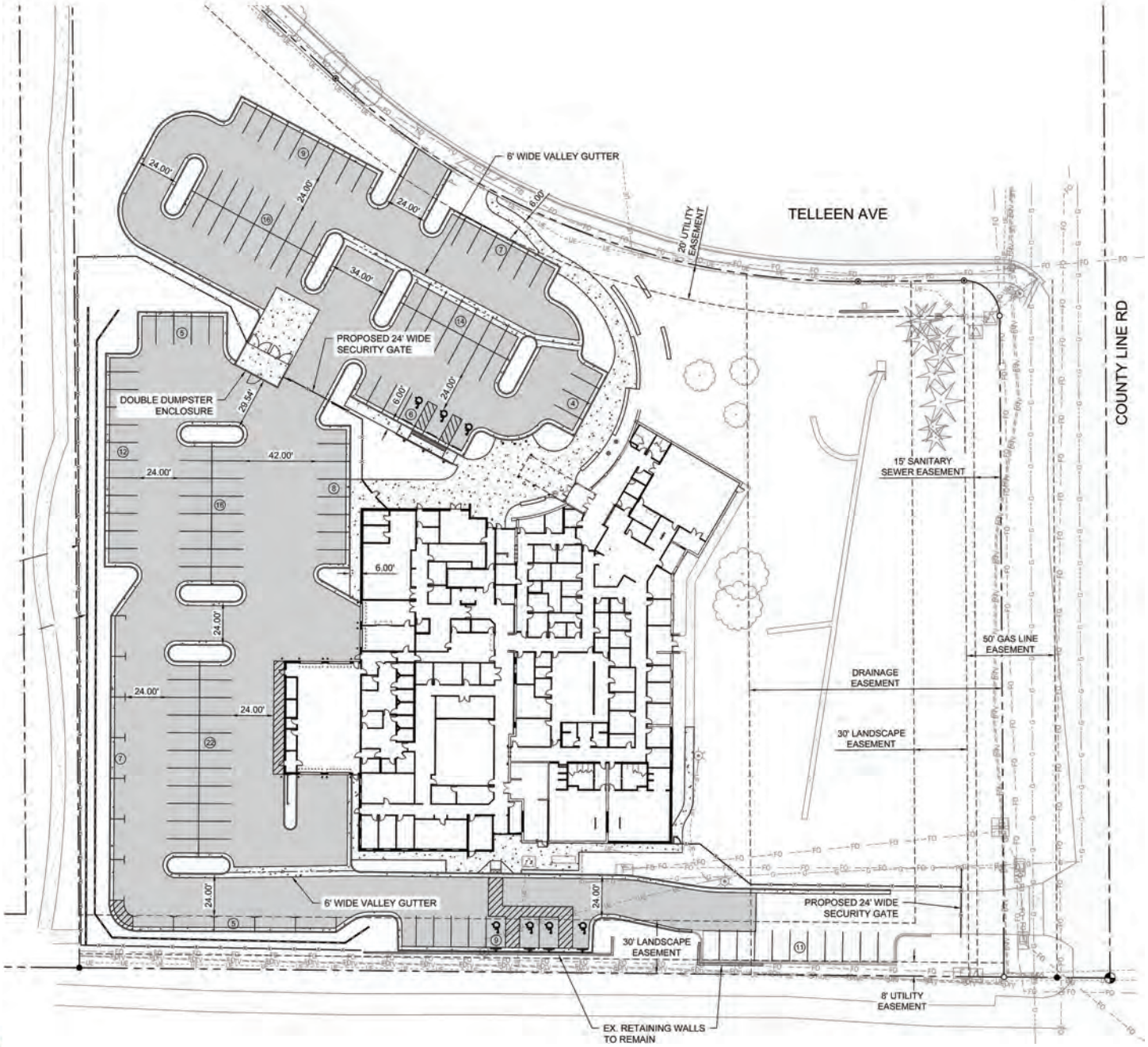


Figure 2

Site Plan

II. EXISTING CONDITIONS

a. Land Uses

The site is now currently being used as a police station and for Town court activity. The courts will be relocated to another building upon the expansion's completion. Residential uses currently exist to the west and commercial development exists to the north across Telleen Avenue. The land is vacant immediately to the south and to the east across County Line Road, but multi-family development is anticipated on the property that sits east of the police station site (across County Line Road).

b. Roadways

Study area roadways are described as follows:

County Line Road is a north-south arterial road that defines the east side of the site. It extends north to Longmont and south to SH 7. This road currently provides two through-lanes of traffic and, turn lanes are provided at the Telleen Avenue intersection, which is side-street stop controlled (north-south approaches having the right-of-way). The posted speed limit is 45 MPH, and bike lanes are provided along both sides of the roadway.

Telleen Avenue is an east-west collector road that defines the north side of the site. Telleen Avenue is a neighborhood collector road that extends west to Jasper Road. It provides one through-lane in each direction plus a continuous median lane. The posted speed limit is 25 MPH, and bikes lane are provided along both sides of the roadway.

c. Transportation Data

The intersections in any network tend to be the most challenging locations with respect to traffic mobility, so data were obtained at the study area intersections including:

- County Line Road/Telleen Avenue
- County Line Road/Site Access
- Telleen Avenue/Site Access

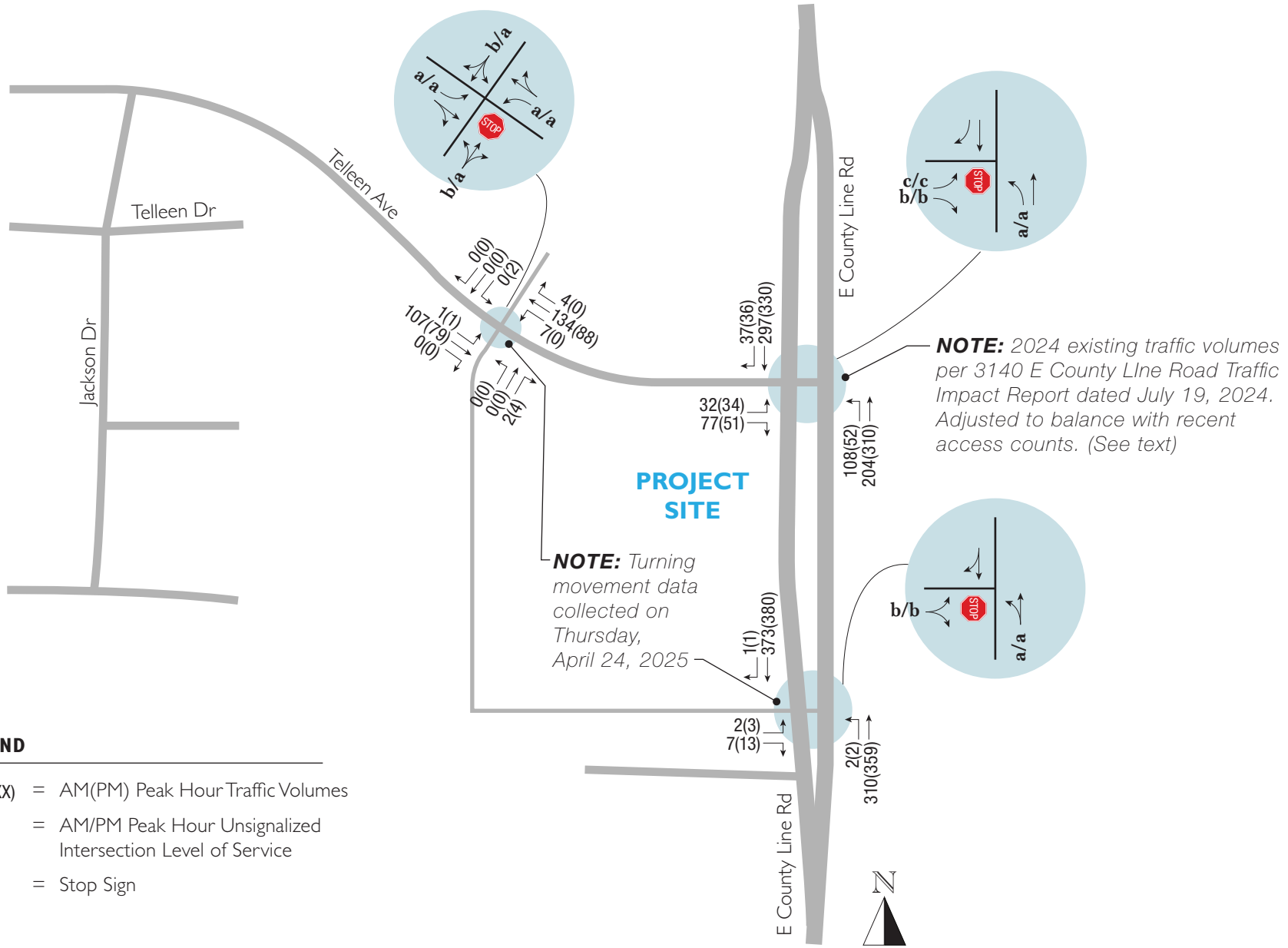
Data for the County Line Road/Telleen Avenue intersection was extracted from the **3140 NE County Line Road Traffic Impact Study** prepared by HKS, July 19, 2024. This study addresses a proposed multifamily development to be located on the east side of County Line Road; Telleen Avenue extended east would serve as that development's main access. The data presented in that study was collected on Wednesday, June 19th, 2024. Since school was not in session, HKS factored up their collected data by 10 percent to better emulate conditions indicative of school being in session.

The peak hour turning movement data collected at the two site access intersections were collected on Thursday, April 24th, 2025. A review of the data with respect to flows into and out of the County Line Road/Telleen Avenue intersection showed that the factored-up HKS data was not factored up enough. Therefore, the HKS data was increased further (exact nature of increase varied by direction) so as to better balance with the site access intersections' turning movement counts. Ideally, this intersection should have been counted as part of the access

intersections as well, but the magnitude of the discrepancy was not discovered until the access count data were obtained and reviewed (and subsequent to scoping with the Town).

Figure 3 shows the representative existing peak hour turning movement counts at the three study area intersections (raw data sheets and the summarized counts from the **3140 NE County Line Road Traffic Impact Study** are shown in **Appendix B**). County Line Road is the busier of the two roads in this area serving a total of 700 to 800 vehicles per hour (vph). Directional flows are fairly balanced. Telleen Avenue serves approximately 250 vph during the AM peak hour and about 170 vph during the PM peak hour with directional flows also being fairly balanced.

Movements at the intersection of these two roadways show a strong pattern north-south along County Line Road. With respect to Telleen Avenue, 60 to 70 percent of its traffic is oriented to/from the south along County Line Road with the remainder being oriented to/from the north.



LEGEND

XXX(XXX)	=	AM(PM) Peak Hour Traffic Volumes
x/x	=	AM/PM Peak Hour Unsignalized Intersection Level of Service
STOP	=	Stop Sign

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Figure 3

Existing Traffic Conditions

d. Existing Operations

Existing intersection Levels of Service (LOS) have been calculated for the study area intersections given the vehicular traffic turning movement data, the results of which are also shown in **Figure 3**. Detailed calculations were conducted using Synchro software to assess operations given current traffic demands. This software employs techniques documented in the *Highway Capacity Manual* (Transportation Research Board, 7th Edition). The worksheets are presented in **Appendix C.**

LOS is a qualitative measure of traffic operational conditions, based on movement capacity and vehicle delay, described by a letter designation ranging from A to F. A LOS A represents nearly free-flow travel indicative of very little delay, while LOS F represents congested conditions and excessive delay. The LOS is defined by the amount of delay drivers endure, on average, during a peak hour, and the *Highway Capacity Manual* procedures are geared toward calculating the average delay for each movement or lane group (as compared to free-flow condition is the intersection did not exist). **Table 1** shows the LOS scale for unsignalized intersections.

Current Erie TIS Guideline objectives with respect to LOS is to achieve no worse than a LOS D overall when considering the peak hours of the day, in which individual approach leg at stop-sign controlled intersections being allowed to function at LOS F provided that average delay on the approach leg is no more than 100 seconds per vehicle.

Table 1. Level of Service (LOS)/Delay Scale

LOS	Unsignalized Intersections
A	<10 Sec/Veh
B	10-15 Sec/Veh
C	15-25 Sec/Veh
D	25-35 Sec/Veh
E	35-50 Sec/Veh
F	>50 Sec/Veh

The study area intersections all function at a LOS C or better during peak hours. The most challenging movement in the study area is the eastbound left turn from Telleen Avenue to northbound County Line Road, but it currently maintains a LOS C

III. FUTURE CONDITIONS

Several steps were involved in developing future peak hour vehicular turning movement forecasts for the study area intersections. These include:

- Trip generation in which the number of vehicular trips generated by the proposed police station are estimated, and these trips are then tracked through the study area intersections based on trip distribution percentage estimates.

- Regional growth traffic which is an estimate of the general increase in traffic demands through study area intersections due to growth of the overall community. This is all other traffic unrelated to the proposed development.

Each is described in the subsequent subsections.

a. Project-Generated Traffic

The Institute of Transportation Engineers' (ITE) Trip Generation, 11th Edition, was reviewed to estimate vehicular-trips. However, a police station is not a land use category within that manual. As such, the proposed operational characteristics of the facility were used in estimating trips for each hour of the day.

Table 2 shows the resulting hourly trip estimates for current-day conditions. Key data inputs in developing **Table 2** came from the Town police staff and entailed:

- Approximately 6 command/administrative staff who arrive between 7:00 and 8:00 AM (plus or minus) and leave between 5:00 and 6:00 PM. Lunch-time and mid-day errand trips associated with day-time staff were estimated as well

- Approximately 6 Records/Restorative Justice/ Victim Advocates staff who arrive between 7:00 and 8:00 AM (plus or minus) and leave between 5:00 and 6:00 PM. Lunch-time and mid-day errand trips associated with day-time staff were estimated as well

- Approximately 5 Investigations staff who arrive and leave during normal business hours

- Approximately 40 patrol officers who work throughout the week (4 10- hour shifts) and through the day in 3 shifts; Wednesday is a common day when shifts overlap and likely a higher trip-making day than other days.

- Two Evidence staff

- Four staff for the courts, which will be moving out of the facility and no longer generating trips. This function is typically only active on Mondays and Tuesdays anyway.

- Deliveries occurring a couple times a week

- Visitation occurring in association of the records division

It is recognized that community tours and events are also held on occasion, but these are not part of normal daily operations as they occur only several times per year. As such, trip estimates for a community meeting are considered atypical and not included in this analysis. The results of **Table 2** reflect current-day police operations which inform short-term conditions upon the facility's completion (short-term planning horizon). It reflects an approximate staff size that totals 60 people. By 2045 and 2055, the staff level could reach 96 and 130 people, respectively. As such, the long-term planning horizon assumes the 130 staffing-level is reached for purposes of this study. **Table 3** then shows the trip generation estimates given a staffing of 130.

Table 2 – Current-Day Erie Police Station Trip Generation Estimates

Hour Beginning	Command / Admin (6 staff)[1]		Records / Resto. Justice / Advocates (6 staff) [2]		Investigations (5 staff)[3]		Patrol (40 on staff)[4]		Evidence (2 staff)[5]		Visitors / Deliveries[6]		Totals	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
12:00 AM							1	5					1	5
1:00							1	1					1	1
2:00							1	1					1	1
3:00							1	1					1	1
4:00							1	1					1	1
5:00					1		2	1					3	1
6:00	1		2		3		10	7					16	7
7:00	4		5		1		3	2	2				15	2
8:00	2		4	1			3	2		1	3	1	12	5
9:00			1	2			2	2		1	3	3	6	8
10:00		1	2	2		1	3	2	1		3	2	9	8
11:00	1	2	2	3	1	1	2	2	1	1	2	2	9	11
12:00 PM	1		2	2	1		2	3	1		2	3	9	8
1:00	1		2	2			3	2		1	2	2	8	7
2:00			2	1			3	3	1	1	2	2	8	7
3:00			2	1			3	2	1	1	2	2	8	6
4:00		2		4		1	4	7	1		2	2	7	16
5:00		4		5		3	3	7		2	2	3	5	24
6:00		1		1		1	2	2				1	2	6
7:00							1	1					1	1
8:00							1	1					1	1
9:00							1	1					1	1
10:00							4	1					4	1
11:00							1	1					1	1
Totals	**10**	**10**	**24**	**24**	**7**	**7**	**58**	**58**	**8**	**8**	**23**	**23**	**130**	**130**

Footnotes for Table 2:

1) 6 staff that commute. Half run an errand during the day.
2) 6 staff that commute. Half run an errand during the day. All are in and out as part of their shift generating 1 or 2 trips per hour.
3) 5 staff that commute, 30 of which run an errand during the day.
4) 40 patrol officers are on staff. 4 work one 10-hour shift, 3 shifts per day. Also assume 2 patrol cars are in and out every hour during the day; 1 per hour during night
5) 2 Evidence staff who commute and are in and out 3 times per day on average.
6) Assume 3 deliveries per day at most and 2 visitors per hour to research records.

Table 3 – Year 2045 Erie Police Station Trip Generation Estimates (Facility full with 130 staff)

Hour Beginning	Command / Admin (13 staff)[1]		Records / Resto. Justice / Advocates (13 staff) [2]		Investigations (12 staff)[3]		Patrol (90 on staff)[4]		Evidence (5 staff)[5]		Visitors / Deliveries[6]		Totals	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
12:00 AM							2	10					2	10
1:00							2	2					2	2
2:00							2	2					2	2
3:00							2	2					2	2
4:00							2	2					2	2
5:00					2		5	3					7	3
6:00	2		4		8		20	14					34	14
7:00	9		10		2		7	5	4				32	5
8:00	4		8	2			6	4		2	6	2	24	10
9:00			2	4			4	4		2	6	6	12	16
10:00		2	4	4		2	6	4	2		6	4	18	16
11:00	2	4	4	6	2	2	4	4	2	2	4	4	18	22
12:00 PM	2		4	4	2	1	4	6	2		4	6	18	17
1:00	2		4	4	1		6	4		2	4	4	17	14
2:00			4	2			6	6	2	2	4	4	16	14
3:00			4	2			6	4	2	2	4	4	16	12
4:00		4		8		2	8	14	2		4	4	14	32
5:00		9		10		8	6	15		4	4	6	10	52
6:00		2		2		2	4	5				2	4	13
7:00							2	2					2	2
8:00							2	2					2	2
9:00							2	2					2	2
10:00							9	2					9	2
11:00							3	2					3	2
Totals	**21**	**21**	**48**	**48**	**17**	**17**	**120**	**120**	**16**	**16**	**46**	**46**	**268**	**268**

Footnotes for Table 3:

1) 13 staff that commute. Half run an errand during the day.
2) 13 staff that commute. Half run an errand during the day. All are in and out as part of their shift generating 4 to 6 trips per hour.
3) 12 staff that commute, 6 of which run an errand during the day.
4) 90 patrol officers are on staff. 9 work one 10-hour shift, 3 shifts per day. Also assume 4 patrol cars are in and out every hour during the day; 2 per hour during night
5) 5 Evidence staff who commute and are in and out 3 times per day on average.
6) Assume 6 deliveries per day at most and 4 visitors per hour to research records.

From **Table 2**, the facility is estimated to generate a total of 260 vehicle-trips per day in the short-term. The commuter AM peak hour trip-making could reach 23 trips per hour with most of these being inbound, and the PM peak hour trip-making could reach 29 trips per hour with most being outbound. By comparison to existing conditions, the existing facility generated 21 trips and 23 trips during the AM and PM peak hour, respectively. Long-term, **Table 3** shows that the facility could generate 536 vehicle-trips per day with 48 and 62 trips per hour during the AM and PM peak hour, respectively.

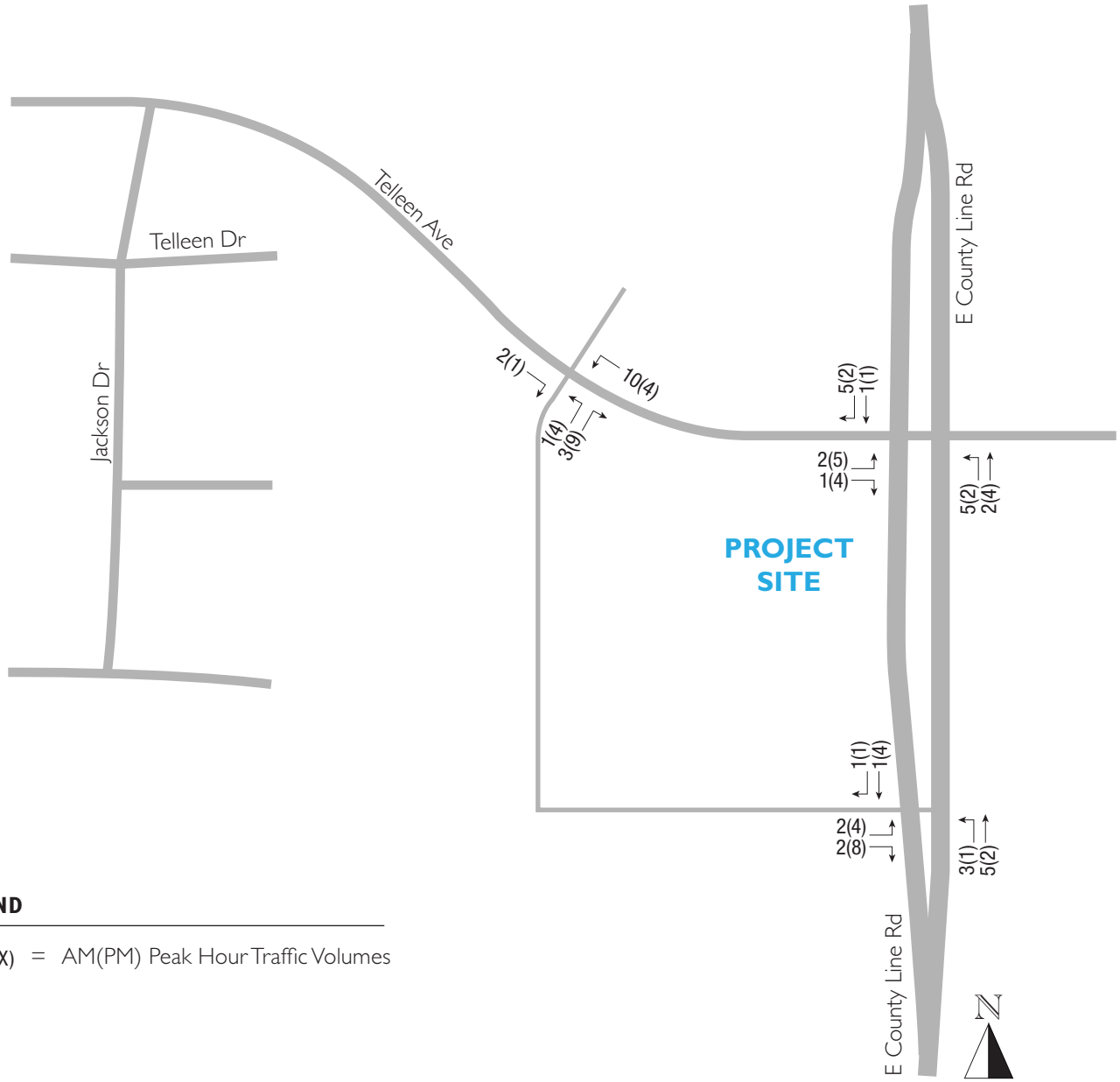
b. Trip Distribution and Traffic Assignment

The second step in determining the project's specific traffic impact to the network entails trip distribution, that is an estimate as to where the above trips are traveling to/from through the study area. This can be partially informed by existing traffic count data as well as the anticipated service area (including surrounding growth) that the facility is intended to serve. Both have been used in developing trip distribution assumptions as follows:

- 50 percent to/from the south
- 35 percent to/from the north
- 15 percent to/from the west

Applying the above distribution percentages to the trip generation estimates of **Table 2** produces the project-only generated traffic volumes which are shown in **Figure 4.** The site's impact will be greatest along County Line Road south of the site, in which 10 to 15 trips per hour are anticipated from this station. This represents a 1.5 to 2.0 percent increase in peak hour traffic along this roadway compared to existing conditions.

Figure 5 shows the project-only traffic associated with 130 staff indicative of long-term conditions (using the same distribution percentages). Impacts along adjacent streets will slightly more than double compared to the short-term project-generated traffic.



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

Figure 4

Short-Term Project-Generated Traffic

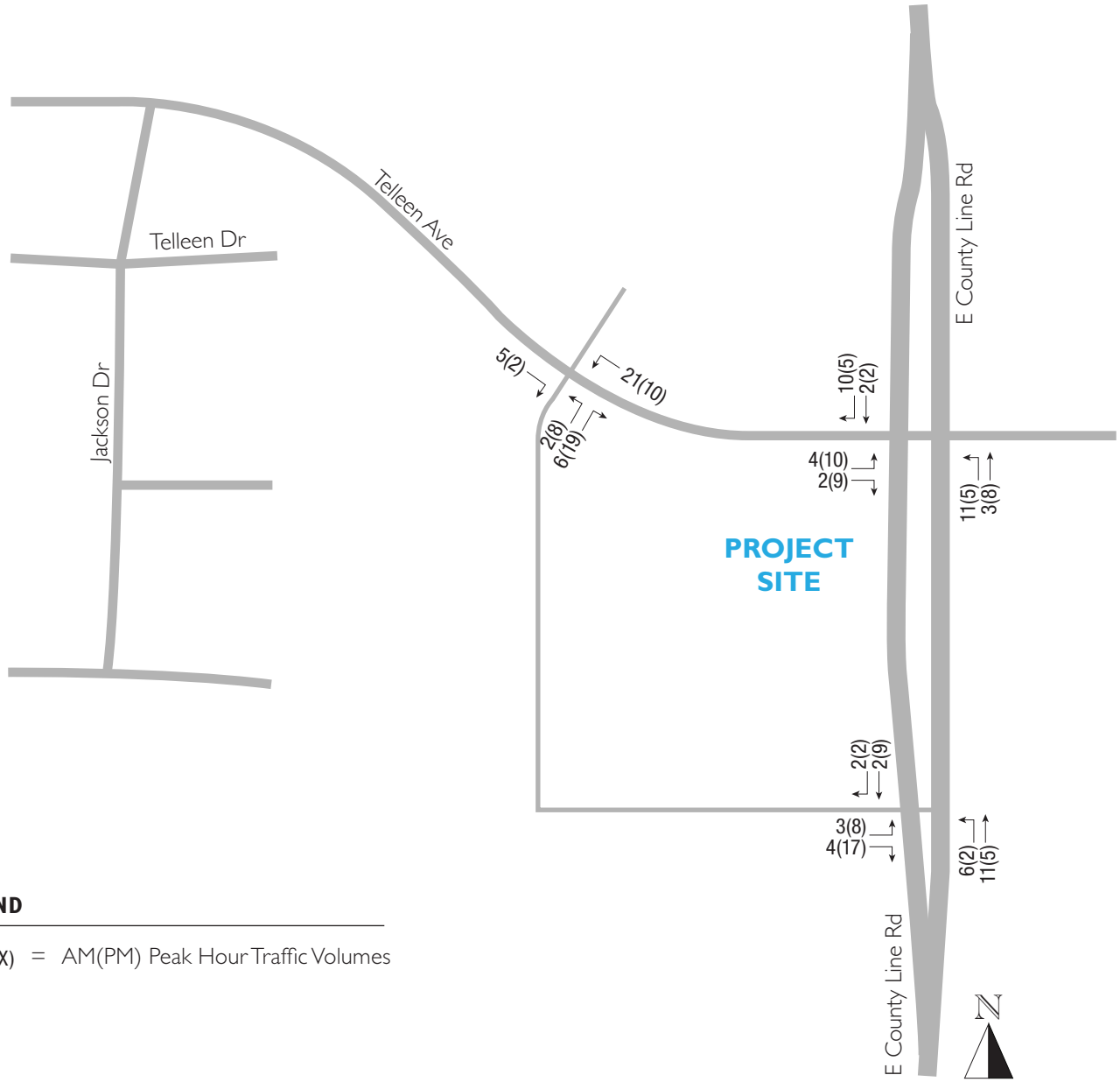


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Figure 5

Long-Term Project-Generated Traffic

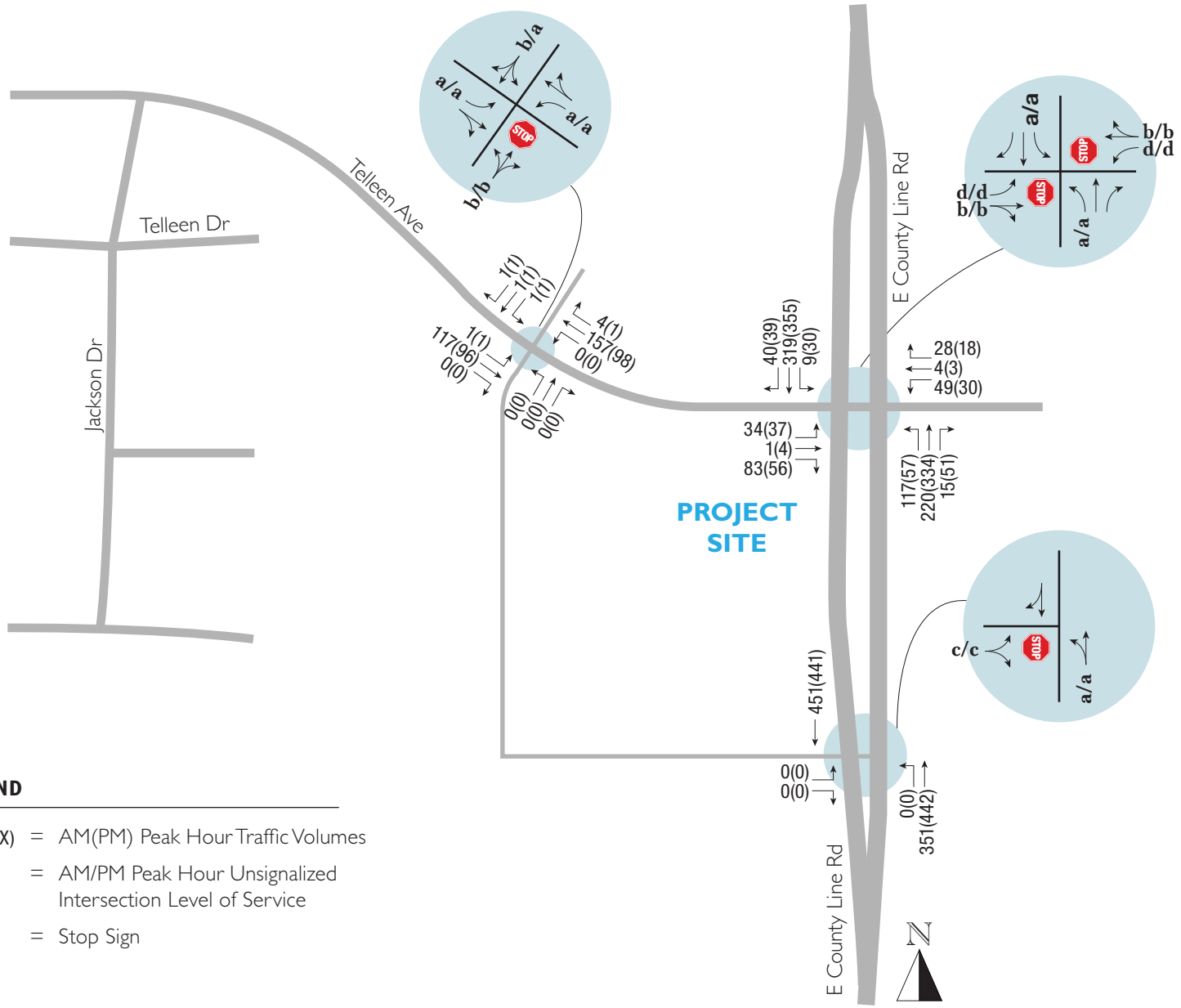
c. Short-Term (Year 2028) Projected Traffic

The project's impact on future year traffic projections is assessed in this section for the year 2028 planning horizon. Background traffic (all other traffic not associated with the project site) for 2028 was estimated by first applying annual growth factors to the existing traffic volumes.

Growth factors were developed by reviewing DRCOG's travel demand model plots for 2050 versus 2020. Their plots show a 2.75 percent per year increase in traffic along County Line Road (nearly doubling in 30 years), so a 2.75 percent annual growth was applied to existing counts. In addition, the additional traffic from 267 multi-family units across County Line Road were added atop amounting to 106 AM peak hour trips and 135 PM peak hour trips, per the HKS TIS previously referenced. This development also changes the nature of the County Line Road/Telleen Avenue intersection by virtue of adding an east leg and creating a four-legged intersection.

Also included in the background traffic were trips estimated from the Lafferty and Canyon Creek development located north and west of the Telleen Avenue/Jasper Road intersection. A review of the TIS's addressing those development show that 15 trips would be added onto Telleen Avenue during the AM peak hour and 20 during the PM peak hour. Most of this development's traffic is assumed to oriented to the south and only a fraction is anticipated to utilize Telleen Avenue. The resulting 2028 background traffic demands from all of the above are shown in **Figure 6.**

Applying the same *Highway Capacity Manual* techniques previously described, intersection movement delays and LOS measures were calculated and are also shown in **Figure 6** (worksheets are included in **Appendix D)**. The study area intersections will remain at an acceptable LOS's, no worse than LOS D.



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

x/x = AM/PM Peak Hour Unsignalized Intersection Level of Service

STOP = Stop Sign

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Figure 6

Short-Term (2028) Background Traffic Conditions

Figure 7 then shows the Short-term (2028) total traffic projections in which background traffic volumes and the project-specific traffic volumes are summed. **Figure 7** also shows the resulting LOS's using these volume projections (worksheets are included in **Appendix D**). The resulting LOS's at County Line Road/Telleen Avenue are not projected to change and would be at LOS D or better.

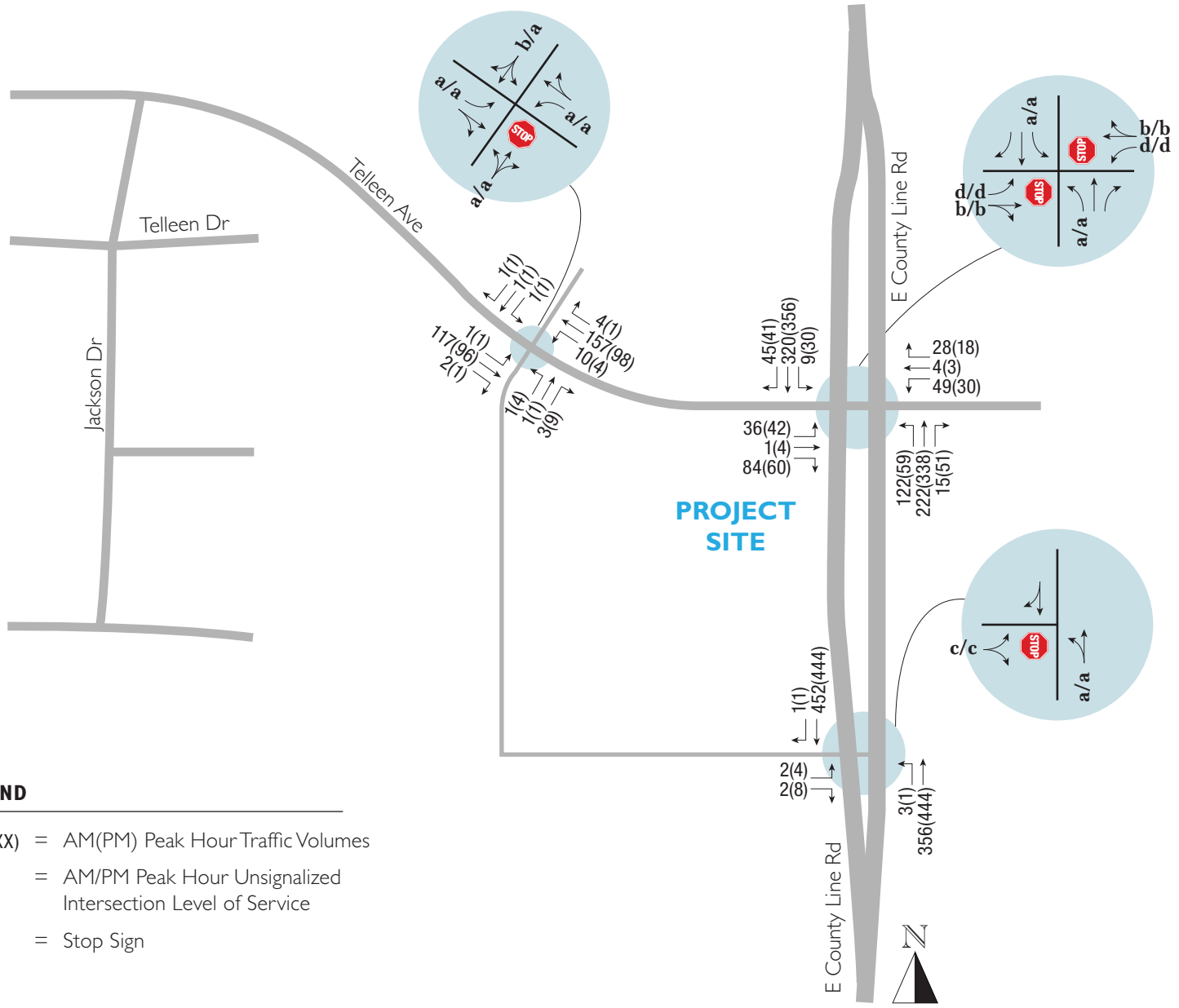


Figure 7

Short-Term (2028) Total Traffic Conditions

d. Long-Term (Year 2045) Projected Background Traffic

The annual growth factors presented in the previous subsection were applied in developing the Long-term (2045) background traffic projections as were the additional trips referenced in nearby planned development; year 2045 background traffic is shown in **Figure 8**.

By 2045, background traffic levels along County Line Road are projected to reach 1100 to 1200 vph during the peak hours (both directions combined) adjacent to the site. Telleen Avenue background traffic is projected to reach 350 to 400 vph during the peak hours adjacent to the site.

Figure 8 also shows the projected level of service of the intersections given 2045 background traffic. The same eastbound and westbound left turn movements at the County Line Road/Telleen Avenue intersection surface as being challenging and projected to operate at a LOS F. The eastbound left turn movement delay would reach 135 seconds per vehicle in the PM peak hour. The other LOS F instances are projected to be less than this, and each approach leg delay (when considering all movements along the approach) would continue to meet Town standards being under 100 seconds per vehicle. The worst approach is projected to be the westbound direction during the AM peak hour which would experience 80 seconds of delay when averaged across all approach movements. LOS worksheets are presented in **Appendix E.**

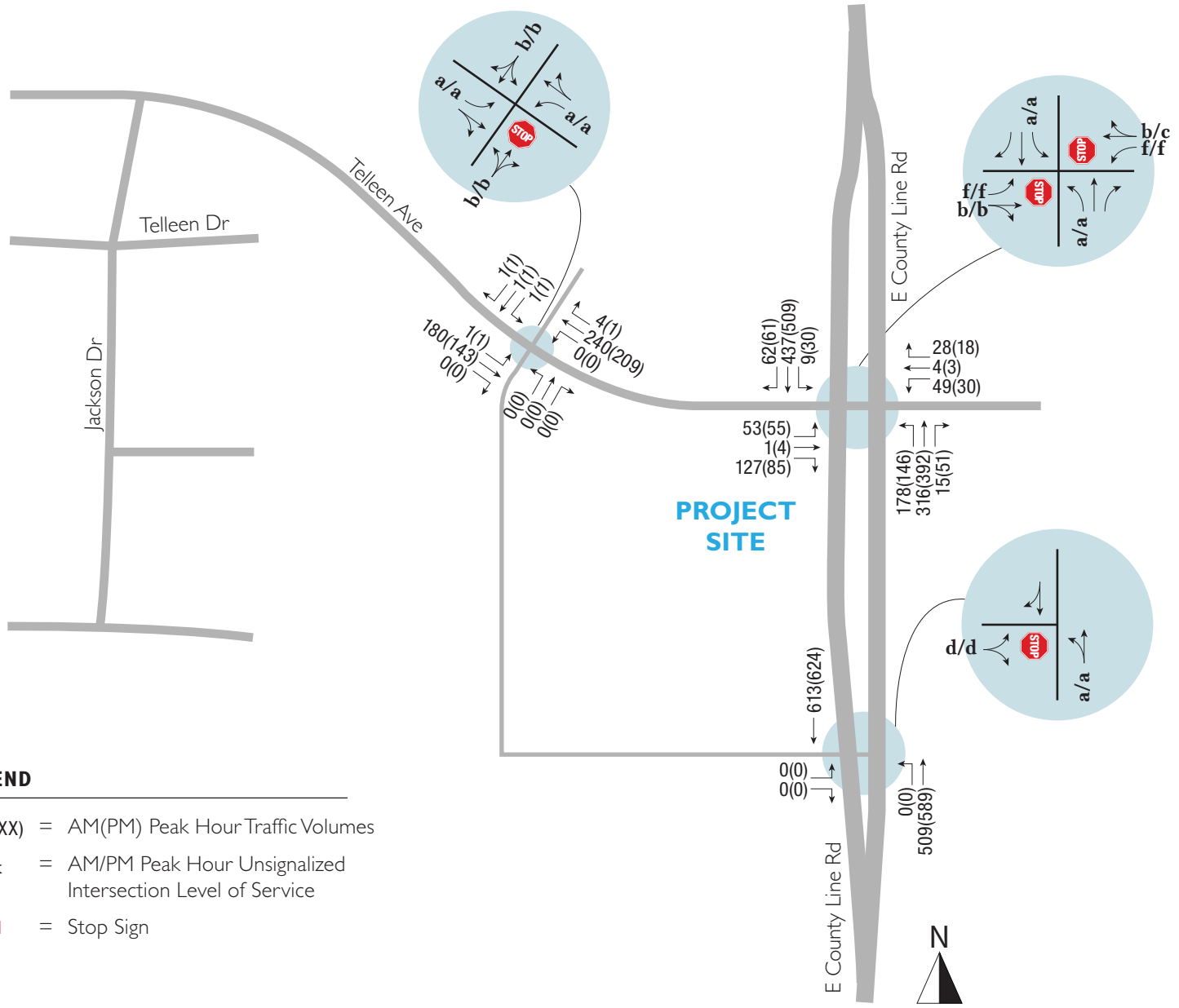


Figure 8

Long-Term (2045) Background Traffic Conditions

Figure 9 shows the 2045 Total traffic projections reflecting a sum of the Long-term background traffic volumes with the project-specific traffic; also shown are the resulting LOS's using these volume projections (worksheets are included in **Appendix E**). Compared to the Long-term background traffic conditions, the same eastbound and westbound left turn movements at the County Line Road/Telleen Avenue intersection would remain critical, each being at LOS F during both peak hours. The eastbound and westbound approach legs would not exceed 99 seconds per vehicle of delay, and therefore this would just meet the Town standard of 100 seconds per vehicle. The eastbound left turn movement volume-to-capacity ratio calculates out to just over 1.0 indicating that it would be at its capacity. A 95th percentile for the eastbound left turn could reach 5 to 6 vehicles.

The amount of traffic projected to utilize this intersection would fall short of warranting signalization when considering the minor street lefts and through movements, the analysis of which is provided in **Appendix F**. However, monitoring for possible signalization in the 20-year timeframe makes sense. Other intersection alternatives include an all-way stop which would end up causing more delay than it would save since the heavy north-south traffic would be subject to being stopped; this is not recommended. A roundabout intersection has the potential of functioning well, and this improvement should be considered by the Town over time. The additional traffic generated by the police station is not the major consideration creating this need, rather it is existing traffic and growth in background traffic that drive the consideration for a roundabout. The Town may want to considering conducting a roundabout feasibility study for the County Line Road/Telleen Avenue intersection to mitigate future eastbound and westbound left turn delays..

A less than desirable delay and LOS result for minor street approaches (particularly left turns) is not uncommon at two-way stop intersections, and this does not necessarily justify a need to be remedied. The approach delay meets Town requirements. No improvements are recommended to alleviate this projected delay, but a roundabout intersection is suggested for consideration and further study..

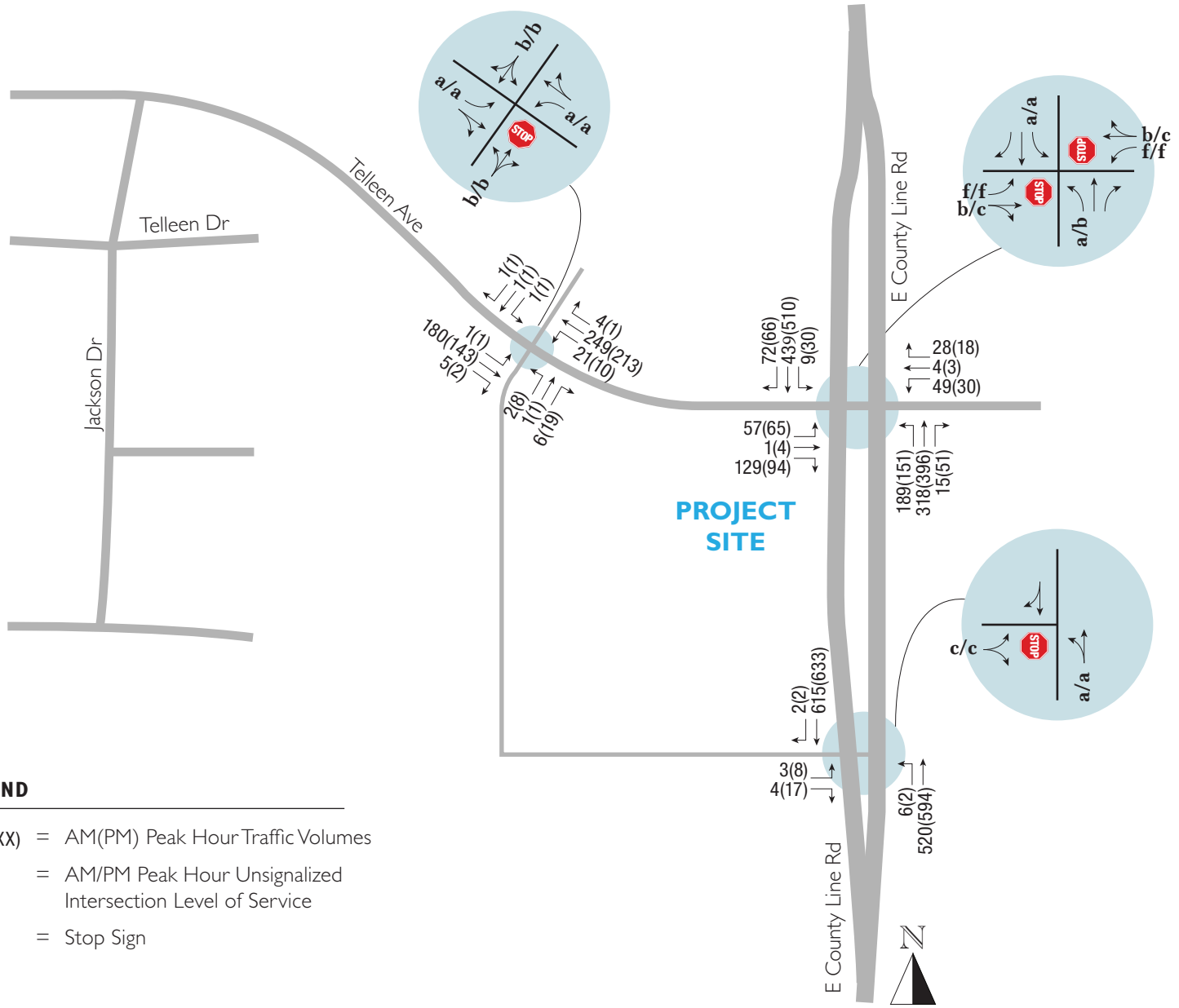


Figure 9

Long-Term (2045) Total Traffic Conditions

e. Operations Summary

Beyond the graphical presentation of all the LOS results, **Table 4** shows the LOS results for each planning horizon scenario for all study area intersections for both peak hours. The table highlights poorer LOS (yellow for LOS E's and red for LOS F's) allowing potential issue areas to pop out to the reader. One can also review the table by intersection/movement, reading across, and gaining a sense of gradual change to a movement's LOS and delay with each increasing traffic scenario.

The Police station traffic make-up of total traffic in the short-term and the long-term planning horizons is fairly minimal. Most movement LOS's and delays change minimally with the additional of the station traffic. At the County Line Road/Telleen Avenue intersection, station traffic would make up approximately 2.5 percent of the 2045 total peak hour intersection traffic.

The County Line Road access intersection currently does not provide an exclusive northbound left turn lane. With plans for this access to be gated, this drive will be used only by authorized vehicles. A review of AASHTO standards relative to auxiliary lanes indicates that at least 5 movements per hour would be needed to technically warrant a center left turn lane. Short-term projections show that 3 movements per hour are projected suggesting that a center turn lane is not technically warranted, but 6 movements per hour are projected long-term. There are plans to widen County Line Road in this area and conceptual layouts show the incorporation of a center left turn lane at this access, which would then address this issue.

Table 4. LOS and Delay Results (Seconds per Vehicle)

Intersection	Mvmt.	Existing		ST Background		ST Total		LT Background		LT Total	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
County Line Rd/Telleen Ave.	NB L	B(8.46)	A(8.4)	A(8.6)	B(8.6)	A(8.6)	A(8.6)	A(9.4)	A(9.9)	A(9.6)	B(10.1)
	SB L	NA	NA	A(7.8)	A(8.3)	A(7.8)	A(8.3)	A(8.1)	A(8.5)	A(8.1)	A(8.5)
	WB L	NA	NA	E(33.5)	D(31.8)	D(34.8)	D(32.8)	F(122)	F(102)	F(140)	F(131)
	WB T/R	NA	NA	B(11.4)	B(12.5)	B(11.5)	B(12.6)	B(14.0)	C(16.2)	B(14.4)	C(17.0)
	EB L	C(18.8)	C(18.8)	D(27.3)	D(30.4)	D(28.7)	D(32.2)	F(94.3)	F(135)	F(119)	F(220)
	EB T/(R)	B(11.1)	B(11.2)	B(11.6)	B(12.7)	B(11.7)	B(12.7)	B(14.4)	B(14.8)	B(14.5)	C(15.5)
County Line Rd/Site Access	NB L	A(8.3)	A(8.1)	NA	NA	A(8.6))	A(8.6)	NA	NA	A(9.2)	A(9.0)
	EB Appr.	B(12.4)	B(12.2)	NA	NA	C(15.4)	C(15.5)	NA	NA	C(20.0)	C(18.3)
Telleen Ave / Site Access	NB Appr	B(10.3)	A(9.3)	NA	NA	B(10.3)	A(9.7)	NA	NA	B(11.5)	B(10.4)
	SB Appr	B(10.7)	A(9.8)	B(10.9)	A(9.8)	B(11.1)	B(10.2)	B(12.5)	B(11.0)	B(13.3)	B(11.4)
	EB L	A(7.6)	A(7.4)	A(7.7)	A(7.4)	A(7.7)	A(7.5)	A(7.9)	A(7.7)	A(7.9)	A(7.7)
	WB L	A(7.6)	A(7.4)	NA	NA	A(7.6)	A(7.5)	NA	NA	A(7.8)	A(7.6)

f. Intersection Queuing

The preceding sections presented traffic projections and the LOS results at the study area intersections. This section expands the results and provides queuing along the intersection approaches by movement, focused on the Long-term planning horizon. The analysis calculates a 95th percentile queue length for each approach's lane movement which can provide additional insight into functionality beyond LOS. The results for the Long-term total traffic projections are shown in **Table 5**. Movements that are free-flow are not included since a queue theoretically will not occur for any movement that is not subject to being stopped at an intersection. Some of the results in **Table 5** are less than one vehicle in length (roughly 25 feet) which is due to the statistical nature of the calculation being on a continuum. One would not design a lane to be only a fraction of vehicle in length, but a short 95th percentile result indicates that the lane need not provide significant storage other than the minimum length for a truck and/or two passenger cars.

Table 5. Long-Term (2045) Intersection Approach 95th Percentile Queue Lengths (ft.)

Intersection	Movement	Long-Term (2045) Total Traffic		Approx. Available Queuing Capacity
		AM	PM	
County Line Rd / Telleen Ave	NB L	20	18	85
	SB L	Min	3	140
	EB L	110	143	Not Built
	EB T/R	35	25	Not Built
	WB L	90	60	100
	WB T/R	8	5	Continuous
County Line Rd / Site Access	NB L	Min	Min	Not Built
	EB Appr	5	3	Continuous
Telleen Ave / Site Access	NB Appr.	3	5	Continuous
	SB Appr.	3	3	Continuous
	EB L	Min	Min	Continuous
	WB L.	3	Min	125

The movement queues are not anticipated to be significant. The eastbound left turn at the County Line Road/Telleen Avenue intersection is projected to be the longest at 143 feet in the 2045 PM peak hour.

IV. SUMMARY AND RECOMMENDATIONS

The Town of Erie is proposing to expand an existing police station facility located on the southwest corner of County Line Road and Telleen Ave. When built out and filled to its capacity, the substation is estimated to generate 536 trips per day with 38 occurring during the AM peak hour and 62 during the PM peak hour. In addition, community tours and other events will occasionally be held at this facility, and these days will see more trip-making depending on the attendance. These are estimated to take place several times a year.

With respect to projected peak hour traffic passing through the Telleen Avenue/County Line Road intersection, the traffic from this station represents approximately 2.5 percent of the 2045 total traffic. The police station expansion will not specifically necessitate intersection improvements at Telleen Avenue/County Line Road nor at the Telleen Avenue/site access intersection. At the County Line Road/site access intersection, future plans to widen County Line Road will incorporate a left turn lane that will serve this access. A turn lane is not needed short-term.

Background traffic growth will result in gradually dimensioning conditions. The specific movements that will operate at a poor LOS are the eastbound and westbound left turn movement and the County Line Road/Telleen Avenue intersection. This intersection functions under a side-street stop condition in which the northbound and southbound approaches are free flowing and the eastbound and westbound approaches are subject to a stop condition.

While the minor street left turn LOS's will be poor at the County Line Road/Telleen Avenue intersection, the eastbound and westbound approach delay (which includes through and right movements) will be equal to or less than 99 seconds per vehicle. Town requirements are to obtain less than 100 seconds per vehicle when considering the entire approach leg, so the projected condition would just meet Town operational criteria. Projected traffic volumes would not satisfy signalization warrants, and an all-way stop scenario would result in significant delay for the northbound and southbound approaches. A roundabout intersection could be the solution in the long-term, and the town should consider conducting a roundabout feasibility study for the County Line Road/Telleen Avenue intersection.

Appendix A. Approved TIS Assumptions Form

Town of Erie - Transportation Impact Analysis (TIA)

Base Assumptions Form

GENERAL INFORMATION						
Project Name: Erie Police Station Expansion						
Project Location: SW Corner of County Line Road/Telleen						
TIA ASSUMPTIONS						
Muni Code Applicability (TIA Warrant):	1-Hour Vol. Exceeds 100 Trips *Est. 1-Hour Vol:* See next page		AADT Exceeds 250 *Est. AADT:* See next page		Other:	
Study Area Boundaries	North: Telleen Ave.	South: Southern site Access	East: County Ln Rd	West: Western site Access		
Study Years	Short Range: 2028		Long Range: 2045			
Future Traffic Growth Rates	2.7%/year. More on Telleen per **Canyon Cr & 3140 CLR TIS's**.		Growth Rate Reference(s): DRCOG 2050 vs **2020 Model Runs and other local TIS's.**			
Study Intersections	1.Telleen/County Line Road*		5. *Will use 3140 NE County Line Road TIS counts			
	2. Telleen/Site Access**		6.			
	3. County Line Rd/Site Access**		7. **New turning movement counts to be obtained.			
	4.		8.			
Time Period(s) For Study	AM Peak Hour: Yes – Exact hour based on counts PM Peak Hour: Yes – Exact hour based on counts					
ITE Trip Generation Rates	ITE does not contain this land use category. Operations will be used to estimate trip-making. See attached.					
Trip Adjustment Factors	Background Trips: None	Transit Investments: None	Captive Market: None			
Trip Distribution Rational (Attach Diagram)	Trip distribution is a balance between where staff will come from and **based on station's ar**ea of coverage. The highest component will be to/from the south. Use 20% west, 35% north, and 45% south.					
Mode Split Assumptions	None					
Committed Roadway Improvements	None in this study area. Roundabouts are planned further south along County Line Rd. Telleen and County Line Road are basically built out adjacent to this site.					
Other Traffic Studies (Less than 2 Years Old)	3140 NE County Line Road, by HKS, July 19, 2024.					
Areas Requiring Special Study	None					
Is the project within 1/2 mile of a State Highway?	Yes_____ No XXX					

Date: 04/21/2025

Signature - Project Traffic Engineer: Christopher J Foschis

Signature - Town of Erie Staff: _____

Trip Generation Consideration

Police station is not a land use category in the ITE Trip Generation manual. For this study, trips will be estimated based on facility operations including, staffing numbers, shifts, anticipated patrol car usage in and out, visitation, deliveries, and any other functions that the facility will house. In addition, the courts may be relocated out of this existing facility which would be a reduction in site trip making. All of this will be consolidated into a final trip generation analysis.

A series of questions will be posed to ascertain all of the above with the notion that trips will be estimated for each operational aspect, inbound and outbound, by hour of the day. This will be presented in a table format.

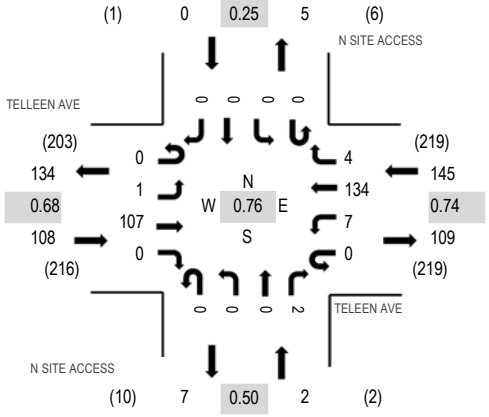
The final trip generation table will be shared with Town staff for further venting. Approval of Town staff will be obtained before its use in the TIS.

Appendix B. Existing Traffic Count Data

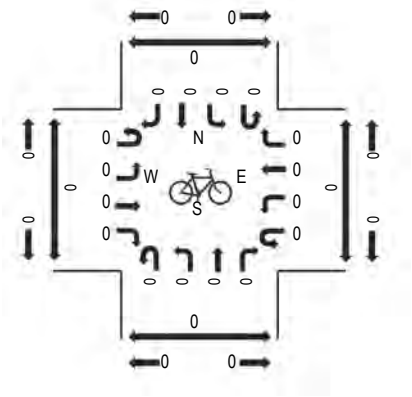
ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

Location: 1 N SITE ACCESS & TELEEN AVE AM
Date: Thursday, April 24, 2025
Peak Hour: 08:00 AM - 09:00 AM
Peak 15-Minutes: 08:45 AM - 09:00 AM

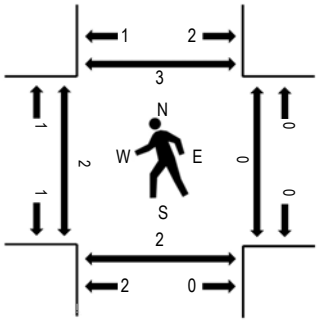
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

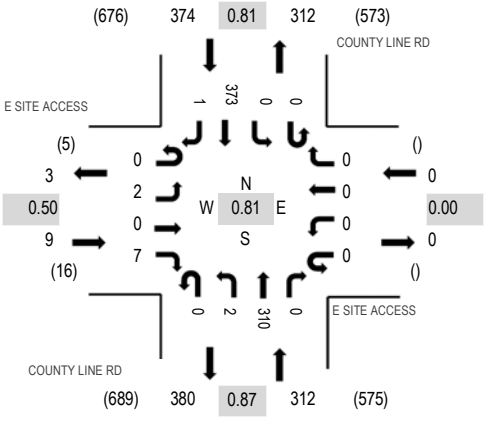
Traffic Counts - Motorized Vehicles

Interval Start Time	TELLEEN AVE Eastbound				TELEEN AVE Westbound				N SITE ACCESS Northbound				N SITE ACCESS Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
7:00 AM	0	0	17	0	0	1	14	1	0	0	0	0	0	1	0	0	34	183	0	0	0	1
7:15 AM	0	0	42	0	0	0	25	0	0	0	0	0	0	0	0	0	67	205	0	0	1	0
7:30 AM	0	0	26	0	1	0	10	0	0	0	0	0	0	0	0	0	37	190	0	0	0	0
7:45 AM	0	0	23	0	0	2	20	0	0	0	0	0	0	0	0	0	45	216	0	0	0	1
8:00 AM	0	0	23	0	0	1	29	3	0	0	0	0	0	0	0	0	56	255	1	0	0	0
8:15 AM	0	0	24	0	0	5	23	0	0	0	0	0	0	0	0	0	52		0	0	0	2
8:30 AM	0	1	26	0	0	0	34	1	0	0	0	1	0	0	0	0	63		0	0	2	0
8:45 AM	0	0	34	0	0	1	48	0	0	0	0	1	0	0	0	0	84		1	0	0	1
Count Total	0	1	215	0	1	10	203	5	0	0	0	2	0	1	0	0	438		2	0	3	5
Peak Hour	0	1	107	0	0	7	134	4	0	0	0	2	0	0	0	0	255		2	0	2	3

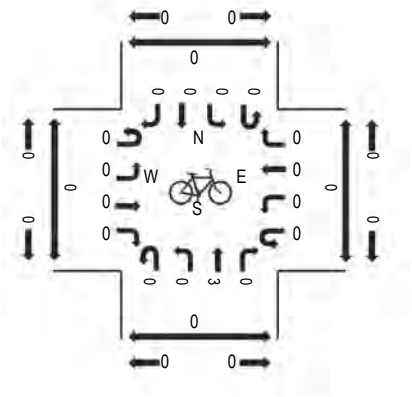
(303) 216-2439
www.alltrafficdata.net

Location: 2 COUNTY LINE RD & E SITE ACCESS AM
Date: Thursday, April 24, 2025
Peak Hour: 07:15 AM - 08:15 AM
Peak 15-Minutes: 07:45 AM - 08:00 AM

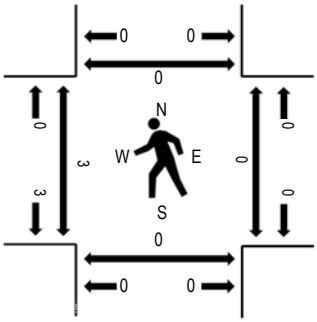
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

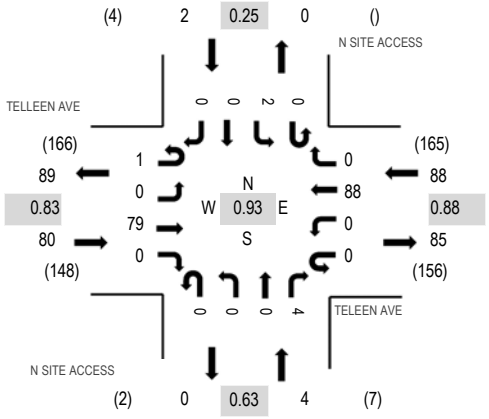
Traffic Counts - Motorized Vehicles

Interval Start Time	E SITE ACCESS Eastbound				E SITE ACCESS Westbound				COUNTY LINE RD Northbound				COUNTY LINE RD Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
7:00 AM	0	0	0	5	0	0	0	0	0	0	33	0	0	0	63	0	101	607	0	0	0	0
7:15 AM	0	1	0	2	0	0	0	0	0	0	57	0	0	0	79	0	139	695	1	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	76	0	0	0	77	0	153	689	0	0	0	0
7:45 AM	0	1	0	1	0	0	0	0	0	1	95	0	0	0	115	1	214	685	0	0	0	0
8:00 AM	0	0	0	4	0	0	0	0	0	1	82	0	0	0	102	0	189	660	2	0	0	0
8:15 AM	0	0	0	1	0	0	0	0	0	0	78	0	0	0	54	0	133		0	2	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	70	0	0	0	79	0	149		0	0	0	0
8:45 AM	0	0	0	1	0	0	0	0	0	2	80	0	0	0	106	0	189		0	0	0	0
Count Total	0	2	0	14	0	0	0	0	0	4	571	0	0	0	675	1	1,267		3	2	0	0
Peak Hour	0	2	0	7	0	0	0	0	0	2	310	0	0	0	373	1	695		3	0	0	0

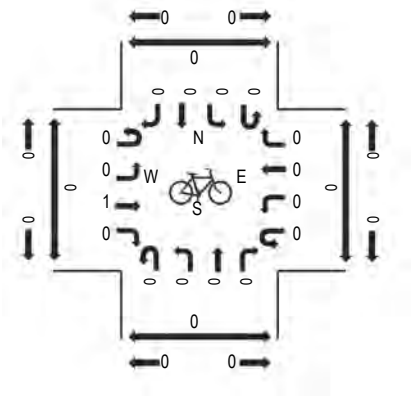
ALL TRAFFIC DATA SERVICES
(303) 216-2439
www.alltrafficdata.net

Location: 1 N SITE ACCESS & TELEEN AVE PM
Date: Thursday, April 24, 2025
Peak Hour: 05:00 PM - 06:00 PM
Peak 15-Minutes: 05:45 PM - 06:00 PM

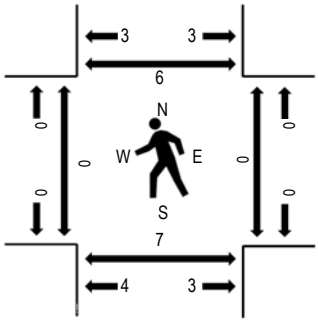
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

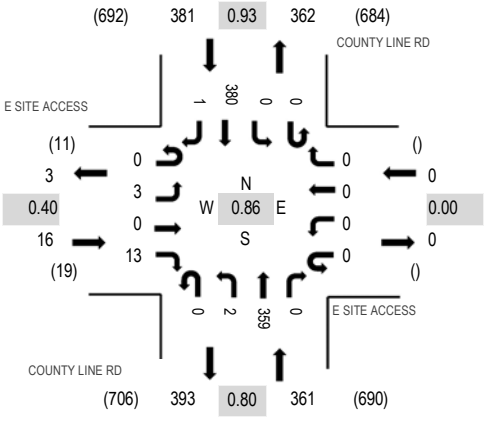
Interval Start Time	TELLEEN AVE Eastbound				TELEEN AVE Westbound				N SITE ACCESS Northbound				N SITE ACCESS Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM	0	0	17	0	0	1	26	0	0	0	0	0	0	1	0	1	46	150	0	0	1	0
4:15 PM	0	0	18	0	0	1	17	0	0	0	0	0	0	0	0	0	36	143	1	0	0	2
4:30 PM	0	0	18	0	0	0	16	0	0	0	0	2	0	0	0	0	36	153	2	0	2	1
4:45 PM	0	0	15	0	0	0	16	0	0	1	0	0	0	0	0	0	32	159	0	0	1	0
5:00 PM	1	0	12	0	0	0	23	0	0	0	0	2	0	1	0	0	39	174	0	0	1	0
5:15 PM	0	0	21	0	0	0	25	0	0	0	0	0	0	0	0	0	46		0	0	0	2
5:30 PM	0	0	24	0	0	0	16	0	0	0	0	1	0	1	0	0	42		0	0	6	2
5:45 PM	0	0	22	0	0	0	24	0	0	0	0	1	0	0	0	0	47		0	0	0	2
Count Total	1	0	147	0	0	2	163	0	0	1	0	6	0	3	0	1	324		3	0	11	9
Peak Hour	1	0	79	0	0	0	88	0	0	0	0	4	0	2	0	0	174		0	0	7	6

ALL TRAFFIC DATA SERVICES

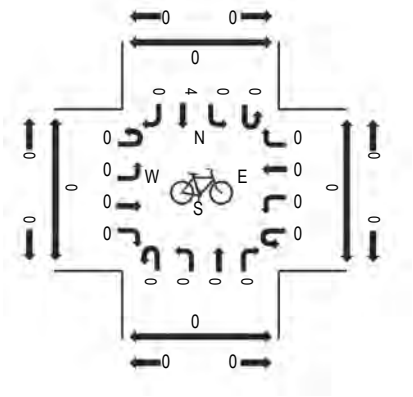
(303) 216-2439
www.alltrafficdata.net

Location: 2 COUNTY LINE RD & E SITE ACCESS PM
Date: Thursday, April 24, 2025
Peak Hour: 04:30 PM - 05:30 PM
Peak 15-Minutes: 05:15 PM - 05:30 PM

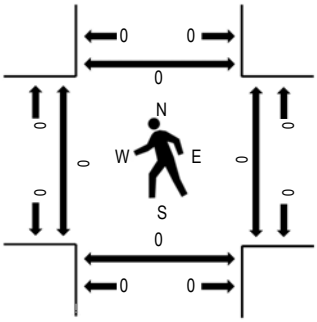
Peak Hour - Motorized Vehicles



Peak Hour - Bicycles



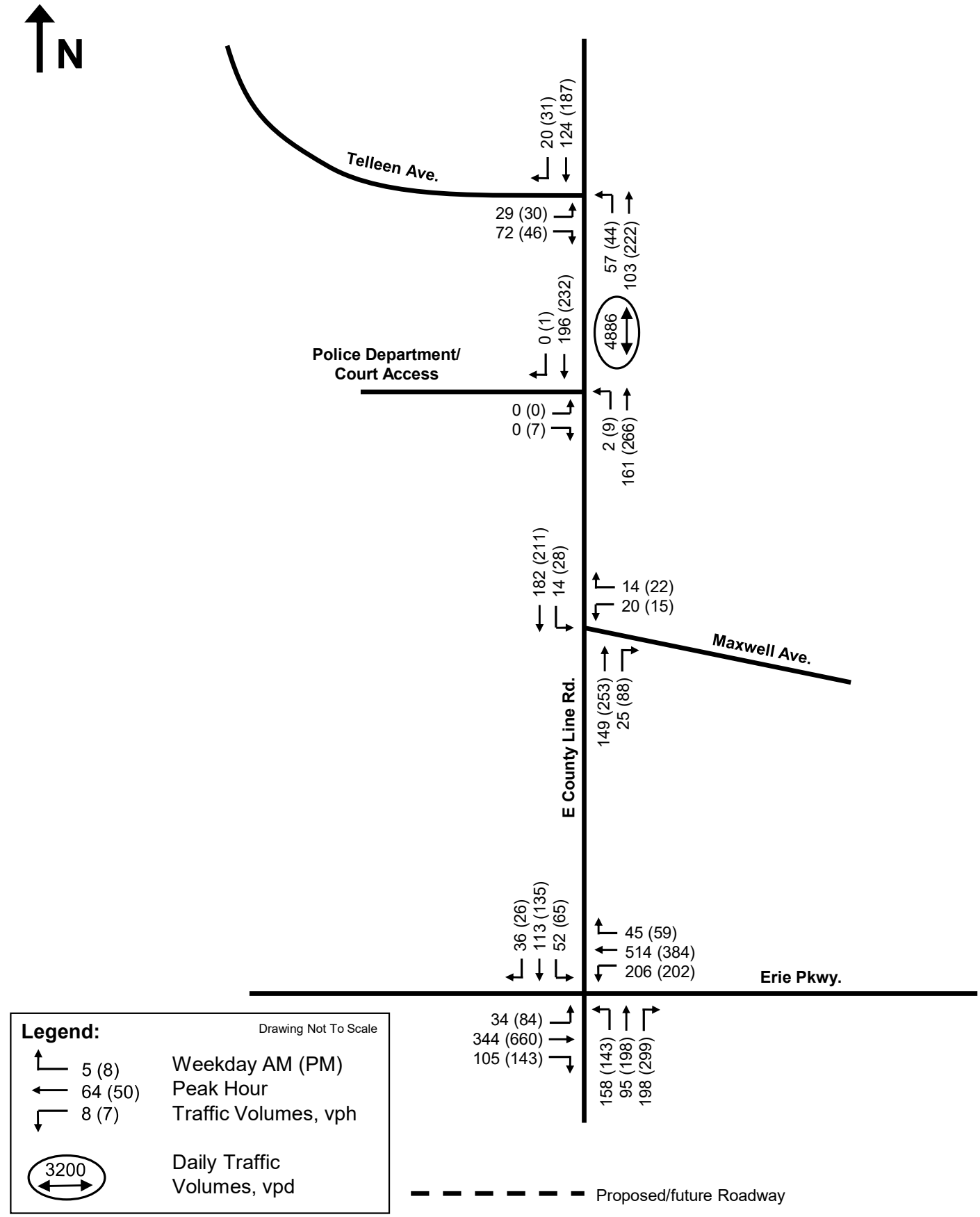
Peak Hour - Pedestrians



Note: Total study counts contained in parentheses.

Traffic Counts - Motorized Vehicles

Interval Start Time	E SITE ACCESS Eastbound				E SITE ACCESS Westbound				COUNTY LINE RD Northbound				COUNTY LINE RD Southbound					Rolling Hour	Pedestrian Crossings			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	Total		West	East	South	North
4:00 PM	0	0	0	0	0	0	0	0	0	2	94	0	0	0	70	1	167	688	0	0	0	0
4:15 PM	0	0	0	3	0	0	0	0	0	2	92	0	0	0	71	0	168	705	0	0	0	0
4:30 PM	0	2	0	8	0	0	0	0	0	0	72	0	0	0	94	0	176	758	0	0	0	0
4:45 PM	0	0	0	2	0	0	0	0	0	0	79	0	0	0	96	0	177	752	0	0	0	0
5:00 PM	0	1	0	0	0	0	0	0	0	1	96	0	0	0	86	0	184	713	0	0	0	0
5:15 PM	0	0	0	3	0	0	0	0	0	1	112	0	0	0	104	1	221		0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	2	63	0	0	0	105	0	170		0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	1	73	0	0	0	64	0	138		0	0	0	0
Count Total	0	3	0	16	0	0	0	0	0	9	681	0	0	0	690	2	1,401		0	0	0	0
Peak Hour	0	3	0	13	0	0	0	0	0	2	359	0	0	0	380	1	758		0	0	0	0



HARRIS KOCHER SMITH
DENVER • DALLAS/FORT WORTH

2024 Existing Traffic Volumes (Adjusted for School Traffic)

3140 NE County Line Road

Crescent Communities

HKS #231017

Figure 3

Appendix C. Existing Traffic LOS Worksheets

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	107	1	7	134	4	1	1	2	1	1	1
Future Vol, veh/h	1	107	1	7	134	4	1	1	2	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	74	74	74	50	50	50	25	25	25
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	157	1	9	181	5	2	2	4	4	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	186	0	0	159	0	0	363	366	158	364	364	184
Stage 1	-	-	-	-	-	-	161	161	-	203	203	-
Stage 2	-	-	-	-	-	-	202	205	-	161	162	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1388	-	-	1421	-	-	593	562	887	592	564	859
Stage 1	-	-	-	-	-	-	841	765	-	799	734	-
Stage 2	-	-	-	-	-	-	800	732	-	841	764	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1388	-	-	1421	-	-	581	558	887	583	559	859
Mov Cap-2 Maneuver	-	-	-	-	-	-	581	558	-	583	559	-
Stage 1	-	-	-	-	-	-	840	764	-	794	729	-
Stage 2	-	-	-	-	-	-	787	727	-	834	763	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.07	0.36	10.25	10.71
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	694	1388	-	-	1421	-	-	643
HCM Lane V/C Ratio	0.012	0.001	-	-	0.007	-	-	0.019
HCM Ctrl Dly (s/v)	10.3	7.6	-	-	7.6	-	-	10.7
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	3.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	32	77	108	204	297	37
Future Vol, veh/h	32	77	108	204	297	37
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	0	0	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	69	69	87	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	46	112	124	234	341	43

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	824	341	384	0	-	0
Stage 1	341	-	-	-	-	-
Stage 2	483	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	343	701	1175	-	-	-
Stage 1	720	-	-	-	-	-
Stage 2	621	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	306	701	1175	-	-	-
Mov Cap-2 Maneuver	306	-	-	-	-	-
Stage 1	644	-	-	-	-	-
Stage 2	621	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	13.37	2.92	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1175	-	306	701	-	-
HCM Lane V/C Ratio	0.106	-	0.151	0.159	-	-
HCM Ctrl Dly (s/v)	8.4	-	18.8	11.1	-	-
HCM Lane LOS	A	-	C	B	-	-
HCM 95th %tile Q(veh)	0.4	-	0.5	0.6	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	7	2	310	373	1
Future Vol, veh/h	2	7	2	310	373	1
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	50	50	80	80	81	81
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	14	3	388	460	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	854	461	462	0	-	0
Stage 1	461	-	-	-	-	-
Stage 2	393	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	329	600	1099	-	-	-
Stage 1	635	-	-	-	-	-
Stage 2	682	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	328	600	1099	-	-	-
Mov Cap-2 Maneuver	328	-	-	-	-	-
Stage 1	633	-	-	-	-	-
Stage 2	682	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.36	0.05	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	12	-	507	-	-
HCM Lane V/C Ratio	0.002	-	0.036	-	-
HCM Ctrl Dly (s/v)	8.3	0	12.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	79	1	7	88	1	1	1	4	2	1	1
Future Vol, veh/h	1	79	1	7	88	1	1	1	4	2	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	88	88	88	63	63	63	25	25	25
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	95	1	8	100	1	2	2	6	8	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	101	0	0	96	0	0	216	215	96	215	215	101
Stage 1	-	-	-	-	-	-	98	98	-	116	116	-
Stage 2	-	-	-	-	-	-	118	117	-	98	99	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1491	-	-	1497	-	-	740	683	961	742	682	955
Stage 1	-	-	-	-	-	-	908	814	-	888	799	-
Stage 2	-	-	-	-	-	-	887	799	-	908	813	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1491	-	-	1497	-	-	728	678	961	731	678	955
Mov Cap-2 Maneuver	-	-	-	-	-	-	728	678	-	731	678	-
Stage 1	-	-	-	-	-	-	907	813	-	883	795	-
Stage 2	-	-	-	-	-	-	874	795	-	899	813	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.09	0.54	9.25	9.83
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	856	1491	-	-	1497	-	-	761
HCM Lane V/C Ratio	0.011	0.001	-	-	0.005	-	-	0.021
HCM Ctrl Dly (s/v)	9.3	7.4	-	-	7.4	-	-	9.8
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	34	51	52	310	330	36
Future Vol, veh/h	34	51	52	310	330	36
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	0	0	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	89	89	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	40	61	58	348	413	45

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	878	413	458	0	-	0
Stage 1	413	-	-	-	-	-
Stage 2	465	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	319	640	1103	-	-	-
Stage 1	668	-	-	-	-	-
Stage 2	632	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	302	640	1103	-	-	-
Mov Cap-2 Maneuver	302	-	-	-	-	-
Stage 1	633	-	-	-	-	-
Stage 2	632	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	14.24	1.21	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1103	-	302	640	-	-
HCM Lane V/C Ratio	0.053	-	0.134	0.095	-	-
HCM Ctrl Dly (s/v)	8.4	-	18.8	11.2	-	-
HCM Lane LOS	A	-	C	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.5	0.3	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	13	2	359	380	1
Future Vol, veh/h	3	13	2	359	380	1
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	40	40	80	80	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	33	3	449	409	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	863	409	410	0	-	0
Stage 1	409	-	-	-	-	-
Stage 2	454	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	325	642	1149	-	-	-
Stage 1	671	-	-	-	-	-
Stage 2	640	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	324	642	1149	-	-	-
Mov Cap-2 Maneuver	324	-	-	-	-	-
Stage 1	669	-	-	-	-	-
Stage 2	640	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	12.16	0.05	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	10	-	542	-	-
HCM Lane V/C Ratio	0.002	-	0.074	-	-
HCM Ctrl Dly (s/v)	8.1	0	12.2	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Appendix D. Short-Term (2028) Traffic LOS Worksheets

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	117	0	0	157	4	0	1	0	1	1	1
Future Vol, veh/h	1	117	0	0	157	4	0	1	0	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	74	74	74	50	50	50	25	25	25
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	172	0	0	212	5	0	2	0	4	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	218	0	0	172	0	0	389	393	172	391	390	215
Stage 1	-	-	-	-	-	-	175	175	-	215	215	-
Stage 2	-	-	-	-	-	-	214	218	-	176	175	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1352	-	-	1405	-	-	570	543	872	568	545	825
Stage 1	-	-	-	-	-	-	827	754	-	787	725	-
Stage 2	-	-	-	-	-	-	788	723	-	826	754	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1352	-	-	1405	-	-	562	543	872	566	545	825
Mov Cap-2 Maneuver	-	-	-	-	-	-	562	543	-	566	545	-
Stage 1	-	-	-	-	-	-	826	753	-	787	725	-
Stage 2	-	-	-	-	-	-	780	723	-	823	753	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.06	0	11.66	10.89
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	543	1352	-	-	1405	-	-	623
HCM Lane V/C Ratio	0.004	0.001	-	-	-	-	-	0.019
HCM Ctrl Dly (s/v)	11.7	7.7	-	-	0	-	-	10.9
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	34	1	83	49	4	28	117	220	15	9	319	40
Future Vol, veh/h	34	1	83	49	4	28	117	220	15	9	319	40
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	0	-	0	0	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	69	69	69	85	85	85	87	87	87	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	49	1	120	58	5	33	134	253	17	10	367	46

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	912	926	367	910	955	253	413	0	0	270	0	0
Stage 1	387	387	-	522	522	-	-	-	-	-	-	-
Stage 2	524	539	-	388	433	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	255	269	679	255	258	786	1146	-	-	1293	-	-
Stage 1	636	609	-	538	531	-	-	-	-	-	-	-
Stage 2	536	522	-	636	581	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	210	235	679	183	226	786	1146	-	-	1293	-	-
Mov Cap-2 Maneuver	210	235	-	183	226	-	-	-	-	-	-	-
Stage 1	631	604	-	475	469	-	-	-	-	-	-	-
Stage 2	449	461	-	518	577	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	16.16	24.74	2.84	0.19
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1146	-	-	210	664	183	600	1293	-	-
HCM Lane V/C Ratio	0.117	-	-	0.235	0.183	0.315	0.063	0.008	-	-
HCM Ctrl Dly (s/v)	8.6	-	-	27.3	11.6	33.5	11.4	7.8	-	-
HCM Lane LOS	A	-	-	D	B	D	B	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	0.9	0.7	1.3	0.2	0	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	0	0	351	451	0
Future Vol, veh/h	1	0	0	351	451	0
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	50	50	87	87	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	0	0	403	485	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	888	485	485	0	-	0
Stage 1	485	-	-	-	-	-
Stage 2	403	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	314	582	1078	-	-	-
Stage 1	619	-	-	-	-	-
Stage 2	675	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	314	582	1078	-	-	-
Mov Cap-2 Maneuver	314	-	-	-	-	-
Stage 1	619	-	-	-	-	-
Stage 2	675	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	16.54	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1078	-	314	-	-
HCM Lane V/C Ratio	-	-	0.006	-	-
HCM Ctrl Dly (s/v)	0	-	16.5	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	96	0	0	98	1	0	1	0	1	1	1
Future Vol, veh/h	1	96	0	0	98	1	0	1	0	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	88	88	88	63	63	63	25	25	25
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	116	0	0	111	1	0	2	0	4	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	113	0	0	116	0	0	231	231	116	231	230	112
Stage 1	-	-	-	-	-	-	118	118	-	112	112	-
Stage 2	-	-	-	-	-	-	113	113	-	119	118	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1477	-	-	1473	-	-	723	669	937	724	670	941
Stage 1	-	-	-	-	-	-	886	798	-	893	803	-
Stage 2	-	-	-	-	-	-	892	802	-	886	798	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1477	-	-	1473	-	-	715	669	937	722	669	941
Mov Cap-2 Maneuver	-	-	-	-	-	-	715	669	-	722	669	-
Stage 1	-	-	-	-	-	-	886	797	-	893	803	-
Stage 2	-	-	-	-	-	-	883	802	-	883	797	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.08	0	10.4	9.81
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	669	1477	-	-	1473	-	-	761
HCM Lane V/C Ratio	0.002	0.001	-	-	-	-	-	0.016
HCM Ctrl Dly (s/v)	10.4	7.4	-	-	0	-	-	9.8
HCM Lane LOS	B	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	37	4	56	30	3	18	57	334	51	30	355	39
Future Vol, veh/h	37	4	56	30	3	18	57	334	51	30	355	39
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	0	-	0	0	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	85	85	85	89	89	89	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	44	5	67	35	4	21	64	375	57	38	444	49

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1024	1079	444	1025	1071	375	493	0	0	433	0	0
Stage 1	519	519	-	503	503	-	-	-	-	-	-	-
Stage 2	505	561	-	521	568	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	214	218	614	214	221	671	1071	-	-	1127	-	-
Stage 1	540	533	-	551	541	-	-	-	-	-	-	-
Stage 2	549	510	-	538	507	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	185	198	614	169	201	671	1071	-	-	1127	-	-
Mov Cap-2 Maneuver	185	198	-	169	201	-	-	-	-	-	-	-
Stage 1	522	515	-	518	509	-	-	-	-	-	-	-
Stage 2	497	480	-	460	490	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	19.46	23.86	1.11	0.59
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1071	-	-	185	539	169	503	1127	-	-
HCM Lane V/C Ratio	0.06	-	-	0.238	0.133	0.209	0.049	0.033	-	-
HCM Ctrl Dly (s/v)	8.6	-	-	30.4	12.7	31.8	12.5	8.3	-	-
HCM Lane LOS	A	-	-	D	B	D	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	0.9	0.5	0.8	0.2	0.1	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	0	0	442	441	0
Future Vol, veh/h	1	0	0	442	441	0
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	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	0	0	553	551	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1104	551	551	0	-	0
Stage 1	551	-	-	-	-	-
Stage 2	553	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	234	534	1019	-	-	-
Stage 1	577	-	-	-	-	-
Stage 2	576	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	234	534	1019	-	-	-
Mov Cap-2 Maneuver	234	-	-	-	-	-
Stage 1	577	-	-	-	-	-
Stage 2	576	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	20.49	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1019	-	234	-	-
HCM Lane V/C Ratio	-	-	0.005	-	-
HCM Ctrl Dly (s/v)	0	-	20.5	-	-
HCM Lane LOS	A	-	C	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	117	2	10	157	4	1	1	3	1	1	1
Future Vol, veh/h	1	117	2	10	157	4	1	1	3	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	74	74	74	50	50	50	25	25	25
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	172	3	14	212	5	2	2	6	4	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	218	0	0	175	0	0	418	421	174	418	420	215
Stage 1	-	-	-	-	-	-	176	176	-	242	242	-
Stage 2	-	-	-	-	-	-	241	245	-	176	178	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1352	-	-	1401	-	-	546	524	870	545	525	825
Stage 1	-	-	-	-	-	-	825	753	-	762	706	-
Stage 2	-	-	-	-	-	-	762	704	-	826	752	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1352	-	-	1401	-	-	533	518	870	534	519	825
Mov Cap-2 Maneuver	-	-	-	-	-	-	533	518	-	534	519	-
Stage 1	-	-	-	-	-	-	824	752	-	754	699	-
Stage 2	-	-	-	-	-	-	747	697	-	817	751	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.06	0.44	10.3	11.14
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	689	1352	-	-	1401	-	-	599
HCM Lane V/C Ratio	0.015	0.001	-	-	0.01	-	-	0.02
HCM Ctrl Dly (s/v)	10.3	7.7	-	-	7.6	-	-	11.1
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	36	1	84	49	4	28	122	222	15	9	320	45
Future Vol, veh/h	36	1	84	49	4	28	122	222	15	9	320	45
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	0	-	0	0	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	69	69	69	85	85	85	87	87	87	87	87	87
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	52	1	122	58	5	33	140	255	17	10	368	52

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	926	941	368	925	976	255	420	0	0	272	0	0
Stage 1	389	389	-	536	536	-	-	-	-	-	-	-
Stage 2	538	553	-	389	440	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	249	263	678	250	251	783	1140	-	-	1291	-	-
Stage 1	635	609	-	529	524	-	-	-	-	-	-	-
Stage 2	527	514	-	635	577	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	204	229	678	177	219	783	1140	-	-	1291	-	-
Mov Cap-2 Maneuver	204	229	-	177	219	-	-	-	-	-	-	-
Stage 1	630	604	-	464	459	-	-	-	-	-	-	-
Stage 2	438	451	-	515	573	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	16.73	25.61	2.92	0.19
HCM LOS	C	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1140	-	-	204	662	177	592	1291	-	-
HCM Lane V/C Ratio	0.123	-	-	0.256	0.186	0.325	0.064	0.008	-	-
HCM Ctrl Dly (s/v)	8.6	-	-	28.7	11.7	34.8	11.5	7.8	-	-
HCM Lane LOS	A	-	-	D	B	D	B	A	-	-
HCM 95th %tile Q(veh)	0.4	-	-	1	0.7	1.3	0.2	0	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	2	3	356	452	0
Future Vol, veh/h	2	2	3	356	452	0
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	50	50	87	87	81	81
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	4	3	409	558	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	974	558	558	0	-	0
Stage 1	558	-	-	-	-	-
Stage 2	416	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	279	529	1013	-	-	-
Stage 1	573	-	-	-	-	-
Stage 2	666	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	278	529	1013	-	-	-
Mov Cap-2 Maneuver	278	-	-	-	-	-
Stage 1	571	-	-	-	-	-
Stage 2	666	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	15.1	0.07	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	15	-	365	-	-
HCM Lane V/C Ratio	0.003	-	0.022	-	-
HCM Ctrl Dly (s/v)	8.6	0	15.1	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	96	2	4	98	1	4	1	9	1	1	1
Future Vol, veh/h	1	96	2	4	98	1	4	1	9	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	68	68	68	74	74	74	50	50	50	25	25	25
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	141	3	5	132	1	8	2	18	4	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	134	0	0	144	0	0	291	290	143	289	291	133
Stage 1	-	-	-	-	-	-	146	146	-	144	144	-
Stage 2	-	-	-	-	-	-	145	145	-	145	147	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1451	-	-	1438	-	-	661	620	905	663	619	916
Stage 1	-	-	-	-	-	-	857	777	-	859	778	-
Stage 2	-	-	-	-	-	-	857	777	-	858	775	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1451	-	-	1438	-	-	651	617	905	645	617	916
Mov Cap-2 Maneuver	-	-	-	-	-	-	651	617	-	645	617	-
Stage 1	-	-	-	-	-	-	856	776	-	856	775	-
Stage 2	-	-	-	-	-	-	846	774	-	838	775	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.08	0.29	9.72	10.21
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	791	1451	-	-	1438	-	-	703
HCM Lane V/C Ratio	0.035	0.001	-	-	0.004	-	-	0.017
HCM Ctrl Dly (s/v)	9.7	7.5	-	-	7.5	-	-	10.2
HCM Lane LOS	A	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	42	4	60	30	3	18	59	338	51	30	356	41
Future Vol, veh/h	42	4	60	30	3	18	59	338	51	30	356	41
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	0	-	0	0	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	85	85	85	89	89	89	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	50	5	71	35	4	21	66	380	57	38	445	51

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1034	1090	445	1035	1084	380	496	0	0	437	0	0
Stage 1	520	520	-	512	512	-	-	-	-	-	-	-
Stage 2	514	570	-	522	571	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	210	215	613	210	217	667	1068	-	-	1123	-	-
Stage 1	539	532	-	544	536	-	-	-	-	-	-	-
Stage 2	543	505	-	538	505	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	182	195	613	165	197	667	1068	-	-	1123	-	-
Mov Cap-2 Maneuver	182	195	-	165	197	-	-	-	-	-	-	-
Stage 1	521	514	-	511	503	-	-	-	-	-	-	-
Stage 2	490	474	-	455	488	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	20.45	24.46	1.13	0.58
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1068	-	-	182	541	165	497	1123	-	-
HCM Lane V/C Ratio	0.062	-	-	0.275	0.141	0.214	0.05	0.033	-	-
HCM Ctrl Dly (s/v)	8.6	-	-	32.2	12.7	32.8	12.6	8.3	-	-
HCM Lane LOS	A	-	-	D	B	D	B	A	-	-
HCM 95th %tile Q(veh)	0.2	-	-	1.1	0.5	0.8	0.2	0.1	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	7	1	444	452	0
Future Vol, veh/h	4	7	1	444	452	0
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	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	9	1	555	565	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1123	565	565	0	-	0
Stage 1	565	-	-	-	-	-
Stage 2	558	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	228	524	1007	-	-	-
Stage 1	569	-	-	-	-	-
Stage 2	573	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	227	524	1007	-	-	-
Mov Cap-2 Maneuver	227	-	-	-	-	-
Stage 1	568	-	-	-	-	-
Stage 2	573	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	15.54	0.02	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	4	-	355	-	-
HCM Lane V/C Ratio	0.001	-	0.039	-	-
HCM Ctrl Dly (s/v)	8.6	0	15.5	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Appendix E. Long-Term (2045) Traffic LOS Worksheets

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	180	0	0	240	4	0	1	0	1	1	1
Future Vol, veh/h	1	180	0	0	240	4	0	1	0	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	76	76	76	52	52	52	27	27	27
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	257	0	0	316	5	0	2	0	4	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	321	0	0	257	0	0	578	581	257	579	578	318
Stage 1	-	-	-	-	-	-	260	260	-	318	318	-
Stage 2	-	-	-	-	-	-	318	321	-	261	260	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1239	-	-	1308	-	-	427	425	781	426	427	722
Stage 1	-	-	-	-	-	-	745	693	-	693	653	-
Stage 2	-	-	-	-	-	-	694	652	-	744	693	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1239	-	-	1308	-	-	421	425	781	424	426	722
Mov Cap-2 Maneuver	-	-	-	-	-	-	421	425	-	424	426	-
Stage 1	-	-	-	-	-	-	744	692	-	693	653	-
Stage 2	-	-	-	-	-	-	686	652	-	741	692	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.04	0	13.52	12.48
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	425	1239	-	-	1308	-	-	492
HCM Lane V/C Ratio	0.005	0.001	-	-	-	-	-	0.023
HCM Ctrl Dly (s/v)	13.5	7.9	-	-	0	-	-	12.5
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	12.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	53	1	127	49	4	28	178	316	15	9	437	62
Future Vol, veh/h	53	1	127	49	4	28	178	316	15	9	437	62
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	0	-	0	0	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	87	87	87	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	75	1	179	56	5	32	200	355	17	10	491	70

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1269	1283	491	1267	1336	355	561	0	0	372	0	0
Stage 1	511	511	-	755	755	-	-	-	-	-	-	-
Stage 2	757	772	-	512	581	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	145	165	578	146	153	689	1010	-	-	1187	-	-
Stage 1	545	537	-	401	417	-	-	-	-	-	-	-
Stage 2	400	409	-	545	500	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	107	131	578	79	122	689	1010	-	-	1187	-	-
Mov Cap-2 Maneuver	107	131	-	79	122	-	-	-	-	-	-	-
Stage 1	541	532	-	321	334	-	-	-	-	-	-	-
Stage 2	301	328	-	372	495	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	37.77	79.54	3.3	0.14
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1010	-	-	107	563	79	436	1187	-	-
HCM Lane V/C Ratio	0.198	-	-	0.699	0.32	0.711	0.084	0.009	-	-
HCM Ctrl Dly (s/v)	9.4	-	-	94.3	14.4	122.3	14	8.1	-	-
HCM Lane LOS	A	-	-	F	B	F	B	A	-	-
HCM 95th %tile Q(veh)	0.7	-	-	3.7	1.4	3.4	0.3	0	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	0	0	509	613	0
Future Vol, veh/h	1	0	0	509	613	0
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	52	52	89	89	83	83
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	0	0	572	739	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1310	739	739	0	-	0
Stage 1	739	-	-	-	-	-
Stage 2	572	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	175	418	868	-	-	-
Stage 1	473	-	-	-	-	-
Stage 2	565	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	175	418	868	-	-	-
Mov Cap-2 Maneuver	175	-	-	-	-	-
Stage 1	473	-	-	-	-	-
Stage 2	565	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	25.76	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	868	-	175	-	-
HCM Lane V/C Ratio	-	-	0.011	-	-
HCM Ctrl Dly (s/v)	0	-	25.8	-	-
HCM Lane LOS	A	-	D	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	143	0	0	209	1	0	1	0	1	1	1
Future Vol, veh/h	1	143	0	0	209	1	0	1	0	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	90	90	90	65	65	65	27	27	27
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	168	0	0	232	1	0	2	0	4	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	233	0	0	168	0	0	405	404	168	404	403	233
Stage 1	-	-	-	-	-	-	171	171	-	233	233	-
Stage 2	-	-	-	-	-	-	234	233	-	171	171	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1334	-	-	1409	-	-	557	536	876	557	536	806
Stage 1	-	-	-	-	-	-	831	758	-	770	712	-
Stage 2	-	-	-	-	-	-	769	712	-	831	758	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1334	-	-	1409	-	-	550	535	876	555	535	806
Mov Cap-2 Maneuver	-	-	-	-	-	-	550	535	-	555	535	-
Stage 1	-	-	-	-	-	-	831	757	-	770	712	-
Stage 2	-	-	-	-	-	-	761	712	-	828	757	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.05	0	11.75	11
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	535	1334	-	-	1409	-	-	611
HCM Lane V/C Ratio	0.003	0.001	-	-	-	-	-	0.018
HCM Ctrl Dly (s/v)	11.7	7.7	-	-	0	-	-	11
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	9.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	55	1	85	30	3	18	146	392	51	30	509	61
Future Vol, veh/h	55	1	85	30	3	18	146	392	51	30	509	61
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	0	-	0	0	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	87	87	87	91	91	91	82	82	82
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	64	1	99	34	3	21	160	431	56	37	621	74

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1447	1502	621	1446	1520	431	695	0	0	487	0	0
Stage 1	694	694	-	752	752	-	-	-	-	-	-	-
Stage 2	753	808	-	694	768	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	109	122	488	109	119	625	901	-	-	1076	-	-
Stage 1	433	444	-	403	418	-	-	-	-	-	-	-
Stage 2	402	394	-	433	411	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	81	97	488	69	94	625	901	-	-	1076	-	-
Mov Cap-2 Maneuver	81	97	-	69	94	-	-	-	-	-	-	-
Stage 1	418	429	-	331	344	-	-	-	-	-	-	-
Stage 2	316	324	-	332	397	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	61.72	66.51	2.44	0.42
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	901	-	-	81	466	69	346	1076	-	-
HCM Lane V/C Ratio	0.178	-	-	0.786	0.215	0.503	0.07	0.034	-	-
HCM Ctrl Dly (s/v)	9.9	-	-	135	14.8	101.7	16.2	8.5	-	-
HCM Lane LOS	A	-	-	F	B	F	C	A	-	-
HCM 95th %tile Q(veh)	0.6	-	-	3.9	0.8	2	0.2	0.1	-	-

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	1	0	0	589	624	0
Future Vol, veh/h	1	0	0	589	624	0
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	42	42	82	82	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	0	0	718	657	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1375	657	657	0	-	0
Stage 1	657	-	-	-	-	-
Stage 2	718	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	160	465	931	-	-	-
Stage 1	516	-	-	-	-	-
Stage 2	483	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	160	465	931	-	-	-
Mov Cap-2 Maneuver	160	-	-	-	-	-
Stage 1	516	-	-	-	-	-
Stage 2	483	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	27.81	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	931	-	160	-	-
HCM Lane V/C Ratio	-	-	0.015	-	-
HCM Ctrl Dly (s/v)	0	-	27.8	-	-
HCM Lane LOS	A	-	D	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	180	5	21	249	4	2	1	6	1	1	1
Future Vol, veh/h	1	180	5	21	249	4	2	1	6	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	70	70	70	76	76	76	52	52	52	27	27	27
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	257	7	28	328	5	4	2	12	4	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	333	0	0	264	0	0	648	652	261	646	653	330
Stage 1	-	-	-	-	-	-	264	264	-	386	386	-
Stage 2	-	-	-	-	-	-	385	388	-	261	267	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1226	-	-	1300	-	-	383	387	778	384	387	711
Stage 1	-	-	-	-	-	-	742	690	-	638	610	-
Stage 2	-	-	-	-	-	-	638	609	-	744	688	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1226	-	-	1300	-	-	369	379	778	368	378	711
Mov Cap-2 Maneuver	-	-	-	-	-	-	369	379	-	368	378	-
Stage 1	-	-	-	-	-	-	741	690	-	624	597	-
Stage 2	-	-	-	-	-	-	618	596	-	730	687	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.04	0.6	11.51	13.33
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	571	1226	-	-	1300	-	-	443
HCM Lane V/C Ratio	0.03	0.001	-	-	0.021	-	-	0.025
HCM Ctrl Dly (s/v)	11.5	7.9	-	-	7.8	-	-	13.3
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0.1

Intersection	
Int Delay, s/veh	14.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	57	1	129	49	4	28	189	318	15	9	438	72
Future Vol, veh/h	57	1	129	49	4	28	189	318	15	9	438	72
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	0	-	0	0	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	71	71	71	87	87	87	89	89	89	89	89	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	80	1	182	56	5	32	212	357	17	10	492	81

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1297	1311	492	1295	1375	357	573	0	0	374	0	0
Stage 1	512	512	-	782	782	-	-	-	-	-	-	-
Stage 2	784	799	-	513	593	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	139	159	577	139	145	687	1000	-	-	1184	-	-
Stage 1	544	536	-	387	405	-	-	-	-	-	-	-
Stage 2	386	398	-	544	493	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	100	124	577	74	113	687	1000	-	-	1184	-	-
Mov Cap-2 Maneuver	100	124	-	74	113	-	-	-	-	-	-	-
Stage 1	540	532	-	305	319	-	-	-	-	-	-	-
Stage 2	286	313	-	368	489	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	46.29	90.61	3.46	0.14
HCM LOS	E	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1000	-	-	100	561	74	421	1184	-	-
HCM Lane V/C Ratio	0.212	-	-	0.802	0.326	0.763	0.087	0.009	-	-
HCM Ctrl Dly (s/v)	9.6	-	-	118.8	14.5	140.4	14.4	8.1	-	-
HCM Lane LOS	A	-	-	F	B	F	B	A	-	-
HCM 95th %tile Q(veh)	0.8	-	-	4.4	1.4	3.6	0.3	0	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	4	6	520	615	2
Future Vol, veh/h	3	4	6	520	615	2
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	52	52	89	89	83	83
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	6	8	7	584	741	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1340	742	743	0	-	0
Stage 1	742	-	-	-	-	-
Stage 2	598	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	168	416	864	-	-	-
Stage 1	471	-	-	-	-	-
Stage 2	549	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	166	416	864	-	-	-
Mov Cap-2 Maneuver	166	-	-	-	-	-
Stage 1	465	-	-	-	-	-
Stage 2	549	-	-	-	-	-

Approach	EB	NB	SB
HCM Ctrl Dly, s/v	20.02	0.1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	21	-	253	-	-
HCM Lane V/C Ratio	0.008	-	0.053	-	-
HCM Ctrl Dly (s/v)	9.2	0	20	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	143	2	10	213	1	8	1	19	1	1	1
Future Vol, veh/h	1	143	2	10	213	1	8	1	19	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	85	85	85	90	90	90	65	65	65	27	27	27
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	168	2	11	237	1	12	2	29	4	4	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	238	0	0	171	0	0	433	432	169	431	432	237
Stage 1	-	-	-	-	-	-	172	172	-	259	259	-
Stage 2	-	-	-	-	-	-	261	260	-	171	173	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1329	-	-	1407	-	-	533	517	875	535	516	802
Stage 1	-	-	-	-	-	-	830	757	-	745	693	-
Stage 2	-	-	-	-	-	-	744	693	-	831	756	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1329	-	-	1407	-	-	523	512	875	511	512	802
Mov Cap-2 Maneuver	-	-	-	-	-	-	523	512	-	511	512	-
Stage 1	-	-	-	-	-	-	829	756	-	739	688	-
Stage 2	-	-	-	-	-	-	731	687	-	800	755	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	0.05	0.34	10.33	11.31
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	718	1329	-	-	1407	-	-	581
HCM Lane V/C Ratio	0.06	0.001	-	-	0.008	-	-	0.019
HCM Ctrl Dly (s/v)	10.3	7.7	-	-	7.6	-	-	11.3
HCM Lane LOS	B	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	13.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	65	1	94	30	3	18	151	396	51	30	510	66
Future Vol, veh/h	65	1	94	30	3	18	151	396	51	30	510	66
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	0	-	-	0	-	0	0	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	87	87	87	91	91	91	82	82	82
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	76	1	109	34	3	21	166	435	56	37	622	80

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1464	1518	622	1463	1543	435	702	0	0	491	0	0
Stage 1	695	695	-	767	767	-	-	-	-	-	-	-
Stage 2	769	823	-	696	776	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	106	119	487	107	115	621	895	-	-	1072	-	-
Stage 1	432	444	-	395	411	-	-	-	-	-	-	-
Stage 2	394	388	-	432	408	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	78	94	487	64	90	621	895	-	-	1072	-	-
Mov Cap-2 Maneuver	78	94	-	64	90	-	-	-	-	-	-	-
Stage 1	418	429	-	322	335	-	-	-	-	-	-	-
Stage 2	307	316	-	323	394	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Ctrl Dly, s/v	83.68	73.03	2.51	0.42
HCM LOS	F	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	895	-	-	78	466	64	338	1072	-	-
HCM Lane V/C Ratio	0.185	-	-	0.963	0.237	0.536	0.071	0.034	-	-
HCM Ctrl Dly (s/v)	9.9	-	-	183.9	15.1	112.6	16.5	8.5	-	-
HCM Lane LOS	A	-	-	F	C	F	C	A	-	-
HCM 95th %tile Q(veh)	0.7	-	-	5.1	0.9	2.2	0.2	0.1	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	7	1	591	627	1
Future Vol, veh/h	4	7	1	591	627	1
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	42	42	82	82	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	17	1	721	660	1

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1384	661	661	0	-	0
Stage 1	661	-	-	-	-	-
Stage 2	723	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	158	463	927	-	-	-
Stage 1	514	-	-	-	-	-
Stage 2	480	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	158	463	927	-	-	-
Mov Cap-2 Maneuver	158	-	-	-	-	-
Stage 1	513	-	-	-	-	-
Stage 2	480	-	-	-	-	-

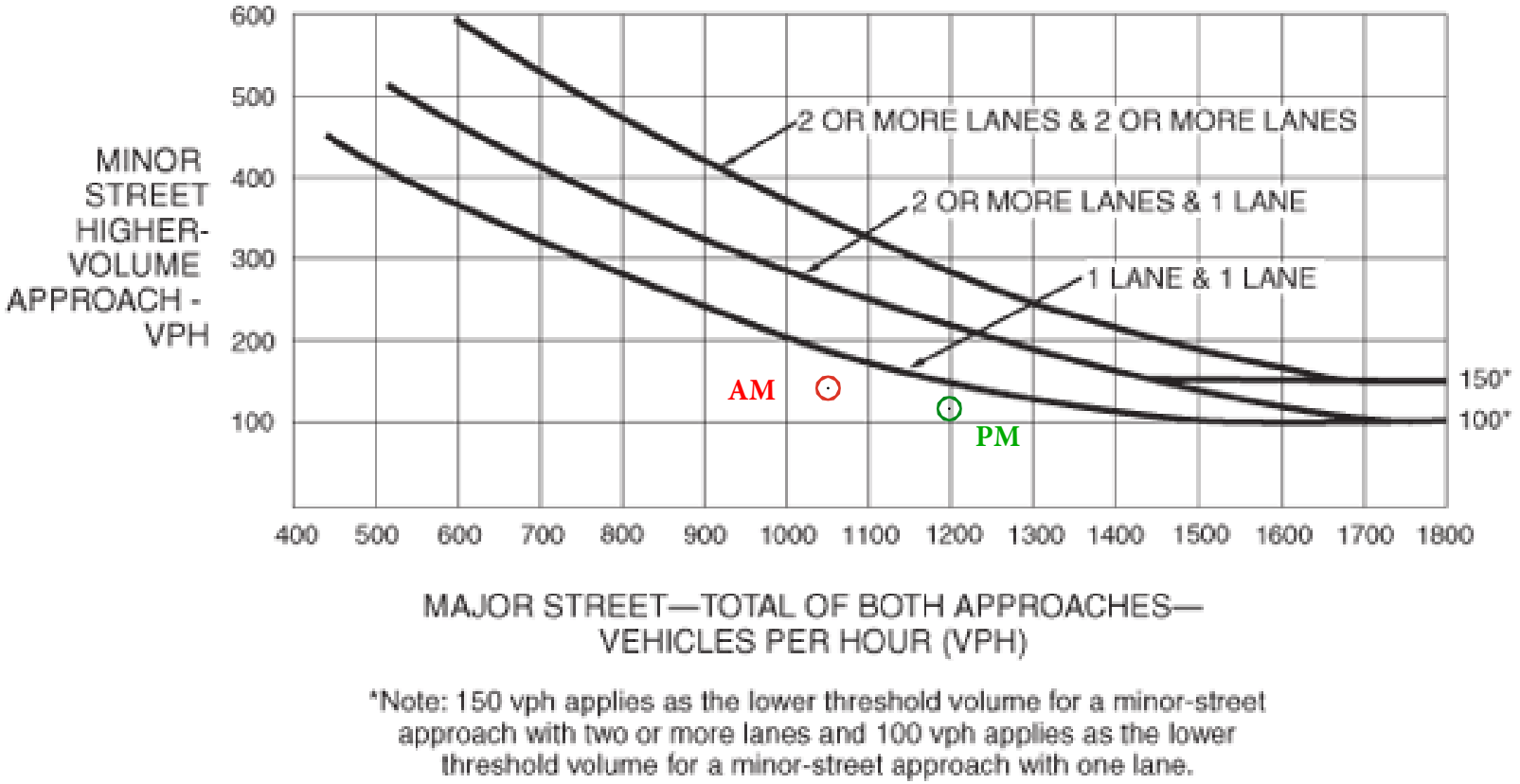
Approach	EB	NB	SB
HCM Ctrl Dly, s/v	19.65	0.02	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	3	-	272	-	-
HCM Lane V/C Ratio	0.001	-	0.096	-	-
HCM Ctrl Dly (s/v)	8.9	0	19.6	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.3	-	-

Appendix F. County Line Road/Telleen Avenue Long-Term (2045) Traffic Signal Warrant Assessment

Year 2045 Total Traffic Signal Warrant Assessment

Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

AM and PM peak hour minor street traffic values comprised of lefts turns, through movements, and 1/2 of the right turn movements (for greater of the EB and WB approaches, which in both peak hours is the EB approach).

Phase III Drainage Report

TOWN OF ERIE
POLICE DEPARTMENT
ADDITION & RENOVATION

Erie, Colorado

Prepared by:
Professional Engineering Consultants (PEC), P.A.

Prepared for:
Town of Erie

PEC PROJECT NO. 240667-000

AUG 2025

351 Linden Street, Suite 100 Fort Collins, CO 80524 970-232-9558 **www.pec1.com**

Engineer's Certification

I hereby certify that this Phase III drainage report for the design of the Town of Erie Police Department Addition & Renovation was prepared by me (or under my direct supervision) in accordance with the provisions of the *Town of Erie Standards and Specifications for Design and Construction* for the owners thereof. I understand that the Town of Erie does not and will not assume liability for drainage facilities designed by others, including the designs presented in this report.

_____

Registered Professional Engineer

State of Colorado No. _____

Town Acceptance

This report has been reviewed and found to be in general compliance with the Town of Erie Standards and Specifications for Design and Construction and other Town requirements. **THE ACCURACY AND VALIDITY OF THE ENGINEERING DESIGN, DETAILS, DIMENSIONS, QUANTITIES, AND CONCEPTS IN THIS REPORT REMAINS THE SOLE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON**.

Accepted by: _____ _____

Town Engineer or designee Date

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1.0 General Location and Description

This is the Phase III drainage report for the Erie Police Department Addition & Renovation located at 1000 Telleen Ave in Erie, Colorado. The project site is located at the southwest corner of Telleen Ave and County Line Rd and contains approximately 5.56 acres. The Erie PD property is located within the SE ¼ of the SE ¼ of Section 13, Township 1N, Range 69W of the 6th Principal Meridian. The Erie PD property was originally platted with the Creekside Subdivision in 2002 which included 56.14 acres. Figure 1-1 below shows the project location.

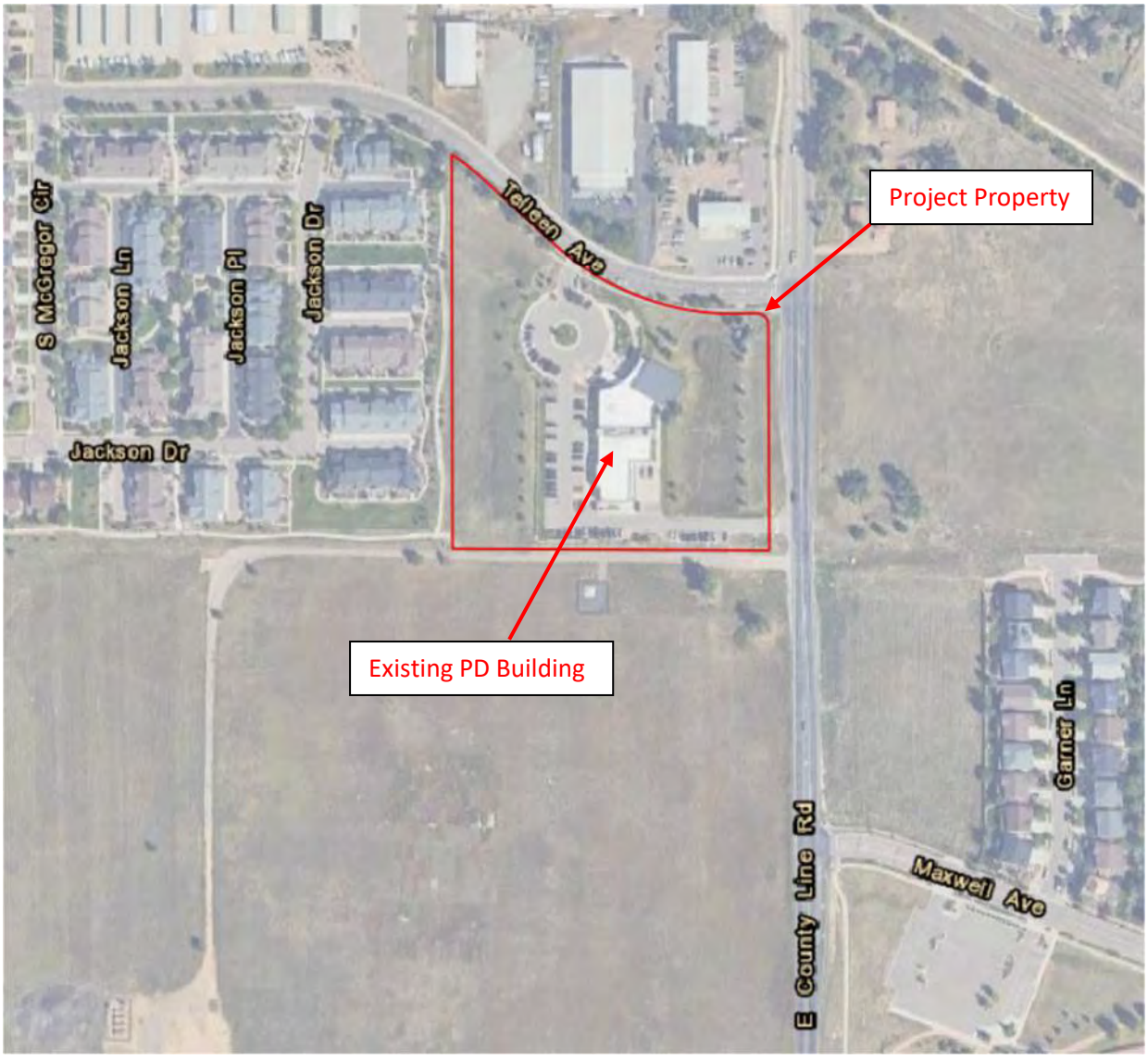


Figure 1-1 – Project location map

Adjacent to the property to the west is a medium density residential development called Creekside Townhomes (part of the Creekside Subdivision). Across the street to the north is a light industrial development called the Telleen Subdivision. Across County Line Rd to the East is a vacant 10.84-acre-lot that is currently under Town review to be included in the Erie Town Center planned development. Adjacent to the property to the south is another vacant lot that is another planned development called Ranchwood Town Center which also under Town review.

The Erie PD property contains an existing 17,971 square foot building and surrounding parking lot. To the east of the existing PD building is an existing 2.48 ac-ft subregional detention facility that serves the Erie PD property and a portion of the Creekside Subdivision to the west with an overall tributary area of approximately 23.12 acres. The existing detention facility is located in a drainage easement that was recorded with the original plat. Near the existing PD building, the ground cover includes pavement and landscape improvements. To the west of the parking lot and to the east of the building, the ground cover mostly includes native grasses with isolated trees from the original landscape improvements.

The building improvements include a complete renovation of the existing PD building and a new 32,000 square foot two-story building addition that will expand the building to the west. Overall, the combined square footage of the new building footprint will be approximately 35,200 whilst the total usable square footage is including both stories of the addition will be approximately 49,971 square feet. Except for a portion of the existing southern driveway, the site improvements include a completely new expanded parking lot that will be relocated farther to the west of the site. Overall, the new public parking lot to the northwest includes 56 parking spaces, and the new secure parking lot to the west and south includes 103 parking spaces. There are no irrigation facilities on or immediately near the property.

The drainage improvements for this project include a new underground storm sewer system (inlets and storm pipe) to convey roof drainage and surface runoff to the existing detention pond located on the east side of the building. It is the intent of this Phase III drainage report to demonstrate that the existing detention pond has adequate capacity for the full buildout of the improvements for this project. The only changes to the existing detention pond proposed is a reconstruction of the existing outlet structure to meet new water surface elevations (WSE's) for the Water Quality Capture Volume (WQCV), as well as 10-year and 100-year design storms.

2.0 Floodplain

The project is located in Zone X per FEMA FIRM 08013C0441J (eff. 12/18/2012). Zone X: areas of minimal flood hazard which are outside the special flood hazard area and above the 0.2% annual chance flood event. Figure 2-1 below shows the FEMA Flood Insurance Rate Map (FIRM) near the project location. Notably, the nearest FEMA-mapped floodway is Coal Creek which lies approximately 2/3 of a mile to the east. At its confluence with Erie Pkwy, the tributary area of Coal Creek is approximately 76.9 square miles. A copy of the FEMA FIRM near the project location is included in Appendix A.

Figure 2-1 – Existing floodplain near the project location

3.0 Drainage Design Criteria

The Town of Erie has established stormwater designs standards under the Town of Erie Engineering Standards & Specifications Section 800 *Storm Drainage Facilities* (updated January 2025). Per Section 800, the following design storms are regulated for *Public Building Areas*.

- Initial Storm: 5-year
- Major Storm: 100-year

The Town of Erie Engineering approves the use of the Colorado Urban Hydrograph Procedure (CUHP) for tributaries in excess of 90 acres. The CUHP Methodology utilizes 1-hour point rainfall depths in analysis. Due to the tributary area draining to the existing detention pond being only 23.12 acres another methodology is used for calculating peak flows within the tributaries sub-basins.

The Town of Erie approves use of the Rational Method for tributaries less than 90 acres when sizing storm sewer infrastructure. The Rational Method utilizes intensity-duration-frequency (IDF) curves with given values at 5-minute intervals to determine peak flows. Within Section 800 *Storm Drainage Facilities* Table 800-3 provides overall imperviousness percentages based on land use characteristics. Final runoff coefficients are determined from Volume 1 Chapter 6 *Runoff* from the Urban Storm Drainage Criteria Manual (USDCM). Per USDCM, runoff coefficients are calculated based on the percent impervious and the hydrologic soil group (HSG). Rainfall intensities for the project were referenced from NOAA Atlas 14.

The Town of Erie requires detention facilities to be sized in accordance with Section 814.09 *Minimum Detention Volume* when the overall tributary area is less than 90 acres. Per Section 814.09, the following equations are provided.

$V = KA$, (Equation 801)

For the 100-year storm event,
$K_{100} = (1.78I - 0.002I^2 - 3.56)/1000$ (Equation 802)

For the 10-year, storm event,

$K_{10} = (0.95I - 1.90)/1000$ (Equation 803)

Where V = required volume for the 100 or 10-year storm event (acre-feet),
I = Developed basin imperviousness (%)
A = Tributary area (Acres)

4.0 Background and Previous Studies

The Erie PD property was originally platted by Carroll & Lange in 2002 with the Creekside Subdivision (Lot 2, Block 9). The overall gross area of the subdivision (including right-of-way) was 56.14 acres which included 14.11 acres (87 lots) of single-family, 9.06 acres of medium density residential, 6.09 acres for commercial, and the remaining areas as right-of-way and tracts for open space and detention. Out of the 56.14 acres of the development, 23.12 acres were designed to be served by the detention pond which is now located on the PD property. This detention pond was referred to as Pond B in the Creekside Subdivision (Detention Basin 1056 in the Town of Erie Outfall Systems Planning) and was constructed with approximately 2.76 ac-ft of storage volume. The initial construction for the develpoment included full build-out of the single-family lots, leaving Lot 1 (future PD property) and Lot 2 (Creekside Townhomes) vacant for future construction. To convey runoff to the detention pond, an underground storm sewer system was constructed with the main line under Telleen Ave. Pipe diameters within Telleen Ave vary with the downstream system outfalling to the pond as 36" RCP.

In 2006, the Creekside Townhomes was platted on Lot 2 by Norris Design and was designed by JR Engineering. Within the 9.06-acre-area, a total of 97 units were constructed. Based on the best available record information, it does not appear that the Creekside Townhomes development constructed modifications to the existing detention pond.

In 2014, the original improvements for the Erie Police Department were constructed to finish the overall development within the Creekside Subdivision. The civil improvements were designed by Martin/Martin and included a minor reduction of volume in the detention pond. Per the 2012 Martin/Martin drainage report, the original detention pond design (performed by Carroll & Lange) assumed an overall imperviousness of 70% for the Erie PD property (Basin B-01, Carroll & Lange). Based on the original Erie PD site plan and the available space for development, it was determined by Martin/Martin that the Erie PD would not develop up to the original assumed 70% imperviousness. The total pond volume was reduced by 0.35 ac-ft to allow for grading of the existing building pad and southern driveway fill slope to extend slightly into the pond. Based on the topo survey prepared for this project, the overall imperviousness of the existing Erie PD site is 30.6%. Previous drainage maps and Martin/Martin existing EDB calculations are provided in Appendix G.

The Erie PD site is located west of Coal Creek and therefore included in the Erie Outfall System Plan (OSP) for tributary area west of Coal Creek developed by RESPEC in 2014. Within the OSP the Erie PD detention pond is represented by SWMM Junction Node 1056 within subbasin 468 and discharges to the first reach of named outfall alignment Briggs Street before discharging into coal creek. The only recommended improvements for Briggs Street Reach 1 are located south of the PD site in the form of planned regional detention for additional tributary area further south. Subbasin 468 at the time of study had an existing land use percent imperviousness of 33.9% and a future planned land use of 55.1% imperviousness.

5.0 Drainage Basins

5.1 Major Basin

The Erie PD property is tributary to Coal Creek which is approximately 2/3 of a mile to the east (as a crow flies). At its confluence with Erie Pkwy, the tributary area of Coal Creek is approximately 76.9 square miles, making it the largest primary drainage way in Erie, Colorado. Approximately 3 miles to the northwest (as a crow flies), Coal Creek discharges into Boulder Creek just outside the town limits. For reference, the tributary area of Boulder Creek and Coal Creek at the confluence is approximately 348 square miles and 80 square miles, respectively.

The general flow direction on the Erie PD property is from west to east where drainage enters the existing detention pond. Overall, existing slopes on the west side of the property are moderate (generally 10-20%). Runoff that enters the detention pond is controlled by an outfall structure at the northeast corner and discharges underground to an existing storm sewer under County Line Rd. Runoff under County Line Rd is conveyed approximately 550 ft to the north where the storm sewer outfalls to an existing open channel which parallels a spine trail on the south side. Runoff in this unnamed open channel is conveyed approximately 3,800 ft (along the thalweg) until it reaches Coal Creek on the north side of Erie Pkwy.

5.2 Minor Basins

Overall, drainage on the Erie PD property is generally limited to the site itself. A relatively small offsite area to the west (0.95 ac) drains onto the property from the Creekside Townhomes development and is mostly limited to the area around the local trail that parallels the property line. The proposed storm sewer system has been designed to account for the minor offsite flow from the west of the site. Minor subbasins within the property have been delineated with the naming convention “B-1” for consistency with previous drainage studies that include the site. Offsite areas to the west have been delineated with the naming convention “OS”. Table 5-1 below summarizes the existing and proposed imperviousness of the property. Total proposed imperviousness of the improvements to the Erie PD site bring the basin to an imperviousness percentage of 55.2% which is in very close proximity to the planned percent imperviousness of 55.1% for the entire subbasin 468 from the 2014 OSP prepared by RESPEC.

Table 5-1 – Impervious area calculations for the property

Imperviousness Summary	
Total Property Area	242,266 SF (5.56 ac)
Existing Imperviousness	74,198 SF (30.2%)
Proposed Imperviousness	132,105 SF (54.5%)
Overall Increase	+59,520 SF

The Web Soil Survey (WSS) map which is available through the Natural Resources Conservation Service (NRCS) indicates mostly HSG B soils on the project site with a small area shown as HSG A. Hydrologic calculations were performed assuming the entire site is HSG B to offer slightly more conservative runoff estimates. Due to the size of the subbasins, a minimum time of concentration of 5 minutes was used for all subbasins. The rainfall intensities referenced from NOAA Atlas 14 are included in Appendix C. An NRCS soils map is included in Appendix B. Table 5-2 below provides a subbasin runoff summary. The delineation of the proposed subbasins on the Erie PD property is included in Appendix D.

Table 5-2 – Subbasin runoff summary

Subbasin ID	Area (ac)	% Imp	C5	C100	Q5 (cfs)	Q100 (cfs)
B-1A	0.29	6.9%	0.05	0.46	0.06	1.43
B-1B	0.62	8.8%	0.06	0.47	0.17	3.09
B1-C	1.00	5.0%	0.03	0.45	0.15	4.83
B-1D	0.56	59.1%	0.48	0.70	1.19	4.19
B-1E	0.84	84.4%	0.71	0.82	2.64	7.40
B-1F	0.69	81.4%	0.68	0.80	2.08	5.95
B-1G	1.04	76.5%	0.64	0.78	2.92	8.68
B-1H	0.02	2.0%	0.01	0.44	0.00	0.10
B-1J	0.51	100.0%	0.86	0.89	1.91	4.84
OS-1	0.12	24.3%	0.18	0.54	0.10	0.68
OS-2	0.23	25.1%	0.19	0.54	0.19	1.34
OS-3	0.60	15.0%	0.11	0.50	0.29	3.19

6.0 Drainage Facility Design

6.1 Detention Analysis

The existing detention facility was analyzed to verify if any additional capacity is present based on the current Town of Erie standards presented in Section 800. The total offsite tributary area that drains to the existing detention pond was delineated based on the most recent available LiDAR survey to verify the overall subbasin area. Land use categories within the offsite area were assigned in accordance with Table 800-3, with the addition of a category for public open space/trails. Table 6-1 below summarizes the land use categories within the offsite area. Appendix E includes exhibits to show the offsite tributary area with LiDAR contours as well as the land cover uses that were assigned.

Table 6-1 – Tributary area summary

Land Cover	Area (ac)	% Imp
Streets	4.00	100.0%
Single-Family	4.60	45.0%
Multi-Unit (Townhomes)	7.65	75.0%
Open Space	1.93	15.0%
Offsite Total	**18.18**	**66.5%**
Erie PD Property	5.56	54.5%
Combined Area	**23.74**	**63.6%**

As shown above, the offsite tributary area to the existing detention pond is approximately 18.18 acres with an overall weighted imperviousness of 66.5%. For reference, the overall imperviousness of the tributary area draining to the detention pond assumed by Carroll & Lange was 67%. Table 800-3 from the Town of Erie does not have a category for multi-unit housing. Therefore, the impervious for the apartments category was selected. It's worth noting that the detention pond tributary area is slightly less than the total combined area shown above (23.74 ac) due to one subbasin that bypasses the pond due to topography (Subbasin B-1B, 0.62 ac). Previous comparison of the Erie PD site imperviousness presented in Section 4.0 Background and Previous studies of this report to the planned impervious of subbasin 468 in the Erie OSP prepared by RESPEC in 2014 was very similar, 54.5% to 55.1% respectively. Comparing the entire tributary area of the existing detention pond, a more representative comparison of planned imperviousness in subbasin 468 of the Erie OSP to the total proposed imperviousness of this basin after improvements to the Erie PD site recognizes a slight increase from 55.1% to 63.6% respectively.

Based on the combined area and weighted imperviousness shown above, Table 6-2 below summarizes the minimum detention volumes as calculated by Section 814.09.

Table 6-2 – Minimum detention volumes

Minimum Detention Volumes	
K_{10} (unitless)	0.0586
K_{100} (unitless)	0.1018
V_{10} (ac-ft)	1.391
V_{100} (ac-ft)	2.416
V_{10} (ft^3)	60,590
V_{100} (ft^3)	105,223

The minimum 100-year detention volume was calculated to be 105,223 ft^3 based on Equation 802. Based on the topographic survey prepared for this project with minor modification for access road regrading, the total pond volume between the lowest elevation and the invert of the existing spillway is 118,206 ft^3. The total pond volume was calculated from contour depth and area within Civil3D for a stage storage analysis utilizing the average end area method. Since the minimum 100-year detention volume is less than the actual detention volume of the existing pond after access road regrading, no additional pond volume is needed to accommodate the expansion of the Erie PD site. The existing detention pond was adequately sized to maintain the overall discharge rate of the development to the historic level. Therefore, the improvements for this project are not anticipated to create adverse impact to downstream properties or floodplain.

Due to the slight increase in overall imperviousness within the tributary area of the detention pond, improvements to the Erie PD site will include reconstruction of the ponds outlet structure to meet new WQCV, 10-year, and 100-year water surface elevations. Reference Appendix J for recalculation of water surface elevations for the WQCV, 10- and 100-year storm events as well as corresponding design of the outlet structures orifice plate, 10-year weir, 100-year overtopping grate, and outlet pipe restrictor plate.

The detention pond improvements will also feature a new forebay to be constructed at the outfall of Storm Sewer No.1 into the south end of the pond. The forebay volume was sized based on a minimum volume requirement equal to 1% of the WQCV draining to the forebay. With a minimum volume required of 20 ft^3 the forebay was designed to accommodate and a drain a larger volume equal to 50 ft^3 utilizing dimensions of 10’ x 10’ at half a foot in depth. The forebay notch was designed at 3” wide in order to drain the 50 ft^3 within 5 minutes per MHFD criteria. A riprap rundown was designed around the forebay and existing trickle channel to mitigate erosion from larger storms that overtop the depth of the forebay. Riprap rock sizing was based upon outlet velocities from Storm Sewer No.1, refer to Appendix F for riprap calculations.

6.2 Storm Sewer Analysis

Storm sewer sizing and inlet calculations were performed with SewerGEMS (CONNECT Edition, 10.04.00.158, 64-bit). The minor storm (5-year) and major storm (100-year) were modeled to demonstrate that the proposed storm sewer system is adequately sized to convey runoff to the existing detention pond. Two separate storm sewers are proposed for this project. One system to convey runoff from the staff parking lot (Storm Sewer No. 1) and another system to convey runoff from the public parking lot (Storm Sewer No. 2).

Storm Sewer No. 1 generally drains south to get around the building, and then heads east along the driveway before ultimately discharging runoff to the north at the southern end of the existing detention pond. Storm Sewer No. 2 generally drains to the northeast to connect to an existing storm pipe which connects to the offsite public storm line from Telleen Ave. SewerGEMS modeling data can be found in Appendix F which demonstrates both systems are adequately sized to convey the 100-year storm event without overtopping.

7.0 Summary

This Phase III drainage report has been prepared to demonstrate compliance with the Town of Erie stormwater standards. The building improvements include a renovation of the existing 17,791 square-foot building and a new 35,200 square-foot two-story addition. The site improvements include a new expanded public and staff parking lot to serve the facility. The Erie PD property is part of the Creekside Subdivision and includes a subregional detention facility that serves slightly less than half of the development. The existing detention facility is adequately sized for the overall development, and the existing outlet structure will be reconstructed to reflect new WQCV, 10- and 100-year water surface elevations proposed with this project.

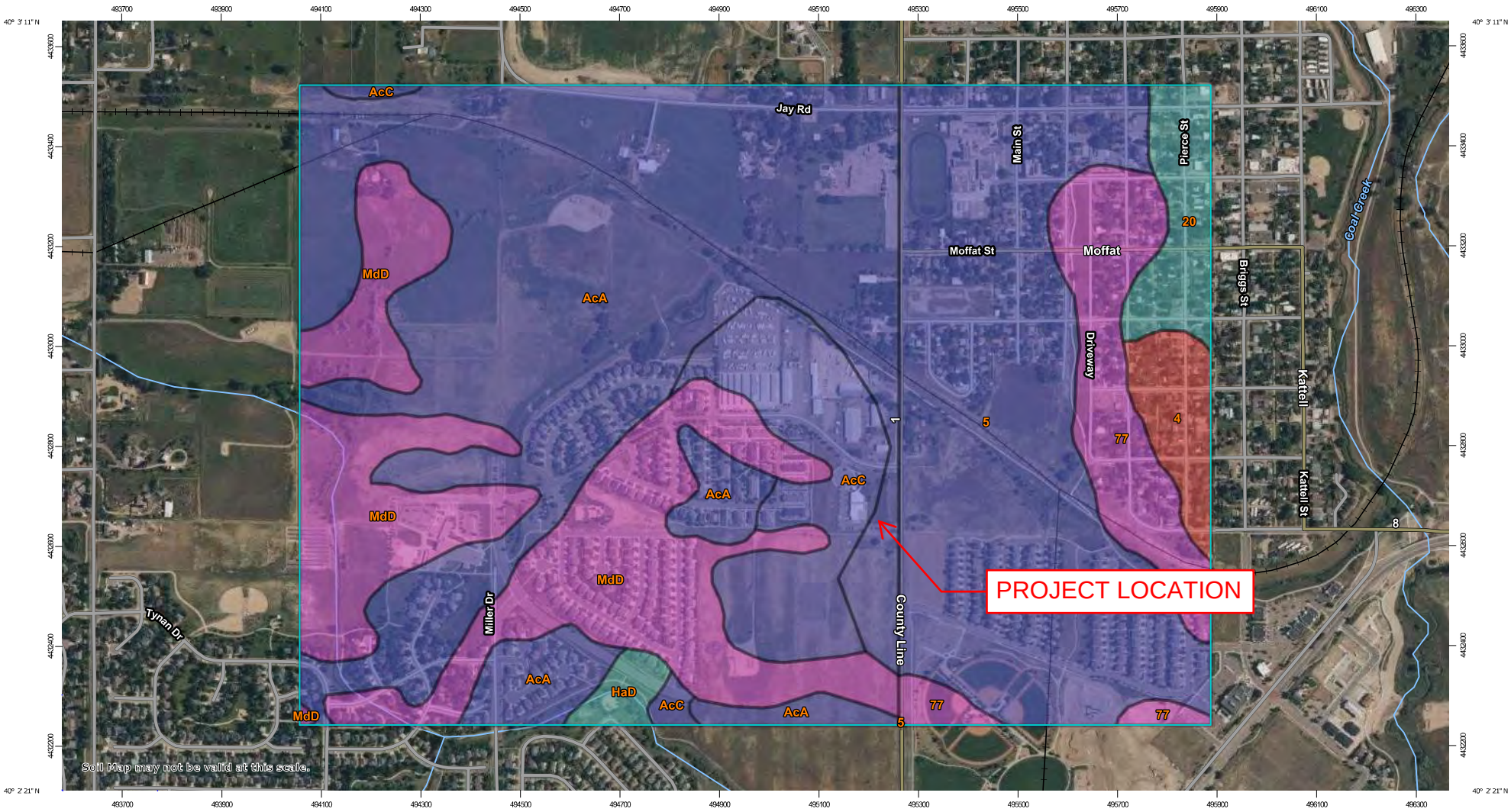
8.0 References

1. Town of Erie, “Engineering Standards & Specifications, Section 800 Storm Drainage Facilities,” (January 2025).
2. Carroll & Lange, “Final Drainage Study for Creekside Subdivision,” (July 2001).
3. Martin/Martin, “Phase III Drainage Report for Erie Police Station.” (September 2012).
4. Mile High Flood District, “Urban Storm Drainage Criteria Manual, Volume 1, Chapter 6 Runoff,” (March 2024).

Appendix A – FEMA FIRM

Appendix B – NRCS Soils Map

Hydrologic Soil Group—Boulder County Area, Colorado; and Weld County, Colorado, Southern Part
(Erie PD - Hydrologic Soil Groups)



Map Scale: 1:7,500 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 21, Sep 6, 2024

Soil Survey Area: Weld County, Colorado, Southern Part
Survey Area Data: Version 23, Aug 29, 2024

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 2, 2021—Aug 25, 2021

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AcA	Ascalon sandy loam, 0 to 3 percent slopes	B	223.6	38.5%
AcC	Ascalon sandy loam, 3 to 5 percent slopes	B	42.5	7.3%
HaD	Hargreave fine sandy loam, 3 to 9 percent slopes	C	4.8	0.8%
MdD	Manter sandy loam, 3 to 9 percent slopes	A	110.9	19.1%
Subtotals for Soil Survey Area			**381.8**	**65.7%**
Totals for Area of Interest			**581.1**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
4	Aquolls and Aquepts, flooded	D	12.2	2.1%
5	Ascalon sandy loam, 0 to 3 percent slopes	B	134.2	23.1%
20	Colombo clay loam, 1 to 3 percent slopes	C	15.8	2.7%
77	Vona sandy loam, 3 to 5 percent slopes	A	37.2	6.4%
Subtotals for Soil Survey Area			**199.3**	**34.3%**
Totals for Area of Interest			**581.1**	**100.0%**

Appendix C – NOAA Atlas 14 Rainfall

NOAA Atlas 14, Volume 8, Version 2
Location name: Erie, Colorado, USA*
Latitude: 40.0444°, Longitude: -105.0565°
Elevation: 5058 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**2.64** (2.06-3.40)	**3.24** (2.52-4.16)	**4.39** (3.41-5.66)	**5.52** (4.26-7.15)	**7.32** (5.58-10.2)	**8.92** (6.58-12.5)	**10.7** (7.61-15.3)	**12.7** (8.64-18.6)	**15.6** (10.2-23.5)	**17.9** (11.4-27.2)
10-min	**1.94** (1.51-2.49)	**2.37** (1.85-3.05)	**3.22** (2.49-4.15)	**4.04** (3.11-5.23)	**5.36** (4.09-7.45)	**6.53** (4.82-9.13)	**7.82** (5.57-11.2)	**9.27** (6.32-13.6)	**11.4** (7.46-17.2)	**13.1** (8.32-19.9)
15-min	**1.58** (1.23-2.02)	**1.93** (1.50-2.48)	**2.61** (2.03-3.37)	**3.28** (2.53-4.26)	**4.36** (3.32-6.06)	**5.31** (3.92-7.42)	**6.36** (4.53-9.12)	**7.54** (5.14-11.1)	**9.26** (6.06-14.0)	**10.7** (6.76-16.2)
30-min	**1.08** (0.844-1.39)	**1.32** (1.03-1.70)	**1.79** (1.38-2.30)	**2.24** (1.73-2.90)	**2.97** (2.26-4.13)	**3.62** (2.67-5.06)	**4.33** (3.08-6.21)	**5.13** (3.50-7.55)	**6.30** (4.13-9.53)	**7.27** (4.60-11.0)
60-min	**0.659** (0.514-0.847)	**0.812** (0.632-1.04)	**1.10** (0.857-1.42)	**1.39** (1.07-1.80)	**1.84** (1.40-2.55)	**2.24** (1.65-3.12)	**2.67** (1.90-3.83)	**3.16** (2.16-4.65)	**3.87** (2.53-5.85)	**4.46** (2.82-6.76)
2-hr	**0.389** (0.306-0.493)	**0.481** (0.379-0.611)	**0.658** (0.516-0.838)	**0.828** (0.646-1.06)	**1.10** (0.843-1.50)	**1.33** (0.992-1.84)	**1.59** (1.14-2.25)	**1.88** (1.29-2.72)	**2.30** (1.52-3.42)	**2.64** (1.69-3.95)
3-hr	**0.280** (0.222-0.352)	**0.348** (0.276-0.439)	**0.476** (0.376-0.603)	**0.599** (0.470-0.761)	**0.791** (0.611-1.07)	**0.958** (0.717-1.31)	**1.14** (0.824-1.60)	**1.34** (0.930-1.93)	**1.64** (1.09-2.42)	**1.88** (1.21-2.78)
6-hr	**0.167** (0.134-0.208)	**0.206** (0.165-0.257)	**0.279** (0.223-0.349)	**0.348** (0.276-0.437)	**0.454** (0.354-0.606)	**0.546** (0.413-0.734)	**0.646** (0.471-0.890)	**0.755** (0.528-1.07)	**0.913** (0.614-1.33)	**1.04** (0.678-1.52)
12-hr	**0.103** (0.084-0.127)	**0.126** (0.102-0.154)	**0.166** (0.134-0.205)	**0.204** (0.163-0.252)	**0.261** (0.205-0.342)	**0.310** (0.237-0.410)	**0.363** (0.268-0.493)	**0.421** (0.298-0.587)	**0.504** (0.342-0.723)	**0.572** (0.376-0.825)
24-hr	**0.062** (0.051-0.076)	**0.076** (0.062-0.093)	**0.101** (0.082-0.123)	**0.122** (0.099-0.150)	**0.154** (0.122-0.198)	**0.181** (0.139-0.235)	**0.209** (0.155-0.278)	**0.239** (0.170-0.326)	**0.280** (0.192-0.395)	**0.314** (0.209-0.446)
2-day	**0.035** (0.029-0.042)	**0.044** (0.037-0.053)	**0.059** (0.049-0.071)	**0.072** (0.059-0.087)	**0.090** (0.071-0.113)	**0.104** (0.080-0.132)	**0.118** (0.088-0.154)	**0.133** (0.095-0.178)	**0.153** (0.105-0.211)	**0.168** (0.113-0.236)
3-day	**0.026** (0.021-0.030)	**0.032** (0.026-0.038)	**0.042** (0.035-0.050)	**0.051** (0.042-0.061)	**0.063** (0.050-0.078)	**0.072** (0.056-0.091)	**0.082** (0.062-0.106)	**0.092** (0.066-0.122)	**0.105** (0.073-0.144)	**0.116** (0.078-0.161)
4-day	**0.020** (0.017-0.024)	**0.025** (0.021-0.030)	**0.032** (0.027-0.039)	**0.039** (0.032-0.046)	**0.048** (0.038-0.059)	**0.055** (0.043-0.069)	**0.062** (0.047-0.080)	**0.070** (0.051-0.093)	**0.080** (0.056-0.109)	**0.088** (0.060-0.122)

7-day	**0.013** (0.011-0.016)	**0.016** (0.013-0.019)	**0.020** (0.017-0.024)	**0.024** (0.020-0.028)	**0.029** (0.023-0.035)	**0.033** (0.026-0.041)	**0.037** (0.028-0.047)	**0.041** (0.030-0.054)	**0.047** (0.033-0.064)	**0.052** (0.036-0.071)
10-day	**0.010** (0.009-0.012)	**0.012** (0.010-0.014)	**0.015** (0.013-0.018)	**0.018** (0.015-0.021)	**0.021** (0.017-0.026)	**0.024** (0.019-0.030)	**0.027** (0.021-0.034)	**0.030** (0.022-0.039)	**0.034** (0.024-0.046)	**0.037** (0.026-0.051)
20-day	**0.007** (0.006-0.008)	**0.008** (0.006-0.009)	**0.009** (0.008-0.011)	**0.011** (0.009-0.012)	**0.013** (0.010-0.015)	**0.014** (0.011-0.017)	**0.016** (0.012-0.019)	**0.017** (0.013-0.022)	**0.019** (0.014-0.025)	**0.021** (0.014-0.028)
30-day	**0.005** (0.004-0.006)	**0.006** (0.005-0.007)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.010** (0.008-0.011)	**0.011** (0.009-0.013)	**0.012** (0.009-0.014)	**0.013** (0.009-0.016)	**0.014** (0.010-0.019)	**0.015** (0.011-0.020)
45-day	**0.004** (0.003-0.004)	**0.004** (0.004-0.005)	**0.006** (0.005-0.006)	**0.006** (0.005-0.007)	**0.007** (0.006-0.009)	**0.008** (0.007-0.010)	**0.009** (0.007-0.011)	**0.010** (0.007-0.012)	**0.011** (0.008-0.014)	**0.012** (0.008-0.015)
60-day	**0.003** (0.003-0.004)	**0.004** (0.003-0.004)	**0.005** (0.004-0.005)	**0.005** (0.005-0.006)	**0.006** (0.005-0.007)	**0.007** (0.006-0.008)	**0.008** (0.006-0.009)	**0.008** (0.006-0.010)	**0.009** (0.006-0.012)	**0.010** (0.007-0.013)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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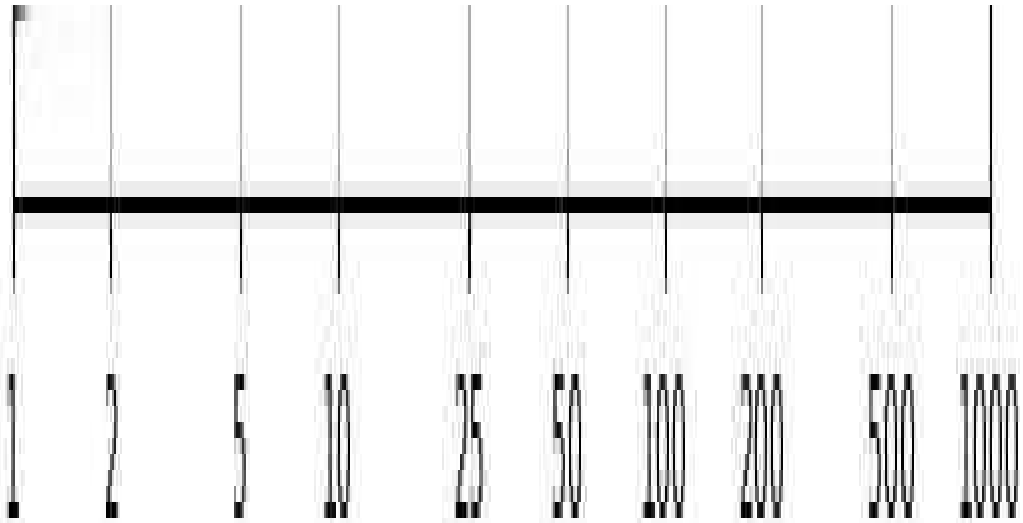
PF graphical



Average recurrence interval (years)

- 1
- 2
- 5
- 10
- 25
- 50
- 100
- 200
- 500
- 1000

Average recurrence interval (years)

Duration

- 5-min
- 10-min
- 15-min
- 30-min
- 60-min
- 2-hr
- 3-hr
- 6-hr
- 12-hr
- 24-hr
- 2-day
- 3-day
- 4-day
- 7-day
- 10-day
- 20-day
- 30-day
- 45-day
- 60-day

Average recurrence interval (years)

NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Wed Feb 5 17:31:31 2025

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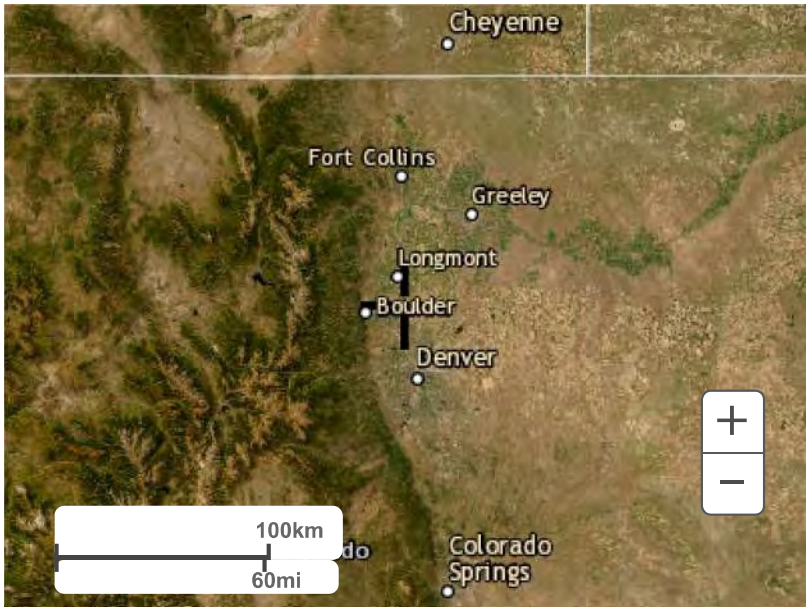
Maps & aerials

Small scale terrain

Large scale terrain

Large scale map

Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Appendix D – Proposed Subbasin Delineation

SUBBASIN RUNOFF SUMMARY

SUBBASIN	AREA (AC)	% IMPERVIOUS	C5	C100	Q5 (CFS)	Q100 (CFS)
B-1A	0.29	6.9%	0.05	0.46	0.06	1.43
B-1B	0.62	8.8%	0.06	0.47	0.17	3.09
B-1C	1.00	5.0%	0.03	0.45	0.15	4.83
B-1D	0.56	59.1%	0.48	0.70	1.19	4.19
B-1E	0.84	84.4%	0.71	0.82	2.64	7.40
B-1F	0.69	81.4%	0.68	0.80	2.08	5.95
B-1G	1.04	76.5%	0.64	0.78	2.92	8.68
B-1H	0.02	2.0%	0.01	0.44	0.00	0.10
B-1J	0.51	100.0%	0.86	0.89	1.91	4.84
OS-1	0.12	24.3%	0.18	0.54	0.10	0.68
OS-2	0.23	25.1%	0.19	0.54	0.19	1.34
OS-3	0.60	15.0%	0.11	0.50	0.29	3.19

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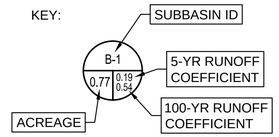


MAJOR SUBBASIN
MINOR SUBBASIN

DESIGN POINT RUNOFF SUMMARY

DESIGN POINT	CONTRIBUTING AREA	Q5 (CFS)	Q100 (CFS)
DP1	B-1A	0.06	1.43
DP2	B-1B	0.17	3.09
DP3	OS-1 + B-1G + B-1H	3.01	9.46
DP4	OS-2 + B-1F	2.27	7.29
DP5	DP4 + OS-3 + B-1E	5.20	17.88
DP6	DP5 + B-1D	6.39	22.06

0 20' 40' 80'

CREEKSIDE TOWNHOMES FILING NO. 2

JACKSON DR

TELLEEN AVE

COUNTY LINE RD

EX. DETENTION POND

CURB INLET

AREA INLET

36" RCP

24" RCP

24" PVC

18" RCP

SD

UTV

D2C ARCHITECTS

PEC
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
351 LINDEN ST, STE 100
FORT COLLINS, CO 80524
970-232-9558 www.pec1.com

MARK	DESCRIPTION	DATE	APPR

DESIGN BY: JBG	ISSUE DATE: MAY 16, 2025
D2C PROJECT NUMBER 202420	CONSULTANT'S PROJECT # 240667-000
DRAWN BY: JBG	CK'D BY: KJB
	SOLICITATION NO.:
SBMT BY: JBG	PLOT DATE: 2/17/2025 10:05:48 AM
	CONTRACT NO.:
PLOT SCALE: 1	FILE NUMBER:
SIZE: 22" x 34"	FILE NAME:

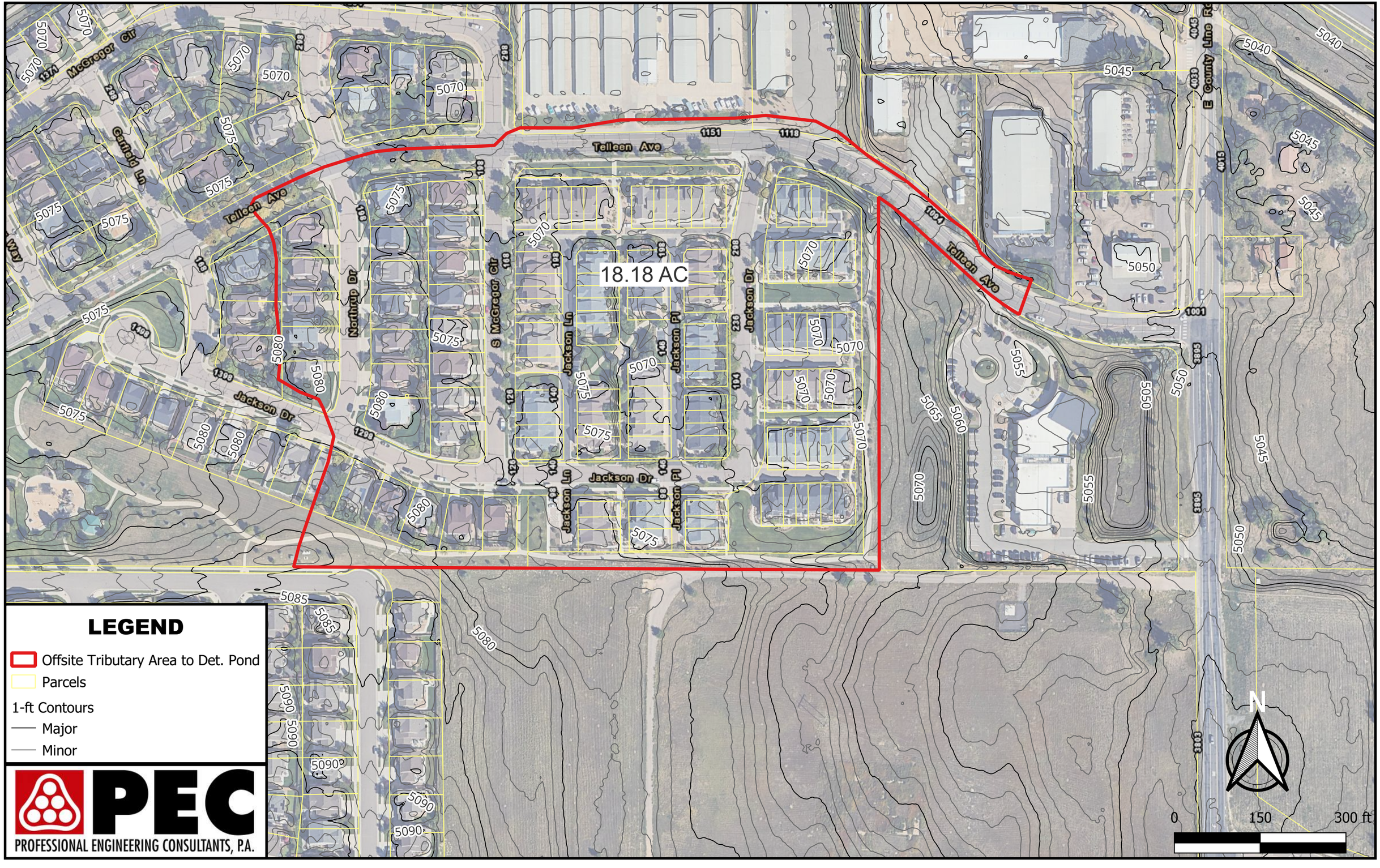
NOT FOR CONSTRUCTION

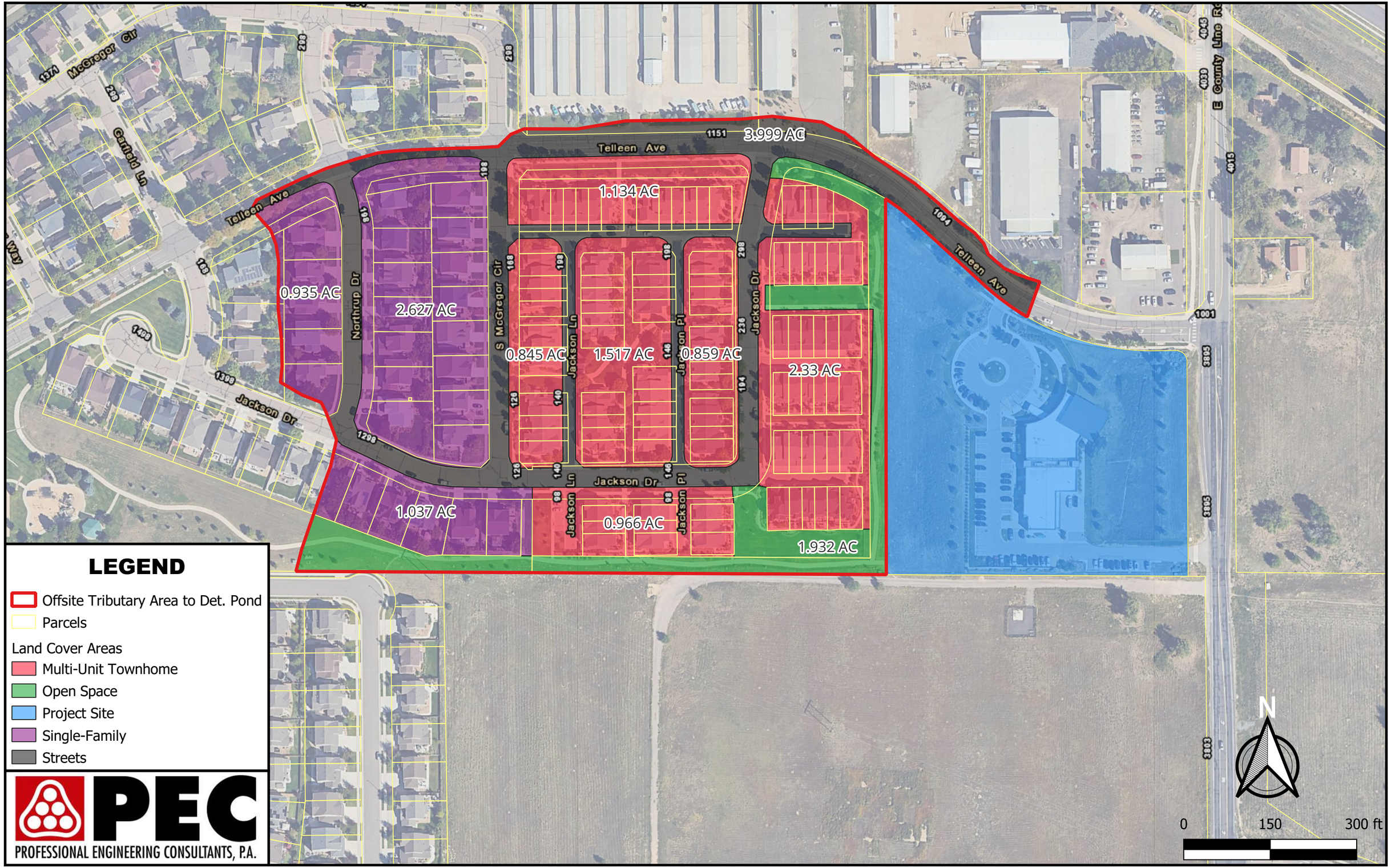
TOWN OF ERIE
ERIE PD - ADDITION & RENOVATION
1000 TELLEEN AVENUE, ERIE, COLORADO 80516

PROPOSED SUBBASIN DELINEATION

SHEET IDENTIFICATION
C1

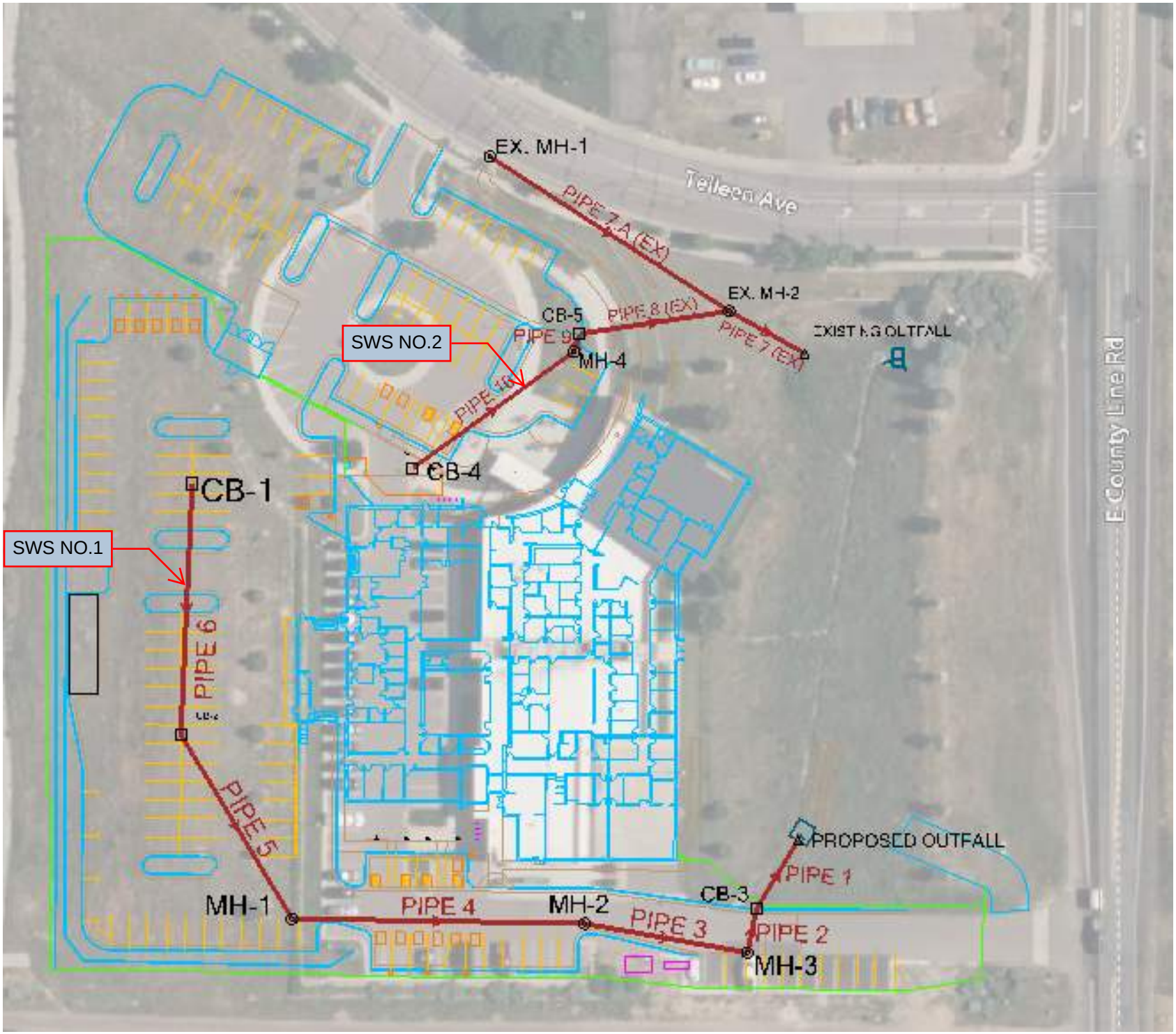
Appendix E – Offsite Tributary Area


18.18 AC
Telleen Ave
Jackson Dr
Jackson Ln
Jackson Pl
S McGregor Cir
Northrup Dr
McGregor Cir
Garfield Ln
E County Line Rd
LEGEND
Offsite Tributary Area to Det. Pond
Parcels
1-ft Contours
Major
Minor
PEC
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
N
0
150
300 ft

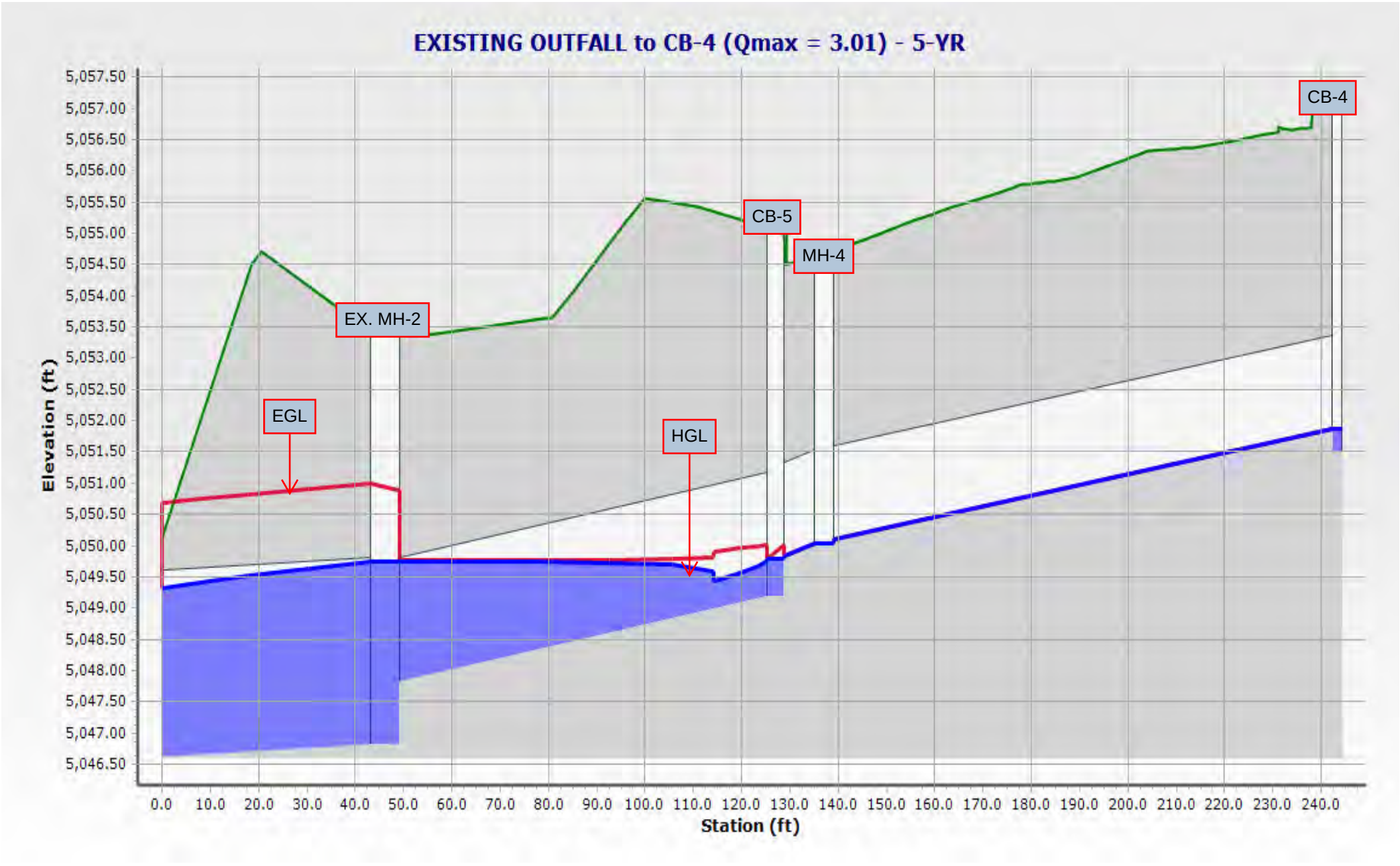

Telleen Ave
3.999 AC
1.134 AC
0.935 AC
2.627 AC
0.845 AC
1.517 AC
0.859 AC
2.33 AC
1.037 AC
0.966 AC
1.932 AC
S McGregor Cir
Northrup Dr
Jackson Ln
Jackson Pl
Jackson Dr
McGregor Cir
Garfield Ln
E County Line Rd
1151
1094
1001
1298
1399
1493
1374
LEGEND
Offsite Tributary Area to Det. Pond
Parcels
Land Cover Areas
Multi-Unit Townhome
Open Space
Project Site
Single-Family
Streets
PEC
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
N
0
150
300 ft

Appendix F – SewerGEMS Modeling Outputs & Riprap Calculation

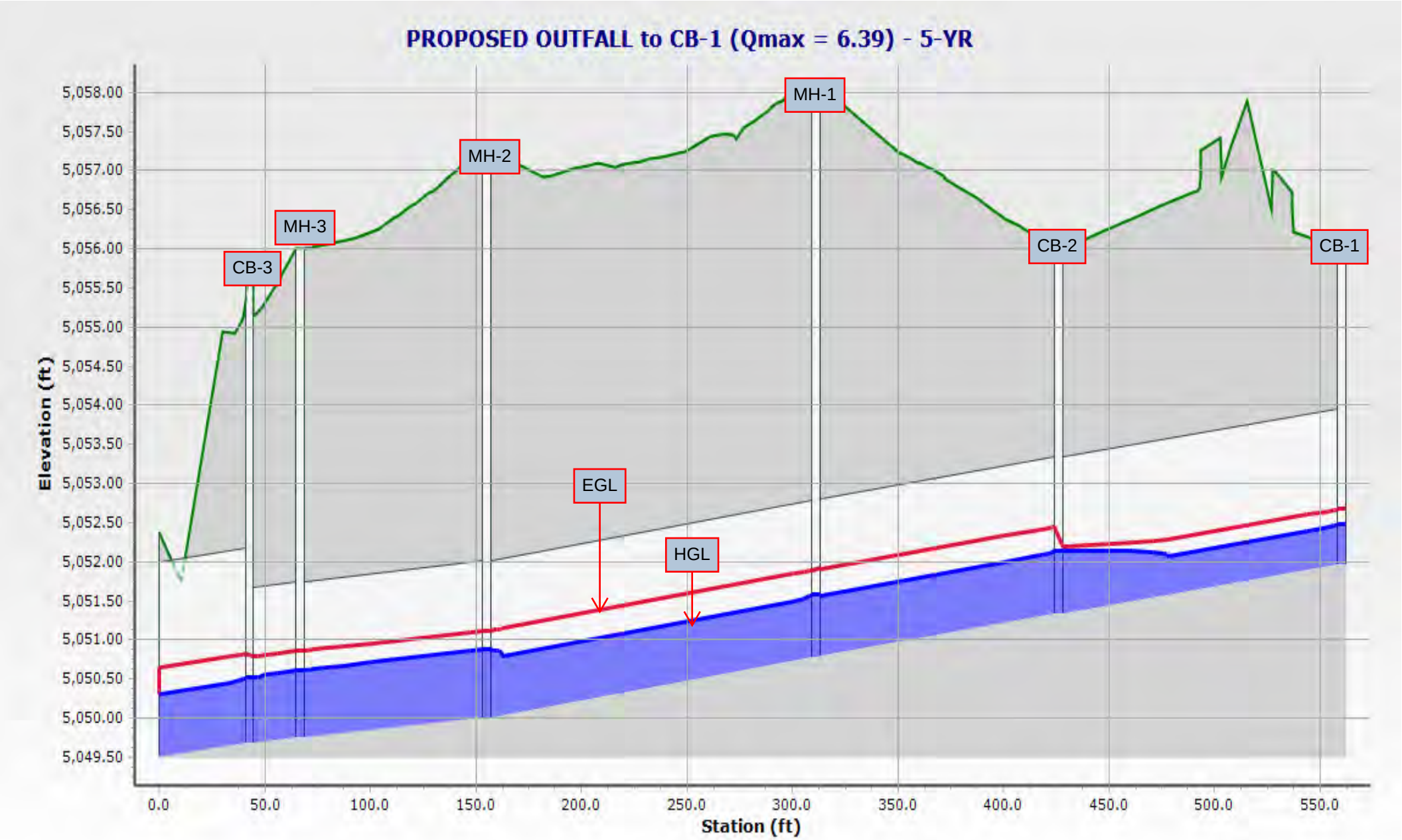
Erie Police Department - SewerGEMS Model Overview



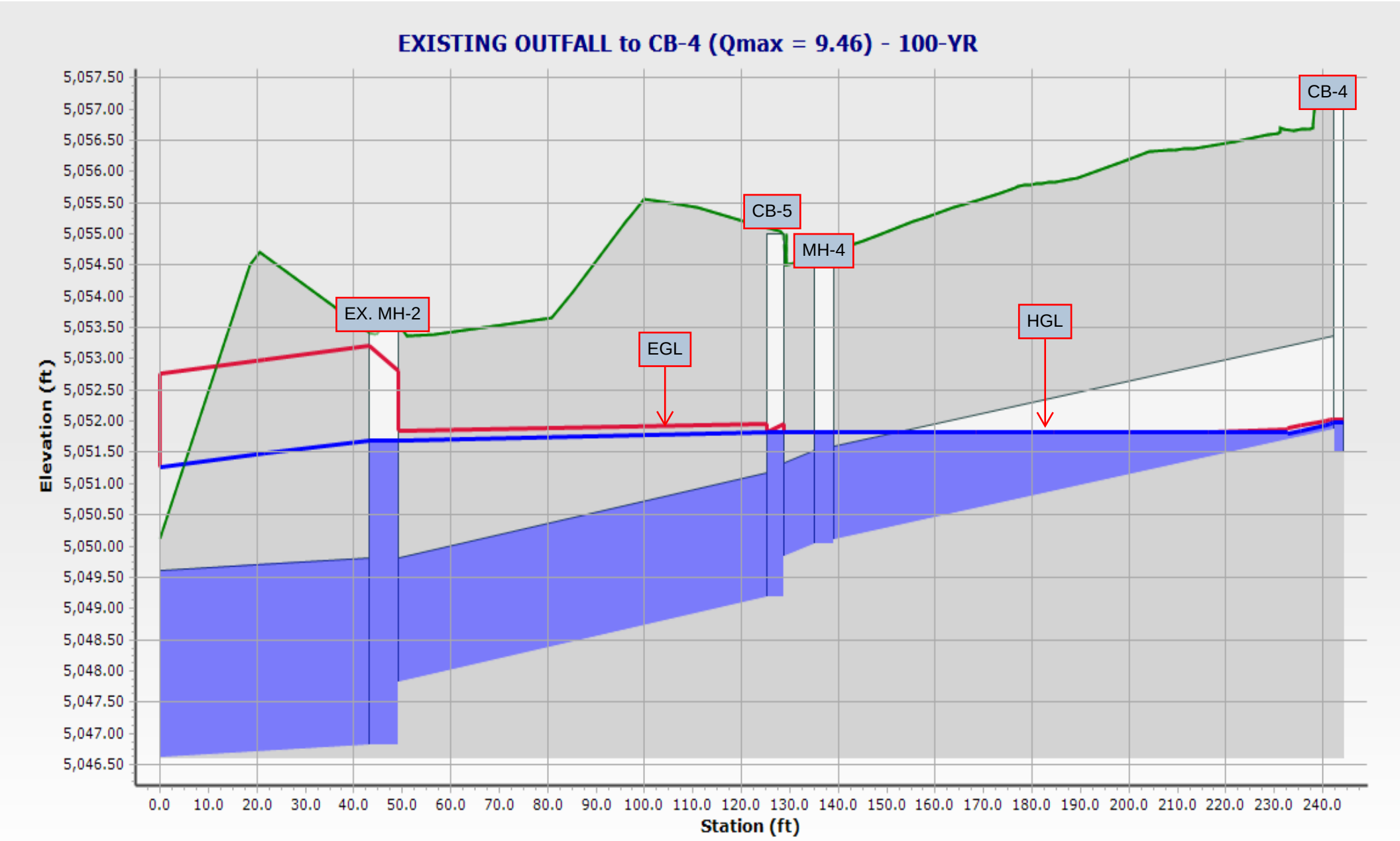
STORM SEWER NO.2, Tailwater = WQCV WSE @ 5049.32



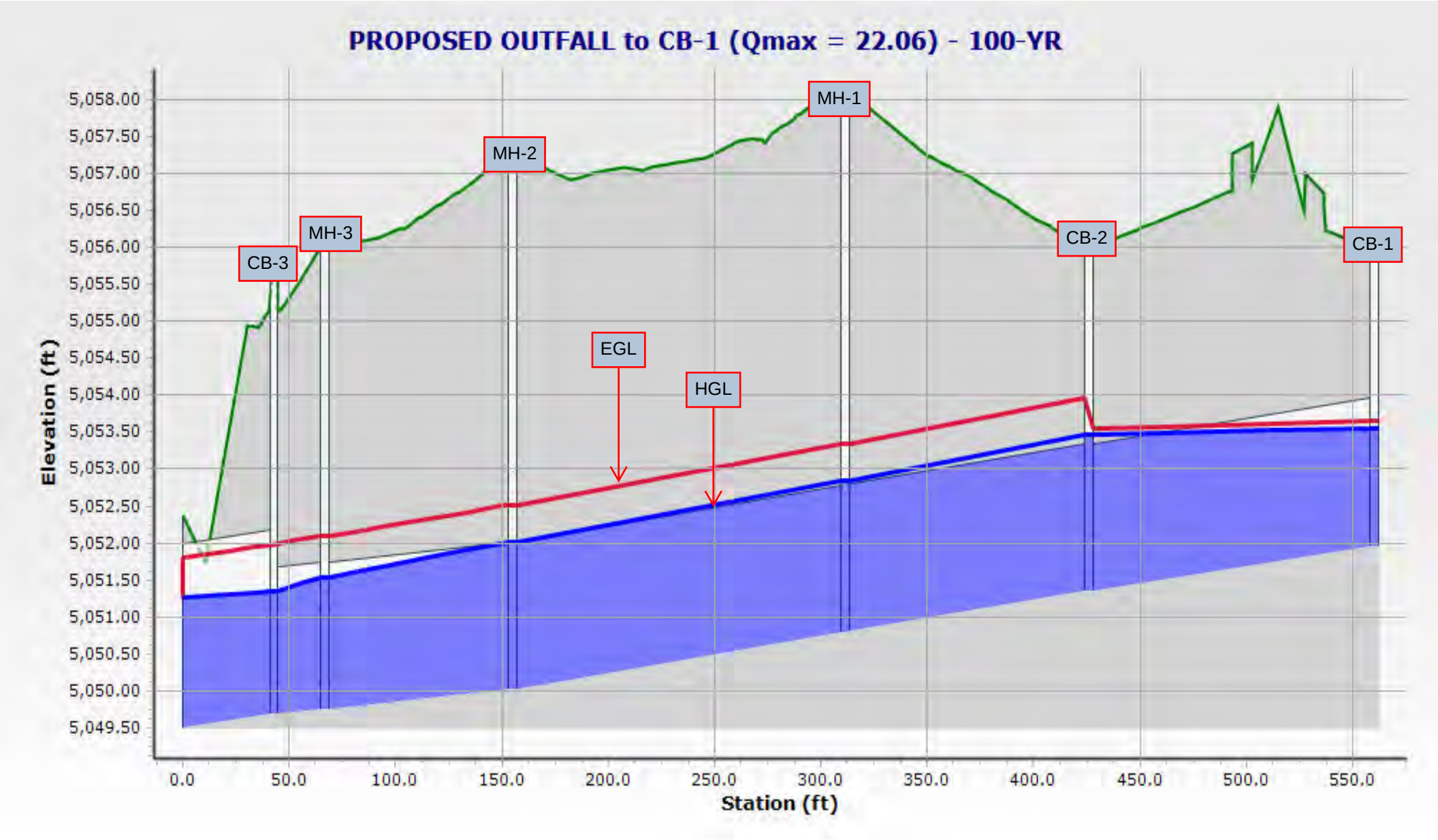
STORM SEWER NO.1, Tailwater = WQCV WSE @ 5049.32



STORM SEWER NO.2, Tailwater = 10-yr WSE @ 5051.26



STORM SEWER NO.1, Tailwater = 10-yr WSE @ 5051.26



5 - YR

FlexTable: Conduit Table

Label	Stop Node	Start Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
PIPE 1	PROPOSED OUTFALL	CB-3	5,049.68	5,049.50	42.6	0.004	30.0	0.012	6.39	4.73	5,050.52	5,050.30
PIPE 2	CB-3	MH-3	5,049.75	5,049.68	24.1	0.003	24.0	0.012	5.20	3.95	5,050.61	5,050.52
PIPE 3	MH-3	MH-2	5,050.01	5,049.75	88.3	0.003	24.0	0.012	5.20	3.97	5,050.88	5,050.61
PIPE 4	MH-2	MH-1	5,050.78	5,050.01	156.1	0.005	24.0	0.012	5.20	4.80	5,051.58	5,050.88
PIPE 5	MH-1	CB-2	5,051.34	5,050.80	114.9	0.005	24.0	0.012	5.20	4.71	5,052.14	5,051.56
PIPE 6	CB-2	CB-1	5,051.96	5,051.34	134.1	0.005	24.0	0.012	2.27	3.71	5,052.48	5,052.14
PIPE 7 (EX)	EXISTING OUTFALL	EX. MH-2	5,046.81	5,046.61	46.2	0.004	36.0	0.012	63.01	8.91	5,049.75	5,049.32
PIPE 7.A (EX)	EX. MH-2	EX. MH-1	5,047.71	5,046.81	152.1	0.006	36.0	0.012	60.00	8.49	5,050.74	5,049.75
PIPE 8 (EX)	EX. MH-2	CB-5	5,049.18	5,047.81	80.8	0.017	24.0	0.012	3.01	6.38	5,049.78	5,049.75
PIPE 9	CB-5	MH-4	5,050.04	5,049.83	10.0	0.020	18.0	0.012	0.00	0.00	5,050.04	5,049.83
PIPE 10	MH-4	CB-4	5,051.87	5,050.09	106.2	0.017	18.0	0.012	0.00	0.00	5,051.87	5,050.09

100 - YR

FlexTable: Conduit Table

Label	Stop Node	Start Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
PIPE 1	PROPOSED OUTFALL	CB-3	5,049.68	5,049.50	42.6	0.004	30.0	0.012	22.07	6.48	5,051.35	5,051.26
PIPE 2	CB-3	MH-3	5,049.75	5,049.68	24.1	0.003	24.0	0.012	17.88	5.69	5,051.53	5,051.35
PIPE 3	MH-3	MH-2	5,050.01	5,049.75	88.3	0.003	24.0	0.012	17.88	5.69	5,052.02	5,051.53
PIPE 4	MH-2	MH-1	5,050.78	5,050.01	156.1	0.005	24.0	0.012	17.88	5.69	5,052.85	5,052.02
PIPE 5	MH-1	CB-2	5,051.34	5,050.80	114.9	0.005	24.0	0.012	17.88	5.69	5,053.46	5,052.85
PIPE 6	CB-2	CB-1	5,051.96	5,051.34	134.1	0.005	24.0	0.012	7.29	5.13	5,053.54	5,053.46
PIPE 7 (EX)	EXISTING OUTFALL	EX. MH-2	5,046.81	5,046.61	46.2	0.004	36.0	0.012	69.56	9.84	5,051.70	5,051.27
PIPE 7.A (EX)	EX. MH-2	EX. MH-1	5,047.71	5,046.81	152.1	0.006	36.0	0.012	60.00	8.49	5,052.75	5,051.70
PIPE 8 (EX)	EX. MH-2	CB-5	5,049.18	5,047.81	80.8	0.017	24.0	0.012	9.56	3.04	5,051.82	5,051.70
PIPE 9	CB-5	MH-4	5,050.04	5,049.83	10.0	0.020	18.0	0.012	0.10	0.06	5,051.82	5,051.82
PIPE 10	MH-4	CB-4	5,051.87	5,050.09	106.2	0.017	18.0	0.012	0.10	2.39	5,051.99	5,051.82

5 - YR

FlexTable: Catch Basin Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Captured) (cfs)	Depth (Gutter) (in)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Is Overflowing?
CB-1	5,055.97	5,051.96	2.27	1.9	5,052.48	5,052.48	5,052.67	5,052.67	False
CB-2	5,056.01	5,051.34	2.93	2.0	5,052.14	5,052.14	5,052.20	5,052.45	False
CB-3	5,055.64	5,049.68	1.19	1.5	5,050.52	5,050.52	5,050.79	5,050.82	False
CB-4	5,057.11	5,051.51	0.00	0.0	5,051.87	5,051.87	5,051.87	5,051.87	False
CB-5	5,055.01	5,049.18	3.01	2.1	5,049.78	5,049.78	5,049.78	5,050.00	False

100 - YR

FlexTable: Catch Basin Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Captured) (cfs)	Depth (Gutter) (in)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Is Overflowing?
CB-1	5,055.97	5,051.96	7.29	2.9	5,053.54	5,053.54	5,053.66	5,053.66	False
CB-2	5,056.01	5,051.34	10.59	3.3	5,053.46	5,053.46	5,053.54	5,053.96	False
CB-3	5,055.64	5,049.68	4.19	2.3	5,051.35	5,051.35	5,051.98	5,051.97	False
CB-4	5,057.11	5,051.51	0.10	0.9	5,051.99	5,051.99	5,052.03	5,052.03	False
CB-5	5,055.01	5,049.18	9.46	3.2	5,051.82	5,051.82	5,051.82	5,051.97	False

5 - YR

FlexTable: Manhole Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Is Overflowing?
EX. MH-1	5,053.50	5,047.71	60.00	5,050.74	5,050.74	5,051.86	5,051.86	False
EX. MH-2	5,053.60	5,046.81	63.01	5,049.75	5,049.75	5,050.88	5,050.99	False
MH-1	5,057.96	5,050.78	5.20	5,051.58	5,051.58	5,051.93	5,051.89	False
MH-2	5,057.10	5,050.01	5.20	5,050.88	5,050.88	5,051.12	5,051.12	False
MH-3	5,056.01	5,049.75	5.20	5,050.61	5,050.61	5,050.86	5,050.86	False
MH-4	5,054.72	5,050.04	0.00	5,050.04	5,050.04	5,050.04	5,050.04	False

100 - YR

FlexTable: Manhole Table

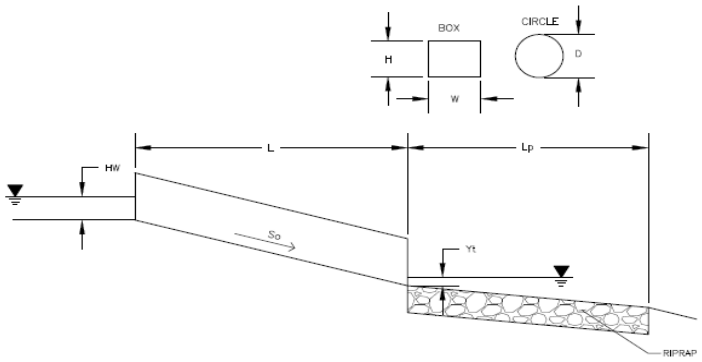
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Is Overflowing?
EX. MH-1	5,053.50	5,047.71	60.00	5,052.75	5,052.75	5,053.87	5,053.87	False
EX. MH-2	5,053.60	5,046.81	69.56	5,051.70	5,051.70	5,052.82	5,053.20	False
MH-1	5,057.96	5,050.78	17.88	5,052.85	5,052.85	5,053.35	5,053.35	False
MH-2	5,057.10	5,050.01	17.88	5,052.02	5,052.02	5,052.52	5,052.52	False
MH-3	5,056.01	5,049.75	17.88	5,051.53	5,051.53	5,052.10	5,052.10	False
MH-4	5,054.72	5,050.04	0.10	5,051.82	5,051.82	5,051.82	5,051.82	False

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **Erie PD**

ID: **Storm Sewer No.1 100-yr Discharge to Forebay - Tailwater @ 10-yr WSE**



Soil Type:

Choose One:

(●) Sandy

( ) Non-Sandy

Design Information:

Design Discharge	Q =	22.06	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	30	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge Projecting	
OR:		**OR**	
Box Culvert:			
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	5049.68	ft
Outlet Elevation **OR** Slope	Elev OUT =	5049.5	ft
Culvert Length	L =	42.6	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0.2	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =	5051.26	ft
Max Allowable Channel Velocity	V =	3	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	4.91	ft^2
Culvert Normal Depth	Y_n =	1.63	ft
Culvert Critical Depth	Y_c =	1.60	ft
Froude Number	Fr =	0.96	
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.33	
Sum of All Loss Coefficients	k_s =	1.73	ft
Headwater:			
Inlet Control Headwater	HW_I =	2.50	ft
Outlet Control Headwater	HW_O =	2.41	ft
Design Headwater Elevation	**HW =**	**5052.18**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.00**	
Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.23	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	1.76	ft
Tailwater/Diameter	Yt/D =	0.70	
Expansion Factor	1/(2*tan(Θ)) =	6.70	
Flow Area at Max Channel Velocity	A_t =	7.35	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	**L_p =**	**12**	**ft**
Width of Riprap Protection at Downstream End	**T =**	**5**	**ft**
Adjusted Diameter for Supercritical Flow	Da =	-	ft
Minimum Theoretical Riprap Size	d_{50} min=	2	in
Nominal Riprap Size	d_{50} nominal=	6	in
MHFD Riprap Type	**Type =**	**VL**	

Appendix G – Reference Drainage Maps & 2012 Martin/Martin Existing EDB Calculations

LEGEND

- MINOR BASIN BOUNDARY
- MAJOR BASIN BOUNDARY
- PROPOSED DRAINAGE BASIN (A=BASIN DESIGNATION, B=AREA IN ACRES, C=5-YEAR COEFFICIENT, D=100-YEAR COEFFICIENT)
- PROPOSED CONTOUR
- EXISTING CONTOUR
- DESIGN POINT
- PROPOSED FLOW DIRECTION

N

SCALE: 1" = 50'
ORIGINAL GRAPHIC SCALE

KEY MAP
1" = 500'

MATCHLINE SEE SHEET 1 OF 3

TELLEEN AVENUE

ERIE INDUSTRIAL EMPIRE VENTURE SUBDIVISION - BLOCK 1

TELLEEN SUBDIVISION

TRACT 'P'

LOT 2

LOT 1

FUTURE ROW

COUNTY LINE ROAD

POND B

B-02 (0.66 AC. | 0.88)

B-03 (1.04 AC. | 0.43 | 0.74)

C-01 (0.23 AC. | 0.88 | 0.93)

C-02 (0.31 AC. | 0.88 | 0.93)

B-01 (14.73 AC. | 0.65 | 0.80)

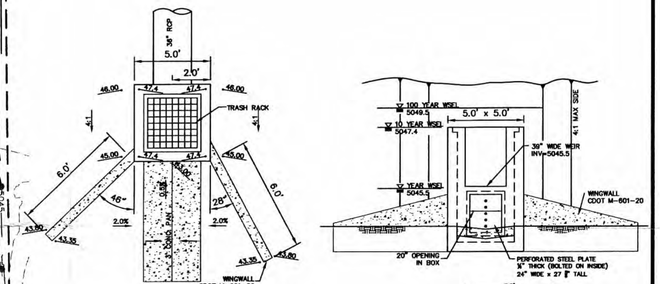
C-03 (1.47 AC. | 0.88 | 0.93)

24" RCP · 30" RCP · 36" RCP · 30" FES · 15" TYPE R INLET · 5'X5' OUTLET STRUCTURE · 3.0' CONCRETE PAN · FOREBAY · EX. BURIED RIP-RAP · PROPOSED TYPE 'L' SOILED RIP-RAP

50' GAS LINE EASEMENT
WESTERN GAS SUPPLY COMPANY
F. 1323, RECEP. NO. 649219

POWER LINE ESMT. ALONG SOUTH PROPERTY LINE
(EASEMENT NOT WITHIN PROPERTY)

UNPLATTED



BENCHMARK

SITE BENCHMARK SE CORNER SECTION 13, 3" BLM BRASS CAP MARKED AND STAMPED "1952" IN MONUMENT BOX. NGS PUBLISHED NGVD 1929 ELEVATION = 5047.51 FEET.

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

PREPARED UNDER THE DIRECT SUPERVISION OF

FOR AND ON BEHALF OF CARROLL & LANGE, INC.

No.	Revisions	Date	By	Chk
9				
8				
7				
6				
5	PER CITY COMMENTS	11/01	TCJ	
4	PER CITY COMMENTS	7/16/01	TCJ	
3	PER CITY COMMENTS	02/01	TCJ	
2	ADD DETENTION PONDS	01/01	TCJ	
1	PER CITY COMMENTS	11/00	SZ	

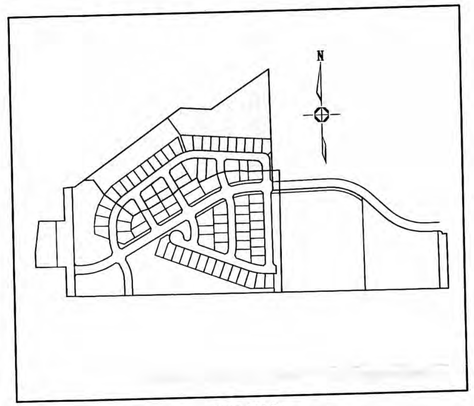
SEE MASTER REVISION/TRACKING TABULATION

Carroll & Lange inc
Professional Engineers & Land Surveyors
165 South Union Blvd., Suite 156
Lakewood, Colorado 80228
(303) 980-0200

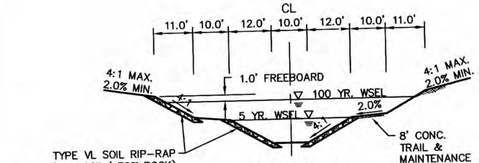
PRINTED NOV 13 2003

Project:	CREEKSIDE SUBDIVISION
Title:	DRAINAGE PLAN
Designed By: SZ	Scale: 1" = 50'
Drawn By: MJ	
Checked By:	Date: JULY, 2000

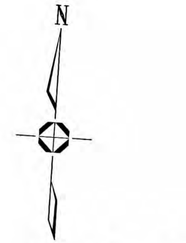
Sheet 3 of 3
Job No. 1964
File No. 1964DR3



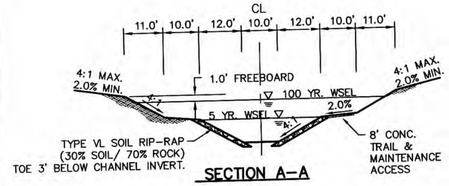
KEY MAP
1" = 500'



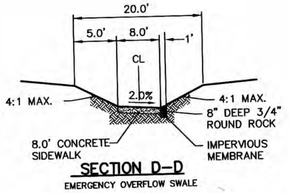
SECTION B-B
STA. 19+33.49 TO STA. 14+91.25



SCALE: 1" = 50'
ORIGINAL GRAPHIC SCALE



SECTION A-A



SECTION D-D
EMERGENCY OVERFLOW SWALE

BENCHMARK
SITE BENCHMARK SE CORNER SECTION 13, 3" BLM BRASS CAP MARKED AND STAMPED "1952" IN MONUMENT BOX. NGS PUBLISHED NGVD 1929 ELEVATION = 5047.51 FEET.

LEGEND

- MINOR BASIN BOUNDARY
- MAJOR BASIN BOUNDARY
- PROPOSED DRAINAGE BASIN (A=BASIN DESIGNATION, B=AREA IN ACRES, C=5-YEAR COEFFICIENT, D=100-YEAR COEFFICIENT)
- PROPOSED CONTOUR (5224)
- EXISTING CONTOUR (5224)
- DESIGN POINT (1)
- FLOW DIRECTION ARROW

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

PREPARED UNDER THE DIRECT SUPERVISION OF

FOR AND ON BEHALF OF CARROLL & LANGE, INC.

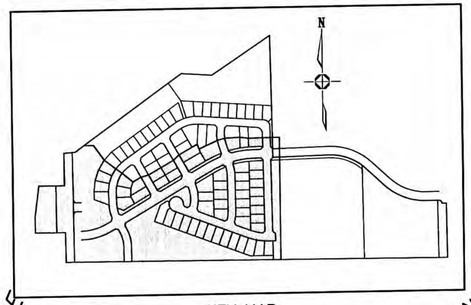
No.	Revisions	Date	By	Chk
9				
8				
7				
6	PER CITY COMMENTS	02/02	TCJ	
5	PER CITY COMMENTS	11/01	TCJ	
4	PER CITY COMMENTS	7/16/01	TCJ	
3	REINSERT CHANNEL	02/28	TCJ	
2	PER CITY COMMENTS	02/01	TCJ	
1	PER CITY COMMENTS	11/00	SZ	

SEE MASTER REVISION/TRACKING TABULATION

Carroll & Lange inc
Professional Engineers & Land Surveyors
165 South Union Blvd., Suite 156
Lakewood, Colorado 80228
(303) 980-0200

PRINTED NOV 13 2003

Project: CREEKSIDE SUBDIVISION
Title: DRAINAGE PLAN
Designed By: SZ
Drawn By: MJ
Checked By:
Scale: 1" = 50'
Date: JULY, 2000
Sheet 2 of 3
Job No. 1964
File No. 1964DR2



MATCHLINE SEE SHEET 2 OF 3

MATCHLINE SEE SHEET 3 OF 3

OFFSITE BASIN OS-2 DETERMINED FROM MASTER STUDY TOPO

GARFIELD LANE

McGREGOR CIRCLE

LISTER WAY

TELLEEN AVENUE

NORTHRUP DRIVE

JACKSON DRIVE

JASPER ROAD

JASPER ROAD 120' ROW

TRACT 'C'

TRACT 'D'

TRACT 'E'

TRACT 'F'

TRACT 'G'

TRACT 'K'

TRACT 'O'

TYPE 'L' RIP-RAP FOR 6'

TYPE 'L' RIPRAP

24" RCP

15" TYPE R INLET

30" FES

54' ROW

32' FL

75' WESTERN AREA POWER ELECTRIC EASEMENT BK. 865, PG. 300

SUNWEST NORTH
GRADING BY OTHERS

OS-1	0.57 AC.	0.88 / 0.93
OS-2	26.6 AC.	0.01 / 0.20
OS-3	0.44 AC.	0.88 / 0.93
OS-4	0.80 AC.	0.88 / 0.93
A-1	0.51 AC.	0.88 / 0.93
A-2	0.23 AC.	0.88 / 0.93
A-3	0.18 AC.	0.88 / 0.93
A-4	0.91 AC.	0.10 / 0.60
A-5	0.20 AC.	0.88 / 0.93
A-6	0.66 AC.	0.88 / 0.93
A-7	1.34 AC.	0.45 / 0.60
A-8	0.29 AC.	0.10 / 0.60
A-9	0.87 AC.	0.45 / 0.60
A-10	0.27 AC.	0.45 / 0.60
A-17	0.91 AC.	0.45 / 0.60
A-18	0.95 AC.	0.45 / 0.60
A-19	0.94 AC.	0.45 / 0.60
A-20	1.02 AC.	0.45 / 0.60
A-21	0.97 AC.	0.45 / 0.60
A-23	0.63 AC.	0.45 / 0.60
A-24	0.68 AC.	0.45 / 0.60
A-26	0.45 AC.	0.45 / 0.60
A-27	0.22 AC.	0.88 / 0.93
A-28	0.74 AC.	0.45 / 0.60
A-32	3.68 AC.	0.13 / 0.60
A-33	0.47 AC.	0.10 / 0.60
A-34	7.88 AC.	0.15 / 0.60
B-4	0.41 AC.	0.10 / 0.60
B-5	0.39 AC.	0.88 / 0.93
B-6	1.67 AC.	0.45 / 0.60
B-7	1.54 AC.	0.45 / 0.60
B-8	1.13 AC.	0.45 / 0.60
B-9	1.52 AC.	0.45 / 0.60

N

SCALE: 1" = 50'
ORIGINAL GRAPHIC SCALE

LEGEND

- MINOR BASIN BOUNDARY
- MAJOR BASIN BOUNDARY
- PROPOSED DRAINAGE BASIN (A=BASIN DESIGNATION, B=AREA IN ACRES, C=5-YEAR COEFFICIENT, D=100-YEAR COEFFICIENT)
- PROPOSED CONTOUR
- EXISTING CONTOUR
- DESIGN POINT
- FLOW DIRECTION ARROW

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

BENCHMARK

SITE BENCHMARK SE CORNER SECTION 13, 3" BLM BRASS CAP MARKED AND STAMPED "1952" IN MONUMENT BOX. NGS PUBLISHED NGVD 1929 ELEVATION = 5047.51 FEET. ELEVATION WAS ESTABLISHED BY DIFFERENTIAL LEVELING METHODS WITH MIS-CLOSURES MEETING OR EXCEEDING SECOND ORDER, CLASS II STANDARDS. THE PRIMARY BENCH MARK USED TO ESTABLISH THIS ELEVATION IS NGS BENCH MARK JR 53 5026, A STANDARD 3 1/2" USGS BRONZE DISK STAMPED "JR 53 5026 1948" SET IN TOP OF A CONCRETE POST. NGS PUBLISHED NGVD 1929 ELEVATION = 5024.957 FEET.

PREPARED UNDER THE DIRECT SUPERVISION OF

FOR AND ON BEHALF OF CARROLL & LANGE, INC.

No.	Revisions	Date	By	Chk
9				
8				
7				
6	PER CITY COMMENTS	02/02	TCJ	
5	PER CITY COMMENTS	11/01	TCJ	
4	PER CITY COMMENTS	7/16/01	TCJ	
3	REINSERT CHANNEL	02/28	TCJ	
2	PER CITY COMMENTS	02/01	TCJ	
1	PER CITY COMMENTS	11/00	SZ	

SEE MASTER REVISION/TRACKING TABULATION

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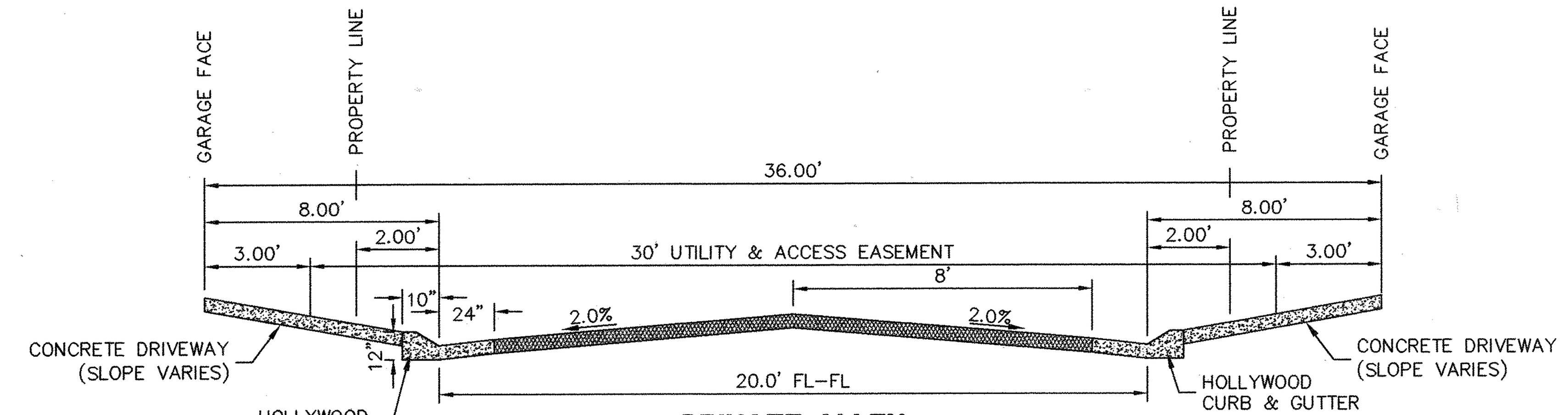
Professional Engineers & Land Surveyors
165 South Union Blvd., Suite 156
Lakewood, Colorado 80228
(303) 980-0200

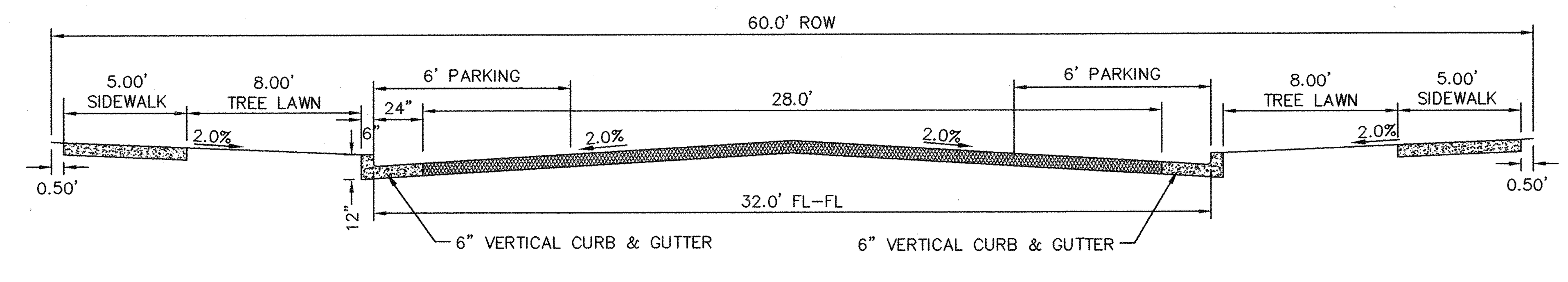
PRINTED NOV 13 2003

Project: CREEKSIDE SUBDIVISION
Title: DRAINAGE PLAN
Designed By: SZ
Drawn By: MJ
Checked By:
Scale: 1" = 50'
Date: JULY, 2000
Sheet 1 of 3
Job No. 1964
File No. 1964DR1

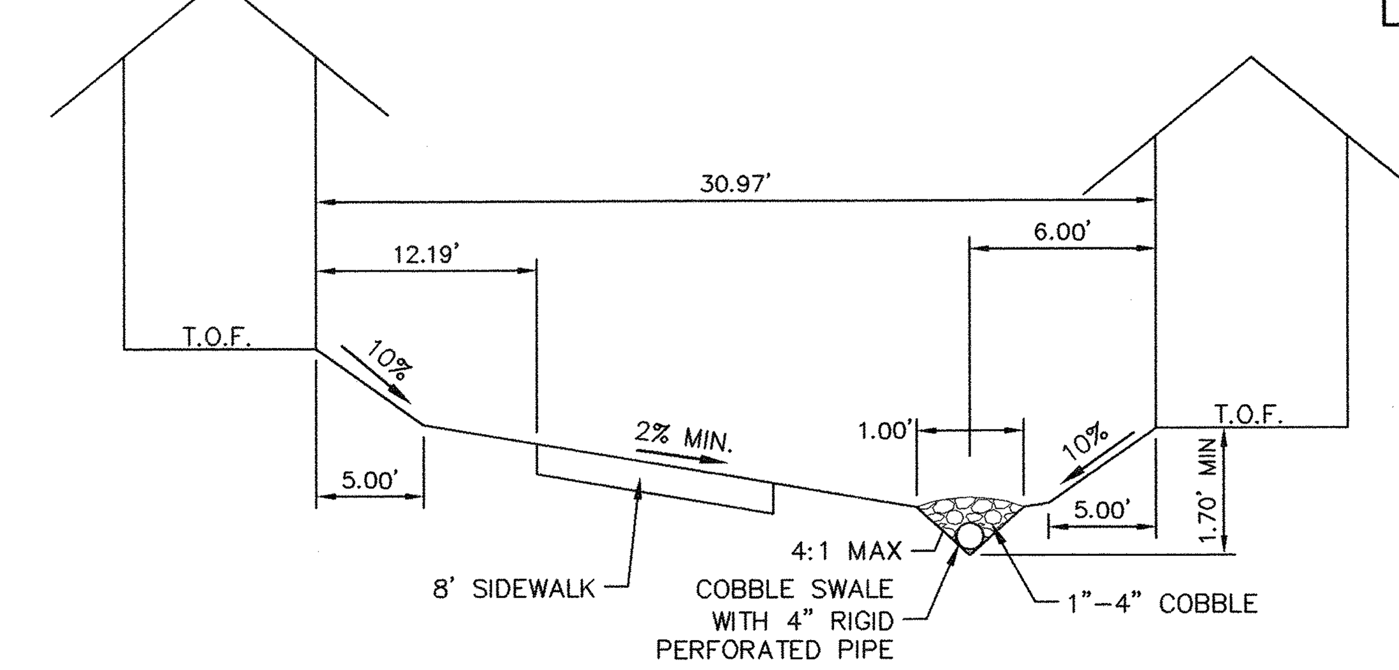
P:\1964\Construction\DRAINAGE\1964DR1.dwg, 09/30/02 04:24:21 PM, Carroll & Lange, Inc.



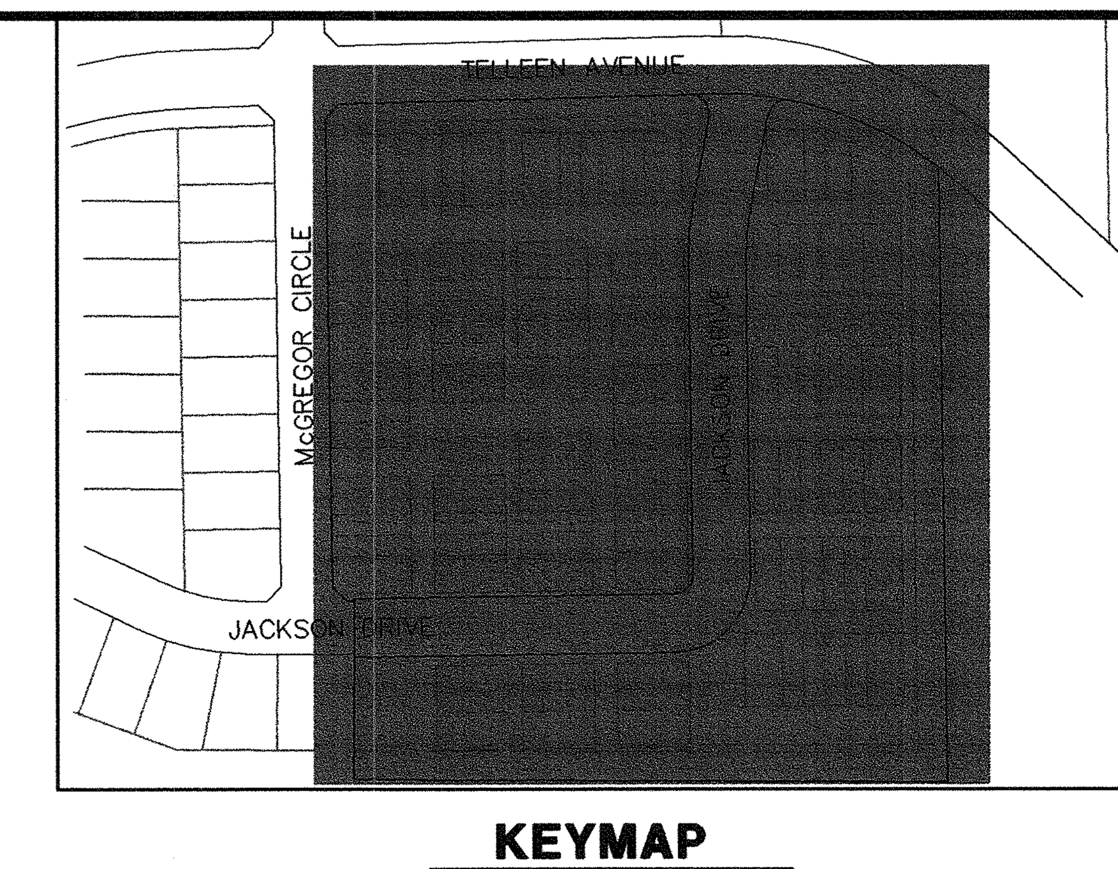
PRIVATE ALLEY
N.T.S.



LOCAL STREET (JACKSON DRIVE)
N.T.S.



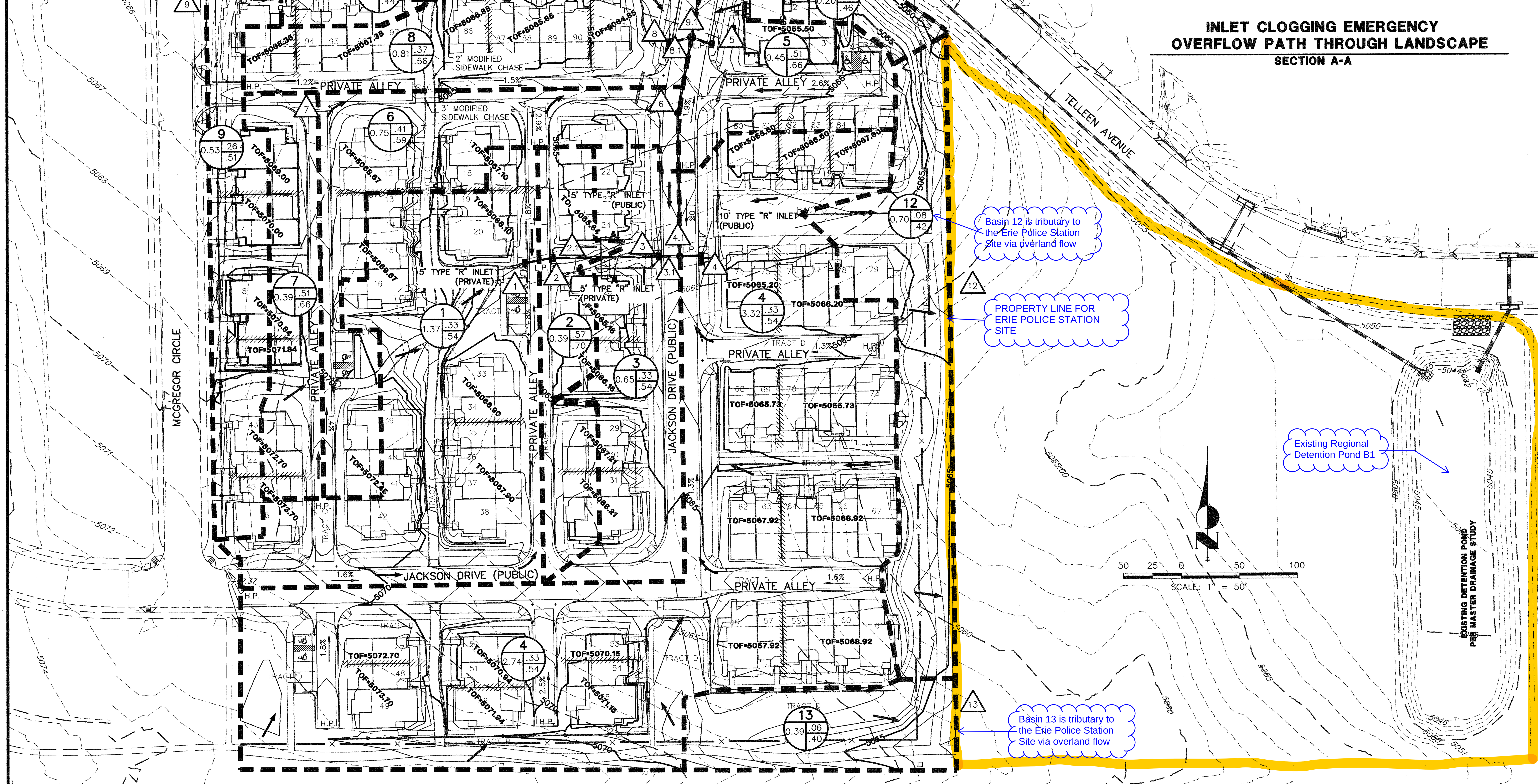
INLET CLOGGING EMERGENCY OVERFLOW PATH THROUGH LANDSCAPE
SECTION A-A



KEYMAP
SCALE: 1" = 200'

RUNOFF SUMMARY

DESIGN POINT	CONTRIBUTING BASIN	AREA (AC)	Q-2 (cfs)	Q-100 (cfs)
1	1	1.37	1.38	5.46
2	2	0.39	1.12	2.58
2.1	1,2		1.98	7.41
3	3	0.65	.80	3.80
3.1	1,2,3		2.59	10.31
4	4	3.32	3.13	14.74
4.1	1,2,3,4		5.63	24.73
5	5	0.45	0.80	2.77
6	6	0.75	0.79	2.99
7	7	0.39	0.59	2.00
8	8	0.81	0.81	3.23
8.1	6,7,8		2.64	17.78
9.1	1,2,3,4,5,6,7,8		8.15	37.15
9	9	0.41	0.35	1.81
10	10	0.37	0.14	1.40
11	11	0.20	0.18	0.88
12	12	0.70	0.32	2.62
13	13	0.39	0.12	1.19
OS-1	OS-1	0.41	0.58	2.65



LEGEND:

- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- 5000 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- STEP IN FOUNDATION
- DRAINAGE BASIN
- A = BASIN DESIGNATION; B = AREA IN ACRES; C = 2-YR RUNOFF COEFFICIENT; D = 100-YR RUNOFF COEFFICIENT
- DESIGN POINT
- H.P. HIGH POINT
- L.P. LOW POINT

CALL UTILITY NOTIFICATION CENTER OF COLORADO

1-800-922-1987

CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

TOWN ACCEPTANCE STATEMENT:

ALL WORK SHALL BE CONSTRUCTED TO TOWN OF ERIE STANDARDS AND SPECIFICATIONS. THIS DRAWING HAS BEEN REVIEW AND FOUND TO BE IN GENERAL COMPLIANCE WITH THESE STANDARDS AND SPECIFICATIONS AND OTHER TOWN REQUIREMENTS.

THE ENGINEERING DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.

ACCEPTED BY:

DIRECTOR OF PUBLIC WORKS — DATE

THIS PLAN AND ... OF THE ACCURATELY REF... IMPROVEMENTS ...

BY:

KURTIS W. WIL... COLORADO P.E...

ENGINEER'S STATEMENT

PREPARED UNDER MY SUPERVISION

KURTIS W. WILLIAMS, P.E. — DATE
COLORADO NO. 34270
FOR AND ON BEHALF OF JR ENGINEERING

COLORADO REGISTERED PROFESSIONAL ENGINEER KURTIS W. WILLIAMS 34270

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
ENGLE HOMES
10700 GEDDES, SUITE 100
ENGLEWOOD, CO 80112
CONTACT: JOHN BEAUPARLANT
(303) 770-4646

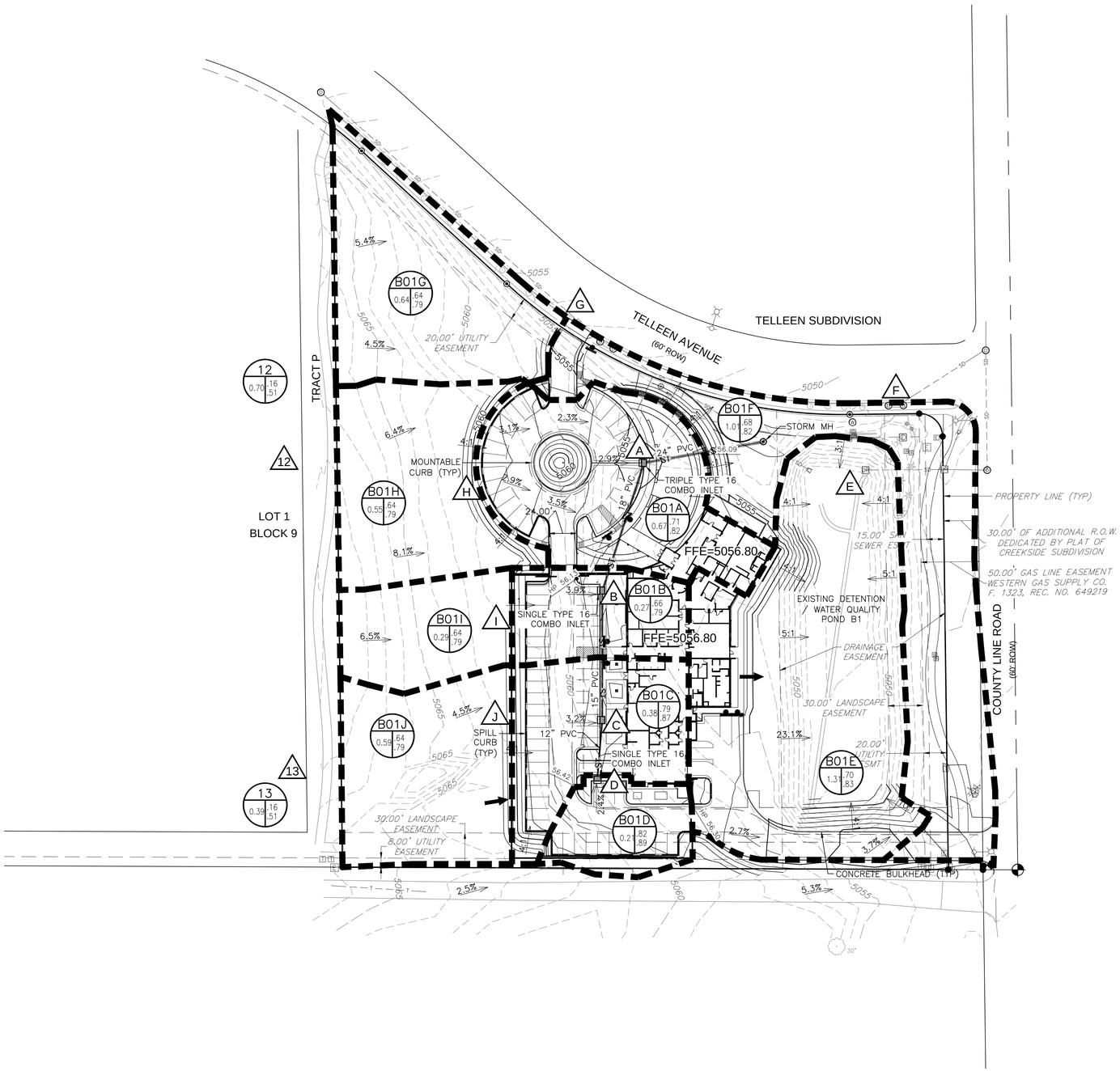
J·R ENGINEERING
A Westrian Company
6020 Greenwood Plaza Blvd • Englewood, CO 80111
303-740-9393 • Fax 303-721-9019
www.jrengineering.com

No.	REVISION	BY	DATE
1	PER TOWN OF ERIE COMMENTS	GWB	6/1/06

H-SCALE	1"=50'
V-SCALE	N/A
DATE	4/7/06
DESIGNED BY	GWB
DRAWN BY	GWB
CHECKED BY	

CREEKSIDE TOWNHOMES FILING NO. 2
DRAINAGE PLANS

SHEET 5 OF 43
JOB NO. 15025.00



LEGEND

EXISTING		PROPOSED
	PROPERTY LINE	
	RIGHT–OF–WAY LINE	
	SECTION LINE	
	EASEMENT	
	RETAINING WALL	
	CURB & GUTTER	
5750	CONTOURS	5750
ST	STORM SEWER	ST
ST	STORM MANHOLE	
RD	ROOF DRAIN	RD
	INLET	
	FLARED END SECTION	
	SIGN	
	GRADING ARROW	
	DECIDUOUS TREE	
	EVERGREEN TREE	
	BUSH/SHRUB	
DRIVE	DESCRIPTIONS	DRIVE
ELEV.	SPOT ELEVATIONS	ELEV.

LEGEND

BASIN BOUNDARY

SUB–BASIN BOUNDARY

DIRECTION OF FLOW

DESIGN POINT 1

BASIN B — 1.25 | .88 / .93 — C5 / C100

AREA IN ACRES

RUNOFF SUMMARY

BASIN	DESIGN POINT	AREA (ACRES)	% IMP.	C5	C100	Q5 (CFS)	Q100 (CFS)
12	12	0.70	2.0%	0.16	0.51	0.41	2.47
13	13	0.39	2.0%	0.16	0.51	0.23	1.38
B-01A	A	0.67	75.7%	0.71	0.82	1.85	4.43
B-01B	B	0.27	67.6%	0.66	0.79	0.75	2.09
B-01C	C	0.38	85.2%	0.79	0.87	1.43	4.28
B-01D	D	0.21	72.2%	0.82	0.89	0.83	1.70
B-01E	E	1.31	22.1%	0.70	0.83	4.45	9.97
B-01F	F	1.01	14.8%	0.68	0.82	3.24	7.37
B-01G	G	0.64	67.0%	0.64	0.79	1.82	4.23
B-01H	H	0.55	67.0%	0.64	0.79	1.69	3.93
B-01I	I	0.29	67.0%	0.64	0.79	0.89	2.07
B-01J	J	0.59	67.0%	0.64	0.79	1.66	3.88

N

50 25 0 50 100

SCALE: 1"=50'

ALL DIMENSIONS SHOWN ARE U.S. SURVEY FEET

MARTIN/MARTIN ASSUMES NO RESPONSIBILITY FOR UTILITY LOCATIONS. THE UTILITIES SHOWN ON THIS DRAWING HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. IT IS, HOWEVER, THE CONTRACTORS RESPONSIBILITY TO FIELD VERIFY THE SIZE, MATERIAL, HORIZONTAL AND VERTICAL LOCATION OF ALL UTILITIES PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION.

MARTIN / MARTIN
CONSULTING ENGINEERS
12499 West Colfax Ave.
Lakewood, CO 80215
303.431.6100
FAX 303.431.4028

ERIE POLICE STATION & MUNICIPAL COURT

DRAINAGE PLAN

No.	Issue / Revision	Date	Name

Job Number 22520.C01
Project Manager P. SULLIVAN
Design By J. YARNELL
Drawn By E. BERNAL
Principal In Charge B. WILLIS

Sheet Number:

D1

PLOT DATE: 6/5/2023 7:23:39 AM LAST SAVED BY: PETER
DRAWING: DRAWINGS\LOCATION\PLAN\SHEETS\POLICE STATION\SITE PLAN\D1.dwg

conditions. See the Appendices for detailed calculations and design aids.

3. Detention volumes were calculated using the V=KA formula as presented in the Urban Drainage Manual. Discharge rates were determined during the design of Pond B1 in the STUDY. Since the police station site is in conformance with the STUDY, no modifications are required to the release rates.

WAIVERS FROM CRITERIA

1. No waivers have been requested at this time.

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

1. The proposed drainage pattern will generally follow the existing drainage patterns. The majority of on-site flows will be routed into the detention and water quality pond at the east side of the property. Sheet flow will occur from west to east, across the parking lots and will become concentrated flow along gutters to the proposed storm inlets and pipe network. Inlets and storm pipes that collect the runoff will connect to the existing storm pipe toward the north of the site, then discharge to the existing on-site Pond B1. The proposed site will receive off-site runoff from sub-basins 12 and 13 from Creekside Townhomes Filing No. 2 to the west. A portion of the site along the perimeter (subbasin B-01F) will release to the adjacent road similar to existing conditions.
2. The Creekside Subdivision Drainage Plan anticipated the 14.7 acre site (Basin B-01) would be built with approximately 59%

Multifamily, 29% Commercial, and 12% Landscaping, resulting in estimated runoff coefficients of:

a. C5 = 0.65
b. C100 = 0.80

Estimated runoff coefficients for the overall 6-acre site are:

a. C5 = 0.60
b. C100 = 0.77

Since the new site will be less impervious than anticipated in the STUDY, the required proposed detention and water quality volumes are estimated to be slightly less than anticipated in the STUDY.

SPECIFIC DETAILS

1. No specific drainage problems were encountered at specific design points during the course of this design.
2. Pond B1 was originally designed for a water quality capture volume (WQCV) of 0.56 acre-feet and a 100-year detention storage volume of 2.2 acre-feet. These volumes assumed a 67% tributary Basin B-01. Since the police station site is being developed to 42.7% imperviousness, less storage volume is required. It is estimated that approximately 0.053 acre-feet of WQCV and 0.295 acre-feet of 100-year detention storage volume can be removed from the existing Pond B1. The resulting total required volume for the pond is approximately 2.382 acre-feet (103,800 cubic feet). Estimates of these volumes can be found in the Appendix. As shown on the stage-storage curve provided in the Appendix, 103,800 cubic feet of storage can be provided with a water surface elevation of approximately 5051.8. This is approximately 6-inches below the existing overflow weir.

The Pond B1 outlet structure was designed in the STUDY and constructed when the first portions of Creekside were built. No modifications to the outlet structure or overflow weir are proposed as part of this project.

3. A 12-foot-wide maintenance access into the pond at 10:1 slope is proposed at the southeast corner of the pond. No additional changes to the existing maintenance and access aspects of the pond are proposed.
4. The existing Pond B1 is within an existing drainage easement.
5. Since the proposed development is in conformance with the STUDY, no additional impacts are anticipated to downstream properties as a result of this project.
6. Since the proposed development is in conformance with the STUDY, no additional impacts are anticipated to existing floodplains of major drainageways.

SUMMARY

COMPLIANCE WITH STANDARDS

1. The proposed storm drainage improvements have been designed in accordance with Town of Erie Storm Drainage Design and Technical Criteria, and the Urban Drainage and Flood Control District Drainage Criteria Manual. Per the design standards, the proposed facilities will attenuate the required 100-yr design storm event and are estimated to be adequate for this site. Therefore, the proposed storm drainage design is not anticipated to negatively impact adjacent and/or downstream properties.

PROJECT INFORMATION

PROJECT NAME: Erie Police Station
PROJECT #: 22520.00
POND NAME: Pond B
DATE: 09/10/12

MARTIN / MARTIN
CONSULTING ENGINEERS

Required Water Quality Volume:

Detention Sizing Method: **WQCV**

NRCS Hydrologic Soil Group: **B**

$$WQCV = a \times \left(0.91i^3 - 1.19i^2 + 0.78i\right)$$

**Figure EDB-2, UDFCD (V.3), Chapter 4, Page S-73*

$$\text{LEED WQCV} = (0.5) \times \left[\frac{WQCV}{0.43}\right]$$

**UDFCD (V.3), Chapter 2, Page SQ-24*

$$EURV_A = 1.1 \cdot (2.0491 \cdot i - 0.1113)$$
$$EURV_B = 1.1 \cdot (1.2846 \cdot i - 0.0461)$$
$$EURV_{C/D} = 1.1 \cdot (1.1381 \cdot i - 0.0339)$$

**Equations SO-11 - SO-13, UDFCD (V.2), Chapter 10, Page SO-12*

Where:

WQCV = Water Quality Capture Volume (Watershed Inches)
a = Constant Dependent on Drain Time (Typically a=1.0 40-Hr Drain Time)
i = Percent Imperviousness

i = 67.0%

WQCV = 0.262 (watershed inches)

$$\text{Required Storage} = \left[\frac{WQCV}{12}\right] \times (AREA) \times 1.2$$

**UDFCD (V.3), Chapter 4, Page S-69*

$$\text{Required Storage} = \left[\frac{EURV}{12}\right] \times (AREA)$$

**UDFCD (V.3), Chapter 2, Page SQ-24*

Where:

WQCV = Water Quality Capture Volume (Watershed Inches)
Area = Contributing Watershed Area (Acres)

Area = 7.01 (acres)

Required Storage = 0.1837 (ac-ft)

PROJECT INFORMATION

PROJECT NAME: Erie Police Station
PROJECT #: 22520.00
POND NAME: Pond B
DATE: 09/10/12

MARTIN / MARTIN
CONSULTING ENGINEERS

Required Detention Volume:

$$V_i = K_i A$$

$$K_{100} = \frac{(1.78I - 0.002I^2 - 3.56)}{900}$$

$$K_{10} = \frac{(0.95I - 1.90)}{1000}$$

$$K_5 = \frac{(0.77I - 2.65)}{1000}$$

For Type A Soils :

$$V_{100A} = (-0.00005501 \cdot I^2 + 0.030148 \cdot I - 0.12) \cdot \frac{A}{12}$$

**Equations SO-1 through SO-5, UDFCD (V.2), Chapter 10, Pg. SO-9*

Where:

V_i = Required Volume Where Subscript i = 100-, 10- or 5-Year Storm (acre-ft)
K_i = Empirical Volume Coefficient
I = Fully Developed Tributary Catchment Imperviousness (%)
A = Tributary Catchment Area (acres)

I =	67.0	(%)
A =	7.0	(acres)

K_{100} =	0.119
K_{10} =	0.062
K_5 =	0.049

V_{100} =	**0.831**	**(ac-ft)**
V_{10} =	**0.433**	**(ac-ft)**
V_5 =	**0.343**	**(ac-ft)**

NRCS Hydrologic Soil Group: B

PROJECT INFORMATION

PROJECT NAME: Erie Police Station
PROJECT #: 22520.00
POND NAME: Pond B
DATE: 09/10/12

MARTIN / MARTIN
CONSULTING ENGINEERS

Required Water Quality Volume:

Detention Sizing Method: **WQCV**

NRCS Hydrologic Soil Group: **B**

$$WQCV = a \times \left(0.91i^3 - 1.19i^2 + 0.78i\right)$$

**Figure EDB-2, UDFCD (V.3), Chapter 4, Page S-73*

$$\text{LEED WQCV} = (0.5) \times \left[\frac{WQCV}{0.43}\right]$$

**UDFCD (V.3), Chapter 2, Page SQ-24*

$$EURV_A = 1.1 \cdot (2.0491 \cdot i - 0.1113)$$
$$EURV_B = 1.1 \cdot (1.2846 \cdot i - 0.0461)$$
$$EURV_{C/D} = 1.1 \cdot (1.1381 \cdot i - 0.0339)$$

**Equations SO-11 - SO-13, UDFCD (V.2), Chapter 10, Page SO-12*

Where:

WQCV = Water Quality Capture Volume (Watershed Inches)
a = Constant Dependent on Drain Time (Typically a=1.0 40-Hr Drain Time)
i = Percent Imperviousness

i = 42.9%

WQCV = 0.187 (watershed inches)

$$\text{Required Storage} = \left[\frac{WQCV}{12}\right] \times (AREA) \times 1.2$$

**UDFCD (V.3), Chapter 4, Page S-69*

$$\text{Required Storage} = \left[\frac{EURV}{12}\right] \times (AREA)$$

**UDFCD (V.3), Chapter 2, Page SQ-24*

Where:

WQCV = Water Quality Capture Volume (Watershed Inches)
Area = Contributing Watershed Area (Acres)

Area = 7.01 (acres)

Required Storage = 0.1314 (ac-ft)

PROJECT INFORMATION

PROJECT NAME: Erie Police Station
PROJECT #: 22520.00
POND NAME: Pond B
DATE: 09/10/12

MARTIN / MARTIN
CONSULTING ENGINEERS

Required Detention Volume:

$$V_i = K_i A$$

$$K_{100} = \frac{(1.78I - 0.002I^2 - 3.56)}{900}$$

$$K_{10} = \frac{(0.95I - 1.90)}{1000}$$

$$K_5 = \frac{(0.77I - 2.65)}{1000}$$

For Type A Soils :

$$V_{100A} = (-0.00005501 \cdot I^2 + 0.030148 \cdot I - 0.12) \cdot \frac{A}{12}$$

**Equations SO-1 through SO-5, UDFCD (V.2), Chapter 10, Pg. SO-9*

Where:

V_i = Required Volume Where Subscript i = 100-, 10- or 5-Year Storm (acre-ft)
K_i = Empirical Volume Coefficient
I = Fully Developed Tributary Catchment Imperviousness (%)
A = Tributary Catchment Area (acres)

I =	42.9	(%)
A =	7.0	(acres)

K_{100} =	0.077
K_{10} =	0.039
K_5 =	0.030

V_{100} =	**0.538**	**(ac-ft)**
V_{10} =	**0.272**	**(ac-ft)**
V_5 =	**0.213**	**(ac-ft)**

NRCS Hydrologic Soil Group: B

Appendix H – Base Design Standards Form

PROJECT SHEET *BASE DESIGN STANDARDS*

Complete one Project Sheet for each project that includes Stormwater Quality Control Measures. Please email stormwater@erieco.gov with any questions. This document acceptance shall not be construed to relieve any requirement to conform to the Standards and Specifications not specifically addressed in this form. The engineering design and concept remain the responsibility of the professional engineer.

SITE INFORMATION

Project Name: Erie PD			
Project Location: 1000 Telleen Ave, Erie Colorado			
Submitted Date: Aug 1, 2025		Submitted By: Nicholas Raley	
Applicant Email: nicholas.raley@pec1.com		Applicant Phone: 970.232.9558 x2514	
Applicant Organization: Professional Engineering Consultants, PA			
Acreage Disturbed: 5.56 Acres			
Existing Impervious: 74,198 SF (30.2 %)		New Net Impervious: 132,105 SF (54.5%)	
Review Date:		Reviewed By:	
✓ Preparer	Requirements		
✓	Design Details are included for all Control Measures (CM)		
✓	List or include a description of any Source CMs (i.e. preventing pollutants from contacting stormwater) or other non-structural CMs: Source control measures shown on the phased Erosion Control Plans within the construction document set include; Erosion Control Blankets, Mulching, Silt Fence, Rock Socks, Vehicle Tracking Control, Concrete Washout Area, and Inlet Protection.		
N/A	Does project overlap multiple MS4 Jurisdictions?	Yes	(No)
N/A	If project overlaps jurisdictions, provide written agreement designating responsibility for CM requirements, review, inspections		

DESIGN STANDARDS

Design Standards may be used in combination, as necessary, to meet the requirements. Additional design methods may be considered if they comply with the MS4 Permit. Evaluation of the suitability of Stormwater Quality Control Measures (CMs) is based on pollutant removal, flood attenuation and long-term maintenance. CMs must be designed in accordance with the most current version of USDCM vol. 3, Chapter 4 "Treatment BMPs" and the Town of Erie's Standards and Specifications. CMs must also meet the specific requirements for each Design Standard used. Design Standard requirements can be found on the MS4 general permit here: COR90000

1. Indicate below, which Design Standards will be used for the project, and
2. Complete a separate, corresponding Design Standards checklist for each CM (e.g., WQCV, etc.)

Design Standard	*# CMs*	*Location/Identifying information*
WQCV	✓	WQCV drains via orifice plate in detention pond
Pollutant Removal	N/A	
Runoff Reduction	N/A	
Regional WQCV Control Measure	N/A	
Regional WQCV Facility	N/A	

CHECKLIST WQCV Standard

WQCV STANDARD Criteria

Control measure(s) must be designed to provide treatment and/or infiltration of the Water Quality Capture Volume (WQCV) for 100% of the site.

Complete checklist if using the WQCV Standard to meet Design Standard requirements.

Project Name: Erie PD		
Preparer	Requirements	
	Control measure(s) provide treatment and/or infiltration of the WQCV for 100% of the site	
	% of site treated: 100% of tributary area to the detention pond	
	CM type: WQCV treatment via orifice plate	CM ID/location: Detention Pond
	See Drainage Report section: Section 6.0 and Appendix J	

If less than 100% of the site is treated, complete the following:

Preparer	Requirements	
	% of site not treated by control measures (not to exceed 20% or 1 acre):	
	%	size (acres)
	Provide explanation that the excluded area is impractical to treat:	
	Provide explanation that another CM is not practicable for the untreated area:	

CHECKLIST Pollutant Removal Standard

POLLUTANT REMOVAL STANDARD Criteria

Control measure(s) must be designed to provide treatment of the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS), at a minimum, to a median value of 30mg/L or less for 100% of the site. Substantiating data must meet criteria in USDCM vol.3and be included in the submittal.

Complete checklist if using the Pollutant Removal Standard to meet Design Standard requirements.

Project Name:		
Preparer	Requirements	
	Control measure(s) provide treatment of the 80th percentile storm event. The control measure(s) treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30mg/L or less for 100% of the site.	
	CM type:	CM ID/location:
	Storm event:	
	TSS mg/L reduction:	
	% of site treated:	
	See Drainage Report section:	

If less than 100% of the site is treated, complete the following:

Preparer	Requirements	
	% of site not treated by control measures (not to exceed 20% or 1 acre):	
	%	size (acres)
	Provide explanation that the excluded area is impractical to treat:	
	Provide explanation that another CM is not practicable for the untreated area:	

CHECKLIST Runoff Reduction Standard

RUNOFF REDUCTION STANDARD Criteria

Control measure(s) must be designed to infiltrate, evaporate or evapotranspire, at a minimum, a quantity of water equal to 60% of what the calculated WQCV would be if all impervious area discharged without infiltration. This Standard can be met through practices such as Green Infrastructure and Low Impact Development practices.

Complete checklist if using the Runoff Reduction Standard to meet Design Standard requirements.

Project Name:		
Preparer	Requirements	
	Control measure infiltrates, evaporates or evapotranspirates at least 60% of WQCV	
	% treated through runoff reduction:	
	CM type:	CM ID/location:
	See Drainage Report section:	

CHECKLIST Regional WQCV Control Measure Standard

REGIONAL WQCV CONTROL MEASURE STANDARD Criteria

Control Measure(s) must be designed to accept the drainage from the applicable development site. Stormwater from the site must not discharge to a water of the state before being discharged to the Regional WQCV Control Measure. The Regional WQCV Control Measure must be designed to provide treatment and/or infiltration of the WQCV for 100% of the applicable development site.

Complete checklist if using the Regional WQCV Control Measure Standard to meet Design Standard requirements.

Project Name:	
Preparer	Requirements
	Control Measure(s) are designed to accept the drainage from the site
	Stormwater from the site must not discharge to a water of the state before being discharged to the Regional WQCV Control Measure
	The Regional WQCV Control Measure is designed to provide treatment and/or infiltration of the WQCV for 100% of the site
	CM ID/location:
	See Drainage Report section:

If less than 100% of the site is treated, complete the following:

Preparer	Requirements	
	% of site not treated by control measures (not to exceed 20% or 1 acre):	
	%	size (acres)
	Provide explanation that the excluded area is impractical to treat:	
	Provide explanation that another CM is not practicable for the untreated area:	

CHECKLIST Regional WQCV Facility Standard

REGIONAL WQCV FACILITY STANDARD Criteria

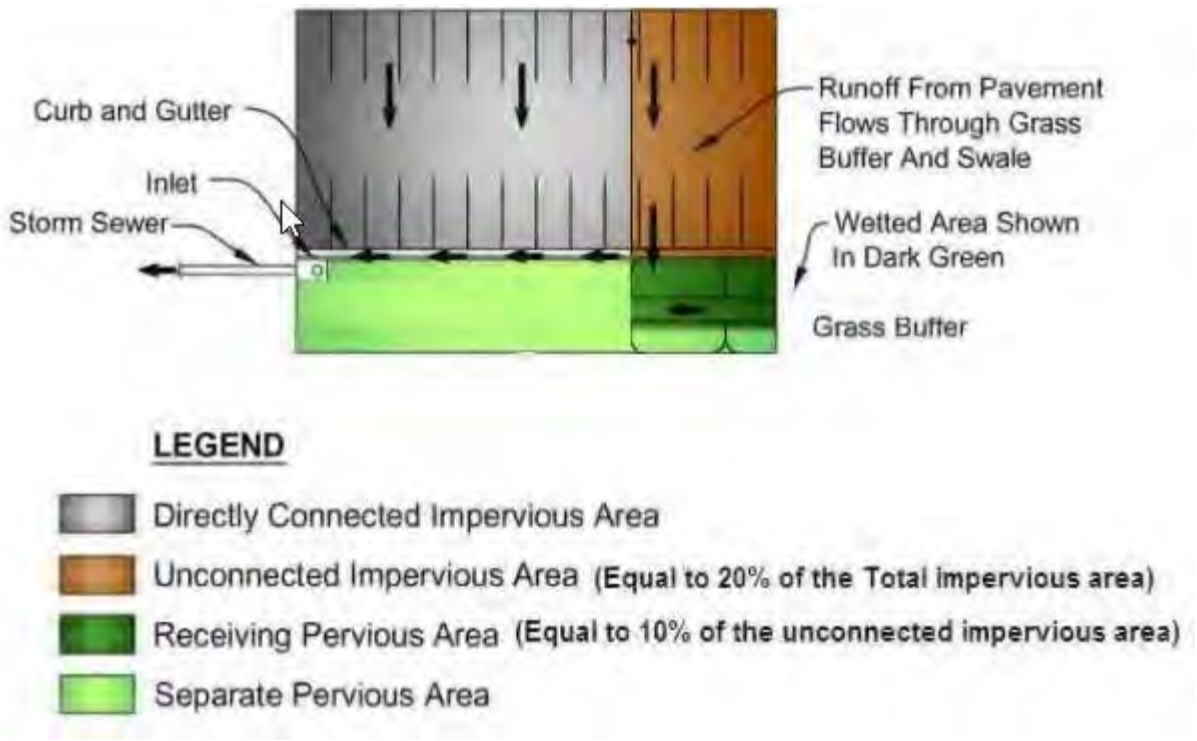
Control Measure(s) must be designed to accept drainage from the applicable development site. Stormwater from the site may be discharged to a water of the state before being discharged to the Regional WQCV facility. Before discharging to a water of the state, at least 20 percent of the upstream imperviousness of the site must be disconnected from the storm drainage system and drain through a receiving pervious area control measure comprising a footprint of at least 10 percent of the upstream disconnected impervious area of the applicable development site. In addition, the stream channel between the discharge point of the applicable development site and the Regional WQCV facility must be stabilized.

Complete checklist if using the Regional WQCV Facility Standard to meet Design Standard requirements.

Project Name:		
Preparer	Requirements	
	The Regional WQCV Facility is implemented, functional, and maintained following good engineering, hydrologic and pollution control practices.	
	The Regional WQCV Facility is designed and operating in accordance with the original design and/or USDCM vol.3.	
	The Regional WQCV Facility is designed and operating to provide 100% WQCV for its entire drainage area.	
	The Regional WQCV Facility has capacity to accommodate the drainage from the site.	
	The Regional WQCV Facility is designed and built to comply with all assumptions for the development planned within the drainage area and site.	
	Evaluation of the minimum drain time is based on the pollutant removal mechanism and functionality of the facility.	
	The Regional WQCV Facility is designed and constructed with flood control and water quality as the primary use. Recreational ponds and reservoirs or Classified State Waters cannot be used as Regional WQCV Facilities.	
	% of site treated in facility:	
	% of unconnected imperviousness area (prior to facility):	
	% of receiving pervious area (prior to facility):	
	Stream channel stabilized (include documentation)	
	Stream reach:	Method of stabilization:
	Date completed:	Included in project scope:
	CM type:	CM ID/location:
	See Drainage Report section:	

Regional WQCV Facility Standard example

Example Water Quality Enhancements for Site Tributary to Regional Facility



Graphic courtesy of SEMSWA
Criteria Regarding Onsite Treatment in a Regional System
2014

PROJECT SHEET *CONSTRAINED SITE STANDARD*

Complete one Project Sheet for each project that is Constrained and includes Stormwater Quality CMs.

CONSTRAINED REDEVELOPMENT SITES

Constrained Redevelopment Sites are sites where the existing condition is >35% imperviousness and the proposed redevelopment will result in >75% imperviousness. If the proposed redevelopment will result in >75% imperviousness, but the existing condition is <35% imperviousness, the Constrained Site Standard cannot be used and Base Design Standards must be followed. **The Constrained Site Standard can only be used if it is determined that it is not practicable to meet any of the Base Design Standards.** It is incumbent on the design engineer to demonstrate adherence to Base Design Standards has been thoroughly evaluated and found to be infeasible before a Constrained Site Standard is proposed.

SITE INFORMATION

Project Name:			
Project Location:			
Submitted Date:		Submitted By:	
Acreage Disturbed:			
Existing Impervious:		New Net Impervious:	
Review Date:		Reviewed By:	
✓ Preparer	Requirements		
	Design Details are included for all CMs		
	List or include a description of any Source CMs (i.e. preventing pollutants from contacting stormwater) or other non-structural CMs:		
	Does project overlap multiple MS4 Jurisdictions?	Yes	No
	If project overlaps jurisdictions, provide written agreement designating responsibility for CM requirements, review, inspections		

DESIGN STANDARDS

Design Standards may be used in combination, as necessary, to meet the requirements. Additional design methods may be considered if they comply with the MS4 Permit. Evaluation of suitability of Stormwater Quality Control Measures (CMs) is based on pollutant removal, flood attenuation and long-term maintenance. CMs must be designed in accordance with the most current version of USDCM vol. 3, Chapter 4 "Treatment BMPs" and the Town of Erie's Standards and Specifications. CMs must also meet the specific requirements for each Design Standard used.

1. Indicate below, which Design Standards will be used for the project, and
2. Complete a separate, corresponding Design Standards checklist for each CM (e.g., WQCV, etc.)

Design Standard	*# CMs*	*Location/Identifying information*
WQCV		
Pollutant Removal		
Runoff Reduction		

CHECKLIST Constrained WQCV Standard

APPLICABILITY

Constrained Redevelopment Sites are sites where the existing condition is >35% imperviousness and the proposed redevelopment will result in >75% imperviousness. If the proposed redevelopment will result in >75% imperviousness, but the existing condition is <35% imperviousness, the Constrained Site Standard cannot be used and Base Design Standards must be followed. **The Constrained Site Standard can only be used if it is determined that it is not practicable to meet any of the Base Design Standards.** It is incumbent on the design engineer to demonstrate adherence to Base Design Standards has been thoroughly evaluated and found to be infeasible before a Constrained Site Standard is proposed.

The minimum treatment levels are included below and treatment should be maximized to the extent feasible under constrained site conditions.

CONSTRAINED WQCV STANDARD Criteria

Control measure(s) must be designed to provide, at a minimum, treatment and/or infiltration of the WQCV for 50% of the site.

Complete checklist if using the Constrained WQCV Standard to meet Design Standard requirements.

Project Name:		
Preparer	Requirements	
	Control measure(s) provide treatment and/or infiltration of the WQCV for 50% of the site	
	% of site treated:	
	CM type:	CM ID/location:
	See Drainage Report section:	
	Provide an evaluation of the infeasibility of Base Design Standards and justification for use of Constrained Site Standard:	

CHECKLIST Constrained Pollutant Removal Standard

APPLICABILITY

Constrained Redevelopment Sites are sites where the existing condition is >35% imperviousness and the proposed redevelopment will result in >75% imperviousness. If the proposed redevelopment will result in >75% imperviousness, but the existing condition is <35% imperviousness, the Constrained Site Standard cannot be used and Base Design Standards must be followed. **The Constrained Site Standard can only be used if it is determined that it is not practicable to meet any of the Base Design Standards.** It is incumbent on the design engineer to demonstrate adherence to Base Design Standards has been thoroughly evaluated and found to be infeasible before a Constrained Site Standard is proposed.

The minimum treatment levels are included below and treatment should be maximized to the extent feasible under constrained site conditions.

CONSTRAINED POLLUTANT REMOVAL STANDARD Criteria

Control measure(s) must be designed to provide treatment of the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS), at a minimum, to a median value of 30mg/L or less for 50% of the site. Substantiating data must meet criteria in USDCM vol.3and be included in the submittal.

Complete checklist if using the Constrained Pollutant Removal Standard to meet Design Standard requirements.

Project Name:		
Preparer	Requirements	
	Control measure(s) provide treatment of the 80th percentile storm event. The control measure(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30mg/L or less for 50% of the site.	
	CM type:	CM ID/location:
	Storm event:	
	TSS mg/L reduction:	
	% of site treated:	
	See Drainage Report section:	
	Provide an evaluation of the infeasibility of Base Design Standards and justification for use of Constrained Site Standard:	

CHECKLIST Constrained Runoff Reduction Standard

APPLICABILITY

Constrained Redevelopment Sites are sites where the existing condition is >35% imperviousness and the proposed redevelopment will result in >75% imperviousness. If the proposed redevelopment will result in >75% imperviousness, but the existing condition is <35% imperviousness, the Constrained Site Standard cannot be used and Base Design Standards must be followed. **The Constrained Site Standard can only be used if it is determined that it is not practicable to meet any of the Base Design Standards.** It is incumbent on the design engineer to demonstrate adherence to Base Design Standards has been thoroughly evaluated and found to be infeasible before a Constrained Site Standard is proposed.

The minimum treatment levels are included below and treatment should be maximized to the extent feasible under constrained site conditions.

CONSTRAINED RUNOFF REDUCTION STANDARD Criteria

Control measure(s) must be designed to infiltrate, evaporate or evapotranspire, at a minimum, a quantity of water equal to 30% of what the calculated WQCV would be if all impervious area discharged without infiltration. This Standard can be met through practices such as Green Infrastructure and Low Impact Development practices.

Complete checklist if using the Constrained Runoff Reduction Standard to meet Design Standard requirements.

Project Name:		
Preparer	Requirements	
	Control measure infiltrates, evaporates or evapotranspires at least 30% of WQCV	
	% treated through runoff reduction:	
	CM type:	CM ID/location:
	See Drainage Report section:	
	Provide an evaluation of the infeasibility of Base Design Standards and justification for use of Constrained Site Standard:	

Appendix I – Excerpts from Erie Outfall System Plan (OSP)

LEGEND

- Study Area Boundary
- Erie Planning Area Boundary
- Town of Erie
- City of Lafayette
- Counties

VICINITY MAP

N
W E
S

0 2,000 4,000 8,000 Feet

1 " = 4,000 FT

MINERAL ROAD (HWY 52)
LOOKOUT ROAD
JASPER ROAD
ARAPAHOE ROAD
BASELINE ROAD
COUNTY LINE ROAD
US HIGHWAY 287
ERIE PARKWAY
UNINCORPORATED BOULDER COUNTY
UNINCORPORATED WELD COUNTY
TOWN OF ERIE
CITY OF LAFAYETTE
BOULDER CREEK
BULLHEAD GULCH
PRINCE TRIBUTARY
COAL CREEK
287
25

M:\2234\GIS\2234 Vicinity Map.mxd - 12/12/12 - NRT

RESPEC
CONSULTING & SERVICES
RESPEC
720 SOUTH COLORADO BLVD, SUITE 410S
DENVER, COLORADO 80246
PHONE: 303-757-3655
FAX: 303-300-1635

TOWN OF ERIE - CITY OF LAFAYETTE - BOULDER COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

TOWN OF ERIE OUTFALL SYSTEMS PLAN
(WEST OF COAL CREEK)

STUDY AREA AND VICINTY MAP

FIGURE
ES-1

LEGEND

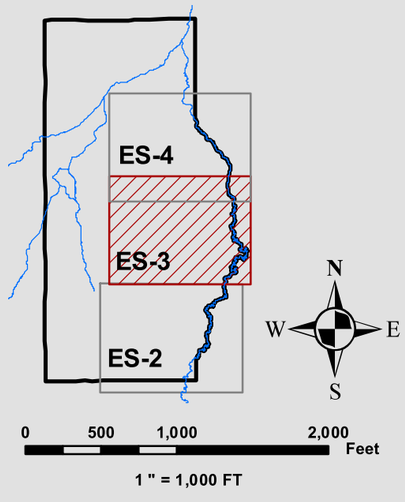
- Study Area Boundary
- Erie Planning Area Boundary
- Town of Erie
- City of Lafayette
- 100-Year Floodplain (FIS)
- Existing Detention Ponds
- Outfall Alignment
  (Outfall Name)

Note: 100-Year floodplain information from Boulder County Flood Insurance Study (FIS), FEMA, December 18, 2012

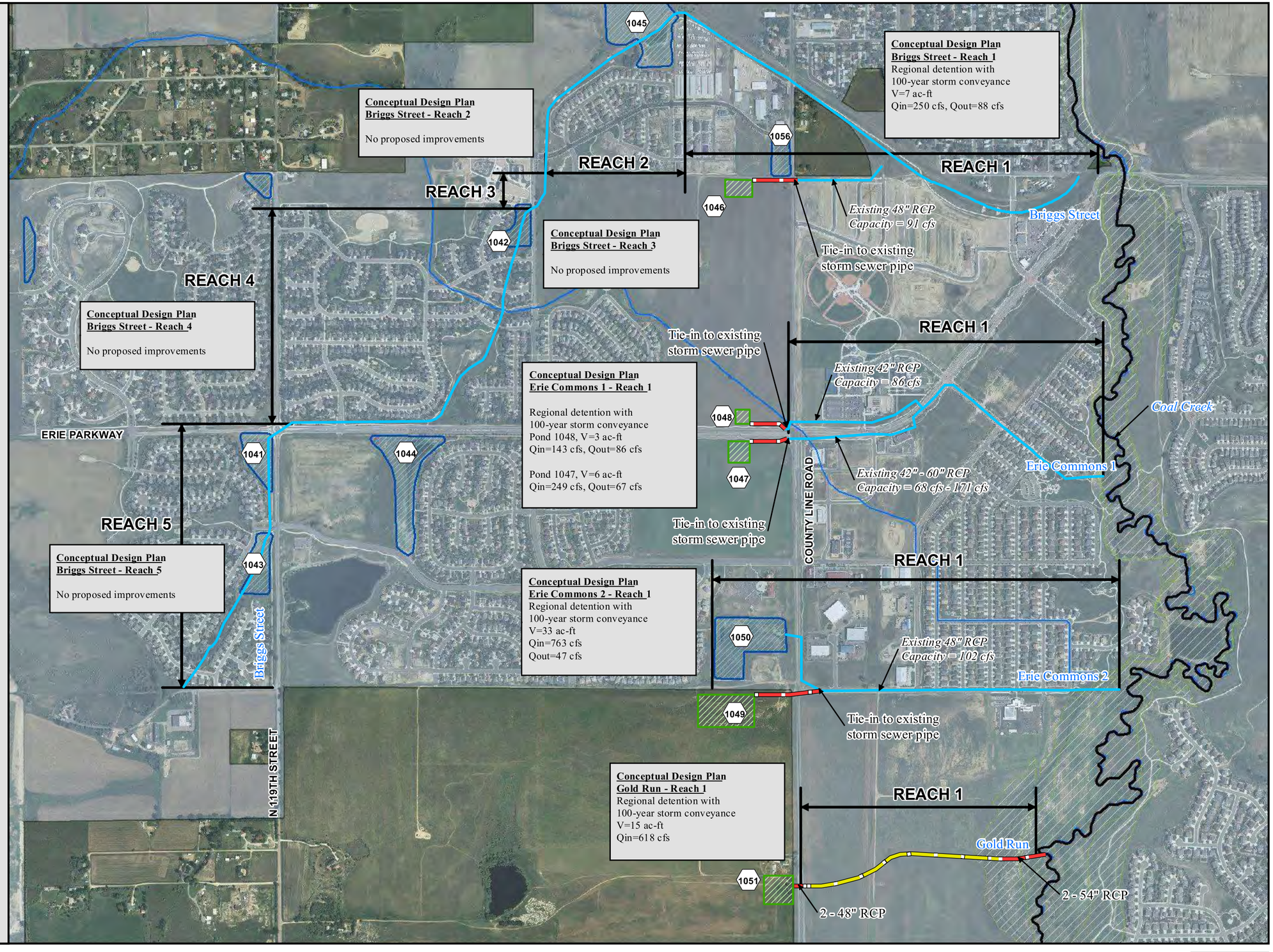
CONCEPTUAL DESIGN

- Storm Sewer
- Channel
- Regional Detention
- Culvert/Bridge Improvements
- Bank Stabilization
- Property Acquisition

KEY MAP



M:\2234\GIS\2234 CONCEPTUAL DESIGN SCHEMATIC.MXD - 3/1/13 - NRT



RESPEC CONSULTING & SERVICES RESPEC 720 SOUTH COLORADO BLVD, SUITE 410S DENVER, COLORADO 80246 PHONE: 303-757-3655 FAX: 303-300-1635	TOWN OF ERIE - CITY OF LAFAYETTE - BOULDER COUNTY URBAN DRAINAGE AND FLOOD CONTROL DISTRICT	TOWN OF ERIE OUTFALL SYSTEMS PLAN (WEST OF COAL CREEK)	CONCEPTUAL DESIGN PLAN COAL CREEK TRIBUTARIES	FIGURE ES-3

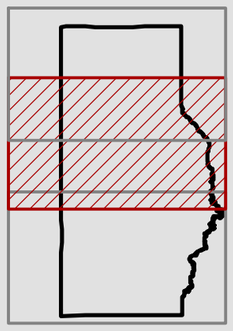
LEGEND

- Study Area Boundary
- Town of Erie
- City of Lafayette
- Subbasin Boundary
- Major Watershed Boundary
- Regional Detention Ponds

SWMM Elements

- xxx — Subbasin
- xxx — Design Point
- xxx — Conveyance Element
- xxx — Detention Facility
- xxx — Outfall

KEY MAP



N W E S

0 750 1,500 3,000 Feet

1 " = 1,500 FT

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KENOSHA ROAD
JASPER ROAD
ERIE PARKWAY
COUNTY LINE ROAD
N 119TH STREET
U.S. HIGHWAY 287
Boulder Creek
Bullhead Gulch
Prince Tributary
Coal Creek

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TOWN OF ERIE
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

TOWN OF ERIE OUTFALL SYSTEMS PLAN (WEST OF COAL CREEK)

SWMM ROUTING MAP

FIGURE B-7

Table B-1
CUHP Input

Subbasin	Area (mi^2)	Distance to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness		Depression Storage		Horton's Infiltration Parameters		
					Existing Land Use	Future Land Use	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/sec)	Final Rate (in/hr)
468	0.031	0.170	0.315	0.024	33.9	55.1	0.38	0.10	4.50	0.0018	0.60
469	0.047	0.185	0.341	0.012	2.0	71.3	0.38	0.10	4.41	0.0018	0.59
470	0.064	0.233	0.452	0.018	31.8	31.8	0.38	0.10	4.50	0.0018	0.60
471	0.121	0.258	0.542	0.020	33.6	33.6	0.38	0.10	4.50	0.0018	0.60
472	0.054	0.160	0.365	0.015	13.5	13.5	0.38	0.10	4.50	0.0018	0.60
473	0.021	0.132	0.273	0.016	35.2	35.2	0.38	0.10	4.50	0.0018	0.60
474	0.058	0.183	0.422	0.015	26.3	26.3	0.38	0.10	4.50	0.0018	0.60
475	0.149	0.162	0.473	0.015	22.8	40.8	0.38	0.10	4.50	0.0018	0.60
476	0.185	0.375	0.785	0.015	35.6	35.8	0.38	0.10	4.50	0.0018	0.60
477	0.054	0.150	0.305	0.017	2.4	40.0	0.38	0.10	4.35	0.0018	0.59
478	0.130	0.364	0.842	0.016	15.7	31.2	0.38	0.10	4.50	0.0018	0.60
479	0.061	0.187	0.404	0.017	38.9	40.0	0.38	0.10	4.05	0.0018	0.57
480	0.049	0.152	0.326	0.023	2.1	78.3	0.38	0.10	4.50	0.0018	0.60
481	0.100	0.297	0.544	0.017	4.4	33.4	0.38	0.10	4.50	0.0018	0.60
482	0.047	0.137	0.321	0.008	58.2	61.4	0.38	0.10	4.50	0.0018	0.60
483	0.043	0.098	0.259	0.010	61.5	61.5	0.38	0.10	4.50	0.0018	0.60
484	0.123	0.094	0.460	0.009	35.2	35.2	0.38	0.10	4.50	0.0018	0.60
485	0.200	0.232	0.581	0.008	27.4	27.4	0.38	0.10	4.16	0.0018	0.58
486	0.138	0.274	0.601	0.011	30.0	46.8	0.38	0.10	3.50	0.0018	0.53
487	0.108	0.235	0.676	0.011	28.3	49.2	0.38	0.10	3.50	0.0018	0.53
488	0.090	0.187	0.539	0.011	19.9	49.7	0.38	0.10	4.26	0.0018	0.58
489	0.052	0.221	0.426	0.012	32.2	32.2	0.38	0.10	4.17	0.0018	0.58
490	0.138	0.463	0.827	0.012	6.2	21.5	0.38	0.10	4.24	0.0018	0.58
491	0.112	0.624	0.934	0.004	22.9	23.0	0.38	0.10	4.13	0.0018	0.58
492	0.171	0.347	0.768	0.009	31.1	32.7	0.38	0.10	3.63	0.0018	0.54
493	0.088	0.207	0.543	0.004	25.5	25.5	0.38	0.10	4.50	0.0018	0.60
494	0.018	0.113	0.279	0.005	5.1	5.1	0.38	0.10	3.99	0.0018	0.57
495	0.046	0.216	0.515	0.006	2.0	2.0	0.38	0.10	3.00	0.0018	0.50
496	0.075	0.472	0.924	0.007	2.0	4.4	0.38	0.10	3.16	0.0018	0.51
497	0.093	0.505	0.926	0.006	2.0	4.1	0.38	0.10	3.00	0.0018	0.50
498	0.078	0.332	0.617	0.008	15.6	40.6	0.38	0.10	3.98	0.0018	0.57
499	0.049	0.327	0.593	0.008	2.2	73.6	0.38	0.10	3.45	0.0018	0.53
600	0.147	0.294	0.585	0.030	4.3	4.3	0.38	0.10	3.73	0.0018	0.55
601	0.080	0.237	0.479	0.003	2.0	2.3	0.38	0.10	4.30	0.0018	0.59
602	0.081	0.228	0.449	0.008	2.0	2.0	0.38	0.10	3.00	0.0018	0.50
603	0.162	0.238	0.538	0.028	5.8	5.8	0.38	0.10	3.35	0.0018	0.52
604	0.040	0.097	0.263	0.020	4.5	4.5	0.38	0.10	4.00	0.0018	0.57
605	0.183	0.415	0.799	0.025	5.6	5.6	0.38	0.10	3.81	0.0018	0.55
606	0.071	0.402	0.694	0.006	2.0	2.0	0.38	0.10	3.00	0.0018	0.50
607	0.040	0.121	0.282	0.010	2.0	16.8	0.38	0.10	4.37	0.0018	0.59
608	0.203	0.377	0.733	0.007	2.8	3.0	0.38	0.10	3.14	0.0018	0.51

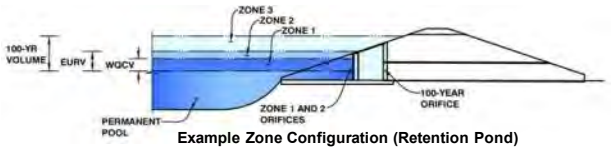
Appendix J – Extended Detention Basin Recalculations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: ERIE PD

Basin ID: NODE 1056 - On Site Sub-Regional Detention Pond ____ Outlet Structure Design



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	23.74	acres
Watershed Length =	2,000	ft
Watershed Length to Centroid =	1,000	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	63.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.493	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.648	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.83 in.) =	0.949	acre-feet		inches
5-yr Runoff Volume (P1 = 1.09 in.) =	1.328	acre-feet		inches
10-yr Runoff Volume (P1 = 1.33 in.) =	1.749	acre-feet		inches
25-yr Runoff Volume (P1 = 1.69 in.) =	2.532	acre-feet		inches
50-yr Runoff Volume (P1 = 1.99 in.) =	3.132	acre-feet		inches
100-yr Runoff Volume (P1 = 2.31 in.) =	3.848	acre-feet		inches
500-yr Runoff Volume (P1 = 3.14 in.) =	5.568	acre-feet		inches
Approximate 2-yr Detention Volume =	0.884	acre-feet		
Approximate 5-yr Detention Volume =	1.245	acre-feet		
Approximate 10-yr Detention Volume =	1.664	acre-feet		
Approximate 25-yr Detention Volume =	1.995	acre-feet		
Approximate 50-yr Detention Volume =	2.175	acre-feet		
Approximate 100-yr Detention Volume =	2.443	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.493	acre-feet
Zone 2 Volume (User Defined - Zone 1) =	0.898	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	1.025	acre-feet
Total Detention Basin Volume =	2.416	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Total detention volume is less than 100-year volume.

Depth Increment = 0.10 ft

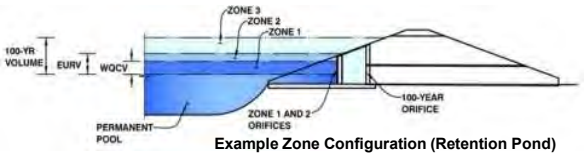
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	85	0.002		
	--	0.10	--	--	--	183	0.004	13	0.000
	--	0.20	--	--	--	413	0.009	43	0.001
	--	0.30	--	--	--	761	0.017	102	0.002
	--	0.40	--	--	--	1,364	0.031	208	0.005
	--	0.50	--	--	--	2,394	0.055	396	0.009
	--	0.60	--	--	--	3,778	0.087	705	0.016
	--	0.70	--	--	--	4,901	0.113	1,139	0.026
	--	0.80	--	--	--	5,759	0.132	1,672	0.038
	--	0.90	--	--	--	6,597	0.151	2,289	0.053
	--	1.00	--	--	--	7,498	0.172	2,994	0.069
	--	1.10	--	--	--	8,457	0.194	3,792	0.087
	--	1.20	--	--	--	9,414	0.216	4,685	0.108
	--	1.30	--	--	--	10,327	0.237	5,672	0.130
	--	1.40	--	--	--	11,177	0.257	6,748	0.155
	--	1.50	--	--	--	11,969	0.275	7,905	0.181
	--	1.60	--	--	--	12,710	0.292	9,139	0.210
	--	1.70	--	--	--	13,394	0.307	10,444	0.240
	--	1.80	--	--	--	14,024	0.322	11,815	0.271
	--	1.90	--	--	--	14,617	0.336	13,247	0.304
	--	2.00	--	--	--	15,158	0.348	14,736	0.338
	--	2.10	--	--	--	15,599	0.358	16,274	0.374
	--	2.20	--	--	--	16,001	0.367	17,854	0.410
	--	2.30	--	--	--	16,400	0.376	19,474	0.447
	--	2.40	--	--	--	16,796	0.386	21,133	0.485
	--	2.50	--	--	--	17,182	0.394	22,832	0.524
	--	2.60	--	--	--	17,545	0.403	24,569	0.564
	--	2.70	--	--	--	17,885	0.411	26,340	0.605
	--	2.80	--	--	--	18,203	0.418	28,145	0.646
	--	2.90	--	--	--	18,518	0.425	29,981	0.688
	--	3.00	--	--	--	18,833	0.432	31,848	0.731
	--	3.10	--	--	--	19,148	0.440	33,747	0.775
	--	3.20	--	--	--	19,463	0.447	35,678	0.819
	--	3.30	--	--	--	19,780	0.454	37,640	0.864
	--	3.40	--	--	--	20,099	0.461	39,634	0.910
	--	3.50	--	--	--	20,419	0.469	41,660	0.956
	--	3.60	--	--	--	20,741	0.476	43,718	1.004
	--	3.70	--	--	--	21,065	0.484	45,808	1.052
	--	3.80	--	--	--	21,390	0.491	47,931	1.100
	--	3.90	--	--	--	21,718	0.499	50,086	1.150
	--	4.00	--	--	--	22,046	0.506	52,274	1.200
	--	4.10	--	--	--	22,377	0.514	54,495	1.251
	--	4.20	--	--	--	22,709	0.521	56,750	1.303
	--	4.30	--	--	--	23,043	0.529	59,037	1.355
	--	4.40	--	--	--	23,379	0.537	61,359	1.409
	--	4.50	--	--	--	23,717	0.544	63,713	1.463
	--	4.60	--	--	--	24,057	0.552	66,102	1.517
	--	4.70	--	--	--	24,398	0.560	68,525	1.573
	--	4.80	--	--	--	24,741	0.568	70,982	1.630
	--	4.90	--	--	--	25,086	0.576	73,473	1.687
	--	5.00	--	--	--	25,432	0.584	75,999	1.745
	--	5.10	--	--	--	25,780	0.592	78,560	1.803
	--	5.20	--	--	--	26,130	0.600	81,155	1.863
	--	5.30	--	--	--	26,481	0.608	83,786	1.923
	--	5.40	--	--	--	26,834	0.616	86,451	1.985
	--	5.50	--	--	--	27,189	0.624	89,153	2.047
	--	5.60	--	--	--	27,546	0.632	91,889	2.109
	--	5.70	--	--	--	27,905	0.641	94,662	2.173
	--	5.80	--	--	--	28,265	0.649	97,470	2.238
	--	5.90	--	--	--	28,627	0.657	100,315	2.303
	--	6.00	--	--	--	28,992	0.666	103,196	2.369
	--	6.10	--	--	--	29,368	0.674	106,114	2.436
	--	6.20	--	--	--	29,823	0.685	109,073	2.504
	--	6.30	--	--	--	30,291	0.695	112,079	2.573
	--	6.40	--	--	--	30,720	0.705	115,130	2.643
	--	6.50	--	--	--	31,104	0.714	118,221	2.714

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: ERIE PD

Basin ID: NODE 1056 - On Site Sub-Regional Detention Pond ____ Outlet Structure Design



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.43	0.493	Orifice Plate
Zone 2 (User)	4.37	0.898	Rectangular Orifice
Zone 3 (User)	6.08	1.025	Weir&Pipe (Circular)
Total (all zones)		2.416	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

			Calculated Parameters for Plate		
Centroid of Lowest Orifice =	0.20	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.458E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.10	sq. inches (diameter = 1-5/8 inches)	Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.20	0.90	1.60	2.30				
Orifice Area (sq. inches)	2.10	2.10	2.10	2.10				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected		Calculated Parameters for Vertical Orifice	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	6.50	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	4.37	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	1.00	N/A	feet
Vertical Orifice Height =	24.00	N/A	inches				
Vertical Orifice Width =	39.00		inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.50	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	3.71	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	12.66	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	6.33	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Circular	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.41	N/A	ft^2
Circular Orifice Diameter =	25.00	N/A	inches	Outlet Orifice Centroid =	1.04	N/A	feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.83	1.09	1.33	1.69	1.99	2.31	3.14
CUHP Runoff Volume (acre-ft) =	0.493	1.648	0.949	1.328	1.749	2.532	3.132	3.848	5.568
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.949	1.328	1.749	2.532	3.132	3.848	5.568
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.3	2.7	10.4	15.1	21.2	34.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.11	0.44	0.63	0.89	1.44
Peak Inflow Q (cfs) =	N/A	N/A	12.6	17.6	23.3	35.6	44.3	54.6	78.7
Peak Outflow Q (cfs) =	0.3	34.7	2.6	5.8	9.4	19.2	26.2	35.2	39.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	21.0	3.5	1.9	1.7	1.7	1.2
Structure Controlling Flow =	Plate	Outlet Plate 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	-0.06	N/A	N/A	N/A	N/A	N/A	0.1	-0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	42	40	46	43	41	37	35	33	28
Time to Drain 99% of Inflow Volume (hours) =	**45**	48	51	50	49	47	45	44	40
Maximum Ponding Depth (ft) =	2.43	4.84	2.97	3.26	3.50	4.01	4.29	4.64	5.93
Area at Maximum Ponding Depth (acres) =	0.39	0.57	0.43	0.45	0.47	0.51	0.53	0.55	0.66
Maximum Volume Stored (acre-ft) =	0.497	1.652	0.718	0.841	0.956	1.200	1.350	1.534	2.316

Representative of the 10-YR and 100-YR required storage volumes calculated using methodology presented in report