



HEXAGON TRANSPORTATION CONSULTANTS, INC.

Memorandum

Date: September 23, 2016
To: Mr. Jered Lawson, Pie Ranch
From: Ricky Williams
Subject: Pie Ranch Traffic Study

Hexagon Transportation Consultants, Inc. has completed a traffic study for Pie Ranch, located at 2080 Cabrillo Highway (Highway 1) in San Mateo County. This traffic study was conducted in order for Pie Ranch to obtain a use permit for current activities.

The purpose of this traffic study is to insure that the project site has adequate access, and its traffic can be accommodated at the existing driveways and on Cabrillo Highway. Pie Ranch operates a farmstand year round selling produce and pies and typically draws customers from the passerby traffic along Cabrillo Highway. The farmstand operates between Noon and 5:00 PM on weekdays, and 10:00 AM and 5:00 PM on weekends. It is closed on some major holidays, winter vacation, and for major special events like the fundraising dinner.

Data Collection

Hexagon conducted turning movement counts at the Pie Ranch driveway and at the intersection of Cabrillo Highway and Green Oaks Way in July 2016. These counts were conducted between 10:00 AM and 5:00 PM on a typical weekend (Saturday), which is when the ranch experiences the highest number of visitors, without a special event. These counts are attached at the end of this memorandum. The existing site layout, driveways, and access roads are shown in Figure 1. Counts were not conducted during a special event or workday as such events occur, at most, once a month, and typically do not occur during the peak hours of traffic along Cabrillo Highway.

Trip Generation and Distribution

Based on the counts, a daily trip generation was determined for Pie Ranch on weekends without special events. The counts showed that the ranch generates 372 total trips including 187 inbound and 185 outbound between 10:00 AM and 5:00 PM (see Table 1).

Table 1
Pie Ranch Trip Generation and Distribution

Pie Ranch Trips	Inbound			Outbound			Total Trips
	Total	From NB	From SB	Total	To NB	To SB	
Weekend (All Day)	187	65%	35%	185	60%	40%	372
Peak Hour (1PM-2PM)	39	74%	26%	26	54%	46%	65

The count distribution shows that a majority of the trips (approximately 95 percent) at Pie Ranch would be considered pass-by trips. These are vehicles that stop in at Pie Ranch while already driving on Highway 1 to and from other destinations. The counts show that very few vehicles make a special trip just to go to Pie Ranch. Based on the counts, Pie Ranch is only generating approximately nine inbound and nine outbound trips that would not have occurred had the ranch not been in operation.

Observed Conditions

Existing traffic operations at the driveways and in the parking area were observed during a typical Saturday peak hour. These observations were made during a non-special event day in July.

Outbound Vehicles

It was observed that vehicles often do not experience delays while waiting to turn left or right out of either project driveway. The driveways are wide enough, and lack any defined lanes, that vehicles are able to make right turns onto Cabrillo Highway while left-turning vehicles are also present at the driveway. Slight sight distance issues exist for vehicles exiting the northern driveway due to the location of the Pie Ranch sign. The location of this sign is not an issue for drivers exiting from the Green Oaks Way driveway. Additionally, due to the close proximity of the two driveways, vehicles turning left from the driveway were observed not immediately spotting vehicles turning right from Green Oaks Way.

Parking

Pie Ranch does not have defined parking spaces or parking areas. A high majority of the vehicles accessing the site parked in the area in front of Pie Ranch. At certain times, the area in front of the ranch building became relatively congested as vehicle entered the site while other vehicles pulled out of parking spaces. Very few vehicles were observed using the rear parking area despite the availability of spaces, and only busses were parked in the rear during the observation period. Very little signage exists notifying drivers that there are additional parking areas at the rear of the ranch building.

Based on the approximate parking map provided by Pie Ranch, there appear to be 72 defined parking places, however, based on the amount of remaining space on the site, this number is considered to be a relatively low estimate. Without parking on roadways, hindering bus/emergency vehicle turnaround, or parking within riparian areas, it is estimated that Pie Ranch would be able to park up to 150 vehicles without the need to double-park. This amount of parking is more than adequate to serve the needs of the ranch during typical operational hours and special events.

Special Events

Pie Ranch supplied Hexagon with a list and description of the special events that occur on site, including the type of event, the typical attendance, the hours and frequency, and the typical on-site circulation and parking. Special events that occur at Pie Ranch include:

Community Workday, Potluck, and Barn Dance. These events occur every third Saturday of the month and attract between 100 and 150 people. The Workday begins at 2:00 PM and is followed by a Potluck at 6:00, and Barn Dance at 7:00 PM. The events end at 10:00 PM. Guests typically arrive as individuals or small groups and park throughout the site.

Annual Fundraising Dinner on the Farm. The annual fund raiser typically occurs on a Saturday in September and involves approximately 300 people. The fund raiser follows a similar schedule as the Barn Dance.

Bay Area Youth Day on the Farm. The Bay Area Youth Day on the Farm is a semi-annual event that draws around 200 youth from around the Bay Area. Each event occurs, typically, mid-week (Wednesday or Thursday) and lasts all day (10 AM to 6 PM). Youth arrive at Pie Ranch via bus, van, and carpool.

Roadside Barn Workshops. Pie Ranch occasionally hosts farm-focused workshops or discussions on farm-related topics in the Roadside Barn. These events have no set schedule and are organized by various organizations. Such events typically occur mid-week in the afternoon and attract 20 to 40 people.

Site Rentals. Pie Ranch allows groups to use the site for semi-farm-related events such as weddings or birthday parties. The Ranch schedules no more than 13 of these events each year, and attendees can range from 50 to 150 persons. These types of events follow similar schedules to Barn Dances and are usually on Saturdays.

Youth Education Programs. During the school year Pie Ranch hosts farm-related education programs for various schools. Approximately one education event is scheduled per week while schools are in session. These events involve between 15 and 30 youth plus teachers and/or parent chaperones. Groups arrive via van or bus.

Shared Driveway Scheduling

The Green Oaks Way driveway is shared with other developments further back on the site not associated with Pie Ranch, including the Green Oaks Farm and Retreat. The retreat is primarily used for private events during weekends. Pie Ranch and the retreat communicate between one another regarding major events occurring at each location. This communication has allowed both venues to operate normally and schedule large events as to not occur at the same time as one another. Pie Ranch has informed Hexagon that there have been no issues with events occurring simultaneously at each venue, and plans to continue this relationship with the retreat, and other neighboring properties, by sharing its event schedules at least a month in advance of major events.

On-Site Circulation

Pie Ranch currently has two primary parking areas, one at the front of the site along Cabrillo Highway, and another behind the site along Green Oaks Way. In total, the ranch provides approximately 72 parking spaces including 13 spaces at the front of the site, and 59 spaces at the rear of the site (see Figure 2). Observations revealed that the parking areas are not clearly marked. However, vehicles typically parked in a similar manner as shown on Figure 2. The site would benefit from better signage and delineation of the parking areas.

Green Oaks Way extends along the southern edge of the site, providing access to parking spaces in the front and rear of the site. This dirt road is wide enough for one vehicle, but provides adequate space for vehicles to pull over to let other vehicles pass. An additional road along the northern edge of the site (labelled as Road 1 on Figure 1) provides access between the project driveway/front parking area and rear parking area. This dirt road is also wide enough for one vehicle but provides numerous places for vehicles to safely pull off if necessary. Further back in the site another dirt road (labelled as Road 2 on Figure 1) connects between Green Oaks Way and Road 1 and provides access to the turnaround area.

Overall, circulation through the site can accommodate the low traffic volume typically occurring. Busses are provided with adequate turnaround space on-site to exit back onto Cabrillo Highway. Busses were observed making this maneuver with ease provided vehicles are parked in the designated areas.

Green Oaks Way Width

Public Works has indicated that the driveways through the Pie Ranch site should provide adequate space for two vehicles to pass each other. Currently, Green Oaks Way and Road 1 are not currently wide enough for this maneuver. Pie Ranch has indicated that it intends to widen Green Oaks Way to provide adequate width for two vehicles through the removal of vegetation currently alongside the roadway. Based on AASHTO's *geometric Design of Highways and Streets, 6th Edition* (2011), Pie Ranch should ensure that Green Oaks Way is a minimum of 18 feet wide.



Figure 1
Project Location

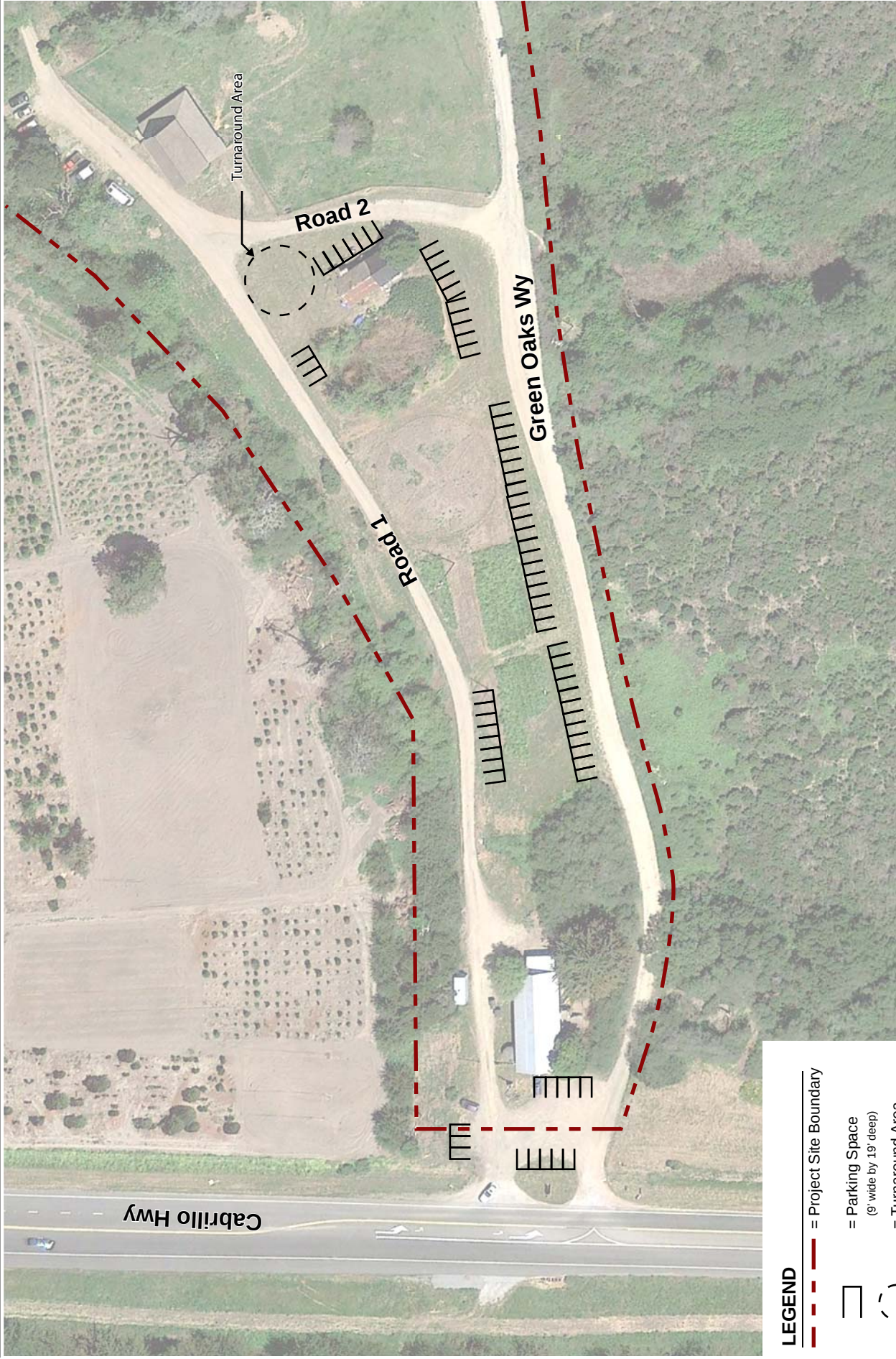


Figure 2
Parking Map

Driveway Operations

Based on the traffic counts and field review of the driveway and Green Oaks Way striping, Hexagon analyzed the weekend driveway operations. Pie Ranch currently has a driveway located approximately 50 feet north of the Green Oaks Way driveway on Cabrillo Highway. A southbound left-turn lane exists on Cabrillo Highway that serves inbound vehicles to both the Pie Ranch driveway and Green Oaks Way. For outbound left turns from Green Oaks Way there is a southbound acceleration lane in the median. Left-turns out of the Pie Ranch driveway cannot legally use the median for refuge because it is an inbound left-turn lane.

Delay and Queuing at the Driveways

The driveways were analyzed for peak hour delay and 95th percentile queuing using a Poisson probability distribution, which estimates the probability of “n” vehicles for a vehicle movement using the following formula:

$$P(x=n) = \frac{\lambda^n e^{-\lambda}}{n!}$$

Where:

$P(x=n)$ = probability of “n” vehicles in queue per lane

n = number of vehicles in the queue per lane

λ = Average # of vehicles in the queue per lane (vehicles per hr per lane/signal cycles per hr)

The basis of the analysis is as follows: (1) the Poisson probability distribution is used to estimate the 95th percentile maximum number of queued vehicles per signal cycle for a particular movement; (2) the estimated maximum number of vehicles in the queue is translated into a queue length, assuming 25 feet per vehicle; and (3) the maximum queue length is compared to the existing or planned available storage capacity for the movement. This analysis thus provides a basis for estimating future left-turn storage requirements at intersections. The 95th percentile queue length value indicates that during the peak hour, a queue of this length or less would occur 95 percent of the time. Or, a queue length larger than the 95th percentile queue would only occur 5 percent of the time. Therefore, left-turn storage pocket designs based on the 95th percentile queue length would ensure that storage space would be exceeded only 5 percent of the time. The 95th percentile queue length is also known as the “design queue length.” The queue estimates and a tabulated summary of the findings are provided in Table 2. For this analysis, the peak hour represents the peak weekend hour from 1:00 – 2:00 PM. All turning movements currently experience relatively low delays at both the driveway and at Green Oaks Way (see Table 2). Currently, a majority of the Pie Ranch outbound vehicles use the driveway to turn left and right onto the highway. However, a majority of the inbound vehicles, including all southbound left-turning vehicles, were observed to enter the site at Green Oaks Way. None of the movements were observed or calculated to experience a queue of greater than a single vehicle. Based on the northbound and southbound volumes on Cabrillo Highway, vehicles exiting Pie Ranch have adequate gaps available to safely turn onto the highway.

To eliminate potential conflicts between the closely spaced driveway and Green Oaks Way, Hexagon recommends that the driveway be closed and all Pie Ranch access come from Green Oaks Way. The removal of the driveway access would minimally increase the average delay for the outbound vehicles at Green Oaks Way, and would not increase the 95th percentile queue. No issues would arise by consolidating access to Green Oaks Way. Closing the driveway could be accomplished with a gate that remains closed during operational hours but could be opened for emergency vehicles.

The question has come up about whether the driveway could be restricted to right turns only with signage. Hexagon's experience has been that simply providing right-turn-only signage is ineffective at preventing left-turning maneuvers.

Table 2
Driveway Delays and Queues

Intersection Movement	Green Oaks Way & Cabrillo Highway			Driveway & Cabrillo Highway	
	Outbound RT	Outbound LT	Inbound LT	Outbound RT	Outbound LT
Existing					
Cycle/Delay ¹ (sec)	9.9	15.4	7.9	9.9	15.3
Lanes	1	1	1	1	1
Volume (vph)	1	2	3	13	10
Volume (vphpl)	1	2	3	13	10
Avg. Queue (veh/ln)	0.0	0.0	0.0	0.0	0.0
Avg. Queue ² (ft/ln)	0	0	0	1	1
95th% Queue (veh/ln)	1	1	1	1	1
95th% Queue (ft/ln)	25	25	25	25	25
Storage (ft/ ln)	75	75	175	50	50
Adequate (Y/N) ³	Y	Y	Y	Y	Y
Green Oaks Access Only					
Cycle/Delay ¹ (sec)	10.0	15.8	7.9	--	--
Lanes	1	1	1	--	--
Volume (vph)	14	12	10	--	--
Volume (vphpl)	14	12	10	--	--
Avg. Queue (veh/ln)	0.0	0.1	0.0	--	--
Avg. Queue ² (ft/ln)	1	1	1	--	--
95th% Queue (veh/ln)	1	1	1	--	--
95th% Queue (ft/ln)	25	25	25	--	--
Storage (ft/ ln)	75	75	175	--	--
Adequate (Y/N) ³	Y	Y	Y	--	--
Notes: RT = right turn movement; LT = left turn movement. ¹ Vehicle queue calculations based on cycle length for signalized intersections and average delay for unsignalized intersections. ² Assumes 25 feet per vehicle queued. ³ A 95th percentile queue length exceeding the available storage by one vehicle (25 feet) is not expected to cause any significant operational issues.					

Driveway Operations for Special Events

A majority of the Pie Ranch special events occur on the weekends and do not have set arrival or departure times for guests. A few of the events, such as the annual fundraiser dinner or select site rentals, may experience high numbers of vehicles arriving and exiting around the same time. Due to the existing left-turn pocket in the southbound direction and the wide shoulder in the northbound direction, arrivals would not be expected to cause any significant operational issues with traffic on Cabrillo Highway. With high numbers of vehicles exiting at the same time, queues on-site are expected as vehicles turn onto Cabrillo Highway. These queues are likely to dissipate in a short amount of time.

Driveway Safety

Pie Ranch is currently accessed via a driveway on Cabrillo Highway and off of Green Oaks Way. Cabrillo Highway has been striped in this location to provide proper left-turn and acceleration lanes for vehicles entering and exiting the site at Greet Oaks Way. Such lanes do not exist for vehicles entering and exiting at the Pie Ranch driveway. The two access points are 50 feet apart, and potential conflicts can occur between them. It is recommended that the project install a barricade of some type to prevent vehicles from using the driveway, ensuring that all vehicles use the Green Oaks Way/Cabrillo Highway intersection. Barricades could include bollards or fences that are permanent and prevent vehicles from maneuvering around them.

Conclusions

The purpose of this traffic study was to insure that Pie Ranch has adequate access, and its traffic can be accommodated at the existing driveways and on Cabrillo Highway.

A high majority of the trips at Pie Ranch are diverted trips that likely would have existed on Cabrillo Highway had the ranch not been in operation. Overall, the ranch is adding very little additional traffic to the highway.

The project is accessed by two driveways, located in close proximity to one another. The intersection at Green Oaks Way has been properly accommodated with the provision of a southbound left-turn lane and a southbound acceleration lane for exiting vehicles. Such roadway facilities do not exist for at the other driveway location.

Recommendation: The project should remove site access at the existing driveway to ensure all inbound and outbound trips use Green Oaks Way. This improvement would result in increased safety and a minimal impact on delay for inbound and outbound vehicles.

Overall the project site has good circulation between the parking areas and access roads, and provides adequate space for larger vehicles such as busses to turn around at the rear of the site. Very little signage exists to delineate the parking areas and to notify drivers where the various parking areas are located.

Recommendation: Pie Ranch should improve signage to notify drivers of existing parking areas in the rear of the building. Parking spaces should be better defined through the use of wheel stops to mark each space.

Pie Ranch has numerous special events that occur throughout the year. It is expected that these events will increase on-site queuing and parking demand, but based on the observed conditions during peak times on weekends, they are not expected to interfere with operations on Cabrillo Highway.

The roadways that currently serve the on-site circulation needs of Pie Ranch do not provide adequate space for two vehicles to maneuver around one another without one vehicle pulling to the side of the driveway.

Recommendation: Pie Ranch should widen Green Oaks Way to a minimum of 18 feet in width by removing existing vegetation.

Attachment 1

Driveway and Intersection Turning Movement Counts

Attachment 2

Responses to Planning and Public Works Comments

Attachment 3

Pie Ranch Site Plan and Parking Layout

Comment**Response****Planning**

Delineation of parking should be a recommended measure. Bus parking spaces should also be delineated.

Recommendation is included in revised report. Bus parking is included in revised Figure 2.

Adequacy of parking plan should be included in analysis.

Included in revised report.

Explain why counts were not done on Farm Workday.

Included in revised report.

Explain why driveway should be barricaded vs. just closed to general public via signage.

Included in revised report.

Please factor in (a) employees which commute to the site, and (b) the number of adjoining properties/cars which use Green Oaks Way

Included in revised report.

Public Works

Use Synchro to provide data.

Traffic information was initially used for the queuing analysis. The queuing analysis has been changed to use Poisson Distribution Probability. Traffic is not used in the document.

Provide layout design of driveways with appropriate lane widths and other standards considering highway speeds.

Included in revised report.

Clearly mark all parking spaces.

Included in Figure 2.

Provide parking calculations to show adequate parking for all events, visitors, and employees.

Estimations included in report.

Provide closure plans for the second driveway.

Pie Ranch is proposing to place a gate at this driveway which would prevent visitors from using the driveway while leaving it as an ingress/egress option for emergency vehicles. Closure plans will be provided to the County and to Caltrans if any work is necessary within the Caltrans right-of-way.

Show dimensions of access roads. Provide enough widths for two lanes.

Access road dimensions are discussed in the revised report.

Provide approval from Caltrans on the project.

The applicant will obtain Caltrans approval if any work is necessary within the Caltrans right-of-way.

Provide encroachment permit from appropriate agency for all work proposed in public right-of-way.

The applicant will obtain County approval for any work on Green Oaks Way and Caltrans approval for any work within the Caltrans right-of-way.

Consider the Green Oaks Creek Farm & Retreat event calendar and how it relates to Pie Ranch events. Provide an analysis showing that combined events will not cause queuing on public right-of-way or obstruction of sight distance at the proposed single driveway.

Included in report.

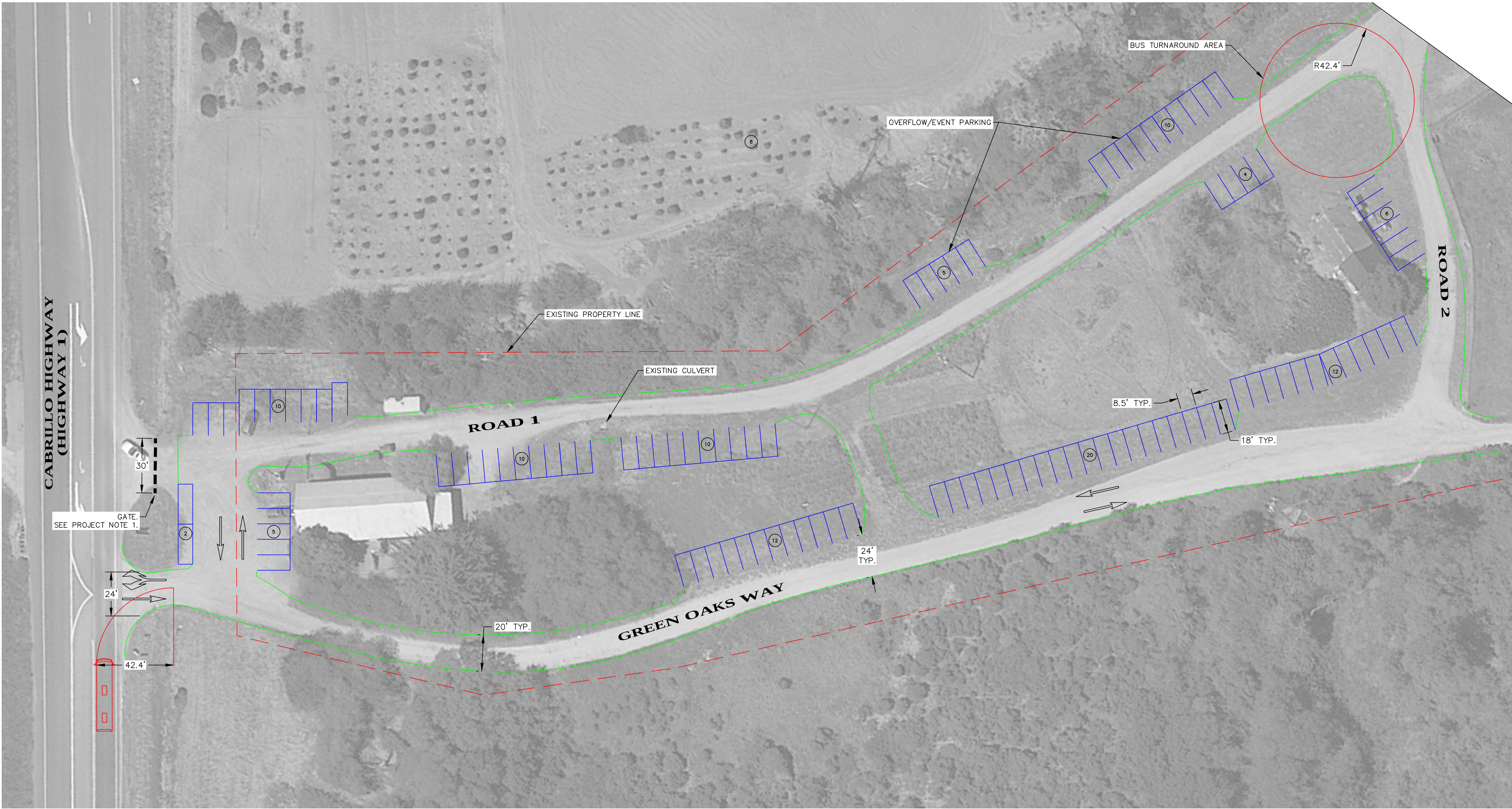
LEGEND

— — — — — = Project Site Boundary

■ ■ ■ ■ ■ = Barricade



Figure 3
Closure Plan

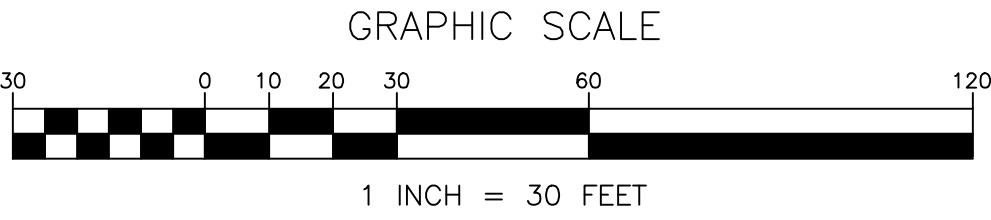


- LEGEND:
- (#) NUMBER OF PARKING SPACES
 - DIRECTION OF TRAVEL
 - ROADWAY EDGE
 - EXISTING PROPERTY LINE

PROJECT NOTES (THIS SHEET ONLY):

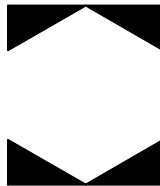
- GATE TO BE INSTALLED ACROSS NORTHERN PROJECT DRIVEWAY TO PREVENT VEHICLES FROM USING THE DRIVEWAY DURING OPERATIONAL HOURS. GATE MAY BE IN CALTRANS RIGHT OF WAY.
- PROJECT INCLUDES 104 STANDARD VEHICLE PARKING SPACES (90 DEGREES) AND 2 PARALLEL VEHICLE PARKING SPACES.
- ALL TRAVELED WAYS SHALL BE A MINIMUM OF 20 FEET TO ALLOW TWO DIRECTIONAL TRAFFIC.
- DISTANCE BETWEEN THE BEGINNING OF EACH PARKING SPACE AND THE EDGE OF THE ROADWAY SHALL BE A MINIMUM OF 24 FEET TO ALLOW ADEQUATE DISTANCE TO MANEUVER OUT OF EACH PARKING SPACE.

PRELIMINARY
DESIGN
NOT FOR CONSTRUCTION



DRAWN R. RODRIGUEZ	DESIGNED R. WILLIAMS	SCALE 1" = 30'
CHECKED	DATE 10/20/16	
APPROVED		
ENGINEER	DATE	CONTRACT NO.

PREPARED BY:

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R E V I S I O N S					
NO.	DATE	BY	DESCRIPTION	APPR.	DATE



County of San Mateo

Pie Ranch
CONCEPTUAL SITE PLAN

PREPARED FOR: County of San Mateo

DRAWING NO.

C-1

SHEET 1 OF 1