Appendix E

Cultural Resource Report

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TOLAY LAKE CARDOZA RANCH

HISTORIC STRUCTURES REPORT

Prepared for:

SONOMA COUNTY REGIONAL PARKS DEPARTMENT

Prepared by:

Architectural Resources Group, Inc.

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TABLE OF CONTENTS

INTRODUCTION

PURPOSE OF THE HISTORIC STRUCTURES REPORT

ARG is part of a team led by MIG to prepare a Master Plan for Tolay Lake Regional Park. This historic structures report provides background information on the historic buildings of the Cardoza Ranch, at the heart of the Tolay Lake Regional Park. This report does not cover all of the structures at the Cardoza Ranch. Some of the buildings – the New Shop (16) and the Modern Barn (17) – are not included because they are not historic. The John Sr. House (3) and the Bunkhouse (2) are not included because they are currently used for ranger housing and will continue in that function under the master plan. The hunting lodge, which is located away from the Ranch, is not included because a viewing station is anticipated at that location.

METHODOLOGY

ARG did not conduct additional historical research for this report, but relied on the previous documentation provided by the County of Sonoma.

ARG visited the site on October 4 and October 17, 2012 to assess the buildings and record their conditions. ARG photographed the buildings and sketched the building plans for review and analysis. Preparation of CAD building plans was not part of the project scope.

Descriptions

The descriptions of the buildings are based on the visual inspection during the site visits. No non-destructive or destructive testing was conducted at any of the buildings. Likewise, no material testing was performed. Some building components were not visible and therefore cannot be fully described or assessed for conditions.

Character Defining Features

A character-defining feature is an aspect of a building's design, construction, or detail that is representative of the building's function, type, or architectural style. Generally, character-defining features include specific building systems, architectural ornament, construction details, massing, materials, craftsmanship, site characteristics and landscape features within the period of significance. In order for an important historic resource to retain its significance, its character-defining features must be retained to the greatest extent possible. An understanding of a building's character-defining features is a crucial step in developing a rehabilitation plan that incorporates an appropriate level of restoration, rehabilitation, maintenance, and preservation.

Character-defining features do not include building features that do not contribute to a building's historic significance or that post-date a building's period of significance. Unfortunately, periods of significance have not been assigned to the buildings at the Tolay Lake Cardoza Ranch site. In the absence of defined periods of significance, ARG has excluded from the lists of character-defining features those elements that are clearly less than 50 years of age and that were clearly added after the building's original construction (for example, the stucco cladding of Buildings 4 and 5.)

Existing Condition

Conditions of spaces and features were evaluated based on standard preservation criteria and guidelines. There are four criteria used to categorize the observed conditions: good, fair, poor and very poor. In some instances, in cases of seriously deteriorated spaces or features, a condition may not be categorized, but described more specifically.

Good The term *good*, as used in this report, indicates that the space or feature is sound, but in need of minor rehabilitation and possible repair.

Fair The term *fair*, as used in this report, indicates the space or feature shows a degree of disrepair and neglect. Rehabilitation and repair is required.

Poor The term *poor*, as used in this report, indicates the space or feature is deteriorated and in disrepair. Substantial rehabilitation and repair or replacement is required.

Very Poor The term *very poor*, as used in this report, indicates the space or feature is severely deteriorated and in complete disrepair. Replacement will likely be required, since the space or feature appears to be beyond rehabilitation and repair.

SUMMARY OF FINDINGS

In general the buildings at the Cardoza Ranch are in fair to poor condition.

Development History

Historical Overview and Context

Project Setting

The Cardoza Ranch sits along the western edge of seasonal Tolay Lake in Sonoma County, in a small valley (Tolay Valley) between the Petaluma River and Sonoma Creek. The Ranch is located in the westernmost portion of the approximately 1,737-acre Tolay Lake Regional Park, approximately 6.5 miles southeast of downtown Petaluma. The Ranch site generally has a northwest-southeast orientation, with Cannon Lane bisecting the site before turning westward to meet Lakeville Road. A dirt road – the Causeway Trail – extends northeast from the Ranch site, traversing the seasonal lake bed.

According to LSA Associates' 2008 Cultural Resources Study for the area:

> [Tolay Lake Regional Park] is situated in the Coast Ranges geomorphic province, an approximately 600-mile stretch of mountain ranges and valleys that extends from the Oregon border south to the Santa Ynez River in Santa Barbara County, California. The Coast Ranges are divided into north and south subprovinces, with San Francisco Bay marking the division between the two. [Tolay Lake Regional Park] is in southern Sonoma County, within a northwest-southeast oriented valley with gentle-to-steep sloping hills. The valley is drained by Tolay Creek, which flows southerly into San Pablo Bay (the northern arm of San Francisco Bay). To the west of [Tolay Lake Regional Park] is the Petaluma River Basin, to the east and north are rolling hills and low mountains, and to the south is the southern end of Tolay Valley, which opens to the tidal marshes of northern San Pablo Bay.[1]

Ethnographic Summary

Prior to Euro-American settlement, the Tolay Lake area was inhabited by speakers of Coast Miwok, a Penutian language group whose settlement area included all of present-day Marin County and much of southern Sonoma County. According to the Cultural Resources Study that LSA Associates completed for the Tolay Lake Regional Park in March 2008:

> Coast Miwok settlements were organized according to "tribelets," which constituted the basic ethnic, political, land-holding units throughout much of California. Within each tribelet's territory were several semi-permanent settlements, along with campsites in outlying areas that were used on a seasonal basis. Settlement locations were chosen for such factors as proximity to water, firewood, food resources, and well-drained soils. Smaller occupation sites were often clustered around a tribelet's principal village, which was the location of the ceremonial roundhouse.
>
> The *Alaguali* tribelet of the Coast Miwok likely inhabited the Tolay Lake area at the time of contact. The name *Tolay* possibly refers to the chief of the Alaguali tribelet, whose name appears on the San Francisco mission register on February 17, 1817. Other important Coast

[1] LSA Associates, "A Cultural Resources Study for the Tolay Lake Regional Park Project," March 28, 2008, 8.

> Miwok tribelets in the vicinity include *Petaluma* (where Mariano Vallejo established the headquarters of his Petaluma Rancho to take advantage of laborers from this village) and *Kotati*, from which Cotate Rancho and the city of Cotati derived their names….
>
> The Coast Miwok were rapidly incorporated into the mission system, with only a few individuals escaping conversion. Enforced conversion occurred from the time that the missions were established at San Francisco (1776), San Rafael (1817), and Sonoma (1823), which dislocated the population and resulted in the disintegration of traditional lifeways. Members of the Alaguali tribelet were incorporated into the three closest missions: Mission San Francisco de Asis, Mission San Jose, and Mission San Francisco Solano. From 1811-1817 50 Alaguali went to Mission San Francisco de Asis and another 70 went to Mission San Jose in 1816 and 1817. Most of the Alaguali survivors from the missions were eventually transferred to Mission San Francisco Solano.[2]

Historical Overview

The following historical overview of the site is taken from the Cultural Resources Study that LSA Associates completed for the Tolay Lake Regional Park in March 2008. Relevant pages of this report (including full citations) are included below in an appendix.

> The earliest visit of a non-native person to [Tolay Lake] occurred in June 1823. At this time, Governor Arguello advised Father Jose Altamira to establish a new mission at Sonoma and transfer the missions at San Francisco and San Rafael there due to the deteriorating conditions of the neophytes at these missions. Father Altamira, who arrived from Spain in 1819 to assist at Mission San Francisco de Asis, promptly traveled north to explore sites for the new mission. Altamira's June 27, 1823 diary entry noted his visit to *Laguna de Tolay* while en route to found the new mission, so named after the Coast Miwok man who was chief of the tribelet from this area. At the time of his visit, Altamira estimated Tolay Lake's dimensions as 150-200 varas (415-500 feet) wide and 1,200 varas (3,500 feet) long. Altamira would establish the last of California's 21 missions, Mission San Francisco Solano, in Sonoma only days later on July 4, 1823. The missions were secularized in 1834.
>
> In 1833, Lieutenant Mariano G. Vallejo was ordered by Governor Jose Figueroa to explore and settle the country north of Mission San Rafael, largely as a means to monitor the nearby Russian colony at Fort Ross. Vallejo applied for and received a 44,000-acre land grant for Rancho Petaluma, which encompassed Lake Tolay, from the governor in 1834. The land grant was confirmed and its size increased by 22,000 acres by Governor Manuel Micheltorena in 1843. This sprawling rancho, one of the largest in the state, stretched eastward from the Petaluma River to Sonoma Creek, from the bayshore north to approximately present-day Glen Ellen. Vallejo's Rancho Petaluma operation relied on Native American labor to produce hides and tallow, agricultural products, blankets, candles, and shoes. The Tolay Lake margins and foothills would have served as rangeland for the large herds of cattle, horses, and sheep owned by Vallejo. Once one of the wealthiest men in

[2] LSA Associates, "A Cultural Resources Study for the Tolay Lake Regional Park Project," 15-19.

the state, legal challenges to Vallejo's land-holdings and squatters forced him to sell his Rancho adobe in 1857.

William Bihler purchased the area that was to become the 1,737-acre Cardoza Ranch in 1865. In 1870, Bihler, noted as a 39-year-old single farmer and native of Baden, was residing on the ranch with a Russian housekeeper and her two children, seven farm laborers, and two cooks (one from Nova Scotia and another from China). Their residence was recorded as being in Vallejo Township, with a Petaluma Post Office address. During his tenure on the property, Bihler reputedly drained Lake Tolay so that he could use it for farming the land. A decade later Bihler was still noted as a farmer, and residing with the same housekeeper (noted as Prussian at this time), a foreman, eight farm laborers, four milkers, a butcher, and a saddler. Ten Chinese farm laborers and one cook were residing in the adjoining household, and presumably working on the same ranch. That same year the Agricultural Production Census noted that Bihler's 430-acre ranch had produced 100 tons of hay, 2,000 bushels of wheat, 400 bushels of apples, 360 dozen eggs, and 300,000 pounds of grapes the previous year.

Although the exact location and dates of operation of the Lake District School are unknown, one source noted that the school was located near the "site of the vanished Lake Tolay" and may have been within the boundaries of the present ranch. Apparently, the school was attended by children of the local ranchers and farmers.

Bihler sold the ranch in the 1880s, and between approximately 1885 and 1894 it was owned by James G. Fair, who had amassed a fortune in the Comstock Lode and served as a United States senator. Fair raised thoroughbred horses and cattle, and operated a vast vineyard that produced prize-winning grapes and brandies, as well as operating the "first continuous brandy distillery on the Pacific Coast."

The ranch was purchased from Fair's heirs by Arthur W. Foster in 1905, who operated it for the next two decades. Foster, president of the San Francisco North Pacific Railroad, operated the ranch as the Lakeville Stock Farm. Foster eventually owned most of the land between Petaluma and Sonoma Creek, purchasing small homesteads and combining them into his large landholdings along his railroad line. He also planted the eucalyptus trees along Lakeville Road, with hired men carrying barrels of water to irrigate them. The trees also line the Foster/Cardoza Road (a segment of the Sears Point-Lakeville Road), the original ranch entrance from Lakeville Road, as Foster reputedly didn't like to ride in the full sun.

Foster, his wife Louisiana, and their nine children never lived on the ranch; they resided instead at their home in San Rafael with numerous servants, in a house now occupied by the Marin Academy as Foster Hall. Foster apparently constructed the elaborate irrigation and drainage system at the ranch, as the date "1907" is incised in some of the concrete work, although some of it may have been constructed earlier.

The ranch was granted to the North Bay Farms Company in 1922, which retained ownership until 1943, the year that it was sold to John S. Cardoza, Sr., George S. Cardoza, and John S. Cardoza, Jr., natives of the Azores, who acquired the property in copartnership. John Cardoza, Sr. was a dairyman who also raised sheep and Hereford cattle on the ranch.

According to descendant Marvin Cardoza, the ranch was in poor condition, undoubtedly due to absentee owners, when John Cardoza, Sr., purchased the property. During the late 1940s and early 1950s, John set about restoring the ranch as a viable livestock and dairy operation, demolishing many of the old buildings and using the timber, lumber, windows, and other architectural elements to build new structures and rebuild others, including barns, equipment sheds, and other amenities. Other buildings were moved around, with the Cottage (1) relocated from the location of the present Bunkhouse (2) area, and Foster's Line Shack (11) moved from the field to a site adjacent to the granary.

The old house on the property was knocked down in 1950 and a new California Ranch style home (3) built for John, Sr. on the site. Two other California Ranch style homes were built for other family members: one for George and Vera Cardoza in 1946 (4), and another for John, Jr. and Beatrice in 1947 (5) (recently the home of Marvin and Rita Cardoza).

The large Dairy Barn (7) on the hill west of the ranch complex was torn down and rebuilt in the late 1940s or early 1950s, with the milk taken to the stone creamery for processing. During this period the original stone Creamery (8) was enlarged and improved with a concrete floor, foundation, side walls, and a frame addition to the east elevation. The creamery was later converted to a winery, and the dairy barn to a sheep shed. The Workshop (12) was evidently one of the few buildings untouched by the Cardozas except for regular maintenance.

The Hay Barn (6) and Tractor Barn (13) were torn down and rebuilt in the early 1950s. A bunkhouse was built during the same period, as was an equipment shed. Corrals, fencing, water troughs, and other amenities were added or improved.

Cattle were butchered in the Slaughterhouse (15), with the offal fed to the hogs and chickens in pens and sheds (no longer extant) located on the hillside below. Hereford cattle grazed the hills, and hay and grains were planted in the fields. Grain was processed in the granary, which had a mill to chop the grain to feed the cattle. The Granary (9) was later converted to a combination museum and event center, primarily for the Cardoza's annual Pumpkin Festival.

In 1979, George S. and Vera Cardoza granted the property to Rita and Marvin Cardoza, who sold the ranch to the Sonoma County Regional Parks Department in 2005. During Marvin and Rita's tenure on the ranch, two new metal barn were erected, one in 1980 and another in 1992.

Portuguese Farmers

Although there is evidence of Portuguese and Spanish Sephardic Jews arriving in the United States as early as the mid-1660s, it wasn't until after 1870 that a sizeable permanent community was established. The first to arrive settled primarily in New England and California and engaged in whaling, fishing, and textile ventures, and in Hawaii, where they worked in the sugar cane industry. In California they engaged in whaling and fishing to a small degree, but their major interest lay in gold mining and agriculture.

The second immigration stage, from 1870 to 1920, saw the decline of both the New England whaling industry and the California Gold Rush. During those years, 60% of the Portuguese in California worked on farms, primarily engaging in the self-supporting, small-scale production of fruits and vegetables and the raising of sheep. Between 1920 and 1960 they became prominent in the dairy industry, comprising 65% of California's dairy farmers.

The vast majority of the Portuguese who came to California emigrated from the Azores, an archipelago approximately 900 miles west of mainland Portugal comprised of nine islands: Corvo, Faial, Flores, Graciosa, Pico, Santa Maria, Sao Miguel, Sao Jorge, and Terceira. Settlement from mainland Portugal began in 1489 and the Azores became important for grain and cattle production for Portugal. Because of their strategic location, the islands became a stopping point between America, Europe, and Africa in the 16th and 17th centuries. In 1976, the Azores became an autonomous region of Portugal, and still produce dairy beef for export. Its primary industry, however, is tourism.

In California in the early years, the Azoreans who were involved in agriculture settled in the Sacramento Valley, Mission San Jose, San Leandro, Oakland, and Castro Valley. By 1880, 84% were living in rural areas, primarily owning or operating farms. Between 1890 and 1910, numerous Portuguese migrated primarily to the San Francisco Bay Area, where several dairies were established in Marin County. Around the turn of the 19th century, many Azoreans moved to the San Joaquin Valley to farm, and the area is still the center of their population. As noted by historian Robert Santos:

> Dairying and the Azoreans are like the euphemistic phrase "goes together like hand and glove." Being unskilled and using very few tools and implements, most Azorean farmer peasants brought only their hands and their farming knowledge to the United States for a livelihood.

His description of dairy farmers in the San Joaquin Valley also characterizes the Azorean experience in Sonoma County:

> Dairying provided security for those who practiced it. For one, there was always a monthly milk check providing constant revenue. The investment was solid because one owned land, equipment, and cattle which could always be sold in an economic crisis. For the thrifty minded Portuguese who save their money continuously, the initial investment was something they could afford. They saw opportunity in something that an unskilled, mostly illiterate, and non-English speaking Azorean peasant could do with success and profit.

Santos goes on to state:

> The Azoreans are family-oriented people who sacrifice and work together as a unit towards a common goal. This family effort is the basic reason why they became so

> successful in dairying. No dairy partnerships are formed outside the family because the children inherit the dairy.

This last description is particularly apt for the Cardoza family, an Azorean family who arrived in the area in 1943, purchased the ranch in partnership, worked together to improve the property, and whose children inherited and continued the ranching operation until the property was acquired by [the Sonoma County Recreation and Parks District] in 2005.[3]

Chronology of Development and Use

Note: Chronological information has been drawn from LSA Associates, "A Cultural Resources Study for the Tolay Lake Regional Park Project," March 28, 2008.

1823	Father Jose Altamira visited *Laguna de Tolay* en route to founding a new Mission in Sonoma.
1834	Mexican Governor Jose Figueroa granted 44,000-acre land grant (Rancho Petaluma), which included Tolay Lake, to Lieutenant Mariano G. Vallejo.
1843	Mexican Governor Manuel Micheltorena expanded Rancho Petaluma land grant to 66,000 acres.
1857	Vallejo sold his Petaluma Adobe. At one time the largest privately-owned adobe building in Northern California, the Petaluma Adobe is California Historical Landmark #18 and is now the centerpiece of the state-owned Petaluma Adobe State Historic Park.
1865	William Bihler purchased the area that would become the 1,737-acre Cardoza Ranch. Bihler reputedly drained Tolay Lake in order to farm the land.
1880s	Bihler sold the ranch.
c.1885-c.1894	Ranch owned by U.S. Senator and Comstock Lode millionaire James G. Fair.
Late 1800s	Workshop (12) constructed.
1905	Arthur W. Foster purchased the ranch from Fair's heirs, who had maintained ownership following Fair's death in 1894. Foster, president of the San Francisco North Pacific Railroad, operated the ranch as the Lakeville Stock Farm, and evidently constructed the elaborate irrigation and drainage system at the ranch.
1922	Ranch acquired by North Bay Farms Company.
1943	Ranch sold to John S. Cardoza, Sr.; George S. Cardoza; and John S. Cardoza, Jr., who converted the ranch to a dairy and cattle operation.
Late 1940s-	Cardozas demolished several buildings at the ranch, reusing the lumber, windows

[3] LSA Associates, "A Cultural Resources Study for the Tolay Lake Regional Park Project," 19-24.

Early 1950s	and other architectural elements to build new structures and rebuild others, including barns and equipment sheds. Some buildings (including the Cottage (1) and the Line Shack (10)) were left intact but relocated on the property. During this time, the Dairy Barn (7) on the hill southwest of the ranch complex was rebuilt and the Creamery (8) was enlarged with a concrete floor, foundation, side walls, and frame addition to the east elevation.
1946	George Cardoza and Vera Cardoza House (4) constructed.
1947	John Cardoza, Jr. and Beatrice Cardoza House (5) constructed.
1950	John Cardoza, Sr. House (3) constructed.
Early 1950s	Hay Barn (6) and Tractor Barn (13) rebuilt. Bunkhouse (2) and Storage Shed (14) constructed.
1979	George S. Cardoza and Vera Cardoza granted the property to Rita Cardoza and Marvin Cardoza.
1980	Metal Barn (16) constructed.
1992	Modern Barn (17) constructed.
2005	Rita Cardoza and Marvin Cardoza sold the property to the Sonoma County Regional Parks Department.

SIGNIFICANCE AND INTEGRITY

Significance

In the Cultural Resources Study that they completed for the Tolay Lake Regional Park in March 2008, LSA Associates found the Cardoza Ranch complex to be

> eligible for listing in the National Register under Criterion A due to its association with the Azorean Portuguese dairy and ranching industry in Sonoma County and California, an industry dominated by them from the 1920s through the 1960s, and Criterion C since the ranch features, while lacking individual distinction, represent a significant distinguishable entity that can trace its history to one family and one operation.[4]

LSA Associates also concluded that the Cardoza Ranch complex is National Register-eligible both as its own district and as a contributor to the larger Tolay Valley Historic District. This latter district, which was identified by LSA Associates, generally corresponds to the boundaries of Tolay Lake Regional Park and consists of 21 prehistoric archaeological sites, historic-period built environment resources, and resources with both prehistoric and historical components.[5]

Integrity

LSA Associate's Cultural Resources Study states that "Pre-Cardoza elements and the Cardoza Ranch retain a high degree of integrity of setting, location, workmanship, materials, feeling, and association."[6]

The LSA Associates study also states that although some of the buildings were used for operations different than originally intended at the time of the study (i.e. the Creamery as a winery, the Granary as a museum), "the landscape within which the ranch is situated has retained the integrity of its period of significance, and reflects a period of time and place when Portuguese dairy farms dotted the rural landscape of Sonoma and Marin counties. Therefore, the Cardoza Ranch appears to possess integrity."[7]

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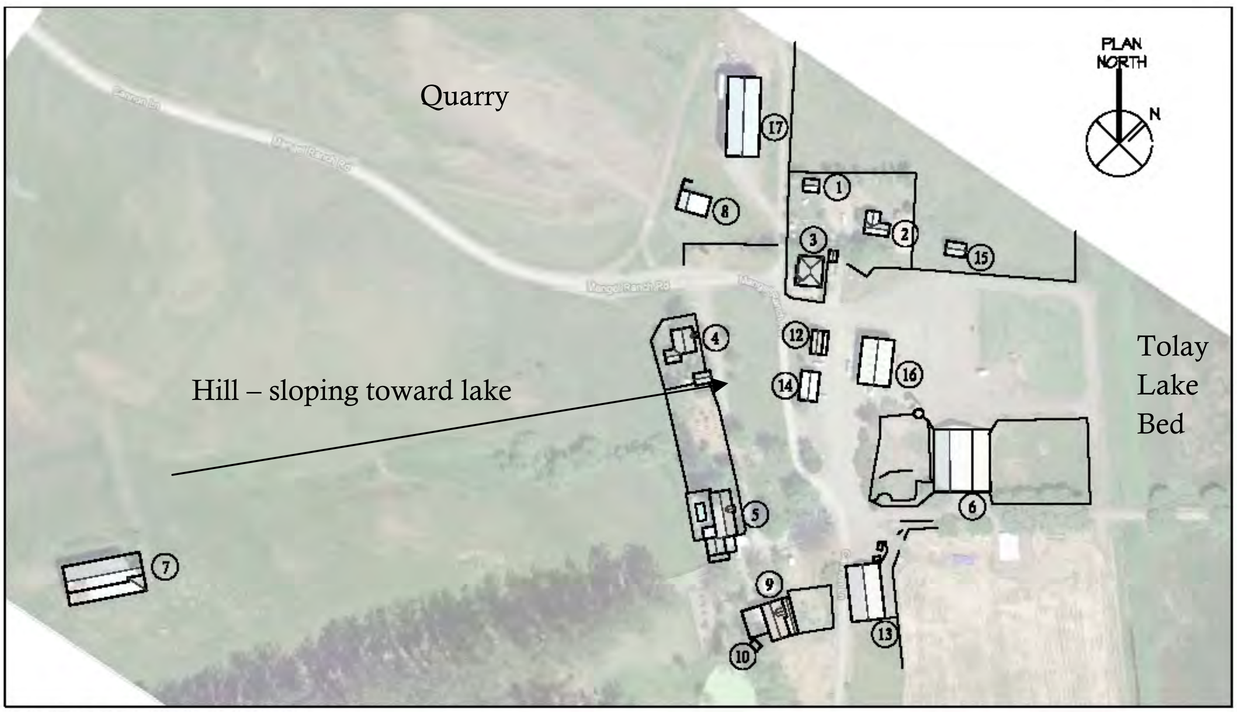
[4] LSA Associates, "A Cultural Resources Study for the Tolay Lake Regional Park Project," 59.
[5] Ibid., 46.
[6] Ibid., 47.
[7] Ibid., 59.

PHYSICAL DESCRIPTIONS, CONDITIONS, & TREATMENT RECOMMENDATIONS

See the introduction for definitions of condition ratings. Treatment recommendations are divided into two broad categories: basic treatments and use-specific treatments. The basic treatments include repairs to deteriorated elements and stabilization of the buildings. Use-specific treatments include modifications to the buildings related to the proposed new use(s).

SITE



BUILDING LOCATION KEY

1. COTTAGE/JULIE'S HOUSE/LITTLE GREEN HOUSE
2. BUNKHOUSE (Not included)
3. JOHN CARDOZA SR HOUSE (Not included)
4. GEORGE & VERA CARDOZA/ GREEN HOUSE
5. JOHN JR. & BEATRICE CARDOZA/ YELLOW HOUSE
6. HAY BARN/ OLD STONE FLOOR BARN
7. OLD DAIRY BARN
8. CREAMERY/ WINE STORAGE
9. GRANARY/ MUSEUM
10. LINE SHACK
11. OLD SHOP/ WORK SHOP
12. TRACTOR BARN / EQUIPMENT BARN
13. STORAGE SHED/ EQUIPMENT SHED
14. SLAUGHTERHOUSE
15. NEW SHOP (Not included)
16. MODERN BARN (Not included)

Physical Description

The Cardoza Ranch site generally follows a northwest-southeast orientation, in accordance with the contour of the low hills southwest of the Ranch and the edge of the Tolay Lake lakebed to the northeast. The Cardoza Ranch site is accessed by two roads: Cannon Lane from the west and Cardoza Road from the southwest. The ranch buildings and structures are clustered around the portion of Cannon Lane that turns southeasterly to meet Cardoza Road. Multiple dirt paths and limited access dirt roads cross the site. The most notable is the dirt road that extends northeasterly along the causeway that bisects the lakebed of Tolay Lake. Fencing is used throughout the site, to demarcate both residential yards and livestock pens.

The Cardoza Ranch site, and the buildings thereon, can be broken into two sections: the upland half to the southwest, and the comparatively flat half to the northeast. The upland portion of the site includes the George and Vera Cardoza House (4) and the John, Jr. and Beatrice Cardoza House (5), along with the Granary (9), the Line Shack (10), the Creamery (8) and the Modern Barn (17). Several trees have been planted around the Granary and the two residences, and mature Eucalyptus line Cardoza Road as it leaves the Ranch site. A pond sits immediately south of the Granary. At the Ranch site's highest elevation, a small quarry has been dug into the hill immediately west of the Creamery. The dairy Barn (7) sits several hundred feet away from the main ranch on the hill to the southwest.

The other buildings occupy the flat half of the Ranch site. These buildings include three residences (the Cottage (1), the Bunkhouse (2) and the John Cardoza, Sr. House (3)) and the Slaughterhouse (15) at the northwest end, and a collection of barns and storage sheds (Hay Barn (6), Old Shop (12), Tractor Barn (13), Storage Shed (14), and Metal Barn (16)) to the southeast. Trees, which are fewer in number here than in the Ranch site's upland half, are concentrated along the Causeway Trail and near the residences at the northwest end. A concrete silo stands between the Hay Barn and the Metal Barn.

BUILDING 1: COTTAGE/JULIE'S HOUSE/LITTLE GREEN HOUSE

Image 1 - Entrance to Cottage, south side

Image 2 – Northeast corner of Cottage

Physical Description

The Cottage is currently located on the north side of the Ranch, behind John Cardoza, Sr.'s House (3) and beside the Bunkhouse (2). It was moved to this location by the Cardozas from the area where the Bunkhouse sits. It is on a relatively flat portion of the site and along with the other nearby houses is fenced off on the north, east and west sides. The Cottage is accessed via a shared driveway that runs between John Cardoza, Sr.'s House and the Bunkhouse. It likely dates from the early 1900s with later modifications.

The Cottage is a simple rectangular form with a gabled roof. The main building is 16 feet deep and 26 feet wide. The southern-facing enclosed porch is 6 feet deep and 26 feet long, and has a shed roof. The framing is enclosed, but is assumed to be standard wood framing.

The exterior walls are clad with three-inch-high rounded edge siding except at the south porch wall, which is clad in eight-inch-high V-groove siding. The roof is covered with asphalt shingles over wood singles.

The Cottage is entered via wood steps, a small landing and a door centered on the south porch. The steps and landing have wood railings. The door has a fixed union jack lower panel and an upper panel of diamond-shaped lights filled with amber-colored bull's-eye glass. The south side of the building has four sliding aluminum windows, with wood trim. There are two double-hung wood windows on the east wall, two on the north wall, and one on the west wall. All of the windows have a single pane of glass per sash. There is a wood-framed foundation vent at the east wall.

The interior of the porch has all painted wood finishes: wood flooring, plywood on the north wall, exposed wood framing and sheathing on the other walls and exposed board sheathing and rafters at the ceiling. The porch is used as the laundry room and contains the water heater, washer and dryer. The east end of the porch is portioned off as the bathroom with a shower, sink and toilet. The walls in the bathroom are painted vertical wood boards, and the ceiling is the exposed structure, also painted.

There is a small step up from the porch to the rest of the Cottage. The door from the porch to the cottage leads directly into the living room. The living room also serves as the kitchen. Along the south wall, there is a counter and sink. Above the sink is a sliding aluminum window, looking into the porch. On both sides of the window are wall mounted cabinets. These cabinets wrap the southwest corner and extend about four feet along the west wall. The floor of the living room and kitchen are painted wood boards. The walls have a random combination of wood siding and paneling. The ceiling consists of painted wood boards.

The bedroom is located in the northeast corner of the cottage and is entered through the east wall of the living room. The closet is located in along the east side of the cottage, between the bedroom and bathroom and is entered form the south wall of the bedroom. Like the living room, the bedroom and closet have painted wood floors, walls and ceilings.

The Cottage has electrical and water service. Gas is provided from a nearby propane tank. The electrical meter is located at the east wall and the panel is located inside the porch, on the north wall. Heat is currently provided with a wall heater on the west wall. However, there are at least two previous heating systems: there is an in-floor grill for a below-the-floor gas heater and there is an old metal flue at the northwest corner from a stove.

Image 3 - Bedroom with various types of wood paneling

Image 4 - Enclosed porch used as laundry room

Character-Defining Features

- One-story height
- Rectangular plan
- Side gable roof with shed roof porch
- Wood siding with wood rakes
- Double-hung wood windows with wood surrounds

Existing Conditions

The Cottage is in poor condition overall.

<u>Foundation</u>
The building does not have a foundation and is resting on the ground.

<u>Structural Framing</u>
The building lacks approved cripple-wall bracing below the floor at exterior walls. The building lacks diagonal or structural sheathing at exterior walls. The building lacks structural sheathing at the roof.

<u>Exterior</u>
Roofing
The asphalt shingle roofing is in poor condition. There is no flashing where the lower roof meets the cottage wall; shingles have been wrapped up the face of the wall, but underlying wood is exposed and deteriorated. The gutter along the south eave has no downspout and drains out its open ends.

Image 5 - Enclosed porch roof at Cottage

Image 6 -Typical wood to earth contact

Cladding
The wood siding is in fair to poor condition. The paint finish is worn. There is wood-to-earth contact on all sides of the cottage and the wood at the base of the walls is very deteriorated.

Doors and Windows
The front door, likely a replacement, is in good condition. Both the wood and aluminum windows are in poor condition. Settlement has caused wracking of some window frames.

Image 7 - Window at east wall showing frame wracked due to settlement

Trim

All of the exterior wood trim is in poor condition, with particularly serious deterioration at the window sills and at the base of the front door trim and corner boards.

Features

The front porch, steps and railings are in poor condition. One porch board has been replaced; the steps are unstable.

<u>Interior</u>

Floor

The painted wood floor in the cottage is in fair condition; on the enclosed porch, several sections have been patched with plywood. The single step at the door between the cottage and enclosed porch presents a trip hazard.

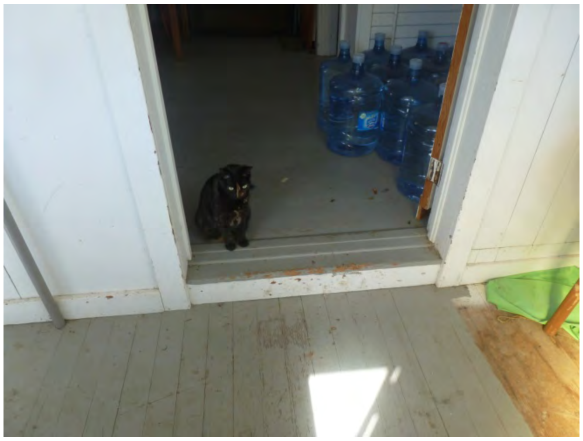


Image 8 - Step between enclosed porch and cottage

Image 9 - Random interior wood paneling at Cottage

Walls and Ceilings
The various types of wood paneling, including the exposed sheathing at the enclosed porch, are generally in fair condition, though the reused wood was installed in a haphazard, poorly fit manner.

Trim
Painted wood trim throughout the interior of the Cottage is in fair condition.

Doors
The interior wood doors are in good condition, except for wear and tear, mainly at the bottom edge.

Features
Washer and dryer are used by park staff and are assumed to be in good condition. The wood cabinets, laminate counter and sink are in fair condition.

Electrical
The circuit breaker and surface mounted conduit to junction boxes in each room are relatively new and in good condition. It does not appear that there is any substandard wiring in use.

Mechanical and Plumbing
The original floor and wall heaters are not functional. The gas water heater and wall heater and two air conditioners are newer and assumed to be functional. Both the water heater and wall heater are properly vented.

Accessibility Issues
The Cottage is not accessible from the exterior. Once inside, the Cottage is generally deficient as regards accessibility and ADA compliance (path of travel, bathroom, etc.). Required level of accessibility will depend upon use.

Code Analysis

Occupancy Classification	R-3 single family residential
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	10,500 square feet
Actual Area	572 square feet
Allowable height (CBC Section 504)	40 feet, 3 stories
Actual Height (feet/ stories)	14 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 200 square feet /occupant	3
Required Exits (CBC Section 1015)	1
Provided Exits	1
Other considerations	The asphalt shingle roof over the wood shingles is a non-compliant condition per CBC 1510.3, paragraph 2

Treatment Recommendations

Basic Treatments

Structure

- Provide concrete foundation.
- Re-grade to provide positive drainage away from building.
- Add necessary seismic connections, shear walls, and plywood sheathing at roof.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Replace asphalt shingle roof on cottage, rolled roofing on enclosed porch; install new flashing, gutters and downspouts.
- Repair or replace damaged wood siding and trim: estimate replacement of 20% of siding and 50% of trim; eliminate all wood to earth contact.
- Realign and restore wood windows: estimate replacement of 50% of window components.
- Replace aluminum porch windows with wood to match those in cottage.
- Remove old woodstove vent pipe.
- Rebuild front steps and landing.
- Provide minor repairs to doors and hardware as needed; replace front door sill.
- Paint all wood elements.

Interior

The interior does not require any rehabilitation for its current storage use.

Systems

- Have all systems evaluated by a licensed contractor or engineer.
- Replace plumbing piping and all fixtures.
- Remove crawl space heater.

<u>Treatments Contingent on Use</u>
The preliminary recommended use for the Cottage is residential.

- Insulate walls and attic, including enclosed porch.
- Add finish over insulation at enclosed porch walls and ceiling.
- Repaint entire interior, including wood floor.
- Completely rehabilitate bathroom.
- Replace sink and counter with functional kitchen.
- Consider constructing a wall separating laundry area from entrance.

BUILDING 4: GEORGE AND VERA'S HOUSE/GREEN HOUSE

Image 10 –Front entrance to George and Vera's House, east side

Image 11 – George and Vera's Garage

Physical Description

This 1946 Ranch style house is located on the west side of the ranch complex, north of John Jr. and Beatrice's house (5) and south of the Creamery (8). The site slopes gently to the northeast, with a slightly leveled area around the house. The front door of the house faces east towards the Old Shop (12) and the lake. Vera still lived in the house when the Ranch became a regional park in 2005.

This house originally had the same general layout as John Jr. and Beatrice's house (5), but differing additions and modifications have since obscured the original form of both houses. This house is slightly smaller and originally had two bedrooms, not three like the other house. The original form was a simple rectangle. This house has an addition off of the southwest corner. A detached garage is located to the south of the house. The original house was 30 feet deep and 36 feet wide. The garage is 26 feet deep and 24 feet wide. The addition is about 17 feet wide and 30 feet deep. The original house has a half basement that is approximately 36 feet wide and 15 feet deep.

The exterior walls have stucco over wood V-groove siding. The front porch is wood framed with a metal railing and posts. The stairs, ceiling, and fascia have been covered with stucco. The garage also has stucco over wood siding. The main roof is asphalt shingles over wood shingles. The addition has asphalt shingles. The garage has asphalt shingles.

The main entrance door is a six panel door. The mud room door is a two panel door with glass in the upper panel. Both doors have screen doors. The door to the basement is a wood sliding door. The garage overhead door is a metal single section lift door; there is a wood man door in the south wall of the garage.

There are two large wood-framed picture windows at the living room, and the other original windows are double-hung with a single pane of glass per sash. The windows in the addition are a combination of fixed wood framed casements and double-hung windows. Most of the double-hung windows have aluminum screen at the exterior. The attic is vented through pointed metal vents at the gable ends. The foundation is vented through metal vents at the east and west walls.

The current layout is as follows. The front door enters into the living room. To the left is the kitchen, which is open to the dining area to the south straight through the living room is the door to the hallway. The mud room is located in the southwest corner of the kitchen. To the west of the hallway are two bedrooms and a bathroom. A second hallway has been added through the second bedroom. This hallway is L-shaped and connects the two bedrooms in the addition and the mud room. The basement is unfinished and contains a freestanding shower, and a two compartment sink.

Image 12 - Kitchen with original cabinets and counters

Image 13 - Bedroom in addition

Image 14 - Bathroom with original tile and fixtures

The interior finishes are primarily painted plaster walls and ceilings, with some gypsum board at the additions and modified areas. The mud room has a sheet vinyl floor and wainscot with wallpaper above. The bathroom has a tile floor and wainscot with wallpaper above. The kitchen has wood cabinets with tile counters and backsplashes. The kitchen walls are covered with wallpaper. The floor in the living room is carpet, but the rest of the house has sheet vinyl flooring.

The garage floor is exposed concrete. The garage has no interior finishes. Roof and wall framing and sheathing are exposed.

The electrical meter is on the north wall of the house, and power enters the building through the attic. The house has propane gas, which is supplied from a tank. The gas water heater is in the basement. There is an in-floor heater in the main hallway. The mud room has hookups for a washer and a gas dryer.

Image 15 - Interior of garage showing stepped foundation walls

Image 16 - Terraced patio on south side of garage

Character-Defining Features

- One-story height
- Rectangular plan
- Side gable roof with verge board
- Double-hung wood windows
- Picture windows at living room
- Gabled front porch with metal posts and railings

Existing Conditions

George and Vera's House is in poor and unstable condition. Significant structural movement has occurred.

<u>Structure</u>

The foundation has failed. It appears the expansive soils are creeping in the downhill (east) direction and are taking the house along with it. The north and west basement walls are cracked and leaning as much as 1.5 inches in 12 inches. Basement walls appear to be unreinforced concrete.

Cripple walls supporting the floor framing above the basement walls have failed and are leaning. Numerous interior girder-support posts are missing, leaning or have inadequate foundation support. Wood scraps and miscellaneous wood debris are littering the crawl space, attracting termites and leading to decay.

The front porch framing is decaying and failing; the porch and steps are pulling away from the house, and the porch roof is sloping along the eave lines.

The interior floor is sloping. Interior door frames are distorted and there are numerous cracks in the interior walls.

Exterior

Roofing

The asphalt shingle roofing is in poor condition. The original gutters are deteriorated and likely not functional. New gutters and downspouts on the back of the house are in good condition and connect to a drain pipe at the northwest corner. The rooftop vents and chimneys are corroded and in poor condition.

Cladding

The stucco finish on the house is in generally poor condition with significant cracking due to the building's movement. There is an almost continuous horizontal crack at the foundation; there is serious cracking and spalling where concrete walls meet stucco at the basement stairway and at both porches. The underlying tongue and groove wood siding could not be observed; there is likely some deterioration at grade due to wood to earth contact where planting beds about the stucco.

Image 17 - Deteriorated shingles and debris

Image 18 - Stucco at basement stair and door

Doors

The doors are in fair condition; their frames and screen doors are in poor condition. Wood sills are very deteriorated.

Windows

The wood and aluminum windows are in fair to poor condition. Sills are deteriorated. Some wood windows are out of plumb due to building settlement and are not operable. Window screens are in fair to poor condition; some are ill-fit due to settlement and some are missing. Wood basement windows are misaligned due to building settlement.

Trim

All wood trim at the roof, doors and windows is in poor condition.

Image 19 - Front porch separated from wall of house

Image 20 - Poorly constructed ramp and stairs at south entrance

Image 21 - Stairs to basement

Features

The covered front porch is not level; it has separated from the house due to differential settlement. The concrete slab and steps and the stucco facing are cracked and deteriorated. The ornamental railing and roof supports are rusted and out of plumb.

The porch at the south entrance is very poorly constructed. Modifications made to add the ramp created an unsafe stair approach. The supporting structure is extremely deteriorated.

Paving and Stairs

Concrete paving around the house has cracked and settled, creating trip hazards. The terraced concrete patio west and south of the garage has extensive settlement and structural cracking.

The concrete stair to the basement and the adjacent retaining walls are in fair condition. The stairway is filled with leaf debris, clogging the drain at the bottom; water can freely enter the basement. The wood fences surrounding the stair are in very poor condition and collapsing. This is a hazardous condition.

Image 22 - Multiple layers of flooring

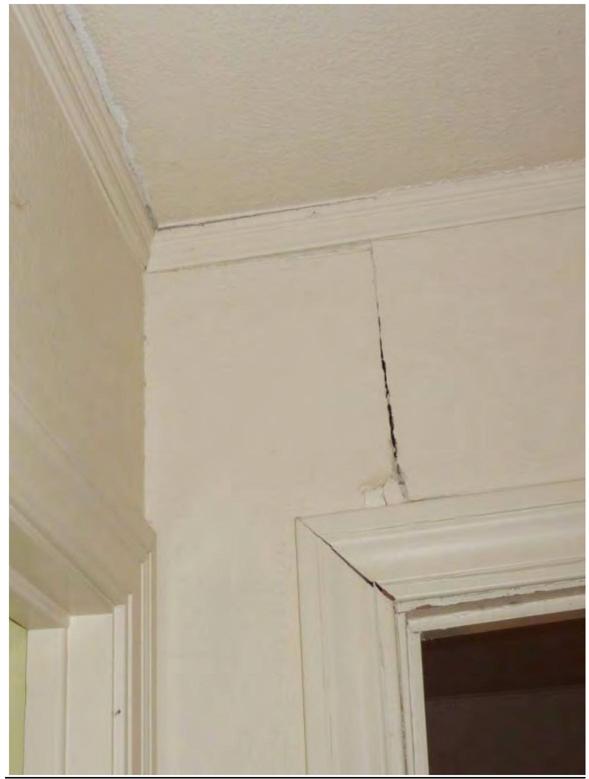


Image 23 - Settlement damage

<u>Interior</u>

Floor

Linoleum and vinyl flooring throughout the house is in poor condition; carpet in northeast room is in fair condition.

Walls and Ceilings

The plaster finish throughout the house is in fair to poor condition with a significant number of cracks due to settlement. Tile wainscots and shower surrounds are in fair to good condition.

Trim

Painted wood trim throughout the house is generally in good condition, except in areas where settlement has led to open joints and some deterioration at window sills.

Doors

Wood doors are in good condition, except for wear and tear, mainly at the bottom edge.

Features

Wood kitchen cabinets and tile counters are in good condition. Miscellaneous built-in casework elsewhere in the house is also in good condition.

Basement

Condition of the exposed framing and foundation in the basement is described above. There are water stains on the concrete walls and floor and also on the wood framing above.

<u>Electrical</u>
Wiring throughout the house is substandard and potentially hazardous.

Image 24 – Mix of knob and tube and newer wiring in attic

<u>Mechanical and Plumbing</u>
The original under floor heater appears to have been removed. The floor grille remains. The gas fired water heater is located in an area of movement in the basement.

The plumbing piping is old and corroded; leaks are evident in the basement. Plumbing fixtures, including stall shower and sinks in the basement, are in poor condition.

<u>Garage</u>
Structure
The garage structure is in fair condition, lacking structural sheathing at the roof. The crack in the north foundation wall does not appear to have caused significant damage to the wood structure.

Exterior
The asphalt shingle roofing is in poor condition; the gutters are badly corroded and partially missing. In addition to the structural crack in the north wall, the stucco finish has numerous cracks, mainly at the lower part of the walls. The door, overhead garage door, and windows are in fair condition. The higher grade outside the south door allows water to enter the building. Wood trim is in fair condition.

Image 25 - Garage roof and corroded gutter

Image 26 - Structural crack in north wall

Interior

The wood structure and the roof and wall cladding exposed on the interior are addressed above. The floor slab is in fair condition. The electrical wiring is not in accordance with code.

Accessibility Issues

The house is not accessible from the exterior; the existing ramp is not code-compliant. Once inside, the house is generally deficient as regards accessibility and ADA compliance (path of travel, bathroom and kitchen, etc.) The garage is not accessible. Required level of accessibility for both buildings will depend upon use.

Code Analysis

House

Occupancy Classification	R-3 single family residential
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	10,500 square feet
Actual Area	1,527 square feet
Allowable height (CBC Section 504)	40 feet, 3 stories
Actual Height (feet/ stories)	14 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 200 square feet/occupant	8
Required Exits (CBC Section 1015)	1
Provided Exits	2
Other considerations	The asphalt shingle roof over the wood shingles is a non-compliant condition per CBC 1510.3, paragraph 2

Garage

Occupancy Classification	U - garage
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	9,625 square feet
Actual Area	160 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	12 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 200 square feet/occupant	1
Required Exits (CBC Section 1015)	1
Provided Exits	1
Other considerations	The asphalt shingle roof over the wood shingles is a non-compliant condition per CBC 1510.3, paragraph 2

Treatment Recommendations

Basic Treatments

The primary issue with this building is the failed foundation. There are three primary ways to deal with this: the first is to build a new foundation, the second is to completely rebuild the entire house and the third is to demolish the house and not rebuild. The recommendations listed below assume the first option.

Structure

- Conduct a geotechnical investigation near the house to determine the soils composition.
- Stabilize soils as recommended by geotechnical report.
- Move the house off of the existing failed foundation. Pour a new reinforced concrete foundation based on the geotechnical report findings. Move the house back to its original location over the new foundation.
- Provide additional shear strength at the walls and roof to resist the seismic loads.
- Improve attachments at the roof to wall connections.

- Eliminate basement and stair to basement.
- Remove existing porch and rebuild steps in concrete.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Remove asphalt and wood shingles. Install new plywood sheathing and new asphalt shingle roof. Install new gutter and downspouts.
- Repair cracks in stucco.
- Insulate exterior walls and attic.
- Repair windows and replace deteriorated elements as needed.
- Replace screen doors.
- Replace thresholds at doors.
- Repair and repaint metal railings at front porch.
- Provide new accessible ramp to kitchen door.
- Replace missing decorative shutters.
- Paint stucco walls and all wood elements.
- Move plantings away from building foundation.
- Add foundation drainage along the uphill side of the house.

Interior

- Insulate walls and attic.
- Replace all floor finishes.
- Repair cracks in walls and ceiling.
- Remove wallpaper and repaint all walls.
- Repair door frames where cracked.
- Repair windows; replace badly deteriorated windows to match.
- Repair and reuse wood cabinets in kitchen.
- Remove old heater and patch hallway floor.

Systems

- Have electrical system evaluated by a licensed contractor or engineer and upgrade as required.
- Replace light fixtures as needed.
- Replace plumbing fixtures in bathroom and mudroom.
- Provide new heating and air conditioning system.

Garage

- Seismic upgrade: install structural sheathing at roof and walls.
- Repair foundation and bolt framing to foundation.
- Install asphalt roof with gutters and downspouts.
- Re-grade around garage to keep soil at least six inches below the wood sill.
- Remove vegetation from around foundation.
- Minor repair of windows.

- Repair cracks in stucco.
- Paint stucco walls and all wood elements.
- Repair or replace patio at south side so that water doesn't drain into garage.
- Add perimeter drain at back of garage.
- Add area drain at side door.

<u>Treatments Contingent on Use</u>
Preliminary use options for the house are guest rental, staff housing, or office space.

- Upgrade kitchen, possibly as ADA-compliant.
- Completely rehabilitate bathroom, possibly as ADA-compliant.
- Upgrade lighting.
- Widen door openings for accessibility.
- Consider alterations to interior layout depending on use.

BUILDING 5: JOHN JR. AND BEATRICE'S HOUSE/YELLOW HOUSE

Image 27 – Front of John Jr. and Beatrice's House, east side

Image 28 - John Jr. and Beatrice's House, with addition and garage at south end

Physical Description

This 1947 Ranch style house is located on the west side of the ranch complex, south of George and Vera's House (4) and north of the Granary (9). The site slopes gently to the east, with a slightly leveled area around the house. The front door of the house faces east towards the Hay Barn (6) and the lake.

This house originally had the same general layout as George and Vera's house (4), but differing additions and modifications have since obscured the original form of both houses. This house was eight feet wider and had three bedrooms instead of two. The original form was a simple rectangle. This house has had a least four different additions. The first addition was the two-car garage to the south of the house. The second addition connected the house and the garage, converted the living room into a bedroom, converted the garage into a living space, and expanded the kitchen dining area. The third addition was a covered patio at the corner between the house and garage. The fourth addition was a shed on the south side of the garage. The original house was 30 feet deep and 44 feet wide. The garage is 26 feet deep and 24 feet wide. The connection between the house and the garage is 30 feet deep and 16 feet wide. The covered patio is about 18 by 20 feet and the shed is 30 feet deep and 14 feet wide. Adjacent to the patio, behind the original house, is a concrete paved terrace with an in-ground swimming pool. The original house has a partial basement that is approximately 20 feet wide and 15 feet deep.

The east side of the garage and the south side of the house have lapped wood siding with a brick wainscot. The other exterior walls have stucco over wood V-groove siding. The front porch is wood-framed with a wood railing and posts. The stairs, ceiling, and fascia have been covered with stucco. The chimney, on the north wall, is made of red brick. The main roof is asphalt shingles over wood shingles. The garage has asphalt shingles. The covered patio has a corrugated metal roof, and the shed has corrugated fiberglass panels.

The main entrance door is a six panel door with glass in the upper four panels. The kitchen door, on the south wall, is a panel door with a union jack panel at the lower half and six panes of glass above. The kitchen door has a small metal awning over it. The garage east doors are two pairs of doors that match the kitchen door. The door from the garage to the covered patio is a two panel door with a flat wood panel below and a single pane of glass above. The door from the second addition to the back patio matches the doors at the front, but also has a screen door of similar design as the door. The door to the shed is a single panel door.

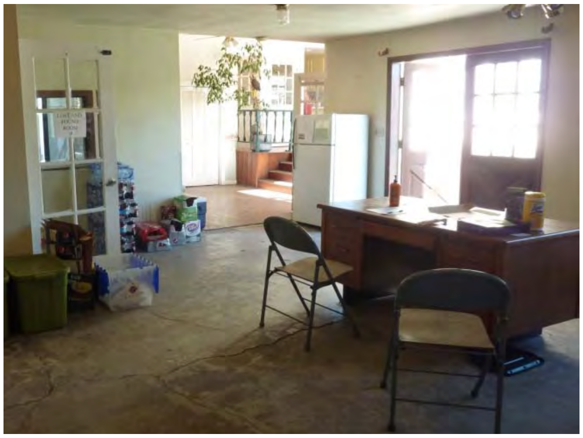


Image 29 –Garage looking into transition space and kitchen beyond. The covered patio is to the left and the front patio is to the right.

Image 30 - Edge of dining room, looking into kitchen and entrance hall beyond. The basement stair is at the left.

The current layout is as follows. The front door enters into a front hallway. To the right of the hallway is a bedroom, which was originally the living room and contains a fireplace and built in shelves on the north wall. To the left is the kitchen, which is open to the dining area to the south. The entrance hall opens up to the main hallway which runs north to south through the house. To the west of the hallway are three bedrooms and a bathroom. The closet in the middle bedroom has been converted to a shower and a sink in a counter added at the northeast corner. The south end of the hallway opens into the dining room. The dining room is the east side of the second addition. The west side of the second addition is four steps lower and is the transition between the garage and the rest of the house. This transition space is connected to the garage with a large framed opening. The garage has a vestibule at the northwest corner. A wood burning stove is located in the southwest corner. The shed can only be entered from the exterior. The basement is accessed via a stair between the kitchen and the main hallway. The basement is unfinished and contains a freestanding shower, a two compartment sink and the pool equipment.

Image 31 - Transition space with dining room at the right and kitchen beyond. The door on the left is to the hallway, the door on the right is to the basement.

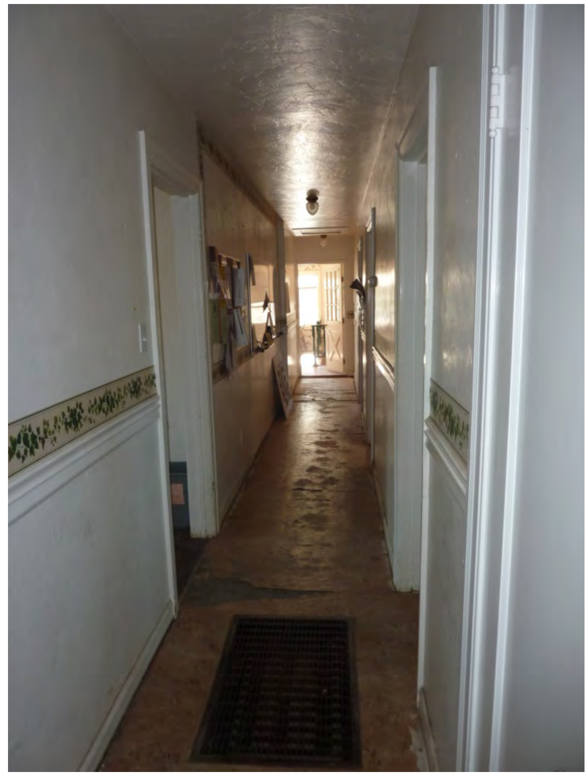


Image 32 - Hallway looking toward the kitchen. The door at the left is to the entrance hall. The door in the right foreground is the linen closet, the next door is the bathroom and the next two doors are bedrooms.

The interior finishes are primarily painted plaster walls and ceilings, with some gypsum board at the additions and modified areas. There is brick wall finish at the fireplace in the former living room, behind the wood burning stove in the garage and at the wall between the basement stair and the kitchen. The kitchen, transition space, and the former living room have wall paper. The bathroom has a wood wainscot. The main hallway has a wood chair rail. The kitchen and bathroom have wood cabinets with tile counters and backsplashes. The middle bedroom has plastic laminate cabinets and counters and the shower has tile floor, walls and ceiling. The former living room and the dining room have wood floors. The garage has an exposed concrete floor and the rest of the rooms have linoleum, vinyl, or vinyl tile floors.

The electrical meter is on the north wall of the house, and the panel is in the basement. The water heater is also in the basement. Some of the pool equipment is located behind the garage and some is in the basement. The house has propane gas, which is supplied from a tank. There is an in-floor heater in the main hallway and a gas stove in the former living room.

Character-Defining Features

- One-story height
- Side gable roof
- Wood siding at south end
- Gabled front porch
- Chimney and fireplace at north wall

Existing Conditions

In general, because it has been used and maintained by park staff, the Yellow House is in fair condition.

<u>Structure</u>

The original building lacks the following: effective cripple-wall bracing and anchor bolts below the floor at the exterior walls, diagonal or structural sheathing at exterior walls, and structural sheathing at the roof.

The front porch and sheathing is decaying and partially failing.

At the second addition, the cripple wall sheathing is decayed and has failed. It appears that concrete has been poured against the sheet metal flashing at along the south wall. The flashing has failed allowing water intrusion and decay of the plywood sheathing. The framing at the cripple wall is also decayed.

<u>Exterior</u>

Roofing

The condition of the roof varies from good to very poor: the asphalt shingle roofing on the former garage is in good condition; that on the west slope of the house is in fair condition, with some detached shingles; and that on the east slope of the house is in very poor condition, with curled and broken shingles and considerable leafy debris. The rooftop vents and chimneys on the garage and the west slope of the house are in fair condition, and those on the east slope are corroded, in poor condition. The gutters appear to be in fair condition, though some may be blocked by debris, and the newer galvanized downspouts drain away from the building via splash blocks. The corrugated sheet metal roof over the patio is in fair condition.

Cladding

The stucco finish on the house is generally in fair condition. There is one major vertical structural crack where the original house was expanded to the south. The underlying tongue and groove wood siding could be seen where the front porch had separated from the east wall of the house and appeared to be in good condition. The condition at other locations could not be observed, but there is likely some deterioration at grade, particularly along the west and north walls of the house, where planting beds abut the stucco. Stucco on the west wall of the former garage is in good condition, but that on the south wall, within the covered storage shed, is in poor condition, with extensive cracking and spalling. The wood siding at both the house and garage is in good condition, as is the brick base.

Image 33 - Deteriorated roofing and vents

Image 35 - Crack in east wall at addition

Image 34 - Debris filled gutter with new downspout

Image 36 - Extensive cracking at south wall

Doors

The wood doors are in fair condition. Aluminum thresholds are high and pose a trip hazard.

Windows

Most of the wood and aluminum windows are in fair condition. One west-facing wood window is in poor condition. Window screens are fair to poor and some are missing.

Trim

Wood trim at the roof, doors and windows is in fair condition. The wood louvered attic vents are in fair condition. The decorative shutters are in good condition. An awning over one door is in poor condition, with a lot of corrosion.

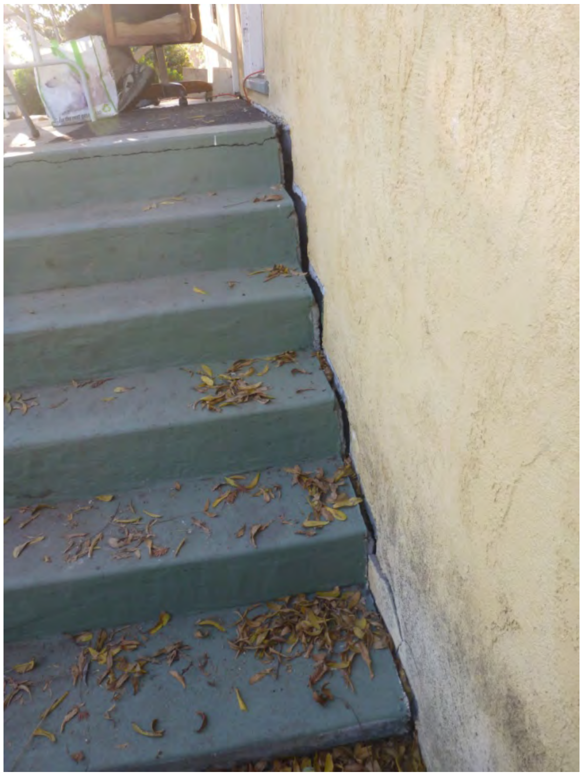


Image 37 - Front porch stair separated from house wall

Image 38 - Misaligned paving at pool

Image 39 - Deterioration in outdoor storage shed

Features

The covered front porch steps and stoop have separated from the house due to differential settlement. The stucco finish is cracked and deteriorated. The wood railing and roof support posts are in fair condition; the posts appear to be adequately supporting the porch roof; but the foundation is failing, so the overall condition should be considered very poor.

The brick chimney at the north end is in good condition, with minor cracking where it meets the stucco wall.

Patios

The concrete patio in front of the former garage is in fair condition. It has no control joints and, although it has a number of cracks, it remains level. The concrete steps and the brick planters surrounding the patio are in good condition.

At the rear patio, the brick planters, wood structure, including lattice, are in fair condition. The patio itself is in poor condition; portions of the concrete paving around the pool have lifted and/or cracked due to expansive soils, creating a trip hazard. The swimming pool appears to be in good condition, although its equipment was not tested.

Outdoor Storage Shed

This structure is in poor condition. The wood framing, various types of cladding (wood boards, plywood, wood lattice), and door are damaged and deteriorated. The concrete slab floor has extensive cracking. The corrugated fiberglass roofing is in fair condition.

Interior

Floor

Where carpet has been removed, the exposed linoleum is in poor condition; the underlying wood subfloor is in fair condition. The wood floor in the dining area is also in fair condition as are the wood stairs down to the lower level. Newer sheet vinyl in several rooms is in good condition. The concrete floor in the former garage is in fair condition, with several large cracks. Transitions between different types of flooring have created trip hazards.

Walls and Ceilings

The plaster finish throughout the house is in good condition. Wood and tile wainscots and shower surrounds are in fair to good condition.

Image 40 - Flooring deterioration and change of level

Image 41 - Floor at former garage

Image 42 - Deteriorated window at west wall

Image 43 - Cabinet at kitchen sink

Trim
Painted wood trim throughout the house is generally in good condition, except at the aluminum windows in the north wall, where it is deteriorated from water infiltration.

Doors
Wood doors and louvered closet doors are in good condition, except for wear and tear, mainly at the bottom edge.

Features
Wood cabinets in the kitchen, offices and bathroom are in good condition, except for water damage at the kitchen sink. Tile and laminate countertops vary from fair to good condition.

A gas range and dishwasher were removed from the kitchen.

The brick fireplace and hearth on the north wall appear to be in good condition, but the condition of the chimney is unknown.

The wood stove and brick hearth in the former garage are in good condition.

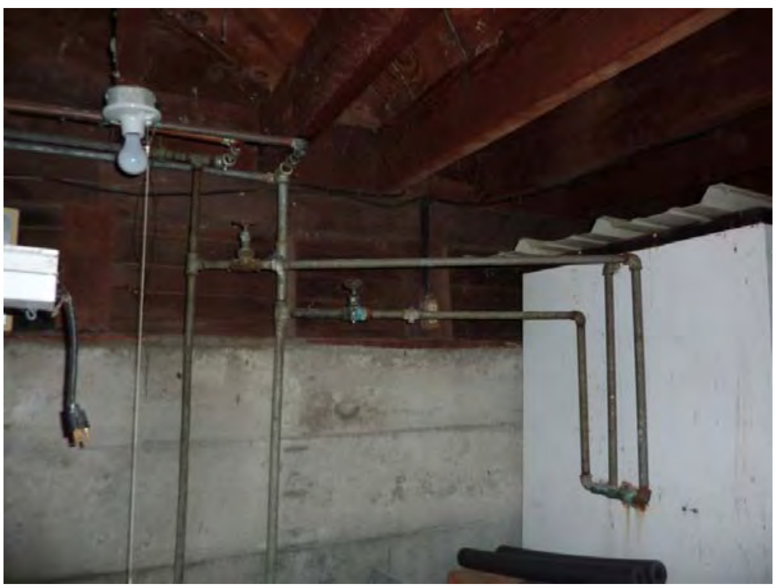


Image 44 - Deteriorated piping in basement

Basement
Condition of the exposed framing and foundation in the basement is described above. There are water stains on the concrete walls and floor. A free standing stall shower is in poor condition.

<u>Electrical</u>
Some components of the electrical system have been upgraded, but some original components remain. The entire system should be evaluated by a licensed engineer.

Mechanical and Plumbing
Mechanical equipment appears to be functioning adequately for the current occupancy, but should be evaluated by a licensed engineer. Elements of the plumbing piping have clearly been repaired and replaced, but much of the visible piping is corroded.

Accessibility Issues
The house is not accessible from the exterior; each entrance is reached via stairs. Once inside, the house has two levels and is generally deficient as regards accessibility and ADA compliance (path of travel, bathroom and kitchen, etc.) Required level of accessibility will depend upon use.

Code Analysis

Occupancy Classification	R-3 single family residential
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	10,800 square feet
Actual Area	2,837 square feet
Allowable height (CBC Section 504)	40 feet, 3 stories
Actual Height (feet/ stories)	14 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 200 square feet/occupant	15
Required Exits (CBC Section 1015)	2
Provided Exits	4
Other considerations	The asphalt shingle roof over the wood shingles is a non-compliant condition per CBC 1510.3, paragraph 2

Treatment Recommendations

Basic Treatments

Structure

- Stabilize soils on hill behind house.
- Reinforce attachment of walls to foundation.
- Reinforce attachments of roof to walls.
- Provide a perimeter foundation drain at the back of the house.
- Provide a perimeter foundation drain at the back of the pool.
- Demolish shed at south end and remove concrete slab.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Remove asphalt and wood shingles. Install new plywood sheathing. Provide new asphalt shingle roof with gutters and downspouts.
- Add shear strength at exterior walls.
- Repair cracked plaster.
- Repair wall at grade level at chimney.
- Repair paving at back porch.
- Repair brick planters and counters at back patio.

- Assess the pool and its equipment.
- Rebuild front porch steps with concrete.
- Make minor repairs to doors and hardware.
- Make minor repairs to windows in general.
- At the north window on the west wall, replace sill and lower sash.
- Paint stucco walls and all wood elements.

Interior

- Install new flooring throughout house.
- Repaint walls and ceilings.
- Remove old heater and repair floor in hallway.
- Inspect fireplace flues.
- Repair kitchen cabinets.
- Replace kitchen sink.

Systems

- Have electrical system evaluated by a licensed contractor or engineer and upgrade as required.
- Provide new heating and air conditioning system.
- Replace water, sewer and gas pipes.

<u>Treatments Contingent on Use</u>

Preliminary use options for the house are visitor center, guest rental, staff housing, or office space.

- Upgrade kitchen, possibly as ADA-compliant; install new appliances.
- Completely rehabilitate bathroom, possibly as ADA-compliant.
- Install a lift between two floor levels at dining/transition space.
- Upgrade lighting.
- Widen door openings for accessibility.
- Add wall and door between house and former garage.
- Consider alterations to interior layout depending on use.

BUILDING 6: HAY BARN/OLD STONE FLOOR BARN

Image 45 – South wall of Hay Barn with shed on right

Image 46 - Hay Barn interior looking north

Physical Description

The Hay Barn was constructed in the late 1940s or early 1950s on the site of a previous barn. Located on a slightly sloping site on the east edge of the ranch complex, it is aligned with the causeway and flanked on the east and west with corrals. A slip-formed concrete silo is located at the northwest corner. The Hay Barn, as its name suggests, was originally used to store hay. It now houses some exhibits and is open to the public for tours and events. A shed runs along the east side of the barn, within the corral, and is used to shelter goats.

The rectangular barn is approximately 60 feet wide and 100 feet long, and the shed to the east is 25 feet wide and 100 feet long. The foundation is concrete piers under the wood posts and a concrete perimeter footing. The structural frame is post and beam construction. The structural members appear to have been reused as they have mortise holes. The main barn is three bays across and ten bays long. The first 15 feet of the shed (west side) is partially enclosed from the exterior and open to the main barn. The last ten feet (east side) are open to the corral.

The exterior walls are covered with 1x12 vertical wood boards spaced about ¼ to ½ inches apart. The gable roof is covered with corrugated metal; the rafter ends are exposed; and the space between the rafters and the ridge are open for ventilation.

The two primary entrances to the barn are through large pairs of sliding doors at the north and south elevations. A smaller set of sliding doors are located on the north wall, near the northwest corner. The west section of the shed is accessed through pairs of sliding doors on the south and north and the east section is accessed through large swinging doors. There are no windows in the barn, but there are three wooden vents at the north gable and one at the south gable. A 68-foot-long section of the east wall of the shed is open with no door or structural supports.

Image 47 - Barn framing and open vent at ridge

Image 48 - Stone floor

The interior floor is about a foot below the adjacent grade and is covered with light tan colored stone set in cementitous grout. Small areas of the floor are unpaved (dirt) and some areas are patched with concrete or asphalt paving. The stone paving may date to the previous barn on the site. The stone pavers extend outside the north end of the building (probably due to the difference in size between the original and rebuilt barns)

Sections of the interior walls are covered with plywood, some with painted murals. There are several stalls at the east side of the barn, which are constructed of 2x wood and plywood and appear to be recent additions.

There is electrical power and lights in the barn. Water is located near the north and south entrances. The building is not heated.

Character-Defining Features

- Rectangular plan with gabled roof
- Stone floor (random rubble)
- Ventilation at roof peak, roof eaves, and upper walls
- Large sliding wood doors
- Vertical wood siding
- Wood truss roof
- Wood post and beam construction
- Alignment with Causeway Trail

Existing Conditions

In general, the barn is in fair condition and its attached shed is in poor condition. The building is very dirty with considerable lichen growth on wood and metal surfaces.

<u>Structure</u>

There is no visible bracing or other lateral-force resisting elements along the east wall of the main barn, at the connection to the east shed. There are only a few isolated pier blocks, but no other foundation at this wall.

At the east wall of the main barn, the load-bearing posts are not continuous from the roof to the ground. A beam runs about two feet above the ground and intersects the posts. The beam is supported on stub posts, which are leaning at the south end.

The interior posts in general do not have adequate connection to their foundations. Some of the posts have shifted to the edge, or partially off of their foundations.

The existing nailed connections at the timber bracing are likely inadequate to resist lateral forces.

<u>Exterior</u>

Roofing

The corrugated metal roofing on both the barn and the shed is intact and in fair condition, with rust staining on the exterior. At the southeast corner of the barn, the roof is sagging and there is corrosion and some warping of the shed roof where it meets the barn wall. The roof drainage system is non-functional. The gutter on the west side of the barn is partially detached and filled with leafy debris. Half of the gutter at the shed is missing. Downspouts are either missing or cut off several feet above grade.

Image 49 - Typical condition of roof

Image 51 - Typical repurposed and deteriorated siding

Image 50 - Failing roof at shed

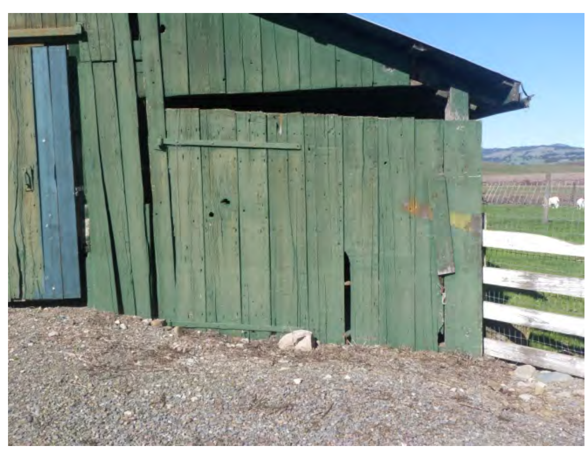


Image 52 - Shed siding with wood to earth contact

Cladding

The wood siding of the barn is in fair condition, considering its use as a hay barn, which required ventilation rather than a weather-tight envelope. Bottoms of boards are deteriorated due to damage from use and from water. As these were reused boards, the damage may date from earlier wood to earth contact. There are a number of split or warped boards, particularly at the east wall above the shed. The corrugated panels cladding the south wall are also in fair condition, with some missing fasteners and bent panels. The painted finish on both wood and metal is worn. The shed cladding is in poor condition. Siding is in contact with the ground and individual boards are warped, broken or missing.

Doors

The randomly constructed doors are in fair to poor condition. As with the wood siding, bottoms of doors are deteriorated due to damage from use and from water. The painted finish on both wood and metal is worn. The large pairs of doors at the ends of the barn are functional, with newer sliding hardware. The shed doors are very deteriorated, with damaged boards and hardware, and rest directly on grade.

Trim

The three wood louvered vents in the north gable and one in the south gable are in fair condition. The sill of the south gable vent is missing.

Paving

Concrete poured to allow access over the concrete perimeter foundation is poorly installed, poses a trip hazard, and does not provide an even slope from grade. This concrete covers the barn's stone pavers where they extend outside the north end of the building.

Image 53 – Gable vent with missing trim

Image 54 – Stone and concrete paving at north entrance

Image 55 - Interior view showing condition of siding

Image 56 - Stone floor with concrete topping at south entrance

<u>Interior</u>
The wood structure and the roof and wall cladding exposed on the interior are addressed above.

Floor
The stone floor, where it remains in place, is in fair condition. Mortar is worn or missing in some places and several sections of pavers have been removed and either left as gravel base or filled in with asphalt concrete. Asphalt and concrete used to create 'ramps' at north and south doors was poorly installed over stone pavers. These are cracked, posing a trip hazard, and do not provide an even slope from grade.

Features
The exposed wood structure is addressed above. The interior partitions, stalls and loft, built from new or reused lumber, are generally in good condition.

<u>Electrical</u>
The electrical system and lighting both need to be upgraded depending on the intended use of the building.

<u>Accessibility Issues</u>
The barn is not accessible from the exterior, due to its raised perimeter foundation and relation to grade. Ramps at entrances and door hardware and operation are not ADA-compliant. Once inside, the uneven stone floor does not provide an accessible path of travel. Required level of accessibility will depend upon use.

Code Analysis

Occupancy Classification	U - Barn
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	9,625 square feet
Actual Area	8,643 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	33 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 300 square feet/occupant	27
Required Exits (CBC Section 1015)	1
Provided Exits	0 (The sliding doors do not meet the requirements of Section 1008 and therefore do not count as required exits. The shed has 2 exits, but they are not accessible from the main barn.)
Other considerations	This barn is occasionally used for assembly purposes, which would greatly increase the occupant load and required exits.

Treatment Recommendations

Basic Treatments

The basic treatment approach for the Hay Barn is to stabilize and strengthen it and halt its deterioration.

Structure

- Repair and improve foundation, adding new footings where required, particularly along the east wall.
- Improve all framing connections and add bracing, as required for seismic strengthening.
- Repair wall structure between barn and shed; level sagging wall at south end.
- Provide added structural support at shed.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Re-grade at shed end walls to eliminate wood to earth contact.
- Re-grade at perimeter to provide positive drainage away from building.
- Remove concrete outside north barn door, possibly remove and salvage stone pavers in this area; install paving sloped up to provide level surface at door.
- Re-secure any loose corrugated roof panels.
- Install new gutters and downspouts at west wall of barn and at shed.
- Rebuild shed end walls.
- Repair and reattach siding; replace seriously damaged boards; estimate replacement of 20%.
- Fasten loose metal siding panels.
- Repair vents at gables, including trim replacement.

- Repair barn doors, replacing damaged boards; rehabilitate or replace hardware as required for functionality.
- Replace doors at both ends of shed.
- Paint all wood elements.

Interior

- Remove asphalt concrete ramping at barn doors and patch stone flooring below.
- Rehabilitate damaged areas of stone flooring and mortar.
- Construct new ramps, non-destructive to stone flooring, inside both doors.

Systems

- Have electrical system evaluated by a licensed contractor or engineer and upgrade as required.

Treatments Contingent on Use

The preliminary recommended use for the Hay Barn is as an unconditioned, non-weatherproof exhibit and/or assembly space. Code requirements for these uses would vary based on the anticipated number of occupants.

- Add exit doors as required for new use.
- Infill area of missing stone paving at west wall.
- Provide a code-compliant path of travel through the building; this could be a raised wood walkway that would not damage the stone floor; estimated coverage for access to exhibits: 25% of floor area.
- For assembly use, construct a raised platform of size required to provide accessible seating and satisfy other code requirements, size to be determined by program.
- Reconfigure interior partitions and stalls as required for intended use.
- Upgrade electrical service and lighting, including emergency lighting, as required for new use.
- Install sprinkler system if recommended or required.

BUILDING 7: OLD DAIRY BARN

Image 57 – North side of Old Dairy Barn with collapsed section at east end

Image 58 – West entrance to Old Dairy Barn

Physical Description

The Dairy Barn was constructed in the late 1940s or early 1950s of salvaged materials. The building is located atop a hill several hundred feet southwest of the rest of the ranch complex. As its name implies it was originally used to house dairy cows. Later it was used to for sheep, but currently is unused.

The dairy barn is rectangular in plan, and measures approximately 65 feet wide and 124 feet long. The foundation is wood posts that rest on wood blocks on the ground. The structural frame is post and beam construction and some of the joints are mortise and tenon connections, while others are nailed. The barn appears to have been built in three sections. The primary section is about 40 feet wide and 100 feet long. A 24-foot-long addition extends the original gabled form toward the east. A 15-foot-wide shed covers the south side, wraps around the east side with a hipped roof at the corner and then abuts the east addition.

The west and north elevations are covered with corrugated, galvanized sheet metal. The east wall and the south side of the east addition are covered with 1x12 vertical wood boards with about ¼- to ½-inch gaps between the boards. A wooden fence approximately three feet tall defines the south side of the building. The roof is covered with corrugated, galvanized metal with an open ridge and rafter ends.

The two primary entrances are at the east and west elevations. At the west elevation, the entrance has a pair of metal gates, while the east side has a pair of wooden gates. Above the east entrance, there is a hay door high on the wall. The south addition is entered through a pair of sliding doors at the east wall.

The interior floor is primarily dirt with small areas of elevated wood floor in the south shed. There are several partial-height partitions made of vertical boards spanning between the posts.

There are currently no utilities to the Dairy Barn. There is not a maintained road to the barn, although a historic road connected it to the main road at the north.

Character-Defining Features

- Rectangular plan with gabled roof
- Corrugated metal cladding
- Roof with wood rafters and purlins
- Southern addition with vertical wood cladding and hipped roof

Existing Conditions

The Dairy Barn has partially collapsed on the east end. The structure is in extremely poor condition and is unsafe. Signs and safety fencing have been placed around it to block access to the building.

<u>Structure</u>
The building has an inadequate foundation.

The south wall has no bracing or other lateral-force resisting elements. The roof framing along the south wall is sagging and has partially failed.

The existing rafters and beams appear to be undersized for their spans. The exterior walls lack any structural sheathing. The nailed connections at the timber bracing are likely inadequate.

<u>Exterior</u>
The sheet metal roofing is in extremely poor condition. The sheet metal siding is also very deteriorated with some missing panels. Large sections of wood siding and trim along the open south side of the barn are rotting, broken, and/or collapsed.

Image 59 - Collapsed east end of barn

Image 60 - Wood framing resting directly on grade

Image 61 - Failed wall at south side

Image 62 - Structural Damaged at south wall

Image 63 - Sheet Metal Roofing

Image 64 - Stalls inside barn

Interior

Within the Dairy Barn, the remaining corrals and stalls are generally in fair condition.

Accessibility Issues

The barn, while at grade level, has no accessible path of travel to or within the remaining building. Required level of accessibility for a rebuilt barn will depend upon use.

Code Analysis

Occupancy Classification	U - Barn
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	9,625 square feet
Actual Area	8,060 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	30 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 300 square feet/occupant	32
Required Exits (CBC Section 1015)	1
Provided Exits	1 (walls are not totally enclosed, thereby allowing exiting along the entire south side)
Other considerations	Current structure does not meet basic code requirements and is unsafe. If rebuilt, the new structure must meet the current building code requirements based on the proposed new use.

Treatment Recommendations

Basic Treatments

The recommended treatment approach for the Old Dairy Barn is demolition and either a) reconstruction to the same footprint, size, shape and materials as the original barn, b) construction of a new smaller barn, or c) no new construction. Prior to demolition, document the barn to HABS (Historic American Building Survey) standards.

Structure

- Demolish and salvage intact structural members for use in rehabilitation of existing ranch buildings or for new construction on site.

Exterior

- Demolish and salvage usable wood siding for use in rehabilitation of existing ranch buildings.

Interior

- Salvage significant barn equipment and/or features (corrals, stalls, etc.) for reinstallation in a reconstructed barn or for possible interpretive use.

BUILDING 8: CREAMERY/ WINE STORAGE

Image 65 – South wall of Creamery

Image 66 – East and north walls of Creamery

Physical Description

The Creamery building was originally constructed in the 1880s or 1890s, with a large addition to the east that dates from the 1940s or 1950s. The building is nestled into the hillside at the northwest corner of the main ranch complex. Originally used to produce and store dairy products, it was later used for wine storage.

The 30-by-49-foot, rectangular building has three sections that descend down the hill. The upper original section is 22 feet wide and 30 feet long, the middle section is 15 by 30 feet and the lower section is 12 by 30 feet. The original section has load bearing stone walls and the rest of the structure is wood framed.

Only the top of the stone wall is above ground on the west side of the building and the grade slopes down on the south side. On the north side, the grade is terraced down by a series of concrete retaining walls and slabs. The rest of the walls consist primarily of vertical boards, with horizontal boards at the north side. The roof is covered with corrugated galvanized metal. At the north gable end, in lieu of a barge board, the corrugated metal has been wrapped down over the exposed ends of the purlins.

Image 67 - Concrete walls on north side of creamery

Image 68 - Interior of upper section, with wood ceiling and stone walls

The upper section of the building is entered from the north and south through small wood plank swinging doors. The middle section is entered from the south through a pair of sliding doors and from the north through a swinging door. The lower section is entered from the east through a single sliding door. There are two small windows, covered with board awning shutters, on the west side of the building. There is a wood covered opening at the north side of the lower section.

The original stone wall separates the original building from the addition. A wood panel door, centered in the wall, allows access between the old and new section of the building. Throughout the building, the floor is made of concrete poured in 3-by-3-foot sections. The elevation of the floor from the original to the middle section drops gradually about one foot. The floor of the middle section is about three feet higher than the lower section. The exterior doors at the upper section are about two and a half feet above the floor level, and are accessed via wooded stairs without handrails. The middle and lower sections of the building are connected by a centered concrete stair. A wood railing, attached to full height framing, separates the two levels. The original section of the building has a wood ceiling, supported by wood framing. Above the ceiling is a large, inaccessible attic space. Some miscellaneous lumber construction, that may have once supported equipment, remains.

There are currently no utilities to the building. Conduit on the north and south gable ends indicates that the building once had electricity. A hose bib is located at the south elevation. There is a stone walkway along the north and east sides of the building. There are a series of concrete walls and slabs along the north side of the building of unknown use.

Character-Defining Features

- Rectangular plan
- Random rubble stone walls
- Saltbox roof
- Vertical and horizontal board siding with corner boards
- Sliding doors composed of vertical boards
- Setting into hill
- Ceiling with attic space above original section

Existing Conditions

The Creamery is in poor and unsound condition. Portions of the building are unsafe to enter.

Structure

The masonry walls are severely cracked and failing to the east (downhill). The building appears to have the same soil related problems as George and Vera's House (4).

The stone masonry and the concrete walls appear to have been constructed without reinforcement. This type of construction is considered hazardous in seismically-active areas.

The existing 2x4 rafters appear to be undersized for their span. The roof and exterior walls do not have any structural sheathing. The wood framing is decaying from water intrusion.

Image 69 - Severe cracking of masonry wall

Image 71 - Metal Roofing, wrapped at gable end

Image 70 - Failed wall at northeast corner

Image 72 - Condition at ridge

Image 74 - South wall showing poor overall condition of siding and doors

Image 73 - Overgrown vegetation on north side

Exterior

Roofing

The corrugated metal roofing is in poor condition. Some panels are bent, have missing fasteners and small holes, and rust staining on the exterior. The panels do not meet at the ridge, but there is no ridge cap covering the space between them.

Cladding

Both the vertical and horizontal wood siding are in very poor condition. Board ends are deteriorated; as these appear to have been reused boards, some of the damage may date from earlier wood to earth contact. The random length boards do not completely cover the ledger on top of the west stone wall. The painted finish is worn.

Doors

The wood doors are in very poor condition. Bottoms of doors are deteriorated due to their contact with the ground and overgrown vegetation that retains water. The painted finish is worn. The doors in the north and south stone walls are extremely deteriorated and falling off their hinges. The sliding door in the east wall is functional and the one in the south wall has newer hardware; however, both of the doors themselves are in very poor condition. The wood shutters over windows in the west stone wall are in similar condition, with missing hinges and very deteriorated frames.

Trim

The Creamery's corner boards remain in place, in the same condition as the siding. The barge board is missing from the east half of the south gable end.

Interior

The wood structure and the roof and wall cladding exposed on the interior are addressed above.

Floor

The concrete floor of the original, west portion of the building is in fair condition. Both levels of the east portion of the building are in very poor condition, becoming extremely poor at the lower level, with settlement/heaving and large structural cracks. Conversely, the concrete stair between the two levels is in good condition.

Features

The exposed wood structure is addressed above. The wood ceiling appears to be in good condition, although it may not be adequately supported from above. The paneled wood door and frame in the interior stone wall is in fair condition. Wood steps at doors in the north and south stone walls are also in fair condition. The board 'railing' between levels is partially collapsed.

Image 75 - General condition of interior

Image 76 - Floor slabs at mid-level of building

Image 77 - Condition at northeast corner.

Accessibility Issues

There is no accessible path of travel to or within the Creamery. With no occupancy, accessibility to and inside the building would not be required.

Code Analysis

Occupancy Classification	U - Barn
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	9,625 square feet
Actual Area	1,455 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	12 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 300 square feet/occupant	5
Required Exits (CBC Section 1015)	1
Provided Exits	3

Treatment Recommendations

Basic Treatments

The recommended treatment approach for the Creamery is to stabilize it in place as a landscape element and interpret it, with no occupancy. Prior to stabilization, document the interior and exterior to HABS (Historic American Building Survey) standards.

Structure

- Repair structural cracks in masonry walls for structural stability and to keep animals out of building.
- Confirm that concrete site walls are structurally stable; repair as required for safety.
- Install interior structural bracing as required for seismic stabilization for an unoccupied building.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Cut back overgrown vegetation and re-grade around building to provide positive drainage away from perimeter.
- Replace corrugated metal roofing.
- Reattach loose wood siding and trim; replace severely deteriorated boards.
- Repair wood doors, replacing damaged boards; secure in place.
- Paint all wood elements.
- Provide interpretive signage nearby building.

Interior

- Remove any historic equipment or features for possible interpretive use elsewhere on site.

BUILDING 9: GRANARY/MUSEUM

Image 78 – East side of Granary with chicken coops

Image 79 – North end of Granary

Physical Description

It is not clear when the Granary building was constructed. It is located at the southwest corner of the ranch complex, near the pond. The site is steeply sloped toward the northeast. The Granary is west of the Tractor Barn (13) and south of John Cardoza Jr.'s House (5). There is a corral at the east and a metal canopy to the west. Originally used to house a mill that ground animal feed, the Cardoza family converted the Granary into a small museum.

The main portion of the building is approximately 60 feet long and 27 feet wide. The original building is rectangular in plan. The addition at the east side is L shaped and includes the entrance, bathroom and a long narrow storage room. A 60-foot-by-20-foot chicken shed is attached to the east side and is rotated about 10 degrees clockwise of the main building. The wood structure is resting concrete footings. The floor is elevated above the ground on a series of walls spaced about seven feet on center and running north-south. The building has load-bearing exterior walls with posts down the center and nailed trusses. There is a wood-framed porch along the west wall. On the west side of the building is a covered patio that is approximately30 feet wide and 40 feet long.

The exterior walls are clad with a variety of metal and wood siding. There is vertical metal siding at the north, east and south sides of the main building, vertical wood boards at the shed and a portion of the west wall, and horizontal wood boards at the vestibule and a portion of the west wall. The granary has a gabled roof, with a gabled dormer on the east side. The chicken coop has a shed roof. The main building and the first 12 feet of the chicken coop are covered with corrugated galvanized sheet metal. The last ten feet of the chicken coop is enclosed with chicken wire at the roof and the east wall. The roof over the patio is a separate structure than the building. The patio roof has metal posts, wood beams, open-web steel trusses, wood purlins and a metal roof.

Image 80 - Patio on west side of building

Image 81 - Recessed entrance at north elevation

The main entrance is recessed 11½ feet into the northeast corner of the building. The door is accessed by flight of stairs. The door is rail and stile with diamond-shaped glass panels. The secondary door is on the west wall and is also a rail and stile door wood door. To the right of the secondary entrance is a sliding barn door. The windows are aluminum sliders on the west and south walls. There is a large picture window flanked by operable casements at the recessed entrance. The dormer has a framed opening filled with corrugated fiberglass. There is a boarded up vent high on the south gable. The chicken coop has a small vestibule and two wood plank doors at the north side. At the south side it has two framed openings filled with chicken wire.

The main interior space is divided into two sections, separated by a partial height wood wall with a pair of sliding barn doors. The south half of the space houses exhibits; the north half appears to have been a sales area, with a counter and some food preparation equipment. It also contains a large ca. 1900 harvester.

The main electrical panel for the barns is located in the Granary. There are water and sewer connections to the building for the ¾ bath and the sink in the northwest corner.

Image 82 - Exhibits in south portion of building

Image 83 - View of museum exhibit area

Character-Defining Features

- Rectangular plan
- Side gable roof with gabled dormer
- Corrugated metal cladding
- Vertical board and board and batten siding

Existing Conditions

The overall condition of the Granary is fair to poor.

<u>Structure</u>

The building does not have sufficient lateral bracing including: adequate cripple-wall bracing below the floor at the exterior walls, diagonal or structural sheathing at the exterior walls, or structural sheathing at the roof.

The picnic area canopy roof trusses lack effective lateral bracing at their bearing points.

Image 84 - Deteriorated structure below building

Image 85 - Deteriorated roof structure over picnic area

<u>Exterior</u>

Roofing

The corrugated metal roofing, including ridge cap and flashing, is in poor condition. Some panels are bent, have missing fasteners and small holes, and heavy rust staining on the exterior. Corrosion is visible on interior surfaces as well. There is a buildup of leafy debris on the relatively flat roof over the picnic area on the west side. The gutter along the east side of the chicken coop and the drainpipe at the south end are deteriorated.

Cladding

Wood and metal siding on the Granary varies from poor to very poor condition. Wood boards are warped and split. The ends are deteriorated; as these appear to have been reused boards, some of the damage may date from earlier wood to earth contact. However, there is still wood to earth contact at many locations. The south end wall and chicken coop walls, in particular, are extremely deteriorated. The metal siding is corroded and damaged; at the southwest corner the siding does not cover the deteriorated framing. The painted finish is worn.

Doors
The two wood panel doors to the Granary are in fair condition. Board doors into the chicken coop are in poor condition.

Windows
Aluminum windows are in poor condition. Two gable end windows that have been in-filled with corrugated fiberglass panels (one with a nailed on screen) are also in poor condition.

Image 86 - General condition of roofing

Image 87 - Roofing and trim at ridge, south end

Image 88 - Typical condition of wood siding and doors to chicken coop.

Image 89 - Typical condition of metal siding.

Image 90 - South Gable window with fiberglass infill.

Image 91 - Poorly installed window adjacent to entrance.

Features
The porch along the west side is in poor condition; the non-compliant plywood ramp and deck are rotting and in contact with the ground. Wood stairs to the north entrance are in fair condition but also have direct wood to earth contact. Trim throughout the Granary is in poor condition: worn, split and rotted.


Image 92 - Deteriorated plywood at ramp to west entrance.


Image 93 - Wood to earth contact at stairs to north entrance.

<u>Interior</u>
The wood structure and the roof and wall cladding exposed on the interior are addressed above.

Floor
The wood plank floor is generally in fair condition. There is some water damage in the bathroom.

Walls
Wood plank walls are in good condition. Wall finishes in the bathroom are in poor condition.

Features
Wood railings and other features of exhibits are in good condition. Wood casework and cabinets are very dirty and in fair to poor condition. The condition of the exhibits themselves ranges from good to poor.

<u>Electrical and Plumbing</u>
The main electrical panel is corroded. Light fixtures inside and outside the building have been installed in a haphazard manner; exterior fixtures are corroded.

Plumbing is also a haphazard installation; steel and plastic bathroom piping is exposed in the chicken coop. Bathroom fixtures are in very poor condition.

Image 94 - Typical electrical installation.

Image 95 - Deteriorated plumbing fixtures.

Accessibility Issues

The Granary has a deteriorated, non-compliant ramp to its east entrance. Inside, the building is generally deficient as regards accessibility and ADA compliance (path of travel, bathroom, etc.) Required level of accessibility will depend upon use.

Code Analysis

Occupancy Classification	A-3 museum, U- agricultural shed
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	9,625 square feet
Actual Area	1,640 square feet (museum), 1,243 square feet (shed), Total:2,883 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	16 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 15 net for A, 300 square feet/occupant for U	80 museum, 4 shed
Required Exits (CBC Section 1015)	2 museum, 1 shed
Provided Exits	2 museum, 1 shed
Other considerations	

Treatment Recommendations

Basic Treatments

Structure

- Make improvements to the foundation.
- Replace deteriorated framing at south end of building.
- Add necessary seismic connections, shear walls, and plywood sheathing at walls and roof of Granary and at canopy over picnic area.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Replace corrugated metal roofing, gutters and downspouts.

- Re-grade where required to provide positive drainage away from building and eliminate wood to earth contact.
- Replace metal siding on walls and dormer.
- Replace wood enclosure walls at both ends of chicken coop; including doors and framed screened openings.
- Repair wood siding and trim elsewhere on building; patch/replace boards as required: estimate replacement of 10% of siding and 20% of trim.
- Provide secure enclosure of space below building.
- Repair entrance doors, including hardware.
- Demolish entrance ramp and porch on west side; reconstruct new porch, possibly larger and with access at both ends, including a code-compliant ramp.
- Add concrete curb at bottom of north entrance stair.
- Repair chicken coop partitions and roof as required.
- Replace deteriorated aluminum windows; replace window in north gable and fiberglass paneled openings in south gable and dormer.
- Paint all wood and painted metal elements.

Interior

- Remove bathroom fixtures.
- Remove miscellaneous cabinets, counters and appliances.
- Retain and rehabilitate granary machinery inside building.

Systems

- Have electrical system evaluated by a licensed contractor or engineer.
- Remove all plumbing and heating equipment, piping, and fixtures.

<u>Treatments Contingent on Use</u>

The Granary, when rehabilitated, would lend itself to a number of possible uses, contingent on program needs and the Master Plan. These include Park offices, meeting/event space, or continued interpretive use.

- Install new mechanical and electrical systems.
- Consider construction of a single user accessible restroom at location of existing bathroom.
- Improve lighting; specific requirements will depend on building use.

For office or meeting room use:

- Remove all exhibits for possible use elsewhere on site.
- Install finished floor over existing wood subfloor.
- Insulate walls and roof and add finishes.
- Consider installation of a small kitchen at location of existing sink.
- Consider installation of air conditioning.

For exhibit/museum use:

- Retain or remove existing exhibits depending on interpretive program established for the site.

BUILDING 10: LINE SHACK

Image 96 – Front of Line Shack, facing north, leaning toward west

Physical Description

The Line Shack is currently located at the southwest corner of the ranch, near the Granary (9) and the pond. It sits slightly tilted on a gradual slope. Built in the 1890s or early 1900s, the line shack housed ranch hands. It was repeatedly moved around the ranch to keep it near the grazing cattle.

The simple gable-form structure is 12 feet wide and 16 feet long, with a shed roof over a 4-foot-deep porch. The structure is wood framed with 2x members for the floor, walls and roof. The floor structure is supported on wood skids on the long sides. The skids are elevated on wood blocks on the east side and the shed is tilted towards the west.

The exterior walls are clad with vertical wood boards tightly fit together. The main roof and porch roof are both covered with cut wood shingles. The west side of the roof is covered with a blue plastic tarp. The front porch is accessed via a center wood stair and surrounded by a wood rail attached to the wood posts.

The only entrance is through the porch to the four panel rail and stile wood door. There are three six-light fixed casement windows: one each on the west, north and south walls. The windows and door are painted at the interior, but have exposed wood at the exterior.

The interior floor is unpainted wood boards of random widths. The walls are painted a mint green.

There are currently no utilities to the building. There is some old knob and tube wiring on the exterior wall, indicating that the building once had electrical power. A wood burning stove is located in the northeast corner.

Character-Defining Features

- One story height
- Gable roof

- Exposed rafter tails
- Rectangular plan
- Rustic vertical board siding
- Wood skids below floor framing
- Shed roof porch
- Wood panel door
- Multi-light wood windows
- Wood burning stove

Existing Conditions

The Line Shack is unstable and leaning to the west due to subsidence along that side of the building. The wood structure sits directly on the ground.

Structure

The line shack lacks a foundation and is rests directly on the ground. It lacks diagonal sheathing or structural sheathing at the walls, and lacks structural sheathing at the roof.

Image 97 - Tarp-clad east side of roof

Image 98 - Roofing and structure at west side

Exterior

Roofing

The wood shingle roofing is in very poor condition. The east side has been covered by a tarp, which is now also deteriorated.

Cladding

The vertical, unfinished wood siding is in very poor condition. Wood boards are warped and split. Several large knot holes have been covered with wire mesh, but other, larger holes are uncovered. A bird or animal nest has been built behind the boards of the west wall.

Door and Windows

The wood panel door and fixed wood windows, and their trim, are in poor condition.

Image 99 - Building set on wood skids directly on ground

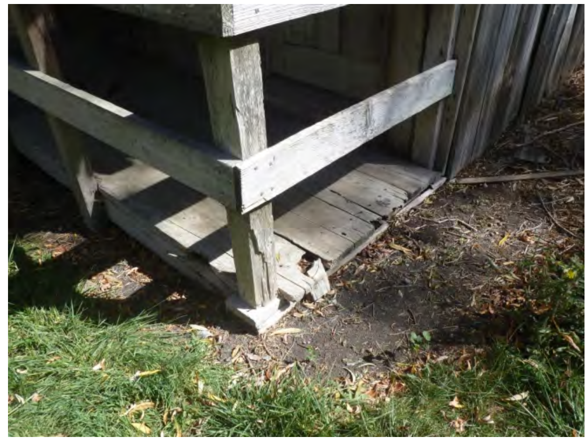


Image 101 - Deterioration at west end of porch

Image 100 - Deteriorated condition of window (typical)

Features
The west end of the front (north) porch has settled almost a foot. The wood decking is rotting and the entire porch is unsafe.

Interior
The interior is in fair condition, considering the building's unstable structure and unprotected exterior.

Accessibility Issues
The Line Shack is not accessible and its sloped porch and stairs are unsafe. Required level of accessibility will depend upon use: with no occupancy, accessibility would not be required.

<u>Code Analysis</u>

Occupancy Classification	R-3 single family residential
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	9,625 square feet
Actual Area	200 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	12 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 200 square feet/occupant	1
Required Exits (CBC Section 1015)	1
Provided Exits	1
Other considerations	

Treatment Recommendations

<u>Basic Treatments</u>

Structure

- Provide precast concrete footings under wood skids.
- Level building so that it is not leaning.
- Reconstruct porch floor.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Replace roof with new shingle roof to match original roof.
- Repair rafter ends and other rotted structural elements.
- Repair siding and replace sections that are deteriorated beyond repair.
- Reinstall chimney flue for stove for interpretive purposes, not to make functional.
- Repaint door.
- Replace window putty and repair window frames.

Interior

- Clean interior.
- Furnish interior as it would have been used in the field.

BUILDING 12: OLD SHOP/WORKSHOP

Image 102 – North wall of Old Shop

Image 103 –Old Shop with shed on east side

Physical Description

The workshop and attached equipment shed are located near the center of the ranch between John Cardoza, Sr.'s House (3) and the Equipment Shed (14). The late 1880s workshop is on the west side and an attached equipment storage shed is on the east. There is a steep slope of the west side of the building and an unpaved road at the top of the incline.

The workshop is 36 feet long and 16 feet wide, while the attached shed is 36 feet long and 9 feet wide. The workshop is a simple gabled form, and the shed is a single slope roof. Both the shop and the shed are balloon framed.

The shop has 7½-inch, V-grooved horizontal wood siding. The shed has a random combination of different wood siding including three inch lap siding and nine inch shiplap siding. The roof of the shop is asphalt shingles over wood shingles. The shed has corrugated galvanized sheet metal.

Image 104 - Interior of workshop

Image 105 - Door hardware

The shop has two swinging doors on the north elevation, which are accessed by wooden stairs. There are no handrails on the stairs. The shop also has a large sliding door at the south elevation. The shed has a pair of large swinging doors on the north elevation and a single swinging door on the east wall. The shop has a fixed casement window high on the gable ends (north and south). The north window is a single pane of glass, while the south window has six panes of glass. There is a fixed casement window on the south elevation of the shed, which has six lights and as unusual trim details.

The shop has a raised wood floor and the shed floor is dirt. The northwest corner of the shed is partially divided from the rest of the shed with a stud wall. The studs are covered with horizontal boards to about three feet above the floor. The area is used for chemical storage and is about 11½ feet long by 6 feet wide. This area currently is storage for chemicals. There is wood-framed shelving along the west wall of the shop and the chemical area. There are wood shelves along the east side of the chemical area, facing the main shop, and along the east wall of the shop. The shed also has some wood shelves, along the west and east walls, near the south end. The interior face of the exterior walls is partially covered with spaced horizontal boards. A table saw is mounted to the floor in the center of the shop. The shop has skipped sheathing and the underside of the wood shingles exposed at the ceiling. The shed has purlins and the metal roofing exposed.

The shop has electricity, but no water or heating.

Image 106 - Original exterior wall within shed

Image 107 - Recycled wood used as shelving

Character-Defining Features

- Gable roof
- Wood corner boards and rakes
- Wood window and door surrounds
- Multi-light, wood windows near gable peak
- Doors composed of vertical wood boards
- V-groove horizontal siding
- Exposed rafters and purlins

Existing Conditions

The Old Shop is in fair to poor condition. There is wood –to-earth contact around the entire perimeter and no positive drainage away from the north, west and south sides of the building. The southwest corner appears to be settling.

Structure

The Old Shop has an inadequate foundation. It lacks diagonal sheathing or structural sheathing at the walls, and lacks structural sheathing at the roof.

Exterior

Roofing

The asphalt shingles on the roof of the workshop are in fair condition; there are no lost shingles, but those at the ridge appear deteriorated. There is staining on the skip sheathing below the roofing, but that may pre-date the installation of the shingles. The corrugated metal roofing on the attached shed is in fair condition.

Image 108 - Typical condition of roofing

Image 109 - Siding at southeast corner of shed

Image 110 - Deteriorated corner boards and earth to wood contact

Cladding
The wood siding of the Old Shop is in poor condition. The painted finish is worn and individual boards are warped, split or missing. The siding on all sides is in contact with the ground. The south wall, in particular, has suffered from ultraviolet damage.

Doors
The two doors that are raised above grade are in fair condition; their wood sills are in poor condition. The doors into the shed are in very poor condition due to their contact with the ground. The large sliding door in the south wall of the workshop is in fair condition, but its lack of threshold exposes the structure below. Doors are hung and secured with miscellaneous hardware.

Windows
The windows are in very poor condition with broken glazing and missing putty and deteriorated frames and mullions. Neither the windows, nailed to the inside face of the wall, nor their exterior trim, fit the openings in which they are mounted.

Features
Wood stairs at both north entrances are in poor, hazardous condition. Wood trim is in fair to poor condition. Many boards have rotten ends; corner boards are warped and rotted at bottoms, in some cases exposing the wall structure. Paint finish is worn.

Image 111 - Poorly fit window with Plexiglas panel

Image 112 - Deteriorated wood stairs directly on ground

Interior

The wood structure and the roof and wall cladding exposed on the interior are addressed above.

Flooring

The board flooring in the workshop is generally in fair condition, with some deterioration at the south end wall and at the doors in the north wall.

Walls

The tongue and groove boards forming the wall between the workshop and the shed are in good condition.

Features

Wood shelving in both the workshop and the shed is in fair to poor condition. It is generally sturdy, but constructed of random lumber, some of it split or warped.

Electrical

The knob and tube wiring could present a hazard if used for power tools which are located in the workshop.

Accessibility Issues

The workshop and shed are generally deficient as regards accessibility and ADA compliance from the exterior and within the building (path of travel, bathroom, etc.). Required level of accessibility will depend upon use.

Code Analysis

Occupancy Classification	S-1 storage
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	13,500 square feet
Actual Area	918 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	14 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 200 square feet/occupant	3
Required Exits (CBC Section 1015)	1
Provided Exits	3
Other considerations	Although chemicals are stored in the building, it is not categorized as a hazardous use under Section 307.1, exception 8.
	The asphalt shingle roof over the wood shingles is a non-compliant condition per CBC 1510.3, paragraph 2

Treatment Recommendations

Basic Treatments

Structure

- Provide a continuous perimeter concrete foundation at the workshop and shed; provide concrete piers at interior posts and at exterior stairs.
- Install structural sheathing at roof and walls.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Re-grade at perimeter to eliminate wood to earth contact and to provide positive drainage away from building.
- Remove asphalt and wood shingle roofing. Install new asphalt shingle roof over plywood sheathing, with new gutters and downspouts.
- Repair metal roof as needed.
- Repair exterior siding and replace in kind where deteriorated beyond repair; estimate replacement of 25% of siding.
- Replace stairs to doors, provide landings and railings.
- Replace windows to match.
- Repair shed doors and eliminate contact with the ground.
- Paint all wood elements.

Interior

- Replace electrical wiring.

Treatments Contingent on Use

Preliminary recommendations include possible adaptation of the workshop for interpretive or exhibit space or for public restrooms. Either of these uses could use the shed for storage. Alternatively, the entire building could continue as storage space.

- Insulate building.
- Provide accessible entrance(s) to workshop from grade.
- Upgrade lighting.
- Install new finishes at walls, floor and ceiling.
- Install plumbing system and fixtures, including ADA-compliant facilities.
- Add heating and air conditioning system.

BUILDING 13: TRACTOR BARN/ EQUIPMENT BARN

Image 113 – North entrance to Tractor Barn.

Image 114 – Southeast corner of Tractor Barn.

Physical Description

The Tractor Barn was built between 1952 and 1953 (date in foundation says 1947) of recycled building materials at the south edge of the ranch. It is located at the intersection of Cannon Lane and Cardoza Road. The east side of the barn has a narrow fenced-in area about 12 feet wide, and a large field beyond. At the northeast corner of the barn are two small structures, one of which houses some water supply equipment. The building historically housed large tractors and farm equipment. Now, in addition to a few historic pieces of farm equipment, it is used for general storage.

Measuring 53 feet wide and 89 feet long, the tractor barn is a simple low-sloped gabled form, with no additions. It is post and beam construction with three structural bays in the east to west direction and six bays in the north to south direction. The center bay is about 20 feet wide and the side bays are about 16 feet wide. The interior posts are supported on concrete footings and the east and west walls have continuous concrete footings.

The exterior walls are clad with vertical 1x12 wood boards, spaced about 1/2 inch apart. The roof is clad with corrugated galvanized metal with open ridge and eaves.

The primary entrance to the barn is from the north through a metal gate across a large framed opening. On the opposite wall, there is a pair of large sliding doors. At the west side bay, there are pairs of hinged doors at the north and side walls. There are three unequally spaced windows along the west wall: each a fixed casement with six panes of glass. Each window is covered with thin Plexiglas at the exterior.

The floor of the barn is dirt and there are no interior partitions. The metal roof is exposed between the rafters and purlins. There are no finishes on interior of the walls.

The barn has limited power and lights. Water is located east of the main entrance.

Image 115 - Barn interior showing framing and dirt floor

Character-Defining Features

- Rectangular plan
- Gable roof
- Walls and door composed of vertical wood boards
- Wood post and beam construction, with exposed rafters and purlins
- Multi-light, wood windows with wood surrounds

Existing Conditions

The Tractor Barn is in fair to poor condition. There is no positive drainage away from the north, west and south sides of the building.

<u>Structure</u>
The east foundation wall is cracked and leaning. It is likely unreinforced and the supporting footing is unknown.

There are numerous decayed framing members due to water intrusion and wood-to-earth contact. One interior post has been cut off above the floor, and the other posts have inadequate connections to their foundations. One horizontal out-of-plane wall brace has failed.

The existing 2x6 rafter and 4x6 beams are undersized for their spans. The 4x6 posts are undersized for their height. The nailed connections at the timber bracing are likely inadequate to resist lateral forces. The roof and walls lack structural sheathing.

Image 116 - Typical condition of roofing

Image 117 - Wood to earth contact of siding

Exterior

Roofing

The corrugated metal roofing is in fair condition. The original roofing as well as the later panels, gable cap, and eave trim are in similar condition, with some missing fasteners and bent panels and trim. The original roofing has rust staining on the exterior. The lack of gutters has contributed to water damage at grade.

Cladding

The wood siding of the barn is in fair to poor condition. The siding at the north, west, and south walls is in contact with the ground and bottoms of boards are deteriorated due to damage from water. The painted finish is worn and individual boards are warped, split or missing.

Doors

The large opening at the north end has no doors. The pair of doors adjacent to this opening is hung unevenly with miscellaneous hardware. The two pairs of large doors at the south end are in very poor condition. Both are inoperable, in part due to built up soil against the bottom. The larger, sliding pair has extremely warped boards. The smaller pair of swinging doors is failing also due to inadequately sized hardware. As with the wood siding, bottoms of doors are deteriorated due to damage from water.

Windows

The windows are in very poor condition with broken glazing and missing putty and deteriorated frames and mullions.

Trim

Trim at the north entrance, windows and gable ends of roof is in fair condition. Paint finish is worn.

Image 118 - Deteriorated doors at south end of building

Image 119 - Typical window with plexiglas cover

Image 120 - Cracked foundation at south wall

Image 121 - Corroded electrical components

<u>Interior</u>
The wood structure and the roof and wall cladding exposed on the interior are addressed above.

<u>Electrical</u>
Electrical switches and some conduit are corroded and potentially unsafe; incandescent fixtures provide bare minimum illumination.

<u>Accessibility Issues</u>
The Tractor Barn's main entrance is on grade; however, the dirt floor is not considered compliant. The building could be made accessible, with the required level of accessibility dependent upon use.

<u>Code Analysis</u>

Occupancy Classification	S-1 storage
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	15,750 square feet
Actual Area	4,673 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	20 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 200 square feet/occupant	16
Required Exits (CBC Section 1015)	1
Provided Exits	1 (gate at north side)

Treatment Recommendations

Basic Treatments

The basic treatment approach for the Tractor Barn is to stabilize and strengthen it and halt its deterioration.

Structure

- Stabilize or remove and replace the east foundation wall.
- Replace decayed and damaged framing and add supplementary framing where required.
- Improve all framing connections and add bracing, as required for seismic strengthening.
- Install plywood sheathing at roof and walls as required for seismic strengthening.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Re-grade at perimeter eliminate wood to earth contact and to provide positive drainage away from building.
- Replace corrugated metal roofing.
- Install new gutters and downspouts at east and west walls of barn.
- Repair and reattach siding; replace seriously damaged boards; estimate replacement of 20%.
- Replace one pair of barn doors at south wall of barn, including hardware.
- Repair other barn doors, replacing damaged boards; rehabilitate or replace hardware as required for functionality.
- Repair windows or replace to match.
- Paint all wood elements.

Interior

- Level dirt floor and eliminate all word to earth contact.

Systems

- Have electrical system evaluated by a licensed contractor or engineer.

Treatments Contingent on Use

The preliminary recommended use for the Tractor Barn is unconditioned agricultural storage and maintenance.

- Upgrade electrical service and lighting as required for safe use of equipment.
- Consider adding doors to opening at north end of barn.

BUILDING 14: STORAGE SHED/ EQUIPMENT SHED

Image 122 – Northeast corner of Storage Shed

Image 123 – West wall and rusted roof of Storage Shed

Physical Description

The 1950 Storage Shed is located at the center of the Cardoza Ranch, northwest of the work yard. The Storage Shed is aligned with the Old Shed to its north. There is a steep slope of the west side of the building and an unpaved road at the top of the incline. This building was used for storage of equipment historically and is now used as the carpentry shop.

Measuring 26 feet wide and 48 feet long, the tractor barn is a simple low-sloped gabled form, with no additions. The building is balloon framed with nailed wood trusses supporting the roof. The walls rest on a continuous concrete footing.

The exterior walls are clad with vertical 1x12 wood boards, spaced about 1/2 inch apart. The roof is clad with corrugated galvanized metal with open ridge and eaves.

There are two pairs of sliding doors on the east elevation and one pair at the south. There are three equally spaced windows on the north wall and five unequally spaced windows on the west wall. All of the windows are fixed casement windows. Two of the windows on the west wall have one pane of glass and the rest have six panes each. All of the windows are covered with a thin Plexiglas at the exterior.

The Storage Shed floor is concrete. The walls have no interior finish and the ceiling is open to the exposed rafters, purlins and metal roofing.

The building has power. Water is located at the exterior, near the south door. There is no heating in the building. There is a small concrete pad in front of the northern door on the east wall.

Image 124 - Interior currently being used as a workshop

Image 125 - Large sliding doors to accommodate equipment.

Character-Defining Features

- Rectangular plan
- Gable roof
- Walls and sliding doors composed of vertical wood boards
- Wood roof truss
- Multi-light, wood windows with wood surrounds
- Large sliding doors

Existing Conditions

The Storage Shed is in fair to poor condition. There is wood-to-earth contact around the entire perimeter and no positive drainage away from the north, west and south sides of the building. The southwest corner appears to be settling.

<u>Structure</u>
The Storage Shed lacks a concrete foundation, diagonal sheathing or structural sheathing at the walls, and structural sheathing at the roof.

<u>Exterior</u>
Roofing
The corrugated metal roofing is in poor condition, with surface staining from corrosion. There is no ridge cap and some panels appear damaged at the ridge. The sheet metal chimney (no longer in use) is corroded and poorly attached to its flashing and the roof. The lack of gutters and minimal overhang of the metal roofing has contributed to deterioration of the wood trim at eaves and at the base of the wall below.

Image 126 – Entrance to working space in Storage Shed

Image 128 - Typical window with Plexiglas covering; damaged trim

Image 127 - Deteriorated siding with wood to earth contact.

Cladding
The wood siding of the Storage Shed is in poor condition. The painted finish is worn and individual boards are warped, split or missing. Although wood-to-earth contact occurs only at the northwest and southwest corners, the bottoms of siding boards are rotting throughout the building.

Doors
The two pairs of sliding doors are functional. The larger pair is in fair condition; the small pair in poor condition. The concrete building slab functions as a sill for both, protecting them from earth contact.

Windows
The windows are in poor condition with broken glazing and missing putty and deteriorated frames and mullions. Plexiglas sheets have been nailed over all of the windows to provide some weather protection.

Wood Trim
Barge boards and fascias are in poor condition, with some broken and missing sections. Trim at windows varies from fair to poor condition.

Interior
The wood structure and the roof and wall cladding exposed on the interior are addressed above.

Flooring
The concrete slab floor has a number of significant structural cracks and poses trip hazards.

Electrical
Upgrades made to the electrical system are temporary and do not meet code. The system is undersized for its current use for shop equipment.

Image 129 - Corrugated roofing and steel beam at door

Image 130 - Cracked concrete slab

Image 131 - Miscellaneous non-compliant electrical modifications

<u>Accessibility Issues</u>
The Storage Shed is built on grade; however, the entrances are not ADA-compliant. The building could be made accessible, with the required level of accessibility dependent upon use.

<u>Code Analysis</u>

Occupancy Classification	F-1 shop
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	12,750 square feet
Actual Area	1,248 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	14 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 200 square feet/occupant	5
Required Exits (CBC Section 1015)	1
Provided Exits	0 (The sliding doors do not meet the requirements of Section 1008 and therefore do not count as required exits.)

Treatment Recommendations

<u>Basic Treatments</u>

Structure

- Install structural sheathing at roof and walls.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Re-grade at perimeter to eliminate wood to earth contact and to provide positive drainage away from building.
- Remove and replace sheet metal roofing over new plywood sheathing. Provide gutters and downspouts.
- Repair exterior siding and trim; replace in kind where deteriorated beyond repair; estimate replacement of 25% of siding and 50% of trim.
- Replace windows to match.
- Paint all wood elements.

Interior

- Upgrade electrical system.
- Repair concrete floor slab.

Treatments Contingent on Use

The preliminary recommended use for the Storage Shed is for interpretive/visitor center use.

- Rehabilitate paved area at west side of building and provide an accessible entrance.
- Upgrade lighting.
- Consider insulating building, installing new finishes at walls, floor and ceiling, and add heating and air conditioning system.

BUILDING 15: SLAUGHTERHOUSE

Image 132 – Entrance in west wall of Slaughterhouse

Image 133 – East end of Slaughterhouse

Physical Description

The Slaughterhouse is located at the northeast corner of the ranch, east of the Bunkhouse. An old unmaintained road runs along the building's south side. The construction date is unknown. As its name implies, it was used for slaughtering cows and other farm animals. Now it is unused. A large blackberry bramble is engulfing the southeast corner of the building.

The 20-foot-wide, 30-foot-long slaughterhouse is a simple gable form. There appears to have been a roof attached on the east wall, perhaps a canopy or enclosed addition. The structure is wood post and beam with rafters supporting the skip sheathing. There is a continuous concrete slab poured over field stones.

The exterior walls are clad with vertical 1x12 wood boards, spaced about 1/2 inch apart. The roof is clad with corrugated galvanized metal with open ridge and eaves. The skip sheathing under the metal indicates that the roof was originally covered with wood shingles.

Large doors cover the west side of the building: a pair of hinged doors at the north side and a sliding door at the right. On the east side is a narrow, tall door with a narrow concrete ramp up to it. This door was likely used to bring in the cattle. At the east corner of the south wall, there is a low, wide door which is hinged from the top. This door may have been used to remove the carcasses. There are no windows in the slaughterhouse.

Like the other farm buildings, there are no interior wall or ceiling finishes. The floor is roughly poured concrete. At the east wall, near the south corner, the concrete slopes to the exterior and there is a gap between the wall and the foundation. This was likely to drain out the blood. At the southeast corner, there is a wood winch and tackle with a large metal hook at the end of the rope. There is a table and a couple of other pieces of equipment in the building, which relate to its historic use.

Image 134 - Concrete drainage trough at east end of building

Image 135 - Winch and tackle near southeast corner

The building currently has no utilities. A light socket mounted below a beam and wiring on the west gable show that the building once had power. No water connection was located.

Character-Defining Features

- Rectangular plan
- Gable roof
- Walls and doors composed of vertical wood boards
- Corner boards
- Wood post-and-beam construction, with exposed rafters and purlins
- Concrete foundation
- Wood winch and tackle

Existing Conditions

The Slaughterhouse is in poor condition. Although its roof is in good condition, the rest of the building envelope is extremely deteriorated.

<u>Structure</u>

The foundation is inadequate and the concrete slab, on which the building rests, is in very poor condition. The Storage Shed lacks diagonal sheathing or structural sheathing at the walls, and lacks structural sheathing at the roof. There is extensive decay of the wood framing due to water intrusion and soil contact.

<u>Exterior</u>

Roofing

The corrugated metal roofing is in generally good condition, with only one bent edge at the southwest corner. The ridge cap is also in good condition.

Cladding

The wood siding of the Slaughterhouse is in very poor condition. There are many warped, split or missing boards. Although the concrete slab separates the wood siding from the ground, dense plant growth around the building has contributed to the deterioration of the lower sections.

Image 136 - General condition of roofing.

Image 137 - Typical condition of wood siding and vestiges of former addition east end.

Doors

The sliding door in the west wall does not appear to be functional. The adjacent pair of doors is extremely deteriorated and also not functional; access to the building is gained by removing one of the door's boards. The smaller door at the opposite end is also in poor condition. The shutter low in the north wall is also in poor condition but may be operable

Wood Trim

All wood trim is in fair condition, with major deterioration at the bottom ends of corner boards.

Features

The short concrete ramp outside the east door is in poor condition.

<u>Interior</u>

The wood structure and the roof and wall cladding exposed on the interior are addressed above.

Flooring

The concrete slab floor is completely broken up in some areas and seriously cracked throughout the building.

Features

Remaining elements of the pulley system appear to be in fair condition.

Image 138 - Non-functional doors at west wall.

Image 139 - General deteriorated condition of slab and siding.

Accessibility Issues

There is no ADA-compliant access to or within the Slaughterhouse. The building is constructed on grade and could be made accessible, with the required level of accessibility dependent upon use.

Code Analysis

Occupancy Classification	F-1
Construction Type (CBC chapter 3)	VB, non-rated, combustible construction
Allowable area (CBC Section 503)	12,750 square feet
Actual Area	1,248 square feet
Allowable height (CBC Section 504)	40 feet, 1 story
Actual Height (feet/ stories)	14 feet, 1 story
Occupant Load (CBC table 1004.1) Factor: 200 square feet/occupant	5
Required Exits (CBC Section 1015)	1
Provided Exits	2
Other considerations	

Treatment Recommendations

Basic Treatments

The recommended treatment approach for the Creamery is to stabilize it in place for storage use. Prior to stabilization, document the interior and exterior to HABS (Historic American Building Survey) standards.

Structure

- Provide continuous perimeter foundation.
- Remove and replace any deteriorated structural elements.
- Provide seismic reinforcement at exterior walls and at roof.
- Refer to Structural Assessment in the Appendix for further discussion.

Exterior

- Cut back overgrown vegetation and re-grade around building to provide positive drainage away from perimeter.
- Reattach loose wood siding and trim; replace severely deteriorated boards; estimate replacement of 20% of siding and trim.
- Repair wood doors, replacing damaged boards, and secure in place. Provide one operable door and safe, level access to it.
- Paint all wood elements.
- Provide interpretive signage nearby building.

Interior

- Remove deteriorated concrete and install new floor slab.
- Remove winch and tackle for possible interpretive use elsewhere on site.

<u>Treatments Contingent on Use</u>
The preliminary recommended use for the slaughterhouse is for storage.

ADDITIONAL RECOMMENDATIONS

RECOMMENDATIONS FOR NEW STRUCTURES OR ADDITIONS

RECOMMENDATIONS FOR FURTHER STUDY

APPENDICES

BIBLIOGRAPHY

STRUCTURAL ENGINEER'S REPORT

Appendix F

Hydrology and Water Quality

DISCLAIMER: Due to the nature and length of this appendix, this document is not available as an accessible document. If you need assistance accessing the contents of this document, please contact Victoria Willard, ADA Coordinator for Sonoma County, at (707) 565-2331, or through the California Relay Service by dialing 711. For an explanation of the contents of this document, please direct inquiries to Karen Davis-Brown, Park Planner II, Sonoma County Regional Parks Department at (707) 565-2041.

HYDROLOGY AND HYDRAULIC REPORT

SONOMA COUNTY, CA

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Prepared for:
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November 14, 2016

TABLE OF CONTENTS

1.0 INTRODUCTION

The purpose of this report is to present additional analyses that build upon the hydrology and geomorphology assessment work done to date. Results are presented that specifically examine hydrologic conditions of Tolay Lake, Tolay Creek, and associated tributaries within and adjacent to the Tolay Lake Regional Park (Park) property boundary under existing and proposed conditions. The purpose of the analyses presented herein is to clarify understanding of potential hydrologic impacts that might be incurred by lake restoration proposed under the Tolay Lake Regional Park Master Plan (Master Plan).

Tolay Lake in Tolay Lake Regional Park, Sonoma County, California, was originally formed by a natural dam across Tolay Creek that was about 14 feet higher than the lake bed (KHE 2003). The natural dam was breached in the 1860s to facilitate draining the lake. The lake and creek were further modified to their present condition over the historic period to create conditions more favorable for ranching (KHE 2003; Florsheim 2009). Under the existing conditions, flooding in the Park is common during the wet season, including overtopping of the existing causeway that crosses and divides Tolay Lake into upper and lower impoundments with approximately two-thirds of the lake upstream from the causeway and the remaining third downstream from the causeway (Figure 2). Tolay Lake generally dries completely during the summer dry season. The Tolay Lake Restoration Project (Project), which is part of the larger Tolay Lake Regional Park Master Plan, is intended to restore the lake to near historic conditions, thereby enhancing wildlife habitat and reducing flooding impacts in the Park without increasing flood risk to upstream landowners.

The hydrologic and hydraulic modeling analyses reported herein were conducted to support the Tolay Lake Master Plan Environmental Impact Report (EIR). MIG is the prime consultant for the Master Plan, which is sponsored by Sonoma County Regional Parks. As part of this effort, Wildscape Engineering Inc. (WE) was tasked with conducting supplemental field topographic surveys, quantifying watershed peak flow rates for modeling, conducting modeling analyses of existing and proposed conditions to determine impacts on hydraulics associated with the proposed project, and prescribing mitigation measures to reduce impacts as needed. This technical report was developed to summarize the methodologies and results of these efforts.

2.0 WATERSHED HYDROLOGY AND GEOLOGY

2.1 Hydrology

Tolay Creek flows from northwest to southeast in a valley situated between and roughly parallel to both Sonoma Creek and the Petaluma River drainages and discharges into a tidally influenced marsh complex at the southern end of Sonoma Valley (Arnold Drive/Hwy 121) before entering San Pablo Bay. The Tolay Creek watershed has a drainage area of approximately 8.3 square miles. The watershed boundary is defined by rounded ridges and hilltops with the highest elevation at approximately 916 feet (unnamed peak) down to 15 feet elevation at Arnold Drive (Florsheim 2009).

Based on topographic maps of the area, Tolay Creek is a third-order channel with a total main channel length of about 6.3 miles (Florsheim 2009). The subwatershed of interest for the purpose of this assessment is the Tolay Lake watershed, which comprises the Tolay Creek watershed upstream from what is known as the "farm bridge" (the furthest downstream hydraulically significant structure within the Park) and is contained entirely in the upper basin of the Tolay Creek watershed, a wide reach approximately 3.0 miles in length with a relatively low average slope of 0.0013 (Florsheim 2009).

The Tolay Lake watershed is bounded on the northeast by the Sonoma Mountains and on the southwest by a low line of hills that separate it from the Petaluma Valley to the west. Headwaters to the west and northwest feed the main channel, and headwaters to the north and northeast feed the two primary tributaries, North Creek and Eagle Creek. The watershed divide in the headwaters has a relatively low elevation and in some places is somewhat indistinct from the adjacent Petaluma River watershed (Florsheim, 2009).

The confluence of the tributaries with the main Tolay Creek channel is within the historic Tolay Lake lakebed just upstream of the farm bridge. The boundaries of the main channel, North Creek, and Eagle Creek sub-watersheds (Figure 1) are partially defined by irrigation channels within the Park and within private property up-gradient from the Park. Upstream water rights and associated management affect flows and hydrographs through the Park. Existing irrigation channels and hydraulic structures in the Park (Figure 2) also significantly affect flow and hydrographs through the Park.

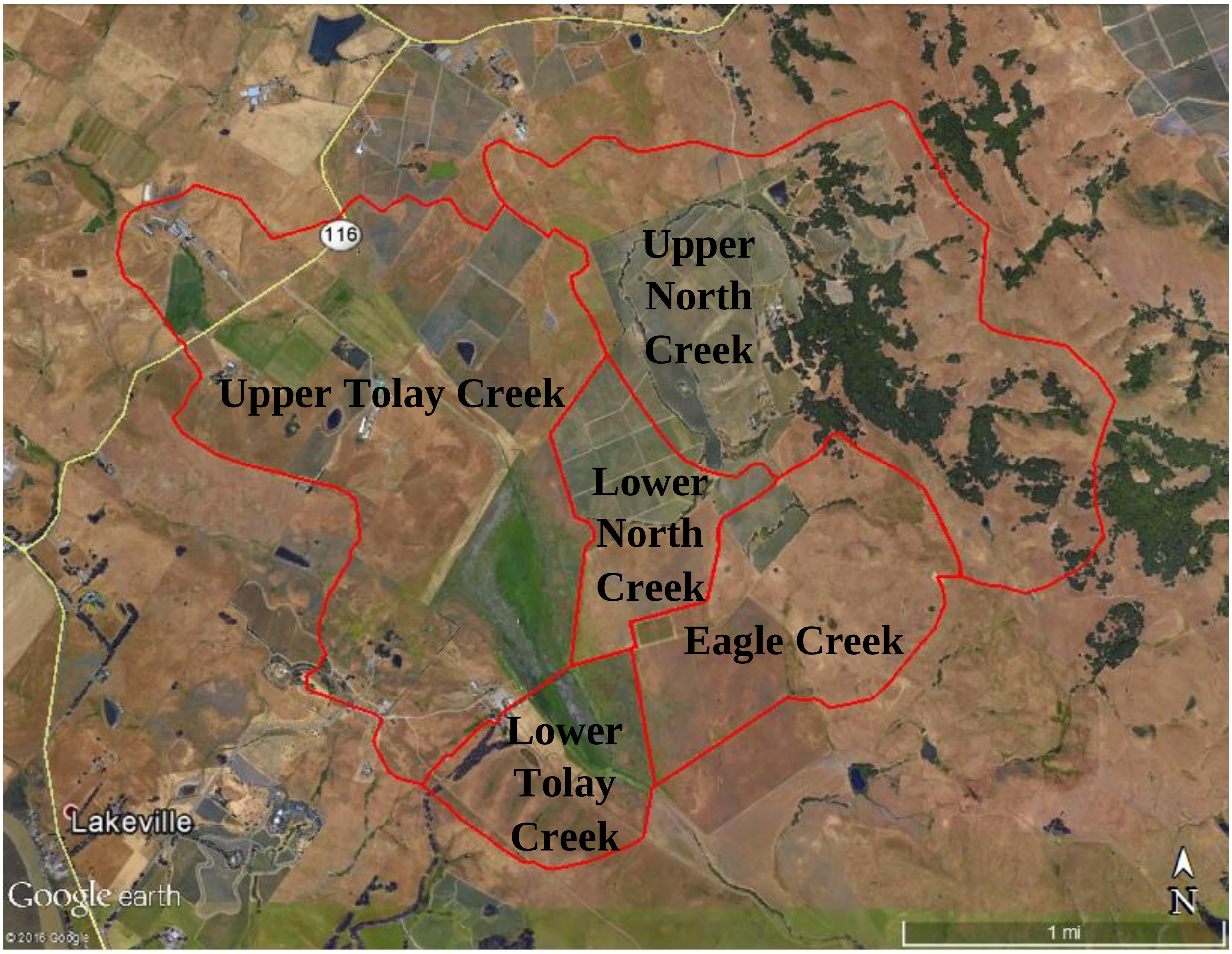

Figure 1. *Tolay Lake Watershed and Sub-Watersheds Upstream of the Farm Bridge (Google Earth 2016).*

Figure 2. *Existing Irrigation Channels and Hydraulic Structures in Tolay Lake Regional Park (WRA 2013).*

2.2 Soils and Geology

According to US Department of Agriculture (USDA) soil mapping (http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm) the majority of Tolay Lake watershed soils consists of clays and clay loams. In general, clay soils are characterized as having low permeability and moderate to high runoff potential.

The valley of the watershed is underlain by Quaternary deposits and the Petaluma Formation composed primarily of silt, clay, with scattered sand or coarse-grained layers (Cardwell 1958; KHE 2003). The hills to the southwest are mainly underlain by Franciscan Formation metamorphic rock and the hills to the northeast are underlain by volcanic rocks; mainly the Sonoma Volcanics but some sources distinguish an older volcanic unit (Donnell Ranch or Tolay Volcanics) along the valley perimeter (Cardwell 1958; KHE 2003). The distribution of these geologic formations follows the northwest-trending regional geologic structure.

3.0 HEC-HMS HYDROLOGIC MODELING

3.1 Background

The assessment of potential hydrologic impacts to Tolay Lake and its infrastructure were undertaken by application of the hydrologic model, HEC-HMS (Scharffenberg and Fleming 2013). Runoff hydrographs resulting from a suite of precipitation events were modeled for existing and proposed conditions such that the relative impacts of the proposed restoration of Tolay Lake and its structures could be assessed.

Tolay Lake is potentially divided into three parts as described here:

1. A causeway crosses Tolay Lake near the midpoint of the lake/wetland and is used as access to the eastern portion of the Park (Figure 2). Drainage from Tolay Creek was at some time conveyed through a 30-inch diameter culvert through the causeway. However, the culvert is now almost completely blocked and provides little conveyance in relation to storm flows contributed to the lake (Figure 3). This was confirmed by field inspection and personal communication with park personnel and is demonstrated in photographs taken during "normal precipitation" years.

2. Downstream from the causeway is a small horseshoe-shaped berm (horseshoe). This feature conveys drainage from the western and eastern contributing watersheds to a point downstream from the horseshoe. Tolay Creek would have been conveyed through the horseshoe via a 42-inch diameter culvert (Figures 2 and 4), but again that culvert is blocked and has insufficient conveyance for significant flows, such as those generated by large precipitation events.

3. Downstream from the horseshoe is a small historic bridge called the "farm bridge" by Park staff. The structure has a relatively small conveyance capacity that is further reduced by a structural member located only about three feet above the channel bed (Figures 2 and 5).

Figure 3. *Largely blocked culvert in Causeway, inlet shown on left, outlet shown on right.*

Figure 4. *Closed gated culvert in horseshoe berm, inlet shown on left, outlet shown on right.*

Figure 5. *Historic farm bridge (view looking upstream)*

3.2. Approach

Modeling watershed runoff through the Tolay Lake system is complicated by the presence of the causeway and the horseshoe. Because the horseshoe does not impound much water and currently has a blocked outlet, it was assumed to not play a significant hydrologic role. The causeway, however, most likely impounds sufficient water to operate as a separate and distinct reservoir from the impoundment resulting from the farm bridge.

Therefore, two scenarios were considered for the existing condition. Under the first scenario it was assumed that the causeway provides a hydraulic control to the portion of the lake upstream from the causeway without backwater from the farm bridge. That is, the upper portion of the lake operates independently from the portion of the lake downstream from the causeway and upstream from the farm bridge. This condition was represented in the HEC-HMS model as two independent reservoirs with the causeway providing the hydraulic control for the upstream portion of Tolay Lake and the farm bridge providing hydraulic control for the lower portion of Tolay Lake. Flows from the upper portion (upstream from the causeway) flow into the lower portion and are routed through the farm bridge (in the model).

However, if backwater or lake elevation resulting from the hydraulic control provided by the farm bridge is sufficient, then overflow of the existing causeway will likely be "drowned" and the lake will behave as a single entity. Therefore, the second scenario was constructed assuming that the hydraulic control for the lake is at the farm bridge with the entire lake providing storage for routing of flows. The control case is the scenario that provides the greatest stage (highest water surface elevation) in the lake (and therefore the maximum extent of flooding from Tolay Lake).

Proposed changes to the Tolay Lake structures under the restoration plan are described in detail elsewhere in this report. In summary, they include:

1) Additional conveyance within the causeway in the form of ten pipe-arch culverts (approximately a five-foot rise and commensurate width),

2) An increase in causeway crest elevation,

3) Elimination of the drainage ditches that currently cross the lake and other ditches that bypass flows to the lake from adjacent watersheds,

4) Reduction/removal of the horseshoe berm,

5) Elimination of drainage ditches from North Creek and Eagle Creek, and

6) Improvements to the farm bridge.

The basic configuration of Tolay Lake under the proposed restoration with hydraulic controls at the causeway and the farm bridge remains unchanged. That is, to determine the worst case scenario, both conditions (one where the causeway splits Tolay Lake into upper and lower reservoirs and the second in which the farm bridge drowns the structures at the causeway) should be considered, parallel to what was done for the existing condition. Therefore, two post-project scenarios for the hydrologic modeling parallel the existing condition scenarios. The first is that the causeway provides a hydraulic control that results in independent operation of the upper and lower portions of Tolay Lake. The second, similar to that for the existing condition, is that the hydraulic control for Tolay Lake is at the farm bridge (with its proposed configuration).

In summary, four conditions were examined in the model:

1) Existing conditions:

   a. The hydraulics of flow over the causeway control operation of the upper portion of Tolay Lake independently from the lower portion of the lake (downstream from the causeway), which is then controlled by the existing farm bridge.

   b. The hydraulics of flow through/over the existing farm bridge control the routing of incoming hydrographs through Tolay Lake.

2) Proposed conditions:

    a. The hydraulics of the proposed changes to the causeway control operation of the upper portion of Tolay Lake independently from the lower portion of the lake (downstream from the causeway), which is controlled by the proposed configuration of the farm bridge. This scenario is a parallel to that of the existing condition, although the hydraulics of the proposed causeway structures are quite different from the existing condition.

    b. The hydraulics of flow through/over the proposed replacement farm bridge control the routing of incoming hydrographs through Tolay Lake. Again, this scenario is parallel to that of the existing condition, subject to the proposed changes to the hydraulics of the new farm bridge.

3.3. Development

There are currently no stream flow gages in the Tolay Creek watershed (Florsheim 2009), thus synthetic hydrology methods were used to construct estimates of runoff hydrographs for the analysis. A variety of technologies are available for such estimates. The approach used for this study are presented in the following paragraphs.

Estimates of watershed runoff hydrographs were developed using the following information:

1) Watershed characteristics (area, length of main channel, slope of main channel),
2) Estimates of rainfall from depth-duration-frequency analysis,
3) Estimates of rainfall temporal distribution through a design hyetograph,
4) Estimates of watershed runoff through a rainfall loss model, and
5) Estimates of watershed response through a characteristic response function (the unit hydrograph).

Watershed characteristics were determined from aerial mapping. The watershed drainage boundaries were hand-drawn using one-foot contours (LiDAR data; WSI 2016). Lengths and slopes of the main channels were measured from these maps. Rainfall depths for the storm durations of interest and appropriate hyetographs were taken from National Oceanic and Atmospheric Agency (NOAA) Atlas 14 (NOAA-14; Perica et al. 2014) for California. The Green-Ampt (1911) loss model was used to convert incoming precipitation to watershed runoff. The Natural Resources Conservation Service (NRCS) dimensionless unit hydrograph method was used to model the conversion of watershed runoff (effective precipitation) to watershed discharge (the runoff hydrograph). These data were combined in the HEC-HMS software for construction of flood hydrograph estimates, which were then used to assess the likely hydrologic impact of the proposed changes to Tolay Lake. Details of the process are provided in subsequent paragraphs.

Based on initial experiments with HEC-HMS, a storm duration of 12-hours was selected. The 12-hour storm provides a balance between maximum rainfall intensity (and therefore peak discharge) and total rainfall depth (and therefore runoff volume loading of reservoir/lake storage during runoff events). Shorter storms tend to emphasize peak discharge at the expense of runoff volume and longer storms tend to emphasize runoff volume (although over a longer time period) over peak discharge.

Rainfall depths for the events of interest for the 12-hour storm duration were obtained from NOAA-14 (http://hdsc.nws.noaa.gov/hdsc/pfds/). The storm depths used for this study were 2.04, 3.31, 4.48, and 5.00 inches for the 2-, 10-, 50-, and 100-year 12-hour storms, respectively. The median second quartile temporal dimensionless rainfall distribution was obtained from NOAA-14. Distributions of storm depth versus storm time for use in HEC-HMS were computed using a spreadsheet.

The Green-Ampt (Green and Ampt 1911) infiltration function was used to convert incoming precipitation into watershed runoff. The process is detailed in the HEC-HMS Technical Reference Manual (USACE 2000). Green-Ampt loss-model parameters were estimated using the Maricopa County method (Maricopa 2013). The Maricopa County method combines soil textural classification for site soils with general Green-Ampt parameter estimates to produce appropriate estimates for site-specific application[1].

Mapping of soil units was obtained from the US Department of Agriculture (through the web soil survey portal at http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm). Geographical Information System (GIS) software was used to intersect watershed boundaries and soil units to produce the required data for parameter estimation. The Maricopa County procedure provides for increases to soil saturated hydraulic conductivity for the presence of vegetation by a multiplicative factor. This was used for the Tolay Lake analysis because site soils generally have reasonable vegetative cover. The Green-Ampt parameter values are presented in ***Table 1***.

Table 1. *Green-Ampt infiltration parameters derived from the Maricopa County hydrologic design manual for Tolay Creek watershed soils*[2].

Watershed	Area (mi²)	Effective Ksat (in/hr)	Suction (in)	Initial Moisture Deficit (in)	Maximum Moisture Deficit (in)
Upper Tolay Creek	1.72	0.058	10.0	0.13	0.23
Lower Tolay Creek	0.31	0.055	10.0	0.12	0.23
Upper North Creek	1.61	0.130	8.0	0.15	0.30
Lower North Creek	0.33	0.068	9.0	0.13	0.23
Eagle Creek	0.61	0.091	9.0	0.15	0.27

[1]*Essentially, the geometric mean saturated hydraulic conductivity is computed using mapping of site soils and soil textural classification from U.S. Department of Agriculture (USDA) mapping. With the site-selected saturated hydraulic conductivity, soil suction and soil moisture parameters are selected using tools in the Maricopa County hydrologic manual.*

[2]*Initial soil moisture deficit and maximum soil moisture deficit are parameters used in the Green-Ampt infiltration model. They represent the starting (beginning of storm) active soil moisture (water in the soil matrix) versus the maximum amount of water the soil matrix can accommodate. As the soil pores fill, then less water can infiltrate and the system moves towards an equilibrium state where the incoming infiltration into the soil is equal to the saturated hydraulic conductivity of the soil. The important point is that these are parameters used in the estimation of runoff from rainfall, which is the quantity that generates runoff hydrographs.*

Main channel length and slope was used to estimate time of concentration for each watershed. Time of concentration is a parameter used to characterize the time-response of a watershed. It is defined as the time a quantity of runoff requires to traverse the watershed from the most hydraulic distant point to the watershed outlet. Shorter response times result in steeper/flashier hydrographs and longer response times result in flatter hydrographs. The time of concentration is used with the NRCS dimensionless unit hydrograph through the lag time, which is 0.6 times the time of concentration.

Based on results from Roussel and others (2005), a combination of the Kirpich (1940) equation with a 30-minute adjustment was used to estimate time of concentration for each watershed. Because of the low-slope condition of the Lower Tolay Creek watershed (0.0009), the adjustment to slope presented by Cleveland and others (2012) was used to obtain the time of concentration. These results are presented in ***Table 2***.

Table 2. *Time of concentration and lag time estimates for Tolay Creek watersheds.*

Watershed	Area (mi^2)	Main Channel Length (ft)	Main Channel Slope	Kirpich (min)	Kirpich +30 (min)	Lag Time (min)
Upper Tolay Creek	1.72	7944	0.011	45	75	45
Lower Tolay Creek	0.31	4200	0.0009	60	90	54
Upper North Creek	1.61	13100	0.047	67	97	58
Lower North Creek	0.33	4610	0.008	33	63	38
Eagle Creek	0.61	9370	0.076	24	54	32

The Natural Resources Conservation Service (NRCS) dimensionless unit hydrograph method was used to model the conversion of watershed runoff (effective precipitation) to watershed discharge (the runoff hydrograph). This procedure uses lag time (derived from time of concentration) and a standard unit hydrograph shape to estimate the unit hydrograph for the watershed of interest. The procedure is included in HEC-HMS.

Estimates of lake storage were obtained using stage-area tables extracted from contour mapping of Tolay Lake. Essentially, the estimate of lake storage is based on the areas of horizontal slices of pond volume bounded by adjacent contour elevations. Areas were estimated using computer software.

Because of the causeway, storage in the upper reservoir below the crest elevation of the causeway is not effective for routing flows through Tolay Lake. That is because the appropriate starting condition for reservoir routing is to assume that the upper reservoir is at capacity at the beginning of the storm event. This is the standard approach used for hydrologic analysis of reservoirs and is conservative. Starting elevation of the upper reservoir (upstream from the causeway) was 217.9 feet, which is the crest elevation of the causeway.

The existing causeway was assumed to act as a broad-crested weir during flood events, given the lack of conveyance through the existing, largely blocked 30-inch culvert. For the proposed condition, the proposed series of pipe-arch culverts were rated using the Federal Highway Administration (FHWA) HY-8 software (http://www.fhwa.dot.gov/engineering/hydraulics/software/hy8/). Estimates of tailwater elevation were constructed from the estimated stage-discharge relation for the farm bridge.

For the post-project condition, starting elevation for the upper reservoir was assumed to be 215feet. This is the target water-surface elevation for the pond to maintain a permanent water surface. This increases the amount of active storage in the upper reservoir used to attenuate incoming runoff hydrographs.

The existing and proposed farm bridge geometries were input into HEC-RAS (Brunner, 2010) for rating the structure[3]. The existing bridge is a non-standard design with a low-member that crosses between structure abutments about three feet above the bridge invert. The gap between the low-member and the low chord of the structure is likely to be ineffective or to be clogged with debris during significant flood events. Therefore, it was assumed that only the lower portion of the structure will be open to convey flows during runoff events.

The invert elevation of the existing farm bridge is 214.4feet. That elevation was used for the existing condition hydrologic analysis. The proposed invert is 215feet (which is also the target water-surface elevation for Tolay Lake) and was used as the starting elevation for the post-project models.

Channel conditions downstream from the farm bridge were extracted from site contours. An initial condition of uniform flow was assumed for the downstream boundary condition flow using the longitudinal slope of the floodplain downstream from the farm bridge. A variety of flows were used to construct the stage-discharge curve for the existing and proposed farm bridge structures. The stage-discharge curve is used in HEC-HMS to compute outflow through the structure.

3.4. Model Validation

Because measured runoff hydrographs to calibrate the hydrologic model are not available, best information is from the U.S. Geological Survey (USGS) suite of regional regression equations. Regional regression equations are relations between *n*-year peak discharge and a set of predictor variables developed by analyzing the flood-frequency curves from stream gages in the region of interest. USGS personnel collect and maintain measurements from numerous stream gaging stations. These data are analyzed by USGS personnel with cooperative funding from interested parties and published in official USGS reports. The most recent set for California are published in Gotvald and others (2012). The HEC-HMS model was operated using the parameters and watershed characteristics previously presented. Results from this model are summarized in ***Table 3*** under "Model" column adjacent to flowrate estimates derived from the regional regression equations ("RRE" column). Uncertainty in the discharge estimates derived from the regional regression equations is quite large – the standard error of estimate for these equations is on the order of 50 percent. Similarly, uncertainty in HEC-HMS modeling is likely quite large, although no statistical estimate of the uncertainty is available. Based on the relative proximity of the estimates displayed in ***Table 3*** and on engineering judgment, the HEC-HMS hydrologic model of Tolay Lake is appropriate for answering questions concerning the impact of proposed changes to the Tolay Lake system. Results from the HEC-HMS model were not further adjusted based on results from the regional regression equations given the standard of error associated with the regional regression equations is such that the HEC-HMS estimates are sufficient for use in this project. Additionally, the water-surface elevations predicted by the existing conditions model (as presented in Section 3.5 below) are consistent with anecdotal data provided by Parks staff, namely the overtopping of the

[3]Although HEC-RAS was used for this project, its use was limited to establish the boundary condition (stage-discharge relation for the farm bridge) for the modeling effort, which was use of HEC-HMS for the computation of watershed runoff hydrographs and routing those hydrographs through Tolay Lake.

causeway and upstream flooding during normal precipitation years and high recurrent, i.e. 2-year, precipitation events.

Table 3. *Results from regional regression equations and HEC-HMS modeling of Tolay Creek watersheds that contribute flows to Tolay Lake.*

		2-year		10-year		50-year		100-year	
Watershed	**Area (mi^2)**	**RRE (cfs)**	**Model (cfs)**	**RRE (cfs)**	**Model (cfs)**	**RRE (cfs)**	**Model (cfs)**	**RRE (cfs)**	**Model (cfs)**
Upper Tolay Creek	1.72	70	132	224	321	387	487	464	557
Lower Tolay Creek	0.31	15	29	50	63	87	92	105	105
Upper North Creek	1.61	66	6.5	211	177	366	342	439	408
Lower North Creek	0.33	16	22	52	60	92	93	111	105
Eagle Creek	0.61	28	21	90	93	157	154	189	178

3.5. Results

Results from modeling runoff hydrographs from the selected events through Tolay Lake for the existing and proposed post-project conditions are presented in ***Table 4***. All four possibilities are included in the table, plus one additional case. The proposed pipe-arch culverts provide substantial conveyance through the causeway, making it possible that more of the storage in the upper reservoir will be available for the post-project condition than for the existing condition. Therefore, the additional case was included wherein the upper and lower reservoir storage was combined for one set of post-project model runs.

For existing conditions, it appears that hydraulic control for Tolay Lake changes between the 2- and 10-year events. That is, the peak stage from the causeway (218.1 feet) is greater than that at the farm bridge (216.6 feet) for the 2-year event, but for rarer larger hydrologic events, the peak stage at the farm bridge exceeds that for the causeway. That means that the hydraulics of the farm bridge controls the behavior of Tolay Lake under existing conditions for most flood events. The best estimate of the 100-year peak stage for Tolay Lake under existing conditions is about 219.9feet (Tolay Lake combined), with the hydraulic control at the farm bridge and the causeway hydraulics drowned by storage in Tolay Lake.

For proposed post-project conditions, conveyance through the proposed causeway pipe-arch culverts is sufficient to convey anticipated flood flows, thus the hydrologic behavior of Tolay Lake is controlled by the hydraulics of the proposed farm bridge. For all events analyzed for this project, post-project peak stages in Tolay Lake are no greater than estimated peak stages for existing conditions. In fact, if the proposed pipe-arch culverts result in greater use of the upper reservoir storage during significant flow events, then it is possible that reduction in peak stages (Tolay Lake PP) during runoff events will result from proposed improvements to Tolay Lake hydraulic structures (at the causeway and the farm bridge).

Table 4. *Estimates of Tolay Lake stage and discharge for existing and post-project conditions.*

		Stage (ft)				Discharge (cfs)			
Reservoir	**Crest (ft)**	**Q2 12Hr QII**	**Q10 12Hr QII**	**Q50 12Hr QII**	**Q100 12Hr QII**	**Q2 12Hr QII**	**Q10 12Hr QII**	**Q50 12Hr QII**	**Q100 12Hr QII**
	Existing Condition -- Independent Upper/Lower Assumption								
Causeway	217.9	218.1	218.3	218.4	218.4	73.8	271	455	530
Farm Bridge	220.0	216.6	219.9	221.1	221.3	58.1	221	672	941
	Existing Condition -- Hydraulic Control at Farm Bridge Assumption								
Tolay Lake (Combined)	220.0	217.5	219.1	219.9	220.2	84.9	166	222	333
	Proposed Condition -- Independent Upper/Lower Assumption								
Proposed Causeway	222.0	215.6	216.9	218.1	218.6	33.2	114	199	227
Proposed Farm Bridge	220.0	216.1	218.5	219.4	219.8	37.3	123	204	241
	Proposed Condition -- Hydraulic Control at Farm Bridge Assumption								
Tolay Lake PP (Alt Storage)	220.0	215.8	217.4	218.6	219.1	24.3	75	140	177
Tolay Lake PP (FB)	220.0	217.6	219.1	219.8	220.2	82.6	176	252	351

In addition, the hydraulics of the farm bridge are impacted by channel conditions downstream from the farm bridge. As part of the review associated with developing the stage-discharge curve for the farm bridge, it was observed that channel conditions immediately downstream from the existing farm bridge to a point approximately 1,000 feet downstream from the structure were modified from natural conditions. That is, stream properties farther downstream appear to be substantially different (wider and deeper) than those adjacent to the existing farm bridge. Therefore, it appears that the floodplain was modified sometime before collection of current aerial photography.

It appears, therefore, that an additional opportunity for riparian restoration is available for the reach of Tolay Creek downstream from the farm bridge approximately 1,000 feet. Such restoration could improve conveyance through the proposed farm bridge and potentially improve runoff outflows through the proposed structure with the result that flood hydrographs would pass through the system more readily.

4.0 SUMMARY AND CONCLUSIONS

A hydrologic model (HEC-HMS) of Tolay Lake and its contributing watersheds was constructed for evaluating proposed changes to Tolay Lake. A suite of 12-hour storms were selected for evaluating the proposed changes with annual return periods of 1-, 10-, 50-, and 100-years. Storm depths and temporal distributions were taken from NOAA data. The procedure documented in the Maricopa County Hydrology Manual was used to estimate parameters for the Green-Ampt infiltration function for use in HEC-HMS to convert incoming precipitation to watershed runoff. The NRCS dimensionless unit hydrograph was the selected procedure for converting watershed runoff to runoff hydrographs. The level-pool reservoir routing method (modified Puls) was selected for routing incoming hydrographs through Tolay Lake. Data and assumptions to support the modeling effort were extracted from a combination of sources documented in the paragraphs above.

Based on results from application of the hydrologic model, the following findings are offered:

1) Model peak discharges compare reasonably well with discharge estimates from regional

regression equations, which means model results are useful for making assessments of existing conditions and potential changes if proposed improvements to Tolay Lake and its structures are constructed.

2) With exception of the 2-year event, the farm bridge is the hydraulic control for runoff events under the existing condition. That is, the hydraulics of the farm bridge and the channel downstream from the farm bridge control flow through Tolay Lake.

3) For the 2-year event, it is likely that the upper and lower portions of Tolay Lake (separated by the causeway) function as two separate reservoirs under existing conditions. This has little impact on subsequent analyses of potential impacts of proposed changes.

4) Peak stages in Tolay Lake under existing conditions for the hydrologic events analyzed are between 218 and 220 feet. These events result in impoundment of water in the reach upstream from the project boundary under existing conditions.

5) For proposed post-project conditions, the worst-case assumption is that backwater from the farm bridge results in some loss of effective storage in the upper reservoir. Based on results from hydrologic modeling of Tolay Lake, peak stages in the lake for the hydrologic events analyzed are no greater than commensurate peak stages for the existing condition. Therefore, proposed changes to the lake and its structures should result in no significant impact from relatively rare hydrologic events.

6) Because of the increased conveyance of the proposed addition of ten pipe-arch culverts to the causeway with invert elevations of 215 feet, it is possible that more of the storage in the upper reservoir will be available for all hydrologic events than in either the existing condition or in the conservative post-project condition. If this is the case, then it is possible that peak stages from relatively rare hydrologic events for the post-project condition will be less than commensurate peak stages for the existing condition, resulting in improved conditions during flood events.

7) Finally, additional improvements to Tolay Lake operation during flood events are possible if the Tolay Creek channel downstream from the farm bridge is restored to conditions approximating those farther downstream from the project area. Those downstream conditions appear to be more representative of Tolay Creek. It appears that channel/floodplain modifications occurred sometime prior to this study.

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ATTACHMENT A
MODEL INPUT DATA AND PHOTOGRAPHS

Tolay Lake Restoration Project

CONTENTS

1. Regression Equations and Inputs

Table 1. Regression Equations

	Equation[1]
Area (sq. mi.)	
Q2 (cfs)	$1.82A^{0.904}P^{0.983}$
Q10 (cfs)	$14.8A^{0.880}P^{0.696}$
Q25 (cfs)	$26.0A^{0.874}P^{0.628}$
Q50 (cfs)	$36.3A^{0.870}P^{0.589}$
Q100 (cfs)	$48.5A^{0.866}P^{0.556}$

[1]Regression equations from Gatval et al (2012) for the North Coast region, where A = Drainage Area (sq. mi. as listed in Table 3 of the Technical Report main body) and P = Mean Annual Precipitation (25 inches). P = 25 inches was selected based on the following considerations. There are no precipitation data from within the Tolay Creek watershed (Florsheim 2009). The mean annual precipitation used for this computation was 25 inches, which was the value at roughly the watershed centroid on the isohyetal map developed by Sonoma County Water Agency (http://www.sonoma-county.org/prmd/docs/landscape_ ord/rainfall_ map.pdf). Furthermore, this mean annual precipitation value is consistent with the following data. At Petaluma Fire Station 3 (046826), average annual precipitation between 1893 and 2007 was about 25 inches, whereas, a shorter record from Mare Island (045333) between 1961 and 1975 reports a somewhat lower average annual precipitation of about 20 inches (Desert Research Institute Regional Climate Summaries; http://www.wrcc.dri.edu/Climsum.html). A long record from the City of Sonoma between 1899 to 1907 and 1931 to 1997 reports an annual average of 29.2 inches (see Figure 4 in McKee et al. 2000). Thus, it can be concluded that the average annual precipitation in the Tolay watershed is 20-30 inches and 25 inches is a suitable estimate.

2. Hydraulic Structures and Channels Photographs

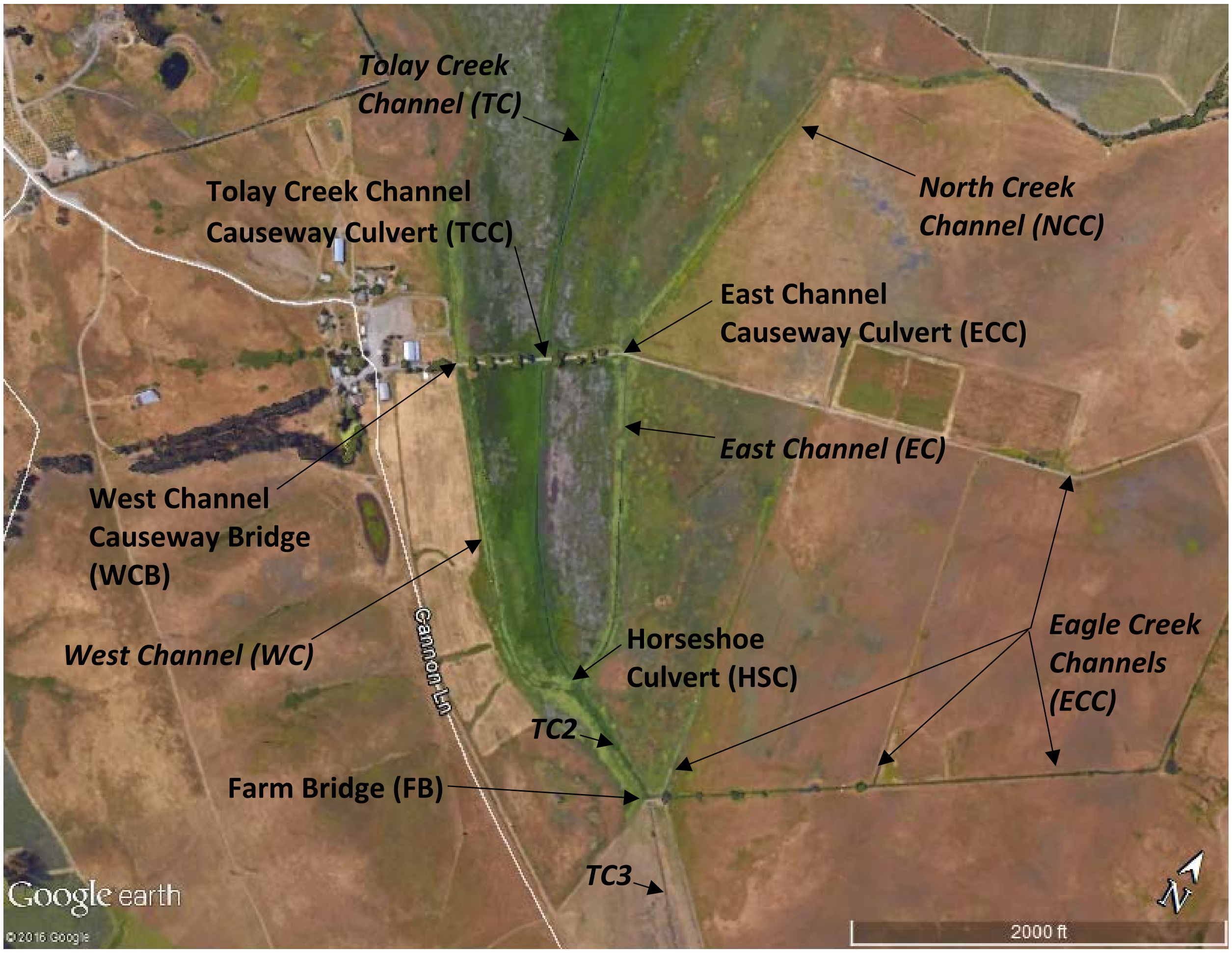


Figure 1. Hydraulic structures and channels and nomenclature used for modeling (channels in italics).

Figure 2. West Channel Causeway Culvert inlet.

Figure 3. West Channel Causeway Bridge.

Figure 4. West Channel downstream of Causeway (viewed from Causeway).

Figure 5. Tolay Creek Channel (TC) downstream of Causeway (looking upstream from the Horseshoe).

Figure 6. East Channel Causeway Culvert inlet.

Figure 7. East Channel Causeway Culvert outlet.

Figure 8. East Channel downstream of Causeway.

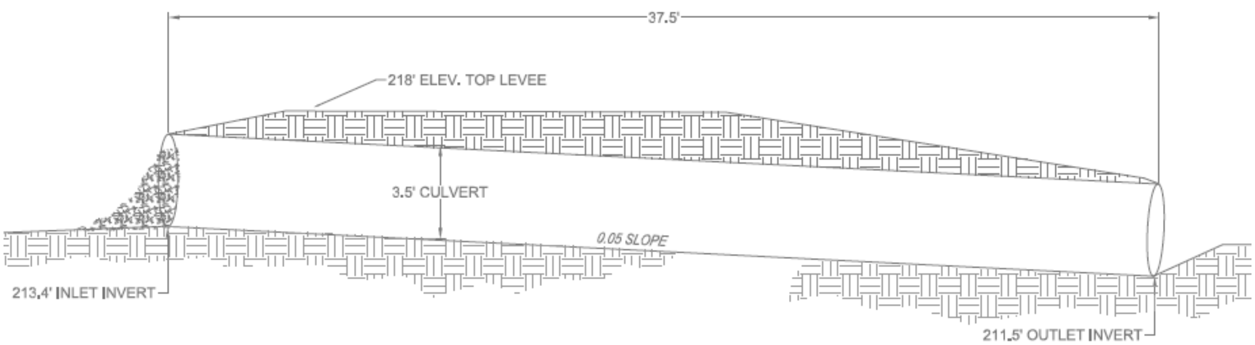


Figure 9. Horseshoe Culvert approximate profile.

Figure 10. Tolay Creek Channel (TC2) downstream of Horseshoe (looking upstream from Farm Bridge).

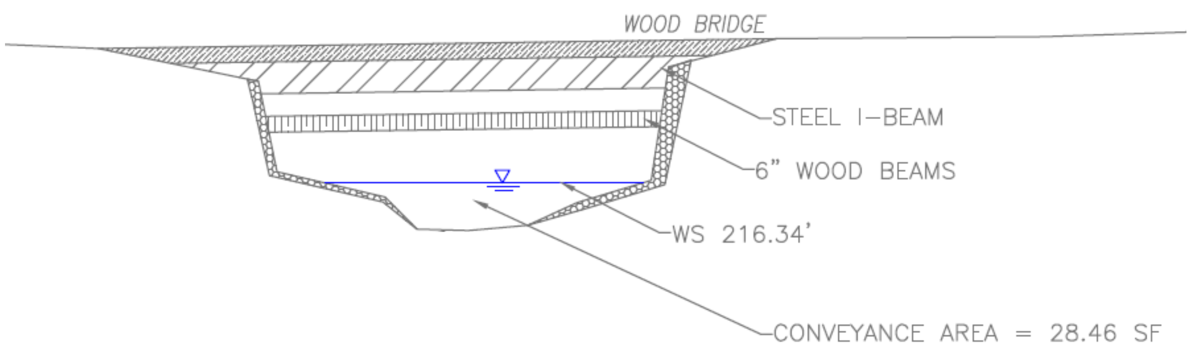


Figure 11. Farm bridge cross-section looking downstream (bottom of wood beams approximately 3 feet above thalweg; bottom of wood beams approximately 4 feet above thalweg).

Figure 12. Tolay Creek looking downstream from the Farm Bridge.

Figure 13. Confluence of Tolay Creek (from the left) and Eagle Creek (from the right) as seen from the Farm Bridge.

3. Stage Areas

Table 2: Stage Areas.

Pond/Stage	Upper Pond[1]	Lower Pond[1]	Total[2]
Stage 213ft: Area (acres)	19.8	0	19.8 (lake bottom)
Stage 214ft: Area (acres)	51.1	0	51.1
Stage 215ft: Area (acres)	75.1	0	75.1
Stage 216ft: Area (acres)	88.8	9.9	98.7
Stage 217ft: Area (acres)	104.7	24.6	129.3
Stage 218ft: Area (acres)	131.3	40.4	171.7
Stage 219ft: Area (acres)	171.0	67.6	238.6

[1]Upper Pond defined as Tolay Lake upstream of Causeway, Lower Pond defined as Tolay Lake downstream of Causeway and upstream of Farm Bridge. [2]Total stage area from WRA (2013), see Figure 24 below.

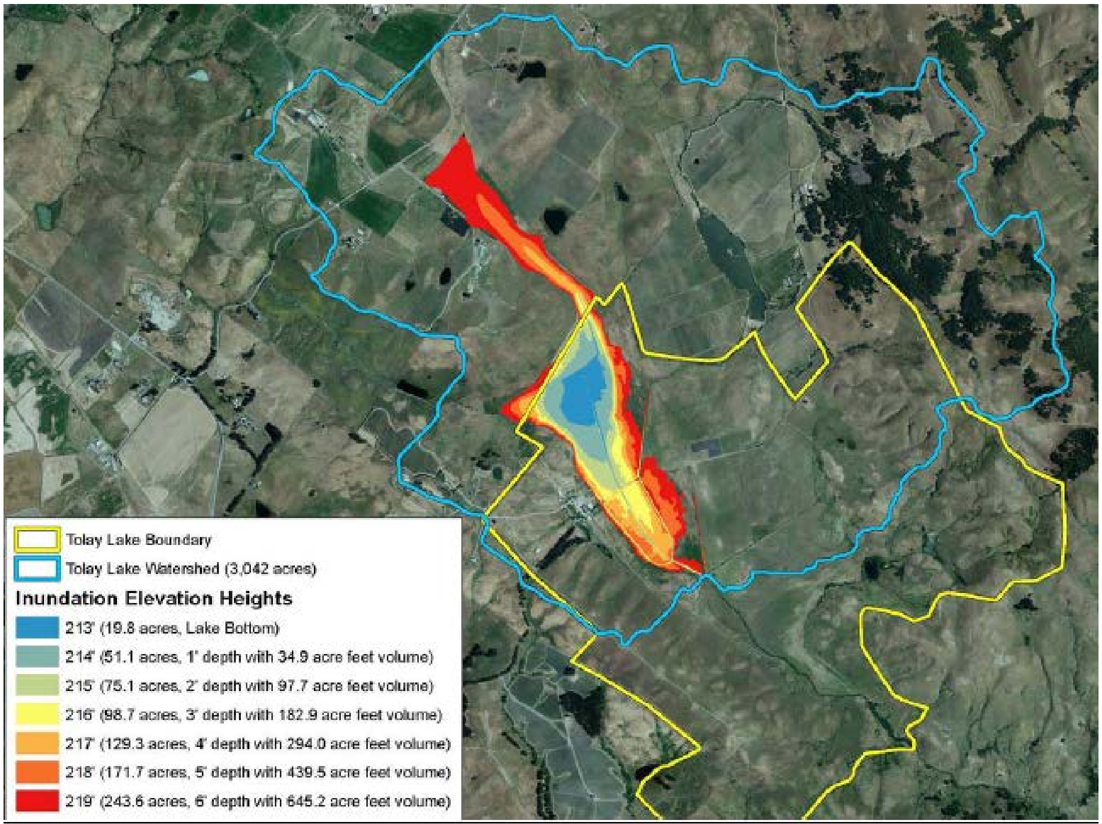


Figure 14. Stage areas from WRA (2013).

4. Proposed Conditions

The preferred restoration alternative, from WRA (2013), is illustrated in Figures 15-17 below.

Restoration Actions to Restore Original Hydrology within Lake:

1. Fill Central Lakebed Channel B (Tolay Creek Channel)
2. Fill Central Lakebed Channel A (Tolay Creek Channel)
3. Fill Drainage Channel 2 (West Channel)

Restoration Actions to Restore Wet Meadow:

4. Remove North Creek Drainage Channels and Culvert
5. Remove Eagle Creek Drainage Channel
6. Fill East-West Drainage Channel (Eagle Creek Channel)
7. Fill Pumpkin Patch Drainage Channels A and B
8. Fill Drainage Channel 1 (Eagle Creek Channel)

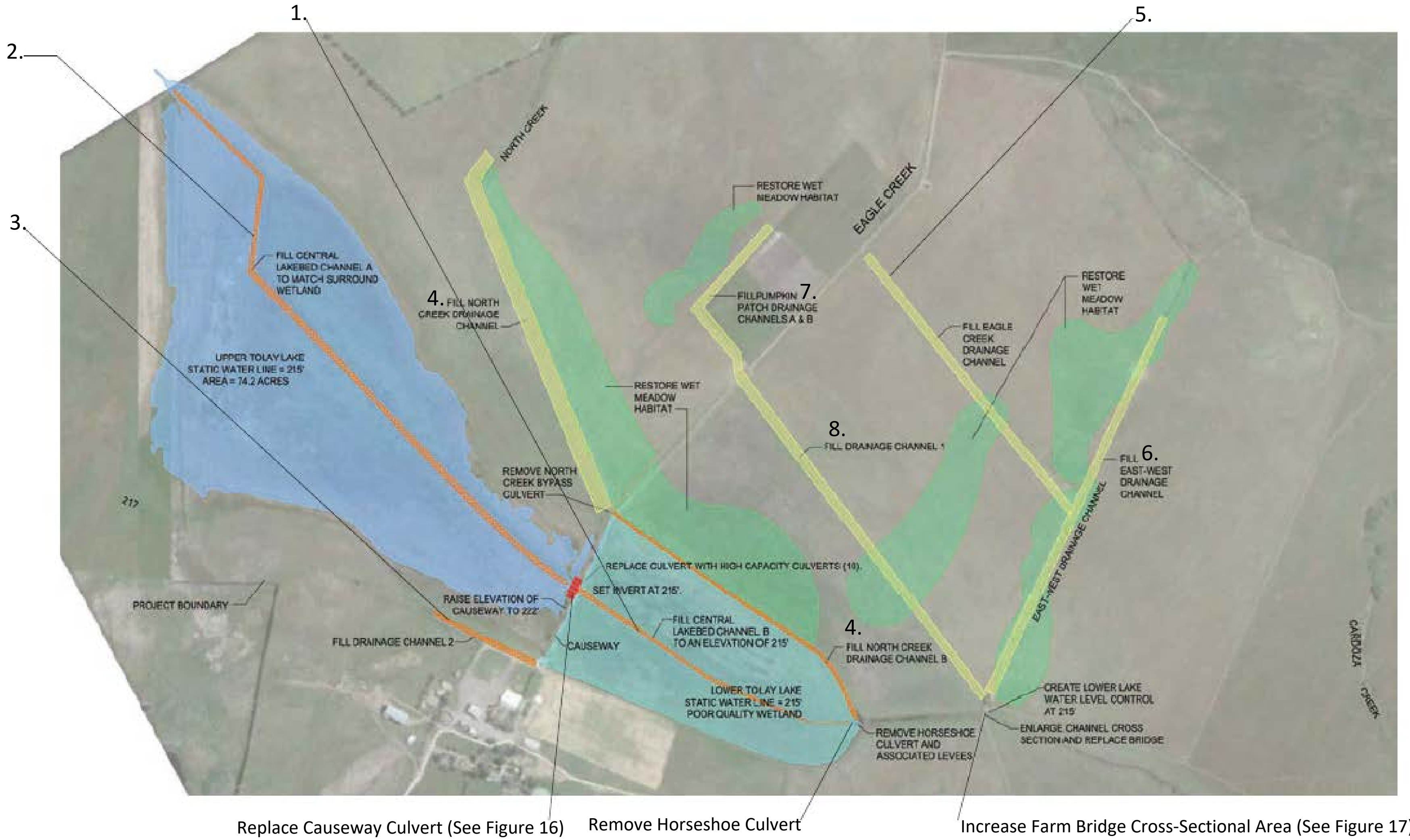
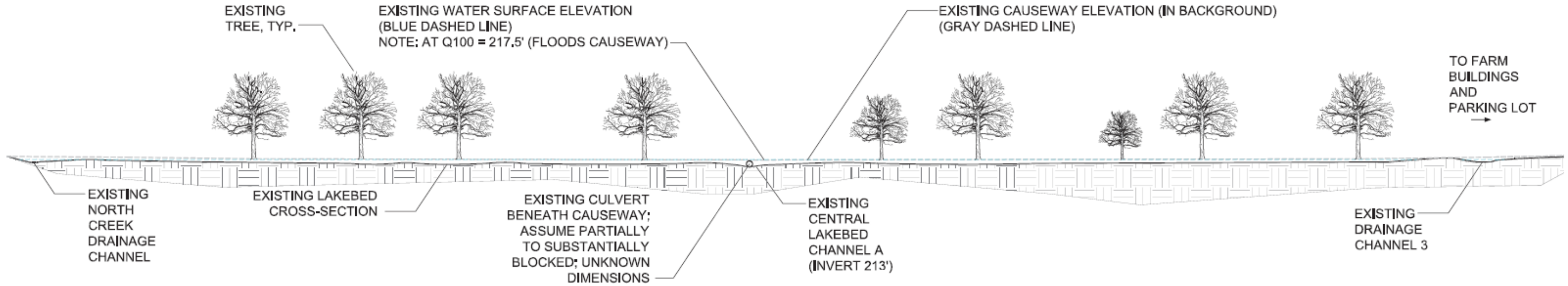
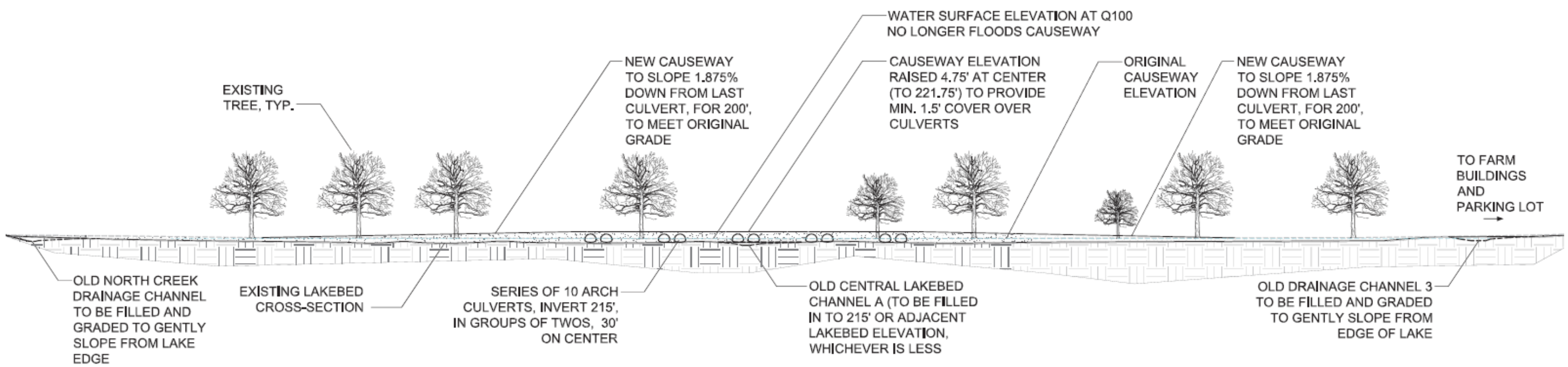


Figure 15. Preferred Restoration Alternative (WRA 2013).

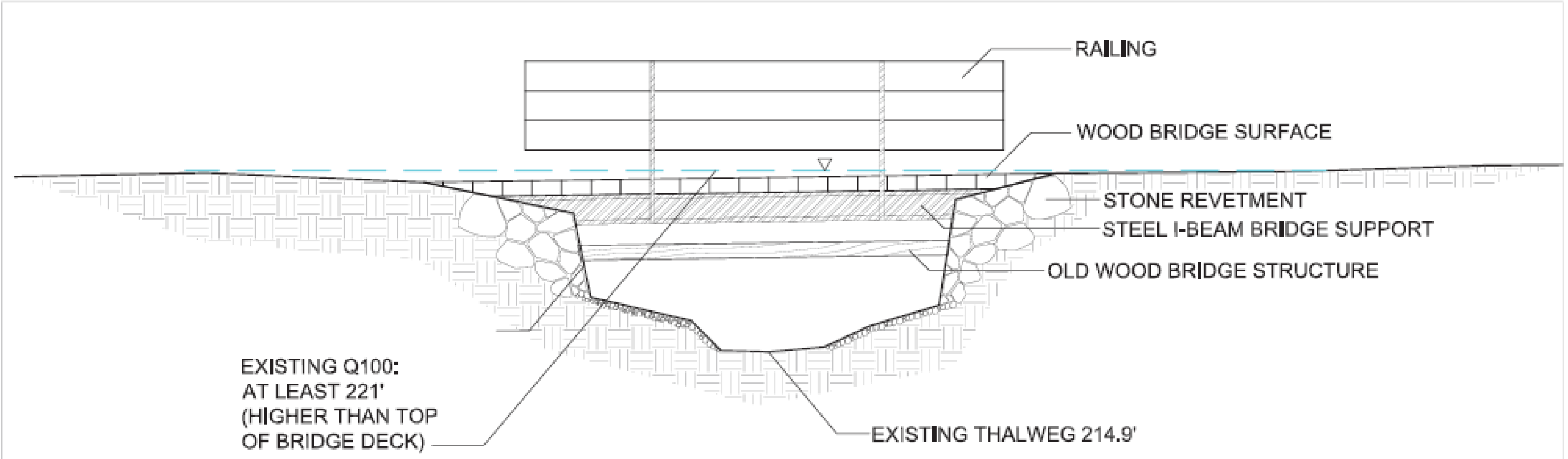


EXISTING CAUSEWAY CROSS SECTION & ELEVATION
SCALE: 1" = 60'



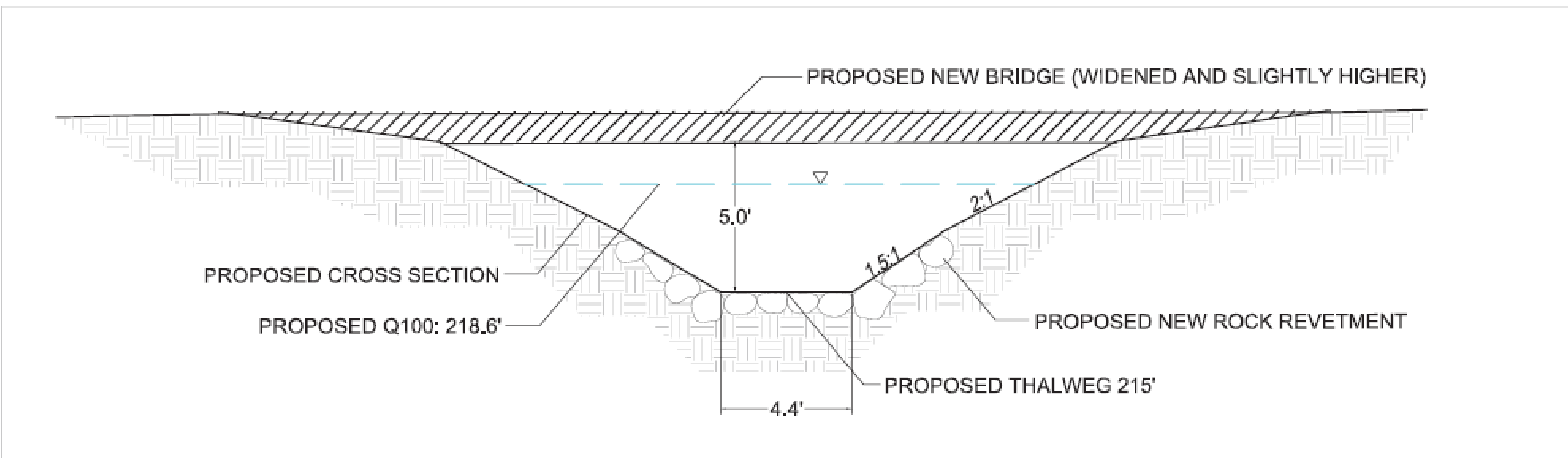
PROPOSED CAUSEWAY CROSS SECTION & ELEVATION
SCALE: 1" = 60'

Figure 16. Proposed Tolay Creek Channel Causeway Culvert improvements.



EXISTING FARM BRIDGE CROSS SECTION

SCALE: 1" = 5'



PROPOSED FARM BRIDGE CROSS SECTION - FOR ALTERNATIVE 1

SCALE: 1" = 5'

Figure 17. Proposed Farm Bridge improvements.

5. Additional Information

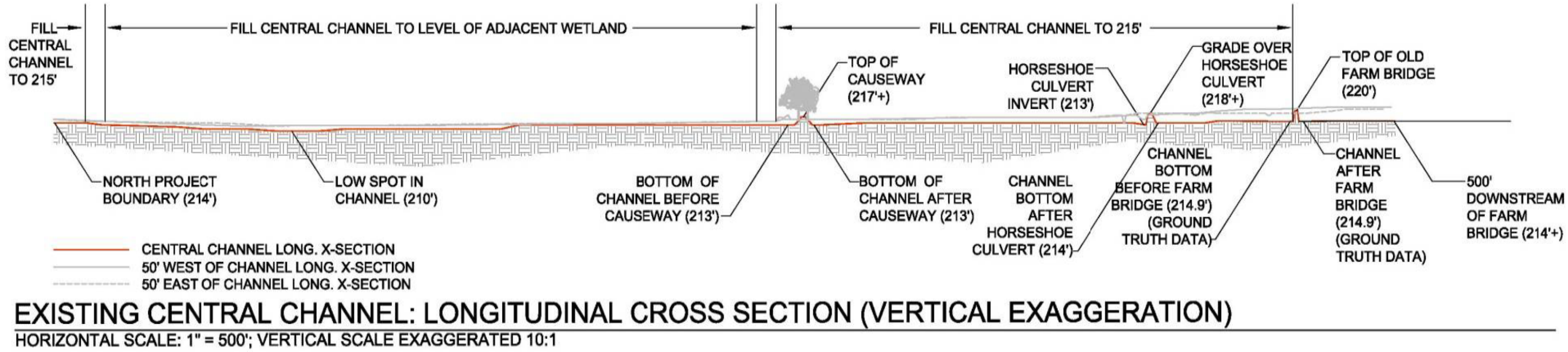


Figure 18. Central Channel longitudinal cross-section from WRA (2013).

Appendix G

Traffic Modeling Sheets

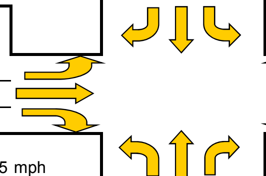
DISCLAIMER: Due to the nature and length of this appendix, this document is not available as an accessible document. If you need assistance accessing the contents of this document, please contact Victoria Willard, ADA Coordinator for Sonoma County, at (707) 565-2331, or through the California Relay Service by dialing 711. For an explanation of the contents of this document, please direct inquiries to Karen Davis-Brown, Park Planner II, Sonoma County Regional Parks Department at (707) 565-2041.

Turn Lane Warrant Analysis - 4 Legged Intersections

Study Intersection: SR 121/Phase B Project Access
Study Scenario: Weekday PM Future 2040 plus Phase B

Direction of Analysis Street: North/South

Phase B Project Access



Ram's Gate Winery

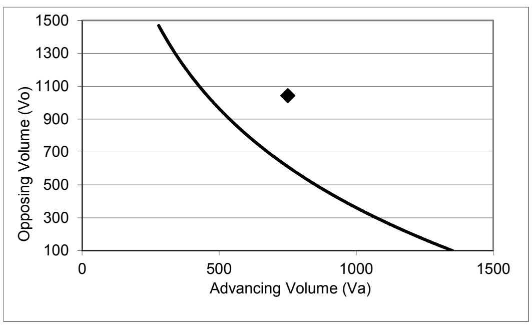
SR 121 Northbound Volumes (veh/hr)		**SR 121** Southbound Volumes (veh/hr)	
Left Turn Volume =	2	6	= Right Turn Volume
Through Volume =	730	1042	= Through Volume
Right Turn Volume =	18	0	= Left Turn Volume

Northbound Speed Limit:	55 mph	Southbound Speed Limit:	55 mph
Northbound Configuration:	2 Lanes Undivided	Southbound Configuration:	2 Lanes Undivided

Northbound Left Turn Lane Warrants

Percentage Left Turns %lt	0.3 %
Advancing Volume Threshold AV	457 veh/hr

If AV<Va then warrant is met



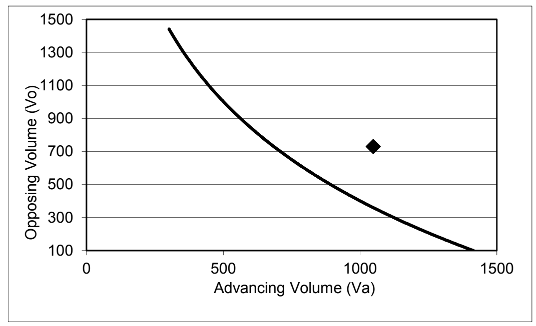
◆ Study Intersection
——— Two lane roadway warrant threshold for: 55 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: YES

Southbound Left Turn Lane Warrants

Percentage Left Turns %lt	0.0 %
Advancing Volume Threshold AV	685 veh/hr

If AV<Va then warrant is met



◆ Study Intersection
——— Two lane roadway warrant threshold for: 55 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: YES

Note: If one direction has a left turn lane warranted, a left turn lane should be installed on the other side as well

Northbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV =	-
Advancing Volume Va =	750
If AV<Va then warrant is met	-

Right Turn Lane Warranted: NO

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV =	-
Advancing Volume Va =	1048
If AV<Va then warrant is met	-

Right Turn Lane Warranted: NO

Northbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 40 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV =	733.3
Advancing Volume Va =	750
If AV<Va then warrant is met	Yes

Right Turn Taper Warranted: YES

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV =	-
Advancing Volume Va =	1048
If AV<Va then warrant is met	-

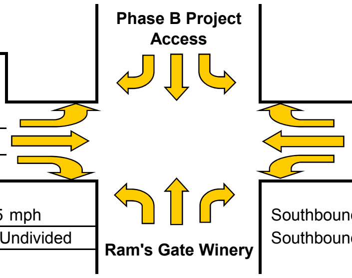
Right Turn Taper Warranted: NO

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements* , Jan. 1997. The right turn lane and taper analysis is based on work conducted by Cottrell in 1981. The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - 4 Legged Intersections

Study Intersection: SR 121/Phase B Project Access
Study Scenario: Weekend Midday Future 2040 plus Phase B

Direction of Analysis Street: North/South



SR 121
Northbound Volumes (veh/hr)

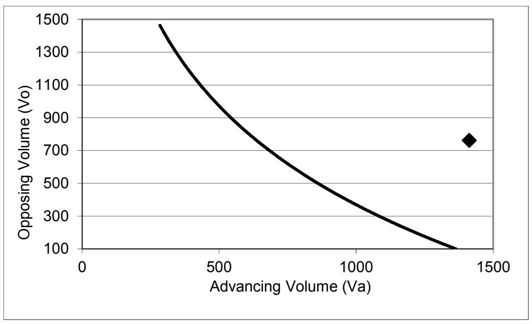
Left Turn Volume =	3
Through Volume =	1391
Right Turn Volume =	18
Northbound Speed Limit:	55 mph
Northbound Configuration:	2 Lanes Undivided

SR 121
Southbound Volumes (veh/hr)

10	= Right Turn Volume
762	= Through Volume
8	= Left Turn Volume
Southbound Speed Limit:	55 mph
Southbound Configuration:	2 Lanes Undivided

Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 0.2 %
Advancing Volume Threshold AV 637 veh/hr
If AV<Va then warrant is met

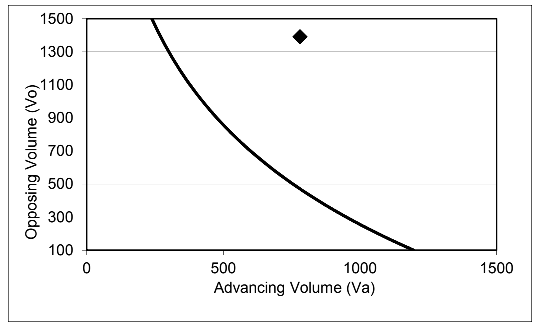


◆ Study Intersection
——— Two lane roadway warrant threshold for: 55 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: **YES**

Southbound Left Turn Lane Warrants

Percentage Left Turns %lt 1.0 %
Advancing Volume Threshold AV 271 veh/hr
If AV<Va then warrant is met



◆ Study Intersection
——— Two lane roadway warrant threshold for: 55 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: **YES**

Note: If one direction has a left turn lane warranted, a left turn lane should be installed on the other side as well

Northbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV =	-
Advancing Volume Va =	1412
If AV<Va then warrant is met	-

Right Turn Lane Warranted: **NO**

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold: AV =	-
Advancing Volume Va =	780
If AV<Va then warrant is met	-

Right Turn Lane Warranted: **NO**

Northbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 40 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV =	733.3
Advancing Volume Va =	1412
If AV<Va then warrant is met	Yes

Right Turn Taper Warranted: **YES**

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

Advancing Volume Threshold AV =	-
Advancing Volume Va =	780
If AV<Va then warrant is met	-

Right Turn Taper Warranted: **NO**

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, Jan. 1997. The right turn lane and taper analysis is based on work conducted by Cottrell in 1981. The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Turn Lane Warrant Analysis - 4 Legged Intersections

Study Intersection: SR 121/Phase B Project Access
Study Scenario: Weekend Midday Future 2040 plus Fall Festival

Direction of Analysis Street: North/South

Phase B Project Access

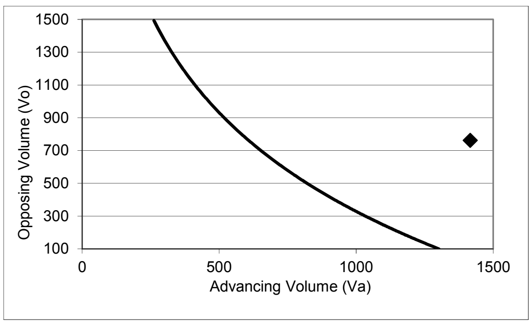
SR 121 Northbound Volumes (veh/hr)			**SR 121** Southbound Volumes (veh/hr)
Left Turn Volume =	7	21	= Right Turn Volume
Through Volume =	1391	762	= Through Volume
Right Turn Volume =	18	8	= Left Turn Volume

Northbound Speed Limit:	55 mph	Southbound Speed Limit:	55 mph
Northbound Configuration:	2 Lanes Undivided	Southbound Configuration:	2 Lanes Undivided

Ram's Gate Winery

Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 0.5 %
Advancing Volume Threshold AV 608 veh/hr
If AV<Va then warrant is met

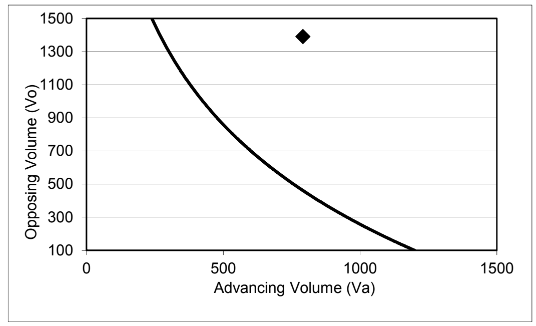


◆ Study Intersection
——— Two lane roadway warrant threshold for: 55 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: YES

Southbound Left Turn Lane Warrants

Percentage Left Turns %lt 1.0 %
Advancing Volume Threshold AV 271 veh/hr
If AV<Va then warrant is met



◆ Study Intersection
——— Two lane roadway warrant threshold for: 55 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: YES

<u>Note:</u> If one direction has a left turn lane warranted, a left turn lane should be installed on the other side as well

Northbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane
   Advancing Volume Threshold: AV = -
   Advancing Volume Va = 1416
   If AV<Va then warrant is met -

Right Turn Lane Warranted: NO

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

NOT WARRANTED Less than 40 vehicles

2. Check advance volume threshold criteria for turn lane
   Advancing Volume Threshold: AV = -
   Advancing Volume Va = 791
   If AV<Va then warrant is met -

Right Turn Lane Warranted: NO

Northbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 40 vehicles

2. Check advance volume threshold criteria for taper
   Advancing Volume Threshold AV = 733.3
   Advancing Volume Va = 1416
   If AV<Va then warrant is met Yes

Right Turn Taper Warranted: YES

Southbound Right Turn Taper Warrants

(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for taper
   Advancing Volume Threshold AV = 490
   Advancing Volume Va = 791
   If AV<Va then warrant is met Yes

Right Turn Taper Warranted: YES

Methodology based on Washington State Transportation Center Research Report *Method For Prioritizing Intersection Improvements*, Jan. 1997.
The right turn lane and taper analysis is based on work conducted by Cottrell in 1981. The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

Warrant 3: Peak-Hour Volumes and Delay

Sonoma County
Lakeville Highway & Stage Gulch Rd

SOX568

	Major Street	Minor Street
Street Name	Lakeville Highway	Stage Gulch Rd
Direction	N-S	E-W
Number of Lanes	2	1
Approach Speed	55	30

Population less than 10,000? No
Date of Count: Tuesday, August 23, 2016
Scenario: PM Existing

Warrant 3 Met?: Met when either Condition A or B is met — **Yes**

Condition A: Met when conditions A1, A2, and A3 are met — Not Met

Condition A1 — Not Met

The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach

Minor Approach Delay: 1.82 vehicle-hours

Condition A2 — Not Met

The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes

Minor Approach Volume: 83 vph

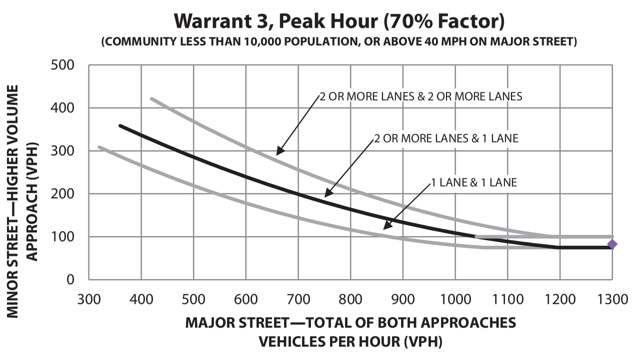
Condition A3 — Met

The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more apprachesor 650 vph for intersections with three approaches

Total Entering Volume: 1982 vph

Condition B — Met

The plotted point falls above the curve



Warrant 3: Peak-Hour Volumes and Delay

Sonoma County
Lakeville Highway & Stage Gulch Rd

SOX568

	Major Street	Minor Street
Street Name	Lakeville Highway	Stage Gulch Rd
Direction	N-S	E-W
Number of Lanes	2	1
Approach Speed	55	30

Population less than 10,000? No
Date of Count: Saturday, August 06, 2016
Scenario: Midday Weekend Existing

Warrant 3 Met?: Met when either Condition A or B is met — **Yes**

Condition A: Met when conditions A1, A2, and A3 are met — Not Met

Condition A1 — Not Met

The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach

Minor Approach Delay: 1.41 vehicle-hours

Condition A2 — Not Met

The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes

Minor Approach Volume: 79 vph

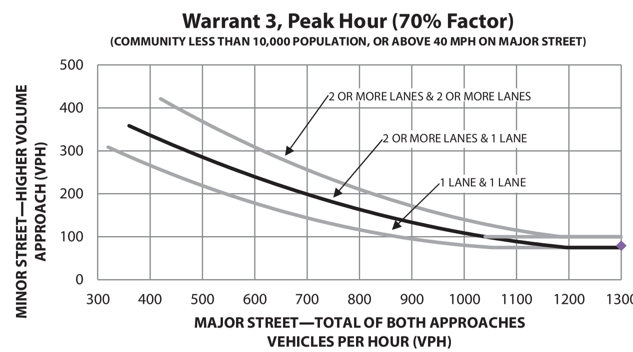
Condition A3 — Met

The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more apprachesor 650 vph for intersections with three approaches

Total Entering Volume: 2115 vph

Condition B — Met

The plotted point falls above the curve



Warrant 3: Peak-Hour Volumes and Delay

Sonoma County
Lakeville Highway & Cannon Lane

SOX568

	Major Street	Minor Street
Street Name	Lakeville Highway	Cannon Lane
Direction	N-S	E-W
Number of Lanes	2	1
Approach Speed	55	25

Population less than 10,000? No
Date of Count: Tuesday, August 23, 2016
Scenario: PM Future 2040

Warrant 3 Met?: Met when either Condition A or B is met — **No**

Condition A: Met when conditions A1, A2, and A3 are met — Not Met

Condition A1 — Not Met

The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach

Minor Approach Delay: 0.22 vehicle-hours

Condition A2 — Not Met

The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes

Minor Approach Volume: 19 vph

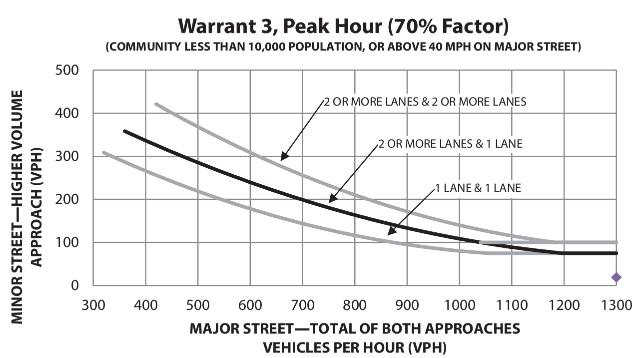
Condition A3 — Met

The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more appraches or 650 vph for intersections with three approaches

Total Entering Volume: 2776 vph

Condition B — Not Met

The plotted point falls above the curve



Warrant 3: Peak-Hour Volumes and Delay

Sonoma County
Lakeville Highway & Cannon Lane

SOX568

	Major Street	Minor Street
Street Name	Lakeville Highway	Cannon Lane
Direction	N-S	E-W
Number of Lanes	2	1
Approach Speed	55	25

Population less than 10,000? No
Date of Count: Tuesday, August 23, 2016
Scenario: PM Future 2040 plus Phase B

Warrant 3 Met?: Met when either Condition A or B is met — **No**

Condition A: Met when conditions A1, A2, and A3 are met — Not Met

Condition A1 — Not Met

The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach

Minor Approach Delay: 0.78 vehicle-hours

Condition A2 — Not Met

The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes

Minor Approach Volume: 40 vph

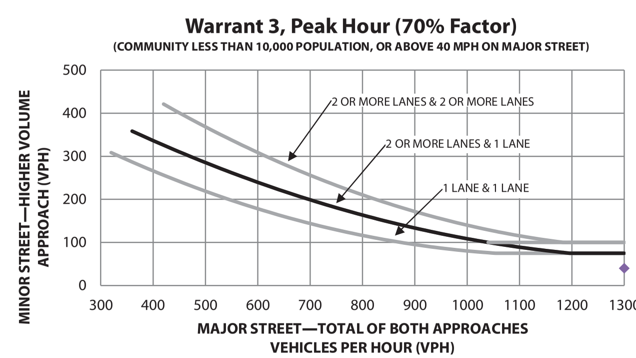
Condition A3 — Met

The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more appraches or 650 vph for intersections with three approaches

Total Entering Volume: 2830 vph

Condition B — Not Met

The plotted point falls above the curve



Warrant 3: Peak-Hour Volumes and Delay

Sonoma County
Lakeville Highway & Cannon Lane

SOX568

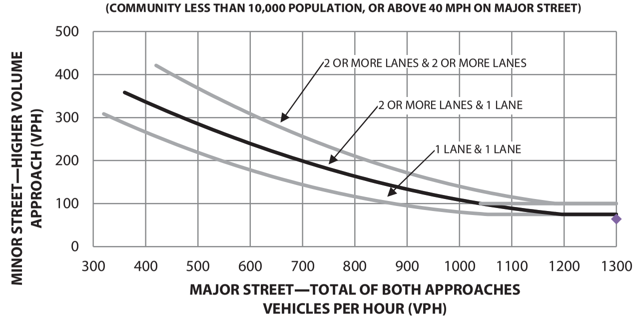
	Major Street	Minor Street
Street Name	Lakeville Highway	Cannon Lane
Direction	N-S	E-W
Number of Lanes	2	1
Approach Speed	55	25

Population less than 10,000? No
Date of Count: Saturday, August 06, 2016
Scenario: Midday Weekend Future 2040 Plus Phase B

Warrant 3 Met?: Met when either Condition A or B is met	**No**
Condition A: Met when conditions A1, A2, and A3 are met	Not Met
Condition A1	Not Met
The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach	
Minor Approach Delay: 3.21 vehicle-hours	
Condition A2	Not Met
The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes	
Minor Approach Volume: 64 vph	
Condition A3	Met
The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more appraches or 650 vph for intersections with three approaches	
Total Entering Volume: 2940 vph	
Condition B	Not Met
The plotted point falls above the curve	

Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION, OR ABOVE 40 MPH ON MAJOR STREET)



Warrant 3: Peak-Hour Volumes and Delay

Sonoma County
Lakeville Highway & Cannon Lane

SOX568

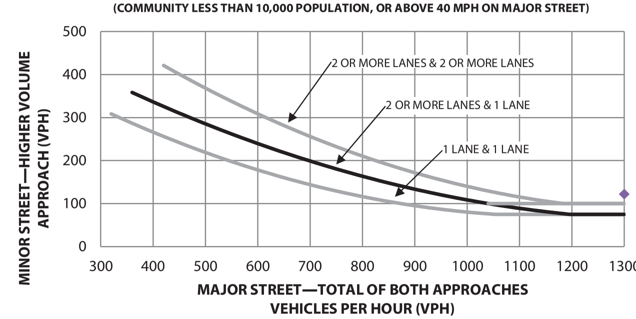
	Major Street	Minor Street
Street Name	Lakeville Highway	Cannon Lane
Direction	N-S	E-W
Number of Lanes	2	1
Approach Speed	55	25

Population less than 10,000? No
Date of Count: Saturday, August 06, 2016
Scenario: Midday Weekend Future 2040 Plus Special Event

Warrant 3 Met?: Met when either Condition A or B is met	**Yes**
Condition A: Met when conditions A1, A2, and A3 are met	Met
Condition A1	Met
The total delay experienced by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one lane approach, or five vehicle-hours for a two-lane approach	
Minor Approach Delay: 15.33 vehicle-hours	
Condition A2	Met
The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic of 150 vph for two moving lanes	
Minor Approach Volume: 122 vph	
Condition A3	Met
The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more appraches or 650 vph for intersections with three approaches	
Total Entering Volume: 3056 vph	
Condition B	Met
The plotted point falls above the curve	

Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION, OR ABOVE 40 MPH ON MAJOR STREET)



Intersection						
Int Delay, s/veh	5.1					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↱		↰	↑
Traffic Vol, veh/h	18	65	1074	257	187	381
Future Vol, veh/h	18	65	1074	257	187	381
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	7	5	2	4	9
Mvmt Flow	20	71	1167	279	203	414

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2128	1307	0	0	1447	0
Stage 1	1307	-	-	-	-	-
Stage 2	821	-	-	-	-	-
Critical Hdwy	6.4	6.27	-	-	4.14	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.363	-	-	2.236	-
Pot Cap-1 Maneuver	55	190	-	-	462	-
Stage 1	256	-	-	-	-	-
Stage 2	436	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	31	190	-	-	462	-
Mov Cap-2 Maneuver	31	-	-	-	-	-
Stage 1	256	-	-	-	-	-
Stage 2	244	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	78.8	0	6.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	31	190	462	-
HCM Lane V/C Ratio	-	-	0.631	0.372	0.44	-
HCM Control Delay (s)	-	-	237.8	34.8	18.8	-
HCM Lane LOS	-	-	F	D	C	-
HCM 95th %tile Q(veh)	-	-	2.1	1.6	2.2	-

Intersection						
Int Delay, s/veh	3.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↱		↰	↑
Traffic Vol, veh/h	17	62	1171	147	125	593
Future Vol, veh/h	17	62	1171	147	125	593
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	18	65	1233	155	132	624

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2197	1310	0	0	1387	0
Stage 1	1310	-	-	-	-	-
Stage 2	887	-	-	-	-	-
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	49	194	-	-	494	-
Stage 1	252	-	-	-	-	-
Stage 2	402	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	36	194	-	-	494	-
Mov Cap-2 Maneuver	36	-	-	-	-	-
Stage 1	252	-	-	-	-	-
Stage 2	295	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	64.3	0	2.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	36	194	494	-
HCM Lane V/C Ratio	-	-	0.497	0.336	0.266	-
HCM Control Delay (s)	-	-	179.4	32.7	14.9	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	1.7	1.4	1.1	-

Intersection						
Int Delay, s/veh	0.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↱		↰	↑
Traffic Vol, veh/h	0	16	1304	2	3	395
Future Vol, veh/h	0	16	1304	2	3	395
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	0	4	0	0	10
Mvmt Flow	0	18	1449	2	3	439

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1896	1450	0	0	1451	0
Stage 1	1450	-	-	-	-	-
Stage 2	446	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	77	162	-	-	473	-
Stage 1	218	-	-	-	-	-
Stage 2	649	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	77	162	-	-	473	-
Mov Cap-2 Maneuver	77	-	-	-	-	-
Stage 1	218	-	-	-	-	-
Stage 2	645	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	29.9	0	0.1
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	-	162	473	-
HCM Lane V/C Ratio	-	-	-	0.11	0.007	-
HCM Control Delay (s)	-	-	0	29.9	12.7	-
HCM Lane LOS	-	-	A	D	B	-
HCM 95th %tile Q(veh)	-	-	-	0.4	0	-

Intersection						
Int Delay, s/veh	0.1					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↱		↰	↑
Traffic Vol, veh/h	1	6	1298	2	7	586
Future Vol, veh/h	1	6	1298	2	7	586
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	6	1366	2	7	617

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1999	1367	0	0	1368	0
Stage 1	1367	-	-	-	-	-
Stage 2	632	-	-	-	-	-
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	66	180	-	-	502	-
Stage 1	237	-	-	-	-	-
Stage 2	530	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	65	180	-	-	502	-
Mov Cap-2 Maneuver	65	-	-	-	-	-
Stage 1	237	-	-	-	-	-
Stage 2	523	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	30.8	0	0.1
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	65	180	502	-
HCM Lane V/C Ratio	-	-	0.016	0.035	0.015	-
HCM Control Delay (s)	-	-	61.3	25.7	12.3	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	0	0.1	0	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	581	1072	1	0	941	564	0	1	0	297	0	135
Future Volume (veh/h)	581	1072	1	0	941	564	0	1	0	297	0	135
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	10	160	0	0	5	2	0	0	0	14	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	599	1105	1	0	970	581	0	1	0	349	0	93
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	778	2443	1	2	1549	512	0	3	0	518	0	562
Arrive On Green	0.22	0.71	0.71	0.00	0.45	0.45	0.00	0.00	0.00	0.13	0.00	0.13
Sat Flow, veh/h	3442	3628	3	1774	3539	1583	0	1863	0	3548	0	1583
Grp Volume(v), veh/h	599	539	567	0	970	581	0	1	0	349	0	93
Grp Sat Flow(s),veh/h/ln	1721	1770	1862	1774	1770	1583	0	1863	0	1774	0	1583
Q Serve(g_s), s	16.2	12.4	12.4	0.0	20.4	31.2	0.0	0.1	0.0	9.3	0.0	4.0
Cycle Q Clear(g_c), s	16.2	12.4	12.4	0.0	20.4	31.2	0.0	0.1	0.0	9.3	0.0	4.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	778	1191	1257	2	1549	512	0	3	0	518	0	562
V/C Ratio(X)	0.77	0.45	0.45	0.00	0.63	1.14	0.00	0.39	0.00	0.67	0.00	0.17
Avail Cap(c_a), veh/h	1398	1285	1352	252	1617	724	0	284	0	1261	0	910
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	37.7	16.2	15.7	0.0	23.4	47.1	0.0	56.0	0.0	42.1	0.0	22.0
Incr Delay (d2), s/veh	2.3	0.6	0.5	0.0	1.1	78.7	0.0	77.0	0.0	1.8	0.0	0.2
Initial Q Delay(d3),s/veh	5.2	59.3	53.1	0.0	0.2	12.3	0.0	0.0	0.0	16.1	0.0	0.1
%ile BackOfQ(50%),veh/ln	9.6	45.8	45.1	0.0	11.6	32.8	0.0	0.1	0.0	7.1	0.0	2.1
LnGrp Delay(d),s/veh	45.2	76.2	69.4	0.0	24.7	138.1	0.0	133.0	0.0	60.0	0.0	22.3
LnGrp LOS	D	E	E		C	F		F		E		C
Approach Vol, veh/h		1705			1551			1			442	
Approach Delay, s/veh		63.0			67.2			133.0			52.1	
Approach LOS		E			E			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		4.1	0.0	76.6		17.7	25.6	51.1
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		15.0	14.0	71.5		35.0	40.0	45.0
Max Q Clear Time (g_c+I1), s		2.1	0.0	14.4		11.3	18.2	33.2
Green Ext Time (p_c), s		0.0	0.0	49.5		1.9	3.4	11.3

Intersection Summary	
HCM 2010 Ctrl Delay	63.5
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	731	1540	10	1	1116	568	2	8	4	576	1	80
Future Volume (veh/h)	731	1540	10	1	1116	568	2	8	4	576	1	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	5	50	0	0	8	2	0	0	0	5	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	761	1604	10	1	1162	592	2	8	4	626	0	56
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	612	2129	10	2	1423	596	4	15	8	761	0	669
Arrive On Green	0.21	0.62	0.62	0.00	0.41	0.41	0.02	0.02	0.02	0.21	0.00	0.21
Sat Flow, veh/h	3442	3606	22	1774	3539	1583	252	1006	503	3548	0	1583
Grp Volume(v), veh/h	761	787	827	1	1162	592	14	0	0	626	0	56
Grp Sat Flow(s),veh/h/ln	1721	1770	1859	1774	1770	1583	1761	0	0	1774	0	1583
Q Serve(g_s), s	26.0	37.2	37.2	0.1	35.6	43.5	1.0	0.0	0.0	20.8	0.0	2.6
Cycle Q Clear(g_c), s	26.0	37.2	37.2	0.1	35.6	43.5	1.0	0.0	0.0	20.8	0.0	2.6
Prop In Lane	1.00		0.01	1.00		1.00	0.14		0.29	1.00		1.00
Lane Grp Cap(c), veh/h	612	1043	1099	2	1423	596	27	0	0	761	0	669
V/C Ratio(X)	1.24	0.75	0.75	0.52	0.82	0.99	0.52	0.00	0.00	0.82	0.00	0.08
Avail Cap(c_a), veh/h	728	1102	1157	202	1584	708	215	0	0	1270	0	902
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	60.1	24.2	23.8	66.7	34.6	45.6	65.3	0.0	0.0	46.7	0.0	21.5
Incr Delay (d2), s/veh	122.8	3.6	3.4	133.3	3.8	32.0	15.0	0.0	0.0	2.8	0.0	0.1
Initial Q Delay(d3),s/veh	23.3	16.9	15.1	0.0	1.2	9.2	0.0	0.0	0.0	1.7	0.0	0.1
%ile BackOfQ(50%),veh/ln	25.3	34.8	35.4	0.1	20.1	30.8	0.6	0.0	0.0	11.2	0.0	1.5
LnGrp Delay(d),s/veh	206.1	44.6	42.2	200.0	39.7	86.8	80.3	0.0	0.0	51.2	0.0	21.6
LnGrp LOS	F	D	D	F	D	F	F			D		C
Approach Vol, veh/h		2375			1755			14			682	
Approach Delay, s/veh		95.5			55.7			80.3			48.8	
Approach LOS		F			E			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		5.9	3.6	83.0		30.4	30.0	56.7
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		15.0	14.0	67.5		44.0	26.0	55.0
Max Q Clear Time (g_c+I1), s		3.0	2.1	39.2		22.8	28.0	45.5
Green Ext Time (p_c), s		0.0	0.0	27.8		3.1	0.0	4.7

Intersection Summary	
HCM 2010 Ctrl Delay	74.4
HCM 2010 LOS	E

Notes

HCM 2010 Signalized Intersection Summary
4: Tolay Creek Rd/Arnold Dr (SR 121) & Sears Point Rd (SR 37) 12/19/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	488	865	0	0	1012	94	0	0	0	345	0	0
Future Volume (veh/h)	488	865	0	0	1012	94	0	0	0	345	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	20	400	0	0	20	3	0	0	0	30	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	493	874	0	0	1022	0	0	0	0	348	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	665	2359	0	2	1776	1052	0	2	0	553	349	0
Arrive On Green	0.18	0.77	0.00	0.00	0.55	0.00	0.00	0.00	0.00	0.13	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	0	1863	0	3548	1863	0
Grp Volume(v), veh/h	493	874	0	0	1022	0	0	0	0	348	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	0	1863	0	1774	1863	0
Q Serve(g_s), s	13.4	7.3	0.0	0.0	17.6	0.0	0.0	0.0	0.0	9.2	0.0	0.0
Cycle Q Clear(g_c), s	13.4	7.3	0.0	0.0	17.6	0.0	0.0	0.0	0.0	9.2	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	665	2359	0	2	1776	1052	0	2	0	553	349	0
V/C Ratio(X)	0.74	0.37	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.63	0.00	0.00
Avail Cap(c_a), veh/h	1560	3299	0	256	2187	1181	0	365	0	1608	844	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	42.2	27.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	44.5	0.0	0.0
Incr Delay (d2), s/veh	1.7	0.4	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Initial Q Delay(d3),s/veh	25.3	327.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	57.3	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.5	159.7	0.0	0.0	15.1	0.0	0.0	0.0	0.0	12.3	0.0	0.0
LnGrp Delay(d),s/veh	69.1	354.3	0.0	0.0	27.2	0.0	0.0	0.0	0.0	102.9	0.0	0.0
LnGrp LOS	E	F			C					F		
Approach Vol, veh/h		1367			1022			0			348	
Approach Delay, s/veh		251.5			27.2			0.0			102.9	
Approach LOS		F			C						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		0.0	0.0	80.7		16.4	21.1	59.6
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		19.0	14.0	90.5		44.0	44.0	60.0
Max Q Clear Time (g_c+I1), s		0.0	0.0	9.3		11.2	15.4	19.6
Green Ext Time (p_c), s		0.0	0.0	59.2		1.2	1.7	34.0

Intersection Summary	
HCM 2010 Ctrl Delay	148.9
HCM 2010 LOS	F

Notes

HCM 2010 Signalized Intersection Summary
4: Tolay Creek Rd/Arnold Dr (SR 121) & Sears Point Rd (SR 37) 12/19/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	895	1197	0	1	1120	136	1	0	0	80	0	0
Future Volume (veh/h)	895	1197	0	1	1120	136	1	0	0	80	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	15	200	0	0	50	3	0	0	0	10	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	904	1209	0	1	1131	0	1	0	0	81	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	917	2376	0	2	1286	961	2	0	0	176	372	0
Arrive On Green	0.30	0.81	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.04	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	1774	0	0	3548	1863	0
Grp Volume(v), veh/h	904	1209	0	1	1131	0	1	0	0	81	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	1774	0	0	1774	1863	0
Q Serve(g_s), s	28.2	11.0	0.0	0.1	25.8	0.0	0.1	0.0	0.0	2.5	0.0	0.0
Cycle Q Clear(g_c), s	28.2	11.0	0.0	0.1	25.8	0.0	0.1	0.0	0.0	2.5	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	917	2376	0	2	1286	961	2	0	0	176	372	0
V/C Ratio(X)	0.99	0.51	0.00	0.52	0.88	0.00	0.52	0.00	0.00	0.46	0.00	0.00
Avail Cap(c_a), veh/h	1345	2875	0	221	1885	905	299	0	0	1386	728	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	60.6	24.4	0.0	74.8	52.6	0.0	74.8	0.0	0.0	53.6	0.0	0.0
Incr Delay (d2), s/veh	17.7	0.6	0.0	172.0	7.5	0.0	133.8	0.0	0.0	1.9	0.0	0.0
Initial Q Delay(d3),s/veh	52.6	103.8	0.0	0.0	85.9	0.0	0.0	0.0	0.0	43.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	29.8	75.1	0.0	0.1	46.0	0.0	0.1	0.0	0.0	3.3	0.0	0.0
LnGrp Delay(d),s/veh	130.9	128.8	0.0	246.8	146.0	0.0	208.6	0.0	0.0	98.4	0.0	0.0
LnGrp LOS	F	F		F	F		F			F		
Approach Vol, veh/h		2113			1132			1			81	
Approach Delay, s/veh		129.7			146.0			208.6			98.4	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.1	3.6	97.5		8.4	37.4	63.7
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		19.0	14.0	90.5		44.0	44.0	60.0
Max Q Clear Time (g_c+I1), s		2.1	2.1	13.0		4.5	30.2	27.8
Green Ext Time (p_c), s		0.0	0.0	71.0		0.3	3.2	29.9

Intersection Summary	
HCM 2010 Ctrl Delay	134.5
HCM 2010 LOS	F

Notes

Intersection												
Int Delay, s/veh	0											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	1	0	2	0	531	0	0	758	0
Future Vol, veh/h	0	0	0	1	0	2	0	531	0	0	758	0
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	96	96	96	96	96	96	96	96	96
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	2	0	553	0	0	790	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1343	1343	790	1343	1343	553	-	0	0	553	0	0
Stage 1	790	790	-	553	553	-	-	-	-	-	-	-
Stage 2	553	553	-	790	790	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	-	-	-	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	-	-
Pot Cap-1 Maneuver	129	152	390	129	152	533	0	-	-	1017	-	-
Stage 1	383	402	-	517	514	-	0	-	-	-	-	-
Stage 2	517	514	-	383	402	-	0	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	128	152	390	129	152	533	-	-	-	1017	-	-
Mov Cap-2 Maneuver	128	152	-	129	152	-	-	-	-	-	-	-
Stage 1	383	402	-	517	514	-	-	-	-	-	-	-
Stage 2	515	514	-	383	402	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	18.9	0	0
HCM LOS	A	C		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	-	-	-	129	533	1017	-	-
HCM Lane V/C Ratio	-	-	-	0.008	0.004	-	-	-
HCM Control Delay (s)	-	-	0	33.1	11.8	0	-	-
HCM Lane LOS	-	-	A	D	B	A	-	-
HCM 95th %tile Q(veh)	-	-	-	0	0	0	-	-

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	0	0	0	1	0	16	0	1015	13	6	556	0
Future Vol, veh/h	0	0	0	1	0	16	0	1015	13	6	556	0
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	92	95	92	92	92	95	95	92	92	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	17	0	1068	14	7	585	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1673	1681	585	1673	1673	1075	585	0	0	1083	0	0
Stage 1	598	598	-	1075	1075	-	-	-	-	-	-	-
Stage 2	1075	1083	-	598	598	-	-	-	-	-	-	-
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	76	95	511	76	96	267	990	-	-	644	-	-
Stage 1	489	491	-	266	296	-	-	-	-	-	-	-
Stage 2	266	293	-	489	491	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	70	94	511	75	95	267	990	-	-	644	-	-
Mov Cap-2 Maneuver	70	94	-	75	95	-	-	-	-	-	-	-
Stage 1	489	486	-	266	296	-	-	-	-	-	-	-
Stage 2	249	293	-	484	486	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	21.4	0	0.1
HCM LOS	A	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	990	-	-	-	75	267	644	-	-
HCM Lane V/C Ratio	-	-	-	-	0.014	0.065	0.01	-	-
HCM Control Delay (s)	0	-	-	0	53.7	19.4	10.6	-	-
HCM Lane LOS	A	-	-	A	F	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0	0.2	0	-	-

Intersection						
Int Delay, s/veh	5.7					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	27	66	1148	259	187	487
Future Vol, veh/h	27	66	1148	259	187	487
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	7	5	2	4	9
Mvmt Flow	27	66	1148	259	187	487

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2139	1278	0	0	1407	0
Stage 1	1278	-	-	-	-	-
Stage 2	861	-	-	-	-	-
Critical Hdwy	6.4	6.27	-	-	4.14	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.363	-	-	2.236	-
Pot Cap-1 Maneuver	55	198	-	-	479	-
Stage 1	264	-	-	-	-	-
Stage 2	417	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	34	198	-	-	479	-
Mov Cap-2 Maneuver	34	-	-	-	-	-
Stage 1	264	-	-	-	-	-
Stage 2	254	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	99.5	0	4.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	34	198	479	-
HCM Lane V/C Ratio	-	-	0.794	0.333	0.39	-
HCM Control Delay (s)	-	-	264.5	32	17.2	-
HCM Lane LOS	-	-	F	D	C	-
HCM 95th %tile Q(veh)	-	-	2.8	1.4	1.8	-

Intersection						
Int Delay, s/veh	4					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	19	69	1294	162	138	655
Future Vol, veh/h	19	69	1294	162	138	655
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	19	69	1294	162	138	655

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2306	1375	0	0	1456	0
Stage 1	1375	-	-	-	-	-
Stage 2	931	-	-	-	-	-
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	42	178	-	-	465	-
Stage 1	235	-	-	-	-	-
Stage 2	384	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	30	178	-	-	465	-
Mov Cap-2 Maneuver	30	-	-	-	-	-
Stage 1	235	-	-	-	-	-
Stage 2	270	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	82.3	0	2.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	30	178	465	-
HCM Lane V/C Ratio	-	-	0.633	0.388	0.297	-
HCM Control Delay (s)	-	-	245	37.5	16	-
HCM Lane LOS	-	-	F	E	C	-
HCM 95th %tile Q(veh)	-	-	2.1	1.7	1.2	-

Intersection	
Int Delay, s/veh	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↱		↰	↑
Traffic Vol, veh/h	0	17	1393	2	3	504
Future Vol, veh/h	0	17	1393	2	3	504
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	4	0	0	10
Mvmt Flow	0	17	1393	2	3	504

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1904	1394	0	0	1395	0
Stage 1	1394	-	-	-	-	-
Stage 2	510	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	77	175	-	-	497	-
Stage 1	232	-	-	-	-	-
Stage 2	607	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	77	175	-	-	497	-
Mov Cap-2 Maneuver	77	-	-	-	-	-
Stage 1	232	-	-	-	-	-
Stage 2	603	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	27.8	0	0.1
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	-	175	497	-
HCM Lane V/C Ratio	-	-	-	0.097	0.006	-
HCM Control Delay (s)	-	-	0	27.8	12.3	-
HCM Lane LOS	-	-	A	D	B	-
HCM 95th %tile Q(veh)	-	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	0.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↱		↰	↑
Traffic Vol, veh/h	1	7	1434	2	8	648
Future Vol, veh/h	1	7	1434	2	8	648
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	7	1434	2	8	648

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2099	1435	0	0	1436	0
Stage 1	1435	-	-	-	-	-
Stage 2	664	-	-	-	-	-
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	57	164	-	-	473	-
Stage 1	219	-	-	-	-	-
Stage 2	512	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	56	164	-	-	473	-
Mov Cap-2 Maneuver	56	-	-	-	-	-
Stage 1	219	-	-	-	-	-
Stage 2	503	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	33.2	0	0.2
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	56	164	473	-
HCM Lane V/C Ratio	-	-	0.018	0.043	0.017	-
HCM Control Delay (s)	-	-	70.5	27.9	12.7	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	0.1	0.1	0.1	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	581	1220	1	0	1039	617	0	1	0	394	0	141
Future Volume (veh/h)	581	1220	1	0	1039	617	0	1	0	394	0	141
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	10	160	0	0	5	2	0	0	0	14	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	581	1220	1	0	1039	617	0	1	0	438	0	94
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	754	2397	1	2	1480	512	0	3	0	608	0	592
Arrive On Green	0.21	0.69	0.69	0.00	0.44	0.44	0.00	0.00	0.00	0.16	0.00	0.16
Sat Flow, veh/h	3442	3629	3	1774	3539	1583	0	1863	0	3548	0	1583
Grp Volume(v), veh/h	581	595	626	0	1039	617	0	1	0	438	0	94
Grp Sat Flow(s),veh/h/ln	1721	1770	1862	1774	1770	1583	0	1863	0	1774	0	1583
Q Serve(g_s), s	16.3	15.9	15.9	0.0	23.7	36.4	0.0	0.1	0.0	12.1	0.0	4.0
Cycle Q Clear(g_c), s	16.3	15.9	15.9	0.0	23.7	36.4	0.0	0.1	0.0	12.1	0.0	4.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	754	1169	1233	2	1480	512	0	3	0	608	0	592
V/C Ratio(X)	0.77	0.51	0.51	0.00	0.70	1.21	0.00	0.39	0.00	0.72	0.00	0.16
Avail Cap(c_a), veh/h	1350	1241	1306	244	1562	699	0	274	0	1218	0	879
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	39.2	17.9	17.4	0.0	27.3	47.1	0.0	57.7	0.0	42.4	0.0	21.5
Incr Delay (d2), s/veh	2.4	0.7	0.7	0.0	1.8	107.9	0.0	77.1	0.0	2.0	0.0	0.1
Initial Q Delay(d3),s/veh	5.5	68.7	61.6	0.0	0.3	11.6	0.0	0.0	0.0	13.6	0.0	0.1
%ile BackOfQ(50%),veh/ln	9.7	51.3	50.5	0.0	13.9	37.0	0.0	0.1	0.0	8.6	0.0	2.1
LnGrp Delay(d),s/veh	47.2	87.4	79.7	0.0	29.3	166.5	0.0	134.8	0.0	57.9	0.0	21.7
LnGrp LOS	D	F	E		C	F		F		E		C
Approach Vol, veh/h		1802			1656			1			532	
Approach Delay, s/veh		71.8			80.5			134.8			51.5	
Approach LOS		E			F			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		4.1	0.0	77.0		20.8	25.6	51.4
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		15.0	14.0	71.5		35.0	40.0	45.0
Max Q Clear Time (g_c+I1), s		2.1	0.0	17.9		14.1	18.3	38.4
Green Ext Time (p_c), s		0.0	0.0	49.0		2.3	3.3	6.5

Intersection Summary		
HCM 2010 Ctrl Delay		72.7
HCM 2010 LOS		E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	811	1717	11	1	1244	630	2	9	4	642	1	89
Future Volume (veh/h)	811	1717	11	1	1244	630	2	9	4	642	1	89
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	5	50	0	0	8	2	0	0	0	5	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	811	1717	11	1	1244	630	2	9	4	670	0	60
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	612	2076	9	2	1416	595	4	17	7	800	0	671
Arrive On Green	0.20	0.62	0.62	0.00	0.41	0.41	0.02	0.02	0.02	0.22	0.00	0.22
Sat Flow, veh/h	3442	3605	23	1774	3539	1583	236	1061	471	3548	0	1583
Grp Volume(v), veh/h	811	842	886	1	1244	630	15	0	0	670	0	60
Grp Sat Flow(s),veh/h/ln	1721	1770	1859	1774	1770	1583	1768	0	0	1774	0	1583
Q Serve(g_s), s	26.0	44.8	44.9	0.1	41.0	50.0	1.1	0.0	0.0	23.4	0.0	2.9
Cycle Q Clear(g_c), s	26.0	44.8	44.9	0.1	41.0	50.0	1.1	0.0	0.0	23.4	0.0	2.9
Prop In Lane	1.00		0.01	1.00		1.00	0.13		0.27	1.00		1.00
Lane Grp Cap(c), veh/h	612	1016	1072	2	1416	595	28	0	0	800	0	671
V/C Ratio(X)	1.33	0.83	0.83	0.52	0.88	1.06	0.54	0.00	0.00	0.84	0.00	0.09
Avail Cap(c_a), veh/h	693	1094	1149	192	1507	674	205	0	0	1208	0	858
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	60.1	28.2	27.7	69.1	38.4	45.6	67.6	0.0	0.0	48.4	0.0	22.5
Incr Delay (d2), s/veh	157.7	6.0	5.6	133.4	6.7	52.0	15.0	0.0	0.0	3.8	0.0	0.1
Initial Q Delay(d3),s/veh	21.8	25.4	22.5	0.0	1.9	11.4	0.0	0.0	0.0	1.7	0.0	0.1
%ile BackOfQ(50%),veh/ln	28.2	43.2	43.9	0.1	24.2	34.6	0.7	0.0	0.0	12.6	0.0	1.6
LnGrp Delay(d),s/veh	239.7	59.6	55.9	202.6	47.0	109.0	82.6	0.0	0.0	53.9	0.0	22.7
LnGrp LOS	F	E	E	F	D	F	F			D		C
Approach Vol, veh/h		2539			1875			15			730	
Approach Delay, s/veh		115.8			67.9			82.6			51.3	
Approach LOS		F			E			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		6.1	3.6	86.4		33.1	30.0	60.0
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		15.0	14.0	67.5		44.0	26.0	55.0
Max Q Clear Time (g_c+I1), s		3.1	2.1	46.9		25.4	28.0	52.0
Green Ext Time (p_c), s		0.0	0.0	20.4		3.2	0.0	1.5

Intersection Summary		
HCM 2010 Ctrl Delay		89.2
HCM 2010 LOS		F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	565	1044	0	0	1144	104	0	0	0	363	0	0
Future Volume (veh/h)	565	1044	0	0	1144	104	0	0	0	363	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	20	400	0	0	20	3	0	0	0	30	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	565	1044	0	0	1144	10	0	0	0	363	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	729	2359	0	1	1627	1063	0	2	0	561	343	0
Arrive On Green	0.20	0.78	0.00	0.00	0.54	0.54	0.00	0.00	0.00	0.13	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	0	1863	0	3548	1863	0
Grp Volume(v), veh/h	565	1044	0	0	1144	10	0	0	0	363	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	0	1863	0	1774	1863	0
Q Serve(g_s), s	16.7	9.9	0.0	0.0	23.1	0.2	0.0	0.0	0.0	10.5	0.0	0.0
Cycle Q Clear(g_c), s	16.7	9.9	0.0	0.0	23.1	0.2	0.0	0.0	0.0	10.5	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	729	2359	0	1	1627	1063	0	2	0	561	343	0
V/C Ratio(X)	0.77	0.44	0.00	0.00	0.70	0.01	0.00	0.00	0.00	0.65	0.00	0.00
Avail Cap(c_a), veh/h	1435	3035	0	235	2012	1106	0	335	0	1479	777	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	44.8	27.0	0.0	0.0	33.0	5.9	0.0	0.0	0.0	47.4	0.0	0.0
Incr Delay (d2), s/veh	1.8	0.5	0.0	0.0	2.1	0.0	0.0	0.0	0.0	1.3	0.0	0.0
Initial Q Delay(d3),s/veh	24.1	359.4	0.0	0.0	3.7	0.1	0.0	0.0	0.0	58.2	0.0	0.0
%ile BackOfQ(50%),veh/ln	13.4	170.4	0.0	0.0	21.2	0.7	0.0	0.0	0.0	13.1	0.0	0.0
LnGrp Delay(d),s/veh	70.7	386.9	0.0	0.0	38.7	6.0	0.0	0.0	0.0	106.8	0.0	0.0
LnGrp LOS	E	F			D	A				F		
Approach Vol, veh/h		1609			1154			0			363	
Approach Delay, s/veh		275.8			38.5			0.0			106.8	
Approach LOS		F			D						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		0.0	0.0	87.8		17.7	24.6	63.2
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		19.0	14.0	90.5		44.0	44.0	60.0
Max Q Clear Time (g_c+I1), s		0.0	0.0	11.9		12.5	18.7	25.1
Green Ext Time (p_c), s		0.0	0.0	66.1		1.2	1.9	32.1

Intersection Summary	
HCM 2010 Ctrl Delay	168.6
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	985	1335	0	0	1249	150	1	0	0	89	0	0
Future Volume (veh/h)	985	1335	0	0	1249	150	1	0	0	89	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	15	200	0	0	50	3	0	0	0	10	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	985	1335	0	0	1249	14	1	0	0	89	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	917	2435	0	1	1286	839	2	0	0	187	319	0
Arrive On Green	0.32	0.84	0.00	0.00	0.49	0.49	0.00	0.00	0.00	0.04	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	1774	0	0	3548	1863	0
Grp Volume(v), veh/h	985	1335	0	0	1249	14	1	0	0	89	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	1774	0	0	1774	1863	0
Q Serve(g_s), s	30.8	10.8	0.0	0.0	31.6	0.5	0.1	0.0	0.0	2.8	0.0	0.0
Cycle Q Clear(g_c), s	30.8	10.8	0.0	0.0	31.6	0.5	0.1	0.0	0.0	2.8	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	917	2435	0	1	1286	839	2	0	0	187	319	0
V/C Ratio(X)	1.07	0.55	0.00	0.00	0.97	0.02	0.52	0.00	0.00	0.48	0.00	0.00
Avail Cap(c_a), veh/h	1343	2978	0	220	1884	909	299	0	0	1385	727	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	60.6	23.8	0.0	0.0	52.6	12.7	71.3	0.0	0.0	53.4	0.0	0.0
Incr Delay (d2), s/veh	45.6	0.7	0.0	0.0	17.4	0.0	133.6	0.0	0.0	1.9	0.0	0.0
Initial Q Delay(d3),s/veh	53.0	107.5	0.0	0.0	127.2	0.1	0.0	0.0	0.0	39.4	0.0	0.0
%ile BackOfQ(50%),veh/ln	34.2	80.3	0.0	0.0	55.1	0.8	0.1	0.0	0.0	3.4	0.0	0.0
LnGrp Delay(d),s/veh	159.2	131.9	0.0	0.0	197.2	12.9	204.9	0.0	0.0	94.7	0.0	0.0
LnGrp LOS	F	F			F	B	F			F		
Approach Vol, veh/h		2320			1263			1			89	
Approach Delay, s/veh		143.5			195.1			204.9			94.7	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.1	0.0	100.9		8.8	40.0	60.9
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		19.0	14.0	90.5		44.0	44.0	60.0
Max Q Clear Time (g_c+I1), s		2.1	0.0	12.8		4.8	32.8	33.6
Green Ext Time (p_c), s		0.0	0.0	74.0		0.3	3.2	21.3

Intersection Summary	
HCM 2010 Ctrl Delay	160.1
HCM 2010 LOS	F

Notes

Intersection												
Int Delay, s/veh	0											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	1	0	2	0	575	0	0	820	0
Future Vol, veh/h	0	0	0	1	0	2	0	575	0	0	820	0
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	2	0	575	0	0	820	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1395	1395	820	1395	1395	575	-	0	0	575	0	0
Stage 1	820	820	-	575	575	-	-	-	-	-	-	-
Stage 2	575	575	-	820	820	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	-	-	-	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	-	-
Pot Cap-1 Maneuver	119	141	375	119	141	518	0	-	-	998	-	-
Stage 1	369	389	-	503	503	-	0	-	-	-	-	-
Stage 2	503	503	-	369	389	-	0	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	119	141	375	119	141	518	-	-	-	998	-	-
Mov Cap-2 Maneuver	119	141	-	119	141	-	-	-	-	-	-	-
Stage 1	369	389	-	503	503	-	-	-	-	-	-	-
Stage 2	501	503	-	369	389	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	19.8	0	0
HCM LOS	A	C		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	-	-	-	119	518	998	-	-
HCM Lane V/C Ratio	-	-	-	0.008	0.004	-	-	-
HCM Control Delay (s)	-	-	0	35.5	12	0	-	-
HCM Lane LOS	-	-	A	E	B	A	-	-
HCM 95th %tile Q(veh)	-	-	-	0	0	0	-	-

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	0	0	0	1	0	17	0	1098	14	6	602	0
Future Vol, veh/h	0	0	0	1	0	17	0	1098	14	6	602	0
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	17	0	1098	14	6	602	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1719	1726	602	1719	1719	1105	602	0	0	1112	0	0
Stage 1	614	614	-	1105	1105	-	-	-	-	-	-	-
Stage 2	1105	1112	-	614	614	-	-	-	-	-	-	-
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	71	89	500	71	90	256	975	-	-	628	-	-
Stage 1	479	483	-	256	286	-	-	-	-	-	-	-
Stage 2	256	284	-	479	483	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	66	88	500	70	89	256	975	-	-	628	-	-
Mov Cap-2 Maneuver	66	88	-	70	89	-	-	-	-	-	-	-
Stage 1	479	478	-	256	286	-	-	-	-	-	-	-
Stage 2	239	284	-	474	478	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	22.2	0	0.1
HCM LOS	A	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	975	-	-	-	70	256	628	-	-
HCM Lane V/C Ratio	-	-	-	-	0.014	0.066	0.01	-	-
HCM Control Delay (s)	0	-	-	0	57.2	20.1	10.8	-	-
HCM Lane LOS	A	-	-	A	F	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0	0.2	0	-	-

Intersection	
Int Delay, s/veh	7.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	32	66	1161	262	187	507
Future Vol, veh/h	32	66	1161	262	187	507
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	7	5	2	4	9
Mvmt Flow	32	66	1161	262	187	507

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2173	1292	0	0	1423	0
Stage 1	1292	-	-	-	-	-
Stage 2	881	-	-	-	-	-
Critical Hdwy	6.4	6.27	-	-	4.14	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.363	-	-	2.236	-
Pot Cap-1 Maneuver	52	194	-	-	472	-
Stage 1	260	-	-	-	-	-
Stage 2	408	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 31	194	-	-	472	-
Mov Cap-2 Maneuver	~ 31	-	-	-	-	-
Stage 1	260	-	-	-	-	-
Stage 2	246	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	139.9	0	4.7
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	31	194	472	-
HCM Lane V/C Ratio	-	-	1.032	0.34	0.396	-
HCM Control Delay (s)	-	-	$ 360.8	32.8	17.5	-
HCM Lane LOS	-	-	F	D	C	-
HCM 95th %tile Q(veh)	-	-	3.5	1.4	1.9	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection	
Int Delay, s/veh	6.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	27	69	1327	170	138	688
Future Vol, veh/h	27	69	1327	170	138	688
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	27	69	1327	170	138	688

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2376	1412	0	0	1497	0
Stage 1	1412	-	-	-	-	-
Stage 2	964	-	-	-	-	-
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	38	169	-	-	448	-
Stage 1	225	-	-	-	-	-
Stage 2	370	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 26	169	-	-	448	-
Mov Cap-2 Maneuver	~ 26	-	-	-	-	-
Stage 1	225	-	-	-	-	-
Stage 2	256	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	143.3	0	2.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	26	169	448	-
HCM Lane V/C Ratio	-	-	1.038	0.408	0.308	-
HCM Control Delay (s)	-	-	$ 406.6	40.3	16.6	-
HCM Lane LOS	-	-	F	E	C	-
HCM 95th %tile Q(veh)	-	-	3.2	1.8	1.3	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	0.8					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	4	33	1393	8	28	504
Future Vol, veh/h	4	33	1393	8	28	504
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	4	0	0	10
Mvmt Flow	4	33	1393	8	28	504

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1957	1397	0	0	1401	0
Stage 1	1397	-	-	-	-	-
Stage 2	560	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	71	174	-	-	494	-
Stage 1	231	-	-	-	-	-
Stage 2	576	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	67	174	-	-	494	-
Mov Cap-2 Maneuver	67	-	-	-	-	-
Stage 1	231	-	-	-	-	-
Stage 2	543	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	33.9	0	0.7
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	67	174	494	-
HCM Lane V/C Ratio	-	-	0.06	0.19	0.057	-
HCM Control Delay (s)	-	-	62.1	30.5	12.7	-
HCM Lane LOS	-	-	F	D	B	-
HCM 95th %tile Q(veh)	-	-	0.2	0.7	0.2	-

Intersection						
Int Delay, s/veh	1.6					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	48	1434	12	49	648
Future Vol, veh/h	11	48	1434	12	49	648
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	48	1434	12	49	648

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2186	1440	0	0	1446	0
Stage 1	1440	-	-	-	-	-
Stage 2	746	-	-	-	-	-
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	50	163	-	-	469	-
Stage 1	218	-	-	-	-	-
Stage 2	469	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	45	163	-	-	469	-
Mov Cap-2 Maneuver	45	-	-	-	-	-
Stage 1	218	-	-	-	-	-
Stage 2	420	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	49.7	0	1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	45	163	469	-
HCM Lane V/C Ratio	-	-	0.244	0.294	0.104	-
HCM Control Delay (s)	-	-	109.2	36.1	13.6	-
HCM Lane LOS	-	-	F	E	B	-
HCM 95th %tile Q(veh)	-	-	0.8	1.2	0.3	-

HCM 2010 Signalized Intersection Summary
3: Reclamation Rd/Lakeville Hwy & Sears Point Rd (SR 37)

12/19/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	586	1220	1	0	1039	619	0	1	0	395	0	144
Future Volume (veh/h)	586	1220	1	0	1039	619	0	1	0	395	0	144
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	10	160	0	0	5	2	0	0	0	14	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	586	1220	1	0	1039	619	0	1	0	440	0	96
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	759	2397	1	2	1476	512	0	3	0	610	0	595
Arrive On Green	0.21	0.69	0.69	0.00	0.44	0.44	0.00	0.00	0.00	0.16	0.00	0.16
Sat Flow, veh/h	3442	3629	3	1774	3539	1583	0	1863	0	3548	0	1583
Grp Volume(v), veh/h	586	595	626	0	1039	619	0	1	0	440	0	96
Grp Sat Flow(s),veh/h/ln	1721	1770	1862	1774	1770	1583	0	1863	0	1774	0	1583
Q Serve(g_s), s	16.5	16.0	16.0	0.0	23.8	36.8	0.0	0.1	0.0	12.2	0.0	4.1
Cycle Q Clear(g_c), s	16.5	16.0	16.0	0.0	23.8	36.8	0.0	0.1	0.0	12.2	0.0	4.1
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	759	1169	1233	2	1476	512	0	3	0	610	0	595
V/C Ratio(X)	0.77	0.51	0.51	0.00	0.70	1.21	0.00	0.39	0.00	0.72	0.00	0.16
Avail Cap(c_a), veh/h	1346	1237	1302	243	1557	697	0	273	0	1214	0	879
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	39.3	17.9	17.4	0.0	27.4	47.1	0.0	57.8	0.0	42.5	0.0	21.5
Incr Delay (d2), s/veh	2.4	0.7	0.7	0.0	1.8	109.5	0.0	77.1	0.0	2.0	0.0	0.2
Initial Q Delay(d3),s/veh	5.5	68.8	61.6	0.0	0.3	11.5	0.0	0.0	0.0	13.6	0.0	0.1
%ile BackOfQ(50%),veh/ln	9.8	51.4	50.6	0.0	14.0	37.2	0.0	0.1	0.0	8.6	0.0	2.2
LnGrp Delay(d),s/veh	47.2	87.4	79.7	0.0	29.5	168.2	0.0	134.9	0.0	58.0	0.0	21.7
LnGrp LOS	D	F	E		C	F		F		E		C
Approach Vol, veh/h		1807			1658			1			536	
Approach Delay, s/veh		71.7			81.3			134.9			51.5	
Approach LOS		E			F			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		4.1	0.0	77.2		20.9	25.8	51.4
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		15.0	14.0	71.5		35.0	40.0	45.0
Max Q Clear Time (g_c+I1), s		2.1	0.0	18.0		14.2	18.5	38.8
Green Ext Time (p_c), s		0.0	0.0	48.9		2.3	3.3	6.1

Intersection Summary	
HCM 2010 Ctrl Delay	73.0
HCM 2010 LOS	E

Notes

HCM 2010 Signalized Intersection Summary
3: Reclamation Rd/Lakeville Hwy & Sears Point Rd (SR 37)

12/19/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	819	1717	11	1	1244	633	2	9	4	645	1	97
Future Volume (veh/h)	819	1717	11	1	1244	633	2	9	4	645	1	97
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	5	50	0	0	8	2	0	0	0	5	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	819	1717	11	1	1244	633	2	9	4	676	0	65
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	612	2075	9	2	1416	595	4	17	7	806	0	671
Arrive On Green	0.20	0.62	0.62	0.00	0.41	0.41	0.02	0.02	0.02	0.22	0.00	0.22
Sat Flow, veh/h	3442	3605	23	1774	3539	1583	236	1061	471	3548	0	1583
Grp Volume(v), veh/h	819	842	886	1	1244	633	15	0	0	676	0	65
Grp Sat Flow(s),veh/h/ln	1721	1770	1859	1774	1770	1583	1768	0	0	1774	0	1583
Q Serve(g_s), s	26.0	45.2	45.3	0.1	41.2	50.7	1.1	0.0	0.0	23.8	0.0	3.2
Cycle Q Clear(g_c), s	26.0	45.2	45.3	0.1	41.2	50.7	1.1	0.0	0.0	23.8	0.0	3.2
Prop In Lane	1.00		0.01	1.00		1.00	0.13		0.27	1.00		1.00
Lane Grp Cap(c), veh/h	612	1016	1072	2	1416	595	28	0	0	806	0	671
V/C Ratio(X)	1.34	0.83	0.83	0.52	0.88	1.06	0.54	0.00	0.00	0.84	0.00	0.10
Avail Cap(c_a), veh/h	689	1092	1147	191	1498	670	204	0	0	1202	0	853
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	60.1	28.3	27.8	69.3	38.5	45.6	67.8	0.0	0.0	48.6	0.0	22.7
Incr Delay (d2), s/veh	163.3	6.0	5.6	133.4	6.7	53.8	15.0	0.0	0.0	3.9	0.0	0.1
Initial Q Delay(d3),s/veh	21.6	25.5	22.6	0.0	1.9	11.3	0.0	0.0	0.0	1.7	0.0	0.1
%ile BackOfQ(50%),veh/ln	28.7	43.3	44.0	0.1	24.2	34.9	0.7	0.0	0.0	12.8	0.0	1.8
LnGrp Delay(d),s/veh	245.1	59.8	56.0	202.7	47.1	110.7	82.8	0.0	0.0	54.2	0.0	22.8
LnGrp LOS	F	E	E	F	D	F	F			D		C
Approach Vol, veh/h		2547			1878			15			741	
Approach Delay, s/veh		118.1			68.6			82.8			51.4	
Approach LOS		F			E			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		6.1	3.6	86.7		33.5	30.0	60.3
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		15.0	14.0	67.5		44.0	26.0	55.0
Max Q Clear Time (g_c+I1), s		3.1	2.1	47.3		25.8	28.0	52.7
Green Ext Time (p_c), s		0.0	0.0	20.1		3.3	0.0	1.1

Intersection Summary	
HCM 2010 Ctrl Delay	90.5
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	565	1045	0	0	1146	104	0	0	0	363	0	0
Future Volume (veh/h)	565	1045	0	0	1146	104	0	0	0	363	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	20	400	0	0	20	3	0	0	0	30	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	565	1045	0	0	1146	10	0	0	0	363	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	729	2359	0	1	1624	1063	0	2	0	561	343	0
Arrive On Green	0.20	0.78	0.00	0.00	0.54	0.54	0.00	0.00	0.00	0.13	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	0	1863	0	3548	1863	0
Grp Volume(v), veh/h	565	1045	0	0	1146	10	0	0	0	363	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	0	1863	0	1774	1863	0
Q Serve(g_s), s	16.7	9.9	0.0	0.0	23.1	0.2	0.0	0.0	0.0	10.5	0.0	0.0
Cycle Q Clear(g_c), s	16.7	9.9	0.0	0.0	23.1	0.2	0.0	0.0	0.0	10.5	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	729	2359	0	1	1624	1063	0	2	0	561	343	0
V/C Ratio(X)	0.77	0.44	0.00	0.00	0.71	0.01	0.00	0.00	0.00	0.65	0.00	0.00
Avail Cap(c_a), veh/h	1435	3034	0	235	2012	1106	0	335	0	1479	776	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	44.8	27.0	0.0	0.0	33.2	5.9	0.0	0.0	0.0	47.4	0.0	0.0
Incr Delay (d2), s/veh	1.8	0.5	0.0	0.0	2.1	0.0	0.0	0.0	0.0	1.3	0.0	0.0
Initial Q Delay(d3),s/veh	24.1	359.6	0.0	0.0	3.7	0.1	0.0	0.0	0.0	58.2	0.0	0.0
%ile BackOfQ(50%),veh/ln	18.4	170.4	0.0	0.0	21.4	0.7	0.0	0.0	0.0	13.1	0.0	0.0
LnGrp Delay(d),s/veh	70.7	387.1	0.0	0.0	39.0	6.0	0.0	0.0	0.0	106.8	0.0	0.0
LnGrp LOS	E	F			D	A				F		
Approach Vol, veh/h		1610			1156			0			363	
Approach Delay, s/veh		276.0			38.7			0.0			106.8	
Approach LOS		F			D						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		0.0	0.0	87.8		17.7	24.6	63.2
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		19.0	14.0	90.5		44.0	44.0	60.0
Max Q Clear Time (g_c+I1), s		0.0	0.0	11.9		12.5	18.7	25.1
Green Ext Time (p_c), s		0.0	0.0	66.2		1.2	1.9	32.1

Intersection Summary	
HCM 2010 Ctrl Delay	168.7
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	985	1338	0	0	1252	150	1	0	0	89	0	0
Future Volume (veh/h)	985	1338	0	0	1252	150	1	0	0	89	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	15	200	0	0	50	3	0	0	0	10	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	985	1338	0	0	1252	14	1	0	0	89	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	917	2434	0	1	1286	839	2	0	0	187	319	0
Arrive On Green	0.32	0.84	0.00	0.00	0.49	0.49	0.00	0.00	0.00	0.04	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	1774	0	0	3548	1863	0
Grp Volume(v), veh/h	985	1338	0	0	1252	14	1	0	0	89	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	1774	0	0	1774	1863	0
Q Serve(g_s), s	30.8	10.9	0.0	0.0	31.7	0.5	0.1	0.0	0.0	2.8	0.0	0.0
Cycle Q Clear(g_c), s	30.8	10.9	0.0	0.0	31.7	0.5	0.1	0.0	0.0	2.8	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	917	2434	0	1	1286	839	2	0	0	187	319	0
V/C Ratio(X)	1.07	0.55	0.00	0.00	0.97	0.02	0.52	0.00	0.00	0.48	0.00	0.00
Avail Cap(c_a), veh/h	1343	2978	0	220	1883	909	299	0	0	1385	727	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	60.6	23.8	0.0	0.0	52.6	12.7	71.4	0.0	0.0	53.4	0.0	0.0
Incr Delay (d2), s/veh	45.6	0.7	0.0	0.0	17.8	0.0	133.6	0.0	0.0	1.9	0.0	0.0
Initial Q Delay(d3),s/veh	53.0	108.0	0.0	0.0	128.3	0.1	0.0	0.0	0.0	39.4	0.0	0.0
%ile BackOfQ(50%),veh/ln	34.2	80.6	0.0	0.0	55.4	0.8	0.1	0.0	0.0	3.4	0.0	0.0
LnGrp Delay(d),s/veh	159.2	132.5	0.0	0.0	198.6	12.9	204.9	0.0	0.0	94.7	0.0	0.0
LnGrp LOS	F	F			F	B	F			F		
Approach Vol, veh/h		2323			1266			1			89	
Approach Delay, s/veh		143.9			196.6			204.9			94.7	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.1	0.0	100.9		8.8	40.0	60.9
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		19.0	14.0	90.5		44.0	44.0	60.0
Max Q Clear Time (g_c+I1), s		2.1	0.0	12.9		4.8	32.8	33.7
Green Ext Time (p_c), s		0.0	0.0	74.0		0.3	3.2	21.2

Intersection Summary	
HCM 2010 Ctrl Delay	160.8
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	1	0	2	0	575	0	0	820	0
Future Vol, veh/h	0	0	0	1	0	2	0	575	0	0	820	0
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	2	0	575	0	0	820	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1395	1395	820	1395	1395	575	-	0	0	575	0	0
Stage 1	820	820	-	575	575	-	-	-	-	-	-	-
Stage 2	575	575	-	820	820	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	-	-	-	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	-	-
Pot Cap-1 Maneuver	119	141	375	119	141	518	0	-	-	998	-	-
Stage 1	369	389	-	503	503	-	0	-	-	-	-	-
Stage 2	503	503	-	369	389	-	0	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	119	141	375	119	141	518	-	-	-	998	-	-
Mov Cap-2 Maneuver	119	141	-	119	141	-	-	-	-	-	-	-
Stage 1	369	389	-	503	503	-	-	-	-	-	-	-
Stage 2	501	503	-	369	389	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	19.8	0	0
HCM LOS	A	C		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	-	-	-	119	518	998	-	-
HCM Lane V/C Ratio	-	-	-	0.008	0.004	-	-	-
HCM Control Delay (s)	-	-	0	35.5	12	0	-	-
HCM Lane LOS	-	-	A	E	B	A	-	-
HCM 95th %tile Q(veh)	-	-	-	0	0	0	-	-

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	0	0	0	1	0	17	0	1098	14	6	602	0
Future Vol, veh/h	0	0	0	1	0	17	0	1098	14	6	602	0
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	17	0	1098	14	6	602	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1719	1726	602	1719	1719	1105	602	0	0	1112	0	0
Stage 1	614	614	-	1105	1105	-	-	-	-	-	-	-
Stage 2	1105	1112	-	614	614	-	-	-	-	-	-	-
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	71	89	500	71	90	256	975	-	-	628	-	-
Stage 1	479	483	-	256	286	-	-	-	-	-	-	-
Stage 2	256	284	-	479	483	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	66	88	500	70	89	256	975	-	-	628	-	-
Mov Cap-2 Maneuver	66	88	-	70	89	-	-	-	-	-	-	-
Stage 1	479	478	-	256	286	-	-	-	-	-	-	-
Stage 2	239	284	-	474	478	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	22.2	0	0.1
HCM LOS	A	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	975	-	-	-	70	256	628	-	-
HCM Lane V/C Ratio	-	-	-	-	0.014	0.066	0.01	-	-
HCM Control Delay (s)	0	-	-	0	57.2	20.1	10.8	-	-
HCM Lane LOS	A	-	-	A	F	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0	0.2	0	-	-

Intersection						
Int Delay, s/veh	162.8					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	95	70	1401	265	187	1013
Future Vol, veh/h	95	70	1401	265	187	1013
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	7	5	2	4	9
Mvmt Flow	95	70	1401	265	187	1013

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2921	1534	0	0	1666	0
Stage 1	1534	-	-	-	-	-
Stage 2	1387	-	-	-	-	-
Critical Hdwy	6.4	6.27	-	-	4.14	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.363	-	-	2.236	-
Pot Cap-1 Maneuver	~ 17	139	-	-	380	-
Stage 1	198	-	-	-	-	-
Stage 2	234	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 9	139	-	-	380	-
Mov Cap-2 Maneuver	~ 9	-	-	-	-	-
Stage 1	198	-	-	-	-	-
Stage 2	119	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 2964.7	0	3.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	9	139	380	-
HCM Lane V/C Ratio	-	-	10.556	0.504	0.492	-
HCM Control Delay (s)	-		$ 5108.9	54.6	23.3	-
HCM Lane LOS	-	-	F	F	C	-
HCM 95th %tile Q(veh)	-	-	13.4	2.4	2.6	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	32.5					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	25	92	1746	219	186	884
Future Vol, veh/h	25	92	1746	219	186	884
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	25	92	1746	219	186	884

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	3112	1856	0	0	1965	0
Stage 1	1856	-	-	-	-	-
Stage 2	1256	-	-	-	-	-
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	~ 13	92	-	-	295	-
Stage 1	136	-	-	-	-	-
Stage 2	268	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 5	92	-	-	295	-
Mov Cap-2 Maneuver	~ 5	-	-	-	-	-
Stage 1	136	-	-	-	-	-
Stage 2	99	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 819.3	0	6.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	5	92	295	-
HCM Lane V/C Ratio	-	-	5	1	0.631	-
HCM Control Delay (s)	-		$ 3183.8	176.8	35.9	-
HCM Lane LOS	-	-	F	F	E	-
HCM 95th %tile Q(veh)	-	-	4.6	5.9	4	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	0.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↳		↰	↑
Traffic Vol, veh/h	0	19	1700	2	4	1051
Future Vol, veh/h	0	19	1700	2	4	1051
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	4	0	0	10
Mvmt Flow	0	19	1700	2	4	1051

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2760	1701	0	0	1702	0
Stage 1	1701	-	-	-	-	-
Stage 2	1059	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	22	115	-	-	379	-
Stage 1	164	-	-	-	-	-
Stage 2	336	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	22	115	-	-	379	-
Mov Cap-2 Maneuver	22	-	-	-	-	-
Stage 1	164	-	-	-	-	-
Stage 2	332	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	42.4	0	0.1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	-	115	379	-
HCM Lane V/C Ratio	-	-	-	0.165	0.011	-
HCM Control Delay (s)	-	-	0	42.4	14.6	-
HCM Lane LOS	-	-	A	E	B	-
HCM 95th %tile Q(veh)	-	-	-	0.6	0	-

Intersection						
Int Delay, s/veh	0.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↳		↰	↑
Traffic Vol, veh/h	1	9	1935	3	10	874
Future Vol, veh/h	1	9	1935	3	10	874
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	9	1935	3	10	874

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2831	1937	0	0	1938	0
Stage 1	1937	-	-	-	-	-
Stage 2	894	-	-	-	-	-
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	19	82	-	-	303	-
Stage 1	123	-	-	-	-	-
Stage 2	399	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	18	82	-	-	303	-
Mov Cap-2 Maneuver	18	-	-	-	-	-
Stage 1	123	-	-	-	-	-
Stage 2	386	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	70.4	0	0.2
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	18	82	303	-
HCM Lane V/C Ratio	-	-	0.056	0.11	0.033	-
HCM Control Delay (s)	-	-	216.5	54.2	17.3	-
HCM Lane LOS	-	-	F	F	C	-
HCM 95th %tile Q(veh)	-	-	0.2	0.4	0.1	-

HCM 2010 Signalized Intersection Summary
3: Reclamation Rd/Lakeville Hwy & Sears Point Rd (SR 37)

12/19/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	581	1798	4	0	1401	809	0	3	0	921	0	159
Future Volume (veh/h)	581	1798	4	0	1401	809	0	3	0	921	0	159
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	10	160	0	0	5	2	0	0	0	14	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	581	1798	4	0	1401	809	0	3	0	970	0	106
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	583	2200	2	1	1453	649	0	7	0	1022	0	722
Arrive On Green	0.17	0.61	0.61	0.00	0.41	0.41	0.00	0.00	0.00	0.29	0.00	0.29
Sat Flow, veh/h	3442	3623	8	1774	3539	1583	0	1863	0	3548	0	1583
Grp Volume(v), veh/h	581	878	924	0	1401	809	0	3	0	970	0	106
Grp Sat Flow(s),veh/h/ln	1721	1770	1861	1774	1770	1583	0	1863	0	1774	0	1583
Q Serve(g_s), s	24.8	56.8	56.8	0.0	56.8	60.5	0.0	0.2	0.0	39.5	0.0	5.7
Cycle Q Clear(g_c), s	24.8	56.8	56.8	0.0	56.8	60.5	0.0	0.2	0.0	39.5	0.0	5.7
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	583	1073	1129	1	1453	649	0	7	0	1022	0	722
V/C Ratio(X)	1.00	0.82	0.82	0.00	0.96	1.25	0.00	0.41	0.00	0.95	0.00	0.15
Avail Cap(c_a), veh/h	585	1076	1132	48	1455	651	0	89	0	1025	0	726
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	61.3	29.0	29.0	0.0	42.8	43.5	0.0	73.3	0.0	52.5	0.0	23.6
Incr Delay (d2), s/veh	36.3	5.7	5.4	0.0	16.0	123.5	0.0	33.0	0.0	17.3	0.0	0.1
Initial Q Delay(d3),s/veh	60.2	186.5	173.3	0.0	2.4	8.8	0.0	0.0	0.0	26.5	0.0	0.1
%ile BackOfQ(50%),veh/ln	19.6	100.8	101.8	0.0	32.1	50.6	0.0	0.2	0.0	26.9	0.0	2.9
LnGrp Delay(d),s/veh	157.8	221.2	207.7	0.0	61.1	175.8	0.0	106.3	0.0	96.3	0.0	23.7
LnGrp LOS	F	F	F		E	F		F		F		C
Approach Vol, veh/h		2383			2210			3			1076	
Approach Delay, s/veh		200.5			103.1			106.3			89.2	
Approach LOS		F			F			F			F	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		4.6	0.0	96.0		46.6	29.0	67.0				
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5				
Max Green Setting (Gmax), s		7.0	4.0	82.0		42.5	25.0	60.5				
Max Q Clear Time (g_c+I1), s		2.2	0.0	58.8		41.5	26.8	62.5				
Green Ext Time (p_c), s		0.0	0.0	23.1		0.6	0.0	0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			141.4									
HCM 2010 LOS			F									
Notes												

HCM 2010 Signalized Intersection Summary
3: Reclamation Rd/Lakeville Hwy & Sears Point Rd (SR 37)

12/19/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1107	2376	15	2	1722	860	3	12	6	889	2	123
Future Volume (veh/h)	1107	2376	15	2	1722	860	3	12	6	889	2	123
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	5	50	0	0	8	2	0	0	0	5	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	1107	2376	15	2	1722	860	3	12	6	928	0	83
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	866	2325	10	4	1382	618	5	19	10	767	0	741
Arrive On Green	0.25	0.64	0.64	0.00	0.39	0.39	0.02	0.02	0.02	0.22	0.00	0.22
Sat Flow, veh/h	3442	3606	23	1774	3539	1583	252	1006	503	3548	0	1583
Grp Volume(v), veh/h	1107	1165	1226	2	1722	860	21	0	0	928	0	83
Grp Sat Flow(s),veh/h/ln	1721	1770	1859	1774	1770	1583	1761	0	0	1774	0	1583
Q Serve(g_s), s	39.0	99.7	99.7	0.2	60.5	60.5	1.8	0.0	0.0	33.5	0.0	4.6
Cycle Q Clear(g_c), s	39.0	99.7	99.7	0.2	60.5	60.5	1.8	0.0	0.0	33.5	0.0	4.6
Prop In Lane	1.00		0.01	1.00		1.00	0.14		0.29	1.00		1.00
Lane Grp Cap(c), veh/h	866	1138	1196	4	1382	618	34	0	0	767	0	741
V/C Ratio(X)	1.28	1.02	1.02	0.53	1.25	1.39	0.62	0.00	0.00	1.21	0.00	0.11
Avail Cap(c_a), veh/h	866	1138	1195	46	1382	618	80	0	0	767	0	741
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	58.0	27.7	27.7	77.2	47.2	47.2	75.4	0.0	0.0	60.7	0.0	23.4
Incr Delay (d2), s/veh	134.1	32.8	32.6	83.2	117.1	185.9	17.1	0.0	0.0	106.5	0.0	0.1
Initial Q Delay(d3),s/veh	16.1	73.9	70.3	0.0	16.5	8.3	0.0	0.0	0.0	19.1	0.0	0.1
%ile BackOfQ(50%),veh/ln	37.2	83.7	86.7	0.2	56.0	60.4	1.1	0.0	0.0	30.2	0.0	2.4
LnGrp Delay(d),s/veh	208.1	134.3	130.5	160.4	180.9	241.5	92.6	0.0	0.0	186.4	0.0	23.5
LnGrp LOS	F	F	F	F	F	F	F			F		C
Approach Vol, veh/h		3498			2584			21			1011	
Approach Delay, s/veh		156.4			201.0			92.6			173.0	
Approach LOS		F			F			F			F	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		7.0	3.8	106.2		38.0	43.0	67.0				
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5				
Max Green Setting (Gmax), s		7.0	4.0	96.0		33.5	39.0	60.5				
Max Q Clear Time (g_c+I1), s		3.8	2.2	101.7		35.5	41.0	62.5				
Green Ext Time (p_c), s		0.0	0.0	0.0		0.0	0.0	0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			174.8									
HCM 2010 LOS			F									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	878	1834	0	0	1655	140	0	0	0	423	0	0
Future Volume (veh/h)	878	1834	0	0	1655	140	0	0	0	423	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	20	400	0	0	20	3	0	0	0	30	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	878	1834	0	0	1655	46	0	0	0	423	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	958	2835	0	1	1783	1021	0	1	0	504	260	0
Arrive On Green	0.27	0.81	0.00	0.00	0.51	0.51	0.00	0.00	0.00	0.13	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	0	1863	0	3548	1863	0
Grp Volume(v), veh/h	878	1834	0	0	1655	46	0	0	0	423	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	0	1863	0	1774	1863	0
Q Serve(g_s), s	41.8	34.6	0.0	0.0	71.7	1.8	0.0	0.0	0.0	19.7	0.0	0.0
Cycle Q Clear(g_c), s	41.8	34.6	0.0	0.0	71.7	1.8	0.0	0.0	0.0	19.7	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	958	2835	0	1	1783	1021	0	1	0	504	260	0
V/C Ratio(X)	0.92	0.65	0.00	0.00	0.93	0.05	0.00	0.00	0.00	0.84	0.00	0.00
Avail Cap(c_a), veh/h	1006	2859	0	42	1859	1041	0	56	0	529	278	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	63.5	17.5	0.0	0.0	42.0	11.1	0.0	0.0	0.0	75.5	0.0	0.0
Incr Delay (d2), s/veh	12.4	1.0	0.0	0.0	9.6	0.1	0.0	0.0	0.0	11.1	0.0	0.0
Initial Q Delay(d3),s/veh	37.5	348.9	0.0	0.0	12.6	0.1	0.0	0.0	0.0	142.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	29.9	205.1	0.0	0.0	46.1	1.7	0.0	0.0	0.0	23.0	0.0	0.0
LnGrp Delay(d),s/veh	113.4	367.4	0.0	0.0	64.2	11.2	0.0	0.0	0.0	228.6	0.0	0.0
LnGrp LOS	F	F			E	B				F		
Approach Vol, veh/h		2712			1701			0			423	
Approach Delay, s/veh		285.2			62.8			0.0			228.6	
Approach LOS		F			E						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		0.0	0.0	141.4		26.2	49.5	91.9
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		5.0	4.0	133.5		25.0	49.0	88.0
Max Q Clear Time (g_c+I1), s		0.0	0.0	36.6		21.7	43.8	73.7
Green Ext Time (p_c), s		0.0	0.0	95.9		0.5	1.7	12.2

Intersection Summary	
HCM 2010 Ctrl Delay	202.0
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1310	1847	0	0	1728	199	1	0	0	123	0	0
Future Volume (veh/h)	1310	1847	0	0	1728	199	1	0	0	123	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	15	200	0	0	50	3	0	0	0	10	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	1310	1847	0	0	1728	63	1	0	0	123	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	1306	3140	0	1	1718	831	2	0	0	139	73	0
Arrive On Green	0.38	0.89	0.00	0.00	0.49	0.49	0.00	0.00	0.00	0.04	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	1774	0	0	3548	1863	0
Grp Volume(v), veh/h	1310	1847	0	0	1728	63	1	0	0	123	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	1774	0	0	1774	1863	0
Q Serve(g_s), s	68.0	22.0	0.0	0.0	87.0	3.5	0.1	0.0	0.0	6.2	0.0	0.0
Cycle Q Clear(g_c), s	68.0	22.0	0.0	0.0	87.0	3.5	0.1	0.0	0.0	6.2	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	1306	3140	0	1	1718	831	2	0	0	139	73	0
V/C Ratio(X)	1.00	0.59	0.00	0.00	1.01	0.08	0.52	0.00	0.00	0.89	0.00	0.00
Avail Cap(c_a), veh/h	1306	3140	0	40	1718	831	50	0	0	139	73	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	55.6	7.2	0.0	0.0	46.1	21.4	89.5	0.0	0.0	86.1	0.0	0.0
Incr Delay (d2), s/veh	25.6	0.7	0.0	0.0	23.1	0.1	134.9	0.0	0.0	44.8	0.0	0.0
Initial Q Delay(d3),s/veh	40.3	70.9	0.0	0.0	98.1	0.1	0.0	0.0	0.0	209.1	0.0	0.0
%ile BackOfQ(50%),veh/ln	44.4	81.4	0.0	0.0	73.0	2.3	0.1	0.0	0.0	8.3	0.0	0.0
LnGrp Delay(d),s/veh	121.6	78.7	0.0	0.0	167.3	21.6	224.3	0.0	0.0	339.9	0.0	0.0
LnGrp LOS	F	E			F	C	F			F		
Approach Vol, veh/h		3157			1791			1			123	
Approach Delay, s/veh		96.5			162.2			224.3			339.9	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.2	0.0	165.0		11.0	72.0	93.0
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		5.0	4.0	151.5		7.0	68.0	87.0
Max Q Clear Time (g_c+I1), s		2.1	0.0	24.0		8.2	70.0	89.0
Green Ext Time (p_c), s		0.0	0.0	126.6		0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	125.6
HCM 2010 LOS	F

Notes

Intersection												
Int Delay, s/veh	0.1											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	1	0	3	0	730	0	0	1042	0
Future Vol, veh/h	0	0	0	1	0	3	0	730	0	0	1042	0
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	3	0	730	0	0	1042	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1772	1772	1042	1772	1772	730	-	0	0	730	0	0
Stage 1	1042	1042	-	730	730	-	-	-	-	-	-	-
Stage 2	730	730	-	1042	1042	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	-	-	-	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	-	-
Pot Cap-1 Maneuver	65	83	279	65	83	422	0	-	-	874	-	-
Stage 1	277	307	-	414	428	-	0	-	-	-	-	-
Stage 2	414	428	-	277	307	-	0	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	65	83	279	65	83	422	-	-	-	874	-	-
Mov Cap-2 Maneuver	65	83	-	65	83	-	-	-	-	-	-	-
Stage 1	277	307	-	414	428	-	-	-	-	-	-	-
Stage 2	411	428	-	277	307	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	25.5	0	0
HCM LOS	A	D		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	-	-	-	65	422	874	-	-
HCM Lane V/C Ratio	-	-	-	0.015	0.007	-	-	-
HCM Control Delay (s)	-	-	0	61.2	13.6	0	-	-
HCM Lane LOS	-	-	A	F	B	A	-	-
HCM 95th %tile Q(veh)	-	-	-	0	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	0	0	0	1	0	22	0	1391	18	8	762	0
Future Vol, veh/h	0	0	0	1	0	22	0	1391	18	8	762	0
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	22	0	1391	18	8	762	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2178	2187	762	2178	2178	1400	762	0	0	1409	0	0
Stage 1	778	778	-	1400	1400	-	-	-	-	-	-	-
Stage 2	1400	1409	-	778	778	-	-	-	-	-	-	-
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	33	46	405	33	46	172	850	-	-	484	-	-
Stage 1	389	407	-	174	207	-	-	-	-	-	-	-
Stage 2	174	205	-	389	407	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	28	45	405	33	45	172	850	-	-	484	-	-
Mov Cap-2 Maneuver	28	45	-	33	45	-	-	-	-	-	-	-
Stage 1	389	400	-	174	207	-	-	-	-	-	-	-
Stage 2	152	205	-	383	400	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	32.8	0	0.1
HCM LOS	A	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	850	-	-	-	33	172	484	-	-
HCM Lane V/C Ratio	-	-	-	-	0.03	0.128	0.017	-	-
HCM Control Delay (s)	0	-	-	0	117.5	29	12.6	-	-
HCM Lane LOS	A	-	-	A	F	D	B	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0.1	0.4	0.1	-	-

HCM 2010 TWSC
1: Lakeville Hwy/Lakeville Hwy (SR 116) & Stage Gulch Rd (SR 116)

12/19/2016

Intersection						
Int Delay, s/veh	297					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	95	70	1418	265	187	1040
Future Vol, veh/h	95	70	1418	265	187	1040
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	7	5	2	4	9
Mvmt Flow	95	70	1418	265	187	1040

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2965	1551	0	0	1683	0
Stage 1	1551	-	-	-	-	-
Stage 2	1414	-	-	-	-	-
Critical Hdwy	7.1	6.27	-	-	4.14	-
Critical Hdwy Stg 1	6.1	-	-	-	-	-
Critical Hdwy Stg 2	6.1	-	-	-	-	-
Follow-up Hdwy	3.5	3.363	-	-	2.236	-
Pot Cap-1 Maneuver	~ 9	136	-	-	375	-
Stage 1	144	-	-	-	-	-
Stage 2	172	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 5	136	-	-	375	-
Mov Cap-2 Maneuver	~ 5	-	-	-	-	-
Stage 1	144	-	-	-	-	-
Stage 2	~ 86	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 5507.9	0	3.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	5	136	375	-
HCM Lane V/C Ratio	-	-	19	0.515	0.499	-
HCM Control Delay (s)	-		$ 9524.6	56.6	23.8	-
HCM Lane LOS	-	-	F	F	C	-
HCM 95th %tile Q(veh)	-	-	13.8	2.5	2.7	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 2010 TWSC
1: Lakeville Hwy/Lakeville Hwy (SR116) & Stage Gulch Rd (SR 116)

12/19/2016

Intersection						
Int Delay, s/veh	39.5					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	25	92	1790	219	186	928
Future Vol, veh/h	25	92	1790	219	186	928
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	25	92	1790	219	186	928

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	3200	1900	0	0	2009	0
Stage 1	1900	-	-	-	-	-
Stage 2	1300	-	-	-	-	-
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	~ 11	~ 86	-	-	284	-
Stage 1	129	-	-	-	-	-
Stage 2	255	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 4	~ 86	-	-	284	-
Mov Cap-2 Maneuver	~ 4	-	-	-	-	-
Stage 1	129	-	-	-	-	-
Stage 2	88	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 1030.7	0	6.5
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	4	86	284	-
HCM Lane V/C Ratio	-	-	6.25	1.07	0.655	-
HCM Control Delay (s)	-		$ 4067.8	205.4	38.8	-
HCM Lane LOS	-	-	F	F	E	-
HCM 95th %tile Q(veh)	-	-	4.6	6.3	4.2	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 2010 TWSC
2: Lakeville Hwy & Cannon Lane

Intersection						
Int Delay, s/veh	1.1					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↱		↰	↑
Traffic Vol, veh/h	4	36	1700	8	31	1051
Future Vol, veh/h	4	36	1700	8	31	1051
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	0	4	0	0	10
Mvmt Flow	4	36	1700	8	31	1051

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2817	1704	0	0	1708	0
Stage 1	1704	-	-	-	-	-
Stage 2	1113	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	20	115	-	-	377	-
Stage 1	163	-	-	-	-	-
Stage 2	317	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	18	115	-	-	377	-
Mov Cap-2 Maneuver	18	-	-	-	-	-
Stage 1	163	-	-	-	-	-
Stage 2	291	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	70.5	0	0.4
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	18	115	377	-
HCM Lane V/C Ratio	-	-	0.222	0.313	0.082	-
HCM Control Delay (s)	-	-	255	50	15.4	-
HCM Lane LOS	-	-	F	F	C	-
HCM 95th %tile Q(veh)	-	-	0.6	1.2	0.3	-

HCM 2010 TWSC
2: Lakeville Hwy & Cannon Lane

Intersection						
Int Delay, s/veh	4.3					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↱		↰	↑
Traffic Vol, veh/h	11	53	1935	13	54	874
Future Vol, veh/h	11	53	1935	13	54	874
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	53	1935	13	54	874

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2924	1942	0	0	1948	0
Stage 1	1942	-	-	-	-	-
Stage 2	982	-	-	-	-	-
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	17	81	-	-	300	-
Stage 1	123	-	-	-	-	-
Stage 2	363	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	14	81	-	-	300	-
Mov Cap-2 Maneuver	14	-	-	-	-	-
Stage 1	123	-	-	-	-	-
Stage 2	298	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	180.3	0	1.1
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	14	81	300	-
HCM Lane V/C Ratio	-	-	0.786	0.654	0.18	-
HCM Control Delay (s)	-	$	519.3	110	19.6	-
HCM Lane LOS	-	-	F	F	C	-
HCM 95th %tile Q(veh)	-	-	1.9	3	0.6	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	587	1798	4	0	1401	809	0	3	0	921	0	163
Future Volume (veh/h)	587	1798	4	0	1401	809	0	3	0	921	0	163
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	10	160	0	0	5	2	0	0	0	14	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	587	1798	4	0	1401	809	0	3	0	972	0	109
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	583	2200	2	1	1453	649	0	7	0	1022	0	722
Arrive On Green	0.17	0.61	0.61	0.00	0.41	0.41	0.00	0.00	0.00	0.29	0.00	0.29
Sat Flow, veh/h	3442	3623	8	1774	3539	1583	0	1863	0	3548	0	1583
Grp Volume(v), veh/h	587	878	924	0	1401	809	0	3	0	972	0	109
Grp Sat Flow(s),veh/h/ln	1721	1770	1861	1774	1770	1583	0	1863	0	1774	0	1583
Q Serve(g_s), s	25.0	56.8	56.9	0.0	56.8	60.5	0.0	0.2	0.0	39.6	0.0	5.9
Cycle Q Clear(g_c), s	25.0	56.8	56.9	0.0	56.8	60.5	0.0	0.2	0.0	39.6	0.0	5.9
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		1.00
Lane Grp Cap(c), veh/h	583	1073	1129	1	1453	649	0	7	0	1022	0	722
V/C Ratio(X)	1.01	0.82	0.82	0.00	0.96	1.25	0.00	0.41	0.00	0.95	0.00	0.15
Avail Cap(c_a), veh/h	584	1076	1132	48	1454	651	0	89	0	1024	0	726
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	61.3	29.0	29.0	0.0	42.8	43.5	0.0	73.3	0.0	52.5	0.0	23.6
Incr Delay (d2), s/veh	39.0	5.7	5.4	0.0	16.1	123.5	0.0	33.0	0.0	17.6	0.0	0.1
Initial Q Delay(d3),s/veh	59.5	186.5	173.3	0.0	2.4	8.8	0.0	0.0	0.0	27.4	0.0	0.1
%ile BackOfQ(50%),veh/ln	20.0	100.8	101.8	0.0	32.2	50.6	0.0	0.2	0.0	27.1	0.0	3.0
LnGrp Delay(d),s/veh	159.7	221.2	207.7	0.0	61.2	175.8	0.0	106.3	0.0	97.6	0.0	23.8
LnGrp LOS	F	F	F		E	F		F		F		C
Approach Vol, veh/h		2389			2210			3			1081	
Approach Delay, s/veh		200.9			103.2			106.3			90.1	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		4.6	0.0	96.0		46.6	29.0	67.0
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		7.0	4.0	82.0		42.5	25.0	60.5
Max Q Clear Time (g_c+I1), s		2.2	0.0	58.9		41.6	27.0	62.5
Green Ext Time (p_c), s		0.0	0.0	23.0		0.5	0.0	0.0

Intersection Summary		
HCM 2010 Ctrl Delay		141.8
HCM 2010 LOS		F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1117	2376	15	2	1722	860	3	12	6	889	2	133
Future Volume (veh/h)	1117	2376	15	2	1722	860	3	12	6	889	2	133
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	5	50	0	0	8	2	0	0	0	5	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	1117	2376	15	2	1722	860	3	12	6	931	0	89
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	866	2325	10	4	1382	618	5	19	10	767	0	741
Arrive On Green	0.25	0.64	0.64	0.00	0.39	0.39	0.02	0.02	0.02	0.22	0.00	0.22
Sat Flow, veh/h	3442	3606	23	1774	3539	1583	252	1006	503	3548	0	1583
Grp Volume(v), veh/h	1117	1165	1226	2	1722	860	21	0	0	931	0	89
Grp Sat Flow(s),veh/h/ln	1721	1770	1859	1774	1770	1583	1761	0	0	1774	0	1583
Q Serve(g_s), s	39.0	99.7	99.7	0.2	60.5	60.5	1.8	0.0	0.0	33.5	0.0	4.9
Cycle Q Clear(g_c), s	39.0	99.7	99.7	0.2	60.5	60.5	1.8	0.0	0.0	33.5	0.0	4.9
Prop In Lane	1.00		0.01	1.00		1.00	0.14		0.29	1.00		1.00
Lane Grp Cap(c), veh/h	866	1138	1196	4	1382	618	34	0	0	767	0	741
V/C Ratio(X)	1.29	1.02	1.02	0.53	1.25	1.39	0.62	0.00	0.00	1.21	0.00	0.12
Avail Cap(c_a), veh/h	866	1138	1195	46	1382	618	80	0	0	767	0	741
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	58.0	27.7	27.7	77.2	47.2	47.2	75.4	0.0	0.0	60.7	0.0	23.5
Incr Delay (d2), s/veh	139.0	32.8	32.6	83.2	117.1	185.9	17.1	0.0	0.0	108.1	0.0	0.1
Initial Q Delay(d3),s/veh	15.9	73.9	70.3	0.0	16.5	8.3	0.0	0.0	0.0	19.1	0.0	0.1
%ile BackOfQ(50%),veh/ln	37.7	83.7	86.7	0.2	56.0	60.4	1.1	0.0	0.0	30.4	0.0	2.5
LnGrp Delay(d),s/veh	213.0	134.3	130.5	160.4	180.9	241.5	92.6	0.0	0.0	187.9	0.0	23.6
LnGrp LOS	F	F	F	F	F	F	F			F		C
Approach Vol, veh/h		3508			2584			21			1020	
Approach Delay, s/veh		158.0			201.0			92.6			173.6	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		7.0	3.8	106.2		38.0	43.0	67.0
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		7.0	4.0	96.0		33.5	39.0	60.5
Max Q Clear Time (g_c+I1), s		3.8	2.2	101.7		35.5	41.0	62.5
Green Ext Time (p_c), s		0.0	0.0	0.0		0.0	0.0	0.0

Intersection Summary		
HCM 2010 Ctrl Delay		175.6
HCM 2010 LOS		F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	878	1834	0	0	1655	142	0	0	0	424	0	0
Future Volume (veh/h)	878	1834	0	0	1655	142	0	0	0	424	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	20	400	0	0	20	3	0	0	0	30	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	878	1834	0	0	1655	48	0	0	0	424	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	958	2835	0	1	1783	1021	0	1	0	504	260	0
Arrive On Green	0.27	0.81	0.00	0.00	0.51	0.51	0.00	0.00	0.00	0.13	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	0	1863	0	3548	1863	0
Grp Volume(v), veh/h	878	1834	0	0	1655	48	0	0	0	424	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	0	1863	0	1774	1863	0
Q Serve(g_s), s	41.8	34.7	0.0	0.0	71.8	1.9	0.0	0.0	0.0	19.7	0.0	0.0
Cycle Q Clear(g_c), s	41.8	34.7	0.0	0.0	71.8	1.9	0.0	0.0	0.0	19.7	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	0.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	958	2835	0	1	1783	1021	0	1	0	504	260	0
V/C Ratio(X)	0.92	0.65	0.00	0.00	0.93	0.05	0.00	0.00	0.00	0.84	0.00	0.00
Avail Cap(c_a), veh/h	1006	2858	0	42	1858	1041	0	56	0	529	278	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	63.5	17.5	0.0	0.0	42.0	11.1	0.0	0.0	0.0	75.5	0.0	0.0
Incr Delay (d2), s/veh	12.4	1.0	0.0	0.0	9.6	0.1	0.0	0.0	0.0	11.3	0.0	0.0
Initial Q Delay(d3),s/veh	37.5	348.9	0.0	0.0	12.6	0.1	0.0	0.0	0.0	142.9	0.0	0.0
%ile BackOfQ(50%),veh/ln	29.9	205.1	0.0	0.0	46.1	1.8	0.0	0.0	0.0	23.0	0.0	0.0
LnGrp Delay(d),s/veh	113.4	367.4	0.0	0.0	64.3	11.2	0.0	0.0	0.0	229.6	0.0	0.0
LnGrp LOS	F	F			E	B				F		
Approach Vol, veh/h		2712			1703			0			424	
Approach Delay, s/veh		285.2			62.8			0.0			229.6	
Approach LOS		F			E						F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		0.0	0.0	141.4		26.2	49.5	91.9
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		5.0	4.0	133.5		25.0	49.0	88.0
Max Q Clear Time (g_c+I1), s		0.0	0.0	36.7		21.7	43.8	73.8
Green Ext Time (p_c), s		0.0	0.0	95.9		0.5	1.7	12.1

Intersection Summary	
HCM 2010 Ctrl Delay	202.0
HCM 2010 LOS	F

Notes

HCM 2010 Signalized Intersection Summary
4: Tolay Creek Rd/Arnold Dr (SR 121) & Sears Point Rd (SR 37) 12/19/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1310	1847	0	0	1728	202	1	0	0	126	0	0
Future Volume (veh/h)	1310	1847	0	0	1728	202	1	0	0	126	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	15	200	0	0	50	3	0	0	0	10	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	1310	1847	0	0	1728	66	1	0	0	126	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	1306	3140	0	1	1718	831	2	0	0	139	73	0
Arrive On Green	0.38	0.89	0.00	0.00	0.49	0.49	0.00	0.00	0.00	0.04	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	1774	0	0	3548	1863	0
Grp Volume(v), veh/h	1310	1847	0	0	1728	66	1	0	0	126	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	1774	0	0	1774	1863	0
Q Serve(g_s), s	68.0	22.0	0.0	0.0	87.0	3.7	0.1	0.0	0.0	6.3	0.0	0.0
Cycle Q Clear(g_c), s	68.0	22.0	0.0	0.0	87.0	3.7	0.1	0.0	0.0	6.3	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	1306	3140	0	1	1718	831	2	0	0	139	73	0
V/C Ratio(X)	1.00	0.59	0.00	0.00	1.01	0.08	0.52	0.00	0.00	0.91	0.00	0.00
Avail Cap(c_a), veh/h	1306	3140	0	40	1718	831	50	0	0	139	73	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	55.6	7.2	0.0	0.0	46.1	21.4	89.5	0.0	0.0	86.1	0.0	0.0
Incr Delay (d2), s/veh	25.6	0.7	0.0	0.0	23.1	0.1	134.9	0.0	0.0	50.1	0.0	0.0
Initial Q Delay(d3),s/veh	40.3	70.9	0.0	0.0	98.1	0.1	0.0	0.0	0.0	218.8	0.0	0.0
%ile BackOfQ(50%),veh/ln	44.4	81.4	0.0	0.0	73.0	2.4	0.1	0.0	0.0	8.6	0.0	0.0
LnGrp Delay(d),s/veh	121.6	78.7	0.0	0.0	167.3	21.7	224.3	0.0	0.0	355.0	0.0	0.0
LnGrp LOS	F	E			F	C	F			F		
Approach Vol, veh/h		3157			1794			1			126	
Approach Delay, s/veh		96.5			161.9			224.3			355.0	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.2	0.0	165.0		11.0	72.0	93.0
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		5.0	4.0	151.5		7.0	68.0	87.0
Max Q Clear Time (g_c+I1), s		2.1	0.0	24.0		8.3	70.0	89.0
Green Ext Time (p_c), s		0.0	0.0	126.6		0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	126.1
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	1	1	0	3	2	730	0	0	1042	6
Future Vol, veh/h	4	0	1	1	0	3	2	730	0	0	1042	6
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	0	1	1	0	3	2	730	0	0	1042	6

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1779	1779	1045	1780	1782	730	1048	0	0	730	0	0
Stage 1	1045	1045	-	734	734	-	-	-	-	-	-	-
Stage 2	734	734	-	1046	1048	-	-	-	-	-	-	-
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	64	82	278	64	82	422	664	-	-	874	-	-
Stage 1	276	306	-	412	426	-	-	-	-	-	-	-
Stage 2	412	426	-	276	305	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	63	82	278	64	82	422	664	-	-	874	-	-
Mov Cap-2 Maneuver	63	82	-	64	82	-	-	-	-	-	-	-
Stage 1	275	306	-	410	424	-	-	-	-	-	-	-
Stage 2	407	424	-	275	305	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	56.4	25.7	0	0
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	664	-	-	75	64	422	874	-	-
HCM Lane V/C Ratio	0.003	-	-	0.067	0.016	0.007	-	-	-
HCM Control Delay (s)	10.4	-	-	56.4	62.1	13.6	0	-	-
HCM Lane LOS	B	-	-	F	F	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0	0	0	-	-

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	10	0	3	1	0	22	3	1391	18	8	762	10
Future Vol, veh/h	10	0	3	1	0	22	3	1391	18	8	762	10
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	0	3	1	0	22	3	1391	18	8	762	10

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2189	2198	767	2191	2194	1400	772	0	0	1409	0	0
Stage 1	783	783	-	1406	1406	-	-	-	-	-	-	-
Stage 2	1406	1415	-	785	788	-	-	-	-	-	-	-
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	33	45	402	33	45	172	843	-	-	484	-	-
Stage 1	387	404	-	172	206	-	-	-	-	-	-	-
Stage 2	172	204	-	386	402	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	28	44	402	32	44	172	843	-	-	484	-	-
Mov Cap-2 Maneuver	28	44	-	32	44	-	-	-	-	-	-	-
Stage 1	380	397	-	169	202	-	-	-	-	-	-	-
Stage 2	147	201	-	377	395	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	153.4	33	0	0.1
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	843	-	-	36	32	172	484	-	-
HCM Lane V/C Ratio	0.004	-	-	0.361	0.031	0.128	0.017	-	-
HCM Control Delay (s)	9.3	0	-	153.4	121.1	29	12.6	-	-
HCM Lane LOS	A	A	-	F	F	D	B	-	-
HCM 95th %tile Q(veh)	0	-	-	1.2	0.1	0.4	0.1	-	-

HCM 2010 TWSC
1: Lakeville Hwy/Lakeville Hwy (SR116) & Stage Gulch Rd (SR 116)

Intersection						
Int Delay, s/veh	14.1					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↳		↰	↑
Traffic Vol, veh/h	40	69	1385	183	138	746
Future Vol, veh/h	40	69	1385	183	138	746
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	40	69	1385	183	138	746

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2499	1477	0	0	1568	0
Stage 1	1477	-	-	-	-	-
Stage 2	1022	-	-	-	-	-
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	~ 32	155	-	-	421	-
Stage 1	209	-	-	-	-	-
Stage 2	347	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 22	155	-	-	421	-
Mov Cap-2 Maneuver	~ 22	-	-	-	-	-
Stage 1	209	-	-	-	-	-
Stage 2	233	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 308.6	0	2.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	22	155	421	-
HCM Lane V/C Ratio	-	-	1.818	0.445	0.328	-
HCM Control Delay (s)	-	-	$ 762.3	45.6	17.7	-
HCM Lane LOS	-	-	F	E	C	-
HCM 95th %tile Q(veh)	-	-	5.2	2	1.4	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

HCM 2010 TWSC
1: Lakeville Hwy/Lakeville Hwy (SR116) & Stage Gulch Rd (SR 116)

Intersection						
Int Delay, s/veh	50.4					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↳		↰	↑
Traffic Vol, veh/h	25	92	1837	219	186	975
Future Vol, veh/h	25	92	1837	219	186	975
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	60	-	-	100	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	25	92	1837	219	186	975

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	3294	1947	0	0	2056	0
Stage 1	1947	-	-	-	-	-
Stage 2	1347	-	-	-	-	-
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	~ 10	~ 81	-	-	272	-
Stage 1	122	-	-	-	-	-
Stage 2	242	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 3	~ 81	-	-	272	-
Mov Cap-2 Maneuver	~ 3	-	-	-	-	-
Stage 1	122	-	-	-	-	-
Stage 2	77	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 1368.1	0	6.8
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	3	81	272	-
HCM Lane V/C Ratio	-	-	8.333	1.136	0.684	-
HCM Control Delay (s)	-	$ 5542.5	233.8	42.7		-
HCM Lane LOS	-	-	F	F	E	-
HCM 95th %tile Q(veh)	-	-	4.7	6.6	4.6	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection						
Int Delay, s/veh	8.6					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	29	119	1434	30	120	648
Future Vol, veh/h	29	119	1434	30	120	648
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	29	119	1434	30	120	648

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	2337	1449	0	0	1464	0
Stage 1	1449	-	-	-	-	-
Stage 2	888	-	-	-	-	-
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	40	161	-	-	461	-
Stage 1	216	-	-	-	-	-
Stage 2	402	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	30	161	-	-	461	-
Mov Cap-2 Maneuver	30	-	-	-	-	-
Stage 1	216	-	-	-	-	-
Stage 2	297	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	126.5	0	2.4
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	30	161	461	-
HCM Lane V/C Ratio	-	-	0.967	0.739	0.26	-
HCM Control Delay (s)	-	-	$ 346.1	73	15.5	-
HCM Lane LOS	-	-	F	F	C	-
HCM 95th %tile Q(veh)	-	-	3.2	4.6	1	-

Intersection						
Int Delay, s/veh	18.8					

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	22	100	1935	24	101	874
Future Vol, veh/h	22	100	1935	24	101	874
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	50	-	-	180	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	22	100	1935	24	101	874

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	3023	1947	0	0	1959	0
Stage 1	1947	-	-	-	-	-
Stage 2	1076	-	-	-	-	-
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	~ 15	~ 81	-	-	297	-
Stage 1	122	-	-	-	-	-
Stage 2	327	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 10	~ 81	-	-	297	-
Mov Cap-2 Maneuver	~ 10	-	-	-	-	-
Stage 1	122	-	-	-	-	-
Stage 2	216	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 452.3	0	2.4
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	10	81	297	-
HCM Lane V/C Ratio	-	-	2.2	1.235	0.34	-
HCM Control Delay (s)	-	$ 1290.2		268	23.2	-
HCM Lane LOS	-	-	F	F	C	-
HCM 95th %tile Q(veh)	-	-	3.7	7.4	1.5	-

Notes
~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	832	1717	11	1	1244	637	2	9	4	649	1	110
Future Volume (veh/h)	832	1717	11	1	1244	637	2	9	4	649	1	110
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	5	50	0	0	8	2	0	0	0	5	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	832	1717	11	1	1244	637	2	9	4	684	0	74
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	612	2074	9	2	1417	595	4	17	7	814	0	673
Arrive On Green	0.20	0.62	0.62	0.00	0.41	0.41	0.02	0.02	0.02	0.23	0.00	0.23
Sat Flow, veh/h	3442	3605	23	1774	3539	1583	236	1061	471	3548	0	1583
Grp Volume(v), veh/h	832	842	886	1	1244	637	15	0	0	684	0	74
Grp Sat Flow(s),veh/h/ln	1721	1770	1859	1774	1770	1583	1768	0	0	1774	0	1583
Q Serve(g_s), s	26.0	45.7	45.8	0.1	41.5	51.6	1.1	0.0	0.0	24.2	0.0	3.7
Cycle Q Clear(g_c), s	26.0	45.7	45.8	0.1	41.5	51.6	1.1	0.0	0.0	24.2	0.0	3.7
Prop In Lane	1.00		0.01	1.00		1.00	0.13		0.27	1.00		1.00
Lane Grp Cap(c), veh/h	612	1015	1071	2	1417	595	28	0	0	814	0	673
V/C Ratio(X)	1.36	0.83	0.83	0.52	0.88	1.07	0.54	0.00	0.00	0.84	0.00	0.11
Avail Cap(c_a), veh/h	684	1090	1145	190	1487	665	203	0	0	1193	0	847
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	60.1	28.3	27.9	69.5	38.7	45.6	68.0	0.0	0.0	48.8	0.0	22.9
Incr Delay (d2), s/veh	172.5	6.0	5.7	133.5	6.7	56.2	15.0	0.0	0.0	4.1	0.0	0.1
Initial Q Delay(d3),s/veh	21.3	25.6	22.7	0.0	1.9	11.2	0.0	0.0	0.0	1.7	0.0	0.1
%ile BackOfQ(50%),veh/ln	29.5	43.4	44.1	0.1	24.3	35.3	0.7	0.0	0.0	13.0	0.0	2.0
LnGrp Delay(d),s/veh	253.9	60.0	56.2	203.0	47.3	113.1	83.1	0.0	0.0	54.5	0.0	23.1
LnGrp LOS	F	E	E	F	D	F	F			D		C
Approach Vol, veh/h		2560			1882			15			758	
Approach Delay, s/veh		121.7			69.6			83.1			51.5	
Approach LOS		F			E			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		6.1	3.6	87.1		34.0	30.0	60.8
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		15.0	14.0	67.5		44.0	26.0	55.0
Max Q Clear Time (g_c+I1), s		3.1	2.1	47.8		26.2	28.0	53.6
Green Ext Time (p_c), s		0.0	0.0	19.6		3.3	0.0	0.7

Intersection Summary		
HCM 2010 Ctrl Delay		92.6
HCM 2010 LOS		F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1128	2376	15	2	1722	860	3	12	6	889	2	144
Future Volume (veh/h)	1128	2376	15	2	1722	860	3	12	6	889	2	144
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	5	50	0	0	8	2	0	0	0	5	0	2
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	1128	2376	15	2	1722	860	3	12	6	935	0	97
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	0	1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	866	2325	10	4	1382	618	5	19	10	767	0	741
Arrive On Green	0.25	0.64	0.64	0.00	0.39	0.39	0.02	0.02	0.02	0.22	0.00	0.22
Sat Flow, veh/h	3442	3606	23	1774	3539	1583	252	1006	503	3548	0	1583
Grp Volume(v), veh/h	1128	1165	1226	2	1722	860	21	0	0	935	0	97
Grp Sat Flow(s),veh/h/ln	1721	1770	1859	1774	1770	1583	1761	0	0	1774	0	1583
Q Serve(g_s), s	39.0	99.7	99.7	0.2	60.5	60.5	1.8	0.0	0.0	33.5	0.0	5.4
Cycle Q Clear(g_c), s	39.0	99.7	99.7	0.2	60.5	60.5	1.8	0.0	0.0	33.5	0.0	5.4
Prop In Lane	1.00		0.01	1.00		1.00	0.14		0.29	1.00		1.00
Lane Grp Cap(c), veh/h	866	1138	1196	4	1382	618	34	0	0	767	0	741
V/C Ratio(X)	1.30	1.02	1.02	0.53	1.25	1.39	0.62	0.00	0.00	1.22	0.00	0.13
Avail Cap(c_a), veh/h	866	1138	1195	46	1382	618	80	0	0	767	0	741
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	58.0	27.7	27.7	77.2	47.2	47.2	75.4	0.0	0.0	60.7	0.0	23.6
Incr Delay (d2), s/veh	144.5	32.8	32.6	83.2	117.1	185.9	17.1	0.0	0.0	110.3	0.0	0.1
Initial Q Delay(d3),s/veh	15.8	73.9	70.3	0.0	16.5	8.3	0.0	0.0	0.0	19.0	0.0	0.1
%ile BackOfQ(50%),veh/ln	38.4	83.7	86.7	0.2	56.0	60.4	1.1	0.0	0.0	30.7	0.0	2.8
LnGrp Delay(d),s/veh	218.3	134.3	130.5	160.4	180.9	241.5	92.6	0.0	0.0	190.0	0.0	23.8
LnGrp LOS	F	F	F	F	F	F	F			F		C
Approach Vol, veh/h		3519			2584			21			1032	
Approach Delay, s/veh		159.9			201.0			92.6			174.4	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		7.0	3.8	106.2		38.0	43.0	67.0
Change Period (Y+Rc), s		4.0	3.5	6.5		4.5	4.0	6.5
Max Green Setting (Gmax), s		7.0	4.0	96.0		33.5	39.0	60.5
Max Q Clear Time (g_c+I1), s		3.8	2.2	101.7		35.5	41.0	62.5
Green Ext Time (p_c), s		0.0	0.0	0.0		0.0	0.0	0.0

Intersection Summary		
HCM 2010 Ctrl Delay		176.6
HCM 2010 LOS		F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	985	1342	0	0	1256	150	1	0	0	89	0	0
Future Volume (veh/h)	985	1342	0	0	1256	150	1	0	0	89	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	15	200	0	0	50	3	0	0	0	10	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	985	1342	0	0	1256	14	1	0	0	89	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	917	2432	0	1	1286	839	2	0	0	187	319	0
Arrive On Green	0.32	0.84	0.00	0.00	0.49	0.49	0.00	0.00	0.00	0.04	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	1774	0	0	3548	1863	0
Grp Volume(v), veh/h	985	1342	0	0	1256	14	1	0	0	89	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	1774	0	0	1774	1863	0
Q Serve(g_s), s	30.8	10.9	0.0	0.0	31.8	0.5	0.1	0.0	0.0	2.8	0.0	0.0
Cycle Q Clear(g_c), s	30.8	10.9	0.0	0.0	31.8	0.5	0.1	0.0	0.0	2.8	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	917	2432	0	1	1286	839	2	0	0	187	319	0
V/C Ratio(X)	1.07	0.55	0.00	0.00	0.98	0.02	0.52	0.00	0.00	0.48	0.00	0.00
Avail Cap(c_a), veh/h	1343	2978	0	220	1883	909	299	0	0	1385	727	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	60.6	23.9	0.0	0.0	52.6	12.7	71.4	0.0	0.0	53.4	0.0	0.0
Incr Delay (d2), s/veh	45.6	0.7	0.0	0.0	18.4	0.0	133.6	0.0	0.0	1.9	0.0	0.0
Initial Q Delay(d3),s/veh	53.0	108.7	0.0	0.0	129.7	0.1	0.0	0.0	0.0	39.4	0.0	0.0
%ile BackOfQ(50%),veh/ln	34.2	81.0	0.0	0.0	55.7	0.8	0.1	0.0	0.0	3.4	0.0	0.0
LnGrp Delay(d),s/veh	159.2	133.4	0.0	0.0	200.6	12.9	205.0	0.0	0.0	94.7	0.0	0.0
LnGrp LOS	F	F			F	B	F			F		
Approach Vol, veh/h		2327			1270			1			89	
Approach Delay, s/veh		144.3			198.6			204.9			94.7	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.1	0.0	100.9		8.8	40.0	60.9
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		19.0	14.0	90.5		44.0	44.0	60.0
Max Q Clear Time (g_c+I1), s		2.1	0.0	12.9		4.8	32.8	33.8
Green Ext Time (p_c), s		0.0	0.0	74.0		0.3	3.2	21.0

Intersection Summary	
HCM 2010 Ctrl Delay	161.8
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1310	1847	0	0	1728	206	1	0	0	130	0	0
Future Volume (veh/h)	1310	1847	0	0	1728	206	1	0	0	130	0	0
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	15	200	0	0	50	3	0	0	0	10	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1900	1863	1900	1863	1863	0
Adj Flow Rate, veh/h	1310	1847	0	0	1728	70	1	0	0	130	0	0
Adj No. of Lanes	2	2	0	1	2	1	0	1	0	2	1	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	0
Cap, veh/h	1306	3140	0	1	1718	831	2	0	0	139	73	0
Arrive On Green	0.38	0.89	0.00	0.00	0.49	0.49	0.00	0.00	0.00	0.04	0.00	0.00
Sat Flow, veh/h	3442	3632	0	1774	3539	1583	1774	0	0	3548	1863	0
Grp Volume(v), veh/h	1310	1847	0	0	1728	70	1	0	0	130	0	0
Grp Sat Flow(s),veh/h/ln	1721	1770	0	1774	1770	1583	1774	0	0	1774	1863	0
Q Serve(g_s), s	68.0	22.0	0.0	0.0	87.0	3.9	0.1	0.0	0.0	6.5	0.0	0.0
Cycle Q Clear(g_c), s	68.0	22.0	0.0	0.0	87.0	3.9	0.1	0.0	0.0	6.5	0.0	0.0
Prop In Lane	1.00		0.00	1.00		1.00	1.00		0.00	1.00		0.00
Lane Grp Cap(c), veh/h	1306	3140	0	1	1718	831	2	0	0	139	73	0
V/C Ratio(X)	1.00	0.59	0.00	0.00	1.01	0.08	0.52	0.00	0.00	0.94	0.00	0.00
Avail Cap(c_a), veh/h	1306	3140	0	40	1718	831	50	0	0	139	73	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	55.6	7.2	0.0	0.0	46.1	21.5	89.5	0.0	0.0	86.1	0.0	0.0
Incr Delay (d2), s/veh	25.6	0.7	0.0	0.0	23.1	0.2	134.9	0.0	0.0	57.8	0.0	0.0
Initial Q Delay(d3),s/veh	40.3	70.9	0.0	0.0	98.1	0.1	0.0	0.0	0.0	231.8	0.0	0.0
%ile BackOfQ(50%),veh/ln	44.4	81.4	0.0	0.0	73.0	2.5	0.1	0.0	0.0	9.0	0.0	0.0
LnGrp Delay(d),s/veh	121.6	78.7	0.0	0.0	167.3	21.8	224.3	0.0	0.0	375.7	0.0	0.0
LnGrp LOS	F	E			F	C	F			F		
Approach Vol, veh/h		3157			1798			1			130	
Approach Delay, s/veh		96.5			161.6			224.3			375.7	
Approach LOS		F			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		3.2	0.0	165.0		11.0	72.0	93.0
Change Period (Y+Rc), s		3.0	3.5	6.0		4.0	4.0	6.0
Max Green Setting (Gmax), s		5.0	4.0	151.5		7.0	68.0	87.0
Max Q Clear Time (g_c+I1), s		2.1	0.0	24.0		8.5	70.0	89.0
Green Ext Time (p_c), s		0.0	0.0	126.6		0.0	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	126.7
HCM 2010 LOS	F

Notes

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	0	0	0	1	0	17	0	1098	14	6	602	0
Future Vol, veh/h	0	0	0	1	0	17	0	1098	14	6	602	0
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	1	0	17	0	1098	14	6	602	0

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1719	1726	602	1719	1719	1105	602	0	0	1112	0	0
Stage 1	614	614	-	1105	1105	-	-	-	-	-	-	-
Stage 2	1105	1112	-	614	614	-	-	-	-	-	-	-
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	71	89	500	71	90	256	975	-	-	628	-	-
Stage 1	479	483	-	256	286	-	-	-	-	-	-	-
Stage 2	256	284	-	479	483	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	66	88	500	70	89	256	975	-	-	628	-	-
Mov Cap-2 Maneuver	66	88	-	70	89	-	-	-	-	-	-	-
Stage 1	479	478	-	256	286	-	-	-	-	-	-	-
Stage 2	239	284	-	474	478	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	22.2	0	0.1
HCM LOS	A	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	975	-	-	-	70	256	628	-	-
HCM Lane V/C Ratio	-	-	-	-	0.014	0.066	0.01	-	-
HCM Control Delay (s)	0	-	-	0	57.2	20.1	10.8	-	-
HCM Lane LOS	A	-	-	A	F	C	B	-	-
HCM 95th %tile Q(veh)	0	-	-	-	0	0.2	0	-	-

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	0	7	1	0	22	7	1391	18	8	762	21
Future Vol, veh/h	21	0	7	1	0	22	7	1391	18	8	762	21
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	-	-	-	-	-	30	-	-	-	150	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	0	7	1	0	22	7	1391	18	8	762	21

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2203	2212	773	2206	2213	1400	783	0	0	1409	0	0
Stage 1	789	789	-	1414	1414	-	-	-	-	-	-	-
Stage 2	1414	1423	-	792	799	-	-	-	-	-	-	-
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	32	44	399	32	44	172	835	-	-	484	-	-
Stage 1	384	402	-	171	204	-	-	-	-	-	-	-
Stage 2	171	202	-	382	398	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	27	42	399	30	42	172	835	-	-	484	-	-
Mov Cap-2 Maneuver	27	42	-	30	42	-	-	-	-	-	-	-
Stage 1	369	395	-	164	196	-	-	-	-	-	-	-
Stage 2	143	194	-	369	391	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	260.5	33.4	0	0.1
HCM LOS	F	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	835	-	-	35	30	172	484	-	-
HCM Lane V/C Ratio	0.008	-	-	0.8	0.033	0.128	0.017	-	-
HCM Control Delay (s)	9.3	0	-	260.5	129.1	29	12.6	-	-
HCM Lane LOS	A	A	-	F	F	D	B	-	-
HCM 95th %tile Q(veh)	0	-	-	2.8	0.1	0.4	0.1	-	-