APPENDIX G

Traffic Impact Study

Farmstead Residential Project

Transportation Impact Study

Prepared for:

City of Vacaville

Prepared by:

Farmstead Residential Project
Transportation Impact Study

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TABLE OF CONTENTS

LIST OF TABLES

APPENDIX

Introduction

The City of Vacaville has retained Omni-Means, a GHD company, to perform a Transportation Impact Study (TIS) for the proposed Farmstead Residential Project. The proposed residential development is located in the southeast quadrant of the intersection of Fruitvale Road & N. Orchard Avenue. The term "project" as used in this TIS refers to the proposed subdivision consisting of 127 single family dwelling units and 5.12 acres of park & trails. This report has been prepared to present the results of the TIS and to determine any operational impacts to the surrounding infrastructure attributable to the proposed development.

This TIS presents the projected transportation operations and impacts associated with the development of the Farmstead Residential Project under the following scenarios:

- *Existing* conditions
- *Existing Plus Project* conditions
- *Short Term* conditions
- *Short Term Plus Project* conditions
- *Year 2035* conditions
- *Year 2035 Plus Project* conditions

Existing conditions quantify the current traffic operations at the study locations.

Existing Plus Project conditions refer to the analysis scenario in which traffic impacts associated with the proposed project are investigated in comparison to the *Existing* conditions scenario. Within this scenario, the project generated peak hour traffic volumes have been added to the *Existing* conditions volumes to obtain the *Existing Plus Project* volumes.

Short Term conditions refer to the analysis scenario in which traffic impacts associated with the approved/pending projects near the proposed project location are investigated. Within this scenario, the approved/pending project generated peak hour traffic volumes have been added to the *Existing* conditions volumes to obtain the *Short Term* volumes.

Short Term Plus Project conditions refer to the analysis scenario in which traffic impacts associated with the proposed project are investigated in comparison to the *Short Term* conditions scenario. Within this scenario, the project generated peak hour traffic volumes have been added to the *Short Term* conditions volumes to obtain the *Short Term Plus Project* volumes.

Year 2035 conditions refer to the analysis scenario in which traffic impacts associated with approximately 20 years of development in the City of Vacaville are investigated. Within this scenario, the projected growth has been added to the *Existing* conditions volumes to obtain the *Year 2035* volumes.

Year 2035 Plus Project conditions refer to the analysis scenario in which traffic impacts associated with the proposed project are investigated in comparison to the *Year 2035* conditions scenario. Within this scenario, the project generated peak hour traffic volumes have been added to the *Year 2035* conditions volumes to obtain the *Year 2035 Plus Project* volumes.

Each scenario is described in further detail and evaluated in subsequent sections of this report. Transportation improvements required to maintain acceptable vehicular access and safety at all locations are identified and documented under the Impacts and Mitigation section of this study.

Study Intersections

The following four (4) intersections were identified by the City of Vacaville for analysis:

1. N. Orchard Avenue & Vaca Valley Road/Farrell Road
2. N. Orchard Avenue & Fruitvale Road
3. Gibson Canyon Road & Fruitvale Road
4. N. Orchard Avenue & W. Monte Vista Avenue

Roadway Network

Roadways that provide primary circulation in the vicinity of the proposed project are described below.

W. Monte Vista Avenue – is an east-west roadway that traverses between Alamo Drive and Vaca Valley Parkway. Within the study area, W. Monte Vista Avenue is a two-lane arterial with a posted speed of 45 MPH.

N. Orchard Avenue – is a north-south roadway which runs between Vaca Valley Road/Farrell Road and Merchant Street. Within the study area, N. Orchard Avenue is a two-lane collector with a posted speed of 25 and 30 MPH.

Fruitvale Road – is an east-west roadway which runs between Dunsmuir Street and Gibson Canyon Road. Within the study area, Fruitvale Road is a two-lane collector with a speed limit of 25 MPH.

Gibson Canyon Road – is a north-south roadway which runs between Vaca Valley Road/Farrell Road and Merchant Street. Within the study area, Gibson Canyon Road is a two-lane arterial with a posted speed of 45 MPH.

Vaca Valley Road/Farrell Road – is an east-west roadway that traverses between Pleasants Valley Road and Gibson Canyon Road. Within the study area, Vaca Valley Road/Farrell Road is a two-lane arterial with a posted speed limit of unposted.

Data Collection & Analysis

Omni-Means collected the existing turning movement count data at all study intersections. These four study intersections are evaluated for average weekday AM and PM peak hour operations under all analysis scenarios. The AM peak hour is defined as the one-hour of peak traffic flow (which is the highest total volume count over four consecutive 15-minute count periods) counted between 7:00 am and 9:00 am on a typical weekday. The PM peak hour is defined as the one hour of peak traffic flow counted between 4:00 pm and 6:00 pm on a typical weekday.

The AM and PM peak hour turning movement counts were collected by Omni-Means on Thursday, February 15, 2018. Schools in the area were in regular session and no known special events were occurring in the area at the time of the traffic counts. Counts were obtained in the absence of inclement weather.

Alternative Transportation Modes

The following section presents the existing alternative transportation modes. All off-site and on-site mitigations would satisfy all analysis scenarios.

Pedestrian Facilities

N. Orchard Avenue, from W. Monte Vista Avenue to Farrell Road, contains continuous sidewalk along the westerly side of the roadway. The easterly side of the roadway has sidewalk present along the majority of the roadway, with the exception of where the proposed project would be located.

Fruitvale Road, from Dunsmuir Street to Gibson Canyon Road, contains continuous sidewalk along the southerly side of the roadway, with the exception of where the proposed project would be located and near the intersection of Gibson Canyon Road and Fruitvale Road. The northerly side contains sporadic sidewalk along the roadway.

Project Frontage

The project proposes to provide continuous sidewalks along the project frontage.

On-site

Pedestrian sidewalks will be provided within the project area.

Bicycle Facilities

The City of Vacaville General Plan identifies the following existing and future bicycle facilities:

- Class I: Bike path from Foothill Drive to Farrell Road (Existing)
- Class III: N. Orchard Avenue from W. Monte Vista Avenue to Farrell Road (Proposed)
- Class III: Fruitvale Road from Dunsmuir Street to Stinson Avenue (Proposed)

The California Streets and Highways Code defines the various classes of bicycle facilities as follows:

(a) Bike paths or shared use paths, also referred to as "Class I bikeways", which provide a completely separated right-of-way designated for the exclusive use of bicycles and pedestrians with cross-flows by motorists minimized.
(b) Bike lanes, also referred to as "Class II bikeways", which provide a restricted right-of-way designated for the exclusive or semi-exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and cross-flows by pedestrians and motorists permitted.
(c) Bike routes, also referred to as "Class III bikeways", which provide a right-of-way on-street or off-street, designated by signs or permanent markings and shared with pedestrians and motorists.
(d) Cycle tracks or separated bikeways, also referred to as "Class IV bikeways", which promote active transportation and provide a right-of-way designated exclusively for bicycle travel adjacent to a roadway and which are separated from vehicular traffic. Types of separation include, but are not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

Project Frontage

No new bicycle facilities are proposed with the development of the project.

On-site

The implementation of the City's development standards will satisfy the transportation needs of bicyclists.

Transit Services

Existing Transit Service is provided primarily by Vacaville City Coach. City Coach provides 8 fixed routes throughout Vacaville. The nearest stop to the project site is at the transit Plaza near the intersection of Dobbins Street and Monte Vista Avenue, and is served by route 4. The project site is approximately 1.4 miles away from this stop.

Project Frontage

Transit services do not currently extend to the project site, therefore no transit stops will be added on the project frontage.

On-site

Accessible paths of travel will be provided between the project's buildings and public right-of-way.

Technical Analysis Parameters & Methodologies

The following section outlines the analysis parameters and methodologies that were used in this analysis to quantify the measures of effectiveness for the analysis scenarios.

Level of Service Methodologies

Traffic operations was quantified through the determination of "Level of Service" (LOS). LOS is a qualitative measure of traffic operating conditions, whereby a letter grade "A" through "F" is assigned to an intersection, representing progressively worsening traffic conditions. LOS "A" represents free-flow operating conditions and LOS "F" represents over-capacity conditions. Levels of Service was be calculated for all intersection control types using the methods documented in the Transportation Research Board Publication *Highway Capacity Manual, Sixth Edition, 2016* (HCM 6).

Intersection Operations

Intersection LOS was calculated for all control types using the methods documented in HCM 6. For a signalized or all way stop controlled (AWSC) intersection, an LOS determination is based on the calculated averaged delay for all approaches and movements. The vehicular-based LOS criteria for different types of intersection controls are presented in Table 1.

TABLE 1
LEVEL OF SERVICE (LOS) CRITERIA FOR INTERSECTIONS

Level of Service	Type of Flow	Delay	Maneuverability	Stopped Delay/Vehicle (sec)	
				Signalized/ Roundabouts	Unsignalized/ All-Way Stop
A	Stable Flow	Very slight delay. Progression is very favorable, with most vehicles arriving during the green phase not stopping at all.	Turning movements are easily made, and nearly all drivers find freedom of operation.	≤ 10.0	≤ 10.0
B	Stable Flow	Good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.	Vehicle platoons are formed. Many drivers begin to feel somewhat restricted within groups of vehicles.	>10 and ≤ 20.0	>10 and ≤ 15.0
C	Stable Flow	Higher delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.	Back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted.	>20 and ≤ 35.0	>15 and ≤ 25.0
D	Approaching Unstable Flow	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	Maneuverability is severely limited during short periods due to temporary back-ups.	>35 and ≤ 55.0	>25 and ≤ 35.0
E	Unstable Flow	Generally considered to be the limit of acceptable delay. Indicative of poor progression, long cycle lengths, and high volume-to-capacity ratios. Individual cycle failures are frequent occurrences.	There are typically long queues of vehicles waiting upstream of the intersection.	>55 and ≤ 80.0	>35 and ≤ 50.0
F	Forced Flow	Generally considered to be unacceptable to most drivers. Often occurs with over saturation. May also occur at high volume-to-capacity ratios. There are many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors.	Jammed conditions. Back-ups from other locations restrict or prevent movement. Volumes may vary widely, depending principally on the downstream back-up conditions.	> 80.0	> 50.0

References: 2010 Highway Capacity Manual

City Level of Service Policy

The City of Vacaville General Plan, adopted in August 2015, has the following policies relating to level of service and traffic congestion:

> **Policy TR-P3.1** Endeavor to maintain LOS C as the LOS goal at all intersections and interchanges to facilitate the safe and efficient movement of people, goods, and services. Strive to design improvements to provide a LOS goal of C, based on the City's most recent 20+ year traffic forecast including signalized and unsignalized intersections.
>
> **Policy TR-P3.2** At signalized and all-way stop control intersections, LOS mid-D shall be the LOS significance threshold. At two-way stop control intersections, LOS D shall be the LOS significance threshold.
>
> **Policy TR-P3.4** The City may allow LOS above the established LOS significance thresholds for a particular location as an interim level of service where improvements are programmed by the City that will improve the service to an acceptable level.
>
> **Policy TR-P3.5** The City may allow LOS above the established LOS significance thresholds for a particular location on the basis of specific findings described in Chapter 14.13 of the Vacaville Land Use and Development Code, Traffic Impact Mitigation Ordinance.

Consistent with City policy and the General Plan, this study will consider LOS "Mid-D" (less than 45 seconds of delay) as the standard acceptable threshold for the intersection service levels.

Technical Analysis Parameters

Table 2 presents the technical parameters that were utilized for the evaluation of the study intersections for the analysis scenarios. All parameters not listed should be assumed as default values or calculated based on parameters listed.

TABLE 2
TECHNICAL ANALYSIS PARAMETERS

Technical Parameters	Assumption
1. Intersection Peak Hour Factor (PHF)	Intersection Overall, based on Existing Counts
2. Intersection Heavy Vehicle Percentage	Intersection Overall, based on Existing Counts, min. 2%
3. Signal Timings	Based on City's timing plans
4. Grades	2% or less at all intersections

Significance Thresholds

City of Vacaville Signalized or Unsignalized Intersections

Based on City's direction and practice, the project is considered to have a significant impact if:

- Project traffic causes minimum LOS standards to be exceeded; or
- Project traffic increases the average delay by more than 5 seconds for intersections operating at an unacceptable service level without the project.

Existing Conditions

Existing conditions establishes the traffic conditions that currently exist in the study area.

Existing geometry including lane usage and storage capacity at the study locations was determined based on current aerial images. All of the study intersections are stop-controlled, except for the intersection of N. orchard Avenue & W. Monte Vista Avenue, which is signal-controlled. The Synchro outputs of each scenario are included in the Appendix.

Intersection Operations

Existing weekday AM and PM peak hour intersection traffic operations were quantified utilizing the Existing traffic volumes and existing intersection lane geometrics and controls. Table 3 presents a summary of the existing study intersection operations.

TABLE 3
EXISTING CONDITIONS INTERSECTION OPERATIONS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	N Orchard Ave & Vaca Valley Rd/Farrell Rd	AWSC	Mid-D	9.1	A	8.0	A
2	N Orchard Ave & Fruitvale Rd	AWSC	Mid-D	11.2	B	11.0	B
3	Gibson Canyon Rd & Fruitvale Rd	AWSC	Mid-D	12.8	B	12.5	B
4	N Orchard Ave & W Monte Vista Ave	Signal	Mid-D	23.0	C	21.7	C

Notes:
1. AWSC = All Way Stop Control
2. LOS = Delay based on average of all approaches for AWSC, Signal

As presented in Table 3, all of the study intersections currently operate at or above the threshold LOS for the *Existing* conditions.

Project Description

The term "project" as used in this study refers to the proposed residential development located at the intersection of Fruitvale Road & N. Orchard Avenue. The proposed project will provide ingress and egress via N. Orchard Avenue and Fruitvale Road.

The proposed project consists of the following land uses:

- 127 units of single family residential housing
- 5.12 acres of public park and trails

Project Trip Generation

Project site trip generation has been estimated for each land use utilizing trip generation rates contained in the Institute of Transportation Engineers (ITE) Publication Trip Generation Manual 10th Edition. Table 4 presents a summary of the land use and quantities for the proposed project, along with the corresponding ITE land use code from which trip generation characteristics were established.

TABLE 4
PROJECT TRIP GENERATION

Land Use Category (ITE Code)	Unit[1]	Daily Trip Rate/Unit[2]	AM Peak Hour Trip Rate/Unit			PM Peak Hour Trip Rate/Unit		
			Total	In %	Out %	Total	In %	Out %
Single-Family Detached Housing (201)	DU	10.20	0.75	25%	75%	1.01	63%	37%
Public Park (411)	Acre	17.92	0.02	59%	41%	4.47	55%	45%
Farmstead Residential Project	**Quantity (Units)**	**Daily Trips**	**AM Peak Hour Trips**			**PM Peak Hour Trips**		
			Total	**In**	**Out**	**Total**	**In**	**Out**
Residential	127	1,296	95	24	71	128	81	47
Park & Trail Area	5.1	92	0	0	0	23	13	10
Net New Project Trips		**1,387**	**95**	**24**	**71**	**151**	**93**	**58**

Notes:
1. DU = dwelling unit
2. Trip rates based on ITE Trip Generation Manual 10th edition fitted-curve equations or average rates

As presented in Table 4, the proposed project will generate approximately 95 AM and 151 PM peak hour trips.

Project Trip Distribution

The directional trip distribution and specific assignment of project-generated trips were established based on an understanding of existing traffic flows and travel patterns within the vicinity of the project site. The proposed trip distribution percentages are listed below:

- 35% on Gibson Canyon Road, south of Fruitvale Road
- 30% on S. Orchard Avenue, south of W. Monte Vista Avenue
- 16% on W. Monte Vista Avenue, east of N. Orchard Avenue
- 12% on W. Monte Vista Avenue, west of N. Orchard Avenue
- 4% on Gibson Canyon Road, north of Fruitvale Road
- 2% on Farrell Road, east of N. Orchard Avenue
- 1% on Vaca Valley Road, west of N. Orchard Avenue

Project Site Access

The proposed project will have two full access driveways, one along Fruitvale Road east of N. Orchard Avenue and one along N. Orchard Avenue at the intersection of N. Orchard Avenue and Parkridge Drive. No other driveway access is proposed.

Existing Plus Project Conditions

Existing Plus Project conditions were simulated by superimposing traffic generated by the proposed project onto the *Existing* intersection and roadway traffic volumes.

Intersection Operations

Table 5 presents a summary of the intersection operations for the weekday AM and PM peak hour scenarios for the *Existing Plus Project* conditions.

TABLE 5
EXISTING PLUS PROJECT CONDITIONS INTERSECTION OPERATIONS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	N Orchard Ave & Vaca Valley Rd/Farrell Rd	AWSC	Mid-D	9.1	A	8.1	A
2	N Orchard Ave & Fruitvale Rd	AWSC	Mid-D	11.2	B	11.1	B
3	Gibson Canyon Rd & Fruitvale Rd	AWSC	Mid-D	13.6	B	14.2	B
4	N Orchard Ave & W Monte Vista Ave	Signal	Mid-D	25.2	C	23.5	C

Notes:
1. AWSC = All Way Stop Control
2. LOS = Delay based on average of all approaches for AWSC, Signal

As presented in Table 5, all of the study intersections are projected to operate at or above the threshold LOS for the *Existing Plus Project* conditions.

Both project driveways are projected to operate acceptably without adding turn lanes to either the project driveways.

Short Term Conditions

Short Term conditions were simulated by superimposing traffic generated by the approved/pending projects onto the *Existing* intersections and roadway traffic volumes. The approved/pending project list provided by the City of Vacaville indicated the following developments:

- The Arroyo Vista Subdivision, an eight (8) single family dwelling unit development at the southwest quadrant of the intersection of Fruitvale Road and Gibson Canyon Road.
- The Canyon View Subdivision, an eleven (11) single family dwelling unit development along Gibson Canyon Road south of Fruitvale Road.

Intersection Operations

Table 6 presents a summary of the intersection operations for the weekday AM and PM peak hour scenarios for the *Short Term* conditions.

TABLE 6
SHORT TERM CONDITIONS INTERSECTION OPERATIONS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	N Orchard Ave & Vaca Valley Rd/Farrell Rd	AWSC	Mid-D	9.1	A	8.1	A
2	N Orchard Ave & Fruitvale Rd	AWSC	Mid-D	11.6	B	11.2	B
3	Gibson Canyon Rd & Fruitvale Rd	AWSC	Mid-D	13.3	B	13.0	B
4	N Orchard Ave & W Monte Vista Ave	Signal	Mid-D	23.5	C	21.9	C

Notes:
1. AWSC = All Way Stop Control
2. LOS = Delay based on average of all approaches for AWSC, Signal

As presented in Table 6, all of the study intersections are projected to operate at or above the threshold LOS for the *Short Term* conditions.

Short Term Plus Project Conditions

Short Term Plus Project conditions were simulated by superimposing traffic generated by the project onto the *Short Term* intersections and roadway traffic volumes.

Intersection Operations

Table 7 presents a summary of the intersection operations for the weekday AM and PM peak hour scenarios for the *Short Term Plus Project* conditions.

TABLE 7
SHORT TERM PLUS PROJECT CONDITIONS INTERSECTION OPERATIONS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	N Orchard Ave & Vaca Valley Rd/Farrell Rd	AWSC	Mid-D	9.2	A	8.1	A
2	N Orchard Ave & Fruitvale Rd	AWSC	Mid-D	11.7	B	11.3	B
3	Gibson Canyon Rd & Fruitvale Rd	AWSC	Mid-D	14.2	B	14.9	B
4	N Orchard Ave & W Monte Vista Ave	Signal	Mid-D	25.7	C	23.8	C

Notes:
1. AWSC = All Way Stop Control
2. LOS = Delay based on average of all approaches for AWSC, Signal

As presented in Table 7, all of the study intersections are projected to operate at or above the threshold LOS for the *Short Term Plus Project* conditions.

Both project driveways are projected to operate acceptably without adding turn lanes to either the project driveways.

Year 2035 Conditions

Year 2035 conditions analyze the scenario that exists following approximately 20 years of development in the City of Vacaville. *Year 2035* conditions represent the long term, future year scenarios used in the evaluation of traffic operations.

Year 2035 weekday AM and PM peak hour intersection traffic operations were quantified using the City's Travel Demand Model (TDM). The Vacaville Citywide model provides AM and PM peak hour outputs in Cube modeling software for the Existing scenario and the Year 2035 Cumulative/General Plan model scenario.

Intersection Operations

Table 8 presents a summary of the intersection operations for the weekday AM and PM peak hour scenarios for the *Year 2035* conditions.

TABLE 8
YEAR 2035 CONDITIONS INTERSECTION OPERATIONS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	N Orchard Ave & Vaca Valley Rd/Farrell Rd	AWSC	Mid-D	9.6	A	8.1	A
2	N Orchard Ave & Fruitvale Rd	AWSC	Mid-D	12.5	B	11.6	B
3	Gibson Canyon Rd & Fruitvale Rd	AWSC	Mid-D	14.8	B	13.9	B
4	N Orchard Ave & W Monte Vista Ave	Signal	Mid-D	27.1	C	23.6	C

Notes:
1. AWSC = All Way Stop Control
2. LOS = Delay based on average of all approaches for AWSC, Signal

As presented in Table 8, all of the study intersections are projected to operate at or above the threshold LOS for the *Year 2035* conditions.

Year 2035 Plus Project Conditions

Year 2035 Plus Project conditions were simulated by superimposing traffic generated by the project onto the *Year 2035* intersections and roadway traffic volumes.

Intersection Operations

Table 9 presents a summary of the intersection operations for the weekday AM and PM peak hour scenarios for the *Year 2035 Plus Project* conditions.

TABLE 9
YEAR 2035 PLUS PROJECT CONDITIONS INTERSECTION OPERATIONS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	N Orchard Ave & Vaca Valley Rd/Farrell Rd	AWSC	Mid-D	9.6	A	8.1	A
2	N Orchard Ave & Fruitvale Rd	AWSC	Mid-D	12.6	B	11.7	B
3	Gibson Canyon Rd & Fruitvale Rd	AWSC	Mid-D	16.0	C	15.6	C
4	N Orchard Ave & W Monte Vista Ave	Signal	Mid-D	30.1	C	25.9	C

Notes:
1. AWSC = All Way Stop Control
2. LOS = Delay based on average of all approaches for AWSC, Signal

As presented in Table 9, all of the study intersections are projected to operate at or above the threshold LOS for the *Year 2035 Plus Project* conditions.

Both project driveways are projected to operate acceptably without adding turn lanes to either the project driveways.

Project Impacts and Mitigation Measures

All of the study intersections are projected to operate at or above the threshold LOS in all study scenarios. Therefore, no significant impacts are identified and no mitigations are required.

Appendices

Appendix A: Intersection Turning Movement Counts

Appendix B: Synchro Outputs

Appendix A: Intersection Turning Movement Counts

Appendix B: Synchro Outputs