Appendices

Appendix A NOP and Comments

Sonoma Valley Unified School District

Notice of Preparation and Notice of Scoping Meeting for a Draft Environmental Impact Report for the SVUSD Sonoma Valley High School Athletic Fields Renovation Project

TO:	**Interested Parties**
SUBJECT:	**Notice of Preparation and Scoping Meeting for a Draft Environmental Impact Report for the proposed SVUSD Sonoma Valley High School Athletic Fields Renovation Project**
LEAD AGENCY:	**Sonoma Valley Unified School District**
SCOPING COMMENT PERIOD:	**January 15, 2019, to February 15, 2019**
SCOPING MEETING:	**6:00 to 9:00 pm, January 28, 2019** Sonoma Valley High School Pavillion 20000 Broadway Sonoma, CA 95476

Pursuant to the State of California Public Resources Code and the Guidelines for Implementation of the California Environmental Quality Act (CEQA), the Sonoma Valley Unified School District (SVUSD) will be the Lead Agency for the preparation of the Environmental Impact Report (EIR) for the proposed Sonoma Valley High School Athletic Fields Renovation Project (project) (described in more detail below). The purpose of this Notice of Preparation (NOP) is to solicit guidance from responsible and trustee agencies and comments from the general public as to the scope and content of the environmental information to be included in the EIR. This may include identification of potential impacts that should be studied or mitigation measures that should be investigated.

Project Location

The project site is located within the Sonoma Valley High School (SVHS) campus at 20000 Broadway in the City of Sonoma, California. Athletic field renovations would occur to that portion of the campus bounded by Nathanson Creek to the west, residences and Prestwood Elementary School to the east, and the residences fronting MacArthur Lane to the north. The renovations would extend to approximately 160 feet south of Denmark Street. Refer to the attached Figure 1 for the Project Location. The SVHS campus is surrounded by residential housing to the North, California Highway 12 and residential housing to the West, Adele Harrison Middle School and residential housing to the South, and Prestwood Elementary School and residential housing to the East. No off-site improvements are proposed.

Project Description

The project includes renovations to the existing Sonoma Valley High School (SVHS) track and field, baseball/softball fields, and basketball courts. Renovations include: removal of the existing track and field; installation of a new all-weather track and an all-weather synthetic turf field; installation of a new seating and viewing areas; construction of several small buildings to house team rooms, storage, restrooms, ticket sales, and concessions; new field lighting at the track and field; and relocation and renovation of all existing softball and baseball fields. Refer to the attached Figure 2 for the Conceptual Site Plan. No offsite improvements, or modifications within Nathanson Creek or the adjacent pedestrian trail are proposed.

The existing SVHS athletic fields are inadequate to support some SVHS sports activities, which are currently held at offsite locations. The project would allow those existing SVHS sport activities that occur at offsite locations to be held on the SVHS campus. Existing activities that would be moved to the project site include: boy's junior varsity (JV) soccer games, boy's varsity soccer practice and games, girl's JV soccer games, girl's varsity soccer practice and games, football JV games, football varsity games, baseball JV practice and games, and baseball varsity practice and games. Field renovations are anticipated to allow a future lacrosse team to hold practice and games on campus. The project would not increase or otherwise change the student population for SVHS. Overall, field renovations would allow existing team sports to return to campus. Other than lacrosse, no new sports would be added to the curriculum.

Project construction would result in a reorganization of the existing track and field facilities, baseball fields, and basketball courts within approximately 16.8-acres of the SVHS campus. The existing basketball courts would be moved to the southern portion of the project site, and the track and field would move to a central position within the project site. The baseball fields, relocated along the northern boundary of the site, would include 30-foot high netting behind an 8-foot fence to protect neighbors from errant baseballs. Two softball fields would be located along the east boundary of the project site. The renovated track and field would have stationary home and visitor bleachers, restrooms, storage, concessions and team rooms located in close proximity to the field. Eight new 70-foot-tall sports lighting poles with focused MUSCO LED light arrays would be installed around the perimeter of the track, and would be focused to the areas of play within the track and field. No lights would be installed around the baseball or softball fields.

Pedestrian and maintenance access would remain the same, with external pedestrian access at the terminus of Denmark Street, and internal access at two locations across Nathanson Creek.

Low impact development (LID) stormwater treatment improvements would be incorporated into the site. The renovated area would drain to a biofiltration area located on the southern boundary of the project site. A standard subsurface stormwater drain would be installed in the biofiltration area to drain to the existing storm drain that connects to Nathanson Creek.

Construction of the project is anticipated to begin in 2020, and would take approximately 12 to 14 months.

Potential Environmental Effects
The following environmental factors have been identified as potential environmental effects of the project and will therefore be evaluated in the EIR:

Aesthetics
Air Quality
Biological Resources
Cultural and Tribal Cultural Resources
Geology and Soils
Greenhouse Gas Emissions and Energy
Hazards and Hazardous Materials
Hydrology and Water Quality
Land Use and Planning
Noise
Public Services and Recreation
Transportation

Utilities and Service Systems

The EIR will not include an evaluation of agricultural or forest resources because the project site does not include any Prime Farmland, Unique Farmland, Farmland of Statewide Importance, or land covered by a Williamson Act contract (California Department of Conservation Sonoma County Important Farmland 2016, Williamson Act FY 2013/2014 Map). In addition, the project site is not zoned for agricultural, forest land, or timberland, nor are there any agricultural or forest lands within the site (City of Sonoma Zoning 2018).

The EIR will not include an evaluation of wildfire because the project site is not located in or near a State Responsibility Area (SRA) or lands classified as very high fire hazard severity zones. The project site is located approximately 0.8 mile from an SRA, and more than 2.5 miles from lands classified as very high fire hazard severity zone (Calfire FHSZ Viewer 2019).

The EIR will not include an evaluation of Mineral Resources. The proposed project is located on an existing developed site. Construction of the project would not result in the loss of a known mineral resource or availability of a locally-important mineral resource recovery site as delineated on a land use plan, such as a local general plan or specific plan. Neither the California Department of Conservation Special Report 205 (CDC 2013) nor the Sonoma County Aggregate Resource Management (ARM) Plan (Sonoma County 2010) designates the project site as having a known mineral resource of value.

The EIR will not include an evaluation of population and housing as the project includes renovations to the athletic fields of an existing school and would not change the capacity of the school or increase the student population. The renovations would not induce population growth, displace existing housing, or displace any people.

The EIR will evaluate the potential cumulative environmental effects related to implementation of the project, identify and evaluate alternatives to the project, and identify mitigation measures that could avoid or reduce significant environmental impacts as a result of the project.

Scoping Period

The scoping period is from January 15 to February 15, 2019. During this time, written comments can be mailed, delivered, or emailed, no later than 5 pm on February 15, 2019 to:

Bruce Abbott, Associate Superintendent
Sonoma Valley Unified School District
17850 Railroad Avenue
Sonoma, CA 95476
Email: babbott@sonomaschools.org

Scoping Meeting

Oral comments, as well as written comments related to the scope and content of the environmental review of the Project, may be received at the public scoping meeting scheduled on January 28, 2019, from 6:00 pm to 9:00 pm, at the following location:

Sonoma Valley High School Pavilion
20000 Broadway
Sonoma, CA 95476

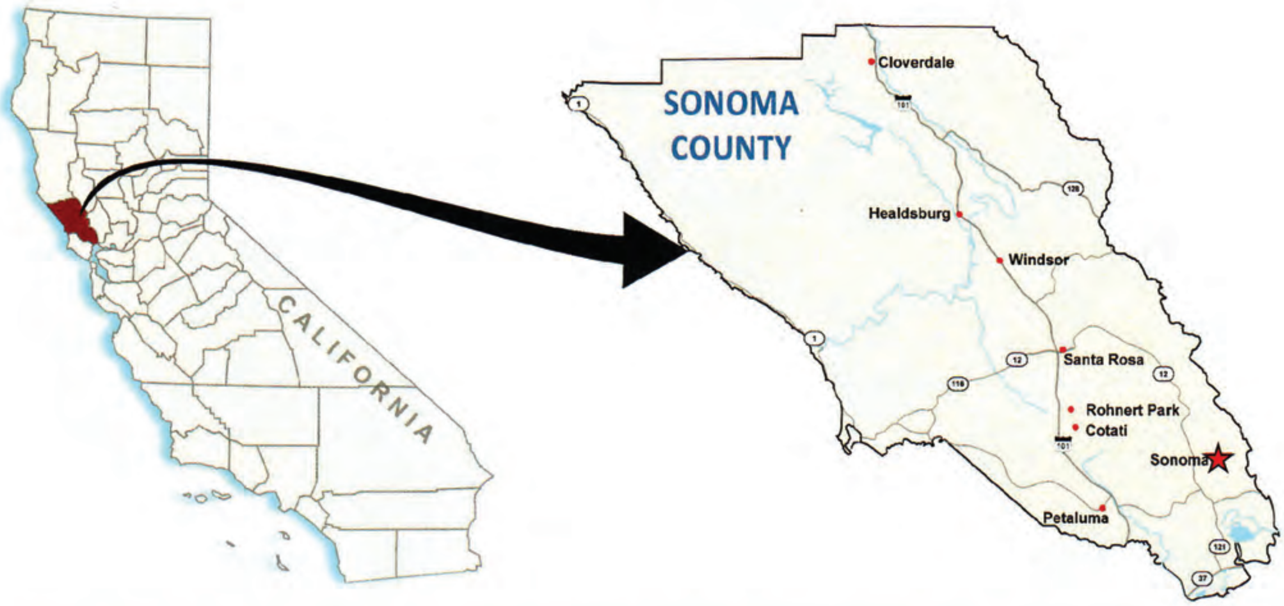
The public scoping meeting will allow responsible and trustee agencies and the general public the opportunity to hear presentations by SVUSD Staff, and the environmental consulting firm that is under contract with the SVUSD to prepare the EIR. The meeting will include a time for the public to provide comments on the scope and content of the EIR.

If you cannot attend the meeting, written comments also will be accepted after the Scoping Meeting through the end of the scoping period on February 15, 2019 at 5:00 p.m.

Please contact the SVUSD at 707-935-4249 if you need further information regarding this Notice of Preparation.

Bruce Abbott
Associate Superintendent

Date 1/10/19



Paper Size ANSI A

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Map Projection: Lambert Conformal Conic
Horizontal Datum: NAD 1983 2011
Grid: NAD 1983 2011 StatePlane California II FIPS 0402 Ft US

GHD

Sonoma Valley Unified School District
Sonoma Valley High School
Athletic Fields Renovation Project

Project No. **11152127**
Revision No.
Date **11/09/2018**

Location Map

FIGURE 1

\\ghdnet\ghd\US\Roseville\Projects\SAC\111\11152127 SVUSD Sonoma Valley HS CEQA\08-GIS\Maps\Working\Project Location.mxd
Print date: 09 Nov 2018 - 13:26

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: rmremillard

PLAN

Sonoma Valley Unified School District
Sonoma Valley High School
Athletic Fields Renovation Project

Project No. 11152127
Revision No.
Date 11/09/2018

STATE OF CALIFORNIA

Gavin Newsom, Governor

NATIVE AMERICAN HERITAGE COMMISSION
Cultural and Environmental Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
Phone (916) 373-3710
Email: nahc@nahc.ca.gov
Website: http://www.nahc.ca.gov
Twitter: @CA_NAHC

RECEIVED
JAN 3 1 2019
BY:

January 25, 2019

Socorro Shiels
Sonoma Valley Unified School District
17850 Railroad Ave
Sonoma, CA 95476

RE: SCH# 2019012028 Sonoma Valley High Athletic Fields Renovation Project, Sonoma County

Dear Ms. Shiels:

The Native American Heritage Commission (NAHC) has received the Notice of Preparation (NOP), Draft Environmental Impact Report (DEIR) or Early Consultation for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code §21000 et seq.), specifically Public Resources Code §21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource, is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, §15064.5 (b) (CEQA Guidelines §15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an Environmental Impact Report (EIR) shall be prepared. (Pub. Resources Code §21080 (d); Cal. Code Regs., tit. 14, § 5064 subd.(a)(1) (CEQA Guidelines §15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources within the area of potential effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code §21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code §21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code §21084.3 (a)). **AB 52 applies to any project for which a notice of preparation, a notice of negative declaration, or a mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements.** If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. §800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of <u>portions</u> of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments.

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:
   - a. A brief description of the project.
   - b. The lead agency contact information.
   - c. Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code §21080.3.1 (d)).
   - d. A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code §21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code §21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or Environmental Impact Report. (Pub. Resources Code §21080.3.1(b)).
   - a. For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code §65352.4 (SB 18). (Pub. Resources Code §21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:
   - a. Alternatives to the project.
   - b. Recommended mitigation measures.
   - c. Significant effects. (Pub. Resources Code §21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:
   - a. Type of environmental review necessary.
   - b. Significance of the tribal cultural resources.
   - c. Significance of the project's impacts on tribal cultural resources.
   - d. If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code §21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code §6254 (r) and §6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code §21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:
   - a. Whether the proposed project has a significant impact on an identified tribal cultural resource.
   - b. Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code §21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code §21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:
   a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
   b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code §21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code §21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code §21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code §21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code §21084.3 (b). (Pub. Resources Code §21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:
    a. Avoidance and preservation of the resources in place, including, but not limited to:
       i. Planning and construction to avoid the resources and protect the cultural and natural context.
       ii. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
    b. Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
       i. Protecting the cultural character and integrity of the resource.
       ii. Protecting the traditional use of the resource.
       iii. Protecting the confidentiality of the resource.
    c. Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
    d. Protecting the resource. (Pub. Resource Code §21084.3 (b)).
    e. Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code §815.3 (c)).
    f. Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code §5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An Environmental Impact Report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:
    a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code §21080.3.1 and §21080.3.2 and concluded pursuant to Public Resources Code §21080.3.2.
    b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
    c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code §21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code §21082.3 (d)).

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code §65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code §65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code §65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code §5097.9 and §5097.993 that are within the city's or county's jurisdiction. (Gov. Code §65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
   a. The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
   b. Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
   a. If part or all of the APE has been previously surveyed for cultural resources.
   b. If any known cultural resources have already been recorded on or adjacent to the APE.
   c. If the probability is low, moderate, or high that cultural resources are located in the APE.
   d. If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
   a. The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
   b. The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:
   a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.
   b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.
   a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, §15064.5(f) (CEQA Guidelines §15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.
   b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.
   c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code §7050.5, Public Resources Code §5097.98, and Cal. Code Regs., tit. 14, §15064.5, subdivisions (d) and (e) (CEQA Guidelines §15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions or need additional information, please contact me at my email address: Sharaya.Souza@nahc.ca.gov.

Sincerely,

for Nancy Gonzalez

Sharaya Souza
Staff Services Analyst

cc: State Clearinghouse

From: Bruce Abbott <babbott@sonomaschools.org>
Sent: Wednesday, January 23, 2019 3:41 PM
To: Judith Alex <judithlalex@gmail.com>
Cc: Tenaya Dale <tdale@counterpointcs.com>
Subject: RE: Sonoma Valley Athletic Fields Renovation Project comment

Hi

Thanks for taking the time to provide your concerns. We will be completing a full environmental impact report which will address traffic and parking issues. I will ensure your concerns are reviewed.

"It Takes a Valley!"

Bruce Abbott
Associate Superintendent: Business Services
Sonoma Valley Unified School District
17850 Railroad Avenue, Sonoma, CA 95476
Telephone: 707 935 4249

From: Judith Alex [mailto:judithlalex@gmail.com]
Sent: Wednesday, January 23, 2019 10:48 AM
To: babbott@sonomaschools.org
Subject: Sonoma Valley Athletic Fields Renovation Project comment

Dear Mr. Abbott:

My husband (Peter Vestal) and I own 920 2nd Street East, which is near the high school track. There is a walkway across the street from us (Nathanson Creek) that is goes along one side of the track.

I am writing to you about the above mention project. Our only concern would be the noise and traffic during these events. (Our streets are already filled with parked cars from the high school students. Fortunately, we have a big driveway and don't need street parking.) We would please ask the committee to consider ways in which our neighborhood might be protected from the traffic and noise. Perhaps limiting the parking on our streets and putting in a locked gate might help.

Thank you,
Judith Alex
--
Judith Alex
judithlalex@gmail.com

From: Bruce Abbott <babbott@sonomaschools.org>
Date: February 18, 2019 at 8:54:04 AM PST
To: Tenaya Dale <TDale@counterpointcs.com>
Subject: Fwd: High School Athletic Fields Renovation Project

---------- Forwarded message ---------
From: **Mike Bobbitt** <mikebobbitt@mikebobbitt.com>
Date: Mon, Feb 18, 2019, 8:27 AM
Subject: High School Athletic Fields Renovation Project
To: <babbott@sonomaschools.org>
Cc: Susan Bobbitt <foshgar@vom.com>

Dear Mr. Abbott,

My wife and I live at 1182 Larkin Dr., next to the High School Ag Center.

Can you please add us to the announcement list for any information on the High School Athletic Fields Renovation Project?

I would like to make sure the EIR for the project addresses the following issues:

1. Mitigation for the additional impermeable surfaces and subsequent accelerated water runoff and flooding potential to streets and properties down slope from the project.
2. How ingress and egress for vehicles and pedestrians from the project is going to handled:
    a. During construction
    b. During normal operation of the stadium and surrounding facilities
3. How is parking going to be handled and what will be done to avoid parking on surrounding residential streets?
4. Noise issues:

    a. During construction
    b. During normal operation of the stadium and surrounding facilities.
5. How the night time lighting from the project is going to be mitigated.
6. The EIR should cover all potential uses for the stadium beyond just athletic events to include musical events, rallies and ceremonies.

Thanks,

Mike & Susan Bobbitt

1182 Larkin Dr.

Sonoma, Ca 95476

(707) 328-3357

mikebobbitt@mikebobbitt.com

SVUSD Sonoma Valley High School Athletic Fields Renovation Project
Draft Environmental Impact Report Public Meeting
January 28th, 2019

WRITTEN COMMENTS

NAME: JEAN BROOKS

ADDRESS: 221 MAC ARTHUR LN

E-MAIL ADDRESS: ~~JEAN @~~ JEANCBROOKS@ME.COM

COMMENTS:

HEIGHT/SIZE OF FENCING WILL IMPACT VISUAL FOR NEIGHBORS ON MAC ARTHUR LN

30' NETTING ALSO CONCERN

EVENT PARKING ON MAC ARTHUR LN WILL BE A MAJOR IMPACT.

You may leave your comments with us tonight or mail your comments to Bruce Abbott, Sonoma Valley Unified School District Office, 17850 Railroad Avenue, Sonoma, CA 95476 or by email to: babbott@sonomaschools.org. Written comments will be received until 5pm on February 15th, 2019.

From: randy cook [mailto:randycook95476@yahoo.com]
Sent: Sunday, February 03, 2019 9:27 PM
To: babbott@sonomaschools.org
Subject: Written Comments

Randall Cook
280 E. MacArthur St.
Sonoma, CA 95476
randycook95476@yahoo.com

Comments on SVUSD Athletic Fields Renovation Project EIR:

The Environmental Impact Report should include consideration of the environmental impacts on the North of the Plaza Neighborhood where Arnold Field is located. I would expect that noise, traffic and night lighting impacts in that neighborhood would be reduced once the High School playing fields are renovated, because the athletic events would no longer be held at Arnold Field.

The EIR should also consider the traffic impacts on the City of Sonoma of having athletic events at the High School instead of at Arnold Field. I would anticipate a reduced impact, particularly at afternoon events, since student spectators and teams would not have to be transported across town. They would be able to walk to the events from the High School.

At the time the Nathanson Creek Restoration Project was conducted some years ago, the plan was to build the asphalt bike trail farther from the creek. Unfortunately, the contractor responsible for the trail took it upon himself to change the plan and lay the trail down at its current location, which impinges somewhat on the habitat of the creek and reduces the health of the creek. As one of the alternative proposals to the Athletic Fields Renovation Project, the EIR could consider the option of actually moving the asphalt trail slightly to the east, where it was originally intended to be. The original plans of the Nathanson Creek Restoration Project must certainly be still available for scrutiny.

Sincerely,
Randall Cook

neighbor

From: Nickolai Mathison [mailto:nickolai.m@gmail.com]
Sent: Friday, February 01, 2019 12:48 PM
To: babbott@sonomaschools.org
Subject: Public Comment on Proposed High School Athletic Field Improvements

Bruce;

I am a neighbor of the High School property, living approximately 500 yards east of the Ag facility. I support the project enthusiastically, and have the following comments:

Athletics is an essential component of the High School experience for athletes and non-athletes alike
Based on the condition of or complete lack of current facilities the project should move forward as quickly as possible
The proposed stadium size is likely a little too large, given historical attendance and the declining interest in the primary draw for that facility - football. A reduced size may allow funds to be spent elsewhere in more forward-thinking areas.
Lights are an essential component of the project, and possibly one of the more impactful aspects on the neighborhood. Consequently significant budget should be allocated to develop the absolute best lighting scheme. (note: lights on the tennis court are currently left on every night with no use of the courts observed).
If there is any ability to install lights on the new Adele soccer field it should be done quickly as both our soccer teams have to play home games IN PETALUMA! It is not hard to imagine an installation that does not cast a great deal of light outside the field, and it would also be very simple to put an absolute time limit on the use of lights to a reasonable hour - say 8pm.

Thank you

Nickolai Mathison
373 Saunders Dr
Sonoma CA 95476
415/606-6425

SVUSD Sonoma Valley High School Athletic Fields Renovation Project
Draft Environmental Impact Report Public Meeting
January 28th, 2019

WRITTEN COMMENTS

NAME: ~~Rachel P~~ Rachel Pedersen

ADDRESS: 1092 Manor Drive

E-MAIL ADDRESS: rachel @ Lyenstreet. com

COMMENTS:

Very excited about this project for our community and CHILDREN

I WORKED for environmental groups, and know there is a way to have healthy environment and amazing facilities!

Thank you!

You may leave your comments with us tonight or mail your comments to Bruce Abbott, Sonoma Valley Unified School District Office, 17850 Railroad Avenue, Sonoma, CA 95476 or by email to: babbott@sonomaschools.org. Written comments will be received until 5pm on February 15th, 2019.

From: Bruce Abbott <babbott@sonomaschools.org>
Date: February 16, 2019 at 8:52:50 AM PST
To: Stewart Saunders <sstewartsaunders@gmail.com>
Cc: emily.charrier@sonomanews.com, "Walsh, Jason" <jason.walsh@sonomanews.com>, lorna.sheridan@sonomanews.com, christian.kallen@sonomanews.com, kate.williams@sonomanews.com, janis.mara@sonomanews.com, robbi.pengelly@sonomanews.com, svfra@svfra.org, planning@sonomacity.org, Socorro Shiels <sshiels@sonomaschools.org>, Nicole Abate Ducarroz <nducarroz.trustee@sonomaschools.org>, Melanie Blake <mblake.trustee@sonomaschools.org>, John Kelly <jkelly.trustee@sonomaschools.org>, Britta Johnson <bjohnson.trustee@sonomaschools.org>, Tenaya Dale <tdale@counterpointcs.com>
Subject: RE: Feedback for Environmental Impact of Proposed Sonoma Valley High School Field Projects due 02/15/2019

Thanks for all you work. We are in the comment period for the scope of the environmental impact report (EIR) so your comments are exactly what we need, areas we need to consider in the EIR. During the EIR process there will addition time to collect comments as well as more public hearings.

On you question on the field cover. Some detail have not been finalized. We expect it to be similar to the Adel field which has cork filling but with a slightly different matting due to the different use. These specifics will be spelling out in the EIR.

SVUSD
"It Takes a Valley!"

Bruce Abbott
Associate Superintendent: Business Services
Sonoma Valley Unified School District
17850 Railroad Avenue, Sonoma, CA 95476
Telephone: 707 935 4249

From: Stewart Saunders [mailto:sstewartsaunders@gmail.com]
Sent: Friday, February 15, 2019 9:00 PM
To: babbott@sonomaschools.org
Cc: emily.charrier@sonomanews.com; Walsh, Jason <jason.walsh@sonomanews.com>; lorna.sheridan@sonomanews.com; christian.kallen@sonomanews.com; kate.williams@sonomanews.com; janis.mara@sonomanews.com; robbi.pengelly@sonomanews.com; svfra@svfra.org; planning@sonomacity.org; sshiels@sonomaschools.org; NDucarroz.Trustee@sonomaschools.org; mblake.trustee@sonomaschools.org; JKelly.Trustee@sonomaschools.org; BJohnson.Trustee@sonomaschools.org
Subject: Feedback for Environmental Impact of Proposed Sonoma Valley High School Field Projects due 02/15/2019

Bruce, I emailed you a request and talked with Nancy the SVUSD offices last week trying to obtain more information on the specifics of the field proposal because I was not able to attend the public meeting. When I receive that I can do more specific research. Given the short amount of time I have for research, I'm assuming you have the full spectrum of field choices.

MY BACKGROUND:

- **Supporting Schools -** First, my background in supporting schools **-** I'm Mr. Mom for the past 16 years raising two children that are now at Sonoma Valley High School and Adelle Harrison Middle School. I coach girls soccer - the U14 team last year, and have been a constant school volunteer - worked in elementary school libraries weekly for 4 years, run book clubs, volunteer driver field trips, etc. I want the schools to have improved fields, but done in a safe and prudent manner.

- **Career -** I've invested 15 years of my career in recycling that aids my understanding of products uses/chemical makeups and how or if they can be recycled. During that time I managed the West Coast and East Coast calling on all of the major recycling operations handling a wide array of products including plastics.

SCOPE OF IMPACT :

- Whatever SVUSD decisions are for this project, the environments it will significantly impact Sonoma are its **1) Ecosystem, 2) Human Environment, and 3) Animal Environment.** Subject area is very near the center of town. Many of these impacts will be significant and irreversible.

AREA COMPONENTS:

- Currently the Sonoma High School Fields are all natural fields with Nathanson Creek running north to south and natural habitat on either side that expands in width after flowing past the fields and schools. The natural habit surrounding Nathanson Creek has deer, fox, nesting hawks, nesting cranes, white herons, bats, squirrel, lizards, salamanders, and snakes that I see. I walk the dogs and/or ride bikes on these paths every day weather permits and see these animals regularly during their seasons. The neighborhoods surrounding the subject school fields are mostly heavy residential backing up to the fields with MacArthur Place Resort and Spa to the North of Sonoma Valley High School and to the south of Adelle Harrison Middle School is Broadway Villa Post-Acute Care and Rehabilitation Center.

RESEARCH:

- The information compiled here is not my own, nor in many cases my original opinion. I've spent a significant number of hours researching impact studies and will quote from a number of sources quoted and linked below and sites for overall "big picture" information from sites such as SynTurf.org, Penn State Center for Turffgrass Science / plantscience.psu.edu, MIT School of Engineering engineering.MIT.EDU, YaleClimateConnetions.org and the most comprehensive research group for considering almost all options is **COALITION FOR SAFE HEALTHY PLAYING FIELDS** safehealthplayingfields.org.

ENVIRONMENTAL IMPACTS CONCERNING:

LIGHTS IMPACT - The proposed 70 foot tall lights would dramatically change the area with impacts in:

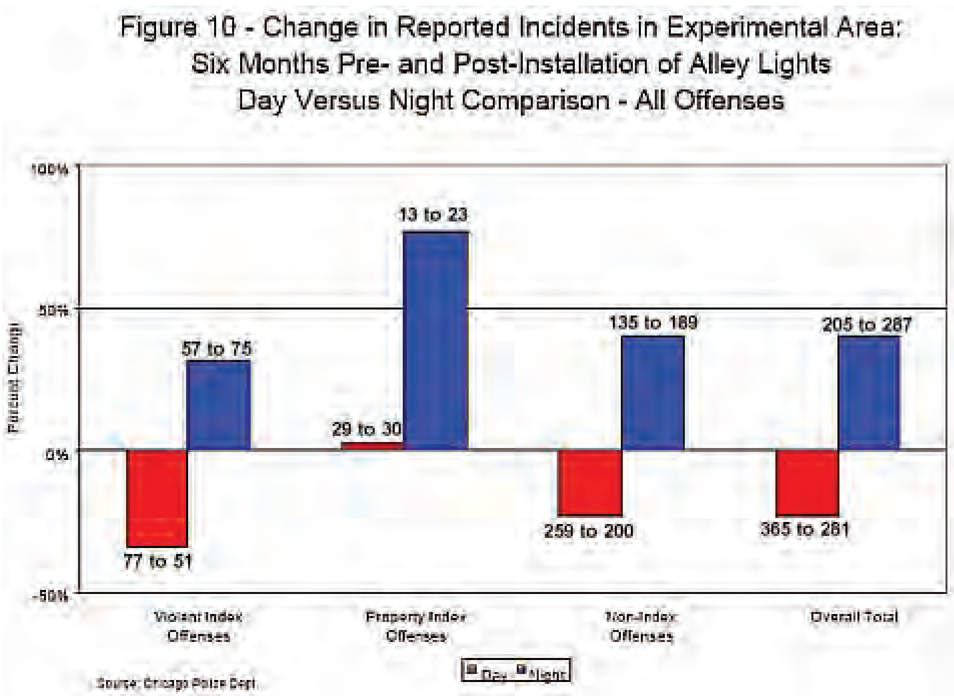
1) Noise Increase- the lighting would extend activities of team/band practices into the night transforming a once quiet area into consistent noise impact throughout the wildlife area, residences, tourist facilities, and the Rehabilitation center. The proposed lighted 2,500 seat stadium would be a venue for rival teams to try and out cheer one another combined with commentation over the loudspeaker system. Traffic noise would be increased dramatically in the evening in every street surrounding the area. The chart below is a sampling on decibel levels produced by a high school marching band as presented by the ACOUSTICAL SOCIETY OF AMERICA (ASA.ORG) titled ***"NOISE EXPOSURE ASSOCIATED WITH MARCHING AND PEP BANDS"*** as presented to ASA/NOISE - CON 2005 Meeting, Minneapolis, MN (acoustics.org). The marching band is in Durham, NC. They do not state whetehr the band is on natural grass or artificial turf, which would affect the outcome OSHA is the United States Department of Labor Occupatioal Safety and Health Administration and NIOSH is the Center for Disease Control and Prevention National Institute for Occupational Safety and Health that set standards in the United States. Green exceeds 100% NIOSH but not 100% OSHA - Orange exceeds both standards, Red, damaging decibel levels in extended time frames.

RIVERSIDE HIGH SCHOOL OUTDOOR REHEARSAL, WITH DRUMLINE					
L_p, dB(A)	Location	Principal Sources of Exposure from other instruments	Exposure Time, min.	OSHA dose	NIOSH dose
85	clarinets (backfield)	none	(120)	12%	24%
86	drum major (show run-through)	entire band, CT	(120)	15%	32%
86	trumpet	entire band, CT	(120)	15%	32%
87	pit	trumpets, CT	(120)	16%	36%
87	trombone	baritone, sousaphones	(120)	17%	42%
89	tenors (much discussion, less playing)	marching percussion, CT	(120)	20%	56%
89	alto saxophone (show run-through)	low brass, CT	(120)	21%	57%
89	clarinets / alto saxophones	mellophones, trombones	(120)	21%	60%
89	piccolo	marching percussion, CT	(120)	23%	68%
90	piccolo	marching percussion, CT	(120)	23%	71%
92	baritone (show run-through)	low brass, CT	(120)	34%	135%
94	piccolo	marching percussion, CT	(120)	44%	205%
94	flugelhorn (show run-through)	low brass, alto saxophones	(120)	46%	219%
95	mellophones	low brass, CT	(120)	47%	224%
95	snare drums	marching percussion, CT	(120)	48%	235%
95	bass drums	marching percussion, CT	(120)	49%	241%
95	pit (percussion solo)	marching percussion	(120)	52%	270%
96	sousaphone	sousaphone, trombones, CT	(120)	57%	310%
99	tenors (show run-through)	marching percussion, trumpets	(120)	82%	579%
100	pit	brass	(120)	101%	819%
106	snare drum (show run-through)	marching percussion, brass	(120)	223%	3055%

***Note that these noise levels are for practice does not include 2,500 cheering fans for rival teams.** The noise levels produced by the high school marching band in the tesing far surpasses any acceptible decibel levels in the **City of Sonoma Munincipal Code Chapter 9.56 Noise** (codepublishing.com). Though

Code 9.56.070 allows an exemption because it is school property, the proposed facility will produce noise levels on a fairly constant basis exceeding city noise standards including the recent gas leaf blower ban. Lights would extend that high noise level exposure to the neighborhood well into the night. The negative impact on our neighbors trying to recover at the **Broadway Villa Post - Acute Care and Rehabilitation Center** should be a major consideration here.

2) Crime Increase - the massive influx of people coming into the area will be accompanied by crime. Once a slow quiet neighborhood so many more people and cars would be coming and going that it naturally attracts criminals to pilfer cars and creates an opportunity to case houses from the heavy activity.
Please see the increase statistics in the example from ***Outdoor Lighting and Crime*** illinoislighting.org and supporting article ***OUTDOOR LIGHTING AND CRIME, PART 2: COUPLED GROWTH*** by B. A. J. Clark (asv.org.au) "In some instances, added lighting has been an encouragement for crime, rather than a deterrent". The theory based on the lighting/crime increase is that criminals can now see to navigate the intended targets property as opposed to no lighting they could not see.



3) Pedestrian Danger Increase - children, people, and pets currently all walk and ride bikes in the neighborhoods in the surrounding areas during day and night. With a dramatic traffic increase of cars headed to events at the proposed stadiums a significant number of the drivers wiil be 10th, 11th, and 12th graders. Negative human impact potential due to new teenage drivers here is in the danger zone. From teendriversource.org Children's Hospital of Philadelphia Research Institute: ***"The teen fatal crash rate is twice as high at night"*** Statistics quoted below fall into the night time/time frame that addition of field lighting would turn into high aactivity time at the High School, Middle School, and Prestwood Elementary School:

- ***"The risk of motor vehicle crashes is higher among 16-to 19-year-olds than any other age group."***

- ***"Approximately one-third (31 percent) of 16- and 17-year-old drivers in the U.S. involved in fatal crashes from 2009 to 2014 crashed between 9 p.m. and 6 a.m.. Among these drivers, 57 percent - or more than 1,000 youths —crashed before midnight, according to the Centers for Disease Control"***

- newsroom.aaa.com WASHINGTON, D.C. (May 30, 2018) –More than 1,050 people were killed in crashes involving a teen driver in 2016 during the 100 Deadliest Days, the period between Memorial Day and Labor Day. That is an average of 10 people per day – a 14 percent increase compared to the rest of the year, according to data analyzed by the AAA Foundation for Traffic Safety.

4) **Change Humans/Animals/Plants Circadian Rhythm** - Obtrusive light pollution in neighborhoods areas that should not be lighted in the evening can suffer from many issues. Please see the article ***Night Lights at Night Have a Dark Side -Artificial light at night impairs stargazing, animal behaviors - and maybe human health. by Alison Pearce Stevens*** ScienceNewsForStudents.org.:

a) Humans with changed circadian rhythm due to extended light hours produce less melatonin which is proven to lessen sleep hours. Disrupted sleep patterns in humans has been proven to create a risk of disease.

b) Animals change feeding, sleeping and mating habits when exposed to artificially extended light hours. Example: Studies have shown that bats move away from lighted areas to feed on insects in darker areas. Lighted areas will see an increase in insect populations normally controlled by bats.

5) **Safety - Installation Oversight Lacking** - data on California code specifically for stadium lights is not readily available. At a minimum, because we are in high wind area EC&M - Electrical Construction and Maintenence Magazine provided contionary data on installation failures ***The Harder They Fall Pole failures expose lack of standards and oversight in stadium and sports field lighting.*** This is an article from 2010, and if changes have been made, I can't find it. Here's the list of pole failures on record by 2010:

October 2005: A pole fell at an athletic field at Northern State University, Aberdeen, S.D. University officials determined that a structural failure was to blame, and two other poles were removed.

February 2007: A 1-yr-old, 90-ft pole fell at a field at Worcester Technical High School, Worcester, Mass. Eleven other poles were removed after testing revealed hidden cracks.

April 2007: A 90-ft pole fell at Applebee's Park, Lexington, Ky., where the Lexington Legends, a Minor League baseball team, played.

December 2008: After a 130-ft light pole at the Round Rock, Texas, athletic complex fell, officials removed three additional poles exhibiting cracks. The forensic engineering report by Wiss, Janney, Elstner Associates, Inc., an Austin, Texas-based engineering firm, cited fatigue cracking caused by wind-induced vibrations for the structural failure.

December 2008: A 70-ft pole fell at a facility in the Midlothian, Texas School District. After the incident, engineers called in to test the remaining poles found hairline cracks on three of them, which were then removed. School officials claim they spent $70,000 replacing the four poles and lights. Six smaller poles remain on the district's baseball field. Ultrasonic tests and continued visual inspections performed on those poles indicate an absence of the flaws that plague the taller poles.

March 2009: A light pole fell onto the Hays High School gymnasium in Buda, Texas. Three additional poles were removed the next day after cracks were found upon closer inspection. The follow-up engineering investigation revealed that poor welding of the giant pole to the base plate was to blame.

April 2009: Under the jurisdiction of the Sanger School District, Sanger, Texas, one 75-ft pole and one 90-ft pole fell, shattering the glass of the lamps, and 14 were preemptively removed after a crack on a third pole was found upon closer inspection.

April 2009: Southlake Carroll School District, near Dallas, discovered cracks on three of four poles at its Dragon Stadium, Southlake, Texas.

April 2009: An 80-ft pole fell on Uniontown High School's football field, Uniontown, Pa., during a storm.

In September 2009, the Agua Fria Union High School District, Avondale, Ariz., hired a structural engineer to inspect the stadium poles installed at its schools after the Consumer Product Safety Commission (CPSC), Washington, D.C., notice was posted to the Web site of the Arizona School Facilities Board. By performing an ultrasonic nondestructive test, the engineer found that all 19 structures had to be fixed — 15 at Desert Edge High School in Goodyear, Ariz., and four at Agua Fria High School in Avondale, Ariz. Five of the poles had a "pretty serious indication" of internal structural faults, according to the engineer's report.

High winds are a big concern - given limited information, extensive testing on soil makeup and contsrtuction technique to estimate impact on the ecosystem. Lights not able to handle 100 miles per hour winds are a hazard. Wine Country Fires Were Fanned by 'Unprecedented' Winds Oct. 23, 2017 (kqed.org) During recent fires, wind speeds were clocked up to 108 miles per hour.

PARKING IMPACT

- Available parking at both Sonoma Valley High School and Adelle Harrison Middle School is approximately 440 spaces total. I've counted them as well as matched the numbers with the front office of Adelle Harrison. Proposed seating of the football stadium is 2,500. I don't have figures on the proposed seating for the 4 baseball/softball diamonds. Because the proposed stadium is so oversized for current parking, I will limit the math as if no other activity was taking place at the time of a field event. Impact:

A) Major Carpooling Required - 2,500 fans as designed in the proposed stadium divided by 440 non-handicapped spaces requires each parked car to have 5.68 people per car. Since you can't have .68 of a person, and there will be at least two teams, coaches, staff, cheerleaders - 6 people per car would be required to handle the proposed stadium. Most family sedans don't comfortably hold more than 5 people, and carpooling is not realistic.
B) Parking Has Only One Entrance/Exit - every bit as important - the parking areas only have one entrance and exit onto Broadway. Currently the High School and Middle school start/ finish times have been staggered to lessen the strain on traffic for the facilities. This are is not designed well to handle an "all at once" influx of cars as well as "all at once" exit of 440 plus cars.
C) The Proposed Model Does Not Take Other School Activities Into Account - on any given school day afternoon/evening there are other activities taing place at the High School and Middle School. Teachers parking, Coaches parking, students involved in activities would further put a strain on the parking facilities.
D) City Code for Parking - City of Sonoma Code 19.48 requires parking to be determined "by commission" on a case by case basis. Under requirements for meeting for public assembly the requirement for mass gathering facilities is one space for every 4 seats. So, under that guideline, the proposed staduium alone

requires 2,500/4 = 625 parking spaces, meaning the proposal puts the staduim oversized by 185 parking places, without taking any other school activities into account.

TRAFFIC IMPACT

Increasing the population by roughly 2,500 plus their cars will have a major impact on Sonoma traffic every time an event is held:

A) **Example of 440 cars in a straight line -** traffic calculations are quite complicated engineering models. Because the parking lot only has one entrance - the example will be as if cars were lining up in a straight line straight south out of town on Broadway. The required space per car multiplied by 440:

1) Average Family Car Length - The average family car is 191 inches long or 15.91 ft. according to cardriveby.com. Our Honda Van is 201 inches or 16.75 ft. as a real world example. Lots of vans/suv's in the community so **16 feet will be used for simple math.**
2) Average Travel Speed in Heavy Traffic - If traffic were moving at an average of 10mph in town it would be covering 14.67 ft. per second (kylesconverter.com). Recomended following distance under 40mph is 1 second per 10 feet of vehicle per Federal Motoer Carrier Safety Administration (fmcsa.dot.gov), so in this case about 2 seconds again for simple math. At roughly 15ft./ second x 2 = **30ft.**
3) Car Length Plus Distance Traveled - Adding average car length 16ft. to 2 seconds of trail at 10mph 16 +15+15= **46 feet total required per car.**
4) Total Lenght of Line in Feet - Therefore, using the 440 car limit of the parking lot times 46 feet of linear spacing…440 x 46 = **20,240 ft. total length.**
5) Total Length of Line - Divide the total feet by 5,280 /mile to get miles. 20,240ft. divided by 5,280ft. = **A line out of the parking lot that is 3.83 miles long.**

B) HEAVY TRAFFIC IMPACT- the net result will be extremely heavy traffic downtown and surrounding areas. Intersecting roads on Broadway can all be expected to be congested. Drivers already avoid the one entrance/exit at the scuoll and park on surrounding streests such as Denmark and Larkin. Of safety concern would be constant backups on Andriex given it is a major ambulance acces to the hospital.

C) TRAFFIC IMPACT STUDY REQUIRED - it's unknown how much time would be required to allow the parking lot to fill and overflow to park in the surrounding City.

D) TRAFFIC POLUTION STUDY REQIRED POST TRAFFIC STUDY - The traffic model would show an estimate of time cars would sit in traffic and idle. That would be a key factor in understanding the air pollution increase in Sonoma.

SYNTHETIC FIELD INSTALLATION CHOICES AND THEIR IMPACTS

The current plans show a synthetic turf football/lacrosse/soccer field in the middle of the track. Understanding from Sonoma Tribune artcle that synthetic turf is the proposed choice due to being more durable. While synthetic turf looks like a great deal at first, the more research shows it to be dramatically higher in cost, a heat dangers to players and pedestrians, impact and injury danger to players of all sports, and a fire danger in a high risk fire area. I strongly urge you to review the entire research by **The Coalition For Safe Healthy Playing Fields** (safehealthyplayingfields.org)

TOXIC CHEMICAL IMPACT - ATHLETE EXPOSURE

- I would expect that because Adelle Harrison Field has cork infill that crumb rubber would not be the choice because of the discovery of so many toxins in the recycled tires. High Incidences of cancers are being associated with this product. Soccer Coach Amy Griffith at University now has a list of 53 players that played on synthetic turf with crumb rubber all diagnosed with cancer - 60% of them were goal keepers that spend much time on the ground and have greater chance of inhalation. (cnn.com) ***Soccer players cancers ignite debate over turf safety by Jaquelin Howard January 27th, 2017.*** Even with cork infill, the totall list of chemicals is unknown depending on manufacturer. Parents need to be aware that infill comes home with their athlete. Shoes should be kept outside and all clothes and equipment that came in contact with the turf thougoughly washed and dried.

CRUMB RUBBER - A DANGEROUS CHOICE:

Table 1. Partial list of chemicals of concern present in crumb rubber artificial turf infill[*]

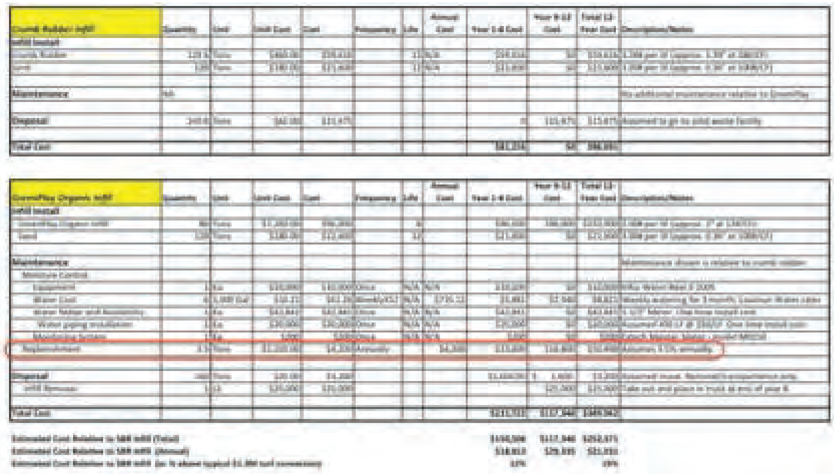
Chemical	Potential Health Effect
Benzene	Known human carcinogen
Arsenic	Known human carcinogen[i]
Styrene	Reasonably anticipated to be a human carcinogen
Polycyclic aromatic hydrocarbons (PAHs)	Reasonably anticipated to be a human carcinogen[ii]
Lead	Neurotoxicant
Zinc	Neurotoxicant
Cadmium	Known human carcinogen[i]
Chromium	Known human carcinogen[i] Respiratory irritant
VOCs and SVOCs (e.g. benzathiazole, hexane, toluene, formaldehyde)	Respiratory irritants or asthma triggers Neurotoxicants Some are known human carcinogens[i]
Phthalates	Reproductive toxicant
Crystalline Silica	Known human carcinogen[i] Respiratory irritant
Latex	Allergen
Particulate matter	Respiratory irritant or asthma trigger

[*]For a more extensive list of chemicals of concern identified in turf see https://www1.nyc.gov/assets/doh/downloads/pdf/eode/turf_report_05-08.pdf

PBI/CORKONUT -- NOT A SAFE ALTERNATIVE

*Choosing PBI (plant based infills) means using an **expensive and controversial** product that requires the use of carcinogens and many chemicals, in addition to being a respiratory risk.*
It means a headlong rush into other dangers with multiple and unknown angles.

MIGRATION/INFILL LOSS
(3.5 TONS OF INFILL HAVE TO BE REPLACED PER FIELD PER YEAR)



Corkonut turns to dust, and it also blows away and floats readily during storm events, fouling waterways with suspended solids (TSS) and nutrients, plus any binders/adhesives and biocides/antifungals, etc., used on the field, and increasing maintenance costs.
7,000 lbs of infill migrate out of GreenPlay artificial turf fields and into the environment every year. This also puts athletes at higher risk for concussions unless the field is groomed, and/or more infill is added. **It costs $4,200/year/field just to replace lost infill.**
Source: Loudon County Public Schools Synthetic Turf Alternative Infill Analysis

CONTAMINATION TO NATHANSON CREEK

- The loss of infill material into Nathonson Creek represents a major threat to all of the wildlife in the area and downstream. Even if its infill is cork, which most likely floats beetter than hard rubber crumbs, that represents sediment that begins to fill in the drainage area we rely on to remove the water during flooding (as we have been experiencing this week). We cannot afford to have the creek compromised.

EACH ARTIFICIAL FIELD LOSES 4,800 LBS OF INFILL INTO THE ENVIRONMENT EACH YEAR

"According to Shaw Sports Turf, 120,000 lbs of Geofill is required for one 80,000 sq ft field. The Geofill FAQ states that approximately 10% (12,000 lbs) of the Geofill will need to be replenished every 2-3 years. **In other words, approximately 4,800 lbs (2.4 tons) will be lost from a single field, migrating into the local environment, waterways and municipal systems, every year, indefinitely.**" - Martha's Vineyard Synthetic Fields Impact Study (Partial): Anticipated Geofill Contamination

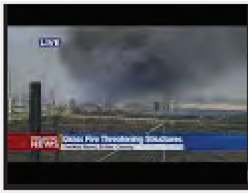
Synthetic Turf is Not Being Recycled And it Burns

- Regardless of infill - synthetic turf will burn and gives off toxic smoke. The impact is obvious in high risk fire country, combined with the fact that if it burns in a fire emergency, a major escape area for the school and townspeople will be eliminated. In recent fires, the farm was used as a rescue center for large and small animals. Should a synthetic fire hazard be installed next door, the farm is no longer a safe refuge. Here are videos of local synthetic turf fires:

Youtube Video - Sacramento Synthetic Turf Fire:

Artificial Turf Fire Sending Off Dark Smoke Near Highway 99 - YouTube

https://www.youtube.com/watch?v=wK_BDvmQ1WU



1:55

Jun 6, 2018 - Uploaded by CBS Sacramento
The **fire** has been contained to one lot in the area, but piles of **artificial turf** nearby have caught **fire** and are ...

nthetic Turf Fires - (artificial soccer / football sports fields ... - YouTube

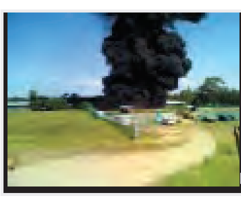
https://www.youtube.com/watch?v=YEFKHuWLgx4

2:30

Nov 7, 2012 - Uploaded by SF Parks
(arson vandalism of football and soccer fields and childrens playgrounds). ...
Purchase Green **Artificial** Grass ...

The Westfields Sports Synthetic Grass Fire #1 - YouTube

https://www.youtube.com/watch?v=1cGj0VoatLI



1:03

Mar 8, 2011 - Uploaded by Bradley Hodges
The Westfields Sports Synthetic Grass **Fire** #1 ... **Synthetic Turf Fires** - (artificial soccer / football sports fields …

Turf Catches On Fire During Pregame Show | Steelers vs ... - YouTube

https://www.youtube.com/watch?v=xxFHvcEE-Oc

▶ 1:21

Sep 27, 2015 - Uploaded by NFL
See the **turf** catch on **fire** during the pregame show between the Pittsburgh Steelers and the St. Louis Rams ...

HEAT DANGER IMPACT TO PLAYERS

Installation of synthetic turf raises heat danger to children in an already warm climate. This is a risk to every player regardless of sport and equipment warn. Quote From The Coalition for Safe Healthy Playing Fields (safehealthyplayingfields.org):

SYNTHETIC TURF IS 40-70 DEGREES HOTTER THAN SURROUNDING AIR TEMPERATURES ON WARM SUNNY DAYS

On clear warm days, synthetic turf fields get superheated to temperatures from 120 to 180 degrees F. Playing on synthetic turf can melt shoes, blister hands and feet, and induce dehydration and heatstroke.

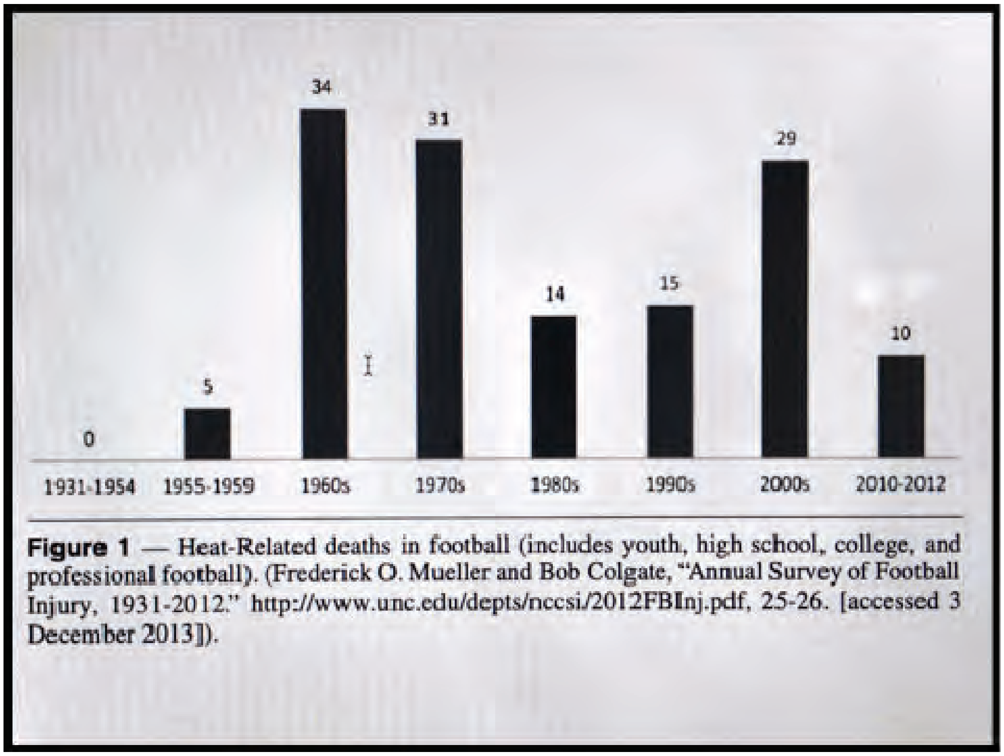


Figure 1 — Heat-Related deaths in football (includes youth, high school, college, and professional football). (Frederick O. Mueller and Bob Colgate, "Annual Survey of Football Injury, 1931-2012." http://www.unc.edu/depts/nccsi/2012FBInj.pdf, 25-26. [accessed 3 December 2013]).

Source : Heat-Related Deaths in American Football: An Interdisciplinary Approach

PAUL HORN / InsideClimate News

It should be noted that the majority of Sonoma Valley High School Football players wear dark green helmets and black jerseys - colors attracting heat.

WATER REQUIREMENTS NOT REDUCED BY SYNTHETIC TURF

Synthetic turf gets very hot and reflects heat. - Industry recomendations to cool synthetic turf require an irrigation system. Experts recommend it be watered 20 minutes before player use it in warm weather to reduce heat and allow player to slide a little easier and lessen “turf burn". ***Synthetic Turf Manufacturers Advance Field Cooling Advice*** by Emily Atwood Aug. 2, 2012 (athleticbusiness.com):

Playing in hot weather is enough of a concern for athletes without adding extra heat. "That reflective heat will wear on you. Just to stand on it will take a toll on you, not to mention any type of physical activity," says Fresenburg. As such, synthetic turf owners and manufacturers alike have sought various options to bring down the field temperature. Watering the fields is one option, but not the most practical. Even when water restrictions aren't an issue, the results are fleeting. "You can cool down the surface with an application of irrigation - you can get a 30- to 40-degree drop - but once that water evaporates, the temperatures are right back up there," Fresenburg says.

TURF BURN

- A common injury on synthetic turf is called turf burn. Regardless of the sport played - the tradeoff is a less forgiving surface that becomes abbrasive to player skin if a slde takes place and skin comes in contact with the synthetic turf.

- Regardless of infill type, synthetic turf still does not give way or stay soft like natural turf.

Turf Burn becoames a potential opening to another set infections - generally brought out of the locker room and make contact on the field.

INFECTION ON THE FIELD

Weekly field cleaning and disinfectant is a must activity for maintenance. Fields need to be disinfected and washed to protect players for infections brought from spit, sweat, blood, dead skin, and locker room bacterias.

TRUST THE CENTER FOR DISEASE CONTROL WHEN IT COMES TO FACTS ABOUT MRSA AND STAPH (SPORTSTURFNW.COM)

THE FIVE "C'S" OF SPREADING MRSA AND STAPH

- **Crowding**
- Frequent Skin to Skin **Contact**
- **Compromised Skin** (cuts, scrapes, small abrasions)
- **Contaminated Items** (sweaty towels, clothes, mats, synthetic turf)
- **Cleanliness**
-

PLAYERS PREFER NATURAL TURF

World Cup Mens Soccer has always been played on natural turf because the players demand it. Womens World Cup eventually did when enough players objected to the synthetic turf. **U.S. women: Men would never play World Cup on turf (usatoday.com)**

-

NFL PLAYERS ASSOCIATION PLAYING SURFACES OPINION SURVEY RESULTS:

89.7% OF NFL PLAYERS THINK SYNTHETIC TURF IS ***MORE LIKELY TO SHORTEN THEIR CAREER***

ATHLETES PREFER PLAYING ON REAL GRASS
STUDENTS AND PROFESSIONAL ATHLETES ALIKE PREFER GRASS AND BELIEVE THAT PLAYING ON SYNTHETIC TURF INCREASES INJURY.

FIFA STUDY:
Professional athletes have consistently shown a preference for playing on real grass. FIFA commissioned an 18 month study to gauge elite soccer players' attitudes towards grass vs. synturf. "In total, responses from 1129 players from 44 different countries were analysed. The majority of players expressed a strong preference for the use of Natural Turf pitches over alternatives such as Artificial Turf." According to the study, "Approximately three-quarters of players felt that all top level games should be played on NT."
Source: Elite Players' Perceptions of Football Playing Surfaces: A Mixed Effects Ordinal Logistic Regression Model of Players' Perceptions, Loughborough University in collaboration with FIFA, 2016

Maintenece of Synthetic Turf

Synthetic turf needs weekly maintenance and specialized equipment.

"SYNTHETIC TURF IS NOT MAINTENANCE-FREE."

MAINTENANCE OF SYNTHETIC TURF INCLUDES:

- Regular cleaning to get rid of debris
- Sanitation and disinfection to protect the health of the players
- Upkeep to keep the field from wearing out more quickly
- Watering to reduce temperature on hot days
- Maintenance and testing of the surface hardness to protect against concussions
- Infill replacement
- Irrigation
- Repairs

ROUTINE MAINTENANCE OVERVIEW BY CORNELL UNIVERSITY SPORTS FIELD MANAGEMENT:

"Some basic practices must be made on a routine basis to protect your investment including:

Measuring field hardness periodically to ensure the level of hardness is lower than the 200 Gmax level. At least once a year.

Sweeping and dragging to keep the carpet fibers in an upright position. Once a week or once a month depending on use.

Loosening and redistributing of infill (to improve footing, reduce static electricity and improve the look of the field). Groom fields before each game.

Checking and replenishing the infill level especially in high use areas. The infill creates the padding and shock-absorption for the synthetic turf system and restores the field's resiliency. At least once a year. It takes about 20 tons of crumb rubber to provide ¼ inch layer.

Using a vacuum or leaf blower to remove debris like sunflower seeds. After each game.

Cleaning with special solvents and cleansers with difficult to remove items. After each game.

Treating with anti-microbial products to remove bacterial growth. Weekly to monthly.

Troubleshooting for common problems and minor repairs, such as seam repair. Frequently.

Removing snow during winter months."

"Prevent problems and extra work by:

Establishing policies that prohibit the use of chewing gum, sunflower seeds, chewing tobacco while on the field surface.

Providing trash containers in strategic places so trash is not place on or around the field

Providing scraper mats where players and coaches enter the field so debris can be removed from shoes.

Involving athletes to help remove debris after reach game"

RECOMMENDATIONS

Based on the information in the discovery process in a short amount of time, should the opportunity arrise I would be happy to do more work. I want to see major improvements to our playing fields, but the proposed venue has major shortcoming and negative impact to Sonoma's Ecosystem, Safety, Humans, and Animals.

1) Proposed Lights - have too great a negative impact on the residents, children, and businesses in terms of noise, safety, and crime. Arnold Field should remain the venue for nightime games. High School and Middle School Fields should be for daytime only. My soccer team practiced into November until 7:00 pm and then cut back as days shortened. Proposed lighting would only be functioning in our rainy season, so much of the play would be cancelled anyway.

2) Proposed Field Components

A) Parking - The proposed stadium seating size did not take into account the infrastructure needed to support a venue that large. More study needs to be done, but at 440 parking places, the maximum seating that the stadium combined with the entire seating for the area should be no more than 1,760 seat capacity.

B) Synthetic Field Choice and Alternative - The artificial turf is ill concieved based the area heat concerns and fire hazard alone. Though maybe more durable that natural turf, it seems odd to put in a plastic field next to our agricultural school. Installing natural thick cut sod and having the school maintain it seems a more logical choice. Given we live in a great growing area, all of the turf fields should have divot boxes like a golf course with grass seed to repair any divots. Students should be required as part of playing requirements walk fields before and after games and practices to fill the divots. Let’s teach them what it takes to maintain proper fields, instead of putting them on throw away plastics. There are reinforced grass fields that build for FIFA venue that could work here.

Stewart Saunders
Sonoma, California

From: scso66 [mailto:scso66@sbcglobal.net]
Sent: Sunday, February 03, 2019 10:31 AM
To: babbott@sonomaschools.org
Subject: Athletic fields at high school

Hi,

I live just south of the high school fields, on Larkin Dr.

I am for the new fields and stadium, with lights. I feel this project is long over due.

As everything else, nearby neighbors will get use to the noise, which will most likely be cause by just several home football games.

As long as the existing walking paths are not effected, I am for the project.

Rocky Seffens
1283 Larkin Dr.
Sonoma, Ca
707-938-0964

Sent from my Verizon, Samsung Galaxy smartphone

Appendix B Lighting Analysis

Sonoma Valley High School

Sonoma, CA

Lighting System

Pole / Fixture Summary

Pole ID	Pole Height	Mtg Height	Fixture Qty	Luminaire Type	Load	Circuit
P1, P4-P5, P8	70'	70'	3	TLC-LED-1200	3.51 kW	A
P2-P3, P6-P7	70'	70'	3	TLC-LED-1200	3.51 kW	A
		70'	2	TLC-LED-400	0.80 kW	B
8			***32***		***31.28 kW***	

Circuit Summary

Circuit	Description	Load	Fixture Qty
A	Soccer 1	28.08 kW	24
B	Bleachers - Egress	3.2 kW	8

Fixture Type Summary

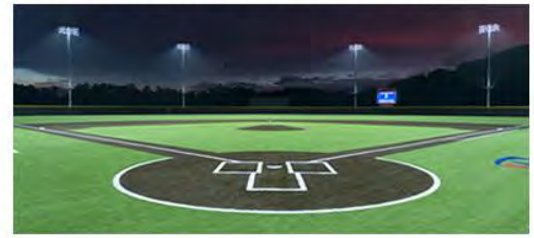
Type	Source	Wattage	Lumens	L90	L80	L70	Quantity
TLC-LED-1200	LED 5700K - 75 CRI	1170W	136,000	>81,000	>81,000	>81,000	24
TLC-LED-400	LED 5700K - 75 CRI	400W	46,500	>81,000	>81,000	>81,000	8

Light Level Summary

Calculation Grid Summary

Grid Name	Calculation Metric	Illumination					Circuits	Fixture Qty
		Ave	Min	Max	Max/Min	Ave/Min		
Football	Horizontal Illuminance	33.4	26	42.9	1.66	1.29	A	24
Glare/Spill - 150' Offset	Horizontal Illuminance	0	0	0	0.00		A	24
Glare/Spill - 150' Offset	Max Candela (by Fixture)	19.8	0	64.6	0.00		A	24
Glare/Spill - 150' Offset	Max Vert Illuminance (by Light Bank)	0	0	0	0.00		A	24
Home Bleachers - Egress	Horizontal Illuminance	8.27	6	10.3	1.74	1.38	B	8
Property Line	Horizontal Illuminance	0	0	0.01	0.00		A	24
Property Line	Max Candela (by Fixture)	71	0	1313	0.00		A	24
Property Line	Max Vertical Illuminance Metric	0	0	0.03	0.00		A	24
Soccer	Horizontal Illuminance	34	25	41.6	1.65	1.36	A	24
Visitor Bleacher - Egress	Horizontal Illuminance	9.34	8	12.7	1.67	1.17	B	8

From Hometown to Professional



musco Lighting

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EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P1, P4-P5 P8	70'	-	70'	TLC-LED-1200	3	3	0
4	P2-P3 P6-P7	70'	-	70' 70'	TLC-LED-1200 TLC-LED-400	3 2	3 0	0 2
8	TOTALS					32	24	8

Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	Football
Size:	360' x 160'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

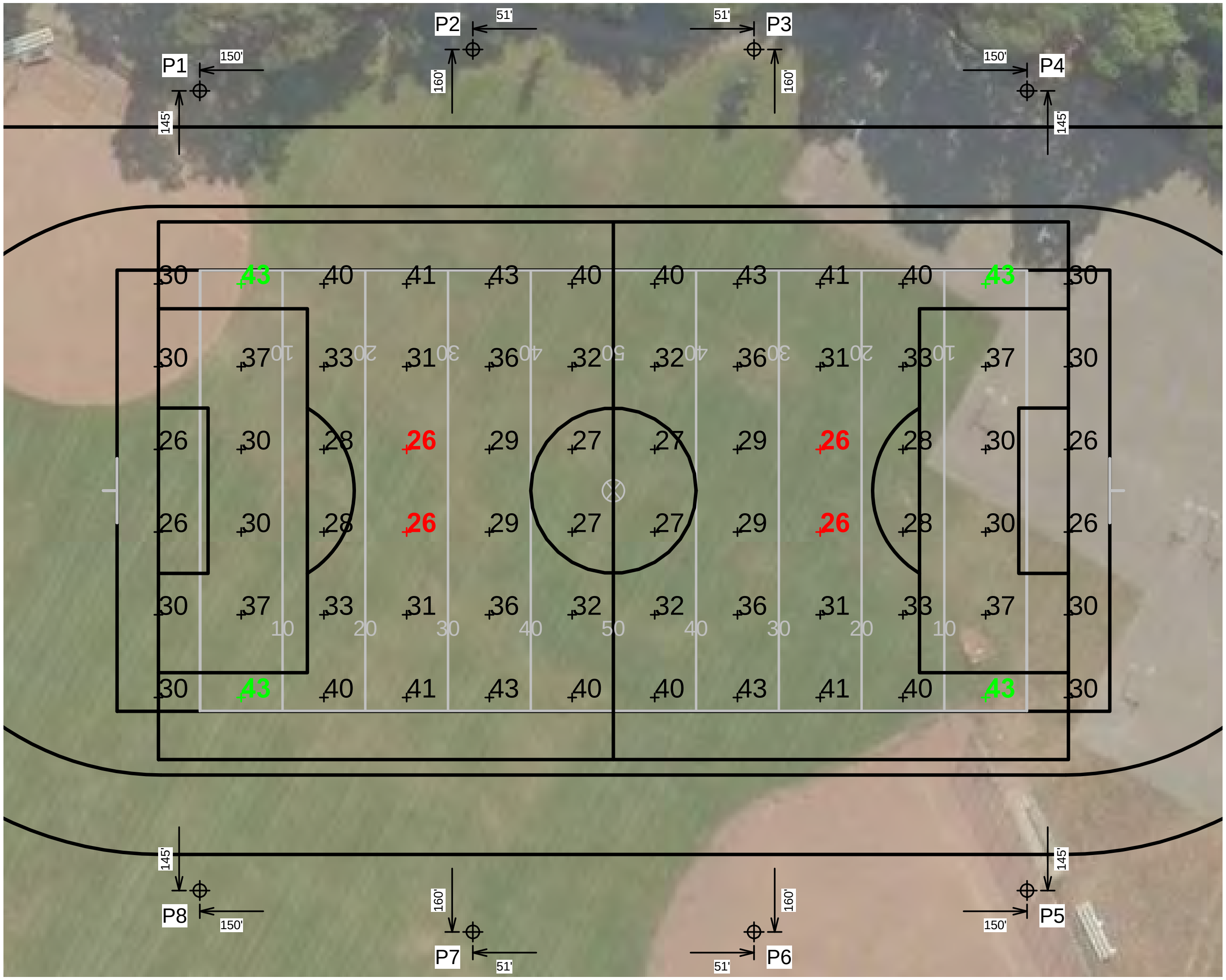
ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES	
	Entire Grid
Guaranteed Average:	**30**
Scan Average:	33.42
Maximum:	42.9
Minimum:	26
Avg / Min:	1.30
Guaranteed Max / Min:	**2**
Max / Min:	1.66
UG (adjacent pts):	1.41
No. of Points:	72
LUMINAIRE INFORMATION	
Color / CRI:	5700K - 75 CRI
Luminaire Output:	136,000 lumens
No. of Luminaires:	**24**
Total Load:	28.08 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1200	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.



SCALE IN FEET 1 : 60

0' 60' 120'

Pole location(s) ⌖ dimensions are relative to 0,0 reference point(s) ⊗

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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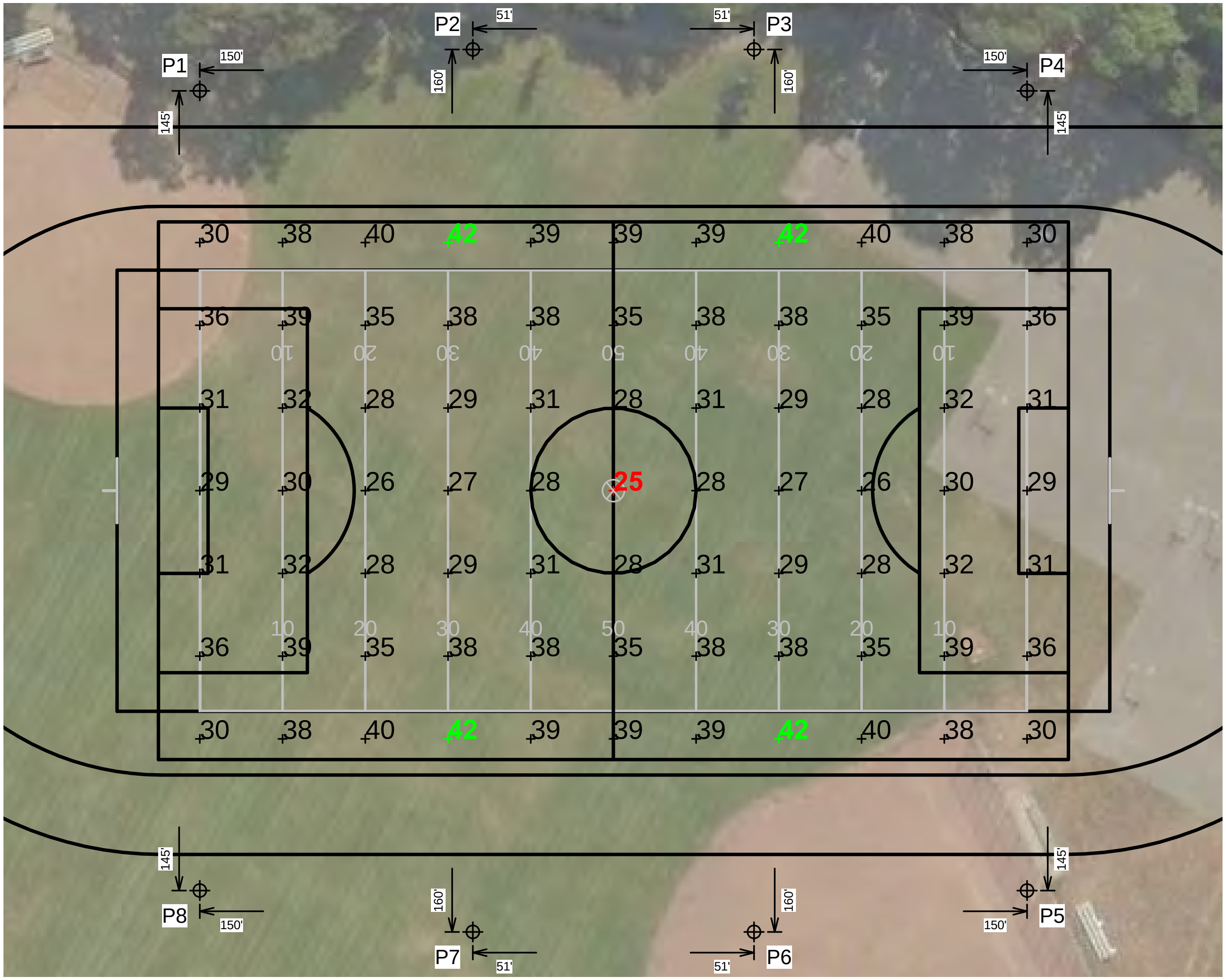
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P1, P4-P5 P8	70'	-	70'	TLC-LED-1200	3	3	0
4	P2-P3 P6-P7	70'	-	70' 70'	TLC-LED-1200 TLC-LED-400	3 2	3 0	0 2
8	TOTALS					32	24	8



SCALE IN FEET 1 : 60

0' 60' 120'

Pole location(s) ⌖ dimensions are relative to 0,0 reference point(s) ⊗

Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	Soccer
Size:	330' x 195'
Spacing:	30.0' x 30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Guaranteed Average:	**30**
Scan Average:	34.02
Maximum:	41.6
Minimum:	25
Avg / Min:	1.34
Guaranteed Max / Min:	**2**
Max / Min:	1.65
UG (adjacent pts):	1.30
No. of Points:	77

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	136,000 lumens
No. of Luminaires:	**24**
Total Load:	28.08 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1200	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P2-P3	70'	-	70'	TLC-LED-1200	3	0	3
	P6-P7			70'	TLC-LED-400	2	2	0
4	TOTALS					20	8	12

Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	Visitor Bleacher - Egress
Size:	330' x 195'
Spacing:	20.0' x 10.0'

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**9.34**
Maximum:	12.7
Minimum:	8
Avg / Min:	1.23
Max / Min:	**1.67**
UG (adjacent pts):	1.35
No. of Points:	16

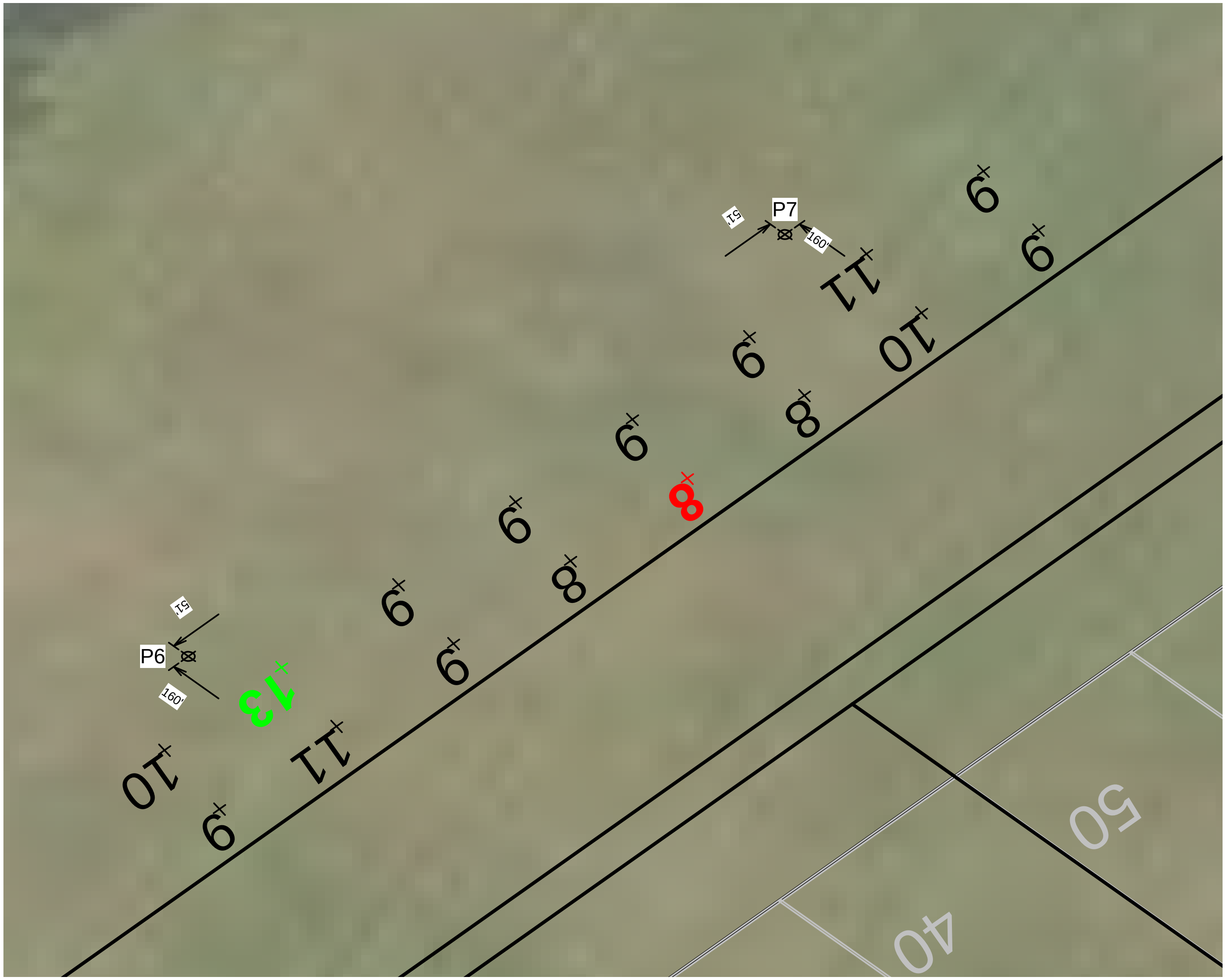
LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	46,500 lumens
No. of Luminaires:	**8**
Total Load:	3.2 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-400	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.



SCALE IN FEET 1 : 20

0' 20' 40'

Pole location(s) ⌖ dimensions are relative to 0,0 reference point(s) ⊗

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P2-P3	70'	-	70'	TLC-LED-1200	3	0	3
	P6-P7			70'	TLC-LED-400	2	2	0
4	TOTALS					20	8	12

SCALE IN FEET 1 : 40

0' 40' 80'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	**Home Bleachers - Egress**
Size:	330' x 195'
Spacing:	20.0' x 10.0'

ILLUMINATION SUMMARY

MAINTAINED HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**8.27**
Maximum:	10.3
Minimum:	6
Avg / Min:	1.40
Max / Min:	**1.74**
UG (adjacent pts):	1.42
No. of Points:	39

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	46,500 lumens
No. of Luminaires:	**8**
Total Load:	3.2 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-400	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document and includes a 0.95 dirt depreciation factor.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P1, P4-P5 P8	70'	-	70'	TLC-LED-1200	3	3	0
4	P2-P3 P6-P7	70'	-	70' 70'	TLC-LED-1200 TLC-LED-400	3 2	3 0	0 2
8	TOTALS					32	24	8

SCALE IN FEET 1 : 200

0' 200' 400'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

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Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	**Property Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**0.0005**
Maximum:	0.012
Minimum:	0.00
No. of Points:	122

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	136,000 lumens
No. of Luminaires:	**24**
Total Load:	28.08 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1200	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P1, P4-P5 P8	70'	-	70'	TLC-LED-1200	3	3	0
4	P2-P3 P6-P7	70'	-	70' 70'	TLC-LED-1200 TLC-LED-400	3 2	3 0	0 2
8	TOTALS					32	24	8

SCALE IN FEET 1 : 200

0' 200' 400'

Pole location(s) ⌖ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: • File #199423A • 14-Jun-19

Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	**Property Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAX VERTICAL FOOTCANDLES

	Entire Grid
Scan Average:	**0.0014**
Maximum:	0.034
Minimum:	0.00
No. of Points:	122

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	136,000 lumens
No. of Luminaires:	**24**
Total Load:	28.08 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1200	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

We Make It Happen.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P1, P4-P5 P8	70'	-	70'	TLC-LED-1200	3	3	0
4	P2-P3 P6-P7	70'	-	70' 70'	TLC-LED-1200 TLC-LED-400	3 2	3 0	0 2
8	TOTALS					32	24	8

Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	**Property Line**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

CANDELA (PER FIXTURE)

	Entire Grid
Scan Average:	**70.9636**
Maximum:	1313.059
Minimum:	0.00
No. of Points:	122

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	136,000 lumens
No. of Luminaires:	**24**
Total Load:	28.08 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1200	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.

SCALE IN FEET 1 : 200

0' 200' 400'

Pole location(s) ⌖ dimensions are relative to 0,0 reference point(s) ⊗

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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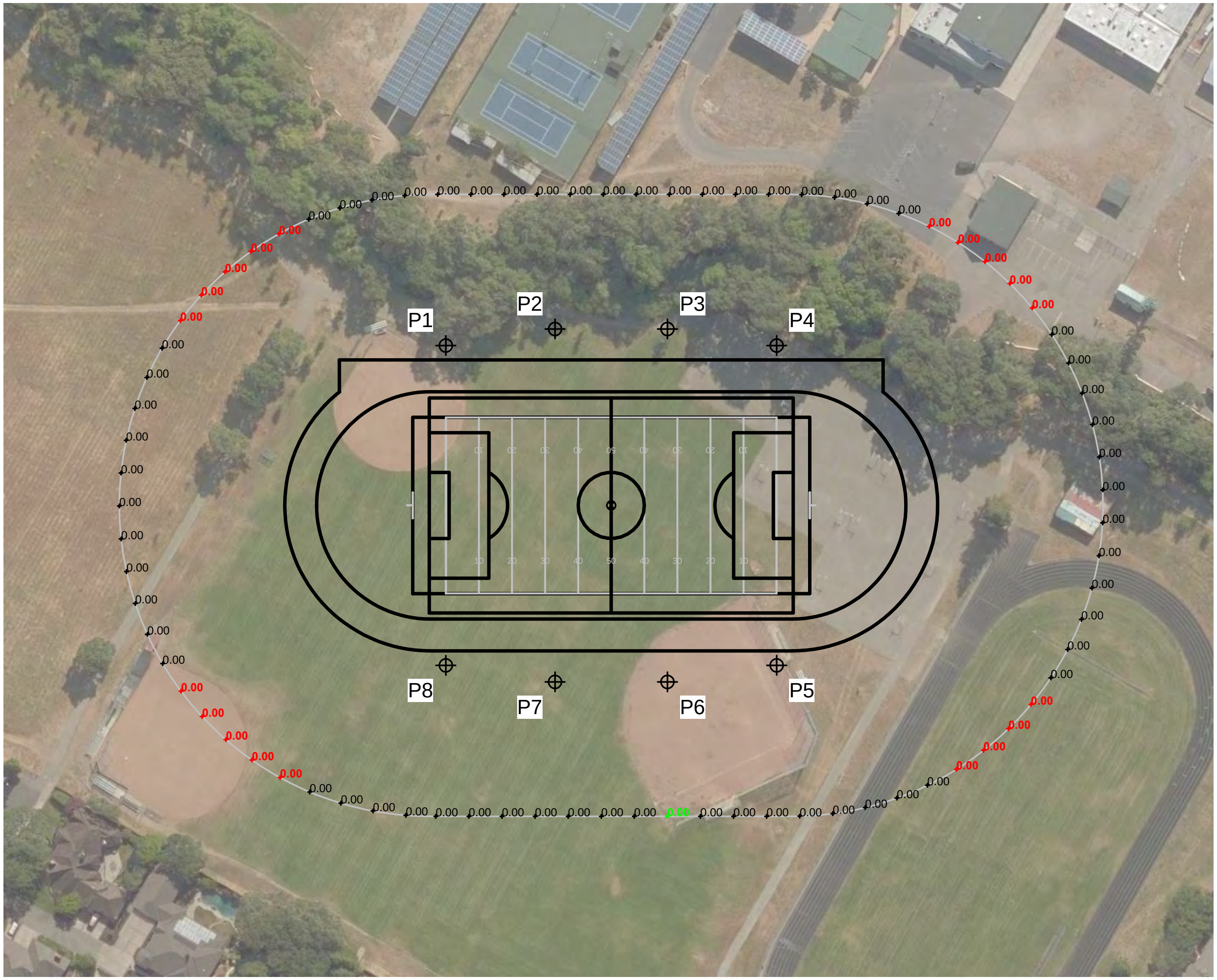
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P1, P4-P5 P8	70'	-	70'	TLC-LED-1200	3	3	0
4	P2-P3 P6-P7	70'	-	70' 70'	TLC-LED-1200 TLC-LED-400	3 2	3 0	0 2
8	TOTALS					32	24	8



SCALE IN FEET 1 : 150

0' 150' 300'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: • File #199423A • 14-Jun-19

Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	**Glare/Spill - 150' Offset**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

HORIZONTAL FOOTCANDLES

	Entire Grid
Scan Average:	**0.0000**
Maximum:	0.000
Minimum:	0.00
No. of Points:	81

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	136,000 lumens
No. of Luminaires:	**24**
Total Load:	28.08 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1200	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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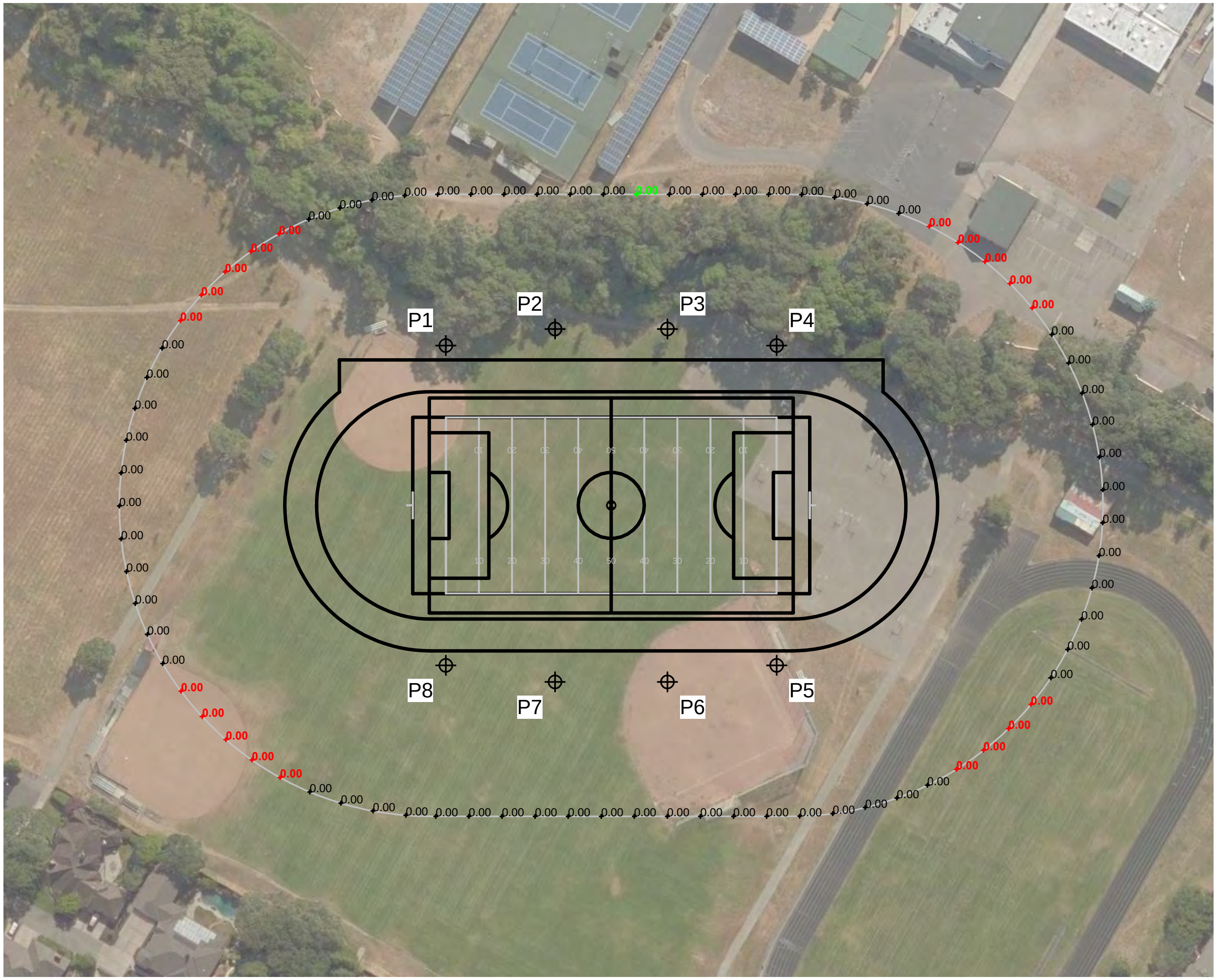
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P1, P4-P5 P8	70'	-	70'	TLC-LED-1200	3	3	0
4	P2-P3 P6-P7	70'	-	70' 70'	TLC-LED-1200 TLC-LED-400	3 2	3 0	0 2
8	TOTALS					32	24	8



SCALE IN FEET 1 : 150

0' 150' 300'

Pole location(s) ⌖ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: • File #199423A • 14-Jun-19

Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	**Glare/Spill - 150' Offset**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

MAX VERTICAL FOOTCANDLES

	Entire Grid
Scan Average:	**0.0002**
Maximum:	0.001
Minimum:	0.00
No. of Points:	81

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	136,000 lumens
No. of Luminaires:	**24**
Total Load:	28.08 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1200	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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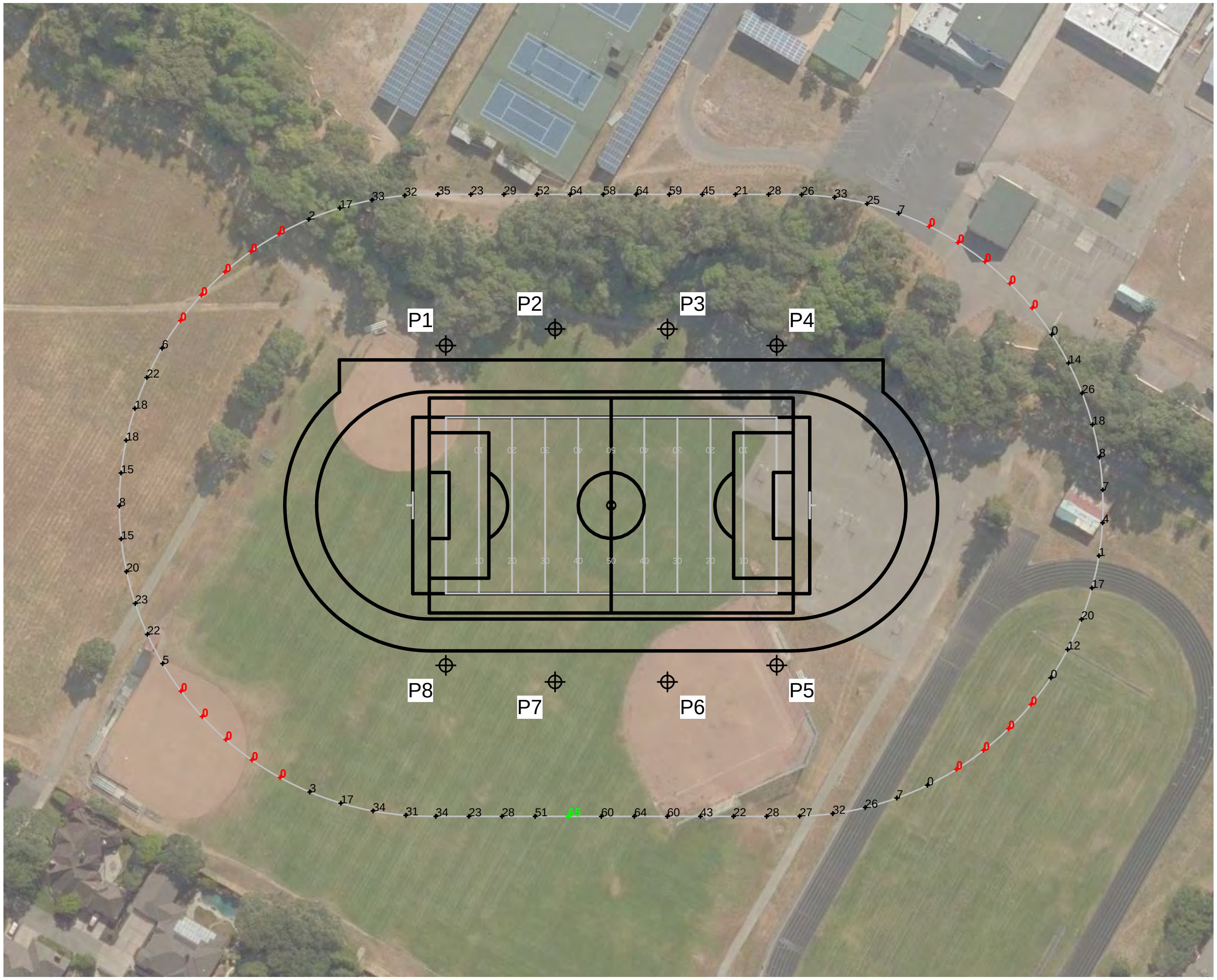
EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires				
QTY	LOCATION	SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE	THIS GRID	OTHER GRIDS
4	P1, P4-P5 P8	70'	-	70'	TLC-LED-1200	3	3	0
4	P2-P3 P6-P7	70'	-	70' 70'	TLC-LED-1200 TLC-LED-400	3 2	3 0	0 2
8	TOTALS					32	24	8



SCALE IN FEET 1 : 150

0' 150' 300'

Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: • File #199423A • 14-Jun-19

Sonoma Valley High School

Sonoma, CA

GRID SUMMARY

Name:	**Glare/Spill - 150' Offset**
Spacing:	30.0'
Height:	3.0' above grade

ILLUMINATION SUMMARY

CANDELA (PER FIXTURE)

	Entire Grid
Scan Average:	19.8341
Maximum:	64.619
Minimum:	0.00
No. of Points:	81

LUMINAIRE INFORMATION

Color / CRI:	5700K - 75 CRI
Luminaire Output:	136,000 lumens
No. of Luminaires:	**24**
Total Load:	28.08 kW

Lumen Maintenance

Luminaire Type	L90 hrs	L80 hrs	L70 hrs
TLC-LED-1200	>81,000	>81,000	>81,000

Reported per TM-21-11. See luminaire datasheet for details.

Guaranteed Performance: The ILLUMINATION described above is guaranteed per your Musco Warranty document.

Field Measurements: Individual field measurements may vary from computer-calculated predictions and should be taken in accordance with IESNA RP-6-15.

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

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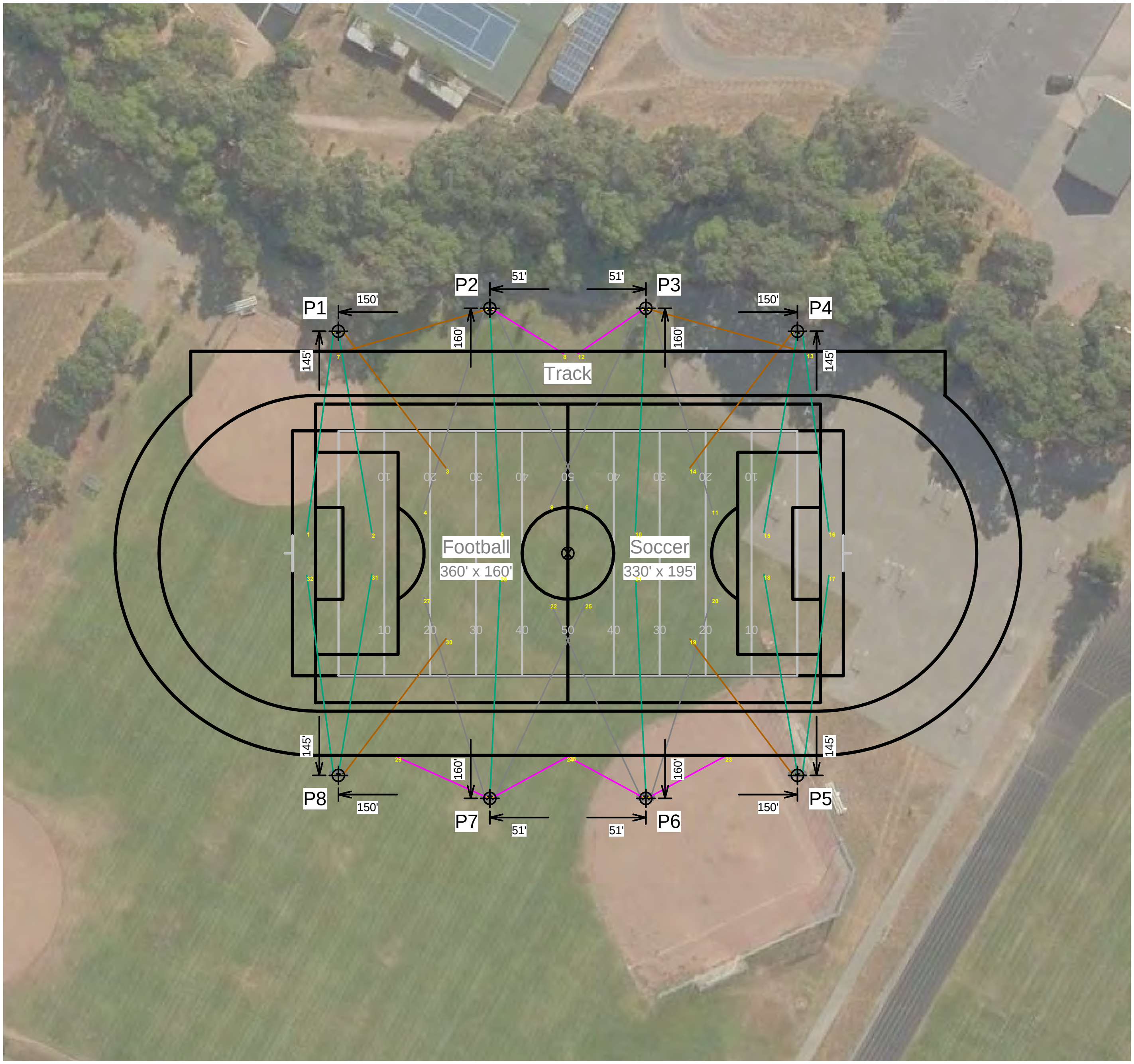

SCALE IN FEET 1 : 100

0' 100' 200'

Pole location(s) ⌖ dimensions are relative to 0,0 reference point(s) ⊗

ENGINEERED DESIGN By: • File #199423A • 14-Jun-19

Sonoma Valley High School

Sonoma, CA

EQUIPMENT LAYOUT

INCLUDES:

- Football
- Soccer
- Track

Electrical System Requirements: Refer to Amperage Draw Chart and/or the **"Musco Control System Summary"** for electrical sizing.

Installation Requirements: Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

EQUIPMENT LIST FOR AREAS SHOWN

Pole				Luminaires		
QTY	LOCATION	CLASS	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE
4	P1, P4-P5 P8	LSS70A	-	70'	TLC-LED-1200	3
4	P2-P3 P6-P7	LSS70C	-	70' 70'	TLC-LED-1200 TLC-LED-400	3 2
8	TOTALS					32

SINGLE LUMINAIRE AMPERAGE DRAW CHART

Ballast Specifications (.90 min power factor)	Line Amperage Per Luminaire (max draw)						
Single Phase Voltage	208 (60)	220 (60)	240 (60)	277 (60)	347 (60)	380 (60)	480 (60)
TLC-LED-1200	7.0	6.6	6.1	5.2	4.2	3.8	3.0
TLC-LED-400-A	2.3	2.2	2.0	1.7	1.4	1.3	1.0

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Sonoma Valley High School

Sonoma, CA

GLARE IMPACT

Summary

Map indicates the maximum candela an observer would see when facing the brightest light source from any direction.

A well-designed lighting system controls light to provide maximum useful on-field illumination with minimal destructive off-site glare.

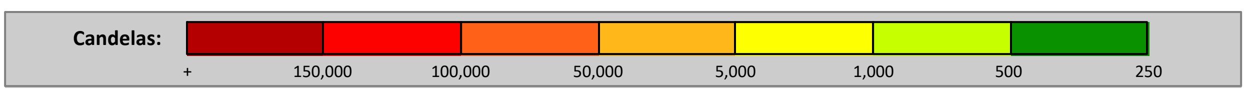
GLARE

Candela Levels

High Glare: 150,000 or more candela
Should only occur on or very near the lit area where the light source is in direct view. Care must be taken to minimize high glare zones.

Significant Glare: 25,000 to 75,000 candela
Equivalent to high beam headlights of a car.

Minimal to No Glare: 500 or less candela
Equivalent to 100W incandescent light bulb.



We Make It Happen.

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Control System Summary

Project Specific Notes:

Project Information

Project #:	199423
Project Name:	Sonoma Valley High School Athletic Complex
Date:	06/14/19
Project Engineer:	JWinegar
Sales Representative:	Jasen Deniz
Control System Type:	Control and Monitoring
Communication Type:	Digital Cellular
Scan:	199423A
Document ID:	199423P1V1-0614094613
Distribution Panel Location or ID:	
Total # of Distribution Panel Locations for Project:	1
Design Voltage/Hertz/Phase:	480/60/3
Control Voltage:	120

Equipment Listing

DESCRIPTION	APPROXIMATE SIZE
1.Control and Monitoring Cabinet	24 X 72

	QTY	SIZE
Total Contactors	12	30 AMP
Total Off/On/Auto Switches:	2	

Materials Checklist

Contractor/Customer Supplied:

- ❑ A dedicated control circuit must be supplied per distribution panel location.
  - — If the control voltage is NOT available, a control transformer is required.
- ❑ Electrical distribution panel to provide overcurrent protection for circuits
  - — HID rated or D-curve circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- ❑ Wiring:
  - — See chart on page 2 for wiring requirements
  - — Equipment grounding conductor and splices must be insulated. (per circuit)
  - — Lightning ground protection (per pole), if not Musco supplied.
- ❑ Electrical conduit wireway system
  - — Entrance hubs rated NEMA 4: must be die-cast zinc, PVC, or copper-free die-cast aluminum
- ❑ Mounting hardware for cabinets
- ❑ Breaker lock-on device to prevent unauthorized power interruption to control power and powerline connection (if present)
- ❑ Anti-corrosion compound to apply to ends of wire, if necessary

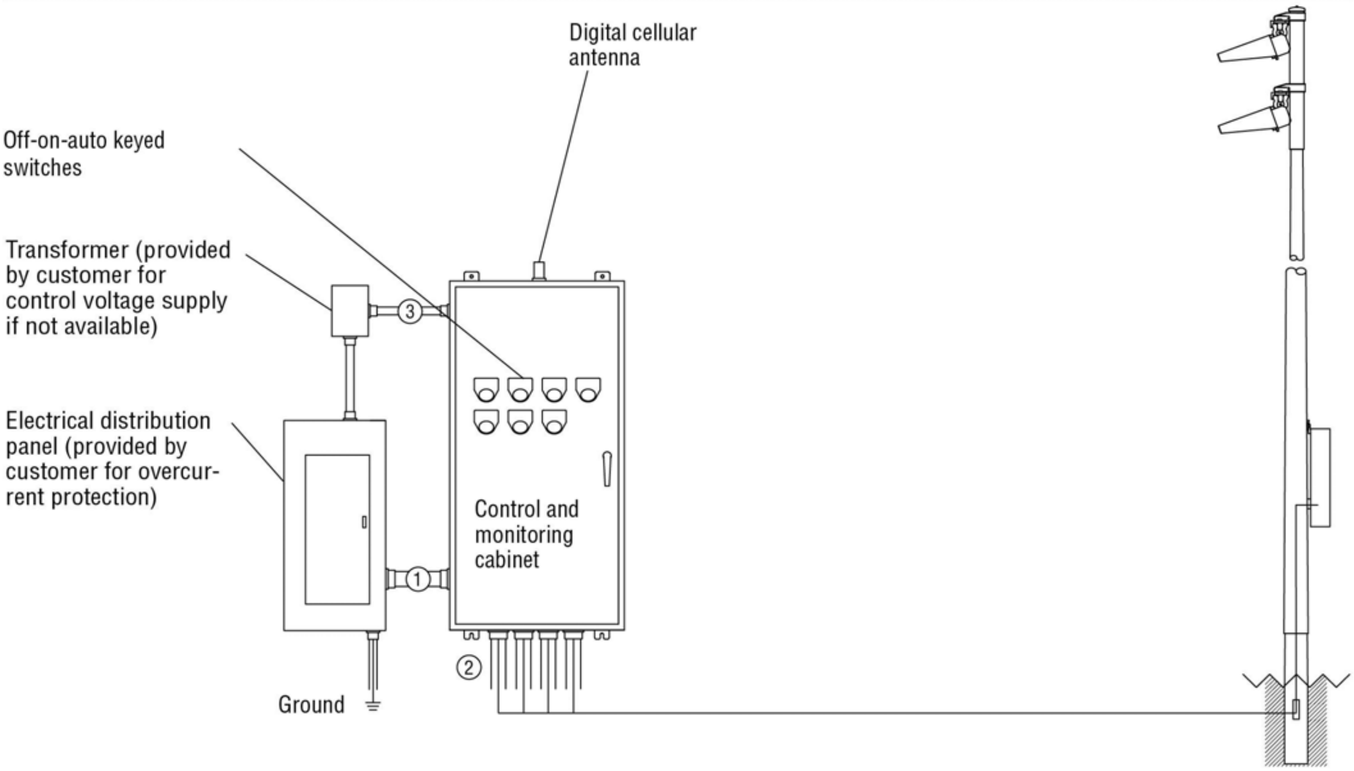
Call Control-Link Central ™ operations center at 877/347-3319 to schedule activation of the control system upon completion of the installation. Note: Activation may take up to 1 1/2 hours

IMPORTANT NOTES

1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's electrical components enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are UL 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements

Control•Link®
Control and Monitoring System



Conduit ID	Description	# of Wires	Wire (AWG)	Conduit (in)	Max. Wire Length (ft)	MUSCO Supplied	Notes
1	Line power to contactors, and equipment grounding conductor	*A	*B	*C	N/A	No	A-E
1	Power-line Communication Connection (dedicated, 20A)	*A	12	*C	N/A	No	A-E
2	Load power to lighting circuits, and equipment grounding conductor	*A	*B	*C	N/A	No	A-E
3	Control power (dedicated, 20A)	3	12	*C	N/A	No	C,E

* Notes:

R60-100-00_A

A. See voltage and phasing per the notes on cover page.
B. Calculate per load and voltage drop.
C. All conduit diameters should be per code unless otherwise specified to allow for connector size.
D. Equipment grounding conductor and any splices must be insulated.
E. Refer to control and monitoring system installation instructions for more details on equipment information and the installation requirements.

IMPORTANT: Control wires (3) must be in separate conduit from line and load power wires (1, 2).

Control System Summary

SWITCHING SCHEDULE

Field/Zone Description	Zones
Football	**1**
Soccer	**1,2**
-Football	1
-Bleachers - Egress	2

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 3513.0
	SEALED: 387.8

CIRCUIT SUMMARY BY ZONE

POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	# OF DRIVERS	*FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
P1,P2,P3,P4,P5	Football	3	3	**5.3**	30		1
P6,P7,P8							
P2,P3,P6,P7	Bleachers - Egress	2	1	**1.7**	30		2

*Full Load Amps based on amps per driver.

Control System Summary

PANEL SUMMARY

CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
1	1		Pole P1	5.25		
1	1		Pole P2	5.25		
1	1		Pole P3	5.25		
1	1		Pole P4	5.25		
1	1		Pole P5	5.25		
1	1		Pole P6	5.25		
1	1		Pole P7	5.25		
1	1		Pole P8	5.25		
1	1		Pole P2	1.73		
1	1		Pole P3	1.73		
1	1		Pole P6	1.73		
1	1		Pole P7	1.73		

ZONE SCHEDULE

			CIRCUIT DESCRIPTION	
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	POLE ID	CONTACTOR ID
Zone 1	1	Football	P1 P2 P3 P4 P5 P6 P7 P8	
Zone 2	2	Bleachers - Egress	P2 P3 P6 P7	

Appendix C CalEEMod

SVHS - Athletic Fields Reno Project - Const

Sonoma-San Francisco County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	1.10	Acre	1.10	47,916.00	0
City Park	17.00	Acre	17.00	740,520.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	75
Climate Zone	4			**Operational Year**	2021
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Construction-Only Run; 1.1 acres basketball court

Construction Phase - Construction schedule approved by contractor; paving is conservative and would occur intermittently.

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	20.00	31.00
tblConstructionPhase	NumDays	300.00	45.00
tblConstructionPhase	NumDays	30.00	230.00
tblConstructionPhase	NumDays	20.00	170.00
tblConstructionPhase	NumDays	10.00	31.00

tblGrading	AcresOfGrading	575.00	75.00
tblTripsAndVMT	HaulingTripLength	20.00	7.30
tblTripsAndVMT	HaulingTripNumber	0.00	600.00
tblTripsAndVMT	HaulingTripNumber	0.00	270.00
tblTripsAndVMT	VendorTripNumber	129.00	5.00
tblTripsAndVMT	WorkerTripNumber	331.00	15.00
tblTripsAndVMT	WorkerTripNumber	66.00	5.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.4247	4.6077	3.0189	5.8100e-003	0.7361	0.2078	0.9439	0.3784	0.1913	0.5697	0.0000	512.4316	512.4316	0.1558	0.0000	516.3275
2021	0.3591	3.6439	2.9719	5.5700e-003	0.3683	0.1663	0.5346	0.1779	0.1536	0.3315	0.0000	490.1301	490.1301	0.1443	0.0000	493.7368
Maximum	**0.4247**	**4.6077**	**3.0189**	**5.8100e-003**	**0.7361**	**0.2078**	**0.9439**	**0.3784**	**0.1913**	**0.5697**	**0.0000**	**512.4316**	**512.4316**	**0.1558**	**0.0000**	**516.3275**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.4247	4.6077	3.0189	5.8100e-003	0.7361	0.2078	0.9439	0.3784	0.1913	0.5697	0.0000	512.4310	512.4310	0.1558	0.0000	516.3269
2021	0.3591	3.6439	2.9718	5.5700e-003	0.3683	0.1663	0.5346	0.1779	0.1536	0.3315	0.0000	490.1295	490.1295	0.1443	0.0000	493.7362
Maximum	**0.4247**	**4.6077**	**3.0189**	**5.8100e-003**	**0.7361**	**0.2078**	**0.9439**	**0.3784**	**0.1913**	**0.5697**	**0.0000**	**512.4310**	**512.4310**	**0.1558**	**0.0000**	**516.3269**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	**Start Date**	**End Date**	**Maximum Unmitigated ROG + NOX (tons/quarter)**	**Maximum Mitigated ROG + NOX (tons/quarter)**
1	**5-25-2020**	**8-24-2020**	2.1299	2.1299
2	**8-25-2020**	**11-24-2020**	1.9572	1.9572
3	**11-25-2020**	**2-24-2021**	2.2415	2.2415
4	**2-25-2021**	**5-24-2021**	2.4997	2.4997
5	**5-25-2021**	**8-24-2021**	0.1843	0.1843
		Highest	2.4997	2.4997

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	5/25/2020	6/19/2020	5	20	
2	Site Preparation	Site Preparation	6/20/2020	8/3/2020	5	31	
3	Grading	Grading	7/4/2020	5/21/2021	5	230	
4	Paving	Paving	11/2/2020	6/25/2021	5	170	
5	Building Construction	Building Construction	3/1/2021	4/30/2021	5	45	
6	Architectural Coating	Architectural Coating	5/1/2021	6/14/2021	5	31	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 1.1

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 2,875

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74

Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	57.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	600.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	15.00	5.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	5.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	270.00	10.80	7.30	7.30	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					6.1800e-003	0.0000	6.1800e-003	9.4000e-004	0.0000	9.4000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0331	0.3320	0.2175	3.9000e-004		0.0166	0.0166		0.0154	0.0154	0.0000	33.9986	33.9986	9.6000e-003	0.0000	34.2386
Total	**0.0331**	**0.3320**	**0.2175**	**3.9000e-004**	**6.1800e-003**	**0.0166**	**0.0228**	**9.4000e-004**	**0.0154**	**0.0164**	**0.0000**	**33.9986**	**33.9986**	**9.6000e-003**	**0.0000**	**34.2386**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.3000e-004	8.4200e-003	1.7200e-003	2.0000e-005	4.7000e-004	3.0000e-005	5.0000e-004	1.3000e-004	3.0000e-005	1.6000e-004	0.0000	2.1955	2.1955	1.3000e-004	0.0000	2.1989
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.2000e-004	5.2000e-004	5.2200e-003	1.0000e-005	1.1800e-003	1.0000e-005	1.1900e-003	3.1000e-004	1.0000e-005	3.2000e-004	0.0000	1.0844	1.0844	4.0000e-005	0.0000	1.0854
Total	**9.5000e-004**	**8.9400e-003**	**6.9400e-003**	**3.0000e-005**	**1.6500e-003**	**4.0000e-005**	**1.6900e-003**	**4.4000e-004**	**4.0000e-005**	**4.8000e-004**	**0.0000**	**3.2799**	**3.2799**	**1.7000e-004**	**0.0000**	**3.2843**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					6.1800e-003	0.0000	6.1800e-003	9.4000e-004	0.0000	9.4000e-004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0331	0.3320	0.2175	3.9000e-004		0.0166	0.0166		0.0154	0.0154	0.0000	33.9986	33.9986	9.6000e-003	0.0000	34.2385
Total	**0.0331**	**0.3320**	**0.2175**	**3.9000e-004**	**6.1800e-003**	**0.0166**	**0.0228**	**9.4000e-004**	**0.0154**	**0.0164**	**0.0000**	**33.9986**	**33.9986**	**9.6000e-003**	**0.0000**	**34.2385**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	2.3000e-004	8.4200e-003	1.7200e-003	2.0000e-005	4.7000e-004	3.0000e-005	5.0000e-004	1.3000e-004	3.0000e-005	1.6000e-004	0.0000	2.1955	2.1955	1.3000e-004	0.0000	2.1989
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.2000e-004	5.2000e-004	5.2200e-003	1.0000e-005	1.1800e-003	1.0000e-005	1.1900e-003	3.1000e-004	1.0000e-005	3.2000e-004	0.0000	1.0844	1.0844	4.0000e-005	0.0000	1.0854
Total	**9.5000e-004**	**8.9400e-003**	**6.9400e-003**	**3.0000e-005**	**1.6500e-003**	**4.0000e-005**	**1.6900e-003**	**4.4000e-004**	**4.0000e-005**	**4.8000e-004**	**0.0000**	**3.2799**	**3.2799**	**1.7000e-004**	**0.0000**	**3.2843**

3.3 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2800	0.0000	0.2800	0.1539	0.0000	0.1539	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0632	0.6575	0.3335	5.9000e-004		0.0341	0.0341		0.0313	0.0313	0.0000	51.8176	51.8176	0.0168	0.0000	52.2365
Total	**0.0632**	**0.6575**	**0.3335**	**5.9000e-004**	**0.2800**	**0.0341**	**0.3141**	**0.1539**	**0.0313**	**0.1853**	**0.0000**	**51.8176**	**51.8176**	**0.0168**	**0.0000**	**52.2365**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3300e-003	9.7000e-004	9.7200e-003	2.0000e-005	2.1900e-003	2.0000e-005	2.2100e-003	5.8000e-004	2.0000e-005	6.0000e-004	0.0000	2.0171	2.0171	7.0000e-005	0.0000	2.0189
Total	**1.3300e-003**	**9.7000e-004**	**9.7200e-003**	**2.0000e-005**	**2.1900e-003**	**2.0000e-005**	**2.2100e-003**	**5.8000e-004**	**2.0000e-005**	**6.0000e-004**	**0.0000**	**2.0171**	**2.0171**	**7.0000e-005**	**0.0000**	**2.0189**

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Fugitive Dust					0.2800	0.0000	0.2800	0.1539	0.0000	0.1539	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0632	0.6575	0.3335	5.9000e-004		0.0341	0.0341		0.0313	0.0313	0.0000	51.8175	51.8175	0.0168	0.0000	52.2365
Total	**0.0632**	**0.6575**	**0.3335**	**5.9000e-004**	**0.2800**	**0.0341**	**0.3141**	**0.1539**	**0.0313**	**0.1853**	**0.0000**	**51.8175**	**51.8175**	**0.0168**	**0.0000**	**52.2365**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3300e-003	9.7000e-004	9.7200e-003	2.0000e-005	2.1900e-003	2.0000e-005	2.2100e-003	5.8000e-004	2.0000e-005	6.0000e-004	0.0000	2.0171	2.0171	7.0000e-005	0.0000	2.0189
Total	**1.3300e-003**	**9.7000e-004**	**9.7200e-003**	**2.0000e-005**	**2.1900e-003**	**2.0000e-005**	**2.2100e-003**	**5.8000e-004**	**2.0000e-005**	**6.0000e-004**	**0.0000**	**2.0171**	**2.0171**	**7.0000e-005**	**0.0000**	**2.0189**

3.4 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.4282	0.0000	0.4282	0.2178	0.0000	0.2178	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2870	3.2377	2.0613	4.0000e-003		0.1402	0.1402		0.1290	0.1290	0.0000	351.4237	351.4237	0.1137	0.0000	354.2651
Total	**0.2870**	**3.2377**	**2.0613**	**4.0000e-003**	**0.4282**	**0.1402**	**0.5684**	**0.2178**	**0.1290**	**0.3468**	**0.0000**	**351.4237**	**351.4237**	**0.1137**	**0.0000**	**354.2651**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.3400e-003	0.0497	0.0101	1.3000e-004	4.4400e-003	1.8000e-004	4.6200e-003	1.1700e-003	1.7000e-004	1.3400e-003	0.0000	12.9619	12.9619	8.0000e-004	0.0000	12.9818
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.1500e-003	4.4700e-003	0.0449	1.0000e-004	0.0101	8.0000e-005	0.0102	2.6900e-003	8.0000e-005	2.7700e-003	0.0000	9.3262	9.3262	3.4000e-004	0.0000	9.3348
Total	**7.4900e-003**	**0.0542**	**0.0551**	**2.3000e-004**	**0.0146**	**2.6000e-004**	**0.0148**	**3.8600e-003**	**2.5000e-004**	**4.1100e-003**	**0.0000**	**22.2881**	**22.2881**	**1.1400e-003**	**0.0000**	**22.3166**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.4282	0.0000	0.4282	0.2178	0.0000	0.2178	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2870	3.2377	2.0613	4.0000e-003		0.1402	0.1402		0.1290	0.1290	0.0000	351.4233	351.4233	0.1137	0.0000	354.2647
Total	**0.2870**	**3.2377**	**2.0613**	**4.0000e-003**	**0.4282**	**0.1402**	**0.5684**	**0.2178**	**0.1290**	**0.3468**	**0.0000**	**351.4233**	**351.4233**	**0.1137**	**0.0000**	**354.2647**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.3400e-003	0.0497	0.0101	1.3000e-004	4.4400e-003	1.8000e-004	4.6200e-003	1.1700e-003	1.7000e-004	1.3400e-003	0.0000	12.9619	12.9619	8.0000e-004	0.0000	12.9818
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.1500e-003	4.4700e-003	0.0449	1.0000e-004	0.0101	8.0000e-005	0.0102	2.6900e-003	8.0000e-005	2.7700e-003	0.0000	9.3262	9.3262	3.4000e-004	0.0000	9.3348
Total	**7.4900e-003**	**0.0542**	**0.0551**	**2.3000e-004**	**0.0146**	**2.6000e-004**	**0.0148**	**3.8600e-003**	**2.5000e-004**	**4.1100e-003**	**0.0000**	**22.2881**	**22.2881**	**1.1400e-003**	**0.0000**	**22.3166**

3.4 Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3439	0.0000	0.3439	0.1715	0.0000	0.1715	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2117	2.3432	1.5594	3.1300e-003		0.1003	0.1003		0.0922	0.0922	0.0000	275.1997	275.1997	0.0890	0.0000	277.4248
Total	**0.2117**	**2.3432**	**1.5594**	**3.1300e-003**	**0.3439**	**0.1003**	**0.4441**	**0.1715**	**0.0922**	**0.2637**	**0.0000**	**275.1997**	**275.1997**	**0.0890**	**0.0000**	**277.4248**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	9.9000e-004	0.0358	7.6100e-003	1.0000e-004	4.2900e-003	1.2000e-004	4.4200e-003	1.1200e-003	1.2000e-004	1.2300e-003	0.0000	10.0158	10.0158	6.2000e-004	0.0000	10.0312
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.4700e-003	3.1200e-003	0.0318	8.0000e-005	7.9300e-003	6.0000e-005	7.9900e-003	2.1100e-003	6.0000e-005	2.1700e-003	0.0000	7.0493	7.0493	2.4000e-004	0.0000	7.0553
Total	**5.4600e-003**	**0.0389**	**0.0394**	**1.8000e-004**	**0.0122**	**1.8000e-004**	**0.0124**	**3.2300e-003**	**1.8000e-004**	**3.4000e-003**	**0.0000**	**17.0651**	**17.0651**	**8.6000e-004**	**0.0000**	**17.0865**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.3439	0.0000	0.3439	0.1715	0.0000	0.1715	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.2117	2.3432	1.5594	3.1300e-003		0.1003	0.1003		0.0922	0.0922	0.0000	275.1993	275.1993	0.0890	0.0000	277.4245
Total	**0.2117**	**2.3432**	**1.5594**	**3.1300e-003**	**0.3439**	**0.1003**	**0.4441**	**0.1715**	**0.0922**	**0.2637**	**0.0000**	**275.1993**	**275.1993**	**0.0890**	**0.0000**	**277.4245**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	9.9000e-004	0.0358	7.6100e-003	1.0000e-004	4.2900e-003	1.2000e-004	4.4200e-003	1.1200e-003	1.2000e-004	1.2300e-003	0.0000	10.0158	10.0158	6.2000e-004	0.0000	10.0312
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.4700e-003	3.1200e-003	0.0318	8.0000e-005	7.9300e-003	6.0000e-005	7.9900e-003	2.1100e-003	6.0000e-005	2.1700e-003	0.0000	7.0493	7.0493	2.4000e-004	0.0000	7.0553
Total	**5.4600e-003**	**0.0389**	**0.0394**	**1.8000e-004**	**0.0122**	**1.8000e-004**	**0.0124**	**3.2300e-003**	**1.8000e-004**	**3.4000e-003**	**0.0000**	**17.0651**	**17.0651**	**8.6000e-004**	**0.0000**	**17.0865**

3.5 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0298	0.3094	0.3224	5.0000e-004		0.0166	0.0166		0.0152	0.0152	0.0000	44.0621	44.0621	0.0143	0.0000	44.4184
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0298**	**0.3094**	**0.3224**	**5.0000e-004**		**0.0166**	**0.0166**		**0.0152**	**0.0152**	**0.0000**	**44.0621**	**44.0621**	**0.0143**	**0.0000**	**44.4184**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.4000e-004	5.8000e-003	1.0800e-003	1.0000e-005	6.7000e-004	2.0000e-005	6.9000e-004	1.7000e-004	1.0000e-005	1.9000e-004	0.0000	1.1588	1.1588	1.0000e-004	0.0000	1.1612
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.5700e-003	1.1400e-003	0.0115	3.0000e-005	2.5900e-003	2.0000e-005	2.6100e-003	6.9000e-004	2.0000e-005	7.1000e-004	0.0000	2.3858	2.3858	9.0000e-005	0.0000	2.3880
Total	**1.7100e-003**	**6.9400e-003**	**0.0126**	**4.0000e-005**	**3.2600e-003**	**4.0000e-005**	**3.3000e-003**	**8.6000e-004**	**3.0000e-005**	**9.0000e-004**	**0.0000**	**3.5446**	**3.5446**	**1.9000e-004**	**0.0000**	**3.5491**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0298	0.3094	0.3224	5.0000e-004		0.0166	0.0166		0.0152	0.0152	0.0000	44.0620	44.0620	0.0143	0.0000	44.4183
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0298**	**0.3094**	**0.3224**	**5.0000e-004**		**0.0166**	**0.0166**		**0.0152**	**0.0152**	**0.0000**	**44.0620**	**44.0620**	**0.0143**	**0.0000**	**44.4183**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.4000e-004	5.8000e-003	1.0800e-003	1.0000e-005	6.7000e-004	2.0000e-005	6.9000e-004	1.7000e-004	1.0000e-005	1.9000e-004	0.0000	1.1588	1.1588	1.0000e-004	0.0000	1.1612
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.5700e-003	1.1400e-003	0.0115	3.0000e-005	2.5900e-003	2.0000e-005	2.6100e-003	6.9000e-004	2.0000e-005	7.1000e-004	0.0000	2.3858	2.3858	9.0000e-005	0.0000	2.3880
Total	**1.7100e-003**	**6.9400e-003**	**0.0126**	**4.0000e-005**	**3.2600e-003**	**4.0000e-005**	**3.3000e-003**	**8.6000e-004**	**3.0000e-005**	**9.0000e-004**	**0.0000**	**3.5446**	**3.5446**	**1.9000e-004**	**0.0000**	**3.5491**

3.5 Paving - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0791	0.8139	0.9232	1.4400e-003		0.0427	0.0427		0.0393	0.0393	0.0000	126.1479	126.1479	0.0408	0.0000	127.1679
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0791**	**0.8139**	**0.9232**	**1.4400e-003**		**0.0427**	**0.0427**		**0.0393**	**0.0393**	**0.0000**	**126.1479**	**126.1479**	**0.0408**	**0.0000**	**127.1679**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.7000e-004	0.0156	2.9300e-003	3.0000e-005	7.7000e-004	4.0000e-005	8.1000e-004	2.1000e-004	4.0000e-005	2.4000e-004	0.0000	3.2790	3.2790	2.7000e-004	0.0000	3.2858
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.1800e-003	2.9200e-003	0.0298	7.0000e-005	7.4200e-003	6.0000e-005	7.4700e-003	1.9700e-003	5.0000e-005	2.0300e-003	0.0000	6.5957	6.5957	2.2000e-004	0.0000	6.6012
Total	**4.5500e-003**	**0.0185**	**0.0327**	**1.0000e-004**	**8.1900e-003**	**1.0000e-004**	**8.2800e-003**	**2.1800e-003**	**9.0000e-005**	**2.2700e-003**	**0.0000**	**9.8746**	**9.8746**	**4.9000e-004**	**0.0000**	**9.8870**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0791	0.8139	0.9232	1.4400e-003		0.0427	0.0427		0.0393	0.0393	0.0000	126.1478	126.1478	0.0408	0.0000	127.1677
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0791**	**0.8139**	**0.9232**	**1.4400e-003**		**0.0427**	**0.0427**		**0.0393**	**0.0393**	**0.0000**	**126.1478**	**126.1478**	**0.0408**	**0.0000**	**127.1677**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.7000e-004	0.0156	2.9300e-003	3.0000e-005	7.7000e-004	4.0000e-005	8.1000e-004	2.1000e-004	4.0000e-005	2.4000e-004	0.0000	3.2790	3.2790	2.7000e-004	0.0000	3.2858
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.1800e-003	2.9200e-003	0.0298	7.0000e-005	7.4200e-003	6.0000e-005	7.4700e-003	1.9700e-003	5.0000e-005	2.0300e-003	0.0000	6.5957	6.5957	2.2000e-004	0.0000	6.6012
Total	**4.5500e-003**	**0.0185**	**0.0327**	**1.0000e-004**	**8.1900e-003**	**1.0000e-004**	**8.2800e-003**	**2.1800e-003**	**9.0000e-005**	**2.2700e-003**	**0.0000**	**9.8746**	**9.8746**	**4.9000e-004**	**0.0000**	**9.8870**

3.6 Building Construction - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0428	0.3922	0.3729	6.1000e-004		0.0216	0.0216		0.0203	0.0203	0.0000	52.1184	52.1184	0.0126	0.0000	52.4327
Total	**0.0428**	**0.3922**	**0.3729**	**6.1000e-004**		**0.0216**	**0.0216**		**0.0203**	**0.0203**	**0.0000**	**52.1184**	**52.1184**	**0.0126**	**0.0000**	**52.4327**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.6000e-004	0.0123	3.0000e-003	3.0000e-005	7.3000e-004	3.0000e-005	7.6000e-004	2.1000e-004	3.0000e-005	2.4000e-004	0.0000	2.8703	2.8703	1.7000e-004	0.0000	2.8746
Worker	1.4900e-003	1.0400e-003	0.0106	3.0000e-005	2.6500e-003	2.0000e-005	2.6700e-003	7.1000e-004	2.0000e-005	7.2000e-004	0.0000	2.3556	2.3556	8.0000e-005	0.0000	2.3576
Total	**1.8500e-003**	**0.0133**	**0.0136**	**6.0000e-005**	**3.3800e-003**	**5.0000e-005**	**3.4300e-003**	**9.2000e-004**	**5.0000e-005**	**9.6000e-004**	**0.0000**	**5.2259**	**5.2259**	**2.5000e-004**	**0.0000**	**5.2322**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0428	0.3922	0.3729	6.1000e-004		0.0216	0.0216		0.0203	0.0203	0.0000	52.1183	52.1183	0.0126	0.0000	52.4327
Total	**0.0428**	**0.3922**	**0.3729**	**6.1000e-004**		**0.0216**	**0.0216**		**0.0203**	**0.0203**	**0.0000**	**52.1183**	**52.1183**	**0.0126**	**0.0000**	**52.4327**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	3.6000e-004	0.0123	3.0000e-003	3.0000e-005	7.3000e-004	3.0000e-005	7.6000e-004	2.1000e-004	3.0000e-005	2.4000e-004	0.0000	2.8703	2.8703	1.7000e-004	0.0000	2.8746
Worker	1.4900e-003	1.0400e-003	0.0106	3.0000e-005	2.6500e-003	2.0000e-005	2.6700e-003	7.1000e-004	2.0000e-005	7.2000e-004	0.0000	2.3556	2.3556	8.0000e-005	0.0000	2.3576
Total	**1.8500e-003**	**0.0133**	**0.0136**	**6.0000e-005**	**3.3800e-003**	**5.0000e-005**	**3.4300e-003**	**9.2000e-004**	**5.0000e-005**	**9.6000e-004**	**0.0000**	**5.2259**	**5.2259**	**2.5000e-004**	**0.0000**	**5.2322**

3.7 Architectural Coating - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	9.9900e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.3900e-003	0.0237	0.0282	5.0000e-005		1.4600e-003	1.4600e-003		1.4600e-003	1.4600e-003	0.0000	3.9575	3.9575	2.7000e-004	0.0000	3.9643
Total	**0.0134**	**0.0237**	**0.0282**	**5.0000e-005**		**1.4600e-003**	**1.4600e-003**		**1.4600e-003**	**1.4600e-003**	**0.0000**	**3.9575**	**3.9575**	**2.7000e-004**	**0.0000**	**3.9643**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.4000e-004	2.4000e-004	2.4400e-003	1.0000e-005	6.1000e-004	0.0000	6.1000e-004	1.6000e-004	0.0000	1.7000e-004	0.0000	0.5409	0.5409	2.0000e-005	0.0000	0.5414
Total	**3.4000e-004**	**2.4000e-004**	**2.4400e-003**	**1.0000e-005**	**6.1000e-004**	**0.0000**	**6.1000e-004**	**1.6000e-004**	**0.0000**	**1.7000e-004**	**0.0000**	**0.5409**	**0.5409**	**2.0000e-005**	**0.0000**	**0.5414**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	9.9900e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.3900e-003	0.0237	0.0282	5.0000e-005		1.4600e-003	1.4600e-003		1.4600e-003	1.4600e-003	0.0000	3.9575	3.9575	2.7000e-004	0.0000	3.9643
Total	**0.0134**	**0.0237**	**0.0282**	**5.0000e-005**		**1.4600e-003**	**1.4600e-003**		**1.4600e-003**	**1.4600e-003**	**0.0000**	**3.9575**	**3.9575**	**2.7000e-004**	**0.0000**	**3.9643**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.4000e-004	2.4000e-004	2.4400e-003	1.0000e-005	6.1000e-004	0.0000	6.1000e-004	1.6000e-004	0.0000	1.7000e-004	0.0000	0.5409	0.5409	2.0000e-005	0.0000	0.5414
Total	**3.4000e-004**	**2.4000e-004**	**2.4400e-003**	**1.0000e-005**	**6.1000e-004**	**0.0000**	**6.1000e-004**	**1.6000e-004**	**0.0000**	**1.7000e-004**	**0.0000**	**0.5409**	**0.5409**	**2.0000e-005**	**0.0000**	**0.5414**

Appendix D Biological Resources Report


Biological Resources Report
Sonoma Valley High School Athletic Fields Renovation Project

Prepared for:

SVUSD
Sonoma Valley Unified School District

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GHD Project No.: 11152127

September 12, 2019

Executive Summary

GHD conducted background research and a biological resource survey in support of the Sonoma Valley Unified School District's (SVUSD) Sonoma Valley High School (SVHS) Track and Field Improvement Project (Project). The Project is situated in southeast Sonoma County within the Sonoma City limits south of State Route 12 and east of Broadway on SVUSD property (Figure 1-3). The 49 acre Study Area includes the Sonoma Valley High School Campus and adjacent Nathanson Creek riparian area.

Current understanding of the Project improvements to the facilities includes: removal of the existing track and fields; upgrading or replacing some softball and baseball fields; installation of an all-weather track, all-weather synthetic turf fields, and field lighting; construction of bleachers, ticketing/concessions building, team rooms, restrooms and storage rooms. The Project also proposes installing about 19,000 square feet of bio-filtration area to capture run-off and improve water quality entering Nathanson Creek and the watershed. Nathanson Creek is a valuable ecological and United States (U.S.) Army Corps of Engineers (USACE) aquatic resource (Figure 4) that flows to Schell Creek, which connects to San Pablo Bay and then to the Pacific Ocean.

Due to the landscaped nature of most of the Study Area, a combination of California Wildlife Habitat Relationships (CWHR) System and the Manual of California Vegetation (MCV) vegetation classification were used to best characterize the vegetation communities/habitats. Four habitats/vegetation communities were identified in the Study Area including Urban Lawn, Urban Shade Tree/Lawn, California Annual Grassland, and *Quercus lobata* Woodland Alliance (Valley Oak Woodland) (Figure 5).

Some listed and sensitive species have the potential to occur in the Study Area. Birds protected by the Migratory Bird Treaty Act and California Fish and Game Code have the potential to nest within the Study Area during the breeding season. In particular, the adjacent riparian area along Nathanson Creek, although outside of the Project Boundary and not proposed for direct disturbance, has the potential to support nesting bird and/or bat species. The likelihood of many special status species occurrences in the Project Boundary is reduced by the turf management regime used to maintain the athletic fields and the edge effect created by the existing residential areas and public school facilities.

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Appendix Index

Acronyms

BGEPA	Bald and Golden Eagle Protection Act
BIOS	Biogeographic Information and Observation System
BMPs	Best management practices
CCC	Central California Coast
CCH	Consortium of California Herbaria
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFGC	California Fish and Game Code
CNDDB	California Natural Diversity Database/
CNPS	California Native Plant Society
CWA	Clean Water Act
CWHR	California Wildlife Habitat Relationship
DOI	Department of the Interior
ECCC	East Contra Costa County
EFH	Essential fish habitat
EPA	Environmental Protection Agency
ESA	Endangered Species Act

FEMA	Federal Emergency Management Agency
FGC	California Fish and Game Code
HCP	Habitat Conservation Plan
IPaC	Information, Planning, and Conservation System
LSAA	Lake and Streambed Alteration Agreement
MBTA	Migratory Bird Treaty Act
MCV	Manual of California Vegetation
NCCP	Natural Community Conservation Planning
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
PFOA	Freshwater Forested/Shrub Wetland
RWQCB	Regional Water Quality Control Board
SAA	Streambed Alteration Agreement
SSC	Species of Special Concern
SVHS	Sonoma Valley High School
SVUSD	Sonoma Valley Unified School District
SWPPP	Storm Water Pollution Prevention Plan
TLC	Total Light Control
U.S.	United States
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VegCAMP	Vegetation Classification and Mapping Program
WSS	Web Soil Survey

1. Introduction

At the request of the Sonoma Valley Unified School District (SVUSD), a GHD biologist conducted background research and general biological surveys for botanical and wildlife resources that have the potential to occur within the Study Area, which includes the Sonoma Valley High School (SVHS) Campus, proposed Renovation Area, surrounding lands and adjacent Nathanson Creek. This document summarizes available biological resources information compiled for the Study Area.

1.1 Project Location

The Study Area is located within the City of Sonoma, in Sonoma County, California (Appendix A-Figure 1). This location is shown on the United States (U.S.) Geological Survey (USGS) Sonoma topographic quadrangle in the Mt. Diablo Meridian Township 5 North, Range 5 West, and Section 18 (Figure 2). The Study Area is located on SVUSD property, and is surrounded by low to medium density residential areas, public facilities (school properties), and other mixed use development (Figure 3). Access to the Project site is via existing paved roads with the nearest intersection at Broadway/Highway 12 and E. MacArthur St. Nathanson Creek bisects the Study Area with the SVHS classrooms on the west side and the athletic fields on the east side. Nathanson Creek is a valuable ecological and U.S. Army Corps of Engineers (USACE) aquatic resource (Figure 4) that flows to Schell Creek, which connects to San Pablo Bay and then to the Pacific Ocean.

1.2 Project Description

Current understanding of SVUSD's Sonoma Valley High School (SVHS) Athletic Fields Renovation Project (Project) upgrades would involve: removal of the existing basketball courts, track, and fields; installation of an all-weather track and synthetic turf field; construction of a new seating area a building with team rooms, storage, restrooms, and concessions; installation of field lighting; and replacing the existing softball and baseball fields. The Project also proposes installing about 19,000 square feet of bio-filtration area to capture surface flows and improve water quality entering the watershed and Nathanson Creek. Preliminary designs for the Project are still in progress.

1.3 Definition of Study Area

The Study Area consists of the entire 49-acres of Sonoma Valley High School Athletic Fields Renovation Project and adjacent Nathanson Creek riparian area. This includes lands and habitats within and surrounding the 17-acre Renovation Area (Figure 1 in Appendix A). The Nathanson Creek riparian area is included to evaluate potential indirect impacts of the Project.

2. Regulatory Background

Following is an overview of agencies that have potential oversight of the Project related to biological resources. The regulatory setting is divided into sections on federal and state jurisdiction.

2.1 Federal Jurisdiction

2.1.1 National Environmental Policy Act (NEPA)

The National Environmental Policy Act of 1969 (NEPA) requires federal agencies to prepare environmental documentation that discloses to decision-makers and the interested public a clear, accurate description of potential environmental effects resulting from proposed federal actions and reasonable alternatives to those actions. Through NEPA, the U.S. Congress directed federal agencies to integrate environmental factors in their planning and decision-making processes, and encourage and facilitate public involvement in decisions that affect the quality of the human environment. Federal agencies are required to consider the environmental effects of a Proposed Action, alternatives to the Proposed Action, and a No Action alternative (assessing the potential environmental effects of not undertaking the Proposed Action).

2.1.2 Endangered Species Act (ESA)

The ESA of 1973 (16 USC 1531 et seq.) establishes a national policy that all federal departments and agencies provide for the conservation of threatened and endangered species and their ecosystems. The Secretary of the Interior and the Secretary of Commerce are designated in the ESA as responsible for: (1) maintaining a list of species likely to become endangered within the foreseeable future throughout all or a significant portion of its range (threatened) and that are currently in danger of extinction throughout all or a significant portion of its range (endangered); (2) carrying out programs for the conservation of these species; and (3) rendering opinions regarding the impact of proposed federal actions on listed species. The ESA also outlines what constitutes unlawful taking, importation, sale, and possession of listed species and specifies civil and criminal penalties for unlawful activities.

Pursuant to the requirements of the ESA, an agency reviewing a proposed Project within its jurisdiction must determine whether any federally listed or proposed species may be present in the Project region, and whether the proposed Project would result in a “take” of such species. The ESA prohibits “take” of a single threatened and endangered species except under certain circumstances and only with authorization from the USFWS or the National Oceanic and Atmospheric Administration (NOAA) Fisheries through a permit under Section 7 (for federal entities or federal actions) or 10(a) (for non-federal entities) of the Act. “Take” under the ESA includes activities such as “harass, harm, pursue, hunt shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” USFWS regulations define harm to include “significant habitat modification or degradation.” On June 29, 1995, a U.S. Supreme Court ruling further defined harm to include habitat modification “…where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.”

In addition, the agency is required to determine whether the Project is likely to jeopardize the continued existence of any species proposed to be listed under the ESA, or result in the destruction or adverse modification of critical habitat for such species (16 USC 1536[3][4]). If it is determined that a project may result in the "take" of a federally-listed species, a permit would be required under Section 7 or Section 10 of the ESA.

Critical Habitat is defined by the ESA as a specific geographic area containing features essential for the conservation of an endangered or threatened species. Under Section 7 of the ESA, critical habitat should be evaluated if designated for federally listed species that may be present in the Project Action Area. The Action Area serves as the “Study Area” for the purposes of a Section 7 Biological Assessment.

2.1.3 Clean Water Act (CWA)

The CWA (1977, as amended) establishes the basic structure for regulating discharges of pollutants into waters of the U.S. It gives the U.S. Environmental Protection Agency (EPA) the authority to implement pollution control programs, including setting wastewater standards for industry and water quality standards for contaminants in surface waters. The CWA makes it unlawful for any person to discharge any pollutant from a point source into navigable waters, without a permit under its provisions.

Discharge of fill material into “waters of the U.S.,” including wetlands, is regulated by the USACE under Section 404 of the CWA (33 USC 1251-1376). USACE regulations implementing Section 404 define “waters of the U.S.” to include intrastate waters (such as, lakes, rivers, streams, wetlands, and natural ponds) that the use, degradation, or destruction of could affect interstate or foreign commerce. Wetlands are defined for regulatory purposes as “areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions” (33 CFR 328.3; 40 CFR 230.3). The placement of structures in “navigable waters of the U.S.” is also regulated by the USACE under Section 10 of the Federal Rivers and Harbors Act (33 USC 401 et seq.). Projects are approved by USACE under standard (i.e., individual) or general (i.e., nationwide, programmatic, or regional) permits. The type of permit is determined by the USACE and based on project parameters.

The USACE and the EPA announced the release of the Clean Water Rule on May 27, 2015 (80 FR 124: 37054-37127). The Rule is intended to ensure waters protected under the CWA are more precisely defined, more predictable, easier to understand, and consistent with the latest science. The intent is to: 1) clearly define and protect tributaries that impact the quality of downstream waters; 2) provide certainty in how far safeguards extend to nearby waters; 3) protect unique regional waters; 4) focus on streams instead of ditches; 5) maintain the status of waters associated with infrastructure (i.e., sewer systems); and 6) reduce the need for case specific analysis of all waters. The U.S. Court of Appeals for the Sixth Circuit stayed implementation of the Clean Water Rule pending further action of the court in October 2015. In response, the USACE and EPA resumed case-by-case analysis of waters of the U.S. determinations. Implementation of the Clean Water Rule was pending litigation prior to February 2017. An Executive Order (Restoring the Rule of Law, Federalism, and Economic Growth by reviewing the “Waters of the United States” Rule) was signed on February 28, 2017, directing the USACE and EPA to review The Rule and publish for notice and comment a proposed rule rescinding or revising The Rule. The USACE and EPA subsequently published a Notice of Intention to Review and Rescind or Revise the Clean Water Rule in the Federal Register on March 6, 2017. The definition of “navigable waters” under the CWA along with The Rule is currently under review per the Executive Order.

The Fish and Wildlife Coordination Act requires consultation with the USFWS, NOAA Fisheries, and responsible state wildlife agency for any federally authorized action to control or modify surface waters. Therefore, any project proposed or permitted by the USACE under the CWA Section 404 must also be reviewed by the federal wildlife agencies and California Department of Fish and Wildlife (CDFW).

Section 401 of the CWA requires any applicant for a federal license or permit, which involves an activity that may result in a discharge of a pollutant into waters of the U.S., obtain a certification that the discharge will comply with applicable effluent limitations and water quality standards. CWA 401 certifications are issued by Regional Water Quality Control Boards (RWQCBs) under the California Environmental Protection Agency.

2.1.4 Executive Order 11990

Executive Order 11990 (1977) furthers the protection of wetlands under NEPA through avoidance of long and short-term adverse impacts associated with the destruction or modification of wetlands where practicable. The order requires all federal agencies managing federal lands, sponsoring federal projects, or funding state or local projects to assess the effects of their actions on wetlands. The agencies are required to follow avoidance, mitigation, and preservation procedures. The Presidential Wetland Policy of 1993 and subsequent reaffirmation of the policy in 1995 supports effective protection and restoration of wetlands, while advocating for increased fairness of federal regulatory programs.

2.1.5 Migratory Bird Treaty Act (MBTA)

The MBTA of 1918 (16 USC 703-711), as amended, established federal responsibilities for the protection of nearly all species of birds, their eggs, and nests. A migratory bird is defined as any species or family of birds that live, reproduce or migrate within or across international borders at some point during their annual life cycle. The MBTA prohibits the take, possession, buying, selling, purchasing, or bartering of any migratory bird listed in 50 CFR Part 10, including feathers or other parts, nests, eggs, or products, except as allowed by implementing regulations (50 CFR 21). Only exotic species such as Rock Pigeons (*Columba livia*), House Sparrows (*Passer domesticus*), and European Starlings (*Sturnus vulgaris*) are exempt from protection.

In 2001, President Clinton defined “take” in Executive Order 13186 to include both “intentional” and “unintentional.” However, in 2017, the Department of the Interior’s (DOI) Office of Solicitor argued via Opinion M-37050 that incidental take was not prohibited under the Migratory Bird Treaty Act. Opinion M-37050 is currently the subject of a lawsuit between eight U.S. states and the U.S. DOI.

2.1.6 Magnuson-Stevens Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) provides the federal government with the authority to manage fisheries in the U.S. Exclusive Economic Zone (EEZ) (from state waters which end 3 nautical miles offshore to a distance of 200 nautical miles). In addition, the Act mandates inter-agency cooperation in achieving protection, conservation, and enhancement of Essential Fish Habitat (EFH). The Act defines EFH as "Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of EFH: 'Waters' include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; 'substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities; 'necessary' means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species' full life cycle" (50 CFR 600.10). EFH designations serve to highlight the importance of habitat conservation for sustainable fisheries and sustaining valuable fish populations. EFH relates directly to the physical fish habitat and indirectly to factors that contribute to degradation of this habitat. Important features of EFH that deserve attention are adequate water quality, temperature, food source, water depth, and cover/vegetation.

2.2 State Jurisdiction

2.2.1 California Environmental Quality Act (CEQA)

CEQA applies to certain activities of state and local public agencies. A public agency must comply with CEQA when it undertakes an activity defined by CEQA as a "project." A project is an activity undertaken by a public agency or a private activity which must receive some discretionary approval. The proposed Project is a project under CEQA; therefore, CEQA compliance is required. Under CEQA, a variety of technical studies including biological, cultural, traffic, and air quality studies as well as research and professional knowledge are considered to determine whether the project may have an “adverse effect” on the environment. Lead agencies are charged with evaluating the best available data when determining what specifically should be considered an “adverse effect” to the environment.

2.2.2 Porter-Cologne Water Quality Act

The Porter-Cologne Act provides for statewide coordination of water quality regulations by establishing the California State Water Resources Control Board. The State Board is the statewide authority that oversees nine separate RWQCBs that collectively oversee water quality at regional and local levels. California RWQCBs issue CWA Section 401 Water Quality Certifications for possible pollutant discharges into waters of the U.S. or state.

2.2.3 California Endangered Species Act (CESA)

The CESA includes provisions for the protection and management of species listed by the State of California as endangered, threatened, or designated as candidates for such listing (California Fish and Game Code (FGC) Sections 2050 through 2085). The CESA generally parallels the main provisions of the ESA and is administered by the CDFW, who maintains a list of state threatened and endangered species as well as candidate and species of special concern. The CESA prohibits the “take” of any species listed as threatened or endangered unless authorized by the CDFW in the form of an Incidental Take Permit. Under FGC, “take” is defined as to “hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.”

Species of special concern are broadly defined as species that are of concern to the CDFW, because of population declines, restricted distributions, and/or they are associated with habitats that are declining in California. Impacts to special status plants and animals may be considered significant under CEQA.

2.2.4 California Fish and Game Code (FGC)

Lake or Streambed Alteration Agreement

Streams, lakes, and riparian vegetation that serve as habitat for fish and other wildlife species are subject to jurisdiction by the CDFW under Sections 1600-1616 of the FGC. Any activity that will do one or more of the following: 1) substantially obstruct or divert the natural flow of a river, stream, or lake; 2) substantially change or use any material from the bed, channel, or bank of a river, stream, or lake; or 3) deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into a river, stream, or lake; generally require a 1602 Lake and Streambed Alteration Agreement (LSAA). The term “stream,” which includes creeks and rivers, is defined in the California Code of Regulations (CCR) as follows: “a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation" (14 CCR 1.72). In addition, the term stream can include ephemeral streams, dry washes, watercourses with subsurface flows, canals, aqueducts, irrigation ditches, and other means of water conveyance if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife. Riparian is defined as, "on, or pertaining to, the banks of a stream;" therefore, riparian vegetation is defined as, "vegetation which occurs in and/or adjacent to a stream and is dependent on, and occurs because of, the stream itself." Removal of riparian vegetation also requires a Section 1602 Lake and Streambed Alteration Agreement from the CDFW.

Native Plant Protection Act

The CDFW administers the Native Plant Protection Act (Sections 1900–1913 of the FGC). These sections allow the California Fish and Game Commission to designate endangered and rare plant species and to notify landowners of the presence of such species. Section 1907 of the California Fish and Game Code allows the Commission to regulate the "taking, possession, propagation, transportation, exportation, importation, or sale of any endangered or rare native plants." Section 1908 further directs that "… [n]o person shall import into this state, or take, possess, or sell within this state, except as incident to the possession or sale of the real property on which the plant is growing, any native plant, or any part or product thereof that the Commission determines to be an endangered native plant or rare native plant."

Birds of Prey and Native Nesting Birds

Section 3503 of the FGC prohibits the take, possession, or needless destruction of the nest or eggs of any bird. Subsection 3503.5 specifically prohibits the take, possession, or destruction of any birds in the orders *Falconiformes* (hawks and eagles) or *Strigiformes* (owls) and their eggs or nests. These provisions, along with the federal MBTA, essentially serve to protect nesting native birds. Non-native species, including the European Starling, Rock Dove, and House Sparrow, are not afforded protection under the MBTA or FGC.

Fully Protected Species

The CDFW enforces the FGC, which provides protection for "fully protected birds" (Section 3511), "fully protected mammals" (Section 4700), "fully protected reptiles and amphibians" (Section 5050), and "fully protected fish" (Section 5515). As fully protected species, the CDFW cannot authorize any project or action that would result in "take" of these species even with an incidental take permit.

2.2.5 Sensitive Plant Communities

CDFW provides oversight of habitats (i.e. plant communities) listed as sensitive in the California Natural Diversity Database (CNDDB), based on global and state rarity rankings according to the list of statewide natural communities, *Hierarchical List of Natural Communities*. The natural communities are broken down to alliance level for vegetation types affiliated with ecological sections in California. The list and alliances coincide with *A Manual of California Vegetation* (Sawyer et al. 2009). According to the CDFW vegetation classification of natural community hierarchy list, habitats are listed as "high priority for inventory" based on global or state rarity rankings. CDFW considers alliances and associations with a S1 to S3 rank to be of special concern as well as highly imperiled (CDFW 2019b).

3. Methods

3.1 Preliminary Investigation

GHD conducted preliminary investigations regarding biological resources within the Study Area and immediate vicinity. These investigations included queries of regulatory agency databases and readily available documents related to biological resources within the vicinity and the local watershed. On August 24, 2018, May 6, 2019, and August 7, 2019, GHD biologist, Joslyn Curtis, conducted a general reconnaissance survey to identify vegetation communities, determine the potential for sensitive species presence, potential wetlands, and/or other permitting concerns within the Study Area. On July 2, 2019, Jane Valerius, botanist and wetland ecologist visited the Study Area.

GHD biologists reviewed available background data pertaining to botanical and wildlife resources within the Study Area prior to performing the field survey and again before the second field survey. Available sources included, but were not limited to:

- Aerial imagery of the Study Area and vicinity;
- 7.5 minute Sonoma topographic quadrangle (USGS 2012);
- USFWS National Wetlands Inventory (NWI) (NWI 2019);
- Natural Resources Conservation Service's (NRCS) Web Soil Survey (WSS) (WSS 2019).
- U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System (IPaC) (IPaC 2019);
- National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) for Sonoma quadrangle (NMFS 2019); and
- California Department of Fish and Wildlife (CDFW) California Natural Diversity Database RareFind 5/Biogeographic Information and Observation System (CNDDB/BIOS) (CDFW 2019a); and
- California Native Plant Society (CNPS), Inventory of Rare and Endangered Plants for the Sonoma and eight surrounding USGS topographic quadrangles (CNPS 2019a).

A complete reference list for all cited materials is provided in Section 9 (References).

3.1.1 National Wetlands Inventory (NWI)

A search of the USFWS NWI was conducted on May 15, 2019 for the Project vicinity. A NWI Map that includes the Study Area and Project Boundary is included in Figure 4. The inventory classifies Nathanson Creek, the creek to the west of the Project Boundary, as Freshwater Forested/Shrub Wetland (PFOA).

3.1.2 Database Searches (IPaC, CNDDB, NMFS, and CNPS)

A database search of the CNDDB, USFWS IPaC database, the NMFS California Species List Tool, and CNPS database was conducted by GHD on August 20, 2018; on May 3, 2019; and again on August 27, 2019. The query encompassed a five mile radius around the Project location for CNDDB; the Study Area boundary for USFWS IPaC; a nine USGS quadrangle (quad) search for CNPS Rare Plant Inventory Database, including the Project site quad (Sonoma) and surrounding 8 quads (Kenwood, Rutherford, Yountville, Glen Ellen, Napa, Petaluma River, Sears Point, and

Cuttings Wharf); and a Sonoma quad search for NMFS species data. Based on these database results, a literature search, as well as personal knowledge regarding the habitat and conditions surrounding the Project site, the following tables were compiled (Appendix D) which summarize special-status state or federal plant and wildlife species that could be present within the Study Area. These tables also discuss the likelihood of each species to occur within the Study Area.

3.2 Field Survey

GHD biologist, Joslyn Curtis, performed a pedestrian reconnaissance level survey of the Study Area on August 24, 2018. The survey was conducted from approximately 0745 to 1045 with conditions being overcast, still, and about 65 degrees Fahrenheit. A second reconnaissance level survey was conducted on May 7, 2019 from 1630 to 1930 with conditions on that day being sunny and 64 degrees Fahrenheit. The third reconnaissance level survey, on August 7, 2019, was performed from 1715 to 1815 with temperatures around 80 degrees Fahrenheit and sunny conditions.

Field investigations during the reconnaissance surveys included general inspections to adequately characterize existing habitat with emphasis on areas having the potential to support special status species. Representative photographs of the Study Area are provided in Appendix B. During the first two surveys, all plant and wildlife species observed were recorded, on the third survey only habitat and vegetation observations were made. These data are included in Appendix C.

During the August 24th, 2018 survey, it was noted that a patch of fallow, non-turf field had recently been mowed and tilled on the southern edge of the Study Area (Appendix B- Photos 31-35). On the May 6th visit, it was seen that a parking lot and bioretention basin had been constructed just outside of the Renovation Area and just south of the tilled area (Photo 30 and 50).

Two constructed drainage swales were noted within the Renovation Area along the south and east sides of the athletic fields. The first drainage swale lies on the east edge of the SVUSD property boundary, from the northeast corner south to the access path at Denmark Avenue (Photos 36 to 45). The second constructed drainage runs east-west on the north side of the access path. It flows west from the batting cage to a culvert that directs flow under the walking path and into Nathanson Creek (Photos 46 to 49). The drainages lack an ordinary high water mark, are constructed in uplands, and are maintained as drainages by the SVUSD. No jurisdictional wetlands were found within the Renovation Area.

Northern California black walnut (*Juglans hindsii*), a CNPS rank 1B.1 plant at the time the surveys began, was observed within the Study Area. Further discussion is provided in Section 5.1. No federal or state listed species (plant or animal) were observed utilizing habitats nearby or on-site. It should be noted that some plant species within the Study Area were not flowering or fruiting during either survey period, so they could not be identified with certainty to a species level. Also, no formal protocol surveys for any particular species were performed.

Four species of birds were seen during the August 24th, 2018 survey including: American Crows (*Corvus brachyrhynchos*), Mourning Dove (*Zenaida macroura*), Green Heron (*Butorides virescens*) (Photo 67), and Black Phoebe (*Sayornis nigricans*). Other notable observations included: three nest boxes and three squirrel dreys (Photos 51 to 56). The August 24th survey was at the very end of the breeding season. On the May 6th visit, ten (10) species of birds were observed (Appendix C), though a full protocol nesting bird survey was not performed. Bridge abutments and under surfaces were examined on all three bridges across Nathanson Creek during the first two survey visits (Photos 57-65). No mud nests or roosting bats were observed. Holes, however, were observed in some areas along the creek banks (Photo 60 and 66). During the August 7th survey, bird activity was not recorded.

3.3 Agency Coordination

This document represents a preliminary review that may be used in future agency coordination (CDFW, USFWS, RWQCB, and USACE). No agency coordination has occurred to date.

4. Existing Conditions

Existing conditions within the Study Area and vicinity are discussed below; including soils, vegetation communities and aquatic resources (Figures 4 to 7). The soils descriptions and map figure are derived from the Natural Resources Conservation Service's (NRCS) Web Soil Survey (NRCS 2019). Vegetation communities/habitats were characterize using a combination of California Wildlife Habitat Relationships (CWHR) System and the Manual of California Vegetation (MCV). The CWHR System was used to best describe the artificially maintained areas of the Study Area, such as the athletic fields, shade trees surrounding the property and the fallow field in the southern part of the Study Area. The MCV was used to better classify the more natural stands of vegetation, such as the Nathanson Creek riparian area.

4.1 Soils

Huichica loam, 0-9% slopes, farmland of statewide importance

The map unit composition is as follows. Huichica and similar soils: 85 percent and 15 percent minor components. The setting includes the base or footslope of terraces with alluvium derived from igneous, metamorphic and sedimentary rock.

Depth to a restrictive feature is 20 to 40 inches to paralithic bedrock. The natural drainage class is well drained. The runoff class is very high. The depth to the water table is more than 80 inches. There is no frequency of flooding or ponding. The available water storage in a soil profile is moderate about 7.3 inches. Irrigated land capability classification is 3e. Non-irrigated land capability classification is 3e. The hydrologic soil group is D. Its ecological site character is a loamy claypan. The soil series unit is not inherently hydric.

The descriptions of the minor components (none of which are inherently hydric) are as follows: 2 percent Cibo clay, 2 percent Diablo clay, 2 percent Gazos clay loam, 2 percent Lodo, clay loam, 2 percent Millsap, loam, 2 percent Rock outcrop, and 2 percent of an Unnamed unit (Web Soil Survey 2019).

Wright loam, 0-9% slopes, farmland of statewide importance

The map unit composition is as follows. Wright and similar soils: 85 percent and 15 percent minor components. The setting includes the tread footslope of terraces derived of alluvial parent material.

Depth to a restrictive feature is about 25 inches to abrupt textural change. The natural drainage class is somewhat poorly drained. The runoff class is high. The depth to the water table is more than 80 inches. There is no frequency of flooding or ponding. The available water storage in a soil profile is low about 3.8 inches. Irrigated land capability classification is 3e. Non-irrigated land capability classification is 3e. The hydrologic soil group is D. Its ecological site character is a loamy claypan. The soil series unit is not inherently hydric.

The descriptions of the minor components (none of which are inherently hydric) are as follows: 10 percent Haire and 5 percent of an Unnamed unit (Web Soil Survey 2019).

4.2 Habitat and Vegetation Communities

4.2.1 Developed/Urban

Urban habitat is distinguished by the presence of both native and exotic species maintained in a relatively static composition within a downtown, residential, or suburbia setting. Species richness in these areas depends greatly upon community design (i.e., open space considerations) and proximity to the natural environment (Mayer and Laudenslayer 1988).

Urban habitat can generally be classified into five different vegetation types: tree grove, street strip, shade tree/lawn, lawn, and shrub cover. Tree groves refer to conditions typically found in city parks, green belts, and cemeteries. These areas vary in tree height, spacing, crown shape, and understory conditions; however, they have a continuous canopy. Street strip vegetation, located roadside, varies with species type, but typically includes a ground cover of grass. Shade trees/lawn refers to characteristic residential landscape, which is reminiscent of natural savannas. Lawns are composed of a variety of grasses, maintained at a uniform height with continuous ground cover through irrigation and fertilization. Shrub cover refers to areas commonly landscaped and maintained with hedges, as typically found in commercial districts. All five types of urban habitat are usually found in combination creating considerable edge effect (Mayer and Laudenslayer 1988).

The Study Area consists of urban shade trees and urban lawn. Urban lawn comprises the majority of the Renovation Area with scattered patches and a border of shade trees surrounding the athletic fields. Many of the trees are native, and some of them contain squirrel dreys and nest boxes (Photos 36 to 41). These trees could provide potential habitat for wildlife, or nest sites for raptors or other migratory birds.

4.2.2 Quercus lobata Woodland Alliance (Valley Oak Woodland)

The *Quercus lobata* Woodland Alliance is characterized by at least a third of the tree canopy being composed of valley oaks. The valley oaks often grow in association with boxelder, Oregon ash, Arroyo willow, Hinds black walnut, interior live oak, and Fremont cottonwood trees (CNPS 2019b). This community can range from a savanna-like structure, with wider tree spacing and very little shrub understory; to the classic, forest-like structure, with partially closed canopies and shade tolerant shrubs or vines. A significant number of wildlife species rely on these woodlands for cover and food (Ritter 2013). The community is found along watercourses or riparian areas on seasonally saturated soils that may be intermittently flooded in lowlands, valley bottoms, lower slopes or summit valleys (CNPS 2019b). Valley Oak Woodlands are ranked as S3-“State Vulnerable” vegetation communities (CNPS 2019b; NatureServe 2019).

The Study Area encompasses the riparian corridor of Nathanson Creek and Nathanson Creek Preserve. This corridor is made up of predominantly valley oaks with a smaller component of Arroyo willow, which classifies it as a Valley Oak Woodland. The Nathanson Creek Preserve has been the focus of flood attenuation and habitat restoration projects in the past. Despite the urban surroundings, site survey observations of birds and other wildlife suggests this woodland provides habitat for at least wildlife species tolerant of proximity to human development (Prunuske Chatham Inc. 2015).

4.2.3 Annual Grassland

As its name suggests Annual Grasslands are dominated by annual graminoid species. This ephemeral nature makes them quite dynamic habitats. Species composition and habitat structure change throughout the seasons due to different stages of plant growth and phenology (Heady 1958), as well as external factors, such as precipitation and animal use (Bartolome et al. 1980). The plant species constituents vary depending on the bioregion in which a grassland is located and the amount of diversity within a habitat depends on its management and health (Garrison et al. 1977). Annual Grasslands are so common that they are found in association with most other habitats. They are important to many wildlife species primarily for forage, but can also provide for cover and reproduction (Basey and Sinclear 1980; White et al.1980; Verner et al.1980).

The Renovation Area encompasses an area south of the athletic fields that is not maintained as turf. This has allowed a semi-natural composition of plants to establish. During the August 24th visit, much of this area was tilled under, with the remaining mowed, likely for weed abatement. On May 6th, a new parking lot and bioretention basin had been built just south of the Renovation Area, in a portion of this field.

4.3 Aquatic Resources

The Study Area encompasses Nathanson Creek a documented USACE aquatic resource (Figure 4) which flows to Schell Creek, which connects to San Pablo Bay and then to the Pacific Ocean. In addition, two constructed drainage swales occur within the Renovation Area. However, as noted above in Section 3.2, neither are considered jurisdictional features.

5. Database Results

A table showing listed and sensitive plant and wildlife species with the potential to occur within the Study Area is provided in Appendix D. The likelihood of occurrence of each species within the Study Area was considered based on individual habitat requirements and site conditions, as observed during field efforts. CNDDB/BIOS occurrence records for wildlife and plants within a five mile radius of the Study Area are shown on Figure 8. ESA designated critical habitat and NMFS identified essential fish habitat search results are also presented below.

5.1 Botanical Resources

Several listed and sensitive plant species were considered for presence within the Study Area (Appendix D). Most plant species are unlikely, or have a low potential, to be present based on the lack of ideal habitat on-site. Previous and on-going site disturbance, including maintenance of the school athletic fields, continuous usage by students, and vegetation management (i.e., turf maintenance and mowing), reduces the likelihood of persistence or establishment of special status plants within the Study Area.

One potential special status species, Northern California black walnut (*Juglans hindsii*), was observed in the Study Area and along the adjacent Nathanson Creek. This species had a CNPS rank of 1B.1 when this study began. This ranking decision was made due to concerns that genetically pure, native populations were in decline, and that commonly occurring individuals were in fact hybrids from cultivated stock. The Northern California black walnuts found in and near the Study Area are young, not old growth individuals that would predate 1840 (the baseline for pure genetics prior to European orchard stock introduction). In addition, a recent peer reviewed paper by

Daniel Potter et al., published in Madroño (Vol. 65, 2018), evaluated this genetic purity hypothesis. Their research concluded, "…genetically pure representatives of *J. hindsii* are common throughout the areas in California and southern Oregon sampled [in the study]... There is no evidence, …, of significant introgression from the widely introduced *J. regia*. Taken together, [the] results indicate that individual *J. hindsii* trees should not be considered a rare or imperiled species as currently treated" (Potter et al. 2018). In light of this new study, the CNPS rank for Northern California black walnut has since been changed to CBR- "Considered, But Rejected". Therefore, these trees do not require special protection.

Six species of plants have a moderate potential of occurrence. These potential species include: bent-flowered fiddleneck (*Amsinckia lunaris*) (1B.2), small-flowered calycadenia (*Calycadenia micrantha*) (1B.2), pappose tarplant (*Centromadia parryi* ssp. *parryi*) (1B.2), congested-headed hayfield tarplant (*Hemizonia congesta* ssp. *congesta*) (1B.2), thin-lobed horkelia (*Horkelia tenuiloba*) (1B.2), and cotula navarretia (*Navarretia cotulifolia)* (4.2). Several of these species have documented occurrences either overlapping the Study Area or within a couple miles of the Study Area. These species are also tolerant of and/or prefer disturbed, weedy habitats, such as roadsides. In fact, other species of *Centromadia* and *Navarretia* were found on-site during the last survey on August 7th, 2019. Five of the six plant species listed above are of CNPS rank 1B status. This status meets the definitions of Rare or Endangered under the California Endangered Species Act (CESA) and the California Fish and Game Code (FGC), and are eligible for state listing. Impacts to these species or their habitat must be analyzed during preparation of environmental documents relating to CEQA, or those considered to be functionally equivalent to CEQA, as they meet the definition of Rare or Endangered under CEQA Guidelines §15125; (c) and/or §15380.

The Renovation Area contains approximately two (2) acres of fallow, annual grassland areas that could be suitable for these species to establish or persist. Although none of these species were observed during site reconnaissance, surveys were not conducted during a time when they could be identified. Since plant species do not have the opportunity to move away from the disturbance, a clearance survey in June could be conducted to determine whether these species occur within the renovation area (Section 7.1.2).

5.2 Wildlife Resources

Based on USFWS and CNDDB database results, several special status wildlife species have the potential to occur in the Study Area (Figure 8 - Appendix A and Species Table - Appendix D). There are three broad (one mile radii or larger) CNDDB species occurrences that overlap with the Study Area, these are Western Bumble Bee (*Bombus occidentalis*) (Candidate California Endangered), Yellow Rail (*Coturnicops noveboracensis*) (a species of special concern (SSC)), and Bank Swallow (*Riparia riparia*) (California Threatened (CT)). These are old records and those species are not believed to be currently extant at the location. A CNDDB occurrence of Western Pond Turtle (*Emys marmorata*) is within one mile of the site. There is also a moderate potential to encounter the species as follows: Steelhead (*Oncorhynchus mykiss irideus*) (federally threatened (FT)), Swainson's Hawk (*Buteo swainsoni*) (CT), and Pallid Bat (*Antrozous pallidus*) (SSC). The following are discussions for those with moderate to high potential for occurrence in the Study Area, or with potential to be indirectly affected by the Project.

5.2.1 Birds

Swainson's Hawk (*Buteo swainsoni*), California State Threatened

Swainson's Hawks breed across interior portions of North America. The vast majority of the population migrates from these breeding areas to wintering grounds in South America. On their breeding grounds, they are closely tied to their foraging habitats: open stands of grass-dominated vegetation, sparse shrublands, open woodlands, or agricultural lands. They typically build nests in trees within or near these areas. During the breeding season, they primarily feed on rodents, rabbits, and reptiles. In contrast, Swainson's Hawks are almost exclusively insectivorous during the wintering season (Bechard et al. 2010).

In California, the loss of foraging and breeding habitats has resulted in significant population declines (CDFW 2018). In 2013, there was a nest occurrence reported a little over two miles from the Study Area in the neighboring Sonoma Creek riparian area. There is a potential this species could utilize habitat in or near the Study Area, and therefore could potentially occur in the Study Area. Conservation measures are recommended in Section 7.1.

Raptors and Migratory Birds

Trees within and adjacent to the Study Area contain nest boxes and trees that could be utilized by nesting birds (Photos 51 to 54). Many of the trees could provide potential habitat for wildlife, or nest sites for raptors or other migratory birds. Migratory birds and raptors forage and nest in a variety of habitats, including urban areas. Raptors and migratory birds are afforded protection under the Bald and Golden Eagle Protection Act (BGEPA), Migratory Bird Treaty Act (MBTA), and Section 3503.5 of the California Fish and Game Code (FGC), if not otherwise listed or considered sensitive. These statutes make it unlawful to destroy an active bird nest or create a disturbance near an active nest that results in nest abandonment. Pre-construction nest surveys should be completed prior to construction activities during the avian breeding season (see Section 7.1.3). Survey results will confirm the presence or absence of birds in and near the Study Area and, when necessary, recommend conservation measures.

5.2.2 Bats

Pallid Bat (*Antrozous pallidus*), California State Species of Special Concern, Moderate Potential

The Pallid Bat is found throughout most of the western U.S., from sea level up to elevations of 6,700 feet. In California, the species is found throughout the state with the exception of the high Sierras. Pallid Bats are commonly associated with habitats such as grassland, scrub, woodland, mixed conifer, and redwood forest (Erickson 2002). They utilize day and night roosts in a variety of habitat types including bridges, mines, barns, rocks pile, rocky outcroppings, dead tree snags, live old-growth tree basal hollows, and buildings (Baker et al. 2008). In general, this species roosts in places that protect them from temperature extremes. During the day, the species uses these sites to go into a shallow state of inactivity, or torpor. Optimal day roost temperatures are around 86 degrees Fahrenheit (in terms of maintaining low metabolic rates) (Trune and Slobodchikof 1976). Day roosts may include up to 200 individuals (in some cases, roosts may include other bat species) (Hermanson and O'Shea 1983).

Foraging habitats include agricultural areas, riparian woodland, open pine forests, oak savannah, and talus slopes (Williams et al. 2006). Pallid Bats forage close to the ground surface and glean prey from the ground or off exposed vegetation. They rely primarily on passive hearing to locate prey moving on the ground (Fuzessery et al. 1993). Preferred prey items include moths, Jerusalem crickets, beetles, grasshoppers, and scorpions (Hermanson and O'Shea 1983, Erickson 2002). Most activity occurs 90 to 190 minutes after sunset and a couple hours before dawn. As temperatures drop in the fall, shorter periods of activity happen, and these periods drop off substantially below 35 degrees Fahrenheit.

The species breeds in the fall and winter (October through as late as February in coastal locations). Females store the sperm over the winter and ovulation occurs the following spring. Maternity colonies are typically formed in April and may consist of up to 100 individuals (Erickson 2002). Females typically give birth to twin pups in May of June (Hermanson and O'Shea 1983). The species hibernates during the winter, but may arouse to forage and drink water (Erickson 2002). As a colonial roosting species, Pallid Bats are very sensitive to roost site disturbance. This is particularly true in the case of maternity colonies.

Ground foraging bats, as opposed to the aerial “hawking” species, are typically light averse. While hawking species are drawn to lights due to the increased insects, slower, less agile, ground foragers are found to avoid these areas; perhaps because they are more vulnerable to terrestrial predators that could see them in the light (Rowse et al. 2016).

There are two CNDDB occurrences reported just over a mile away from the Study Area in the Sonoma Creek riparian area. In addition, there is suitable roosting and foraging habitat in and near the Study Area, and it is possible for this species to occur in the Study Area. Conservation measure are recommended in Section 7.1.4.

5.2.3 Aquatic Species

Western Pond Turtle (*Emys marmorata*), California State Species of Special Concern, Moderate Potential

Based on molecular analysis, Spinks et al (2014) proposed recognizing all pond turtles north of San Francisco Bay as *Emys marmorata*; many available literature sources refer to the species as *Actinemys marmorata*. Pond turtles occur in a variety of permanent and semi-permanent freshwater aquatic habitats including lakes, rivers, ponds, creeks, and marshes.

Breeding can occur on loose soils on south or west facing slopes so a few pond turtles may venture away from the river into the study area. The species is frequently observed basking on exposed banks, logs, and rocks. Winter activity is possible but limited to unusually warm, sunny days; normally pond turtles are dormant during winter months on the north coast; dormancy typically involved burrowing into loose substrate above the high water mark (Thompson et al 2016). Overwintering sites can include undercut banks, burrowing under leaf/needle litter, or in soil or mud (Reese and Welsh 1997, ECCC 2006). Pond turtles have been documented nesting up to 0.5 kilometers from water (Reese and Welsh 1997).

There is a CNDDB occurrence of this species in Nathanson Creek a half mile upstream of the Study Area. Aquatic habitat for this species does not occur directly in the Project Boundary, but the species has been known to travel into upland habitats around their main water body. Due to the daily use/disturbance by school children and regular turf maintenance regime at the site, it is unlikely this species would utilize habitat outside of Nathanson Creek. Recommended avoidance measures are outlined in Section 7.1.1 and Section 7.2.

Amphibians and Steelhead Trout

The California Giant Salamander and Steelhead Trout have moderate potential to be present in the Study Area. These are predominantly or completely aquatic creatures, and have reportedly been known to occur in Nathanson Creek in the past. Steelhead trout were documented in Nathanson Creek and a few Chinook were reported during surveys in 2004 and 2005 (Leidy 2005, Sonoma Ecology Center 2007, Prunuske Chatham Inc. 2015). Aquatic habitat for these species does not occur within the Renovation Area. Similar to the Western Pond Turtle, it is unlikely any of the amphibian species would utilize habitat outside of Nathanson Creek, within the Renovation Area, due to the school athletic field use and conditions and lack of cover or complex habitat structure. Steelhead Trout would likely only occur seasonally in the creek. No construction or permanent impacts are expected in Nathanson Creek or the riparian area around the creek. Impacts would only be expected if degraded water quality or erosion is allowed to enter the creek while fish are present. Recommended avoidance measures are outlined in Section 7.1.1 and Section 7.2.

5.3 Critical Habitat

Critical habitat is designated by the USFWS and NMFS under the Federal Endangered Species Act (ESA). Critical habitat refers to specific geographic areas that contain features essential for conservation of a threatened or endangered species and that may require special management and protection.

Nathanson Creek is identified as critical habitat for Central California Coast (CCC) Steelhead. The Study Area is not within designated critical habitat for any other species.

5.4 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the 1996 Sustainable Fisheries Act (Public Law 104-297), mandates inter-agency cooperation in achieving protection, conservation, and enhancement of Essential Fish Habitat (EFH). Essential fish habitat (EFH) are those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA § 3(10)). For the purpose of interpreting the definition of essential fish habitat: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle. EFH is described by the Councils in amendments to Fishery Management Plans, and is approved by the Secretary of Commerce acting through NOAA Fisheries (50 CFR 600.10).

EFH designations serve to highlight the importance of habitat conservation for sustainable fisheries and sustaining valuable fish populations. EFH relates directly to the physical fish habitat and indirectly to factors that contribute to degradation of this habitat. Important features of EFH that deserve attention are adequate water quality, temperature, food source, water depth, and cover/vegetation.

Essential fish habitat is designated for species managed in Fisheries Management Plans under the Magnuson-Stevens Fishery Conservation and Management Act. Under the Magnuson-Stevens Fishery Conservation and Management Act, t

Tributaries in the San Pablo Bay watershed, including Nathanson Creek, are designated as Essential Fish Habitat within the Pacific Coast Salmon Fisheries Management Plan. Species included in this Plan are Chinook Salmon (*Oncorhynchus tshawytscha*) and, Coho Salmon (*Oncorhynchus kisutch*) and Puget Sound Pink Salmon (*Oncorhynchus gorbuscha*).Chinook Salmon has documented presence in Nathanson Creek (Sonoma Ecology Center 2007, Prunuske Chatham Inc. 2015).

6. Impact Analysis

The following sections generally describe potential effects to sensitive biological resources that would result from the construction, operation, and maintenance of the proposed Project.

6.1 Annual Grassland

The Study Area habitats/vegetation communities, for the most part, will not change. The proposed Project will, however, convert about two (2) acres of fallow, annual grassland to accommodate Project facilities.

6.2 Special-Status Plant Species

The fallow, annual grassland has the potential to support several special-status plant species. If these species were to occur, construction within the Renovation Area could have a direct impact. Therefore, clearance surveys should be conducted at the appropriate time of year to determine absence of these five species as recommended in the conservation measures to verify level of impact (Section 7.1.2).

6.3 Special Status and Protected Bats and Nesting Birds

The habitat within and adjacent to the Study Area provides potentially suitable roosting and nesting opportunities for Pallid Bats, Swainson's Hawks, and many other migratory bird species. Raptor and migratory bird nests are considered to be a protected resource by federal and state agencies under the MBTA and California Fish and Game Code. Removal of some trees will be needed in order to construct the Project. Bats, Swainson's Hawks, and/or nesting migratory birds could utilize trees designated for removal. The proposed Project could result in nest abandonment and/or direct mortality to eggs and chicks during tree removal. Therefore, a conservation measure is recommended to reduce the significance of this potential impact (Section 7.1.3 and 7.1.4).

6.4 Water Quality

Water Quality could be affected by run-off, erosion, sedimentation, leaking equipment, chemical/material spills, or trash/debris. Construction activities could degrade water quality and/or increase erosion within or near Nathanson Creek. Nathanson Creek could support special status fish, reptile, and amphibian species. Impacts to this aquatic resource and the riparian corridor should be avoided if possible. A non-intrusion buffer should be maintained around the riparian area to protect riparian vegetation from being impacted and tree roots from compaction. Best management practices (BMPs) should be observed (Section 7.2), and water quality protections (Section 7.1.1) should be developed to ensure that no aquatic resources or riparian habitats are impacted by Project activities.

6.5 Construction Noise

The equipment required to construct Project improvements will increase ambient sound levels. This added disturbance could cause nesting birds, if present, to leave their nest for too long to incubate their eggs properly, or to abandon the nest all together. Due to the fact that construction activities will be limited to daylight hours, potential effects of construction noise on bats would be limited to day roosts in the Project vicinity and could potentially include: acute acoustic trauma and disturbance/displacement from important food and shelter resources. Avoidance and conservation measures are recommended in Section 7.1.3 and Section 7.1.4.

6.6 Nighttime Lighting

Nighttime construction work is not anticipated to be required for the Project. The Project improvements, however, include plans to install Total Light Control (TLC) LED sports lighting. The lighting would be focused onto the relocated track and field. This light system minimizes light spill and glare outside the target area (track and field within the Renovation Area). The sports lights would be shielded and aimed directly down and not directed toward sensitive wildlife habitats or corridors.

The nighttime lighting would only be necessary occasionally when events would continue after daylight hours. This is estimated to occur in winter when the sun sets as early as 4:49 PM (Time and Date 2019) and games will go until 9 pm. The sports lighting would only be used during those occasional events, and would be turned off promptly after the events are concluded. If light spill is great enough in adjacent habitat, this could disrupt bat roosting during winter months when torpor and energy reserves are critical. As noted in Section 5.2.3 slower, less agile, ground foraging bats avoid nighttime lighting. However, given the design of the lights and that they would focus on the synthetic field which would not provide foraging habitat, the nighttime lighting is not anticipated to impact the foraging ability of bats. Ample foraging exists along the riparian corridor north and south of the renovation area. Lighting can also reportedly have a negative impact on amphibians during breeding migrations, although no known breeding wetlands are present within the potential impact area.

7. Recommended Avoidance/Mitigation Measures and Best Management Practices

The avoidance/mitigation measures and BMPs presented in this section are based on consideration of federal and state regulations concerning biological resources.

7.1 Avoidance/Mitigation Measures

In order to avoid sensitive biological resources and reduce potential adverse effects, implementation of the avoidance/mitigation measures outlined below are recommended for the proposed Project.

7.1.1 Riparian Protection, Water Quality, Sensitive Habitats, and Special-Status Aquatic Species

Special care needs to be taken to prevent impacts to the Nathanson Creek Valley Oak Woodland riparian corridor. This rare natural vegetation community has an S3 State Ranking status, and is afforded protection as a vegetation community by CDFW. Furthermore, impacting a riparian system, regardless of rarity, triggers the need for a Lake and Streambed Alteration Agreement (LSAA) from CDFW. In addition, by avoiding this area and habitat, impacts to special status fish, reptiles and amphibians can be avoided.

To prevent impact to the Valley Oak Woodland riparian corridor associated with the Nathanson Creek, it is advised:

a) A Stormwater Pollution Prevention Plan (SWPPP) be developed and implemented to address and prevent possible stormwater contamination, control sedimentation and erosion, and comply with requirements of the CWA.

b) A tree root protection zone and non-intrusion boundary for the riparian community be developed by a certified arborist, to ensure adequate protection is afforded to this rare natural vegetation community and habitat.

c) Prior to exclusion fence placement and construction, a CDFW approved, qualified biologist should conduct clearance surveys to ensure that special-status amphibians or reptiles are not found in the construction area beyond where the exclusion fence will be placed.

d) Exclusion fencing be installed around the riparian habitat to prevent amphibians or western pond turtles from entering the construction area. Fencing should be at least 24 inches in height.

e) General BMPs (Section 7.2) are suggested to reduce dust or erosion to the nearby waterway.

7.1.2 Special-Status Plants

It is recommended that a qualified botanist, approved by CDFW, conduct a botanical clearance survey in any potentially impacted natural, semi-natural or unmaintained areas during the time of year when the species listed in Section 5.1 are blooming and identifiable. All potential sensitive plant species have an overlapping bloom period in June.

7.1.3 Special-Status and Nesting Birds

Nesting opportunities for special-status and protected bird species, including those protected under the BGEPA, MBTA, and California Fish and Game Code, are present in the vicinity of the proposed Project. Construction-related disturbances during the general bird nesting season (February 1st through August 31st) could adversely affect nesting birds in violation of federal and state laws.

Clearing of shrubs or other vegetation or ground disturbance shall be conducted, if possible, during the fall and/or winter months and outside of the avian nesting season (February 1st through August 31st) for Sonoma County to avoid any direct effects to special status and protected birds. If vegetation removal (including trimming of vegetation) or ground disturbance cannot be confined to work outside of the nesting season, a qualified ornithologist shall conduct pre-construction surveys within the vicinity of the Project Area, to check for nesting activity of native birds and to evaluate the site for presence of raptors and special-status bird species. The ornithologist shall conduct a minimum of one day pre-construction survey within the 7-day period prior to vegetation removal and ground-disturbing activities. If ground disturbance and vegetation removal work lapses for seven days or longer during the breeding season, a qualified biologist shall conduct a supplemental avian pre-construction survey before project work is reinitiated.

If active nests are detected within the construction footprint or within 500-feet of construction activities, the biologist shall flag a buffer around each nest. Construction activities shall avoid nest sites until the biologist determines that the young have fledged or nesting activity has ceased. If nests are documented outside of the construction (disturbance) footprint, but within 500-feet of the construction area, buffers will be implemented as needed. In general, the buffer size for common species would be determined on a case-by-case basis in consultation with the CDFW. Buffer sizes will take into account factors such as (1) noise and human disturbance levels at the construction site at the time of the survey and the noise and disturbance expected during the construction activity; (2) distance and amount of vegetation or other screening between the construction site and the nest; and (3) sensitivity of individual nesting species and behaviors of the nesting birds.

If active nests are detected during the survey, the qualified ornithologist shall monitor all nests at least once per week to determine whether birds are being disturbed. Activities that might, in the opinion of the qualified ornithologist, disturb nesting activities (e.g., excessive noise), shall be prohibited within the buffer zone until such a determination is made. If signs of disturbance or distress are observed, the qualified ornithologist shall immediately implement adaptive measures to reduce disturbance. These measures may include, but are not limited to, increasing buffer size, halting disruptive construction activities in the vicinity of the nest until fledging is confirmed, placement of visual screens or sound dampening structures between the nest and construction activity, reducing speed limits, replacing and updating noisy equipment, queuing trucks to distribute idling noise, locating vehicle access points and loading and shipping facilities away from noise-sensitive receptors, reducing the number of noisy construction activities occurring simultaneously, and/or reorienting and/or relocating construction equipment to minimize noise at noise-sensitive receptors.

Nest boxes could be removed from around the Renovation Area, outside of the avian nesting season (February 1st through August 31st) for Sonoma County, to avoid encouraging birds to nest there. Special care should be taken to ensure other special status wildlife species, such as bats, are not utilizing these structures before removal.

7.1.4 Special-Status Bats

A qualified bat biologist could conduct habitat surveys for special-status bats. Survey methodology should include visual examination of suitable habitat areas for signs of bat use and may utilize ultrasonic detectors to determine if special status bat species utilize the vicinity. Trees within 300 feet of construction activities should be examined. If habitat exists, species presence and site use patterns should be documented, including roost sites. Bat presence in the Study Area may vary seasonally and annually. Surveys should be conducted in a manner to detect the presence of hibernating or torpid bats, reproductive colonies and/or migratory stop-over roosts. If no bat utilization or roosts are found, then no further study or action is required. If bats are found to utilize the Study Area, or presence is assumed, a bat specialist should be engaged to advise the best method to prevent impact.

7.2 Best Management Practices

General BMPs recommended to be employed during Project construction and operation in order to further reduce potential impact to biological resources are as follows:

- Ensure readily available copies of resource agency correspondence (i.e., permits and authorizations), if any, are maintained by the construction foreman/manager on the Project site whenever construction and/or earthmoving is taking place.

- Clearly delineate work zones on-site; workers should not be allowed to access the riparian corridor along Nathanson Creek.
- Wildlife found within construction zones shall be allowed to passively leave the area without harassment. Resource authorities (USFWS and/or CDFW) would be contacted regarding actions to remove wildlife out harm's way if construction is delayed. No wildlife will be purposefully harmed during Project construction and operation.
- Check underneath stationary vehicles before moving them each morning at start of work to ensure wildlife are not hiding underneath.
- Ensure that fugitive dust emissions are kept to a minimum by periodically watering during construction activities, though water should not be allowed to pool.
- Parking/staging areas of all on-site vehicles (including construction equipment) should be designated in disturbed areas at least 100 feet away from any open water and riparian system whenever possible.
- To reduce potential attraction of predators, store all food, toiletries, and other potential attractants in sealed containers.
- Remove all trash from the Project site at the end of each work day and dispose of trash in a way that is unavailable to wildlife (i.e. in closed, sealed bins).
- No hunting or fishing and no dogs (other than with law enforcement) or other pets belonging to construction personnel shall be allowed on-site.
- Collection of any wildlife species shall be prohibited at the Project location except by qualified biologists with appropriate permits if applicable.
- Regulatory authorities should have reasonable access to the Project during all phases of construction in order to verify compliance with or effectiveness of measures set forth in Project authorizations/permits.

8. Concluding Remarks

The impacts and recommended avoidance/mitigation measures outlined in this report should be considered preliminary until Project design is complete. Furthermore, federal and state regulatory authorities will have the opportunity to comment and recommend additional measures during the environmental review and permit process.

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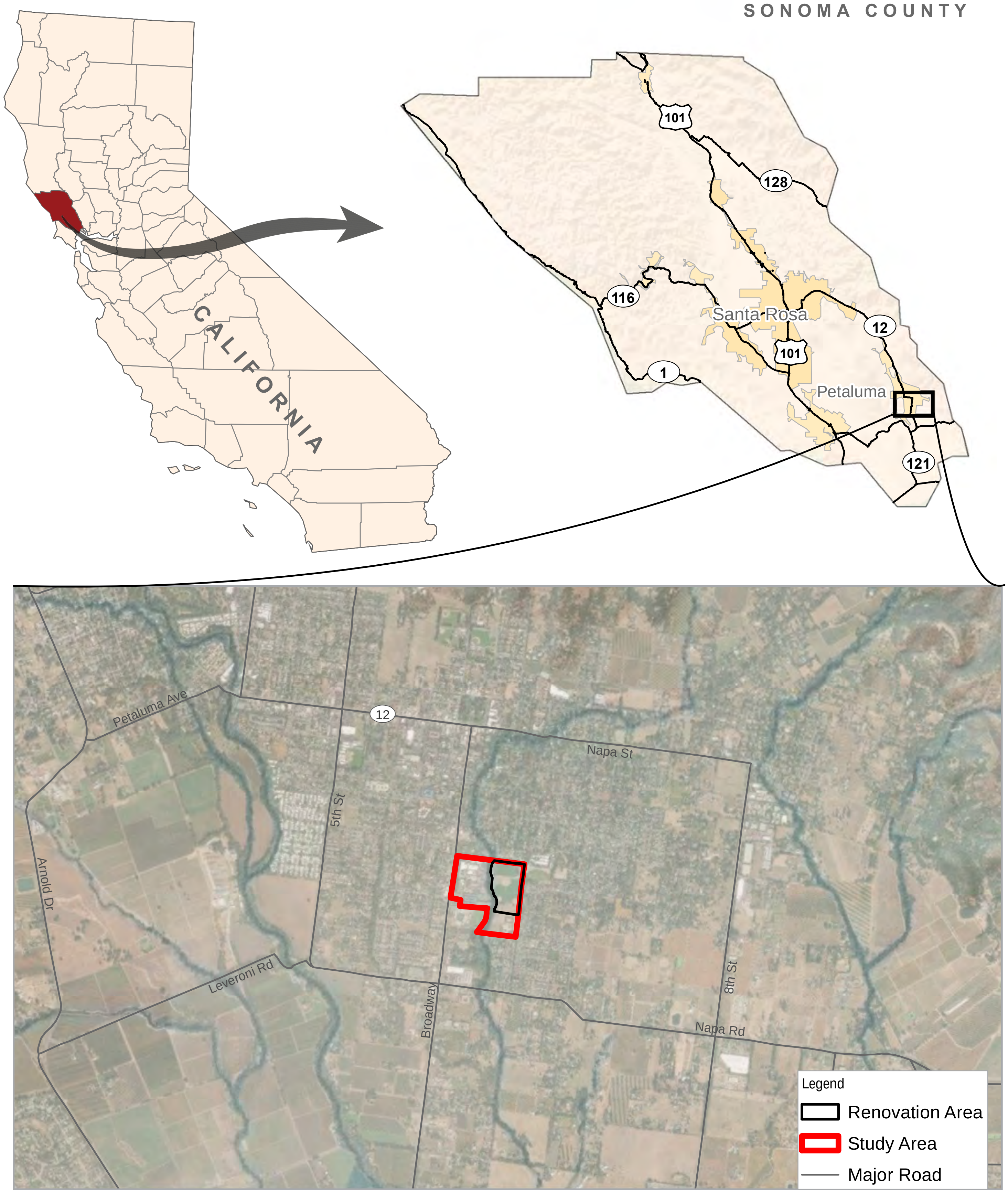
Appendix A Supporting Map Figures

Figure Index



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Sonoma Valley High School
Athletic Fields Renovation Project

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Project No. 11152127
Revision No. -
Date 09/04/2019

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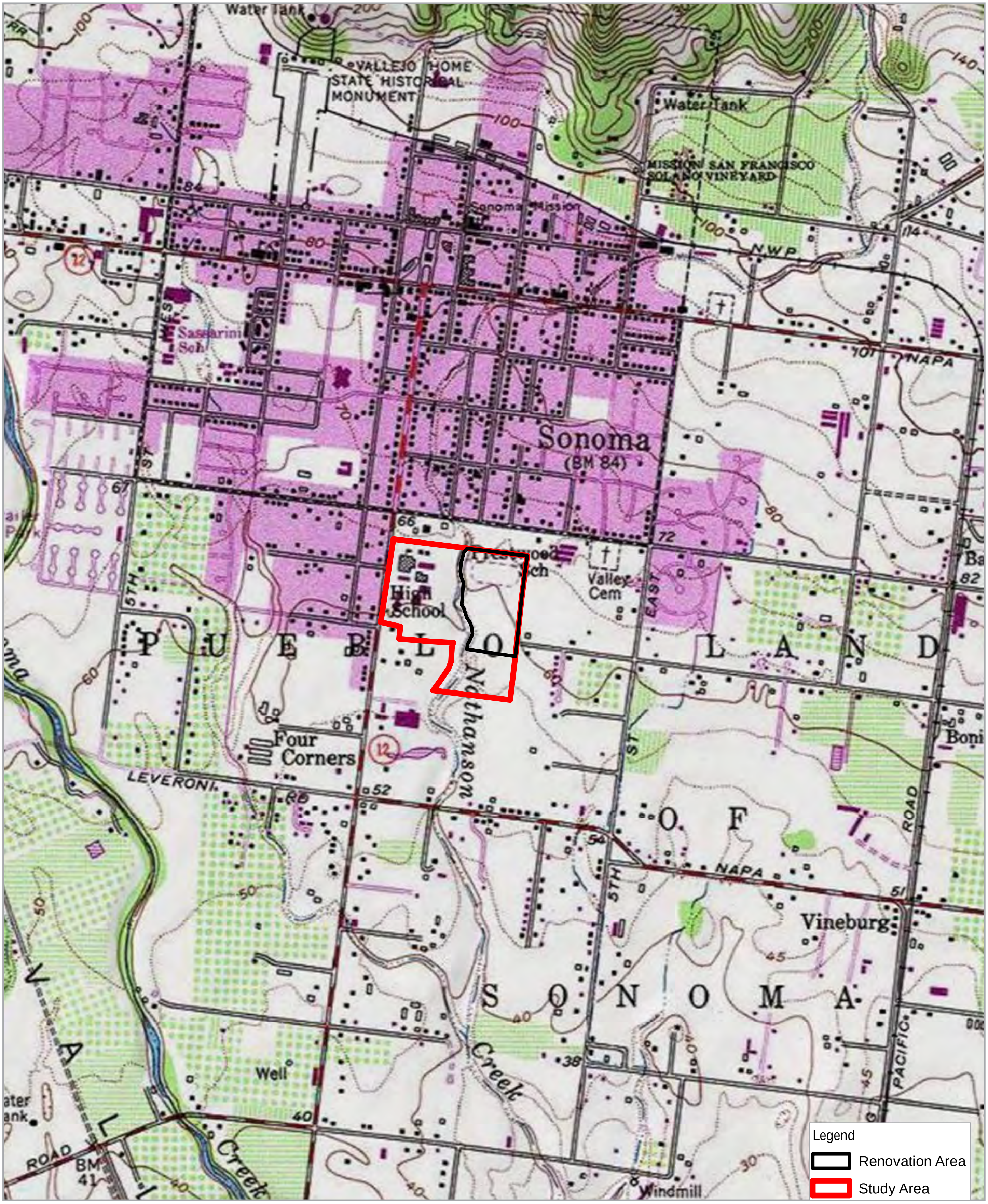

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GHD

Sonoma Valley Unified School District
Sonoma Valley High School
Athletic Fields Renovation Project

USGS Topography Quad

Project No.	11152127
Revision No.	-
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FIGURE 2

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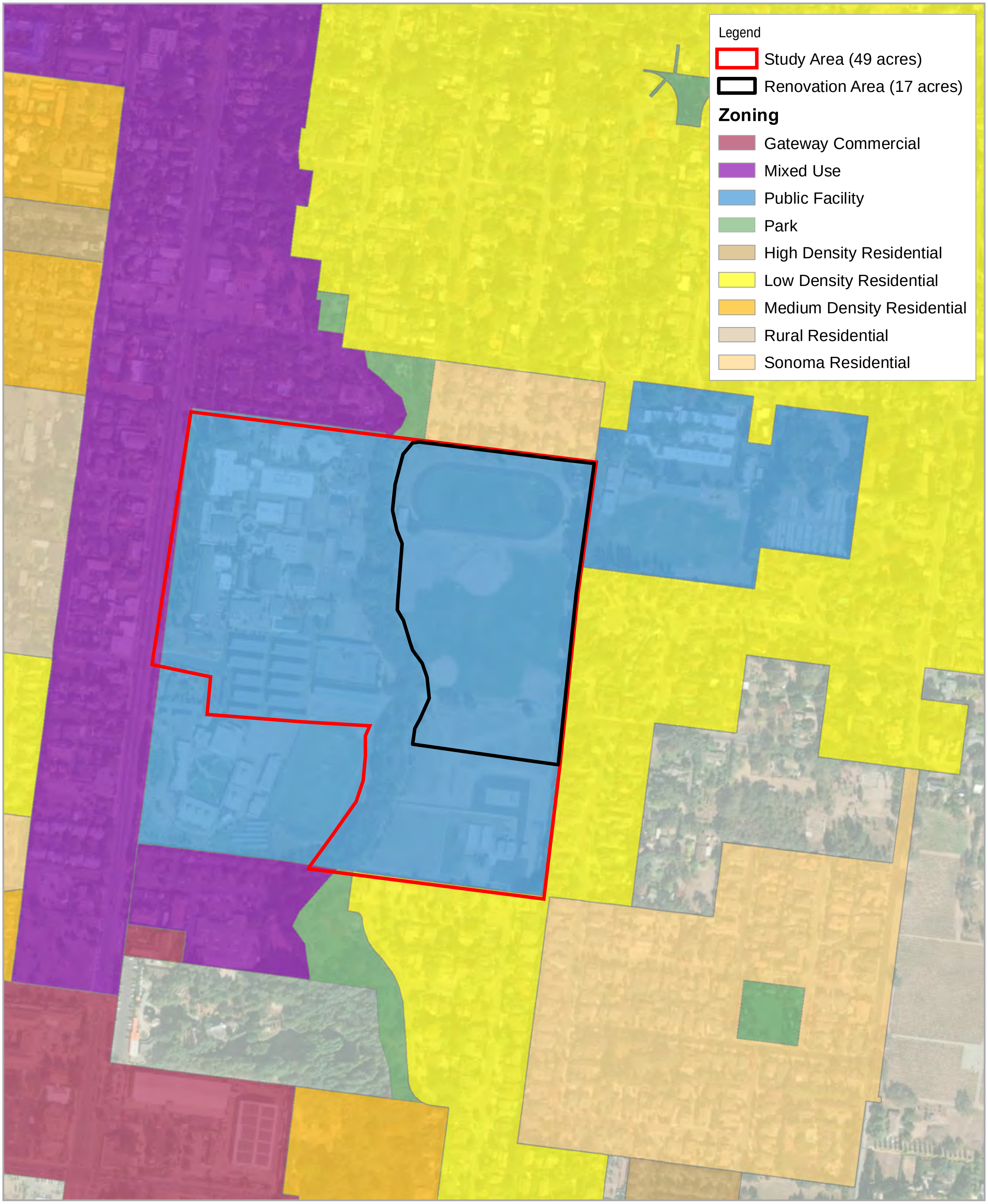

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GHD

Sonoma Valley Unified School District
Sonoma Valley High School
Athletic Fields Renovation Project

Land Use

Project No. 11152127
Revision No. -
Date 09/04/2019

FIGURE 3

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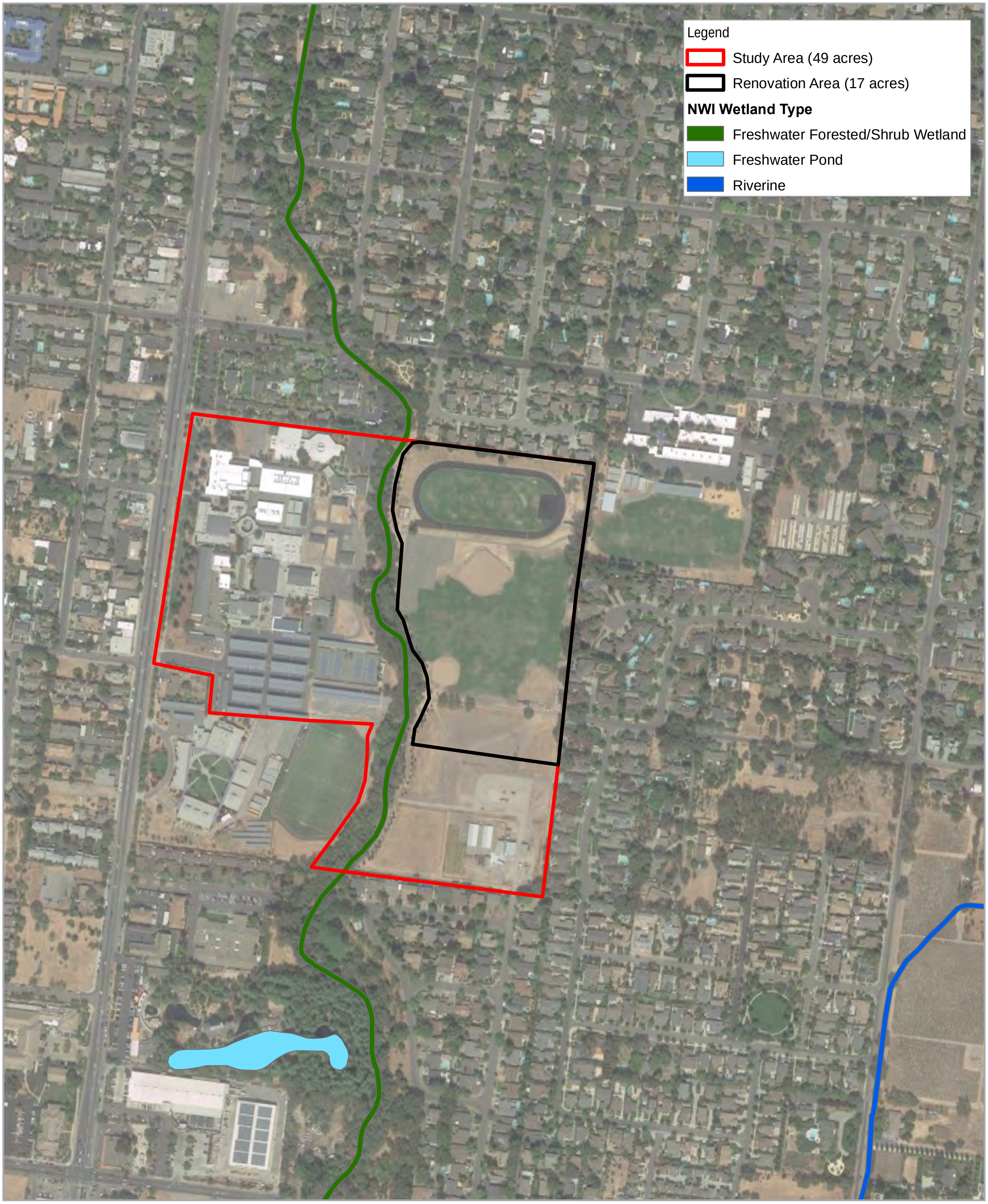
Data source: GHD 2019, County of Sonoma 2019, City of Sonoma 2019. Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: jclark2



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GHD

Sonoma Valley Unified School District
Sonoma Valley High School
Athletic Fields Renovation Project

National Wetland Inventory

Project No. 11152127
Revision No. -
Date 09/04/2019

FIGURE 4

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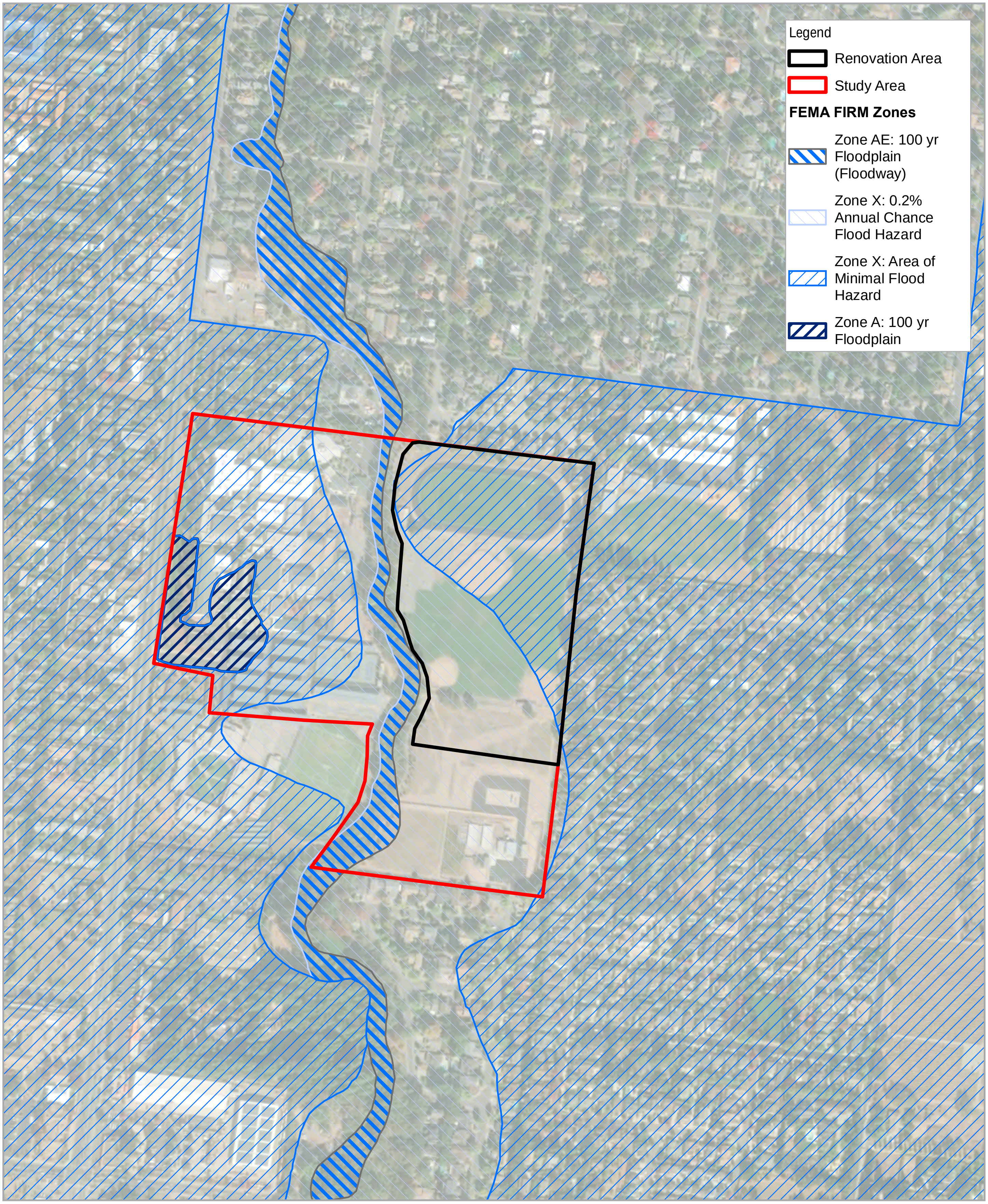
Data source: FEMA FIRM data; . Created by: jclark2



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GHD

Sonoma Valley Unified School District
Sonoma Valley High School
Athletic Fields Renovation Project

Project No. 11152127
Revision No. -
Date 09/04/2019

Floodplain

FIGURE 5

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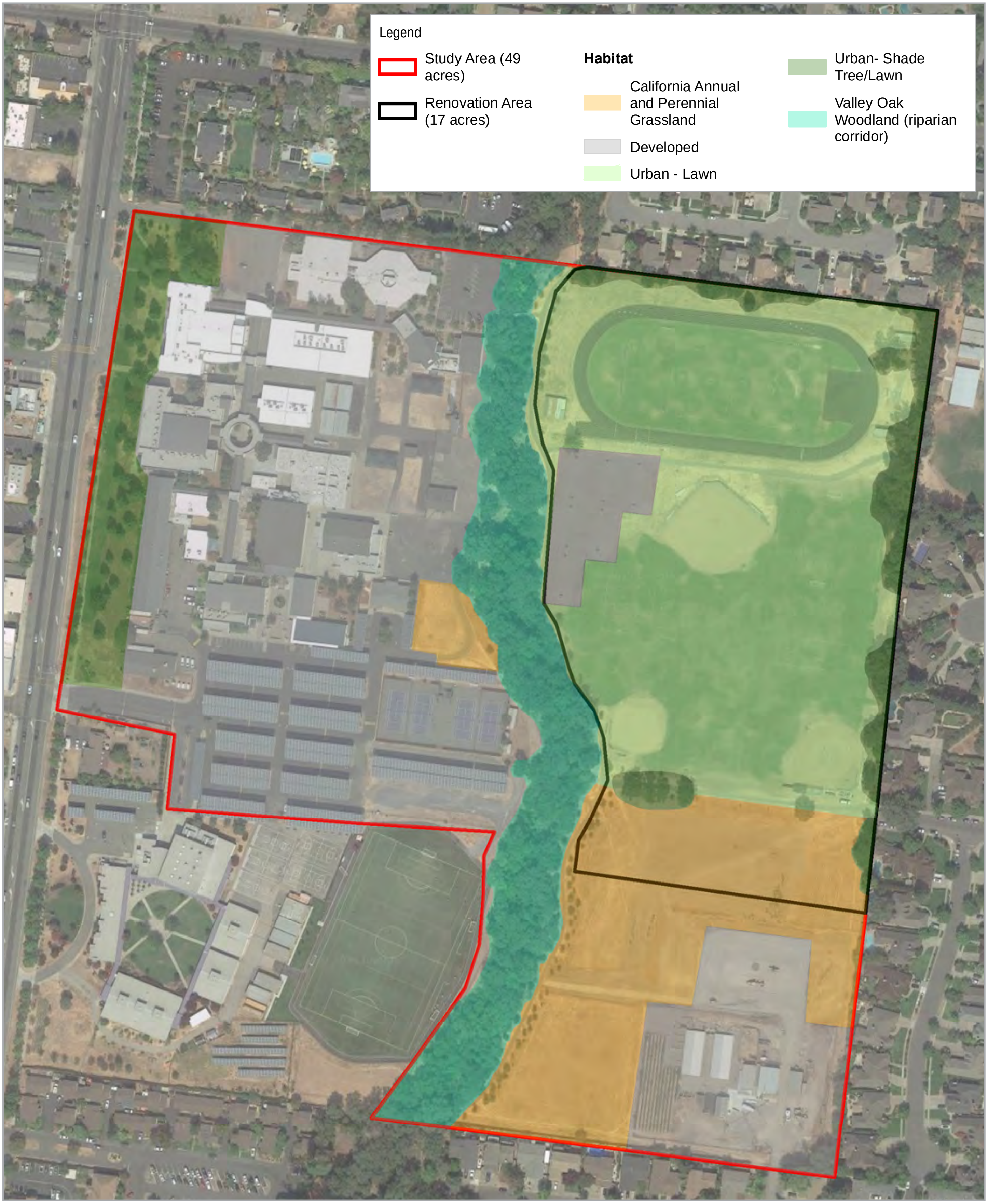
Data source: FEMA FIRM data 2019; Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: jclark2



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Horizontal Datum: North American 1983
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GHD

Sonoma Valley Unified School District
Sonoma Valley High School
Athletic Fields Renovation Project

Habitat Map

Project No. 11152127
Revision No. -
Date 09/04/2019

FIGURE 6

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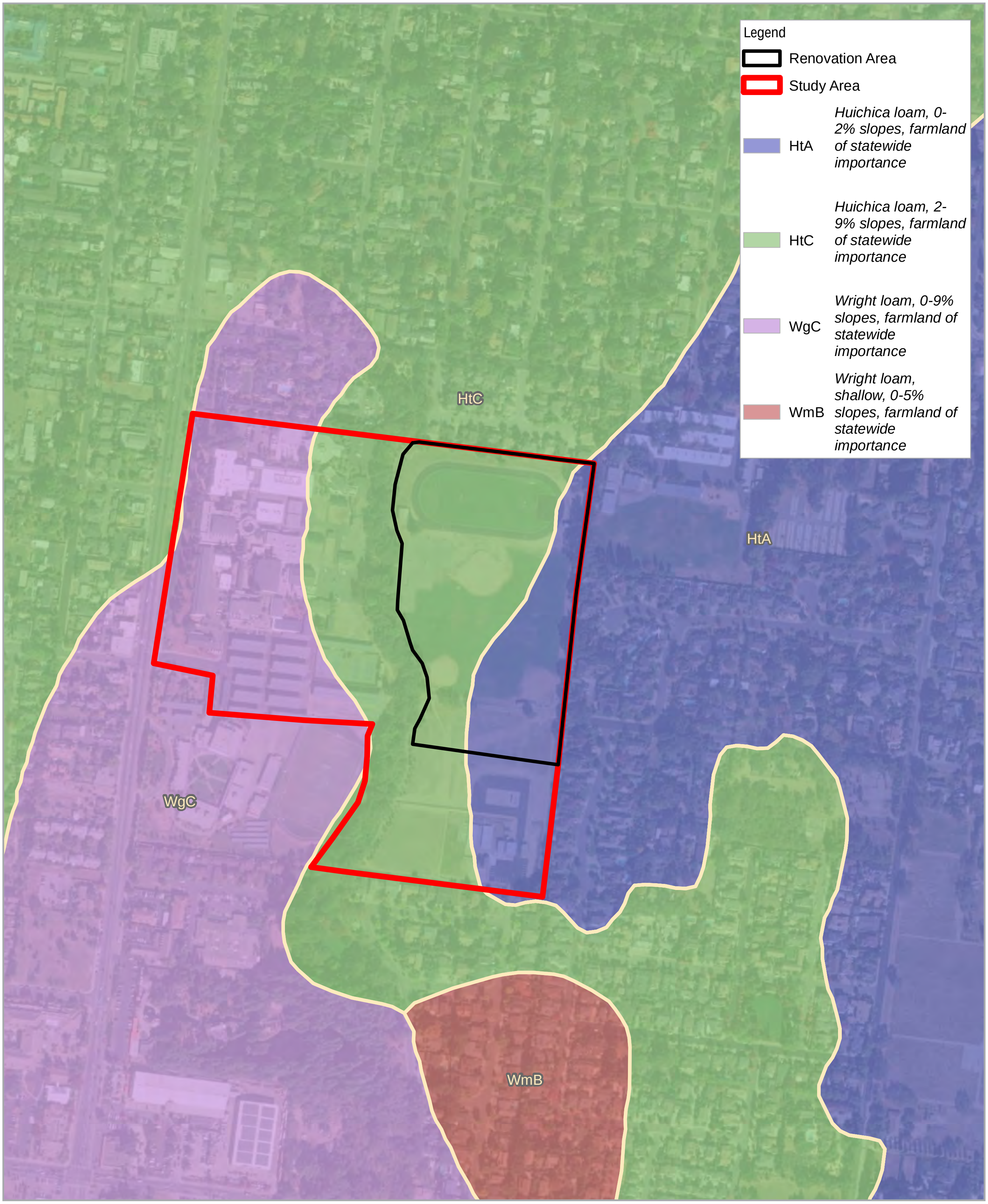
Data source: FEMA FIRM data; Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community. Created by: jclark2



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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
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Sonoma Valley Unified School District
Sonoma Valley High School
Athletic Fields Renovation Project

Project No. 11152127
Revision No. -
Date 09/04/2019

USDA NRCS Soils

FIGURE 7

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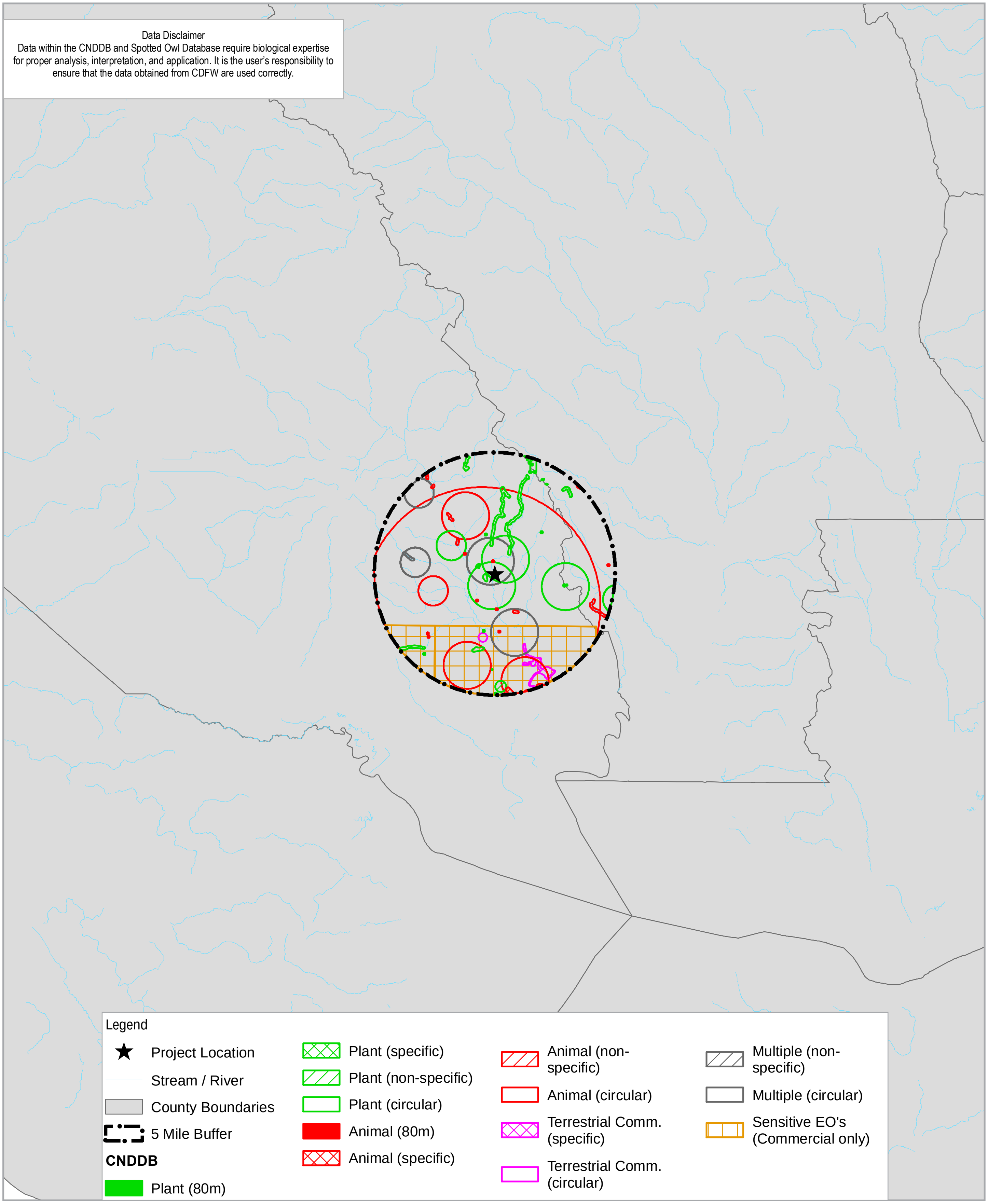

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California II FIPS 0402 Feet

Sonoma Valley Unified School District
Sonoma Valley High School
Athletic Fields Renovation Project

Project No. 11152127
Revision No. -
Date 09/04/2019

CNDDB Plants & Wildlife

FIGURE 8

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Print date: 04 Sep 2019 - 12:40

Data source: CNDDB, August 2019; GHD 2019; NHD Flowline . Created by: jclark2

Appendix B Site Photographs

Appendix B: Site Photographs

Photo 1: Facing west- August 24th, 2018, View of Study Area near southernmost bridge across Nathanson Creek.

Photo 2: Facing south- August 24th, View of Study Area near southernmost bridge across Nathanson Creek.

Photo 3: Facing north- August 24th, View of Study Area near southernmost bridge across Nathanson Creek.

Photo 4: Facing north- August 24th, Nathanson Creek trail along athletic fields.

Appendix B: Site Photographs

Photo 5: Facing east- August 24th, View of open athletic fields.

Photo 6: Facing south- August 24th, Nathanson Creek trail along athletic fields.

Appendix B: Site Photographs

Photo 7: Facing north- August 24th, Nathanson Creek trail beside basketball courts.

Photo 8: Facing northeast- August 24th, Sonoma Valley High School (SVHS) outdoor basketball courts.

Photo 9: Facing southeast- August 24th, SVHS outdoor basketball courts.

Photo 10: Facing south- August 24th, Nathanson Creek trail beside basketball courts.

Appendix B: Site Photographs

Photo 11: Facing south- August 24th, View of northwest corner of property. Nathanson creek trail adjacent to the track and field area.

Photo 12: Facing east- August 24th, View of northwest corner of property. Nathanson creek trail in foreground; track and field area beyond fence.

Appendix B: Site Photographs

Photo 13: Facing east- August 24th, View of the track and field area at the northern edge of property.

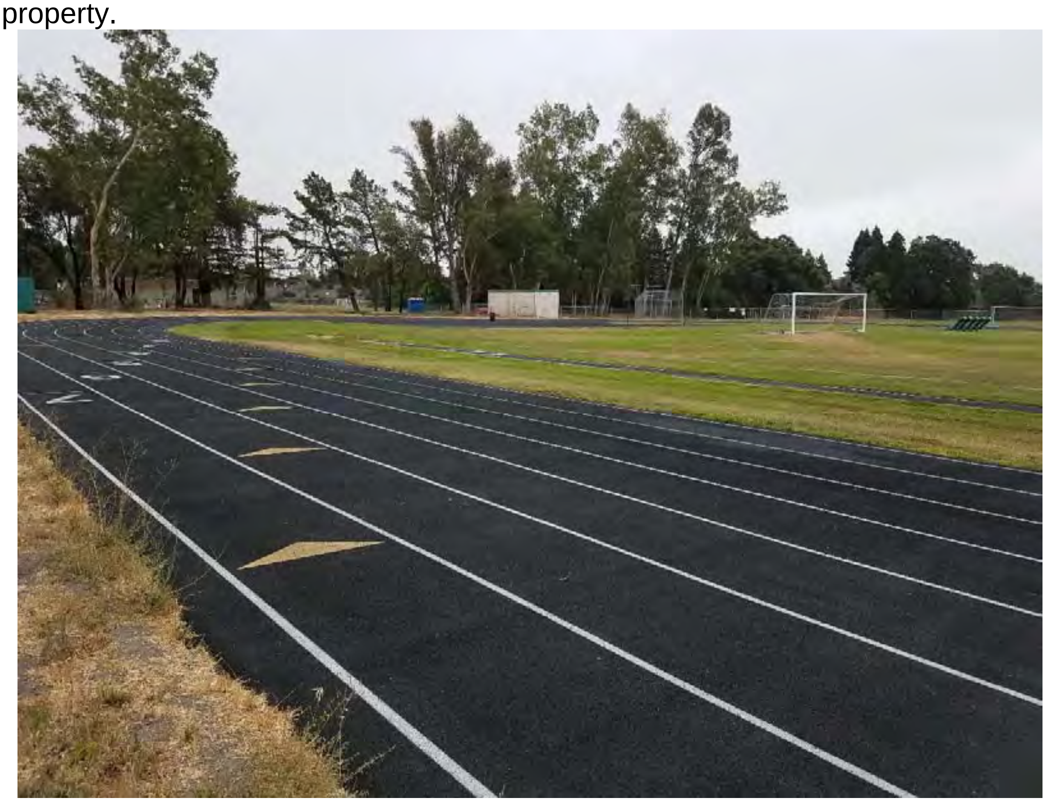

Photo 14: Facing southeast- August 24th, View of the track and field area at the northern edge of property.

Appendix B: Site Photographs

Photo 15: Facing south- August 24th, View of the track and field area at the northern edge of property.

Photo 16: Facing southwest- August 24th, View of the track and field area at the northern edge of property.

Appendix B: Site Photographs

Photo 17: Facing west- August 24th, View of the track and field area at the northern edge of property.

Photo 18: Facing northwest- August 24th, View of the track and field area at the northern edge of property.

Appendix B: Site Photographs

Photo 19: Facing east- August 24th, View of eastern path/exit leading out of athletic fields.

Photo 20: Facing northeast- August 24th, View of path leading to the track and field.

Appendix B: Site Photographs

Photo 21: Facing southeast- August 24th, View of eastern edge of athletic fields and property boundary.

Photo 22: Facing south- August 24th, View of eastern edge of athletic fields and property boundary.

Appendix B: Site Photographs

Photo 23: Facing northwest- August 24th, View of eastern side of athletic fields.

Photo 24: Facing north- August 24th, View of eastern edge of athletic fields.

Photo 25: Facing north- August 24th, View of eastern property boundary and entrance at Denmark St.

Photo 26: Facing west- August 24th, View of path from entrance at Denmark St. The beginnings of the Denmark access path drainage is visible in the mid-ground of the picture.

Photo 27: Facing north- August 24th, View of fields from southeast corner of Project Boundary.

Photo 28: Facing northwest- August 24th, View of fields from southeast corner of Project Boundary.

Appendix B: Site Photographs

Photo 29: Facing west- August 24th, View of fallow field from southeast corner of Project Boundary.

Photo 30: Facing west- May 3rd, 2019, View of fallow field and newly constructed parking lot from southeast corner of Project Boundary.

Photo 31: Facing east- August 24th, View of Study Area from middle of fallow field south of Denmark Rd. access path.

Photo 32: Facing northeast- August 24th, View of Study Area from middle of fallow field south of Denmark Rd. access path.

Photo 33: Facing north- August 24th, View of Study Area from middle of fallow field south of Denmark Rd. access path.

Photo 34: Facing northwest- August 24th, View of Study Area from middle of fallow field south of Denmark Rd. access path.

Photo 35: Facing west- August 24th, View of Study Area from middle of fallow field south of Denmark Rd. access path.

Photo 36: Facing northeast- May 3rd, 2019, View of eastern drainage starting near northeast corner of Study Area and adjacent to Prestwood Elementary School.

Photo 37: Facing south- May 3rd, View of eastern drainage starting near northeast corner of Study Area, adjacent to Prestwood Elementary School, and running south toward a grove of eucalyptus and redwoods.

Photo 38: Facing south- May 3rd, View of eastern drainage starting near northeast corner of Study Area, adjacent to Prestwood Elementary School, and running south toward a grove of eucalyptus and redwoods.

Photo 39: Facing northeast- May 3rd, View of eastern drainage where it appears to pool in a grove of eucalyptus and redwoods.

Photo 40: Facing south- May 3[rd], View of eastern drainage where it appears to pool in a grove of eucalyptus and redwoods.

Appendix B: Site Photographs

Photo 41: Facing east- May 3rd, View of eastern drainage from southern end of eucalyptus and redwood grove.

Photo 42: Facing south- May 3rd, View of eastern drainage to small pedestrian access crossing.

Photo 43: Facing south- May 3rd, View of blackberry clump within eastern drainage. Small pedestrian access crossing in background.

Photo 44: Facing northeast- May 3rd, View of eastern drainage from Denmark Rd. access path to small pedestrian access crossing in the background.

Photo 45: Facing south- May 3rd, View of eastern drainage towards Denmark Rd. access path. Drainage does not appear to continue from here or connect to other features.

Photo 46: Facing west- August 24th, In mid-ground view of beginnings of drainage along Denmark Rd. access path leading to culvert and Nathanson Creek in the background.

Appendix B: Site Photographs

Photo 47: Facing east- May 3rd, View of a drainage leading to culvert and Nathanson Creek, near southernmost bridge to SVHS.

Photo 48: Facing west- May 3rd, View of a culvert draining from the Project Boundary to Nathanson Creek, near southwest corner of Project Boundary and southernmost bridge to SVHS campus.

Photo 49: Facing southwest- August 24th, View of a culvert draining from the Project Boundary to Nathanson Creek, near southwest corner of Project Boundary and southernmost bridge to SVHS.

Photo 50: Facing west- May 3rd, View of newly constructed bioretention basin, near southeast corner of Project Boundary and newly constructed parking lot.

Photo 51: Facing southwest- August 24th, 2018, Tree along Nathanson Creek with nest box.

Photo 52: Facing west- August 24th, Second tree along Nathanson Creek with nest box.

Photo 53: Facing west- August 24th, Nest in tree along Nathanson Creek.

Photo 54: Facing southeast- August 24th, Tree with nest box along eastern boundary near northern path/exit from athletic fields.

Photo 55: Facing northwest- August 24th, Nest in tree along northern edge of Study Area.

Photo 56: Facing northeast- August 24th, Nest in tree along northern edge of Study Area.

Photo 57: Facing east- May 3rd, 2019, Underside of southernmost bridge across Nathanson Creek from SVHS and athletic fields.

Photo 58: Facing west- May 3rd, Underside of southernmost bridge across Nathanson Creek from SVHS and athletic fields.

Photo 59: Facing west- May 3rd, Underside of southernmost bridge across Nathanson Creek from SVHS and athletic fields.

Photo 60: Facing east- May 3rd, Holes and crevices in creek bank that could be used by swallows, near southernmost bridge.

Photo 61: Facing northwest- August 24th, Middle bridge across Nathanson Creek from SVHS and athletic fields.

Photo 62: Facing west- August 24th, Underside of middle bridge across Nathanson Creek between SVHS and athletic fields.

Photo 63: Facing east- August 24th, Underside of middle bridge across Nathanson Creek between SVHS and athletic fields.

Photo 64: Facing northwest- August 24th, Underside of northern most bridge across Nathanson Creek between SVHS and athletic fields.

Appendix B: Site Photographs

Photo 65: Facing northeast- August 24th, Underside of northern most bridge across Nathanson Creek from SVHS and athletic fields.

Photo 66: Facing east- May 3rd, Holes and crevices in creek bank to the left that could be used by swallows, near southernmost bridge.

Photo 67: Facing south- August 24th, Green Heron (*Butorides virescens*) utilizing Nathanson Creek, near southernmost bridge in Study Area.

Appendix B: Site Photographs

Appendix C On-site Biology Summary

Appendix C: On-site Biology Summary

Scientific Name	Common Name
Plants	
Acer macrophyllum	Bigleaf maple
Acer negundo	Boxelder
Acmispon americanus	American bird's foot trefoil
Aesculus californica	Buckeye
Alisma triviale	Northern water plantain
Allium sp.	
Amaranthus powellii	Powell's amaranth
Aristolochia californica	California pipevine
Artemisia douglasiana	California mugwort
Avena barbata	Slim oat
Avena fatua	Wildoats
Baccharis pilularis	Coyote brush
Brassica nigra	Black Mustard
Briza minor	Little rattlesnake grass
Bromus carinatus	California bromegrass
Bromus diandrus	Ripgut brome
Bromus hordeaceus	Soft chess
Calendula arvensis	Field marigold
Carduus pycnocephalus	Italian thistle
Centaurea solstitialis	Yellow starthistle
Centromadia fitchii	Spikeweed
Cichorium intybus	Chicory
Convolvulus arvensis	Field bindweed
Cotoneaster sp.	Cotoneaster
Cynodon dactylon	Bermuda grass
Cyperus eragrostis	Tall cyperus
Daucus carota	Carrot
Elymus glaucus	Blue wildrye
Erigeron sp.	Erigeron
Erodium botrys	Broad leaf filaree
Erodium moschatum	Whitestem filaree
Eschscholzia californica	California poppy
Eucalyptus sp.	Eucalyptus
Festuca bromoides	Brome fescue
Festuca perennis	Italian rye grass
Foeniculum vulgare	Sweet fennel
Fraxinus latifolia	Oregon ash
Galium aparine	Common bedstraw
Geranium dissectum	Wild geranium
Geranium purpureum	Herb robert

Glyceria (declinata)	Waxy mannagrass
Hedera helix	English ivy
Hirschfeldia incana	Short podded mustard
Hordeum brachyantherum	Meadow barley
Hordeum marinum ssp. gussoneanum	Mediterranean barley
Hordeum murinum	Smooth barley
Heuchera (micrantha)	Alum root
Juglans hindsii	Northern california black walnut
Juncus bufonius	Toad rush
Lactuca serriola	Prickly lettuce
Leontodon saxatilis	Hawkbit
Ligustrum sp.	Privet
Lepidium sp.	Pepper grass
Lonicera hispidula	Pink honeysuckle
Lysimachia arvensis	Scarlet pimpernel
Lythrum hyssopifolia	Hyssop loosestrife
Malva neglecta	Common mallow
Malva parviflora	Cheeseweed
Matricaria discoidea	Pineapple weed
Medicago polymorpha	California burclover
Navarretia squarrosa	Skunkweed
Paspalum dilatatum	Dallis grass
Poa annua	Annual blue grass
Poa pratensis	Kentucky bluegrass
Polypogon monspeliensis	Rabbitsfoot grass
Populus trichocarpa	Black cottonwood
Persicaria amphibia	Water smartweed
Plantago lanceolata	Ribwort
Plantago major	Common plantain
Polygonum aviculare	Prostrate knotweed
Portulaca oleracea	Common purslane
Quercus agrifolia	Coast live oak
Quercus kelloggii	California black oak
Quercus lobata	Valley oak
Ranunculus californicus var. californicus	Common buttercup
Raphanus sativus	Jointed charlock
Robinia pseudoacacia	Black locust
Rubus armeniacus	Himalayan blackberry
Rubus parviflorus	Thimbleberry
Rumex acetosella	Sheep sorrel
Rumex sp.	Dock
Salix lasiolepis	Arroyo willow
Sequoia sempervirens	Coast redwood
Sonchus asper ssp. asper	Sow thistle

Sonchus oleraceus	Sow thistle
Spergula arvensis	Corn spurry
Spergularia rubra	Purple sand spurry
Symphoricarpos mollis	Trailing snowberry
Taraxacum officinale	Dandelion
Toxicodendron diversilobum	Poison oak
Trifolium hirtum	Rose clover
Trifolium repens	White clover
Trifolium subterraneum	Subterranean clover
Ulmus sp.	Elm
Umbellularia californica	California bay
Various turf grasses	Mowed and Not in flower
Vicia sativa	Spring vetch
Vinca major	Vinca
Birds	
Baeolophus inornatus	Oak Titmouse
Butorides virescens	Green Heron
Cathartes aura	Turkey Vulture
Corvus brachyrhynchos	American Crow
Haemorhous mexicanus	House Finch
Passer domesticus	House Sparrow
Sayornis nigricans	Black Phoebe
Sialia mexicana	Western Bluebird
Sturnus vulgaris	European Starling
Tachycineta bicolor?	Tree swallows?
Trochilidae	Hummingbird sp.
Turdus migratorius	American Robin
Zenaida macroura	Mourning Dove

Appendix D Special Status Species Occurrence Table

Appendix D: Special Status Species Occurrence Table

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
PLANTS						
Monocots	*Lilium pardalinum ssp. pitkinense* (Pitkin Marsh lily)	FE/CE/1B.1	Cismontane woodland, Freshwater marsh, Marsh and swamp, Meadow and seep, Wetland. Cismontane woodland, meadows and seeps, marshes and swamps. Saturated, sandy soils with grasses and shrubs. (Elevation 145-215 ft.) (CNDDB 2018)	None	Habitat for this species does not exist on-site.	No
Alliaceae	*Allium peninsulare var. franciscanum* (Franciscan onion)	--/--/1B.2	Cismontane woodland, Valley and foothill grassland. clay, volcanic, often serpentinite. (Elevation 170-1000 ft.) Bloom period: (Apr)May-Jun (CNPS 2018)	None	Suitable conditions for this species do not exist on-site. A CNDDB occurrence is within two miles of the site.	No
Poaceae	*Alopecurus aequalis var. sonomensis* (Sonoma alopecurus)	FE/--/1B.1	Marshes and swamps (freshwater), Riparian scrub. (Elevation 15-1200 ft.) Bloom period: May-Jul (CNPS 2018)	Low	Suitable conditions for this species do not exist at the project site.	No
Fabaceae	*Amorpha californica var. napensis* (Napa false indigo)	--/--/1B.2	Broadleafed upland forest (openings), Chaparral, Cismontane woodland. (Elevation 390-6560 ft.) Bloom period: Apr-Jul (CNPS 2018)	None	The project site is outside the species elevation range. A CNDDB occurrence is within two miles of the site.	No
Boraginaceae	*Amsinckia lunaris* (bent-flowered fiddleneck)	--/--/1B.2	Coastal bluff scrub, Cismontane woodland, Valley and foothill grassland. (Elevation 5-1640 ft.) Bloom period: Mar-Jun (CNPS 2018)	Medium	There are no CNDDB occurences within 5 miles, but there are patches of unmaintained, herbaceous vegetation at the project site where a population could establish.	Yes
Plantaginaceae	*Antirrhinum virga* (twig-like snapdragon)	--/--/4.3	Chaparral, Lower montane coniferous forest. rocky, openings, often serpentinite. (Elevation 325-6610 ft.) Bloom period: Jun-Jul (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Ericaceae	*Arctostaphylos bakeri ssp. bakeri* (Baker's manzanita)	--/CR/1B.1	Broadleafed upland forest, Chaparral. often serpentinite. (Elevation 245-985 ft.) Bloom period: Feb-Apr (CNPS 2018)	None	Habitat for this species does not exist on-site.	No

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Ericaceae	*Arctostaphylos stanfordiana ssp. decumbens* (Rincon Ridge manzanita)	--/--/1B.1	Chaparral (rhyolitic), Cismontane woodland. (Elevation 245-1215 ft.) Bloom period: Feb-Apr(May) (CNPS 2018)	None	The project site is outside the species elevation range, and suitable habitat for this species does not exist on-site.	No
Fabaceae	*Astragalus claranus* (Clara Hunt's milk-vetch)	FE/CT/1B.1	Chaparral (openings), Cismontane woodland, Valley and foothill grassland. serpentinite or volcanic, rocky, clay. (Elevation 245-900 ft.) Bloom period: Mar-May (CNPS 2018)	None	The project site is outside the species elevation range.	No
Fabaceae	*Astragalus clevelandii* (Cleveland's milk-vetch)	--/--/4.3	Chaparral, Cismontane woodland, Riparian forest. serpentinite seeps. (Elevation 655-4920 ft.) Bloom period: Jun-Sep (CNPS 2018)	None	The project site is outside the species elevation range and suitable habitat for this species does not exist on-site.	No
Fabaceae	*Astragalus tener var. tener* (alkali milk-vetch)	--/--/1B.2	Playas, Valley and foothill grassland (adobe clay), Vernal pools. alkaline. (Elevation 0-195 ft.) Bloom period: Mar-Jun (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Asteraceae	*Balsamorhiza macrolepis* (big-scale balsamroot)	--/--/1B.2	Chaparral, Cismontane woodland, Valley and foothill grassland. sometimes serpentinite. (Elevation 145-5100 ft.) Bloom period: Mar-Jun (CNPS 2018)	Low	A broad CNDDB occurrence radius overlaps the site. The project site is outside the species elevation range.	No
Asteraceae	*Blennosperma bakeri* (Sonoma sunshine)	FE/CE/1B.1	Valley and foothill grassland (mesic), Vernal pools. (Elevation 30-360 ft.) Bloom period: Mar-May (IPaC 2018, CNPS 2018)	Low	A CNDDB occurrence is within a half mile of the site.	No
Themidaceae	*Brodiaea leptandra* (narrow-anthered brodiaea)	--/--/1B.2	Broadleafed upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest, Valley and foothill grassland. volcanic. (Elevation 360-3000 ft.) Bloom period: May-Jul (CNPS 2018)	None	Habitat for this species does not exist on-site. A CNDDB occurrence is within one mile of the site.	No
Poaceae	*Calamagrostis ophitidis* (serpentine reed grass)	--/--/4.3	Chaparral (open, often north-facing slopes), Lower montane coniferous forest, Meadows and seeps, Valley and foothill grassland. serpentinite, rocky. (Elevation 295-3495 ft.) Bloom period: Apr-Jul (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Montiaceae	*Calandrinia breweri* (Brewer's calandrinia)	--/--/4.2	Chaparral, Coastal scrub. sandy or loamy, disturbed sites and burns. (Elevation 30-4005 ft.) Bloom period: (Jan)Mar-Jun (CNPS 2018)	None	Habitat for this species does not exist on-site.	No

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Liliaceae	*Calochortus uniflorus* (pink star-tulip)	--/--/4.2	Coastal prairie, Coastal scrub, Meadows and seeps, North Coast coniferous forest. (Elevation 30-3510 ft.) Bloom period: Apr-Jun (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Asteraceae	*Calycadenia micrantha* (small-flowered calycadenia)	--/--/1B.2	Chaparral, Meadows and seeps (volcanic), Valley and foothill grassland. Roadsides, rocky, talus, scree, sometimes serpentinite, sparsely vegetated areas. (Elevation 15-4920 ft.) Bloom period: Jun-Sep (CNPS 2018)	Medium	There are no CNDDB occurences within 5 miles, but there are patches of unmaintained, herbaceous vegetation at the project site where a population could establish.	Yes
Cyperaceae	*Carex lyngbyei* (Lyngbye's sedge)	--/--/2B.2	Marshes and swamps (brackish or freshwater). (Elevation 0-35 ft.) Bloom period: Apr-Aug (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Orobanchaceae	*Castilleja ambigua var. ambigua* (johnny-nip)	--/--/4.2	Coastal bluff scrub, Coastal prairie, Coastal scrub, Marshes and swamps, Valley and foothill grassland, Vernal pools margins. (Elevation 0-1425 ft.) Bloom period: Mar-Aug (CNPS 2018)	Low	Suitable conditions for this species do not exist at the project site.	No
Orobanchaceae	*Castilleja ambigua var. meadii* (Mead's owl's-clover)	--/--/1B.1	Meadows and seeps, Vernal pools. Gravelly, volcanic, clay. (Elevation 1475-1560 ft.) Bloom period: Apr-May (CNPS 2018)	None	The project site is outside the species elevation range.	No
Rhamnaceae	*Ceanothus confusus* (Rincon Ridge ceanothus)	--/--/1B.1	Closed-cone coniferous forest, Chaparral, Cismontane woodland. volcanic or serpentinite. (Elevation 245-3495 ft.) Bloom period: Feb-Jun (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Rhamnaceae	*Ceanothus divergens* (Calistoga ceanothus)	--/--/1B.2	Chaparral (serpentinite or volcanic, rocky). (Elevation 555-3115 ft.) Bloom period: Feb-Apr (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Rhamnaceae	*Ceanothus gloriosus var. exaltatus* (glory brush)	--/--/4.3	Chaparral. (Elevation 95-2000 ft.) Bloom period: Mar-Jun(Aug) (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Rhamnaceae	*Ceanothus purpureus* (holly-leaved ceanothus)	--/--/1B.2	Chaparral, Cismontane woodland. volcanic, rocky. (Elevation 390-2100 ft.) Bloom period: Feb-Jun (CNPS 2018)	None	The project site is outside the species elevation range.	No

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Rhamnaceae	*Ceanothus sonomensis* (Sonoma ceanothus)	--/--/1B.2	Chaparral (sandy, serpentinite or volcanic). (Elevation 705-2625 ft.) Bloom period: Feb-Apr (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Asteraceae	*Centromadia parryi ssp. parryi* (pappose tarplant)	--/--/1B.2	Chaparral, Coastal prairie, Meadows and seeps, Marshes and swamps (coastal salt), Valley and foothill grassland (vernally mesic). often alkaline. (Elevation 0-1380 ft.) Bloom period: May-Nov (CNPS 2018)	Medium	There are no CNDDB occurences within 5 miles, but there are patches of unmaintained, herbaceous vegetation at the project site where a population could establish.	Yes
Orobanchaceae	*Chloropyron maritimum ssp. palustre* (Point Reyes bird's-beak)	--/--/1B.2	Marshes and swamps (coastal salt). (Elevation 0-35 ft.) Bloom period: Jun-Oct (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Orobanchaceae	*Chloropyron molle ssp. molle* (soft bird's-beak)	FE/CR/1B.2	Marshes and swamps (coastal salt). (Elevation 0-10 ft.) Bloom period: Jun-Nov (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Polygonaceae	*Chorizanthe valida* (Sonoma spineflower)	FE/CE/1B.1	Coastal prairie (sandy). (Elevation 30-1000 ft.) Bloom period: Jun-Aug (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Onagraceae	*Clarkia breweri* (Brewer's clarkia)	--/--/4.2	Chaparral, Cismontane woodland, Coastal scrub. often serpentinite. (Elevation 705-3660 ft.) Bloom period: Apr-Jun (CNPS 2018)	None	The project site is outside the species elevation range.	No
Onagraceae	*Clarkia gracilis ssp. tracyi* (Tracy's clarkia)	--/--/4.2	Chaparral (openings, usually serpentinite). (Elevation 210-2135 ft.) Bloom period: Apr-Jul (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Orobanchaceae	*Cordylanthus tenuis ssp. brunneus* (serpentine bird's-beak)	--/--/4.3	Closed-cone coniferous forest, Chaparral, Cismontane woodland. usually serpentinite. (Elevation 1000-3000 ft.) Bloom period: Jul-Aug (CNPS 2018)	None	The project site is outside the species elevation range.	No
Campanulaceae	*Downingia pusilla* (dwarf downingia)	--/--/2B.2	Valley and foothill grassland (mesic), Vernal pools. (Elevation 0-1460 ft.) Bloom period: Mar-May (CNPS 2018)	Low	A CNDDB occurrence is within two miles of the site.	No
Cyperaceae	*Eleocharis parvula* (small spikerush)	--/--/4.3	Marshes and swamps. (Elevation 0-9910 ft.) Bloom period: (Apr)Jun-Aug(Sep) (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Asteraceae	*Erigeron biolettii* (streamside daisy)	--/--/3	Broadleafed upland forest, Cismontane woodland, North Coast coniferous forest. rocky, mesic. (Elevation 95-3610 ft.) Bloom period: Jun-Oct (CNPS 2018)	None	The project site is outside the species elevation range.	No

Appendix D: Special Status Species Occurrence Table

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Asteraceae	*Erigeron greenei* (Greene's narrow-leaved daisy)	--/--/1B.2	Chaparral (serpentinite or volcanic). (Elevation 260-3295 ft.) Bloom period: May-Sep (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Polygonaceae	*Eriogonum luteolum var. caninum* (Tiburon buckwheat)	--/--/1B.2	Chaparral, Cismontane woodland, Coastal prairie, Valley and foothill grassland. serpentinite, sandy to gravelly. (Elevation 0-2295 ft.) Bloom period: May-Sep (CNPS 2018)	None	Suitable conditions for this species do not exist at the project site.	No
Apiaceae	*Eryngium jepsonii* (Jepson's coyote thistle)	--/--/1B.2	Valley and foothill grassland, Vernal pools. clay. (Elevation 5-985 ft.) Bloom period: Apr-Aug (CNPS 2018)	Low	There are no CCH occurences nearby and suitable conditions for this species do not exist at the project site.	No
Chenopodiaceae	*Extriplex joaquinana* (San Joaquin spearscale)	--/--/1B.2	Chenopod scrub, Meadows and seeps, Playas, Valley and foothill grassland. alkaline. (Elevation 0-2740 ft.) Bloom period: Apr-Oct (CNPS 2018)	None	Suitable conditions for this species do not exist at the project site.	No
Liliaceae	*Fritillaria liliacea* (fragrant fritillary)	--/--/1B.2	Cismontane woodland, Coastal prairie, Coastal scrub, Valley and foothill grassland. Often serpentinite. (Elevation 5-1345 ft.) Bloom period: Feb-Apr (CNPS 2018)	None	Suitable conditions for this species do not exist at the project site.	No
Asteraceae	*Harmonia nutans* (nodding harmonia)	--/--/4.3	Chaparral, Cismontane woodland. rocky or gravelly, volcanic. (Elevation 245-3200 ft.) Bloom period: Mar-May (CNPS 2018)	None	Suitable conditions for this species do not exist at the project site.	No
Asteraceae	*Hemizonia congesta ssp. congesta* (congested-headed hayfield tarplant)	--/--/1B.2	Valley and foothill grassland. sometimes roadsides. (Elevation 65-1835 ft.) Bloom period: Apr-Nov (CNPS 2018)	High	A CNDDB occurrence overlaps the site and suitable habitat exist within the Project Boundary	Yes
Linaceae	*Hesperolinon bicarpellatum* (two-carpellate western flax)	--/--/1B.2	Chaparral (serpentinite). (Elevation 195-3295 ft.) Bloom period: May-Jul (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Linaceae	*Hesperolinon congestum* (Marin western flax)	FT/CT/1B.1	Chaparral, Valley and foothill grassland. serpentinite. (Elevation 15-1215 ft.) Bloom period: Apr-Jul (CNPS 2018)	None	Suitable conditions for this species do not exist at the project site.	No

Appendix D: Special Status Species Occurrence Table

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Linaceae	*Hesperolinon sharsmithiae* (Sharsmith's western flax)	--/--/1B.2	Chaparral. serpentinite. (Elevation 885-985 ft.) Bloom period: May-Jul (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Rosaceae	*Horkelia tenuiloba* (thin-lobed horkelia)	--/--/1B.2	Broadleafed upland forest, Chaparral, Valley and foothill grassland. mesic openings, sandy. (Elevation 160-1640 ft.) Bloom period: May-Jul(Aug) (CNPS 2018)	Medium	Consortium of California Herbaria (CCH) has a specimen (collected in 1994) within a mile and a half of the project site; at the headwaters of Nathanson Creek. There are also patches of unmaintained, herbaceous vegetation at the project site where a population could establish.	Yes
Iridaceae	*Iris longipetala* (coast iris)	--/--/4.2	Coastal prairie, Lower montane coniferous forest, Meadows and seeps. mesic. (Elevation 0-1970 ft.) Bloom period: Mar-May (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Juglandaceae	*Juglans hindsii* (Northern California black walnut)	--/--/CBR	Riparian forest, Riparian woodland. (Elevation 0-1445 ft.) Bloom period: Apr-May (CNPS 2018)	High	This species occurs in the project area.	Yes
Asteraceae	*Lasthenia conjugens* (Contra Costa goldfields)	FE/--/1B.1	Cismontane woodland, Playas (alkaline), Valley and foothill grassland, Vernal pools. mesic. (Elevation 0-1540 ft.) Bloom period: Mar-Jun (CNPS 2018)	Low	CCH has a specimen (collected in 1960) within a mile of the project site, however, suitable habitat for this species does not exist on-site.	No
Fabaceae	*Lathyrus jepsonii var. jepsonii* (Delta tule pea)	--/--/1B.2	Marshes and swamps (freshwater and brackish). (Elevation 0-15 ft.) Bloom period: May-Jul(Aug-Sep) (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Asteraceae	*Layia septentrionalis* (Colusa layia)	--/--/1B.2	Chaparral, Cismontane woodland, Valley and foothill grassland. sandy, serpentinite. (Elevation 325-3595 ft.) Bloom period: Apr-May (CNPS 2018)	None	Suitable conditions for this species do not exist at the project site.	No
Campanulaceae	*Legenere limosa* (legenere)	--/--/1B.1	Vernal pools. (Elevation 0-2885 ft.) Bloom period: Apr-Jun (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Polemoniaceae	*Leptosiphon acicularis* (bristly leptosiphon)	--/--/4.2	Chaparral, Cismontane woodland, Coastal prairie, Valley and foothill grassland. (Elevation 180-4920 ft.) Bloom period: Apr-Jul (CNPS 2018)	None	The project site is outside the species elevation range.	No

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Polemoniaceae	*Leptosiphon jepsonii* (Jepson's leptosiphon)	--/--/1B.2	Chaparral, Cismontane woodland, Valley and foothill grassland. usually volcanic. (Elevation 325-1640 ft.) Bloom period: Mar-May (CNPS 2018)	None	The project site is outside the species elevation range.	No
Polemoniaceae	*Leptosiphon latisectus* (broad-lobed leptosiphon)	--/--/4.3	Broadleafed upland forest, Cismontane woodland. (Elevation 555-4920 ft.) Bloom period: Apr-Jun (CNPS 2018)	None	The project site is outside the species elevation range.	No
Asteraceae	*Lessingia hololeuca* (woolly-headed lessingia)	--/--/3	Broadleafed upland forest, Coastal scrub, Lower montane coniferous forest, Valley and foothill grassland. clay, serpentinite. (Elevation 45-1000 ft.) Bloom period: Jun-Oct (CNPS 2018)	None	Suitable conditions for this species do not exist at the project site.	No
Apiaceae	*Lilaeopsis masonii* (Mason's lilaeopsis)	--/CR/1B.1	Marshes and swamps (brackish or freshwater), Riparian scrub. (Elevation 0-35 ft.) Bloom period: Apr-Nov (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Liliaceae	*Lilium rubescens* (redwood lily)	--/--/4.2	Broadleafed upland forest, Chaparral, Lower montane coniferous forest, North Coast coniferous forest, Upper montane coniferous forest. Sometimes serpentinite, sometimes roadsides. (Elevation 95-6265 ft.) Bloom period: Apr-Aug(Sep) (CNPS 2018)	None	The project site is outside the species elevation range.	No
Limnanthaceae	*Limnanthes vinculans* (Sebastopol meadowfoam)	FE/CE/1B.1	Meadows and seeps, Valley and foothill grassland, Vernal pools. vernally mesic. (Elevation 45-1000 ft.) Bloom period: Apr-May (CNPS 2018)	Low	Suitable conditions for this species do not exist at the project site.	No
Apiaceae	*Lomatium repostum* (Napa lomatium)	--/--/4.3	Chaparral, Cismontane woodland. serpentinite. (Elevation 295-2725 ft.) Bloom period: Mar-Jun (CNPS 2018)	None	The project site is outside the species elevation range.	No
Fabaceae	*Lupinus sericatus* (Cobb Mountain lupine)	--/--/1B.2	Broadleafed upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest. (Elevation 900-5005 ft.) Bloom period: Mar-Jun (CNPS 2018)	None	The project site is outside the species elevation range.	No

Taxon	Species	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Asteraceae	*Micropus amphibolus* (Mt. Diablo cottonweed)	--/--/3.2	Broadleafed upland forest, Chaparral, Cismontane woodland, Valley and foothill grassland. rocky. (Elevation 145-2705 ft.) Bloom period: Mar-May (CNPS 2018)	None	The project site is outside the species elevation range.	No
Lamiaceae	*Monardella viridis* (green monardella)	--/--/4.3	Broadleafed upland forest, Chaparral, Cismontane woodland. (Elevation 325-3315 ft.) Bloom period: Jun-Sep (CNPS 2018)	None	The project site is outside the species elevation range.	No
Polemoniaceae	*Navarretia cotulifolia* (cotula navarretia)	--/--/4.2	Chaparral, Cismontane woodland, Valley and foothill grassland. adobe. (Elevation 10-6005 ft.) Bloom period: May-Jun (CNPS 2018)	Medium	CCH has a specimen (collected in 2003) within two miles of the project site. There are also patches of unmaintained, herbaceous vegetation at the project site where a population could establish.	Yes
Polemoniaceae	*Navarretia heterandra* (Tehama navarretia)	--/--/4.3	Valley and foothill grassland (mesic), Vernal pools. (Elevation 95-3315 ft.) Bloom period: Apr-Jun (CNPS 2018)	None	No records of this species occur nearby, and the project site is outside the species elevation range.	No
Polemoniaceae	*Navarretia leucocephala ssp. bakeri* (Baker's navarretia)	--/--/1B.1	Cismontane woodland, Lower montane coniferous forest, Meadows and seeps, Valley and foothill grassland, Vernal pools. Mesic. (Elevation 15-5710 ft.) Bloom period: Apr-Jul (CNPS 2018)	Low	No records of this species occur nearby, and suitable conditions for this species do not exist on-site.	No
Polemoniaceae	*Navarretia leucocephala ssp. pauciflora* (few-flowered navarretia)	FE/CT/1B.1	Vernal pools (volcanic ash flow). (Elevation 1310-2805 ft.) Bloom period: May-Jun (CNPS 2018)	None	No habitat exists on-site and the site is outside its elevation range.	No
Polemoniaceae	*Navarretia leucocephala ssp. plieantha* (many-flowered navarretia)	FE/CE/1B.2	Vernal pools (volcanic ash flow). (Elevation 95-3115 ft.) Bloom period: May-Jun (CNPS 2018)	None	No habitat exists on-site and the site is outside its elevation range.	No
Plantaginaceae	*Penstemon newberryi var. sonomensis* (Sonoma beardtongue)	--/--/1B.3	Chaparral (rocky). (Elevation 2295-4495 ft.) Bloom period: Apr-Aug (CNPS 2018)	None	No habitat exists on-site and the site is outside its elevation range.	No
Polygonaceae	*Polygonum marinense* (Marin knotweed)	--/--/3.1	Marshes and swamps (coastal salt or brackish). (Elevation 0-35 ft.) Bloom period: (Apr)May-Aug(Oct) (CNPS 2018)	None	No habitat exists on-site and the site is outside its elevation range.	No

Appendix D: Special Status Species Occurrence Table

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Ranunculaceae	*Ranunculus lobbii* (Lobb's aquatic buttercup)	--/--/4.2	Cismontane woodland, North Coast coniferous forest, Valley and foothill grassland, Vernal pools. mesic. (Elevation 45-1540 ft.) Bloom period: Feb-May (CNPS 2018)	Low	No records of this species occur nearby, and suitable habitat for this species does not exist on-site.	No
Alismataceae	*Sagittaria sanfordii* (Sanford's arrowhead)	--/--/1B.2	Marshes and swamps (assorted shallow freshwater). (Elevation 0-2135 ft.) Bloom period: May-Oct(Nov) (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Malvaceae	*Sidalcea oregana ssp. valida* (Kenwood Marsh checkerbloom)	FE/CE/1B.1	Marshes and swamps (freshwater). (Elevation 375-490 ft.) Bloom period: Jun-Sep (CNPS 2018)	None	The project site is outside the species elevation range.	No
Brassicaceae	*Streptanthus hesperidis* (green jewelflower)	--/--/1B.2	Chaparral (openings), Cismontane woodland. serpentinite, rocky. (Elevation 425-2495 ft.) Bloom period: May-Jul (CNPS 2018)	None	The project site is outside the species elevation range.	No
Asteraceae	*Symphyotrichum lentum* (Suisun Marsh aster)	--/--/1B.2	Marshes and swamps (brackish and freshwater). (Elevation 0-10 ft.) Bloom period: (Apr)May-Nov (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Lamiaceae	*Trichostema ruygtii* (Napa bluecurls)	--/--/1B.2	Chaparral, Cismontane woodland, Lower montane coniferous forest, Valley and foothill grassland, Vernal pools. (Elevation 95-2230 ft.) Bloom period: Jun-Oct (CNPS 2018)	None	The project site is outside the species elevation range.	No
Fabaceae	*Trifolium amoenum* (two-fork clover)	FE/--/1B.1	Coastal bluff scrub, Valley and foothill grassland (sometimes serpentinite). (Elevation 15-1360 ft.) Bloom period: Apr-Jun (CNPS 2018)	Low	No records of this species occur nearby, and suitable habitat for this species does not exist on-site.	No
Fabaceae	*Trifolium hydrophilum* (saline clover)	--/--/1B.2	Marshes and swamps, Valley and foothill grassland (mesic, alkaline), Vernal pools. (Elevation 0-985 ft.) Bloom period: Apr-Jun (CNPS 2018)	None	Habitat for this species does not exist on-site.	No
Themidaceae	*Triteleia lugens* (dark-mouthed triteleia)	--/--/4.3	Broadleafed upland forest, Chaparral, Coastal scrub, Lower montane coniferous forest. (Elevation 325-3280 ft.) Bloom period: Apr-Jun (CNPS 2018)	None	The project site is outside the species elevation range.	No
Adoxaceae	*Viburnum ellipticum* (oval-leaved viburnum)	--/--/2B.3	Chaparral, Cismontane woodland, Lower montane coniferous forest. (Elevation 705-4595 ft.) Bloom period: May-Jun (CNPS 2018)	Low	A broad CNDDB occurrence radius overlaps the site. The project site is outside the species elevation range.	No

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
VEGETATION COMMUNITY						
Marsh	*Coastal Brackish Marsh* (Coastal Brackish Marsh)	--/--/--	Marsh and swamp, Wetland. (CNDDB 2018)	None	This community does not exist at the site.	No
Herbaceous	*Northern Vernal Pool* (Northern Vernal Pool)	--/--/--	Vernal pool, Wetland. (CNDDB 2018)	None	This community does not exist at the site.	No
CRUSTACEAN						
Crustaceans	*Syncaris pacifica* (California freshwater shrimp)	FE/CE/--	Aquatic, Sacramento/San Joaquin flowing waters. Endemic to Marin, Napa, and Sonoma counties. Found in low elevation, low gradient streams where riparian cover is moderate to heavy. Shallow pools away from main streamflow. Winter: undercut banks with exposed roots. Summer: leafy branches touching water. (IPaC 2018, CNDDB 2018)	Low	A CNDDB occurrence is within two miles of the site, however, there are no known occurences of this species within the Nathanson Creek's stream system.	No
INSECT						
Insects	*Andrena blennospermatis* (Blennosperma vernal pool andrenid bee)	--/--/--	Vernal pool. This bee is oligolectic on vernal pool blennosperma. Bees nest in the uplands around vernal pools. (CNDDB 2018)	None	No host plants exist on-site.	No
Insects	*Bombus crotchii* (Crotch bumble bee)	--/Candidate CE/--	Coastal California east to the Sierra-Cascade crest and south into Mexico. Food plant genera include Antirrhinum, Phacelia, Clarkia, Dendromecon, Eschscholzia, and Eriogonum. (CNDDB 2018)	None	The nearest CNDDB occurrence is around 5 miles away. In addition, no host plants exist on-site.	No
Insects	*Bombus occidentalis* (western bumble bee)	--/ Candidate CE/--	Once common and widespread, species has declined precipitously from central CA to southern B.C., perhaps from disease. (CNDDB 2018)	Low	A CNDDB occurrence radius overlaps the site, however IUCN updated distribution maps indicate it has been extirpated from much of western California (IUCN 2012).	No
Insects	*Callophrys mossii bayensis* (San Bruno Elfin Butterfly)	FE/--/--	Coastal, mountainous areas with grassy ground cover, mainly in the vicinity of San Bruno Mountain, San Mateo County. Colonies are located on steep, north-facing slopes within the fog belt. Larval host plant is Sedum spathulifolium. (IPaC 2018, CNDDB 2018)	None	Distance is too far from main population and no host plants exist on-site. In addition no steep, north-facing slopes are on the site.	No

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Insects	*Speyeria zerene sonomensis* (Sonoma zerene fritillary)	--/--/--	Valley and foothill grassland. Restricted to low elevation grasslands of the Sonoma Mountains. This subspecies apparently flies from mid May to early July, with a peak flight period in early to mid June. Larval food plant is thought to be Viola sp.; Viola pedunculata and Viola adunca were present at type locality. (CNDDB 2018)	Medium	This site is in near the Sonoma Mountains and there is a nonspecific occurrence grid within 2.5 miles of the project site. No host plants exist withing the Study Area. In addition, this species is not a special status species however and will not be addressed.	No
Fish						
Fish	*Oncorhynchus mykiss irideus pop. 8* (steelhead - central California coast DPS)	FT/--/--	Aquatic, Sacramento/San Joaquin flowing waters. From Russian River, south to Soquel Creek and to, but not including, Pajaro River. Also San Francisco and San Pablo Bay basins. (CNDDB 2018)	Medium	Reports have indicated that Nathanson Creek has occurrences of this species (Leidy 2005, Sonoma Ecology Center 2007, Prunuske Chatham, Inc. 2015).	Yes
Fish	*Hypomesus transpaci* (Delta Smelt)	FT/CE/--	Aquatic, Estuary. Sacramento-San Joaquin Delta. Seasonally in Suisun Bay, Carquinez Strait & San Pablo Bay. Seldom found at salinities > 10 ppt. Most often at salinities < 2ppt.	None	There are no CNDDB occurences within 5 miles. In addition, Nathanson Creek is freshwater exclusively. There is no possibility of this species occuring in the Study Area.	No
Reptile						
Reptiles	*Emys marmorata* (western pond turtle)	--/--/SSC	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh and swamp, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland. A thoroughly aquatic turtle of ponds, marshes, rivers, streams and irrigation ditches, usually with aquatic vegetation, below 6000 ft elevation. Needs basking sites and suitable (sandy banks or grassy open fields) upland habitat up to 0.5 km from water for egg-laying. (CNDDB 2018)	Medium	A CNDDB occurrence is within a half mile of the site. Neighboring Nathanson Creek could provide habitat for this speices and dispersal through the project area could occur.	Yes

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
AMPHIBIAN						
Amphibians	*Dicamptodon ensatus* (California giant salamander)	--/--/SSC	Aquatic, Meadow and seep, North coast coniferous forest, Riparian forest. Known from wet coastal forests near streams and seeps from Mendocino County south to Monterey County, and east to Napa County. Aquatic larvae found in cold, clear streams, occasionally in lakes and ponds. Adults known from wet forests under rocks and logs near streams and lakes. (CNDDB 2018)	Medium	A CNDDB occurrence is within two miles of the site. Neighboring Nathanson Creek could provide habitat for this speices and dispersal through the project area could occur.	Yes
Amphibians	*Rana boylii* (foothill yellow-legged frog)	--/Candidate CT/SSC	Aquatic, Chaparral, Cismontane woodland, Coastal scrub, Klamath/North coast flowing waters, Lower montane coniferous forest, Meadow and seep, Riparian forest, Riparian woodland, Sacramento/San Joaquin flowing waters. Partly-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Needs at least some cobble-sized substrate for egg-laying. Needs at least 15 weeks to attain metamorphosis. (CNDDB 2018)	Low	Reports have indicated that Nathanson Creek has been habitat for this species in the past, but no recent occurrences have been documented (Prunuske Chatham, Inc. 2015). It is unlikely this species will occur in the Study Area.	No
Amphibians	*Rana draytonii* (California red-legged frog)	FT/--/SSC	Aquatic, Artificial flowing waters, Artificial standing waters, Freshwater marsh, Marsh and swamp, Riparian forest, Riparian scrub, Riparian woodland, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland. Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development. Must have access to estivation habitat. (IPaC 2018, CNDDB 2018)	Low	Reports have indicated that Nathanson Creek has been habitat for this species in the past, but no recent occurrences have been documented (Prunuske Chatham, Inc. 2015). It is unlikely this species will occur in the Study Area.	No

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Bird						
Birds	*Buteo swainsoni* (Swainson's hawk)	--/CT/BCC	Great Basin grassland, Riparian forest, Riparian woodland, Valley and foothill grassland. Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, and agricultural or ranch lands with groves or lines of trees. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations. (CNDDB 2018)	Medium	A CNDDB occurrence is within two miles of the project site. This observation was made in 2013. It is likely that this species utilizes habitat in or near the project area.	Yes
Birds	*Coturnicops noveboracensis* (yellow rail)	--/--/SSC	Freshwater marsh, Meadow and seep. Summer resident in eastern Sierra Nevada in Mono County. Freshwater marshlands. (CNDDB 2018)	Low	A broad CNDDB occurrence overlaps the site, however this sighting was mapped to a general locality around the City of Sonoma. It was observed in 1898. In addition, marsh habitat does not exist at the project site. For these reasons it is unlikely this species will be affected by the project.	No
Birds	*Geothlypis trichas sinuosa* (saltmarsh common yellowthroat)	--/--/SSC	Marsh and swamp. Resident of the San Francisco Bay region, in fresh and salt water marshes. Requires thick, continuous cover down to water surface for foraging; tall grasses, tule patches, willows for nesting. (CNDDB 2018)	None	Habitat for this species does not exist on-site.	No
Birds	*Melospiza melodia samuelis* (San Pablo song sparrow)	--/--/SSC	Salt marsh. Resident of salt marshes along the north side of San Francisco and San Pablo bays. Inhabits tidal sloughs in the Salicornia marshes; nests in Grindelia bordering slough channels. (CNDDB 2018)	None	A CNDDB occurrence is within two miles of the site, however, habitat for this species does not exist on-site.	No

Taxon	*Species*	Status (Federal/ State)	General Habitat Description (Site elevation ~63ft)	Potential to Occur	Rationale	Further Analysis Included
Birds	*Riparia riparia* (bank swallow)	--/CT/--	Riparian scrub, Riparian woodland. Colonial nester; nests primarily in riparian and other lowland habitats west of the desert. Requires vertical banks/cliffs with fine-textured/sandy soils near streams, rivers, lakes, ocean to dig nesting hole. (CNDDB 2018)	Low	There is a broad CNDDB occurrence radius overlaping the site, however the CNDDB occurrence was observed in 1893. All recent occurrences of this species are along the Sacramento and Feather River. It is unlikely this species will be affected by the project.	No
Birds	*Strix occidentalis caurina* (Northern Spotted Owl)	FT/CT/SSC	Old-growth forests or mixed stands of old-growth and mature trees. Occasionally in younger forests with patches of big trees. High, multistory canopy dominated by big trees, many trees with cavities or broken tops, woody debris, and space under canopy. (IPaC 2018, CNDDB 2018)	None	There is an activity center within 2.5 miles of the site, however there are no old-growth trees on-site. There is potential for owls to disperse through the area, but there is more suitable habitat available for them within the Study Area.	No
MAMMAL						
Mammals	*Antrozous pallidus* (pallid bat)	--/--/SSC	Chaparral, coastal scrub, desert wash, Great Basin grassland and scrub, Mojavean desert scrub, riparian woodland, Sonoran desert scrub, upper montane coniferous forest, valley and foothill grassland. Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites. (CNDDB 2018)	Medium	A CNDDB occurrence is a little over one mile from the site. There is habitat adjacent to the project area that could be utilized by this species.	Yes
Mammals	*Reithrodontomys raviventris* (Salt Marsh Harvest Mouse)	FE/CE/FP	Marsh and swamp, Wetlands. Only in the saline emergent wetlands of San Francisco Bay and its tributaries. Pickleweed is primary habitat, but may occur in other marsh vegetation types and in adjacent upland areas. Does not burrow; builds loosely organized nests. Requires higher areas for flood escape.	None	There are no CNDDB occurences within 5 miles. In addition, there is no pickleweed habitat in the Study Area. There is no possibility of this species occuring in the Study Area.	No

Appendix E Geotechnical Investigation and Geological Hazard Evaluation

GEOTECHNICAL INVESTIGATION AND GEOLOGIC HAZARD EVALUATION

SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 BROADWAY
SONOMA, CALIFORNIA

Project Number 12207.05.1

October 17, 2018

Brunsing Associates, Inc.

GEOTECHNICAL INVESTIGATION AND GEOLOGIC HAZARD EVALUATION

SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 BROADWAY
SONOMA, CALIFORNIA

Project Number – 12207.05.1

prepared for

Sonoma Valley Unified School District
17850 Railroad Avenue
Sonoma, California 95476

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1.0 INTRODUCTION

This report presents the results of the geotechnical investigation performed by Brunsing Associates, Inc. (BAI), for the Field Project at Sonoma Valley High School. The school address is 20000 Broadway, Sonoma, California, the assessor parcel numbers where the field project will be built are 018-421-002 and 023-030-001, address 950 and 1150 Broadway, respectively. The project site is located east of Nathanson Creek, as shown on the Vicinity Map, Plate 1. The project site existing features are shown on the Site Geologic Map, Plate 2a.

BAI understands that the project will consist of a synthetic turf field, baseball fields, bleachers, stadium lighting, basketball courts and varies small buildings. A conceptual design of the improvements is shown on the Site Map, Plate 2b. The purpose of our geotechnical investigation and geologic hazard evaluation was to evaluate the soil and groundwater conditions at the site in order to provide conclusions and recommendations regarding site grading and foundation support for the planned improvements.

Our approach to providing the geotechnical and geologic information necessary to perform this investigation and evaluation utilized our knowledge of the geologic conditions in the site vicinity and our experience with similar projects. Field exploration and laboratory testing for this investigation were directed towards confirming anticipated geotechnical and geologic conditions in order to provide the basis for our conclusions and recommendations.

The scope of our services, as outlined in our Professional Services Agreements dated December 28, 2015, and May 1, 2018 consisted of document review, research, subsurface exploration, laboratory testing, geologic and engineering analyses and preparation of this report.

2.0 INVESTIGATION AND LABORATORY TESTING

2.1 Document Review

As part of our investigation, we reviewed published geotechnical literature, including geologic, fault, and seismic hazard maps for the site and vicinity. We also reviewed previous geotechnical reports prepared by BAI and others on the school property and nearby school properties. A list of selected published references reviewed for this investigation is presented in Appendix A.

2.2 Field Reconnaissance

BAI's principal geotechnical engineer, Keith A. Colorado, G.E. - 2894, performed an initial reconnaissance of the site and vicinity on February 29, 2016. Mr. Colorado also photographed the site and observed drill rig access conditions and constraints. Mr. Colorado returned to the site on May 23, 2018 to perform a supplemental reconnaissance of the site and mark boring locations.

2.3 Field Exploration

Our subsurface drilling exploration was conducted on March 3 and 4, 2016 and June 5 and 6, 2018 and consisted of drilling, logging, and sampling 25 exploratory test borings B-1 through B-

25. The test borings were advanced to depths ranging from 5.0 to 41.5 feet below ground surface (bgs), with a truck-mounted drill rig using hollow and solid stem flight auger drilling equipment. The approximate locations of our current and previous test borings are shown on Plates 2a and 2b.

Our staff geologist and principal geotechnical engineer made a descriptive log of each test boring and obtained relatively undisturbed, disturbed and bulk samples of the soil materials encountered for visual classification and laboratory testing. Relatively undisturbed samples were obtained using a 3.0-inch outside diameter modified California (CA) split-barrel sampler and disturbed samples were obtained with a 2.5-inch diameter modified California (CM) and 2-inch outside diameter Standard Penetration Test (SPT) samplers. Samplers were driven by a 140-pound drop hammer falling 30 inches per blow. Blows required to drive the CA and CM samplers were converted to SPT blow counts for correlation with empirical test data, using a conversion factor of 0.64 and 0.79, respectively. Blow counts are presented on the boring logs[1].

Graphic logs of the borings, showing the soil materials encountered are presented on Plates 3 through 27. The soils are classified in accordance with the Unified Soil Classification System outlined on Plate 28. The various descriptive properties used to describe the soils are listed on Plate 29. Two other shallow borings, for a previous, nearby project on the school site, were drilled on June 8, 2016, and presented in Appendix B.

2.4 Laboratory Testing

Soil samples obtained during our subsurface exploration were transported to our laboratory and examined to confirm field classifications. Laboratory tests were performed on selected samples to estimate their pertinent geotechnical engineering characteristics. Laboratory testing consisted of moisture content, dry density, classification (grain size and Atterberg limits), resistance value, unconsolidated-undrained triaxial compression and corrosivity tests.

The laboratory test results are presented opposite the samples tested on the boring logs. A key to test data is provided on Plate 28. Atterberg limits test results are presented on Plate 30, triaxial compression test data are presented on Plates 31 through 33 and resistance value test data is presented on Plate 34. Near-surface soil was sent to JDH Corrosion Consultants, Inc. for corrosivity potential testing consisting of resistivity, pH, chloride, sulfate and redox. Corrosivity test results are presented in Appendix C.

3.0 SITE CONDITIONS

The property is at an elevation of approximately 62 to 69 feet above Mean Sea Level (MSL) according to United States Geological Survey (USGS) 7-1/2 minute Sonoma Quadrangle. Nathanson Creek approximately splits the school property in half and flows from north to south. The field project, as shown on Plate 2b, is on the east side of Nathanson Creek. The creek is approximately 6 to 8 feet in depth with near vertical banks.

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[1] SPT blow counts provide a relative measure of soil consistency and strength, and are utilized in our engineering analyses.

The near-level school property has been previously graded. Currently, the area is developed with an asphalt paved track, basketball courts, three baseball fields and a few portable sheds. The rest of the property consists of grass fields with planted trees. The Nathanson Creek channel is thickly vegetated with brush and trees.

4.0 SITE GEOLOGY AND SOIL CONDITIONS

4.1 Regional Geologic and Seismic Setting

The project site is located within the northern Coast Ranges geomorphic province of California. The Coast Ranges geomorphic province is generally characterized by a series of northwesterly trending, structurally controlled, elongated ridges and valleys.

The basement rock assemblages with the northern Coast Ranges province are comprised of sedimentary, igneous, and metamorphic rocks of the Jurassic to early Tertiary Periods. East of the San Andreas Fault, the basement rocks consist of three major geologic units that overlap in age; the Great Valley Sequence, the Franciscan Complex, and an ultramatic body composed primarily of serpentinite. Portions of these basement rocks are covered by relatively thin deposits of late Tertiary and Quaternary Period igneous and sedimentary rocks as well as younger alluvium. Alluvial soils, including stream terrace deposits of varying ages, form in-fill deposits within the valleys above the basement rocks and Tertiary-Quaternary formations.

As shown on the Regional Geologic Map, Plate 35, the bedrock formations in the project vicinity mainly consist of Miocene Sonoma Volcanics and early Pleistocene and Pliocene Huichica Formation. The Sonoma Volcanics consist of igneous rocks, primarily rhyolite, andesite and tuff. The Huichica Formation consists of sedimentary rocks and tuff. According to the Geologic Map of the Sonoma 7.5’Quadrangle, 2006, prepared by the California Geological Survey (CGS), the school site is underlain by continental alluvial deposits of Holocene to early Pleistocene age. According to CDMG Special Report 120, the alluvium at the school site could be as much as 150 feet in thickness. The alluvium is described as alluvial fan, stream terrace, basin and channel deposits.

4.2 Site Soil and Geologic Conditions

The planned improvement areas appear to be covered by shallow fill. The fill would have been placed during grading operations for the existing sport fields. The fill appears to be on the order of 6 to 12 inches deep, or more. Fill and near-surface soils consist of very loose to loose silty/clayey sand and soft sandy clay. Most of the surface soils appear to have a low expansion potential (subject to volume changes with change in moisture content).

As indicated by the published geologic maps, the site is underlain by Holocene to early Pleistocene alluvial deposits. These deposits generally consist of sand, gravel, silt and clay. The site subsurface conditions are shown on the cross sections, Plates 36 and 37.

Groundwater was encountered and measured at the following depths within our borings

Table 1: Depth to Groundwater

Boring	Depth to water below ground surface (feet)	Date
B-1	5.0	3/3/16
B-2	3.0	3/3/16
B-3	8.0	3/3/16
B-4	3.0	3/3/16
B-14	4.5	3/4/16
B-17	10.0	6/5/18
B-18	14.0	6/5/18
B-23	14.0	6/6/18

The other borings not mentioned above did not encounter groundwater during our investigations.

4.3 Landslides and Slope Stability

No evidence of active landsliding, slumps or debris slides was observed in the site vicinity during our site reconnaissance or exploration. No landslides are shown within the near-level property on the published geologic maps we reviewed for this investigation and evaluation.

4.4 Faulting and Seismicity

A network of generally northwest-trending strike-slip faults associated with the San Andreas Fault system controls the seismicity and tectonics of the Sonoma County region. The nearest Holocene-active faults are the Hayward-Rodgers Creek Fault, located approximately 4.3 miles southwest of the site and the West Napa Fault, approximately 7.0 miles to the east-northeast. As shown on the Regional Active Fault Map, Plate 38, other splays of the Hayward-Rodgers Creek Fault have experienced Late Quaternary displacement (last 1.6 million years).

A northwest-trending, Pre-Quaternary fault (older than 1.6 million years) is shown (concealed by alluvium) crossing the northeast corner of the campus on the Fault Activity Map of California (Jennings and Bryant, 2010). Since the alluvium is as much as 150 feet in thickness and no geomorphic evidence of faulting was observed by BAI, the presence of this older fault is doubtful. Therefore, further subsurface exploration for this fault is not warranted.

No evidence of active or inactive faulting was observed at the school property during our site reconnaissance, and no active faults are shown on, or trending toward the property on the published geologic maps we reviewed. The site is not within a Fault Rupture Hazard Zone as defined by the Alquist-Priolo Earthquake Fault Zoning Act and associated maps. However, due to the site's proximity to major active faults discussed above, future large magnitude earthquakes are expected to cause strong ground shaking at the site. The most recent significant earthquakes in the immediate area occurred in 1969 and 2014. Two moderate shocks (Richter Magnitude 5.6 and 5.7) on the Rodgers Creek –Healdsburg Fault caused damage to downtown structures in the Santa Rosa area. On August 24, 2014 a moderate shock (Richter Magnitude 6.0) on the West Napa Fault caused damage to structures in the Napa area and minor, localized damage to older structures in the Sonoma Valley.

5.0 DISCUSSION AND CONCLUSIONS

5.1 General

Based upon the results of our investigation and review of available geologic data, we conclude that the site is suitable for the planned improvements. The main geotechnical considerations are weak surface soils, liquefaction, settlement and strong seismic shaking from future earthquakes. These and other considerations and their suggested mitigation measures are discussed below.

5.2 Groundwater

Results of our investigation indicate that excavations may encounter shallow groundwater, within three to five feet of the ground surface, if excavations are performed during or shortly after the rainy season (November through June). If dewatering is necessary, it can likely be accomplished by conventional pumping. However, installation of gravel drain blankets, geotextile fabric, and sumps (at the Contractor's option) will facilitate dewatering and provide a reasonably dry working pad for subsequent fill placement and compaction.

5.3 Settlement

Assuming building and other structural pads are properly prepared, and building foundations are designed and constructed in accordance with our recommendations, we estimate that the maximum post-construction settlement due to foundation loads will be less than 1/2 inch. We judge that post-construction differential settlement will be less than 1/4 inch between adjacent footings, along an individual wall footing, or between a footing and adjacent exterior slab.

5.4 Landslide Potential

The topography of the site is of a sufficiently shallow gradient that we do not consider landsliding to pose a potential hazard at the site. There are no upslope areas of sufficient steepness that could generate a landslide that could reach the school property. According to USGS Open File Report 97-745D, the site is located within an area of greatest relative stability due to low slope inclination, Flat Land.

5.5 Potential Seismic Hazards

5.5.1 Faulting and Surface Rupture

The main trace of the active Hayward-Rodgers Creek Fault is located 4.3 miles southwest of the site. Many active faults are complex and movement (including surface rupture or warping) is actually distributed among multiple branches, or across a zone. The subject property is not within an Alquist-Priolo Earthquake Fault Zone. We consider the likelihood of surface rupture occurring at the subject property to be low.

5.5.2 Seismic Parameters for Nearby Faults

The site coordinates are 38.281546 degrees north (latitude) and –122.455520 degrees west (longitude). Nearby active faults are summarized in Table 1.

Table 2
Seismic Parameters for Nearby Active Faults

Fault	Geometry	Closest Distance from Fault to Site	Maximum Moment Magnitude	Average Slip Rate (mm/yr)	Fault Class (CGS, 2003)
		Miles			
Hayward-Rodgers Creek	Right lateral-Strike Slip	4.3	7.3	9.0	A
West Napa	Right lateral-Strike Slip	7.0	6.7	1.0	B
Green Valley	Right lateral-Strike Slip	14.5	6.8	4.7	B
Hunting Creek-Berryessa	Right lateral-Strike Slip	31.2	7.1	6.0	B
Maacama - Garberville	Right lateral-Strike Slip	18.5	7.4	9.0	B
San Andreas (North Coast South Segment)	Right lateral-Strike Slip	24.5	8.0	24.0	A

References: USGS, 2008 National Seismic Hazard Maps – Source Parameters, CGS, 2003 The Revised 2002 California Probabilistic Seismic Hazard Maps

5.5.3 Ground Shaking

In general, the intensity of ground shaking at the site will depend on the distance to the causative earthquake epicenter, the magnitude of the shock, and the response characteristics of the underlying earth materials. The August 24, 2014 South Napa Earthquake, magnitude 6.0 on the West Napa Fault, and the October 2, 1969 Santa Rosa, Earthquake, magnitude 5.7 on the Healdsburg Fault, caused widespread ground shaking in the Sonoma area. However, we are not aware of any reports of significant damage in the school vicinity during either event.

A non-quantitative Earthquake Shaking Potential Map reproduced from the County of Sonoma is presented on Plate 39. Due to the location of the Hayward-Rodgers Creek and West Napa Faults, Sonoma is within a region expected to experience moderate to strong ground shaking during future earthquakes. Typically, structures founded in firm soil materials, and designed in accordance with current building codes, are well suited to resist the effects of ground shaking. We performed a probabilistic seismic hazard analysis (PSHA) using USGS U.S. Seismic Design Maps Web Application. The input and output data files for the analyses are presented in Appendix D.

Horizontal peak ground acceleration values were calculated for ground motions having a 10-percent chance of exceedance in 50 years. The calculated horizontal peak ground acceleration using $S_{DS}/2.5$ is 0.40g and the site-specific evaluation is 0.525g. The effects of ground shaking, including ground acceleration and horizontal ground motion, and seismically induced ground failures, are discussed in the following subsections and in Section 5.5.5.

5.5.4 Seismic Design Considerations

BAI understands that the planned improvements do not have irregular shapes or other structural constraints that could require special seismic design provisions (beyond current code provisions). Therefore, the structures may be designed in accordance with California Building Code criteria for a school facility, with review by CGS, in accordance with their most current guidelines. Structural design using normalized response spectral accelerations or scaled time histories of earthquake ground motions appear un-warranted for the planned structures. Recommended geological seismic design parameter values, for use in structural seismic design of the buildings are provided in Section 6.3 of this report.

5.5.5 Liquefaction

To evaluate liquefaction[2] potential, we performed laboratory testing of the soils and a liquefaction analysis. The results of our analysis indicate the potential for liquefaction at the site during a design earthquake is low to moderate. This analysis was based on procedures by Idriss and Boulanger, 2008, with 2014 update.

Where the factor of safety for liquefaction was 2.0 or less, we performed an analysis to estimate induced vertical settlement due to liquefaction. This analysis was based on procedures by Idriss and Boulanger, 2008, with 2014 update. The results of our analysis indicate liquefaction induced settlement of 0.21 to 0.33-inches could occur at borings B-1 and B-22, respectively. Liquefaction analysis results are presented in Appendix E.

Lateral spreading is generally caused by liquefaction of marginally stable soils underlying gently to steeply-inclined slopes. In these cases, the saturated soils move toward an unsupported face, such as an incised river channel or body of water. We conclude from our analysis that lateral spreading is essentially nil.

5.6 Flooding

Review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), Panel 937 and 939 of 1150, Map Number 06097C0937E and 06097C0939, dated December 2, 2008 indicates that the site is in area of minimal flood hazard Zone X and in an area of 0.2 percent annual chance flood hazard Zone X with a depth less than one foot.

5.7 Soil Corrosivity

To assess the potential of the near-surface soil chemistry to corrode subsurface utility conduits and other subsurface structures, we submitted samples of the near-surface soils to our sub-

[2] Liquefaction results in a loss of shear strength and potential soil volume reduction in saturated sandy, silty, silty/clayey, and also coarse gravelly soils below the groundwater table from earthquake shaking. The occurrence of this phenomenon is dependent on many factors, including the intensity and duration of ground shaking, the soil age, density, particle size distribution, and position of the groundwater table.

consultant, JDH Corrosion Consultants, Inc. for soil corrosivity testing. The laboratory test results, interpretation of the raw data and associated recommendations for corrosion control are presented in Appendix C.

6.0 RECOMMENDATIONS

6.1 Site Grading

6.1.1 Clearing and Stripping

Areas to be graded should be cleared of existing vegetation, rubbish, existing structures, and debris. After clearing, surface soils that contain organic matter should be stripped. In general, the depth of required stripping will be about 4 to 6 inches; deeper stripping and grubbing may be required to remove isolated concentrations of organic matter or roots. The cleared materials should be removed from the site or stockpiled for later use in landscape areas, as appropriate.

6.1.2 Structural Area Preparation

As used in this report, "Structural Areas" refers to the foundation envelope and the areas extending five feet beyond their perimeters, and to pavement and exterior concrete slabs areas and the areas extending three feet beyond their edges.

Within Structural Areas, existing weak soils should be removed to a depth of at least 2 foot below soil subgrade as determined in the field by BAI. Deeper excavating may be necessary to remove isolated, very weak soils. After the recommended excavations are complete, BAI should observe the soils encountered to confirm suitable materials are exposed.

Contractor should be prepared for very wet and pumping soils at the bottom of the excavation. The bottom of excavations will most likely need to be dried back to optimum moisture content and compacted to provide an unyielding surface. The exposed soils should be scarified to about six inches deep; moisture conditioned (wetting or drying of soils) to at least optimum moisture content and compacted to at least 90 percent relative compaction as determined by the ASTM D 1557 test procedure, latest edition. The bottom of excavation might need to be scarified multiple times to turn the soils to help dry the soil. These moisture conditioning and compaction procedures should be observed by BAI to check that the soil is properly moisture conditioned and the recommended compaction is achieved. Most of the on-site soils encountered in our test borings are suitable for re-use as compacted fill. On-site clays, if encountered, should be used outside of structural pads or removed from site. The fill material should be checked by BAI prior to use.

Fill material, on-site or imported, should be free of perishable matter and rocks greater than four inches in largest dimension, have an expansion index less than 30 and be approved by BAI before fill placement. Fill should be placed in thin lifts (six to eight inches depending on compaction equipment), moisture conditioned to near optimum moisture content, and compacted to at least 90 percent relative compaction, to achieve planned grades.

6.1.3 Field Area Preparation

Field area refers to the synthetic turf and running path and the areas extending three feet beyond their perimeters. Within the field area, existing weak fill and natural soils should be removed to a depth of at least 2.0 feet below soil subgrade as determined in the field by BAI. Deeper excavating may be necessary to remove isolated, very weak soils. After the recommended excavations are complete, BAI should observe the soils encountered to confirm suitable materials are exposed.

Contractor should be prepared for very wet and pumping soils at the bottom of the excavation. The bottom of excavation will most likely need to be dried back to optimum moisture content and compacted to provide an unyielding surface. The exposed soils should be scarified to about six inches deep, moisture conditioned (wetting or drying of soils) to at least optimum moisture content and compacted between 90 to 95 percent relative compaction as determined by the ASTM D 1557 test procedure, latest edition. The bottom of excavation might need to be scarified multiple times to turn and dry the soils. These moisture conditioning and compaction procedures should be observed by BAI to check that the soil is properly moisture conditioned and the recommended compaction is achieved. Most of the on-site soils encountered in our test borings are suitable for re-use as compacted fill. On-site clays, if encountered, should be used outside of structural pads or removed from site. The fill material should be checked by BAI prior to use.

Fill material, on-site or imported, should be free of perishable matter and rocks greater than three inches in largest dimension, have an expansion index less than 30, plastic index of not more than 20, liquid limit of not more than 40 and be approved by BAI before fill placement. Fill should be placed in thin lifts (six to eight inches depending on compaction equipment), moisture conditioned to near optimum moisture content, and compacted between 90 to 95 percent relative compaction, to achieve planned grades. Soil subgrade should be proof rolled and observed by BAI for soft and/or yielding areas. Subgrade should be compacted to provide a smooth unyielding surface.

6.2 Foundation Support

6.2.1 Spread Footings

Moveable structures can be supported on top of compacted fill placed in accordance with our recommendations. Permanent structures can be supported on reinforced concrete footings, continuous or square footing, founded in compacted fill placed in accordance with our recommendations. Footings can be designed using an allowable soil bearing pressure of 2,000 pounds per square foot (psf) for dead plus live loads. A 33 percent increase in bearing pressure is allowable for total loads, including wind or seismic loads.

Footing elements should be founded at least 12 inches below lowest adjacent finish grade. Wall footings should be no less than 12 inches wide. Completed foundation excavations should be observed by a representative from BAI prior to the placement of reinforcing steel.

6.2.2 Drilled Piers

The field light structures can be supported on drilled cast-in-place concrete (C-I-P C) piers. Drilled piers should be at least 18 inches in diameter and penetrate at least ten feet into suitable supporting soils encountered at about 3 to 6 feet below existing ground surface in the test boring locations. Resulting pier depths should be a minimum of about 13 to 16 feet below the existing ground surface; actual pier diameters and lengths should be determined by a structural engineer.

Spacing for the piers should be no closer than 3 pier diameters, center to center. Support for the piers may be gained from skin friction resistance equal to 400 pounds per square foot of pier surface area for dead plus long-term live downward loads. For the total downward load design, including wind or seismic forces, increase downward capacity by one-third. Uplift frictional capacity for piers should be limited to 2/3 of the allowable downward capacity. Both downward and uplift frictional capacity should be neglected in the weak near surface zones.

When final pier depths have been achieved, as verified by BAI, the bottoms of the pier holes should be thoroughly cleaned of loose material. BAI should observe the drilling and final clean out of the pier holes, prior to the placement of reinforcing steel and/or concrete.

If groundwater is encountered during construction, the pier holes should be dewatered prior to placement of reinforcing steel and concrete. Alternatively, if more than six inches of ground water has entered the pier hole, concrete can be tremied into place with an adequate head to displace water or slurry. Concrete should not be placed by freefall in such a manner as to hit the sidewalls of the excavation.

Caving was encountered in a few of our test borings. The driller should be prepared to case pier holes where caving occurs. If used, the casing would need to be withdrawn from the pier holes as the pier concrete is placed.

6.2.3 Lateral Loads

Resistance to lateral loads can be obtained using a combination of passive earth pressure against the face of foundations and frictional resistance along the base of foundations. An allowable passive pressure of 500 psf plus 100 psf per foot of depth below soil subgrade (trapezoidal distribution), and frictional resistance of 0.30 times the net vertical dead load should be used in design.

Passive pressure should be neglected within the upper three to six feet where porous and weak soils are not removed. If drilled C-I-P C piers are used, passive pressure can be projected over two pier diameters, however, should not be used below depths of about 7 pier diameters from top of piers.

6.3 Seismic Design Criteria

The structures should be designed and/or constructed to resist the effects of strong ground shaking (on the order of Modified Mercalli Intensity IX) in accordance with current building codes. The California Building Code (CBC) 2016 edition indicates that the site classification for the property is Site Class F, due to the liquefaction potential. BAI is anticipating that the fundamental period of vibration will be equal to or less than 0.5 seconds, for which a site-response analysis is not required in accordance with ASCE 7-05. However, if the structural engineer determines that the fundamental period of vibration is greater than 0.5 seconds, BAI will need to re-evaluate the site and may need to perform a site response analysis. For design purposes BAI is using Site Class D. Accordingly, CBC indicates that the following seismic design parameters are appropriate for the site:

Table 3: Seismic Design Parameters

Site Class	=	D
Mapped Spectral Response Acceleration at 0.2 sec	Ss =	1.500g
Mapped Spectral Response Acceleration at 1.0 sec	S_1 =	0.600g
Modified Spectral Response Acceleration at 0.2 sec	S_{MS} =	1.500g
Modified Spectral Response Acceleration at 1.0 sec	S_{M1} =	0.900g
Design Spectral Response Acceleration at 0.2 sec	S_{DS} =	1.000g
Design Spectral Response Acceleration at 1.0 sec	S_{D1} =	0.600g
Site Coefficient	F_a =	1.0
Site Coefficient	F_v =	1.5
Seismic Design Category	=	D

6.4 Concrete Slab Support

The weak near-surface soils in their present condition are not suitable for slab support. Concrete slabs-on-grade should be supported on properly compacted fill soils placed in accordance with our recommendations previously presented in Section 6.1, Site Grading.

During foundation and utility trench construction, previously compacted subgrade surfaces may be disturbed. Where this is the case, the subgrade should be moisture conditioned as necessary, and compacted to provide a firm, smooth, unyielding surface compacted to at least 90 percent relative compaction before construction of slabs-on-grade.

Concrete interior slab floors should be underlain by at least four inches of clean, free-draining gravel or crushed rock, graded in size from 3/4 inches maximum to 1/4 inches minimum, to act as a capillary moisture break. An underslab drain should be constructed as shown on the attached Plate 40. Underslab drain lines should be spaced no more than 20 feet apart. Underslab drain outlets should be constructed through the footings/stem walls by placing 4-inch sleeves within the forms at or below ground level prior to concrete placement.

Where migration of moisture through the slab would be detrimental to its intended use, the installation of a vapor retarder membrane should be considered. The moisture/vapor retarder geomembrane, placed upon the gravel layer, should be at least 15 mils thick (i.e., Stego® Wrap 15-mil Class A, Carlisle RMB 400 15-mil Class A, or equivalent), installed in accordance with the manufacturer's specifications to prevent moisture migration through the seams. With a 15-mil minimum thickness membrane, the 2 inches of wetted sand typically placed upon the membrane may be omitted. Construction of moisture/vapor retarders does not guarantee the prevention of moisture moving through the slab. However, this provision should substantially reduce the potential for moisture-vapor problems on the slab and/or future mold and mildew problems.

6.5 Asphalt Paved Areas

Laboratory tests indicate near surface soils have a resistance value of 22. For the pavement design we used Caltrans flexible pavement design procedures and utilized the pavement design software CalFP v1.5. Based on the above, we recommend the following asphalt pavement thicknesses:

Table 4. Pavement Design Thicknesses

	Thickness (feet)	
Traffic Index (T.I.)	Asphalt Concrete Surfacing	Class 2 Aggregate Base
3.0	0.17	0.5
4.0	0.21	0.5
5.0	0.25	0.6
6.0	0.29	0.75

These thicknesses are the recommended minimums. Increasing asphalt concrete thickness in place of Class 2 Aggregate Base would increase the life and durability of the pavement section. If a different T.I. value is determined for this project, BAI can provide additional pavement sections.

Weak soils within pavement areas should be removed and replaced with compacted fill to at least 90 percent relative compaction, as described in Section 6.1 of this report. The upper 6 inches of subgrade soils should be compacted to at least 95 percent relative compaction to provide a smooth, unyielding surface.

Class 2 Aggregate Base should have a minimum R-value of 78 and conform to the requirements contained in Section 26 of Caltrans (State of California) Standard Specifications, latest edition. Aggregate base should be placed in thin lifts and in a manner to prevent segregation; moisture conditioned to near optimum moisture content, and compacted to at least 95 percent relative compaction to provide a smooth unyielding surface.

6.6 Site Drainage

Because surface and/or subsurface water is often the cause of stability problems, care should be taken to intercept and divert concentrated surface flows and subsurface seepage away from site improvements. Drainage across the site should be by sheet-flow. Surface grades should maintain a recommended two percent gradient away from synthetic turf field.

The synthetic turf should be underlain by at least six inches of crushed, clean, free-draining rock graded in size from ¾ inches maximum to ¼ inches minimum. A drainage system should be construction under the synthetic turf as shown on the attached Plate 41. The drain rock should be placed in thin lifts and in a manner to prevent segregation; moisture conditioned to near optimum moisture content and compacted between 90 and 95 percent relative compaction to provide a firm unyielding surface. The rocks should not be loose, but vibrated in place to ensure a tight inter-locking of the rocks. The drainage system should be designed by a civil engineer.

7.0 ADDITIONAL SERVICES

Prior to construction, BAI should review the final grading and foundation plans, and soil related specifications for conformance with the intent of our recommendations. During construction, BAI should provide periodic observations, together with the appropriate field and laboratory testing during site preparation and grading, subdrain installations, and/or foundation excavations. Foundation excavations should be reviewed by BAI while the excavation operations are being performed. Our reviews and tests would allow us to check that the work is being performed in accordance with project guidelines, confirm that the soil conditions are as anticipated, and to modify our recommendations, if necessary.

8.0 LIMITATIONS

This geotechnical investigation and geologic evaluation was performed in accordance with the usual and current standards of the profession, as they relate to this and similar localities. No other warranty, expressed or implied, is provided as to the conclusions and professional advice presented in this report. Our conclusions are based upon reasonable geological and engineering interpretation of available data.

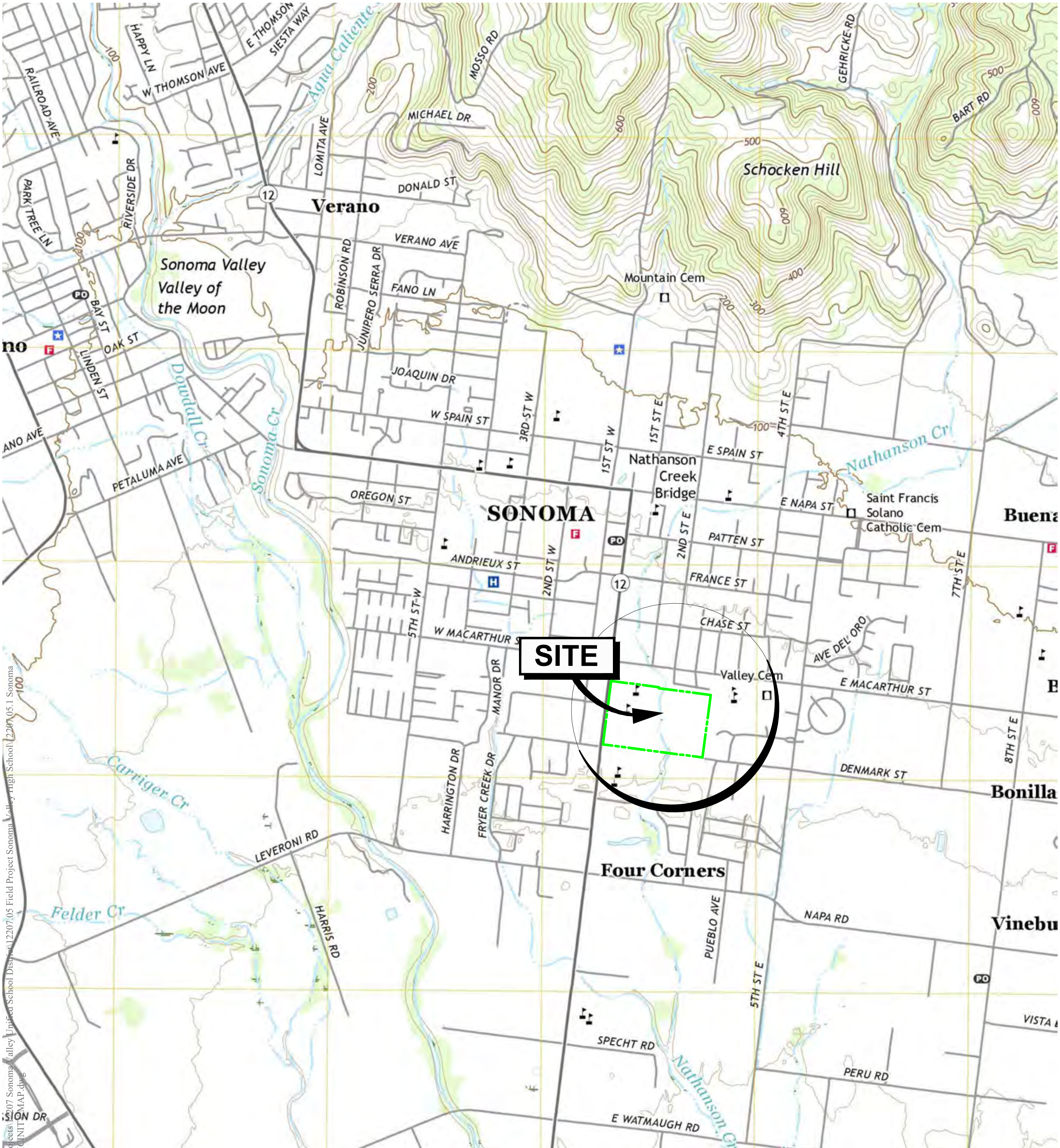
The samples taken and tested, and the observations made, are considered to be representative of the site; however, soil and geologic conditions may vary significantly between test borings and across the site. As in most projects, conditions revealed during construction excavation may be at variance with preliminary findings. If this occurs, the changed conditions must be evaluated by BAI, and revised recommendations be provided as required.

This report is issued with the understanding that it is the responsibility of the Owner, or his/her representative, to insure that the information and recommendations contained herein are brought to the attention of all other design professionals for the project, and incorporated into the plans, and that the Contractor and Subcontractors implement such recommendations in the field. The safety of others is the responsibility of the Contractor. The Contractor should notify the owner and BAI if he/she considers any of the recommended actions presented herein to be unsafe or otherwise impractical.

Changes in the condition of a site can occur with the passage of time, whether they are due to natural events or to human activities on this, or adjacent sites. In addition, changes in applicable or appropriate codes and standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, this report may become invalidated wholly or partially by changes outside of our control. Therefore, this report is subject to review and revision as changed conditions are identified.

The recommendations contained in this report are based on certain specific project information regarding type of construction and current building location, which have been made available to us. If conceptual changes are undertaken during final project design, we should be allowed to review them in light of this report to determine if our recommendations are still applicable.

ILLUSTRATIONS



REFERENCE:
Sonoma Quadrangle
7.5-Minute Series, USGS, 2018

Latitude: 38.281546
Longitude: -122.455520

NORTH

APPROXIMATE SCALE (FEET)
0 1000 2000 4000

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Job No.: 12207.05.1
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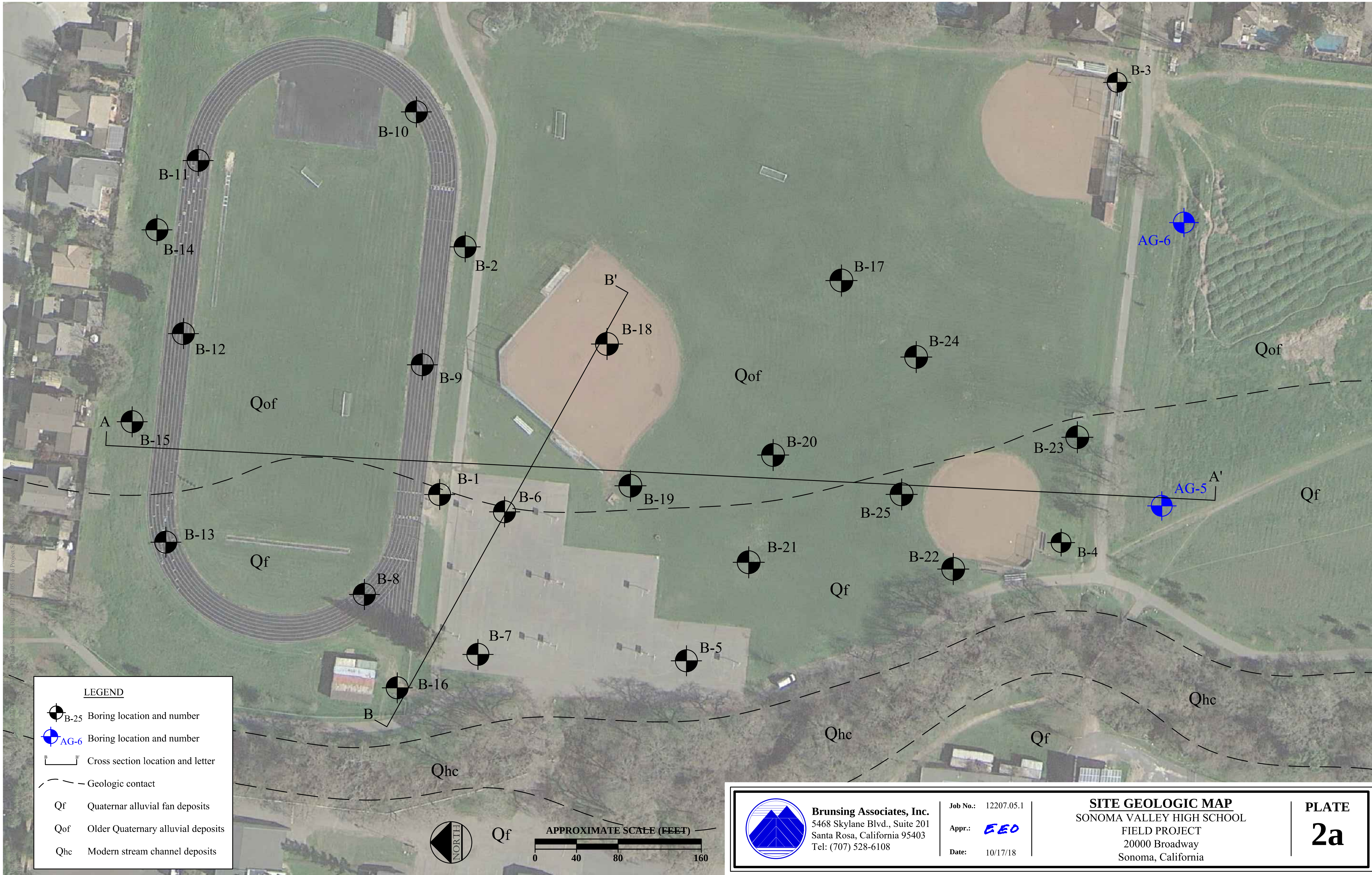
Date: 10/17/18

VICINITY MAP
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE
1



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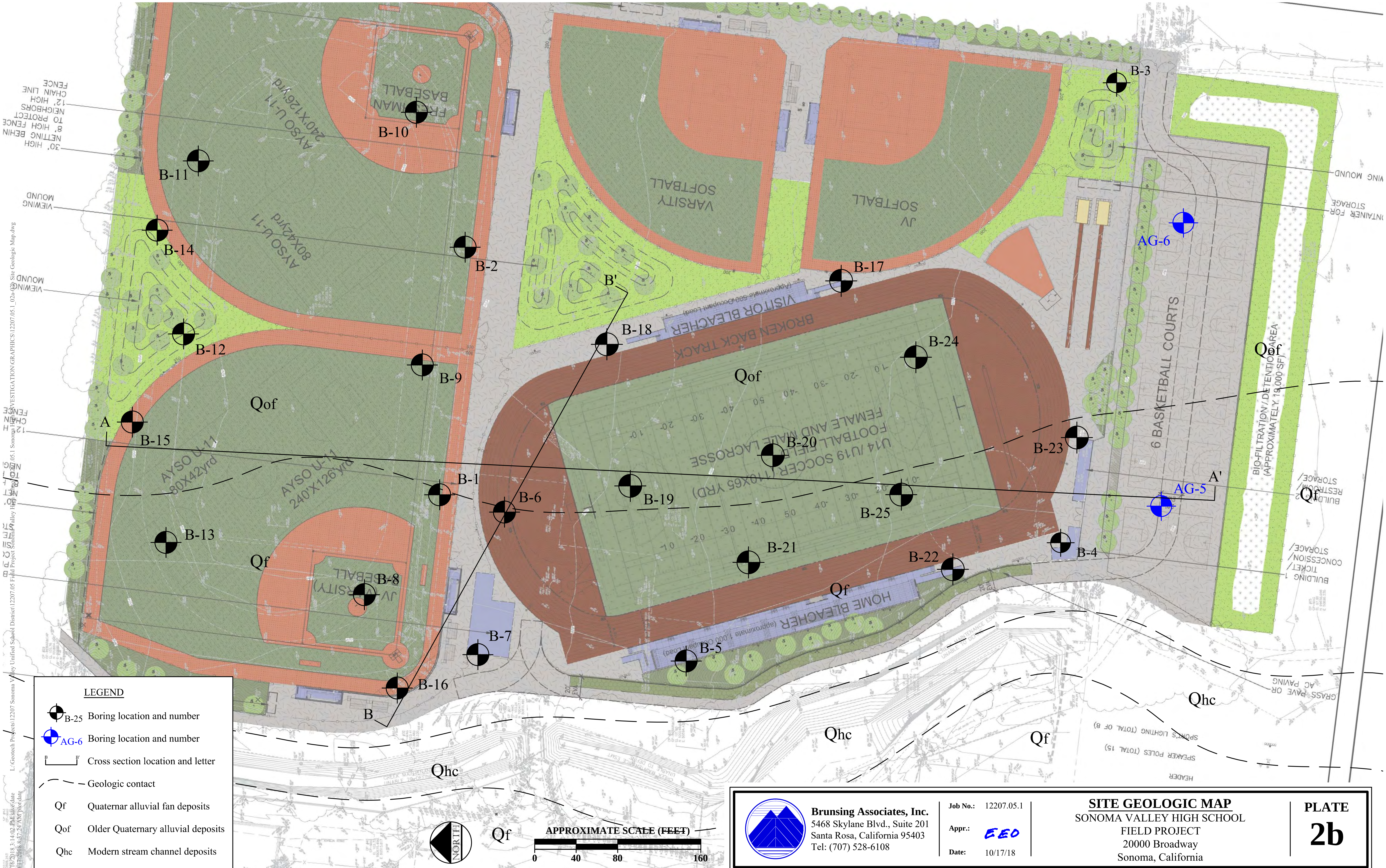
SITE GEOLOGIC MAP
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE
2a



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Date: 10/17/18

SITE GEOLOGIC MAP
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE
2b

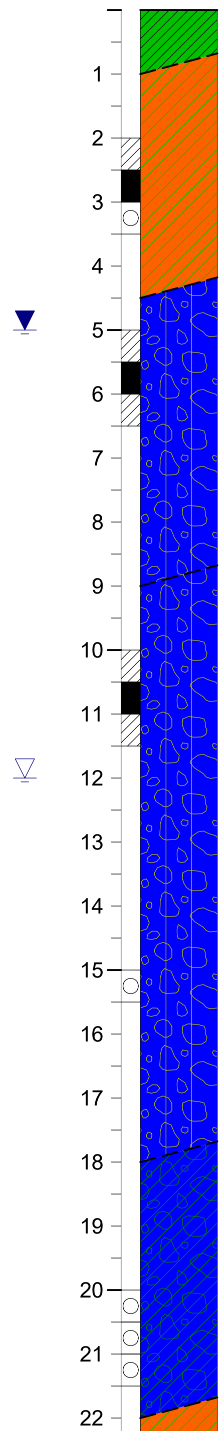
Log of Boring B- 1

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/3/16 **Logged By:** JEW

Elevation: 67 feet *** **Latitude:** 38.282534 **Longitude:** -122.455466

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
	CA			5**	3
Tx 665 (1008)		19.6	93		
	CA			11**	6
		22.3	97		
	CA			27**	11
	SPT			50/6"	15
	SPT			13	21



DARK GRAY-BROWN SILTY SANDY CLAY (CL) with gravel
loose, moist

DARK GRAY-BROWN SILTY CLAYEY SAND (SC) with gravel
loose, moist

LIGHT GRAY-BROWN SANDY SILTY GRAVEL (GM) with clay
medium dense, wet to saturated

LIGHT GRAY-REDDISH-BROWN SILTY SANDY GRAVEL (GM)
with clay
medium dense to dense, wet to saturated

REDDISH-BROWN SILTY SANDY CLAYEY GRAVEL (GC)
medium dense to dense, saturated

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Date: 10/17/18

LOG OF BORING B- 1
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 3
SHEET 1 of 2

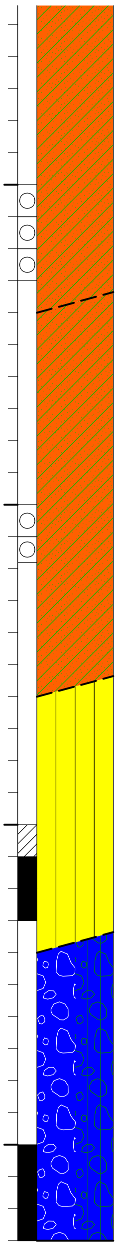
Log of Boring B- 1

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/3/16 **Logged By:** JEW

Elevation: 67 feet *** **Latitude:** 38.282534 **Longitude:** -122.455466

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
	SPT			35	26
	CA			32/4"**	30.5
	CA	21.8	102	54**	36
		35.4	83		40.5
	CA			47**	41



REDDISH-BROWN SILTY CLAYEY SAND (SC)
medium dense to dense, saturated

OLIVE-BROWN SILTY CLAYEY SAND (SC) with gravel
dense, saturated
gravels up to 1.5 inch in diameter

LIGHT BUFF SANDY SILT (ML)
stiff to hard, moist to wet

REDDISH-ORANGE-BROWN SANDY GRAVEL (GP-GM) with silt
dense, moist to wet
trace clay, coarse grained gravels up to 1/2 inch in diameter

Notes:
1. Practical drilling refusal at 40 feet below ground surface
2. Water encountered at about 12 feet during drilling
3. Water measured at 5 feet, 30 minutes after completion of drilling
4. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B- 1
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 3

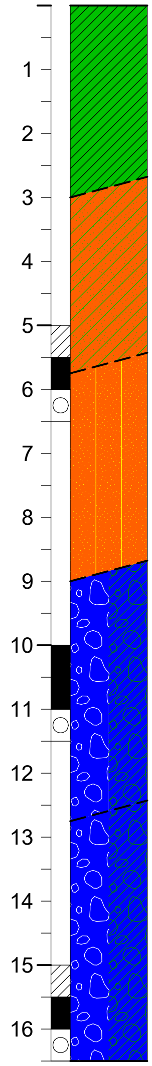
Log of Boring B- 2

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/3/16 **Logged By:** JEW

Elevation: 67 feet *** **Latitude:** 38.282467 **Longitude:** -122.454576

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
18% Passing #200	CM	15.8	111	8**	5–6
Tx 2152 (1728)	CM	16.9	114	28**	10–11
	SPT	10.7	176	73	15–16



DARK GRAY-BROWN SILTY SANDY CLAY (CL)
soft, damp to moist
trace gravels

BROWN SILTY CLAYEY SAND (SC)
loose, saturated
trace gravels up to 1/2 inch on diameter

BROWN OLIVE-BROWN SILTY GRAVELLY SAND (SM)
loose, saturated
gravel up to 1/2 inch in diameter

DARK BROWN SANDY GRAVEL (GP-GC) with clay
medium dense, moist to wet
gravels up to 1 inch in diameter

DARK OLIVE-BROWN SANDY GRAVEL (GP-GC) with clay
dense to very dense, wet to saturated
gravels up to 1 inch in diameter

Notes:
1. Water encountered at 3 feet
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B- 2
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 4

SHEET 1 of 1

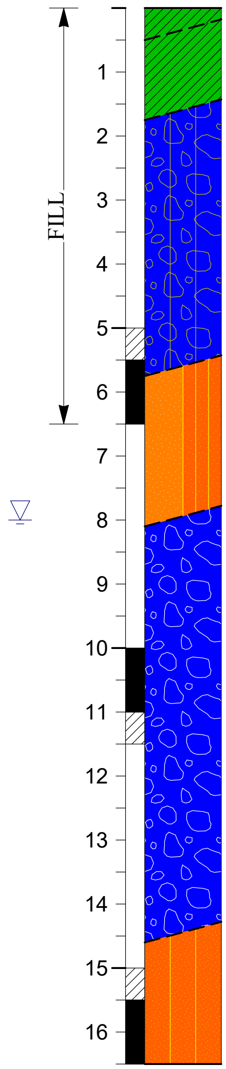
Log of Boring B- 3

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/3/16 **Logged By:** JEW

Elevation: 63 feet *** **Latitude:** 38.280735 **Longitude:** -122.45407

Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
	23.8	99		
CA			18**	6
	18.6	106		
CA			27**	11
	38.6	79		
SPT			29	16



DARK GRAY-BROWN SILTY SANDY CLAY (CL)
soft, moist
trace gravels

DARK GRAY-BROWN SILTY SANDY CLAY (CL)
soft, moist

LIGHT OLIVE-GRAY SILTY SANDY GRAVEL (GM) with clay
medium dense, damp to moist

LIGHT OLIVE-BROWN SAND (SP-SM) with silt
medium dense, damp to moist
few gravels up to 1/2 inch in diameter

LIGHT OLIVE-BROWN SANDY GRAVEL (GP)
medium dense, saturated
gravels up to 1 inch in diameter

LIGHT BUFF SILTY SAND (SM)
medium dense, saturated

Notes:
1. Water encountered at 8 feet
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Job No.: 12207.05.1
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Date: 10/17/18

LOG OF BORING B- 3
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE
5
SHEET 1 of 1

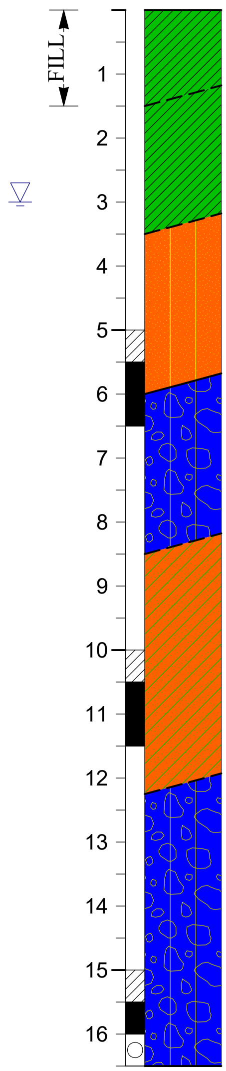
Log of Boring B- 4

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/3/16 **Logged By:** JEW

Elevation: 63 feet *** **Latitude:** 38.280881 **Longitude:** -122.455638

Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
CA	14.5	115	21**	6
CA	37.0	81	8**	11
	13.4	12		
SPT			48	16



DARK GRAY-BROWN SILTY SANDY CLAY (CL)
soft, damp
occasional gravels

DARK GRAY-BROWN SILT SANDY CLAY (CL)
soft, wet

LIGHT BROWN SILTY SAND (SM)
medium dense, wet

LIGHT OLIVE-BROWN SILTY SANDY GRAVEL (GM)
medium dense, wet
gravels up to 1 inch in diameter

LIGHT OLIVE-BROWN SILTY CLAYEY SAND (SC) with gravel
loose, wet
gravels up to 1/2 inch in diameter

LIGHT OLIVE-BROWN SILTY SANDY GRAVEL (GM) with clay
medium dense to dense, wet
gravels up to 1 inch in diameter

Notes:
1. Water encountered at 3 feet
2. Caving at 4 feet

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B- 4
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 6
SHEET 1 of 1

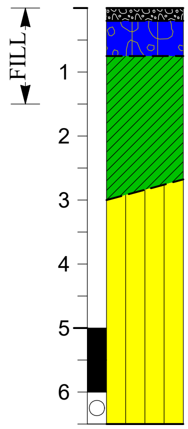
Log of Boring B- 5

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/3/16 **Logged By:** JEW

Elevation: 65 feet *** **Latitude:** 38.281872 **Longitude:** -122.456024

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
62% Passing #200	CA	9.1	106	29**	6



ASPHALT
LIGHT GRAY-BROWN BLUE-GRAY SILTY SANDY GRAVEL (GM)
loose, dry
DARK GRAY-BROWN SILTY SANDY CLAY (CL)
soft, damp

LIGHT GRAYISH-BROWN SANDY SILT (ML)
medium dense, damp to moist
gravels up to 1 inch in diameter

Notes:
1. No free water encountered
2. Minor caving at base of hole

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Date: 10/17/18

LOG OF BORING B- 5
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

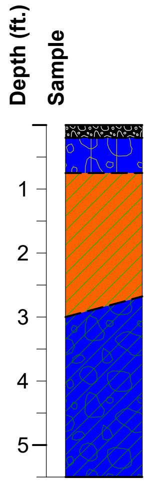
PLATE 7
SHEET 1 of 1

Log of Boring B- 6

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 66 feet *** **Latitude:** 38.282352 **Longitude:** -122.45553



ASPHALT

LIGHT GRAY-BROWN BLUE-GRAY SILTY SANDY GRAVEL (GM)
loose, dry

DARK BROWN BROWN SILTY CLAYEY SAND (SC)
loose to damp
trace gravels

BROWN SILTY CLAYEY SANDY GRAVEL (GC)
medium dense, damp to moist
gravels up to 1 inch in diameter

Notes:
1. No free water encountered
2. Minor caving at base

*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Date: 10/17/18

LOG OF BORING B- 6
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE
8
SHEET 1 of 1

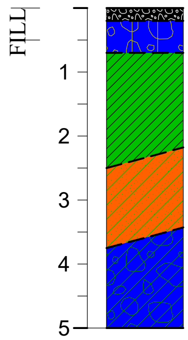
Log of Boring B- 7

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 67 feet *** **Latitude:** 38.282443 **Longitude:** -122.456019

Depth (ft.) **Sample**



ASPHALT
GRAY SILTY SANDY GRAVEL (GM)
loose, dry
DARK GRAY-BROWN SILTY SANDY CLAY (CL)
soft, damp

LIGHT GRAYISH-REDDISH-BROWN SILTY CLAYEY SAND (SC)
with gravel
medium dense to dense, damp to moist

DARK GRAYISH-BROWN REDDISH-BROWN SILTY SANDY CLAYEY GRAVEL (GC)
medium dense, damp to moist

Notes:
1. No free water encountered
2. Minor caving at base of hole

*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B- 7
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

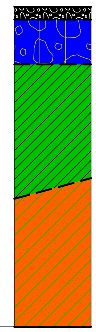
PLATE
9
SHEET 1 of 1

Log of Boring B- 8

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 68 feet *** **Latitude:** 38.282712 **Longitude:** -122.455787

Depth (ft.)	Sample		Description
			ASPHALT
			LIGHT GRAY-BROWN BLUE-GRAY SILTY SANDY GRAVEL (GM) loose, dry
1			DARK REDDISH-BROWN SILTY SANDY CLAY (CL) soft to medium stiff, damp to moist
2			
3			DARK REDDISH-BROWN ORANGE-BROWN SILTY CLAYEY SAND (SC) with gravel medium dense, damp to moist
4			
5			

Notes:
1. No free water encountered
2. No caving

*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Job No.: 12207.05.1
Appr.: KAC
Date: 10/17/18

LOG OF BORING B- 8
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 10

SHEET 1 of 1

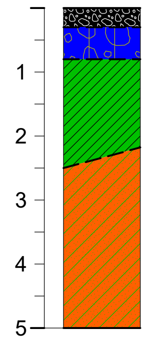
Log of Boring B- 9

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 68 feet *** **Latitude:** 38.282581 **Longitude:** -122.455033

Depth (ft.) | Sample



ASPHALT

LIGHT GRAY-BROWN BLUE-GRAY SILTY SANDY GRAVEL (GM)
loose, dry

DARK BROWN MEDIUM BROWN SILTY SANDY CLAY (CL)
soft to medium stiff, damp to moist

LIGHT TAN-BROWN SILTY CLAYEY SAND (SC) with gravel
medium dense, damp to moist

Notes:
1. No free water encountered
2. No caving

*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Tel: (707) 528-6108

Job No.: 12207.05.1

Appr.: KAC

Date: 10/17/18

LOG OF BORING B- 9
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

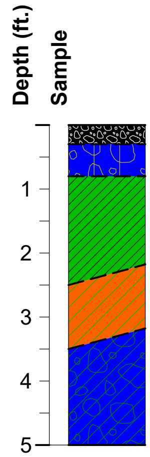
PLATE
11

Log of Boring B-10

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 68 feet *** **Latitude:** 38.282573 **Longitude:** -122.454214



ASPHALT

LIGHT GRAY-BROWN BLUE-GRAY SILTY SANDY GRAVEL (GM)
loose, dry

DARK BROWN MEDIUM BROWN SILTY SANDY CLAY (CL)
soft to medium stiff, damp to moist

LIGHT TAN TO BUFF SILTY CLAYEY SAND (SC) with gravel
medium dense, damp to moist

BUFF TAN TO ORANGE-BROWN SILTY CLAYEY SANDY GRAVEL (GC)
medium dense, damp to moist

Notes:
1. No free water encountered
2. No caving

*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-10
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 12

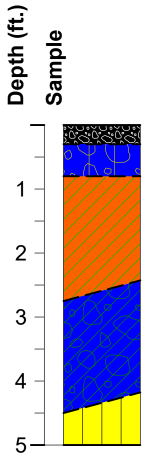
SHEET 1 of 1

Log of Boring B-11

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 68 feet *** **Latitude:** 38.283172 **Longitude:** -122.454357



ASPHALT

LIGHT GRAY-BROWN BLUE-GRAY SILTY SANDY GRAVEL (GM)
loose, dry

REDDISH-BROWN SILTY CLAYEY SAND (SC) with gravel
medium dense, damp to moist

BUFF TAN TO ORANGE-BROWN SILTY CLAYEY SANDY GRAVEL (GC)
medium dense, damp to moist

TAN TO BUFF SANDY SILT (ML)
medium stiff, dry to damp

Notes:
1. No free water encountered
2. No caving

*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-11
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 13

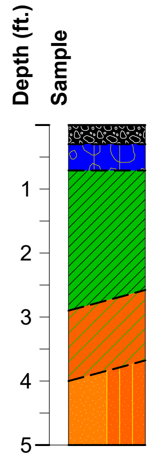
SHEET 1 of 1

Log of Boring B-12

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 68 feet *** **Latitude:** 38.2832 **Longitude:** -122.454875



ASPHALT
LIGHT GRAY-BROWN BLUE-GRAY SILTY SANDY GRAVEL (GM)
loose, dry
DARK BROWN SANDY SILTY CLAY (CL)
soft to medium stiff, damp to moist

REDDISH-BROWN SILTY CLAYEY SAND (SC)
medium dense, damp to moist

LIGHT BROWN SILTY SAND (SP-SM)
medium dense, moist
trace gravels

Notes:
1. No free water encountered
2. No caving

*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-12
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 14

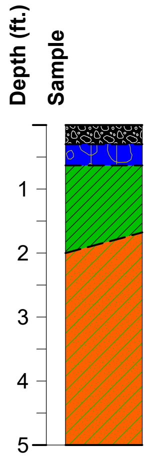
SHEET 1 of 1

Log of Boring B-13

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 68 feet *** **Latitude:** 38.283263 **Longitude:** -122.455579



ASPHALT
LIGHT GRAY-BROWN BLUE-GRAY SILTY SANDY GRAVEL (GM)
loose, dry
gravels up to 3/4 inches in diameter
DARK BROWN SANDY SILTY CLAY (CL)
soft to medium stiff, damp to moist
dark brown silty clayey sand (sc)
medium dense, moist

Notes:
1. No free water encountered
2. No caving

*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-13
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 15
SHEET 1 of 1

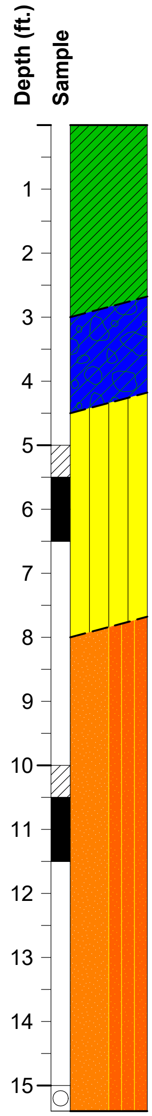
Log of Boring B-14

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 68 feet *** **Latitude:** 38.283279 **Longitude:** -122.454542

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
Tx 1413 (1152)	CA	37.5	81	15**	6
Tx 1687 (1872)	CA	29.7	92	17**	11
	SPT			50/4.5"	15



DARK BROWN SANDY SILTY CLAY (CL)
soft, damp to moist

REDDISH-BROWN SILTY CLAYEY SANDY GRAVEL (GC)
medium dense, wet

LIGHT TAN BUFF SANDY SILT (ML)
medium stiff, damp
occasional to rare gravels

LIGHT TAN-BUFF OLIVE-BROWN SAND (SP-SM) with silt
medium dense to dense, moist
medium to coarse sand with depth

few gravels at 12 feet below ground surface

Notes:
1. Practical drilling refusal at 15.5 feet
2. Water encountered at 5.0 feet during drilling
3. Water measured at 4.5 below ground surface after completion of drilling
4. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-14
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 16

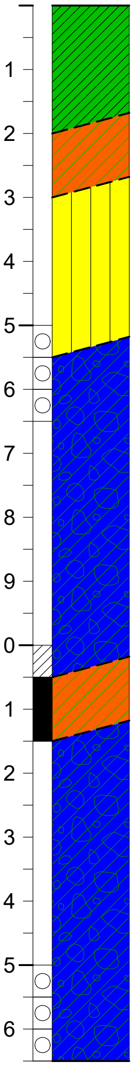
SHEET 1 of 1

Log of Boring B-15

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 69 feet *** **Latitude:** 38.283337 **Longitude:** -122.45519



Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)	Description
					0	DARK GRAY-BROWN SANDY SILTY CLAY (CL) soft, damp to moist
					2	DARK REDDISH-BROWN SILTY CLAYEY SAND (SC) medium dense, damp to moist
					3	LIGHT BUFF TAN SANDY SILT (ML) medium stiff, dry to damp
					5.5	OLIVE-BROWN SILTY CLAYEY SANDY GRAVEL (GC) medium dense, damp to moist
	CA			17**	6	
16% Passing #200		19.7	109			
	SPT			23	11	OLIVE-BROWN CLAYEY SAND (SC) with gravel medium dense, damp to moist
					11.5	OLIVE-BROWN SILTY CLAYEY SANDY GRAVEL (GC) medium dense, damp to wet
	SPT			29	16	

Notes:
1. No free water encountered
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Date: 10/17/18

LOG OF BORING B-15
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 17

SHEET 1 of 1

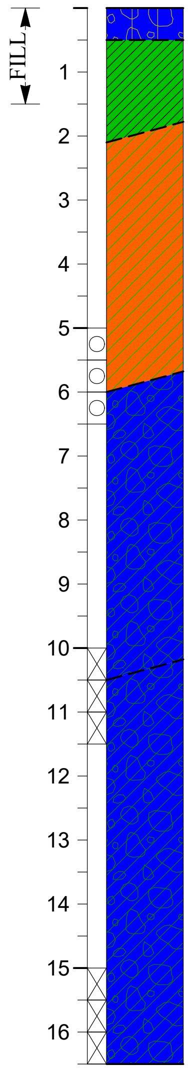
Log of Boring B-16

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 3/4/16 **Logged By:** JEW

Elevation: 67 feet *** **Latitude:** 38.28266 **Longitude:** -122.45609

Sampler Type*	Blows/foot	Depth (ft.)	Description
		0	LIGHT GRAY-BROWN GRAY-BLUE SANDY GRAVEL (GM) loose, dry
		0.5	DARK GRAY-BROWN SANDY SILTY CLAY (CL) soft, damp to moist
		2	DARK GRAY-BROWN SILTY CLAYEY SAND (SC) loose, damp to moist
CA	5**	6	OLIVE-BROWN REDDISH-BROWN CLAYEY SANDY GRAVEL (GC) medium dense, damp to moist
SPT	19	10.5–11	OLIVE-BROWN REDDISH-BROWN CLAYEY SANDY GRAVEL (GC) medium dense, damp to wet
SPT	35	16	



Notes:
1. No free water encountered
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-16
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 18

SHEET 1 of 1

Log of Boring B-17

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 6/5/18 **Logged By:** KAC

Elevation: 64 feet *** **Latitude:** 38.281488 **Longitude:** -122.454749

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)	Description
					0	BROWN SILTY SAND (SM) loose to medium dense, moist
					3.5	BROWN SILTY GRAVELLY SAND (SM) medium dense, moist
					4.5	OLIVE-BROWN SILTY SAND (SM) medium dense, moist
Tx 1579 (720)	CA	25.2	97	22**	6	
					7.5	BROWN CLAYEY SAND (SC) with gravel medium dense, moist
					9	OLIVE-BROWN SILTY SAND (SM) with gravel dense, moist
	SPT			44	11	
					14	BROWN SILTY SAND (SM) dense, moist
	SPT			37	16	
					17	BROWN CLAYEY SILTY SAND (SM) dense, wet to saturated
	SPT			41	21	

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Date: 10/17/18

LOG OF BORING B-17
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 19

SHEET 1 of 2

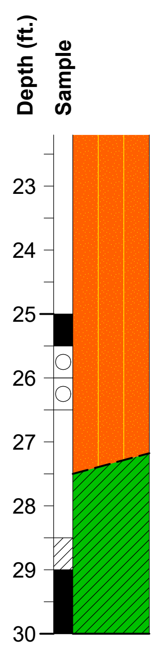
Log of Boring B-17

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 6/5/18 **Logged By:** KAC

Elevation: 64 feet *** **Latitude:** 38.281488 **Longitude:** -122.454749

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
	SPT			27	26
Tx 3632 (3600)	CA	48.1	72	23**	29.5



OLIVE SANDY CLAY (CL)
stiff, wet

Notes:
1. Water encountered at 10 feet during drilling
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-17
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 19

Log of Boring B-18

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 6/5/18 **Logged By:** KAC

Elevation: 66 feet *** **Latitude:** 38.282077 **Longitude:** -122.454973

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)	Description
					0	LIGHT GRAY SILTY SAND (SM) medium dense, dry to moist
					3.5	OLIVE-BROWN SILTY SAND (SM) dense, damp
	CA			32**	5	
					8	OLIVE-BROWN SILTY SAND (SM) medium dense, moist few small gravels
LL=42, PI=14 Tx 1736 (1152)	CA	39.6	80	15**	10	
					12	OLIVE-GRAY SILTY SAND (SM) medium dense to dense, wet to saturated
				∇ (groundwater)	approx. 14	
	SPT			15/6"	14.5	
					18.5	LIGHT BROWN SILTY SAND (SM) with gravels very dense, saturated
	SPT			29/6"	19.5	
					22	

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-18
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 20

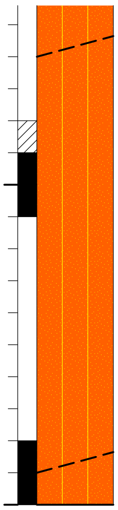
Log of Boring B-18

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 6/5/18 **Logged By:** KAC

Elevation: 66 feet *** **Latitude:** 38.282077 **Longitude:** -122.454973

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)	Description
					23	OLIVE SILTY SAND (SM) medium dense, moist
					24	
LL=93, PI=45						
Tx 3111 (2880)	CA	43.6	76	19**	25	
					26	
					27	
					28	
					29	
	CA			32/4.5"**		OLIVE SITLY SAND (SM) very dense, moist
					30	



Notes:
1. Water encountered at 14 feet during drilling
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-18
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE
20

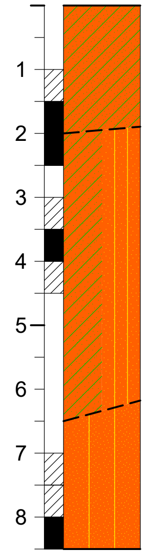
Log of Boring B-19

Equipment: Mobile B-53; 6-inch solid-stem flight auger

Date: 6/5/18 **Logged By:** KAC

Elevation: 65 feet *** **Latitude:** 38.282028 **Longitude:** -122.45545

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
44% Passing #200; LL=30, PI=7	CA	25.5	96	2**	2
	CA			5**	4
	CA	37.1	82	17**	8



REDDISH-BROWN CLAYEY SAND (SC)
very loose, saturated

DARK BROWN SILTY CLAYEY SAND (SC-SM)
very loose, saturated

LIGHT BROWB SILTY SAND (SM)
medium dense, damp

Notes:
1. No free water encountered during drilling
2. No caving

BORING LOG 1 PER PAGE, 12207.05.1 GINT HIGH SCHOOL.GPJ, 10/17/18

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-19
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
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Sonoma, California

PLATE 21
SHEET 1 of 1

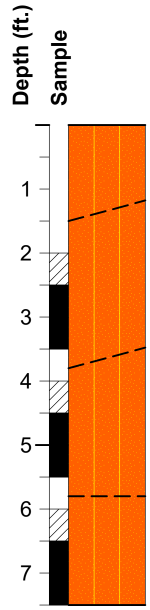
Log of Boring B-20

Equipment: Mobile B-53; 6-inch solid-stem flight auger

Date: 6/5/18 **Logged By:** KAC

Elevation: 64 feet *** **Latitude:** 38.28168 **Longitude:** -122.455359

Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
CA	12.5	95	9**	3
CA			17**	5
	32.5	89		
CA			19**	7



BROWN SILTY SAND (SM)
loose, moist

BROWN SILTY SAND (SM) with gravels
loose, damp

OLIVE-BROWN SILTY SAND (SM)
medium dense, moist
few gravels

OLIVE-BROWN SILTY SAND (SM)
medium dense, moist

Notes:
1. No free water encountered during drilling
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

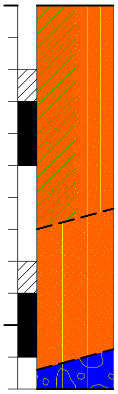
Log of Boring B-21

Equipment: Mobile B-53; 6-inch solid-stem flight auger

Date: 6/5/18 **Logged By:** KAC

Elevation: 64 feet *** **Latitude:** 38.281719 **Longitude:** -122.455729

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
					1
LL=27, PI=6 / 34% Passing #200		11.2	85		
	CA			8**	2
					3
					4
		19.0	97		
	CA			7**	5
					6



BROWN SILTY CLAYEY SAND (SC-SM)
loose, damp
few gravels

BROWN SILTY SAND (SM) with gravels
loose, damp

MOTTLED YELLOW-BROWN SILTY SANDY GRAVEL (GM)
loose, damp

Notes:
1. No free water encountered during drilling
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-21
SONOMA VALLEY HIGH SCHOOL
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PLATE 23
SHEET 1 of 1

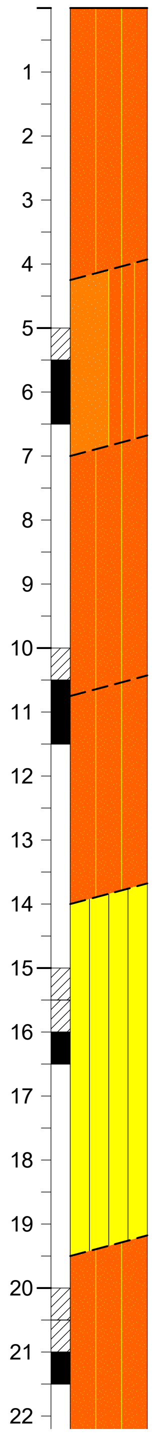
Log of Boring B-22

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 6/6/18 **Logged By:** KAC

Elevation: 63 feet *** **Latitude:** 38.281187 **Longitude:** -122.455729

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
	CA			16**	6
	CA			34**	11
Tx 2533 (1872) 16% Passing #200	CA	18.1	107	28**	16
	CA			21**	21



BROWN SILTY SAND (SM)
loose to medium dense, dry to damp

BROWN GRAVELLY SAND (SP-SM) with silt
medium dense, moist to wet

BROWN CLAYEY SILTY SAND (SM)
medium dense to dense, wet

OLIVE-BROWN SILTY SAND (SM)
dense, moist to wet
few gravels

OLIVE SILT (ML)
stiff, moist

OLIVE-BROWN CLAYEY SILTY SAND (SM)
medium dense, saturated

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Appr.: KAC
Date: 10/17/18

LOG OF BORING B-22
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 24

SHEET 1 of 2

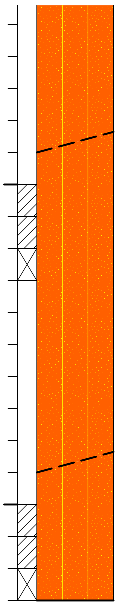
Log of Boring B-22

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 6/6/18 **Logged By:** KAC

Elevation: 63 feet *** **Latitude:** 38.281187 **Longitude:** -122.455729

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)	Description
					23	
					24	
					25	OLIVE-BROWN SILTY SAND (SM) medium dense, saturated
37% Passing #200	SPT			11	26	
					27	
					28	
					29	
					30	OLIVE-BROWN SILTY SAND (SM) medium dense, wet to saturated
	SPT			22	31	



Notes:
1. No free water encountered during drilling
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-22
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

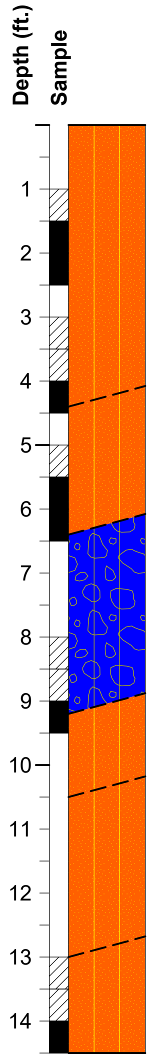
Log of Boring B-23

Equipment: Mobile B-53; 7-inch hollow-stem auger

Date: 6/6/18 **Logged By:** KAC

Elevation: 62 feet *** **Latitude:** 38.280845 **Longitude:** -122.455286

Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
	12.0	80		
CA			4**	2
CA	25.6	93	15**	4
CA			36**	6
CA			13**	9
CA			40/9"*** ▽	14



BROWN SILTY SAND (SM)
very loose, moist

OLIVE-BROWN SILTY SAND (SM)
medium dense, moist

GREEN-BROWN SILTY SANDY GRAVEL (GM)
dense, moist

BROWN SILTY SAND (SM)
medium dense, wet

BROWN SILTY SAND (SM)
dense, wet
few gravels

OLIVE-BROWN SILTY SAND (SM)
very dense, wet

Notes:
1. Possible water encountered at 14 feet during drilling
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-23
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
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PLATE 25
SHEET 1 of 1

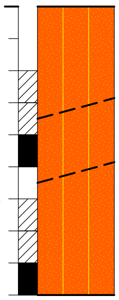
Log of Boring B-24

Equipment: Mobile B-53; 6-inch solid-stem flight auger

Date: 6/6/18 **Logged By:** KAC

Elevation: 64 feet *** **Latitude:** 38.281298 **Longitude:** -122.454974

Laboratory Tests	Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)
					1
43% Passing #200 LL=20, PI=3	CA	14.7	102	11**	2
					3
	CA	31.9	87	26**	4



DARK BROWN SILTY SAND (SM)
loose, moist

BROWN SILTY SAND (SM)
medium dense, moist

OLIVE-BROWN SILTY SAND (SM)
medium dense, moist

Notes:
1. No free water encountered during drilling
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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LOG OF BORING B-24
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
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PLATE 26

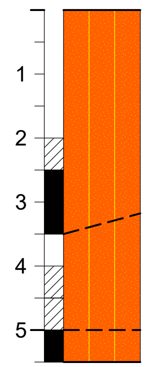
Log of Boring B-25

Equipment: Mobile B-53; 6-inch solid-stem flight auger

Date: 6/6/18 **Logged By:** KAC

Elevation: 63 feet *** **Latitude:** 38.281315 **Longitude:** -122.455462

Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)	Description
				0	BROWN SILTY SAND (SM) loose, moist
CA			10**	3	
				3.5	BROWN SILTY COARSE SAND (SM) loose, moist
CA	16.5	106	11**	5	OLIVE-BROWN SILTY SAND (SM) medium dense, moist



Notes:
1. No free water encountered during drilling
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from City of Santa Rosa Public GIS Viewer, accessed 10/5/18.

Scale: 1" = 3'

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Job No.: 12207.05.1
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Date: 10/17/18

LOG OF BORING B-25
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
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PLATE
27
SHEET 1 of 1

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			SYMBOLS GRAPHIC	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (Less than 5% fines)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (Greater than 12% fines)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS 50% OR MORE OF COARSE FRACTION PASSING THROUGH NO. 4 SIEVE	CLEAN SANDS (Less than 5% fines)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (Greater than 12% fines)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMOUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

KEY TO TEST DATA

LL - Liquid Limit
PI - Plasticity Index
■ Sample Retained
▨ Sample Recovered, Not Retained
☒ Bulk Sample
◯ Sample Not Recovered
CA - California Modified Split Barrel Sampler 3.0-inch O.D.
CM - California Modified Split Barrel Sampler 2.5-inch O.D.
SPT - California Split Barrel Sampler 2.0-inch O.D.
SH - Shelby Tube
RC - Rock Coring
Recovery - Percent Core Recovered
RQD - Rock Quality Designation (length of core pieces >= 4-inches / core length)

Consol - Consolidation
EI - Expansion Index
SA - Sieve Analysis

Shear Strength, psf / **Confining Pressure, psf**

Tx	1564 (1440)	- Unconsolidated Undrained Triaxial
TxCU	1564 (1440)	- Consolidated Undrained Triaxial
DS	2020 (1440)	- Consolidated Drained Direct Shear
FVS	520	- Field Vane Shear
UC	1500	- Unconfined Compression
PP	1500	- Field Pocket Penetrometer
Sat		- Sample saturated prior to test

▽ Groundwater Level Reading
▼ Second Groundwater Level Reading

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SOIL CLASSIFICATION CHART & KEY TO TEST DATA
SONOMA VALLEY HIGH SCHOOL
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PLATE 28

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	Standard Penetration Test Blow Count (blows per foot)
Very loose	4 or less
Loose	5 to 10
Medium dense	11 to 30
Dense	31 to 50
Very dense	More than 50

CONSISTENCY OF FINE-GRAINED SOILS

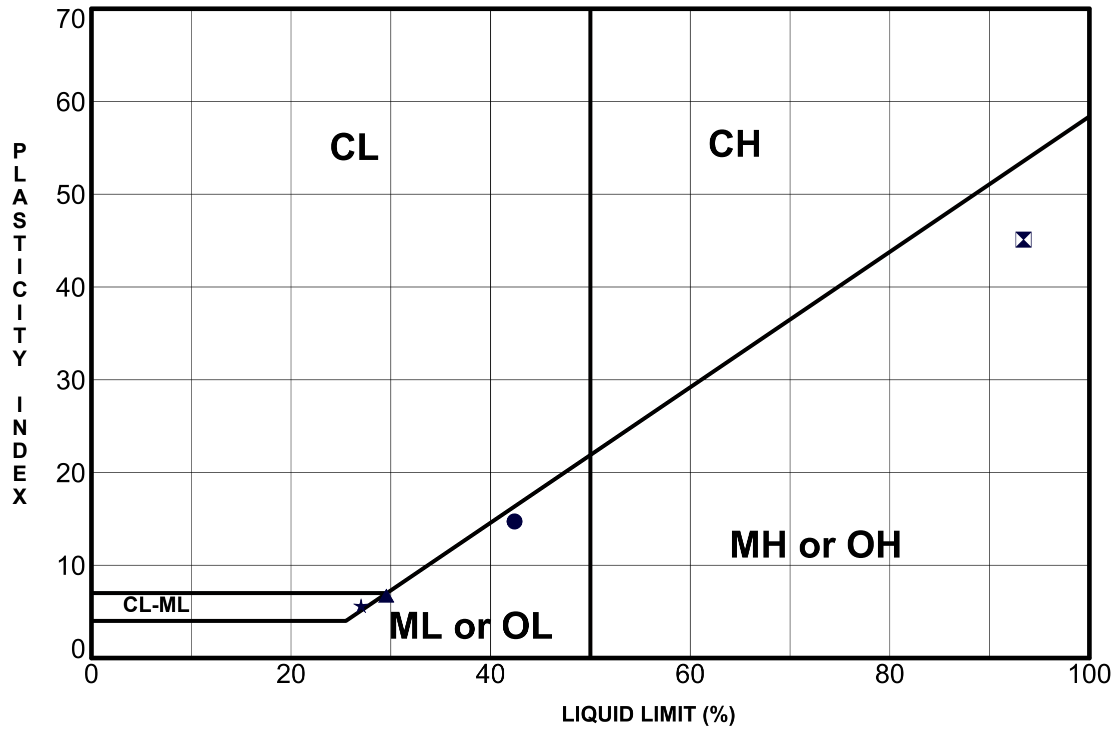
Consistency	Identification Procedure	Approximate Shear Strength (psf)
Very soft	Easily penetrated several inches with fist	Less than 250
Soft	Easily penetrated several inches with thumb	250 to 500
Medium stiff	Penetrated several inches by thumb with moderate effort	500 to 1000
Stiff	Readily indented by thumb, but penetrated only with great effort	1000 to 2000
Very stiff	Readily indented by thumb nail	2000 to 4000
Hard	indented with difficulty by thumb nail	More than 4000

NATURAL MOISTURE CONTENT

Dry	No noticeable moisture content. Requires considerable moisture to obtain optimum moisture content* for compaction.
Damp	Contains some moisture, but is on the dry side of optimum.
Moist	Near optimum moisture content for compaction.
Wet	Requires drying to obtain optimum moisture content for compaction.
Saturated	Near or below the water table, from capillarity, or from perched or ponded water. All void spaces filled with water.

* Optimum moisture content as determined in accordance with ASTM Test Method D1557, latest edition.

Where laboratory test data are not available, the above field classifications provide a general indication of material properties; the classifications may require modification based upon laboratory tests.



SYMBOL	CLASSIFICATION AND SOURCE	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX	% PASSING No. 200 SIEVE
●	**OLIVE-BROWN SILTY SAND (SM)** **B-18 @ 9.5 feet**	**42**	**28**	**14**	
⧗	**OLIVE SILTY SAND (SM)** **B-18 @ 24.5 feet**	**93**	**48**	**45**	
▲	**DARK BROWN SILTY CLAYEY SAND (SC-SM)** **B-19 @ 2.0 feet**	**30**	**23**	**7**	**44**
★	**BROWN SILTY CLAYEY SAND (SC-SM)** **B-21 @ 1.5 feet**	**27**	**21**	**6**	**34**

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ATTERBERG LIMITS TEST RESULTS
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
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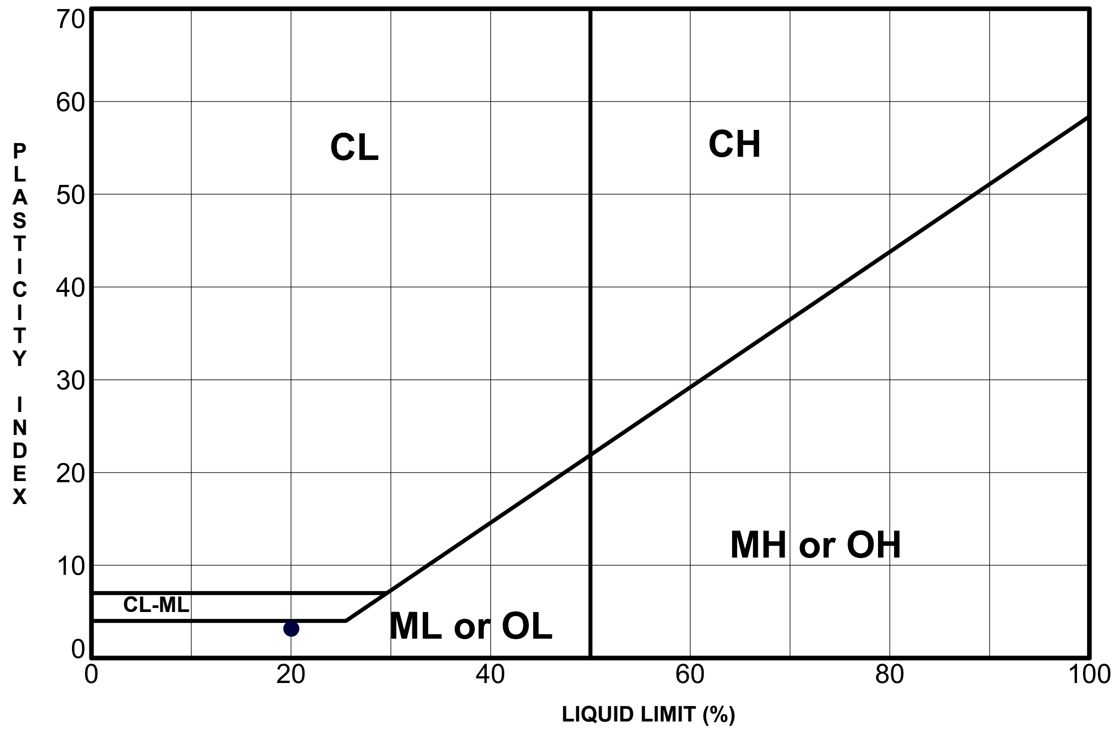
PLATE
30



SYMBOL	CLASSIFICATION AND SOURCE	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX	% PASSING No. 200 SIEVE
●	**BROWN SILTY SAND (SM)** **B-24 @ 2.0 feet**	**20**	**17**	**3**	**43**

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ATTERBERG LIMITS TEST RESULTS
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
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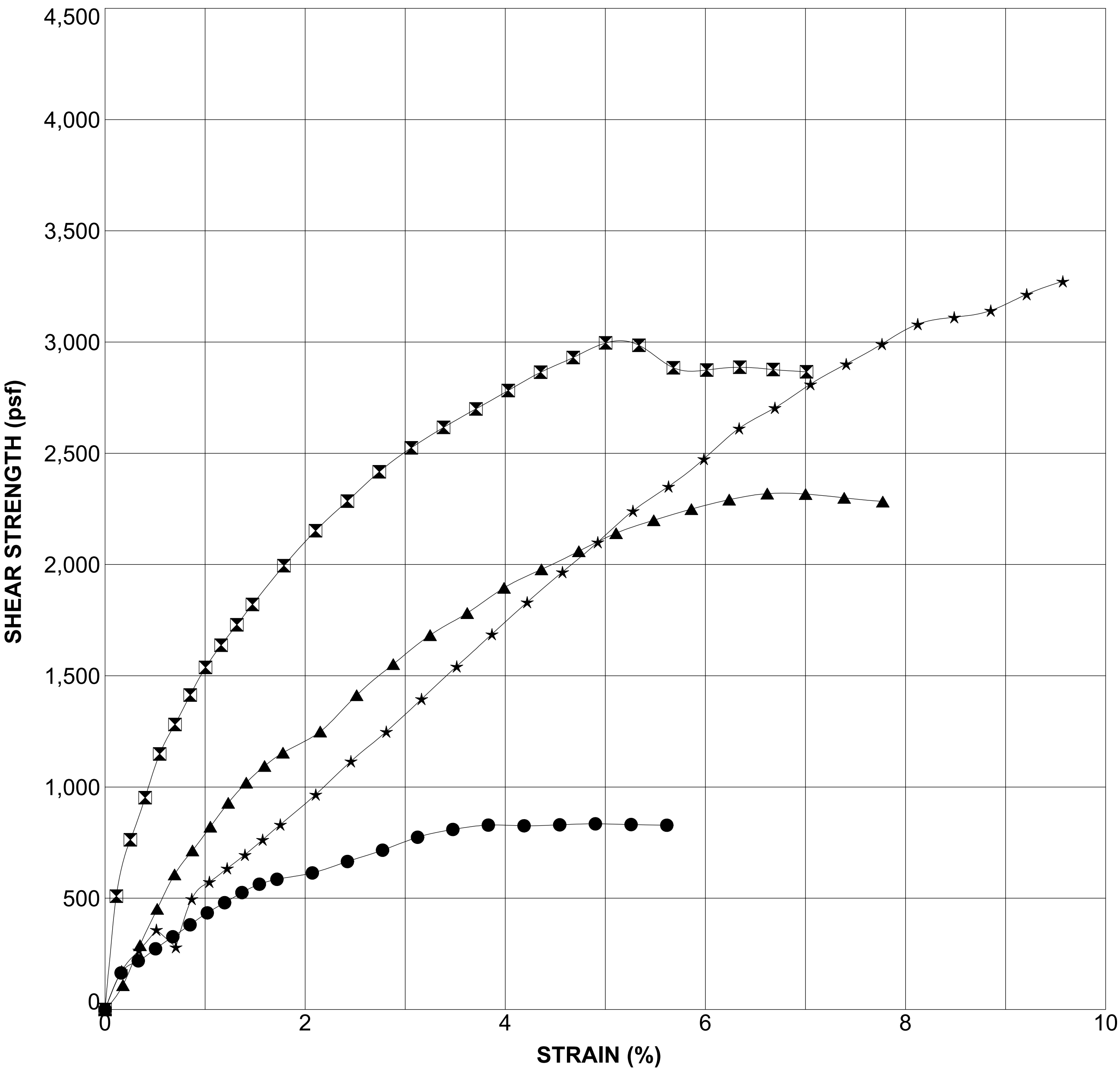
PLATE
31



Sample Source	Classification	Confining Pressure (psf)	Yield Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
● B- 1 at 5.5 ft	LIGHT GRAY-BROWN SANDY SILTY GRAVEL (GM) with clay	1008	665	2.4	93	19.6
⧗ B- 2 at 10.5 ft	DARK BROWN SANDY GRAVEL (GP-GC) with clay	1728	2152	2.1	114	16.9
▲ B-14 at 6 ft	LIGHT TAN BUFF SANDY SILT (ML)	1152	1413	2.5	81	37.5
★ B-14 at 11 ft	LIGHT TAN-BUFF OLIVE-BROWN SAND (SP-SM) with silt	1872	1687	3.9	92	29.7

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UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

SONOMA VALLEY HIGH SCHOOL
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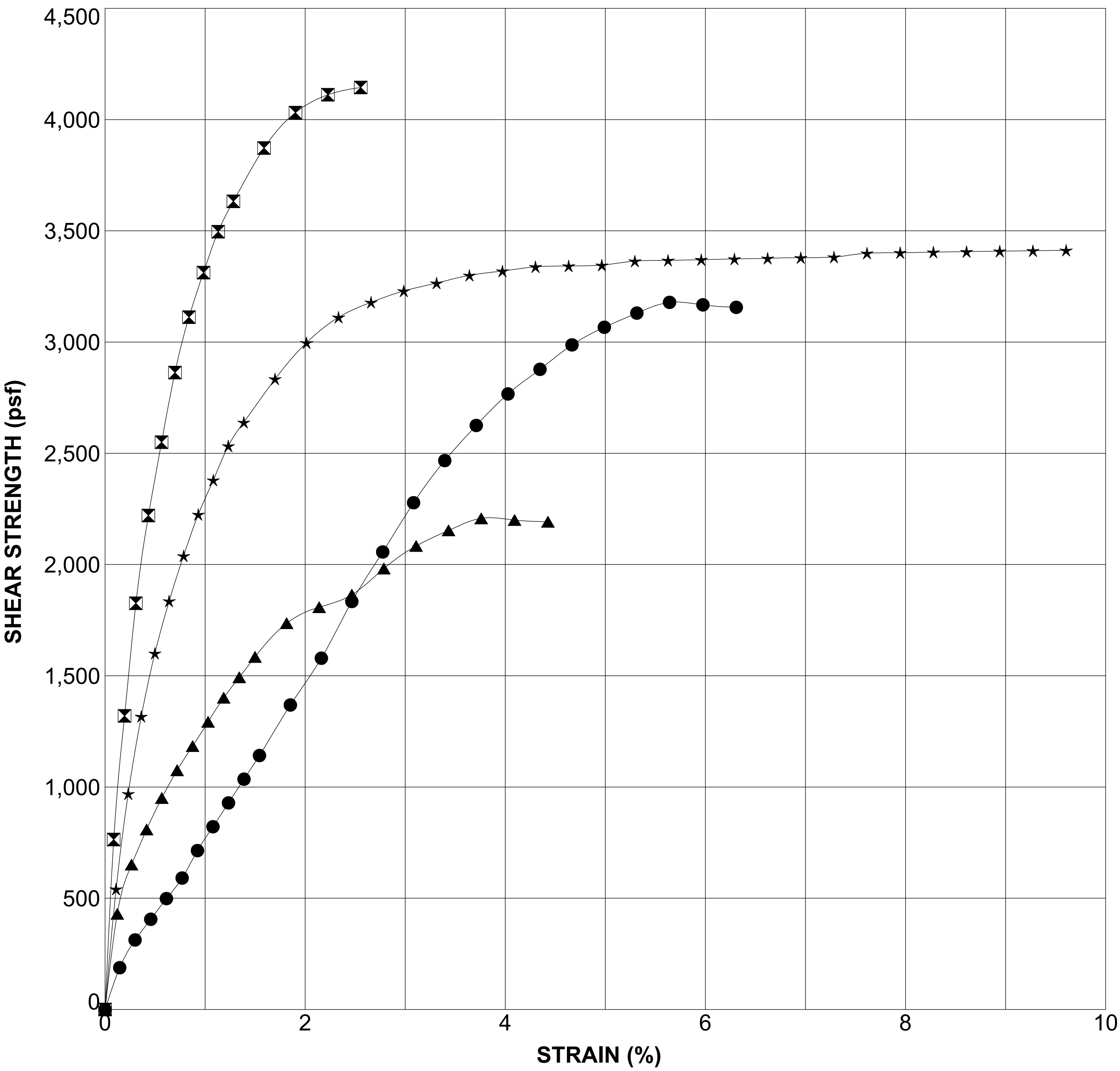
PLATE
32



Sample Source	Classification	Confining Pressure (psf)	Yield Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
● B-17 at 6 ft	OLIVE-BROWN SILTY SAND (SM)	720	1579	2.2	97	25.2
⧗ B-17 at 29.5 ft	OLIVE SANDY CLAY (CL)	3600	3632	1.3	72	48.1
▲ B-18 at 10 ft	OLIVE-BROWN SILTY SAND (SM)	1152	1736	1.8	80	39.6
★ B-18 at 25 ft	OLIVE CLAYEY SAND (SM)	2880	3111	2.3	76	43.6

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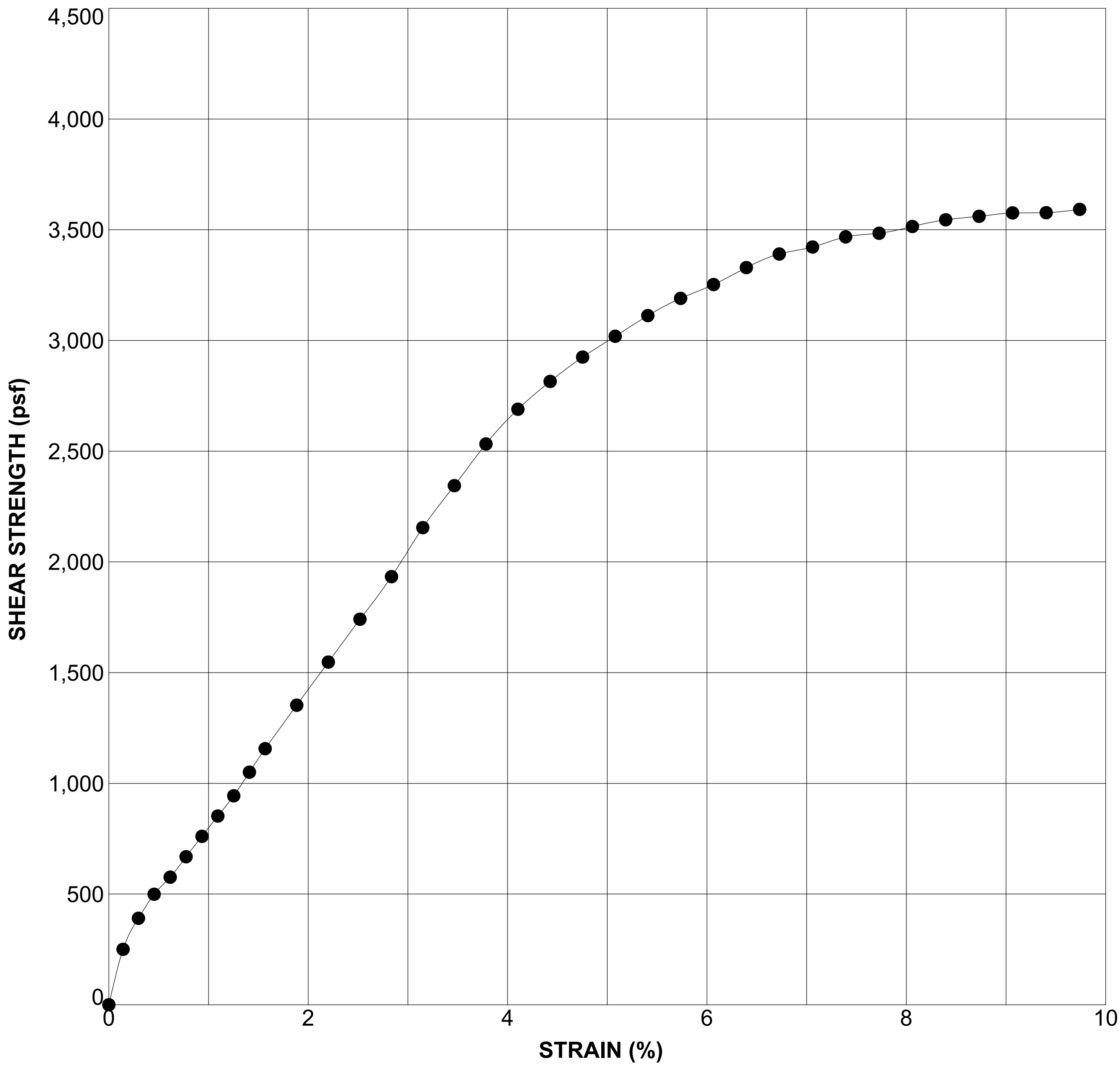
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE
33



Sample Source	Classification	Confining Pressure (psf)	Yield Strength (psf)	Strain (%)	Dry Density (pcf)	Moisture Content (%)
● B-22 at 16 ft	OLIVE SILT (ML)	1872	2533	3.8	107	18.1

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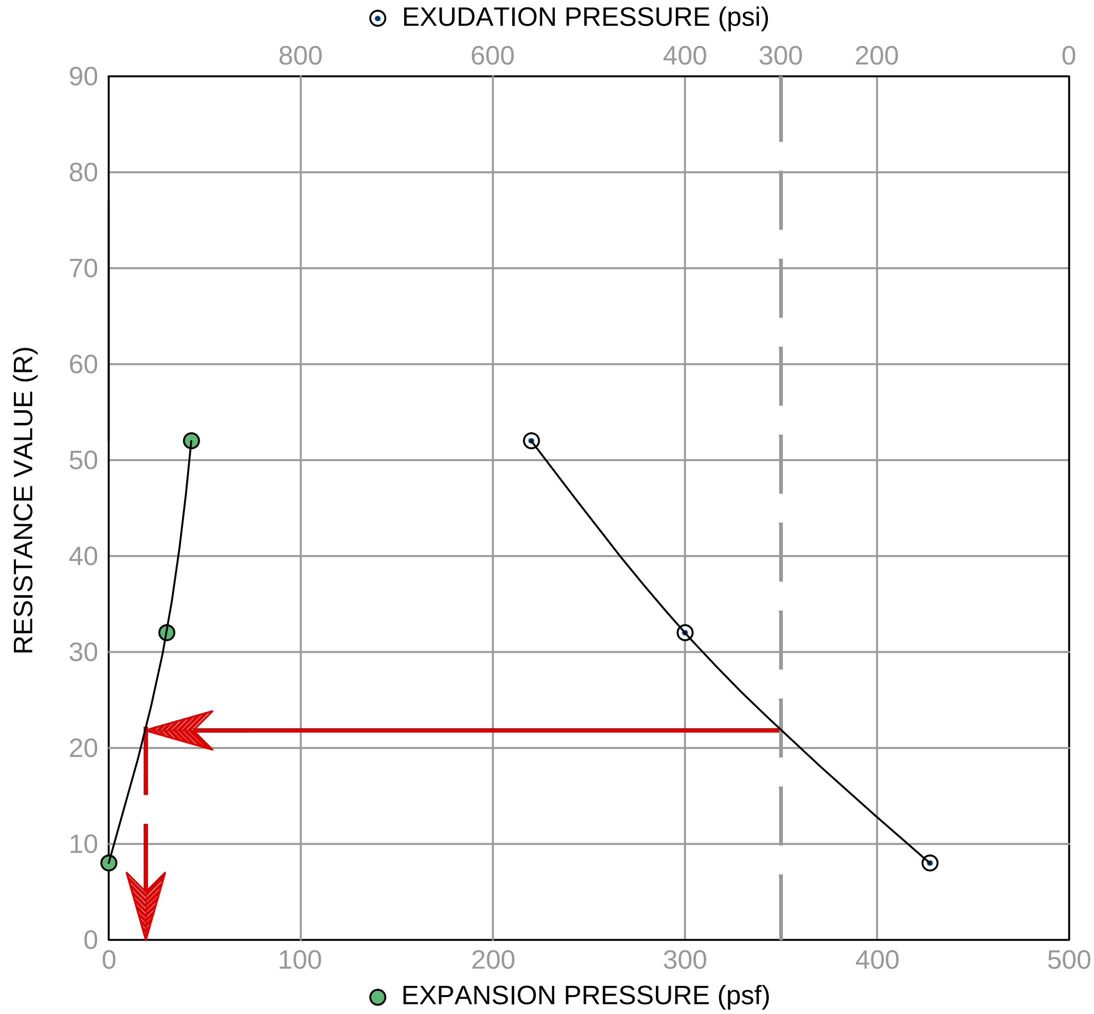
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE 34



Specimen Number	A	B	C	D
Exudation Pressure (psi)	400	145	560	--
Moisture Content (%)	13.5	15.3	12.5	--
Dry Density (pcf)	113.2	109.3	113.5	--
Expansion Pressure (psf)	30.1	0.0	43.0	--
Resistance Value (R)	32	8	52	--

			Values at 300 psi Exudation	
Sample Source	Classification	Sand Equivalent	Expansion Pressure (psf)	**R-Value**
B-8, B-9, B-10, B-11, B-12 and B-13 at 0.5 to 2 feet	DARK BROWN CLAYEY SAND (SC) with gravel	--	20	22

L:\Geotech Projects\12207 Sonoma Valley Unified School District\12207.05 Field Project Sonoma Valley High School\12207.05.1 Sonoma High\INVESTIGATION\GRAPHICS\12207.05.1_35 RESISTANCE (R-) VALUE TEST DATA.dwg
10/16/2018 3:13:58 PM save date
10/17/2018 8:38:12 AM plot date

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RESISTANCE VALUE TEST DATA

SONOMA VALLEY HIGH SCHOOL
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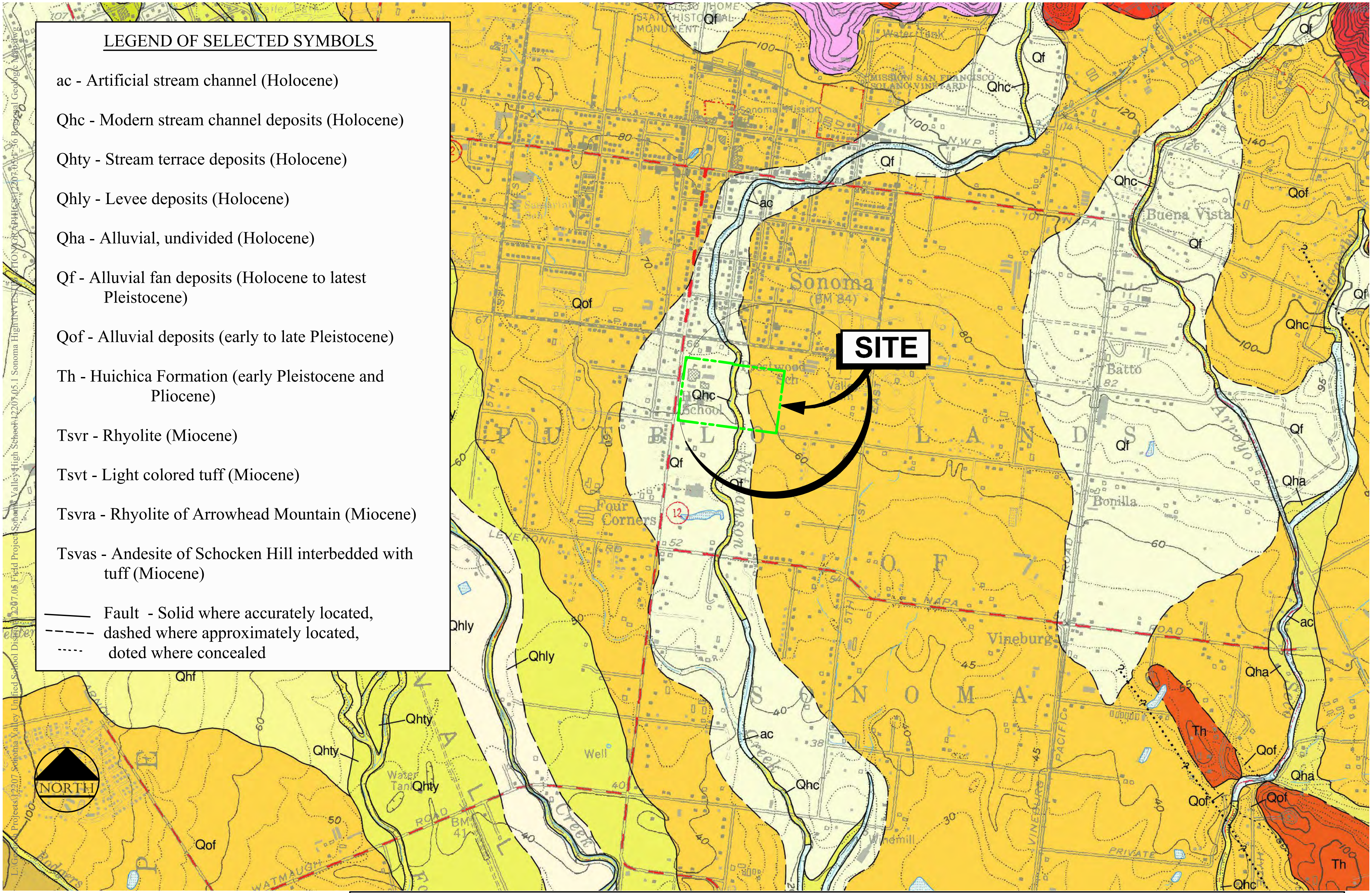
PLATE 35



APPROXIMATE SCALE (FEET)

0 1000 2000 4000

REFERENCE:
Geologic Map of the Sonoma 7.5' Quadrangle, by CGS dated 2006

10/16/2018 3:13:53 PM save date
10/17/2018 8:39:04 AM plot date

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REGIONAL GEOLOGIC MAP
SONOMA VALLEY HIGH SCHOOL
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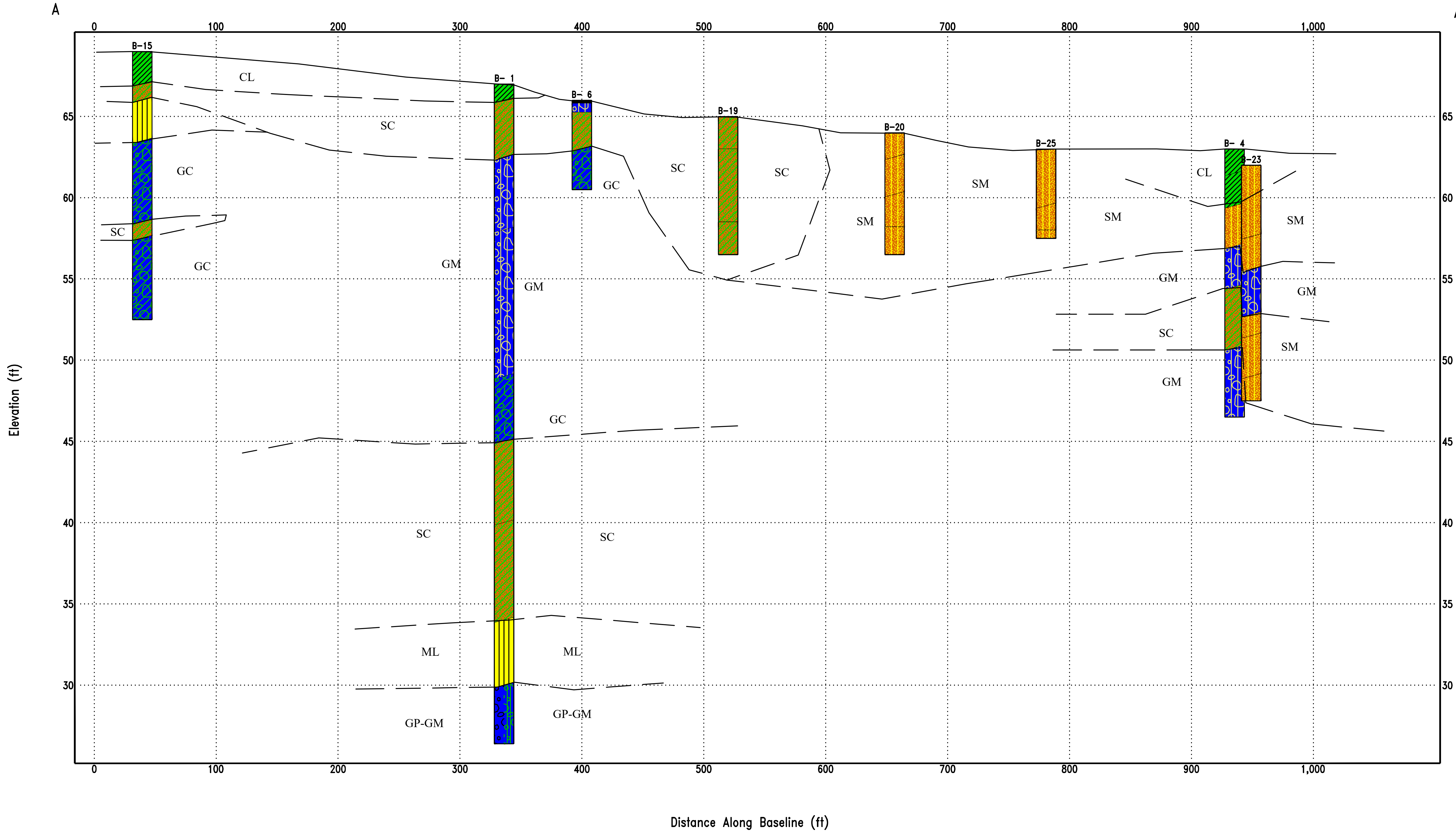
PLATE
36



LEGEND

Geologic contact, dashed where uncertain

CL - Clay

ML - Silt

SM - Silty Sand

SC - Clayey Sand

Asphalt Concrete

GM - Silty Gravel

GC - Clayey Gravel

GP-GM - Poorly Graded Gravel with silt

HORIZONTAL SCALE (FEET)

0 40 80 160

VERTICAL SCALE (FEET)

0 3 6 12

Notes:
Boring widths are exaggerated for clarity.

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CROSS SECTION A-A'

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PLATE
37

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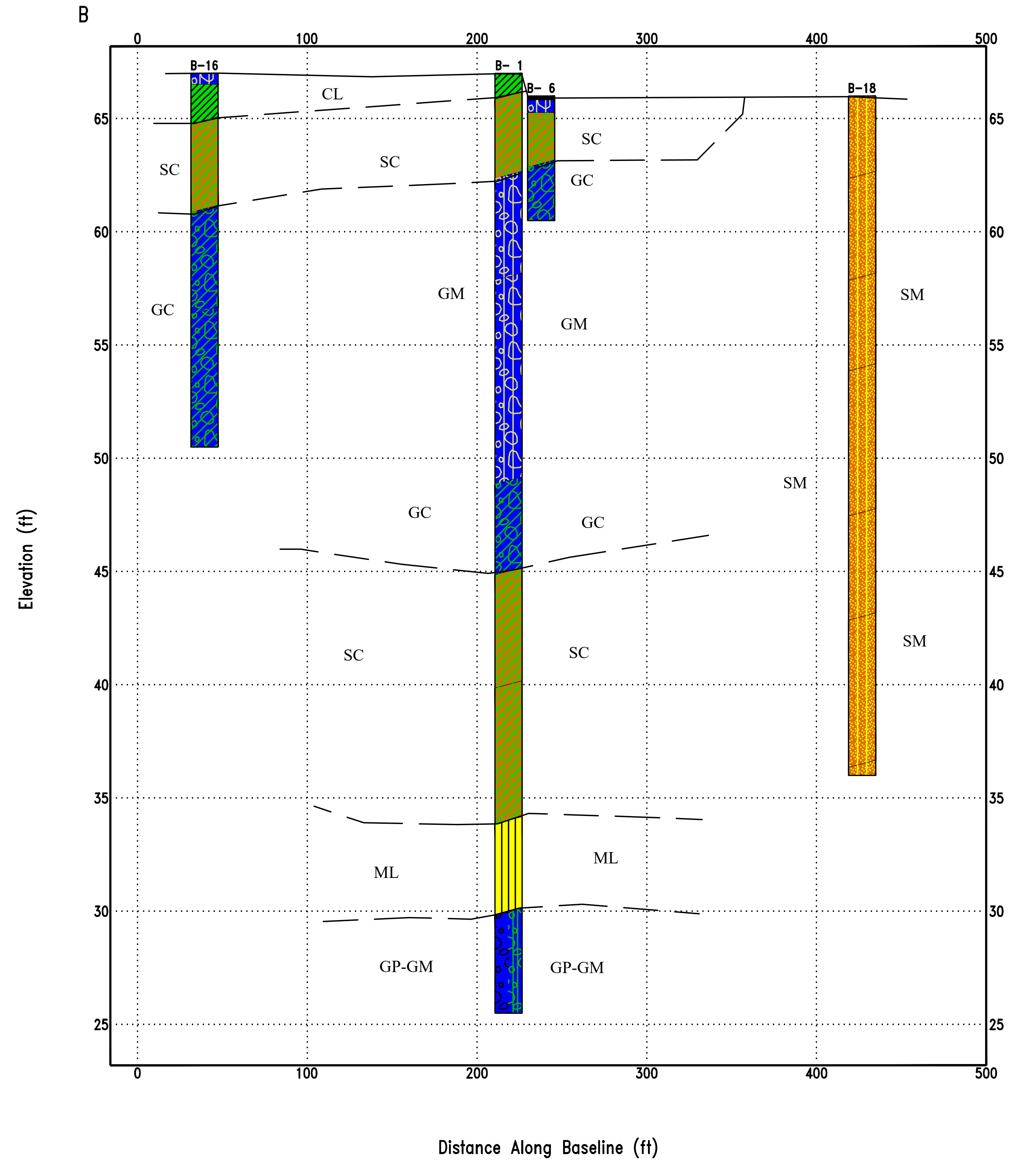

Notes:
Boring widths are exaggerated for clarity.

LEGEND

Geologic contact, dashed where uncertain

- CL - Clay
- ML - Silt
- SM - Silty Sand
- SC - Clayey Sand
- Asphalt Concrete
- GM - Silty Gravel
- GC - Clayey Gravel
- GP-GM - Poorly Graded Gravel with silt

HORIZONTAL SCALE (FEET)
0 40 80 160

VERTICAL SCALE (FEET)
0 3 6 12

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CROSS SECTION B-B'
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PLATE
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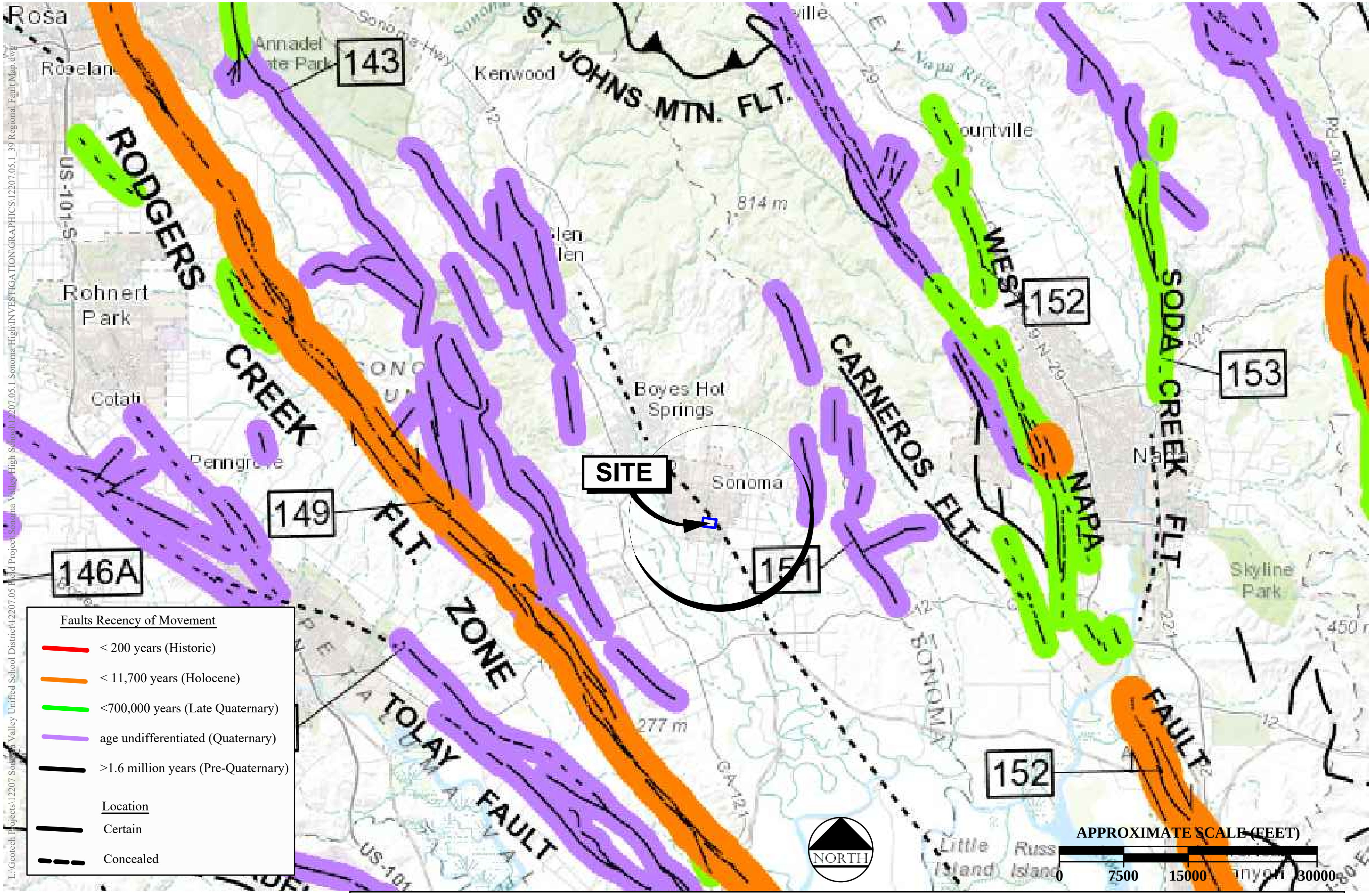

REFERENCE:
CGS, 2015, Fault Activity Map of California (2010), accessed October 8, 2018 from maps.conservation.ca.gov/cgs/fam/

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REGIONAL ACTIVE FAULT MAP

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PLATE
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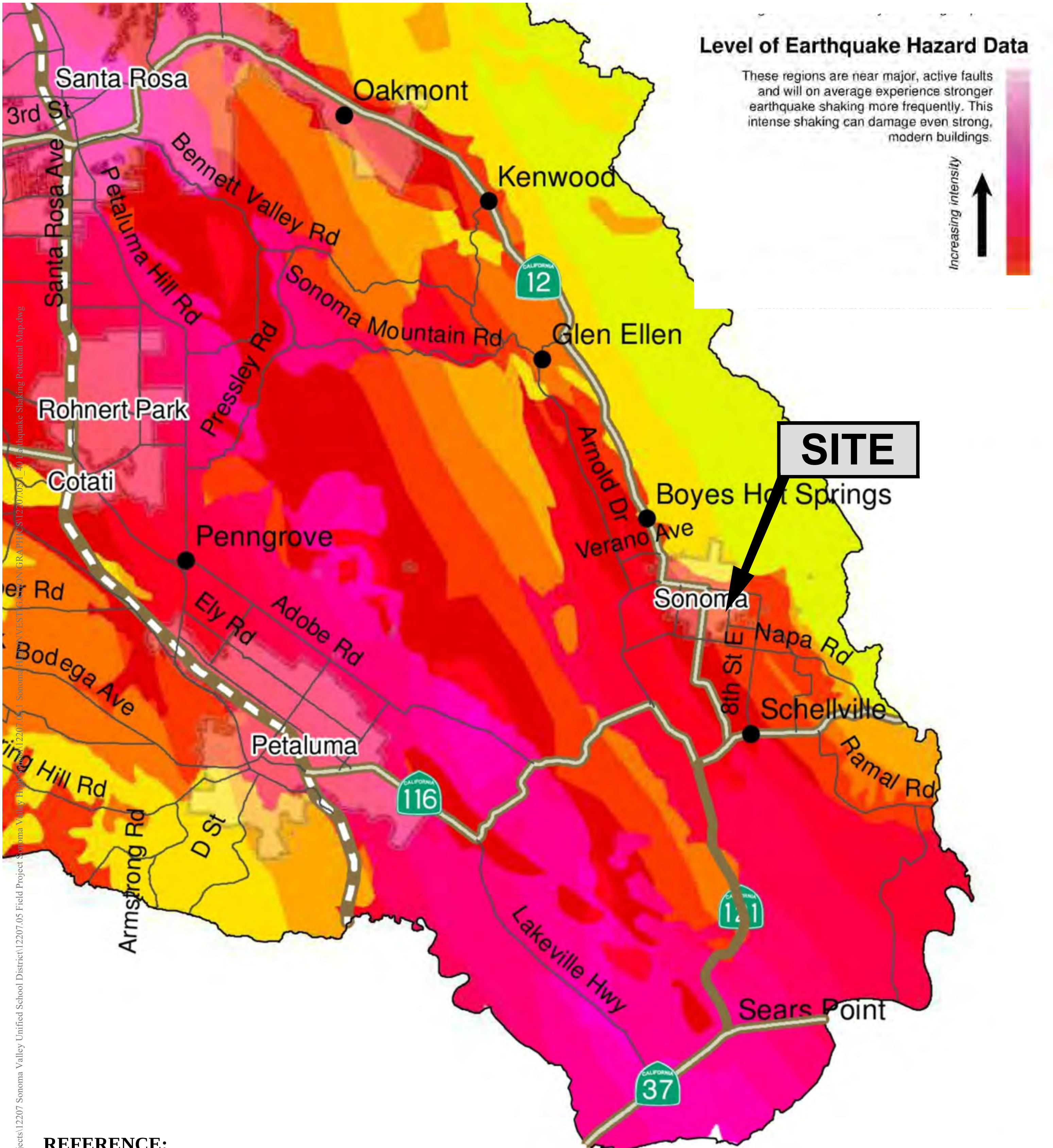

REFERENCE:

County of Sonoma Permit and Resource Management Department, Sonoma County Hazard Mitigation Plan, Figure 8.2, dated 07/15/2016

NORTH

APPROXIMATE SCALE (FEET)

0 | 7,500 | 15,000 | 30,000

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EARTHQUAKE SHAKING POTENTIAL MAP
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
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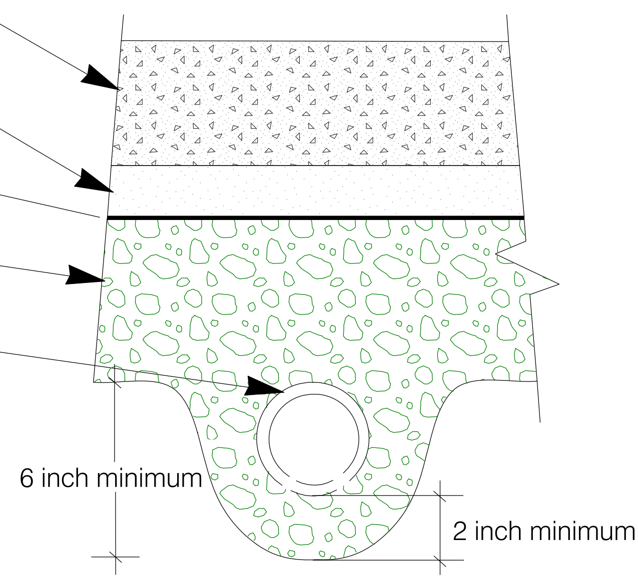
PLATE
40



NOT TO SCALE

NOTES:

1. Drain rock should be clean, free-draining material graded in size between the No.4 and 3/4 inch sieves.
2. Pipe should be SDR 35 or equivalent, perforations placed down, sloped at least 1 percent to gravity outlet, or sump with automatic pump.
3. A clean-out pipe with cap should be installed at the up-slope end of perforated pipe.
4. Vapor retarder should be at least 15-mils thick and installed in accordance with the manufacturer's specifications.

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UNDERSLAB DRAINAGE DETAILS
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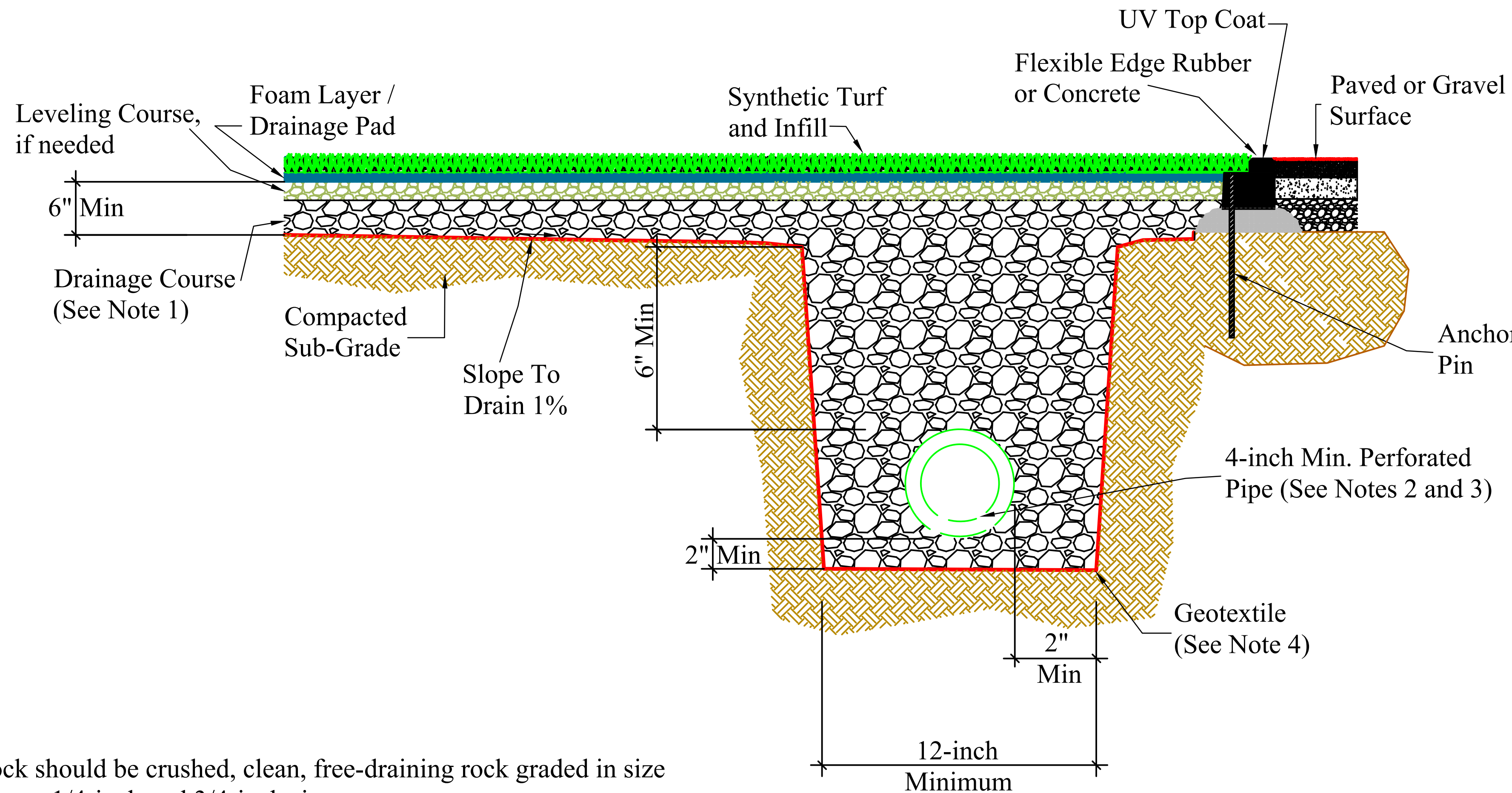
20000 Broadway
Sonoma, California

PLATE 41



NOTES:
1. Drain rock should be crushed, clean, free-draining rock graded in size between 1/4-inch and 3/4-inch sieves.
2. Pipe should be SDR 35 or equivalent, placed with perforations down, sloped at 1 percent to gravity outlet, or sump with automatic pump. Spacing of pipes should be a maximum of 60 feet.
3. A clean-out pipe with cap should be installed at the up-slope end of perforated pipe.
4. Filter fabric should be Mirafi 140N or equivalent
5. Civil engineer should design final sizing and spacing of drainage system.

Brunsing Associates, Inc.
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Santa Rosa, California 95403
Tel: (707) 528-6108

Job No.: 12207.05.1
Appr.: KAC
Date: 10/17/18

SYNTHETIC TURF DRAINAGE DETAIL
SONOMA VALLEY HIGH SCHOOL
FIELD PROJECT
20000 Broadway
Sonoma, California

PLATE
42

APPENDIX A

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APPENDIX B

BAI's Previous Boring Logs

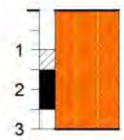
Log of Boring AG-5

Equipment: Mobile B-53; 6-inch solid-stem flight auger

Date: 6/8/16 **Logged By:** KAC

Elevation: 62 feet *** **Latitude:** 38.280599 **Longitude:** -122.455512

Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)	Sample	Description
						BROWN SILTY SAND (SM) loose, dry porous
				1		
CA	9.9	87	6**	2		
				3		



Notes:
1. No water encountered during drilling
2. No caving

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from Google Earth, accessed on August 1, 2016.

Scale: 1" = 4'

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Job No.: 12207.08
Appr.: KAC
Date: 08/23/16

LOG OF BORING AG-5
SONOMA VALLEY HIGH SCHOOL
AGRICULTURE PROJECT
1150 Boradway
Sonoma, California

PLATE
7
SHEET 1 of 1

Log of Boring AG-6

Equipment: Mobile B-53; 6-inch solid-stem flight auger

Date: 6/8/16 **Logged By:** KAC

Elevation: 60 feet *** **Latitude:** 38.280545 **Longitude:** -122.45454

Sampler Type*	Moisture Content (%)	Dry Density (pcf)	Blows/foot	Depth (ft.)	Description
				0–1.8	BROWN SILTY SAND (SC) loose, dry porous
	10.0	98		1.5	
CA			35**	2–3.5	OLIVE-BROWN SILTY SAND (SM) dense, damp

* See Soil Classification Chart & Key to Test Data
** Equivalent "Standard Penetration" Blow Counts.
*** Elevations interpolated from Google Earth, accessed on August 1, 2016.

Scale: 1" = 4'

Brunsing Associates, Inc.
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Santa Rosa, California 95403
Tel: (707) 528-6108

Job No.: 12207.08
Appr.: KAC
Date: 08/23/16

LOG OF BORING AG-6
SONOMA VALLEY HIGH SCHOOL
AGRICULTURE PROJECT
1150 Boradway
Sonoma, California

PLATE 8
SHEET 1 of 1

APPENDIX C

JDH Corrosion Consultants, Inc.

Corrosivity Testing Results and Recommendations for Corrosion Control jdh corrosion consultants, inc.

Protecting the infrastructure through innovative Corrosion Engineering Solutions

May 4, 2016

Brunsing Associates, Inc.
5468 Skylane Blvd., Suite 201
Santa Rosa, CA 95403

Attention: **Mr. Keith A. Colorado**
Civil Engineer- 69011

Subject: **Site Corrosivity Evaluation**
Sonoma Valley High School
Project No: 12207.05

Dear Keith,

In accordance with your request, we have reviewed the laboratory soils data for the above referenced project site. Our evaluation of these results and our corresponding recommendations for corrosion control for the above referenced project concrete foundations and buried site utilities are presented herein for your consideration.

SOIL TESTING & ANALYSIS

Soil Chemical Analysis

One (1) soil sample from the site was transported to a state certified testing laboratory, **CERCO Analytical, Inc.** (certificate no. 2153) located in Concord, CA for chemical analysis. This sample was analyzed for pH, chlorides, resistivity (@ 100% saturation), sulfates and Redox potential using ASTM test methods as detailed in the table below. The preparation of the soil sample for chemical analysis was in accordance with the applicable specifications.

Soil Analysis Test Methods

Chemical Analysis	ASTM Method
Chlorides	D4327
pH	D4972
Resistivity (100% Saturation)	G57
Sulfate	D4327
Redox Potential	D1498

The results of the chemical analysis are provided in CERCO Analytical, Inc. report dated May 3, 2016. The results are summarized as follows:

1100 Willow Pass Court, Concord, CA 94520 Tel No. 925.927.6630 Fax No. 925.927.6634

CERCO Analytical, Inc.
Soil Laboratory Analysis

Chemical Analysis	Range of Results	Corrosion Classification*
Chlorides	None Detected	Non-corrosive*
pH	6.41	Mildly Corrosive*
Resistivity	6,000 Ohms-cm	Moderately Corrosive *
Sulfate	None Detected	Non-corrosive**
Redox Potential	450 mV	Mildly Corrosive*

* With respect to bare steel or ductile iron.
** With respect to mortar coated steel

DISCUSSION

Reinforced Concrete Foundations

Due to the low level of water-soluble sulfates and chlorides in these soils there are no special requirements for sulfate resistant cement or other additives. However, the minimum depth of cover for the reinforcing steel should be as specified in the California Building Code (CBC Section 1907) and the America Concrete Institute (ACI 318-08 Section 7.7)

Underground Metallic Pipelines

The soils at the project site are generally considered to be "moderately corrosive" to ductile/cast iron, steel and dielectric coated steel based on the saturated resistivity measurements. Therefore, special requirements for corrosion control are required for buried metallic utilities at this site depending upon the critical nature of the piping. Pressure piping systems such as domestic and fire water should be provided with appropriate coating systems and cathodic protection, where warranted. In addition, all underground pipelines should be electrically isolated from above grade structures, reinforced concrete structures and copper lines in order to avoid potential galvanic corrosion problems.

LIMITATIONS

The conclusions and recommendations contained in this report are based on the information and assumptions referenced herein. All services provided herein were performed by persons who are experienced and skilled in providing these types of services and in accordance with the standards of workmanship in this profession. No other warrantees or guarantees, expressed or implied, are provided.

We thank you form the opportunity to be of service to **Brunsing Associates Inc.** on this project and trust that you find the enclosed information satisfactory. If you have any questions, or if we can be of any additional assistance, please feel free to contact us at (925) 927-6630.

Site Corrosivity Evaluation
Sonoma Valley High School

Respectfully submitted,

J. Darby Howard, Jr

J. Darby Howard, Jr., P.E.
JDH Corrosion Consultants, Inc.
Principal

Brendon Hurley

Brendon Hurley
JDH Corrosion Consultants, Inc.
Field Technician

REGISTERED PROFESSIONAL ENGINEER
J. DARBY HOWARD, JR.
No. CR 1055
Exp. June 30, 2017
CORROSION
STATE OF CALIFORNIA

Cc: File 16090

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client:	JDH Corrosion Consultants, Inc.
Client's Project No.:	16090 (Brunsing Associates)
Client's Project Name:	Sonoma Valley High School - T.O. No. 33
Date Sampled:	21-Apr-16
Date Received:	22-Apr-16
Matrix:	Soil
Authorization:	Signed Chain of Custody

Date of Report: 3-May-2016

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Resistivity (As Received) (ohms-cm)	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1604208-001	12207.5	450	6.41	-	6,000	-	N.D.	N.D.

	Redox	pH	Resistivity (As Received)	Resistivity (100% Saturation)	Sulfide	Chloride	Sulfate
Method:	ASTM D1498	ASTM D4972	ASTM G57	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	-	-	50	15	15
Date Analyzed:	28-Apr-2016	28-Apr-2016	-	28-Apr-2016	-	28-Apr-2016	28-Apr-2016

* Results Reported on "As Received" Basis

N.D. - None Detected

Cheryl McMillen
Laboratory Director

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

Page No. 1

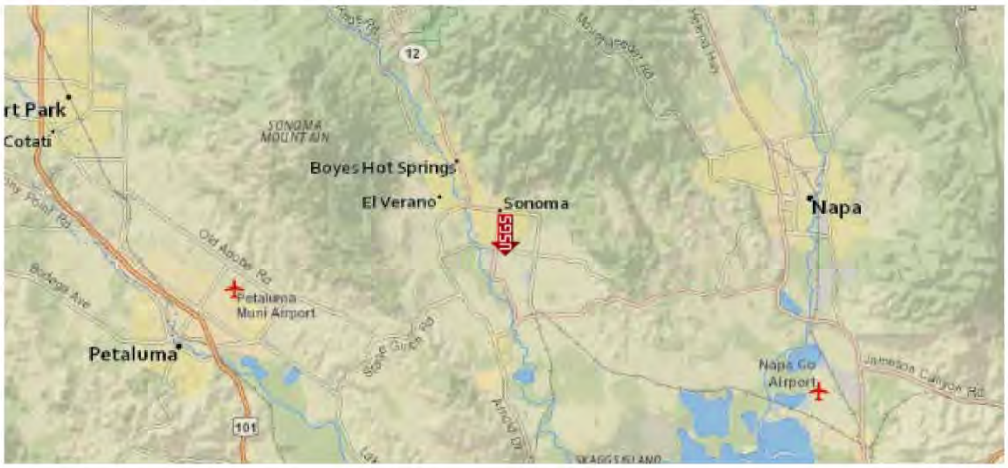
APPENDIX D

USGS Design Maps Summary Report

USGS Design Maps Summary Report

User–Specified Input

Report Title	Sonoma Valley High School Mon October 8, 2018 21:38:52 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	38.28155°N, 122.45552°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

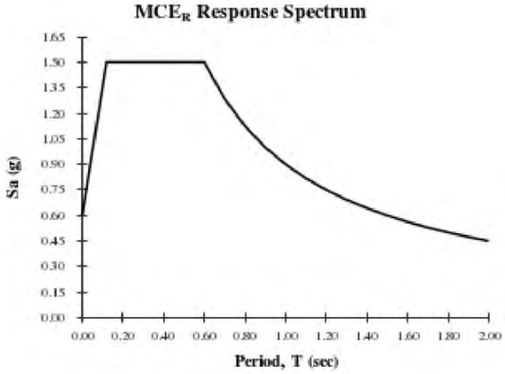


USGS–Provided Output

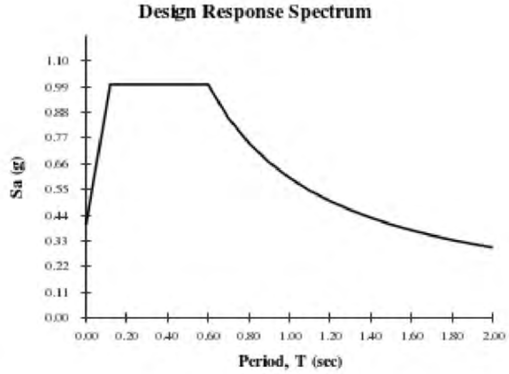
S_S =	1.500 g	S_{MS} =	1.500 g	S_{DS} =	1.000 g
S_1 =	0.600 g	S_{M1} =	0.900 g	S_{D1} =	0.600 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (38.28155°N, 122.45552°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] S_S = 1.500 g

From Figure 22-2 [2] S_1 = 0.600 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_S$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index *PI* > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_S = 1.500 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.600 g, F_v = 1.500

Equation (11.4–1):	$S_{MS} = F_a S_S = 1.000 \times 1.500 = 1.500$ g
Equation (11.4–2):	$S_{M1} = F_v S_1 = 1.500 \times 0.600 = 0.900$ g

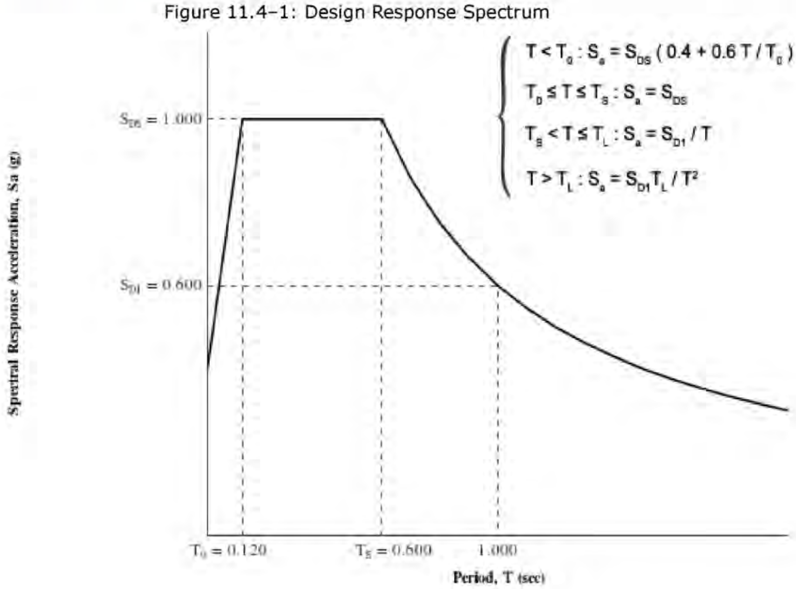
Section 11.4.4 — Design Spectral Acceleration Parameters

Equation (11.4–3):	$S_{DS} = ⅔\, S_{MS} = ⅔ \times 1.500 = 1.000$ g
Equation (11.4–4):	$S_{D1} = ⅔\, S_{M1} = ⅔ \times 0.900 = 0.600$ g

Section 11.4.5 — Design Response Spectrum

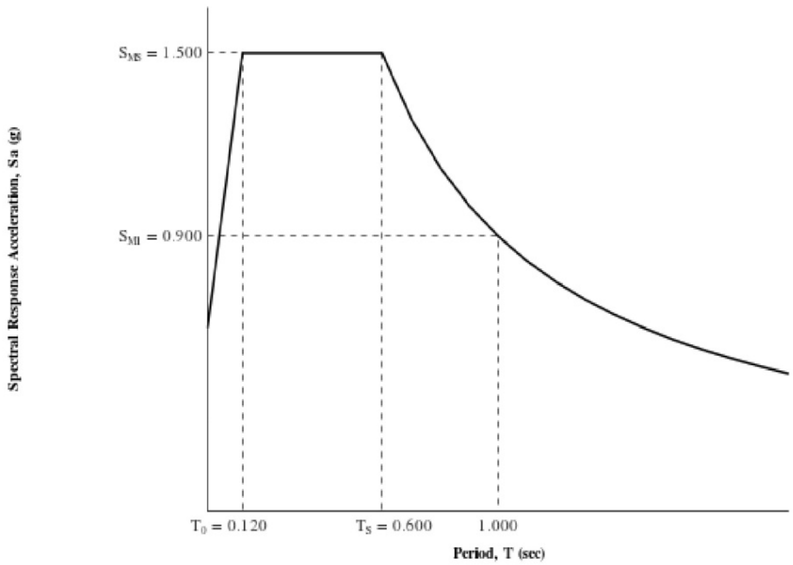
From Figure 22-12 [3]	T_L = 8 seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4]	PGA = 0.525
Equation (11.8–1):	$PGA_M = F_{PGA}PGA = 1.000 \times 0.525 = 0.525$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.525 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5]	C_{RS} = 1.044
From Figure 22-18 [6]	C_{R1} = 1.029

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
S_{DS} < 0.167g	A	A	A
0.167g ≤ S_{DS} < 0.33g	B	B	C
0.33g ≤ S_{DS} < 0.50g	C	C	D
0.50g ≤ S_{DS}	D	D	D

For Risk Category = I and S_{DS} = 1.000 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
S_{D1} < 0.067g	A	A	A
0.067g ≤ S_{D1} < 0.133g	B	B	C
0.133g ≤ S_{D1} < 0.20g	C	C	D
0.20g ≤ S_{D1}	D	D	D

For Risk Category = I and S_{D1} = 0.600 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

APPENDIX E

Liquefaction Potential and Induced Vertical Settlement Calculations

Project: Sonoma Valley High School, Field Project
Project #: 12207.05.1
Date: 10/10/2018
Boring: B-1

Input Parameters:

Peak Ground Accel (g) =	0.525		
Earthquake Magnitude, M =	7.0		
Water Table Depth (m) =	1.5	(ft)	5.00
Average γ Above Water Table (kN/m^3) =	17.4	(lb/ft^3)	111
Average γ Below Water Table (kN/m^3) =	18.2	(lb/ft^3)	116
Borehole Diameter (mm) =	177.80	(in)	7
Requires Correction for Sample Liners (YES/NO):	no		
Rod Lengths Assumed Equal to the Depth Plus	1.5	m (for the above ground extension)	
Gravity Acceleration (m/sec^2)	9.81		
Height of Exposed Face (m)	2	(ft)	8

Liquefaction Potential

SPT Sample Number	Depth (m)	Measured Depth (ft)	Measured N	Soil Type (USCS)	Flag "Clay"	Sat/Unsat	Fines Content (%)	Energy Ratio, ER (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for Fines Content	$(N_1)_{60\text{-}cs}$	Stress Reduct. Coeff, r_d	CSR	MSF_{max}	MSF for Sand	K_σ for Sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	Factor of Safety
1	0.30	1.00	5	CL		0	80	75	1.25	1.15	0.75	1.00	5.4	5	5	1.70	9.16	5.5	14.71	1.00	0.343	1.3	1.05	1.10	0.154	N.A.	N.A.
2	1.37	4.50	5	SC		0	30	75	1.25	1.15	0.75	1.00	5.4	24	24	1.70	9.16	5.4	14.53	0.99	0.339	1.3	1.05	1.10	0.152	N.A.	N.A.
3	2.74	9.00	11	GM		1	30	75	1.25	1.15	0.85	1.00	13.4	49	37	1.49	20.06	5.4	25.42	0.98	0.442	1.7	1.13	1.10	0.300	0.37	0.85
4	3.96	13.00	27	GM		1	30	75	1.25	1.15	0.85	1.00	33.0	71	47	1.22	40.37	5.4	45.74	0.96	0.495	2.2	1.21	1.10	2.000	2.00	2.00
5	5.49	18.00	100	GM		1	30	75	1.25	1.15	0.95	1.00	136.6	99	60	1.15	156.68	5.4	162.04	0.94	0.528	2.2	1.21	1.10	2.000	2.00	2.00
6	6.71	22.00	13	GC		1	30	75	1.25	1.15	0.95	1.00	17.8	121	70	1.15	20.49	5.4	25.85	0.92	0.541	1.8	1.13	1.06	0.312	0.38	0.69
7	8.23	27.00	35	SC		1	30	75	1.25	1.15	0.95	1.00	47.8	149	83	1.05	50.33	5.4	55.69	0.89	0.547	2.2	1.21	1.06	2.000	2.00	2.00
8	10.06	33.00	96	SC		1	30	75	1.25	1.15	1	1.00	138.0	182	98	1.01	138.96	5.4	144.32	0.86	0.544	2.2	1.21	1.01	2.000	2.00	2.00
9	11.28	37.00	54	ML		1	60	75	1.25	1.15	1	1.00	77.6	204	109	0.98	76.15	5.6	81.75	0.84	0.539	2.2	1.21	0.98	2.000	2.00	2.00
10	12.65	41.50	47	GP-GM		1	10	75	1.25	1.15	1	1.00	67.6	229	120	0.96	64.54	1.1	65.69	0.81	0.530	2.2	1.21	0.95	2.000	2.00	2.00

Liquefaction Potential

Liquefaction Induced Settlement and Lateral Spreading

Depth (m)	Depth (ft)	Limiting Shear Strain γ_{lim}	Parameter F_α	Maximum Shear Strain γ_{max}	ΔH_i (m)	ΔLDI_i (m)	ΔLDI_i (in)	Vertical Reconsol. Strain ε_v	ΔS_i (m)	ΔS_i (in)
0.30	1.00	0.284	0.766	0.000	0.30	0.000	0.0	0.000	0.000	0.00
1.37	4.50	0.290	0.773	0.000	1.07	0.000	0.0	0.000	0.000	0.00
2.74	9.00	0.084	0.206	0.050	1.37	0.000	0.0	0.012	0.002	0.10
3.96	13.00	0.002	-1.247	0.000	1.22	0.000	0.0	0.000	0.000	0.00
5.49	18.00	0.000	-12.250	0.000	1.52	0.000	0.0	0.000	0.000	0.00
6.71	22.00	0.080	0.180	0.073	1.22	0.000	0.0	0.017	0.003	0.12
8.23	27.00	0.000	-2.059	0.000	1.52	0.000	0.0	0.000	0.000	0.00
10.06	33.00	0.000	-10.440	0.000	1.83	0.000	0.0	0.000	0.000	0.00
11.28	37.00	0.000	-4.357	0.000	1.22	0.000	0.0	0.000	0.000	0.00
12.65	41.50	0.000	-2.915	0.000	1.37	0.000	0.0	0.000	0.000	0.00
					LDI=	0.00 (m)	0.0 (in)	S=	0.005 (m)	0.21 (in)

Project: Sonoma Valley High School, Field Project
Project #: 12207.05.1
Date: 10/10/2018
Boring: B-17

Input Parameters:

Peak Ground Accel (g) =	0.525			
Earthquake Magnitude, M =	7.0			
Water Table Depth (m) =	1.5		(ft)	5.00
Average γ Above Water Table (kN/m³) =		17.4	(lb/ft³)	111
Average γ Below Water Table (kN/m³) =		18.2	(lb/ft³)	116
Borehole Diameter (mm) =	177.80		(in)	7
Requires Correction for Sample Liners (YES/NO):			no	
Rod Lengths Assumed Equal to the Depth Plus		1.5	m (for the above ground extension)	
Gravity Acceleration (m/sec²)		9.81		
Height of Exposed Face (m)		2	(ft)	8

Liquefaction Potential

SPT Sample Number	Depth (m)	Measured Depth (ft)	Measured N	Soil Type (USCS)	Flag "Clay"	Sat/Unsat	Fines Content (%)	Energy Ratio, ER (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for Fines Content	$(N_1)_{60\text{-}cs}$	Stress Reduct. Coeff, r_d	CSR	MSF_{max}	MSF for Sand	K_σ for Sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	Factor of Safety
1	1.37	4.50	15	SM		0	30	75	1.25	1.15	0.75	1.00	16.2	24	24	1.65	26.73	5.4	32.10	0.99	0.339	2.1	1.20	1.10	0.654	N.A.	N.A.
2	2.29	7.50	22	SM		1	30	75	1.25	1.15	0.8	1.00	25.3	40	33	1.39	35.19	5.4	40.56	0.98	0.412	2.2	1.21	1.10	2.000	2.00	2.00
3	2.74	9.00	20	SC		1	30	75	1.25	1.15	0.85	1.00	24.4	49	37	1.36	33.29	5.4	38.65	0.98	0.442	2.2	1.21	1.10	2.000	2.00	2.00
4	4.27	14.00	44	SM		1	30	75	1.25	1.15	0.85	1.00	53.8	77	50	1.21	64.81	5.4	70.17	0.96	0.504	2.2	1.21	1.10	2.000	2.00	2.00
5	5.18	17.00	37	SM		1	30	75	1.25	1.15	0.95	1.00	50.5	93	57	1.16	58.64	5.4	64.00	0.94	0.524	2.2	1.21	1.10	2.000	2.00	2.00
6	7.01	23.00	41	SM		1	30	75	1.25	1.15	0.95	1.00	56.0	127	73	1.09	61.04	5.4	66.40	0.91	0.543	2.2	1.21	1.10	2.000	2.00	2.00
7	8.38	27.50	27	SM		1	30	75	1.25	1.15	0.95	1.00	36.9	152	84	1.05	38.75	5.4	44.11	0.89	0.547	2.2	1.21	1.05	2.000	2.00	2.00
8	9.14	30.00	23	CL		1	60	75	1.25	1.15	1	1.00	33.1	165	91	1.03	34.15	5.6	39.75	0.88	0.547	2.2	1.21	1.03	2.000	2.00	2.00

Liquefaction Potential

Liquefaction Induced Settlement and Lateral Spreading

Depth (m)	Depth (ft)	Limiting Shear Strain γ_{lim}	Parameter F_α	Maximum Shear Strain γ_{max}	ΔH_i (m)	ΔLDI_i (m)	ΔLDI_i (in)	Vertical Reconsol. Strain ε_v	ΔS_i (m)	ΔS_i (in)
1.37	4.50	0.034	-0.231	0.000	1.37	0.000	0.0	0.000	0.000	0.00
2.29	7.50	0.008	-0.846	0.000	0.91	0.000	0.0	0.000	0.000	0.00
2.74	9.00	0.011	-0.703	0.000	0.46	0.000	0.0	0.000	0.000	0.00
4.27	14.00	0.000	-3.310	0.000	1.52	0.000	0.0	0.000	0.000	0.00
5.18	17.00	0.000	-2.768	0.000	0.91	0.000	0.0	0.000	0.000	0.00
7.01	23.00	0.000	-2.978	0.000	1.83	0.000	0.0	0.000	0.000	0.00
8.38	27.50	0.003	-1.120	0.000	1.37	0.000	0.0	0.000	0.000	0.00
9.14	30.00	0.009	-0.785	0.000	0.76	0.000	0.0	0.000	0.000	0.00
					LDI=	0.00 (m)	0.0 (in)	S=	0.000 (m)	0.00 (in)

Project: Sonoma Valley High School, Field Project
Project #: 12207.05.1
Date: 10/10/2018
Boring: B-18

Input Parameters:

Peak Ground Accel (g) =	0.525			
Earthquake Magnitude, M =	7.0			
Water Table Depth (m) =	1.5		(ft)	5.00
Average γ Above Water Table (kN/m^3) =		17.4	(lb/ft^3)	111
Average γ Below Water Table (kN/m^3) =		18.2	(lb/ft^3)	116
Borehole Diameter (mm) =	177.80		(in)	7
Requires Correction for Sample Liners (YES/NO):			no	
Rod Lengths Assumed Equal to the Depth Plus		1.5	m (for the above ground extension)	
Gravity Acceleration (m/sec^2)		9.81		
Height of Exposed Face (m)		2	(ft)	8

Liquefaction Potential

SPT Sample Number	Depth (m)	Measured Depth (ft)	Measured N	Soil Type (USCS)	Flag "Clay"	Sat/Unsat	Fines Content (%)	Energy Ratio, ER (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	$\sigma_{vc'}$ (kPa)	C_N	$(N_1)_{60}$	ΔN for Fines Content	$(N_1)_{60\text{-cs}}$	Stress Reduct, Coeff, r_d	CSR	MSF_{max}	MSF for Sand	K_σ for Sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	Factor of Safety
1	1.07	3.50	10	SM		0	30	75	1.25	1.15	0.75	1.00	10.8	19	19	1.70	18.33	5.4	23.69	1.00	0.340	1.7	1.12	1.10	0.262	N.A.	N.A.
2	2.44	8.00	32	SM		1	30	75	1.25	1.15	0.8	1.00	36.8	43	34	1.33	48.91	5.4	54.27	0.98	0.423	2.2	1.21	1.10	2.000	2.00	2.00
3	3.66	12.00	15	SM		1	30	75	1.25	1.15	0.85	1.00	18.3	65	45	1.35	24.68	5.4	30.04	0.97	0.484	2.0	1.18	1.10	0.487	0.63	1.30
4	5.49	18.00	30	SM		1	30	75	1.25	1.15	0.95	1.00	41.0	99	60	1.15	47.00	5.4	52.37	0.94	0.528	2.2	1.21	1.10	2.000	2.00	2.00
5	7.01	23.00	40	SM		1	30	75	1.25	1.15	0.95	1.00	54.6	127	73	1.09	59.55	5.4	64.92	0.91	0.543	2.2	1.21	1.10	2.000	2.00	2.00
6	8.23	27.00	19	SM		1	30	75	1.25	1.15	0.95	1.00	25.9	149	83	1.07	27.75	5.4	33.11	0.89	0.547	2.2	1.21	1.05	0.774	0.98	1.79
7	9.14	30.00	50	SM		1	30	75	1.25	1.15	1	1.00	71.9	165	91	1.03	73.94	5.4	79.30	0.88	0.547	2.2	1.21	1.03	2.000	2.00	2.00

Liquefaction Potential

Liquefaction Induced Settlement and Lateral Spreading

Depth (m)	Depth (ft)	Limiting Shear Strain γ_{lim}	Parameter F_α	Maximum Shear Strain γ_{max}	ΔH_i (m)	ΔLDI_i (m)	ΔLDI_i (in)	Vertical Reconsol. Strain ε_v	ΔS_i (m)	ΔS_i (in)
1.07	3.50	0.104	0.311	0.000	1.07	0.000	0.0	0.000	0.000	0.00
2.44	8.00	0.000	-1.940	0.000	1.37	0.000	0.0	0.000	0.000	0.00
3.66	12.00	0.046	-0.091	0.019	1.22	0.000	0.0	0.004	0.000	-0.01
5.49	18.00	0.000	-1.782	0.000	1.83	0.000	0.0	0.000	0.000	0.00
7.01	23.00	0.000	-2.848	0.000	1.52	0.000	0.0	0.000	0.000	0.00
8.23	27.00	0.030	-0.302	0.005	1.22	0.000	0.0	0.001	0.000	-0.01
9.14	30.00	0.000	-4.133	0.000	0.91	0.000	0.0	0.000	0.000	0.00
					LDI=	0.00	0.0	S=	-0.001	-0.02
						(m)	(in)		(m)	(in)

Project: Sonoma Valley High School, Field Project
Project #: 12207.05.1
Date: 10/10/2018
Boring: B-22

Input Parameters:

Peak Ground Accel (g) =	0.525		
Earthquake Magnitude, M =	7.0		
Water Table Depth (m) =	1.5	(ft)	5.00
Average γ Above Water Table (kN/m³) =	17.4	(lb/ft³)	111
Average γ Below Water Table (kN/m³) =	18.2	(lb/ft³)	116
Borehole Diameter (mm) =	177.80	(in)	7
Requires Correction for Sample Liners (YES/NO):		no	
Rod Lengths Assumed Equal to the Depth Plus	1.5	m (for the above ground extension)	
Gravity Acceleration (m/sec²)	9.81		
Height of Exposed Face (m)	2	(ft)	8

Liquefaction Potential

SPT Sample Number	Depth (m)	Measured Depth (ft)	Measured N	Soil Type (USCS)	Flag "Clay"	Sat/Unsat	Fines Content (%)	Energy Ratio, ER (%)	C_E	C_B	C_R	C_S	N_{60}	σ_{vc} (kPa)	σ_{vc}' (kPa)	C_N	$(N_1)_{60}$	ΔN for Fines Content	$(N_1)_{60-cs}$	Stress Reduct, Coeff, r_d	CSR	MSF_{max}	MSF for Sand	K_σ for Sand	CRR for M=7.5 & σ_{vc}'=1atm	CRR	Factor of Safety
1	1.22	4.00	10	SM		0	30	75	1.25	1.15	0.75	1.00	10.8	21	21	1.70	18.33	5.4	23.69	1.00	0.340	1.7	1.12	1.10	0.262	N.A.	N.A.
2	2.13	7.00	16	SP-SM		1	30	75	1.25	1.15	0.8	1.00	18.4	38	32	1.49	27.42	5.4	32.78	0.98	0.400	2.2	1.21	1.10	0.731	0.97	2.00
3	3.35	11.00	30	SM		1	30	75	1.25	1.15	0.85	1.00	36.7	60	42	1.26	46.19	5.4	51.55	0.97	0.472	2.2	1.21	1.10	2.000	2.00	2.00
4	4.27	14.00	34	SM		1	30	75	1.25	1.15	0.85	1.00	41.5	77	50	1.21	50.08	5.4	55.44	0.96	0.504	2.2	1.21	1.10	2.000	2.00	2.00
5	5.94	19.50	28	ML		1	60	75	1.25	1.15	0.95	1.00	38.2	107	64	1.13	43.16	5.6	48.76	0.93	0.534	2.2	1.21	1.10	2.000	2.00	2.00
6	7.47	24.50	21	SM		1	30	75	1.25	1.15	0.95	1.00	28.7	135	77	1.09	31.32	5.4	36.69	0.91	0.545	2.2	1.21	1.08	1.620	2.00	2.00
7	8.99	29.50	11	SM		1	37	75	1.25	1.15	1	1.00	15.8	163	89	1.05	16.65	5.5	22.19	0.88	0.547	1.6	1.10	1.02	0.236	0.26	0.48
8	9.60	31.50	22	SM		1	30	75	1.25	1.15	1	1.00	31.6	174	95	1.02	32.29	5.4	37.65	0.87	0.546	2.2	1.21	1.02	2.000	2.00	2.00

Liquefaction Potential

Liquefaction Induced Settlement and Lateral Spreading

Depth (m)	Depth (ft)	Limiting Shear Strain γ_{lim}	Parameter F_α	Maximum Shear Strain γ_{max}	ΔH_i (m)	ΔLDI_i (m)	ΔLDI_i (in)	Vertical Reconsol. Strain ε_v	ΔS_i (m)	ΔS_i (in)
1.22	4.00	0.104	0.311	0.000	1.22	0.000	0.0	0.000	0.000	0.00
2.13	7.00	0.031	-0.279	0.000	0.91	0.000	0.0	0.000	0.000	0.00
3.35	11.00	0.000	-1.715	0.000	1.22	0.000	0.0	0.000	0.000	0.00
4.27	14.00	0.000	-2.038	0.000	0.91	0.000	0.0	0.000	0.000	0.00
5.94	19.50	0.001	-1.489	0.000	1.68	0.000	0.0	0.000	0.000	0.00
7.47	24.50	0.016	-0.558	0.000	1.52	0.000	0.0	0.000	0.000	0.00
8.99	29.50	0.124	0.398	0.124	1.52	0.000	0.0	0.021	0.008	0.33
9.60	31.50	0.014	-0.629	0.000	0.61	0.000	0.0	0.000	0.000	0.00
					LDI=	0.00	0.0	S=	0.008	0.33
						(m)	(in)		(m)	(in)

DISTRIBUTION

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Appendix F Noise Study

SONOMA VALLEY HIGH SCHOOL ATHLETIC FIELDS RENOVATION NOISE AND VIBRATION ASSESSMENT

Sonoma, California

September 19, 2019

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I&R Project: 18-121

INTRODUCTION

The Sonoma Valley High School Athletic Fields Renovation Project (Project) proposes to renovate and modernize the existing athletic fields with a new track & field, baseball and softball fields, and basketball courts. The Project would provide facilities to support the existing athletic field practices and events conducted by the high school, as well as community events held on the campus.

This report evaluates the project's potential to result in significant noise impacts with respect to the applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the General Plan Consistency section discusses land use compatibility utilizing noise-related policies in the City's General Plan; and 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts and provides a discussion of each project impact.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (*frequency*) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA)*. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (*DNL* or L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise - Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open windows and 65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, those facing major roadways and freeways typically need special glass windows.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sounds are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from “Historic and some old buildings” to “Modern industrial/commercial buildings”. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Threshold at which there is a risk of damage to fragile buildings with no risk of damage to most buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential structures
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to new residential and modern commercial/industrial structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background - Noise

The Sonoma Valley Unified School District (District) is the Lead Agency for preparation of this Environmental Impact Report (EIR) for the Project. The Project is located in the City of Sonoma. The State CEQA Guidelines, Appendix G, are used to assess the potential significance of environmental noise impacts.

State CEQA Guidelines. CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(b) Generation of excessive groundborne vibration or groundborne noise levels;

(c) For a project located within the vicinity of a private airstrip or an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels.

City of Sonoma General Plan. The Noise Element of the City of Sonoma's General Plan identifies policies that are intended to guide the development of new projects with regard to exposure to or generation of noise. These guidelines are used to assess the compatibility of a land use relative to the noise environment where the land use is proposed. The City does not identify noise and land use compatibility thresholds for school athletic facilities. Outdoor noise levels up to 60 dBA L_{dn} are considered 'normally acceptable' within outdoor public facilities such as neighborhood parks. The exterior 'normally acceptable' threshold for public buildings including school buildings is 65 dBA L_{dn}. There are no noise sensitive buildings proposed for the Project; therefore, the more conservative outdoor public facility standard of 60 dBA L_{dn} is used in this analysis.

The City limits stationary noise sources to hourly average noise levels of 50 dBA L_{eq} during daytime hours and 40 dBA L_{eq} during nighttime hours and maximum instantaneous noise levels to 70 dBA L_{max} during daytime hours and 60 dBA L_{max} during nighttime hours, as determined at the property line of the receiving land use. This standard would normally be applied to continuous ongoing noise sources, such as rooftop mechanical equipment or air conditioning equipment. The project does not propose any stationary noise sources; therefore, this limit is not applied.

City of Sonoma Municipal Code. Chapter 9.56.070 of the City's Municipal Code exempts athletic and recreational events and other activities performed on public parks, property owned by the school district, and other properties zoned as "Public" from the provisions of the noise chapter.

Under Section 9.56.050, construction, alteration, demolition, maintenance of construction equipment, deliveries of materials or equipment, or repair activities otherwise allowed under applicable law are allowed between 8:00 a.m. and 6:00 p.m., Monday through Friday, 9:00 a.m. and 6:00 p.m. on Saturday, and 10:00 a.m. and 6:00 p.m. on Sundays and holidays. The Code limits the construction noise level at any point outside of the property plane of the project to not exceed 90 dBA.

Regulatory Background - Vibration

There are no applicable Federal, state, or local quantitatively defined regulations relating to vibration resulting from construction activities. Thresholds for annoyance and structural damage reported by Caltrans (2013) are used in this analysis. Table 3 summarizes vibration damage thresholds.

Existing Noise Environment

The Project site is the Sonoma Valley High School (SVHS) Campus at 20000 Broadway, in the City of Sonoma. Proposed improvements are mostly located on approximately 16.8 acres of the northeastern portion of the campus, identified as the renovation area. Within the renovation area, existing athletic facilities include an athletic field that is used for soccer and other sports with a 7-lane all-weather track, three softball fields, and six basketball courts. The renovation area is surrounded by existing residences to the north, Prestwood Elementary to the northeast, residences to the east, SVHS Campus agricultural farm to the south, and SVHS Campus and Nathanson Creek Preserve and associated pedestrian trail to the west. Two improvements would be located outside of the renovation area: 1) utility connections at Denmark Street; and 2) six ADA compliant parking spaces that would be added south of the existing tennis courts and solar panels west of Nathanson Creek.

A noise monitoring survey was conducted from September 20th, 2018 through September 25th, 2018 to document existing noise conditions at the site and in the surrounding area. The noise monitoring survey included two long-term (5-day) measurements and one short-term (10-minute) measurement, shown in Figure 1. The primary noise sources at the project site include distant traffic noise and localized school activity noise.

Long-term site LT-1 was located on the north side of the site, adjacent to the rear yard of the residence at 235 MacArthur Lane. The measured noise levels at site LT-1 are shown in Figures 2, 3, 4, and 5. Hourly equivalent noise levels at LT-1 ranged from 50 to 57 dBA L_{eq} during weekday daytime periods, 44 to 56 dBA L_{eq} during the daytime period on Saturday, and 47 to 53 L_{eq} during the daytime period on Sunday. At night, hourly equivalent noise levels ranged from 36 to 52 dBA L_{eq} on weekdays, 35 to 47 dBA L_{eq} on Saturday, and 37 to 46 L_{eq} on Sunday. The Day/Night Average Noise Level (L_{dn}) ranged from 51 to 56 dBA L_{dn}.

Long-term site LT-2 was located on the east side of the site, adjacent to the rear yard of the residence at 300 Denmark Street. The measured noise levels at site LT-2 are shown in Figures 6, 7, 8, and 9. Hourly equivalent noise levels at LT-2 ranged from 47 to 53 dBA L_{eq} during weekday daytime periods, 44 to 60 dBA L_{eq} during the daytime period on Saturday, and 40 to 60 L_{eq} during the daytime period on Sunday. At night, hourly equivalent noise levels ranged from 35 to 49 dBA L_{eq} on weekdays, 35 to 42 dBA L_{eq} on Saturday, and 36 to 42 L_{eq} on Sunday. The Day/Night Average Noise Level (L_{dn}) ranged from 50 to 53 dBA L_{dn}.

Short-term site ST-1 was situated in front of the residence at 231 East MacArthur Street, approximately 300 feet north of the project site. The primary noise source at this location was vehicular traffic traveling along East MacArthur Street. School activities were inaudible during the short-term measurement, which was conducted from 12:20 pm to 12:30 pm on Tuesday, September 25th, 2018. The 10-minute average equivalent noise level at this location was 61 dBA L_{eq} and maximum instantaneous noise levels ranged from 69 to 78 dBA L_{max}.

FIGURE 1 Noise Measurement Locations

GENERAL PLAN CONSISTENCY ANALYSIS

The impacts of site constraints such as exposure of the proposed project to excessive levels of noise are not considered under CEQA. This section addresses Noise and Land Use Compatibility for consistency with the policies set forth in the City's General Plan for informational purposes.

Consistency Analysis Thresholds

The Noise Element of the City of Sonoma's General Plan identifies policies that are intended to guide the development of new projects with regard to exposure to or generation of noise. The City does not identify noise and land use compatibility thresholds for school athletic facilities; therefore, the outdoor public facility standard of 60 dBA L_{dn} is used as the most relevant standard in this analysis.

Noise and Land Use Compatibility

Proposed exterior use areas include the playing fields and basketball courts. The primary background noise source for these outdoor areas is distant traffic. The playing fields and basketball courts will be shielded on all sides from nearby traffic noise sources by surrounding buildings. Based on measurements made during the noise monitoring survey (see Setting Section), proposed outdoor areas would be exposed to noise levels of to 50 to 56 dBA L_{dn}. Noise levels at the school's playing fields and basketball courts would not exceed the City's acceptable exterior noise level criteria of 60 dBA L_{dn} for outdoor public facilities.

NOISE IMPACTS AND MITIGATION MEASURES

This section describes the significance criteria used to evaluate project impacts under CEQA and provides a discussion of each project impact. All project impacts were found to be less-than-significant. Therefore, mitigation measures are not necessary to provide a compatible project in relation to adjacent land uses.

Significance Criteria

The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- **Temporary or Permanent Noise Increases in Excess of Established Standards.** A significant impact would be identified if project construction or operations would result in a substantial temporary or permanent increase in ambient noise levels at sensitive receivers.

- **Generation of Excessive Groundborne Vibration.** The City of Sonoma does not specify a construction vibration limit; therefore, a significant impact would be identified if the construction of the project would expose persons to vibration levels exceeding the levels indicated in Table 3.

- **Exposure of Residents or Workers to Excessive Noise Levels in the Vicinity of a Private Airstrip or an Airport Land Use Plan.** A significant impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1 Temporary or Permanent Noise Increases in Excess of Established Standards. The project would not be anticipated to exceed local regulatory guidelines or result in a substantial temporary or permanent increase in ambient noise levels at sensitive receivers. **This is a less-than-significant impact.**

a. Permanent Noise from On-Site Operations

The City of Sonoma's Municipal Code specifically excepts athletic and recreational events and other activities performed on property owned by the school district from the regulations established in the Noise Ordinance. Therefore, criteria are applied to school activities in this assessment for comparative purposes only as a measure of the acceptability of community noise resulting from the project.

Existing Athletic Fields and Activities

Within the renovation area, existing athletic facilities include an athletic field that is used for soccer and other sports with a 7-lane all-weather track, three softball fields, and six basketball courts. Portable metal bleacher units are located adjacent to the softball fields. To the south of the athletic fields, the renovation area consists of managed grassland.

There are approximately 623 existing SVHS athletic and special events occurring on-campus from August through June each year. In addition, 429 SVHS athletic events are held at off-campus locations due to inadequacy of existing on-campus facilities. The off-campus events include varsity football and graduation, which typically have the highest attendance. In addition to SVHS events, the existing athletic fields support an estimated 166 non-SVHS events, including soccer, softball, and track & field for Adele Harrison Middle School and an array of community and youth groups. In total, more than 1,200 athletic and special events are held on- and off-campus throughout the year. The athletic fields are also used daily during the school year to support physical education classes at both SVHS and Adele Harrison Middle School.

Project Components

The Project would renovate and reorganize the existing track & field, softball and baseball fields, and basketball courts within approximately 16.8 acres of the SVHS Campus. Along the southern portion of the renovation area a biofiltration/detention basin would be constructed. Table 4 shows the existing and proposed future usage of the fields. As indicated in Table 4, many practices and events that are currently held off campus would be moved to the SVHS Campus with the Project. This includes Junior Varsity (JV) Soccer Games, Varsity Soccer games and practices, JV and Varsity Football Games, Cheer Games, JV Baseball practice and games, Lacrosse practice and games, and senior graduation. The project is also anticipated to result in 1 additional on-campus track competition. The remaining events would not change in frequency from what is currently occurring on-campus; however, the location of these events would shift as the fields are redeveloped and moved.

TABLE 4 Existing and Proposed Field Usage

Event Months, Days	Existing Usage			Proposed Usage			Changes	
	Field	Frequency	Average Attendance	Field	Frequency	Average Attendance	Frequency	Average Attendance
SVHS Boy's JV Soccer Practice Nov-Feb, M, W, F	Soccer Field	48	22	Soccer/Football/ Lacrosse/Track	48	22	No Change	
SVHS Boy's JV Soccer Games Nov-Feb, Vary	Off Campus			Soccer/Football/ Lacrosse/Track	6	30	6	30
SVHS Boys' Varsity Soccer Practice, Nov-Feb, M, W, F	Off Campus			Soccer/Football/ Lacrosse/Track	48	22	48	22
SVHS Boys' Varsity Soccer Games, Nov-Feb, Vary	Off Campus			Soccer/Football/ Lacrosse/Track	6	40	6	40
SVHS Girls JV Soccer Practice Nov-Feb, M-F	Soccer Field	80	16	Soccer/Football/ Lacrosse/Track	80	16	No Change	
SVHS Girls JV Soccer Games Nov-Feb, Vary	Off Campus			Soccer/Football/ Lacrosse/Track	8	35	8	35
SVHS Girls' Varsity Soccer Practice, Nov-Feb, M-F	Off Campus			Soccer/Football/ Lacrosse/Track	80	16	80	16
SVHS Girls' Varsity Soccer Games, Nov-Feb, Vary	Off Campus			Soccer/Football/ Lacrosse/Track	8	35	8	35
SVHS Football JV Practice Aug-Nov, M-TH	Soccer Field	64	40	Soccer/Football/ Lacrosse/Track	64	40	No Change	
SVHS Football JV Games Aug-Nov, F	Off Campus			Soccer/Football/ Lacrosse/Track	6	500	6	500
SVHS Football Varsity Practice Aug-Nov, M-TH	Soccer Field	64	40	Soccer/Football/ Lacrosse/Track	64	40	No Change	
SVHS Football Varsity Games (Homecoming) Aug-Nov, F	Off Campus			Soccer/Football/ Lacrosse/Track	6	1300 (2500)	6	1300 (2500)
SVHS Cross-Country Practice Sep-Nov, M-F	Track	2	25	Soccer/Football/ Lacrosse/Track	2	25	No Change	
SVHS Cheer Games Aug-Dec, n/a	Off Campus			Soccer/Football/ Lacrosse/Track	64	12	64	12
SVHS Baseball Frosh Practice Feb-May, M-F	Baseball Field	80	20	Freshman Baseball Field	80	20	No Change	

Event Months, Days	Existing Usage			Proposed Usage			Changes	
	Field	**Frequency**	**Average Attendance**	**Field**	**Frequency**	**Average Attendance**	**Frequency**	**Average Attendance**
SVHS Baseball Frosh Games Feb-May, M-F	Baseball Field	12	75	Freshman Baseball Field	12	75	No Change	
SVHS Baseball JV Practice Feb-May, M-F	Off Campus			JV/Varsity Baseball Field	80	20	80	20
SVHS Baseball JV Games Feb-May, M-F	Off Campus			JV/Varsity Baseball Field	12	40	12	40
SVHS Baseball Varsity Practice, Feb-May, M-Sat	Off Campus			JV/Varsity Baseball Field	Off Change		No Change	
SVHS Baseball Varsity Games Feb-May, M-Sat	Off Campus			JV/Varsity Baseball Field	Off Campus		No Change	
SVHS Softball JV Practice Mar-May, M-F	JV Softball Field	80	15	JV Softball Field	80	15	No Change	
SVHS Softball JV Games Mar-May, Vary	JV Softball Field	15	30	JV Softball Field	15	30	No Change	
SVHS Softball Varsity Practice Mar-May, M-F	Varsity Softball Field	80	15	Varsity Softball Field	80	15	No Change	
SVHS Softball Varsity Games Mar-May, Vary	Varsity Softball Field	15	40	Varsity Softball Field	15	40	No Change	
SVHS Track Practice Feb-May, M-F	Track	80	60	Soccer/Football/ Lacrosse/Track	80	60	No Change	
SVHS Track Competition Feb-May, M-F	Track	3	80	Soccer/Football/ Lacrosse/Track	3 (1)	80 (500)	1	500
SVHS Lacrosse Practice Feb-May, M, W, F	Off Campus			Soccer/Football/ Lacrosse/Track	48	20	48	20
SVHS Lacrosse Games Feb-May, Vary	Off Campus			Soccer/Football/ Lacrosse/Track	12	60	12	60
Senior Graduation, May	Off Campus			Soccer/Football/ Lacrosse/Track	1	2500	1	2500
Prestwood Elementary School P.E. Class Aug-May, M-F	Track	160	85	Track	160	85	No Change	

Event Months, Days	Existing Usage			Proposed Usage			Changes	
	Field	**Frequency**	**Average Attendance**	**Field**	**Frequency**	**Average Attendance**	**Frequency**	**Average Attendance**
Babe Ruth Baseball Mar-May, M-F	Freshman Baseball	26	12	Freshman Baseball Field	26	12	No Change	
Adele Track Mar-Apr, W, TH	Track	5	60	Track	5	60	No Change	
Adele Soccer Team Aug-Sep, T, TH	Soccer Field	24	30	Soccer Field	24	30	No Change	
Stack Traveling Softball Jan-May, Sun	Varsity Softball	16	15	Varsity Softball	16	15	No Change	
Sonoma Soccer Club Jun-Nov, M, W, F	Soccer Field	60	30	Soccer Field	60	30	No Change	
Sonoma Youth Soccer Association, May-Jun, Sat-Sun	Soccer Field & Track	10	30	Soccer Field & Track	10	30	No Change	
Nor Cal Throwers Sept-Oct, Sun	Soccer Field	3	7	Soccer Field	3	7	No Change	
Girls on the Run Sep-Nov, T, Th	Track	22	8	Track	22	8	No Change	

Soccer/Football/Lacrosse/Track Field

The track & field would be relocated to a central location on the west side of the renovation area, away from neighboring residences. Renovation would include an 8-lane all-weather track, an all-weather synthetic turf field, aluminum bleachers (1,300-person capacity), building to house team rooms, storage, and restrooms, buildings to house concessions and ticket sales, Public Address (PA) system, scoreboard, and field lighting.

Football Games and Graduation

Events with the highest attendance would be the regular season varsity football games held on six Friday evenings from August through November, including the homecoming game, and graduation. The typical Friday evening football schedule has a JV game starting around 4:30 p.m., with the varsity game kick-off at 7:00 or 7:30 p.m. Unless a varsity game goes into overtime, the games generally end at approximately 9:30 p.m., with cleanup completed by 11:00 p.m.

The typical number of persons in attendance at football games is expected to be 500 for a JV game and 1,300 for a Varsity game. The renovated track & field would have stationary home and visitor bleachers that can accommodate up to 1,300 visitors. It is estimated that full capacity (2,500) would occur during two special events at the track & field: homecoming and graduation. Homecoming occurs once in the fall and graduation occurs once at the close of the school year.

Based on measurements made at various high school football games in the Bay Area[1,2,3], the variation in spectator noise primarily depends upon the attendance and level of excitement generated by the game. The highest attendance events produce the highest noise levels. Otherwise, noise levels generated by the public address (PA) system or the referees' whistles would be about the same regardless of the number of people in attendance.

The nearest noise sensitive receptors include residences located about 480 feet to the east and 700 feet to the north of the center of the field. Existing ambient noise levels during the period of proposed Friday evening Varsity games were measured to be about 50 dBA L_{eq} at residences to the east (LT-2) and 56 dBA L_{eq} at residences to the north (LT-1). Existing day-night average ambient noise levels on Fridays are 52 dBA L_{dn} at residences to the east (LT-2) and 56 dBA L_{dn} at residences to the north (LT-1).

Table 5 summarizes hourly average noise levels expected at the nearest receivers, based on the number of spectators. Table 6 shows the calculated L_{dn} noise levels resulting from continuous football events occurring between the hours of 4:30 p.m. and 9:30 p.m.

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1 Santa Teresa High School Stadium Lighting Project, Environmental Noise Assessment, Illingworth & Rodkin, Inc., September 12, 2013.

2 Lynbrook High School Field Improvements and Lighting Project Environmental Noise Assessment, Illingworth & Rodkin, Inc., June 3, 2010.

3 Silver Creek High School Sports Lighting Project Environmental Noise Assessment, Prepared by Illingworth & Rodkin, Inc., September 9, 2013.

TABLE 5 Worst Hour Noise Levels during Football Events (L_{eq}, dBA)

Number of Spectators	Residences to East (480 feet)	Residences to North (700 feet)
500 (Typical JV)	59	56
1,300 (Capacity)	63	60
2,500 (Homecoming)	66	63

As shown in Table 5, football games would generate noise levels of about 66 dBA L_{eq} with 2,500 spectators, 63 dBA L_{eq} with 1,300 spectators, and about 59 dBA L_{eq} with 500 spectators at a distance of 480 feet from the center of the field, not taking shielding from structures or terrain into account. These noise levels would be 9 to 16 dBA above existing ambient levels during these same hours. At a distance of 700 feet, noise levels would be anticipated to be about 3 dB lower, resulting in levels that are about 0 to 7 dBA above existing ambient. Shielding from structures or terrain would be anticipated to provide an additional 5 to 20 dB of reduction.

TABLE 6 L_{dn} Resulting from Football Events between 4:30 PM and 9:30 PM (dBA)

Number of Spectators	Residences to East (480 feet)	Residences to North (700 feet)
500 (Typical JV)	52	49
1,300 (Capacity)	56	53
2,500 (Homecoming)	59	56

L_{dn} levels are not anticipated to exceed 60 dBA L_{dn} at adjacent residences due to football games or events, including the homecoming game and graduation. However, noise levels could exceed Friday ambient L_{dn} levels at residences to the east by 4 dBA L_{dn} during bleacher capacity games and by 7 dBA L_{dn} during the homecoming game and graduation. At residences to the north, the homecoming game and graduation noise levels would be similar in level to existing Friday ambient levels and capacity and JV games would be 3 to 7 dBA L_{dn} below ambient. Noise levels in the greater community (shielded receivers at distances greater than 1,000 feet from the site) would not exceed 55 dBA L_{eq} on an hourly average basis or 55 dBA L_{dn} as a result of evening football games.

Athletic and recreational events and other activities performed on property owned by the school district are exempt from the regulations established in the City of Sonoma Noise Ordinance. Given the small number of higher attendance events per year (seven, including graduation), the impact is **less-than-significant**.

Soccer, Lacrosse, and Track Activities

In comparison to football games, attendance for other athletic events would be considerably smaller, ranging on average from 12 to 80 attendees. These events happen throughout the school year, many of which already occur at the athletic fields. For example, track & field events already occur at the campus and have an estimated attendance of up to 80 attendees. Field lights would be used for after school practices and soccer games during daylight savings time (November through mid-March). After school practices and soccer games are anticipated to end by 6:00 pm.

Noise levels generated by track meets, soccer, and lacrosse games are generally limited to whistles and some cheering. Starting guns are used for track and field events. These activities are Based on noise monitoring of soccer games at other high schools with 100 to 200 spectators,[4,5] whistles and cheering would be anticipated to generate maximum noise levels of about 58 to 63 dBA L_{max} at locations adjoining the field and band practice would be anticipated to generate noise levels of 45 to 60 dBA L_{max}. Hourly average noise levels during field hockey, soccer, and lacrosse events would be anticipated to be about 60 dBA L_{eq} at a distance of about 100 feet from the center of the field, 46 dBA L_{eq} at residences to the east, located about 480 feet from the center of the field, and 43 dBA L_{eq} at residences to the north, located about 700 feet from the center of the field. Ambient noise levels at these residences during weekday after school hours (4:00 to 6:00 p.m.) range from 48 to 53 dBA L_{eq}. Event noise may occasionally be distinguishable at residences due to the characteristics of the noise sources, but would be well below ambient noise levels. In addition, many of these events are already taking place on the existing fields.

In addition to typical athletic events, the Project would include one track and field event with an attendance of 500 spectators. Noise levels generated by this event would be similar to those shown in Tables 5 and 6 for a 500-spectator football event.

Again, athletic and recreational events and other activities performed on property owned by the school district are exempt from the regulations established in the City of Sonoma Noise Ordinance. Track meets, soccer, and lacrosse games generate noise levels well below those resulting from football games and are in character with the existing use of the fields. This is a **less-than-significant** impact.

Public Announcement System

The PA system would be used during football games, track & field events, and graduation. The District has specified that the PA system be limited to a maximum sound pressure level of 55 dBA or less, measured at the property line. Speakers would be field aimed and adjusted for full coverage of bleachers and the field. Equipment would be adjusted and tuned for optimal sound performance and reduction of unwanted sound toward residences to the extent possible. After installation, the District has offered to retain a qualified acoustic engineer to test the public address system and ensure that noise does not exceed the sound pressure level of 55 dBA at surrounding residences to the extent possible. Assuming the PA system complies with this requirement, noise levels from the PA would be below those generated by spectator cheering and maximum noise levels generated by other ambient noise sources, such as local traffic and community activity. This is a **less-than-significant** impact.

[4] Silver Creek High School Sports Lighting Project Environmental Noise Assessment, Prepared by Illingworth & Rodkin, Inc., September 9, 2013.

[5] Santa Teresa High School Sports Lighting Project Environmental Noise Assessment, Prepared by Illingworth & Rodkin, Inc., September 12, 2013.

Softball and Baseball Fields

The softball and baseball fields would be reconfigured along the northern and eastern boundary of the renovation area. This would include the renovation of the existing softball field adjacent to the Denmark pedestrian access point, construction of a second softball field immediately north of the renovated field, and construction of one JV/Varsity baseball field and an open recreation field along the northern extent of the renovation area. No lights would be installed around the baseball field, softball fields, or the open recreational field.

Many of the softball and baseball events already occur at the athletic fields. Frosh baseball games and practices would be moved from the existing baseball field to the proposed JV/Varsity baseball field to the north. JV baseball games and practices would be moved from off-site to the new proposed field. Varsity baseball games and practices would continue to occur off-campus at Arnold Field. The Varsity softball field would be moved north of its existing configuration and reconfigured with the infield located away from residences to the east. The JV softball field would be moved to the east of its existing location.

Noise levels at the baseball and softball athletic fields would not be as prominent as the noise levels generated by football games due to much lower attendance (typically 15 to 40 attendees). Based on attended measurements conducted during similar high school sporting events with 100 to 200 spectators,[6] softball and baseball games can generate noise levels of up to about 57 dBA L_{eq} at a distance of 100 feet from the infield. Maximum noise levels of about 65 dBA L_{max} at 100 feet typically result from balls being hit and shouting from players and spectators.

Residences are located as close as about 260 feet north of the center of the JV baseball field infield, 120 feet east of the center of the Varsity softball field infield and 50 feet east of the center of the JV softball field infield. Residences to the east currently adjoin the existing Varsity softball field and soccer field and residences to the north currently adjoin the existing track. Noise levels generated with the proposed configuration would be similar to those occurring with the existing field activities. At a distance of 260 feet, JV baseball games would be anticipated to generate noise levels up to 49 dBA L_{eq}. Given the attendance anticipated at softball games and practices (typically 15 to 40 attendees), noise levels are anticipated to be below 55 dBA L_{eq} at residences adjoining these fields. Again, school activity noise may occasionally be distinguishable at residences due to the characteristics of the noise sources, but would generally be below ambient noise levels. Noise levels on a day-night hourly average are not anticipated to be affected. This is a **less-than-significant** impact.

Basketball Courts

The Project would relocate the six existing basketball courts to the southern end of the renovation area. These courts are currently located on the southwestern side of the site. The noise associated with the use of the hardscape areas is typically characterized by children yelling and playing and

[6] St. Mary's High School Athletic Field Environmental Noise Assessment, Prepared by Illingworth & Rodkin, Inc., February 23, 2007.

whistles during recess or physical education classes. Average noise levels generated during hardscape activities typically range from 59 to 67 dBA L_{eq} at a distance of 50 feet.

The closest hardscape court is proposed to be located about 100 feet from residences to the east. At this distance, noise levels would be anticipated to range from 53 to 61 dBA L_{eq}. Lighting and PA system use is not proposed for these areas, so activities would be limited to daylight hours. This is a **less-than-significant** impact.

Mitigation Measure 1a: None Required.

b. Permanent Noise Increases from Project Traffic

Neither the City of Sonoma nor the State of California define the traffic noise level increase that is considered substantial. A significant impact would typically be identified if project generated traffic were to result in a permanent noise level increase of 3 dBA L_{dn} or greater in a residential area where the resulting noise environment would exceed or continue to exceed 60 dBA L_{dn} or result in a permanent noise increase of 5 dBA L_{dn} or greater in a residential area where the resulting in a noise environment would continue to be 60 dBA L_{dn} or less. For reference, existing traffic volumes would have to double for noise levels to increase by 3 dBA L_{dn}.

Traffic data provided in the project's Traffic Impact Study[7] was reviewed to calculate potential traffic noise level increases attributable to the project expected along roadways serving the site. Roadways evaluated in the analysis included Broadway, Napa Street, 5th Street West, East MacArthur Street, Newcomb Street, and Napa Road. Three project traffic scenarios were evaluated; 1) a midweek event with 60 attendees, representing sports practices, 2) a worst-case 1,500-person event, representing typical Friday evening football games (1,000 attendees) with an overlapping second event (500 attendees), and 3) 2,500-person events representing either a highly attended football game, such as Homecoming, or a graduation ceremony. Roadway link traffic volumes under the existing plus project scenario were compared to existing conditions to calculate the traffic noise increase attributable to the project.

The data indicate that traffic volumes in the site vicinity will increase as a result of the proposed project. The midweek sports practices with 60 attendees resulted in traffic noise increases of less than 1 dBA L_{eq} during the midweek PM peak hour, the overlapping Friday evening football game with 1,500 attendees resulted in traffic noise increases of 0 to 1 dBA L_{eq} during the Friday PM peak hour, and the highly attended 2,500 attendee event resulted in traffic noise increases of 0 to 2 dBA L_{eq} during the Friday PM peak hour. Given that event traffic would be isolated to time periods surrounding the event, the daily average noise level increases would be anticipated to be lower.

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7 Traffic Impact Study for the SVHS Track and Field Renovation Project, W-Trans, September 3, 2019.

Traffic noise increases resulting from the proposed project would not increase ambient traffic noise levels by 3 dBA L_{dn} or more at noise sensitive receptors in the vicinity. This is a **less-than-significant** impact.

Mitigation Measure 1b: None required.

c. Temporary Noise Increases from Project Construction

The significance of temporary noise increases resulting from construction depend upon the noise levels generated by various pieces of construction equipment, the timing and duration of noise-generating activities, the distance between construction noise sources and noise-sensitive areas, and the presence of intervening shielding features such as buildings or terrain. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time. The City of Sonoma's Municipal Code specifies hours of construction and limits the construction noise level at any point outside of the property plane of the project to 90 dBA or less.

Construction activities would be carried out in stages. During each stage of construction, there would be a different mix of equipment operating, and noise levels would vary by stage and vary within stages, based on the amount of equipment in operation and the location at which the equipment is operating. Typical construction noise levels at a distance of 50 feet are shown in Tables 7 and 8. Table 7 shows the average noise level range by construction phase and Table 8 shows the maximum noise level range for different construction equipment. Table 8 levels are consistent with construction noise levels calculated for the project in the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM), including the anticipated equipment that would be used for each phase of the project. Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain can provide an additional 5 to 10 dBA noise reduction at distant receptors.

TABLE 7 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	**II**	**I**	**II**	**I**	**II**	**I**	**II**
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

Source: USE.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 8 Construction Equipment 50-Foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

[1] Measured at 50 feet from the construction equipment, with a “slow” (1 sec.) time constant.

[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

[3] Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

The Project includes demolition and removal of the existing athletic fields, and approximately 39,000 square feet of pavement (existing basketball courts), and mass grading on the entire 16.8-acre renovation area to prepare for installation of the new facilities. Two improvements would be located outside of the renovation area: 1) utility connections at Denmark Street; and 2) six ADA compliant parking spaces that would be added south of the existing tennis courts and solar panels west of Nathanson Creek. Construction of the project is anticipated to begin in May 2020 and would take approximately 12 to 14 months. The anticipated workday hours are 8:00 a.m.to 6:00 p.m. Monday through Friday, 9:00 a.m. to 6:00 p.m. on Saturday, and 10:00 a.m. to 6:00 p.m. on Sundays and holidays. These work hours are consistent with Section 9.56.050 of the City of Sonoma Municipal Code. This schedule has been developed so that the bulk of construction activities, including demolition and grading, could occur through the summer months to minimize conflict with school activities.

Project construction equipment is anticipated to include backhoes, forklifts, pick-up trucks, concrete mixer trucks, front-end loaders, rollers, dump trucks, graders, scrapers, and excavators. Most of the heavy equipment would be used during the first two to three months of construction, during site preparation and grading. The concrete mixer and pick-up trucks would be used throughout construction, including bleacher construction, track installation, and paving. Pile driving would not be used as a method of construction.

Table 9 provides noise levels for the default number of construction equipment that may be anticipated for the project, based on the California Emissions Estimator Model® (CalEEMod) Default Parameters and Assumptions. Noise levels for default construction equipment were calculated using the Federal Highway Administration (FHWA) software - Roadway Construction Noise Model (RCNM). As shown in Table 8, maximum instantaneous noise levels would be anticipated to range from 75 to 90 dBA L_{max} and hourly average noise levels are anticipated to range from 74 to 88 dBA L_{eq} at a distance of 50 feet during periods of heavy construction. \

Noise sensitive uses surrounding the primary construction site include residences to the north, Prestwood Elementary to the northeast, residences to the east, SVHS Campus agricultural farm to the south, and SVHS classrooms, Nathanson Creek Preserve and associated pedestrian trail to the west. The proposed parking spaces would be surrounded by existing SVHS uses. Utility connections would be located a short distance down Denmark Street, adjacent to residences. Construction for the Denmark Street utility connection would be limited in duration to a period of a few weeks.

TABLE 9 Construction Noise Levels for Default Construction Equipment

Construction Phase	Equipment	Number	Noise Level at 50 feet	
			L_{max}, dBA	L_{eq}, dBA
Demolition (1 month)	Concrete/Industrial Saw	1	90	86
	Excavator	3	81	
	Rubber Tired Dozers	2	82	
Site Preparation and Grading 10 months	Rubber Tired Dozers	3	82	86
	Tractors/Loaders/Backhoes	4	84	
	Excavators	2	81	88
	Graders	1	85	
	Rubber-Tired Dozers	1	82	
	Scrapers	2	84	
	Tractors/Loaders/Backhoes	2	84	
Building Construction (5 months)	Cranes	1	81	84
	Forklifts	3	75	
	Generator Sets	1	81	
	Tractors/Loaders/Backhoes	3	84	
	Welders	1	74	
Paving (7 months)	Pavers	2	77	86
	Paving Equipment	2	85	
	Rollers	2	80	
Architectural Coating (2 months)	Air Compressor	1	78	74

Source: CalEEMod Default equipment modeled using RCNM.

Construction would be expected to comply with the City's allowable construction hours. Only use of the concrete/industrial saw within 50 feet of shared property lines would exceed the City's 90 dBA noise limit. Use of the concrete/industrial saw is not anticipated to occur within 50 feet of shared property lines, given that existing paved areas to be demolished are located primarily in the central portions of the site (existing basketball courts) and all existing paved areas are 60 feet or greater from shared property lines. Therefore, noise levels from construction would also be anticipated to comply with the construction noise thresholds. This is a **less-than-significant** impact. In addition, the Project proposes to include the following best management practices:

- Construction will be limited to between the hours of 8:00 a.m. and 6:00 p.m. on Monday through Friday, 9:00 a.m. to 6:00 p.m. on Saturday, and 10:00 a.m. to 6:00 p.m. on Sundays and holidays, in compliance with the City of Sonoma Municipal Code.

- Construction equipment will be well maintained and used judiciously to be as quiet as practical.

- "Quiet" models of air compressors and other stationary noise sources will be utilized where technology exists and when feasible.

- Unnecessary idling of internal combustion engines will be prohibited and all internal combustion engine-driven equipment will be equipped with intake and exhaust mufflers which are in good condition and appropriate for the equipment.

- All stationary noise-generating equipment, such as air compressors and portable power generators, will be located as far away as possible from residences, school buildings or other noise-sensitive land uses.

- All internal combustion engine-driven equipment will be equipped with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Radios will not be permitted at the project site during construction.

- Prior to the start of construction, the District will designate a "disturbance coordinator" who will be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem be implemented. The District will conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

Mitigation Measure 1c: None required.

Impact 2 **Exposure to Excessive Groundborne Vibration due to Construction.** The proposed project will not result in excessive groundborne vibration at structures in the vicinity. **This is a less-than-significant impact.**

The City of Sonoma does not specify a construction vibration limit. For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for new residential and modern commercial/industrial structures, 0.3 in/sec PPV for older residential structures, and a conservative limit of 0.25 in/sec PPV for historic and some old buildings (see Table 3). The 0.3 in/sec PPV vibration limit would be applicable to properties in the vicinity of the project site.

Project construction equipment is anticipated to include backhoes, forklifts, pick-up trucks, concrete mixer trucks, front-end loaders, rollers, dump trucks, graders, scrapers, and excavators.

Pile driving is not anticipated as a method of construction. Table 10 presents typical vibration levels from construction equipment at a reference distance of 25 feet and at distances representative of the nearest structures to the project site. Vibration levels were calculated from the reference level assuming an attenuation drop off rate of $(D_{ref}/D)^{1.1}$, where D is the distance from the source in feet and D_{ref} is the reference distance of 25 feet. Vibration levels vary depending on soil conditions, construction methods, and equipment used.

TABLE 10 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Vibration Levels at Nearest Surrounding Building Façades (in/sec PPV)			
			North (20 ft.)	East (35 ft.)	West (140 ft.)	South (250 ft.)
Clam shovel drop		0.202	0.258	0.140	0.030	0.016
Hydromill (slurry wall)	in soil	0.008	0.010	0.006	0.001	0.001
	in rock	0.017	0.022	0.012	0.003	0.001
Vibratory Roller		0.210	0.268	0.145	0.032	0.017
Hoe Ram		0.089	0.114	0.061	0.013	0.007
Large bulldozer		0.089	0.114	0.061	0.013	0.007
Caisson drilling		0.089	0.114	0.061	0.013	0.007
Loaded trucks		0.076	0.097	0.052	0.011	0.006
Jackhammer		0.035	0.045	0.024	0.005	0.003
Small bulldozer		0.003	0.004	0.002	0.000	0.000

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006 and modified by Illingworth & Rodkin, Inc., September 2019.

As indicated in Table 9, vibration levels generated by proposed activities and equipment would be below the 0.3 in/sec PPV criteria when construction occurs at distances of 20 feet or greater from sensitive structures. Vibration levels generated by construction activities would be perceptible indoors when construction is located adjacent to structures and secondary vibration, such as a slight rattling of windows or doors, may be considered annoying at times. However, architectural damage to normal residential structures would not be anticipated and vibration levels would be below those anticipated to cause structural damage. In addition, construction would occur during daytime hours only, thus reducing the potential for residential annoyance during typical periods of rest or sleep. This is a **less-than-significant** impact.

Mitigation Measure 2: None Required.

Impact 3 **Exposure of Residents or Workers to Excessive Noise Levels in the Vicinity of a Private Airstrip or an Airport Land Use Plan.** The project site would not be exposed to aircraft noise levels of 65 dBA CNEL or greater. **This is a less-than-significant impact.**

The project site is located approximately 1.7 miles northwest of Sonoma Skypark, which is the closest airport/airstrip to the site. Based on a review of Figure AT-7 of the Sonoma County General

Plan 2020 Air Transportation Element[8], the project site is located outside of the ALUC referral area and the airport's 55 dBA CNEL noise contour. Aircraft associated with Sonoma Skypark would not be expected to expose persons to excessive airport-related noise. This is a **less-than-significant** impact.

Mitigation Measure 3: None Required.

[8] Sonoma County General Plan 2020 Air Transportation Element, Figure AT-7 Projected Noise Contours and Referral Area, Sonoma Skypark Airport, September 23, 2008. Accessed via https://sonomacounty.ca.gov/PRMD/Long-Range-Plans/General-Plan/Air-Transportation-Sonoma-Skypark-Airport/ on September 3, 2019.

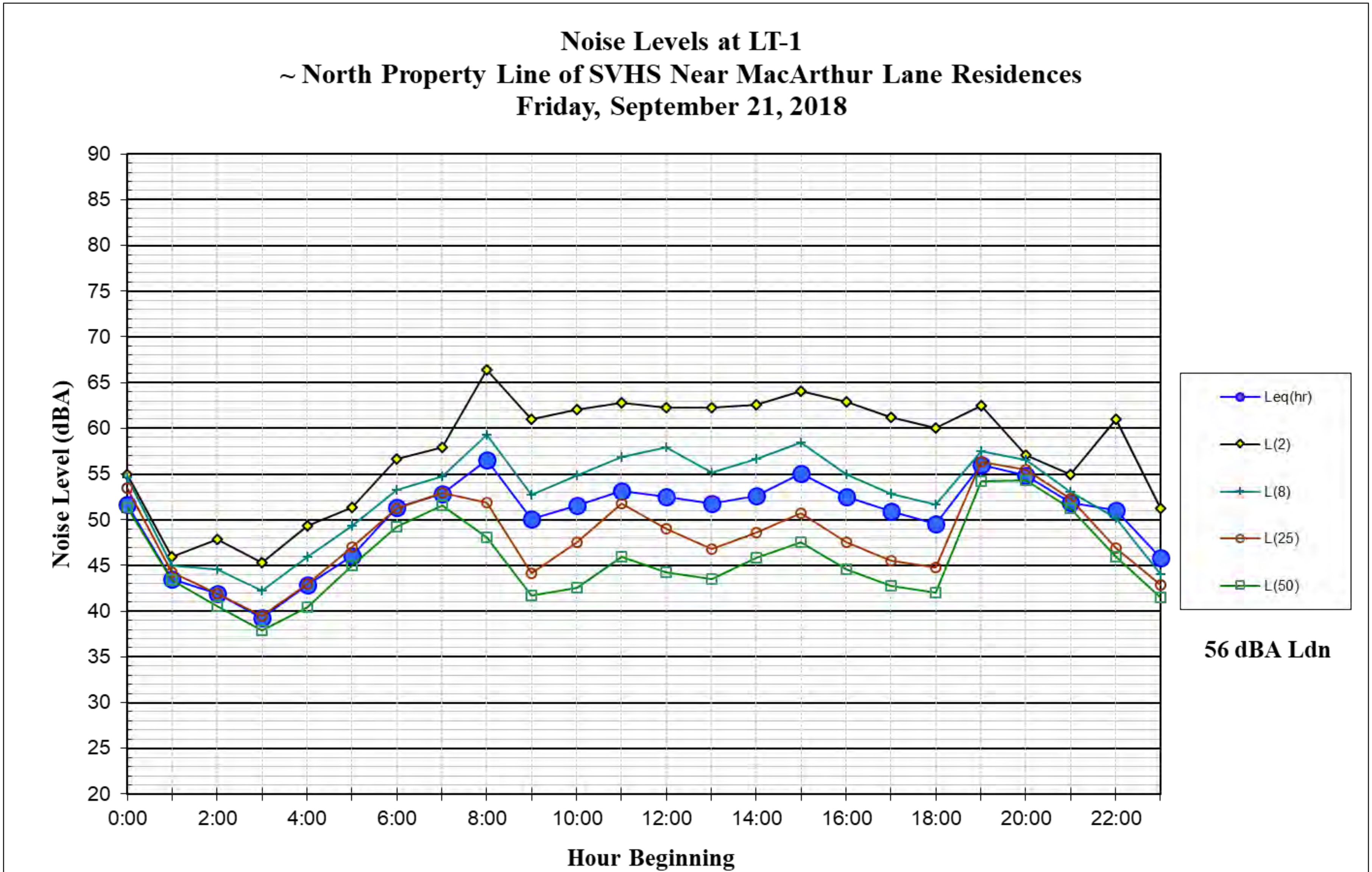
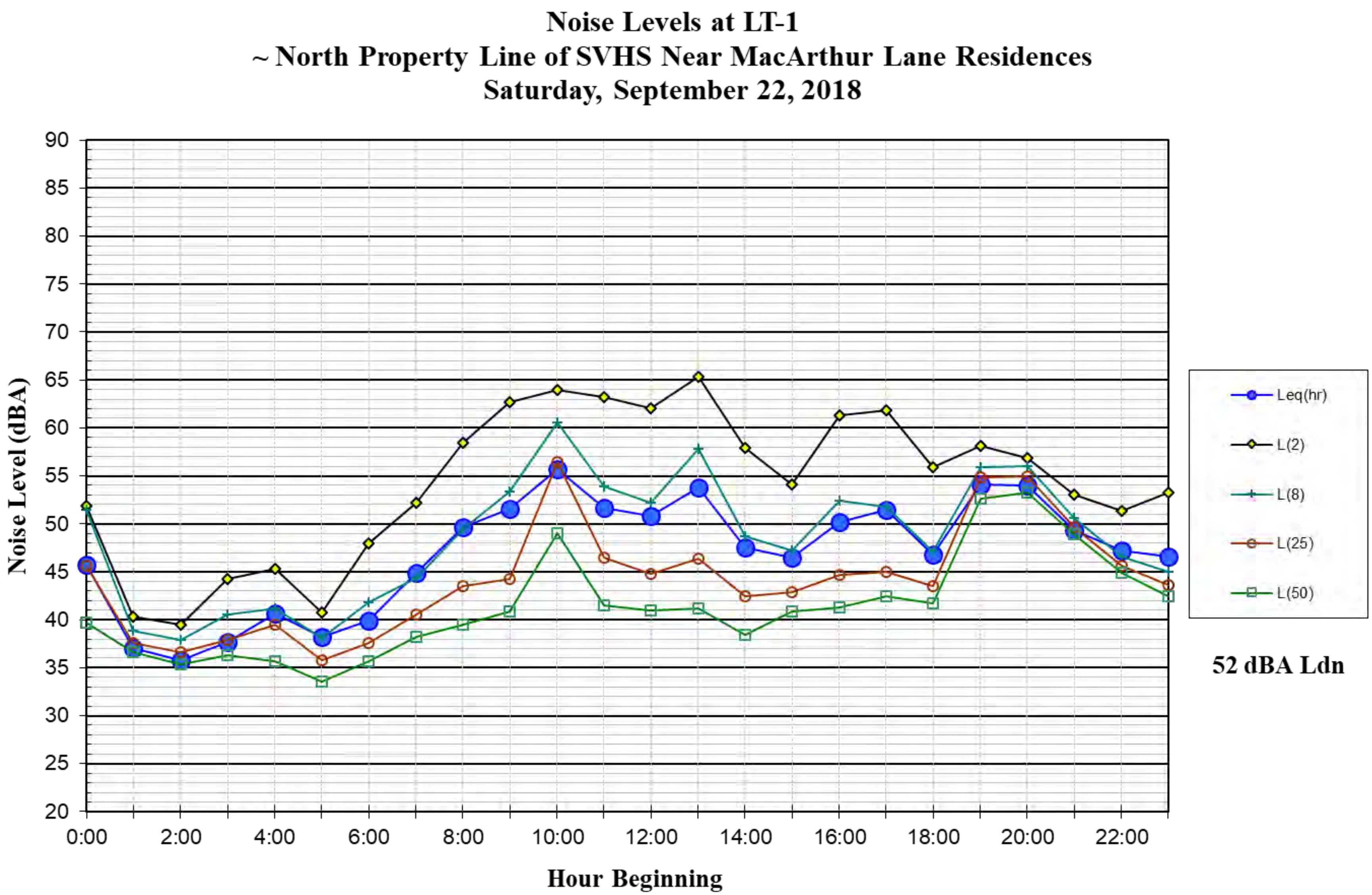

Noise Levels at LT-1
~ North Property Line of SVHS Near MacArthur Lane Residences
Friday, September 21, 2018
Noise Level (dBA)
Hour Beginning
Leq(hr)
L(2)
L(8)
L(25)
L(50)
56 dBA Ldn

Figure 2



Noise Levels at LT-1
~ North Property Line of SVHS Near MacArthur Lane Residences
Saturday, September 22, 2018
Noise Level (dBA)
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85
80
75
70
65
60
55
50
45
40
35
30
25
20
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
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Hour Beginning
Leq(hr)
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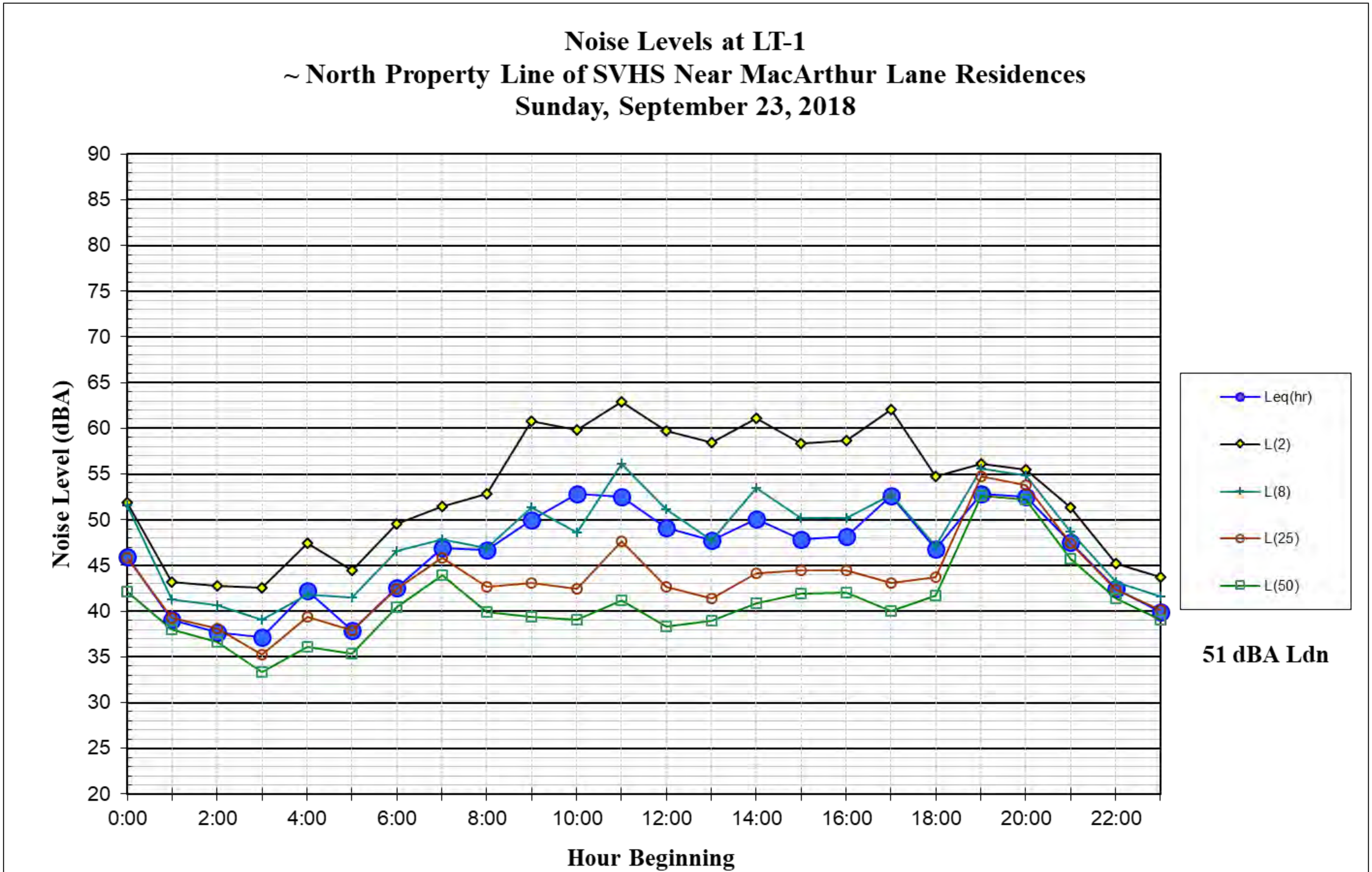
L(8)
L(25)
L(50)
52 dBA Ldn

Figure 3


Noise Levels at LT-1
~ North Property Line of SVHS Near MacArthur Lane Residences
Sunday, September 23, 2018
90
85
80
75
70
65
60
55
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35
30
25
20
Noise Level (dBA)
0:00
2:00
4:00
6:00
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10:00
12:00
14:00
16:00
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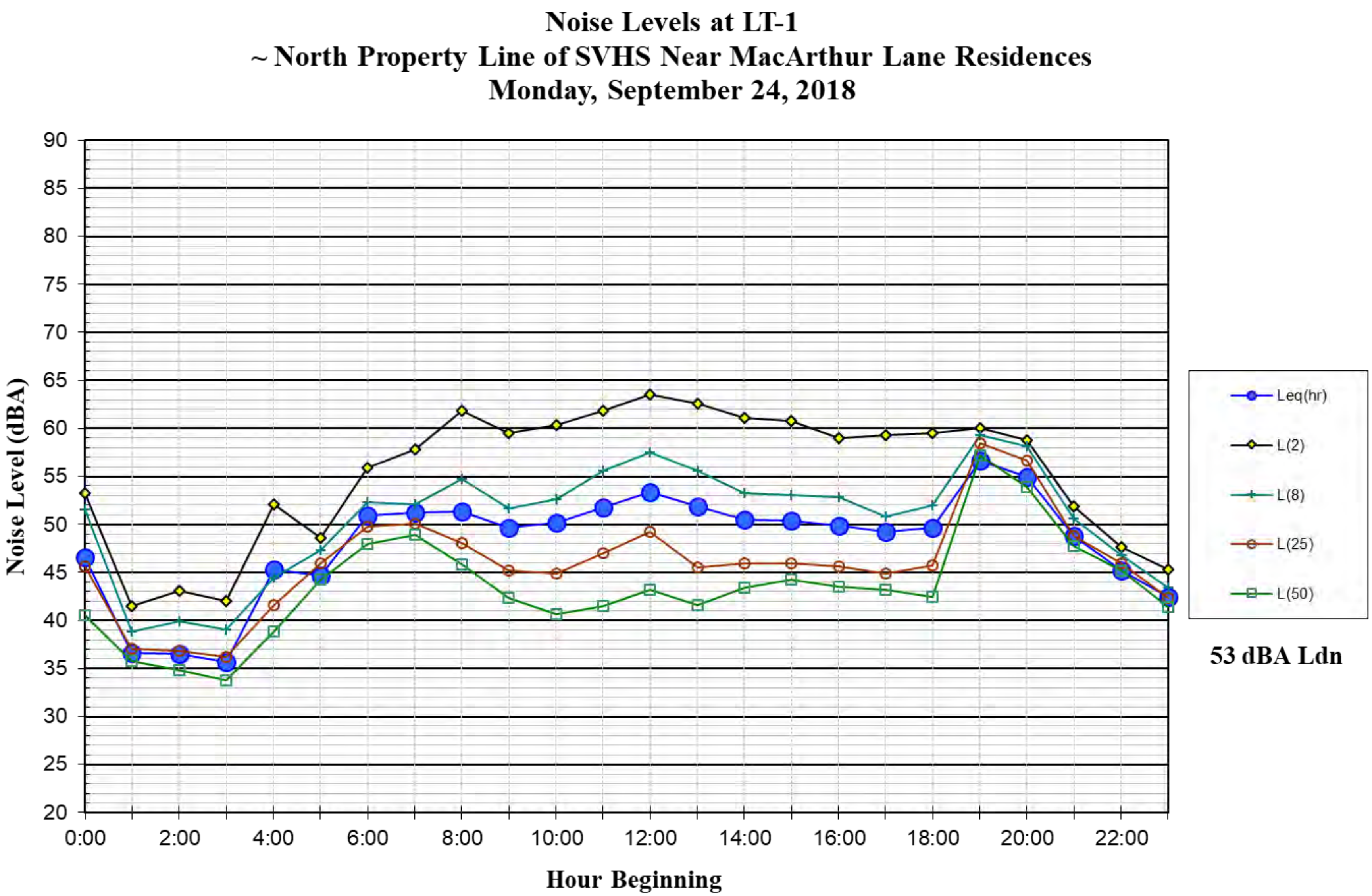
L(25)
L(50)
51 dBA Ldn

Figure 4


Noise Levels at LT-1
~ North Property Line of SVHS Near MacArthur Lane Residences
Monday, September 24, 2018
Noise Level (dBA)
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45
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35
30
25
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0:00
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12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Leq(hr)
L(2)
L(8)
L(25)
L(50)
53 dBA Ldn

Figure 5

Noise Levels at LT-2
~ East Property Line of SVHS Near Denmark Street Residences
Friday, September 21, 2018

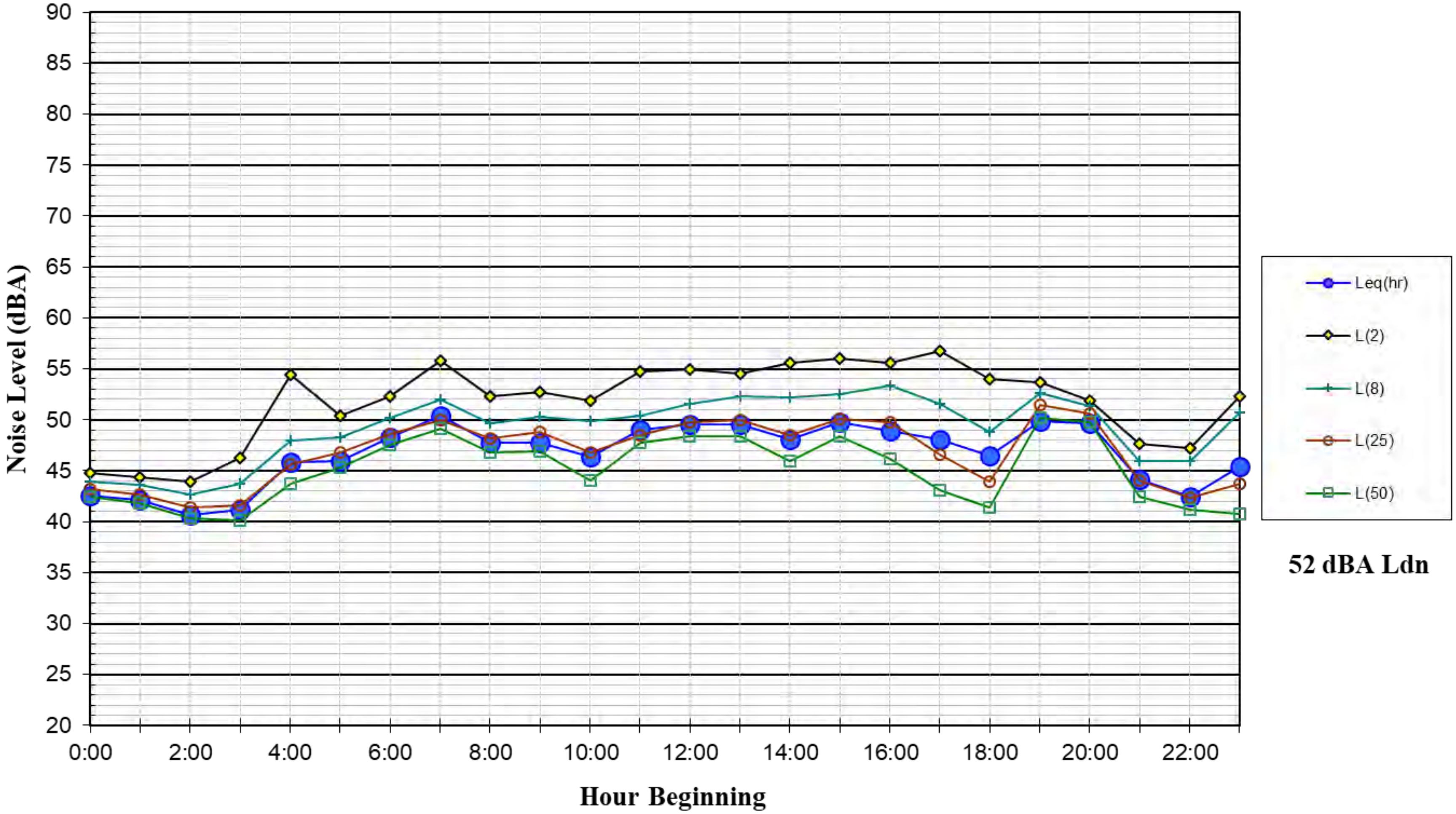
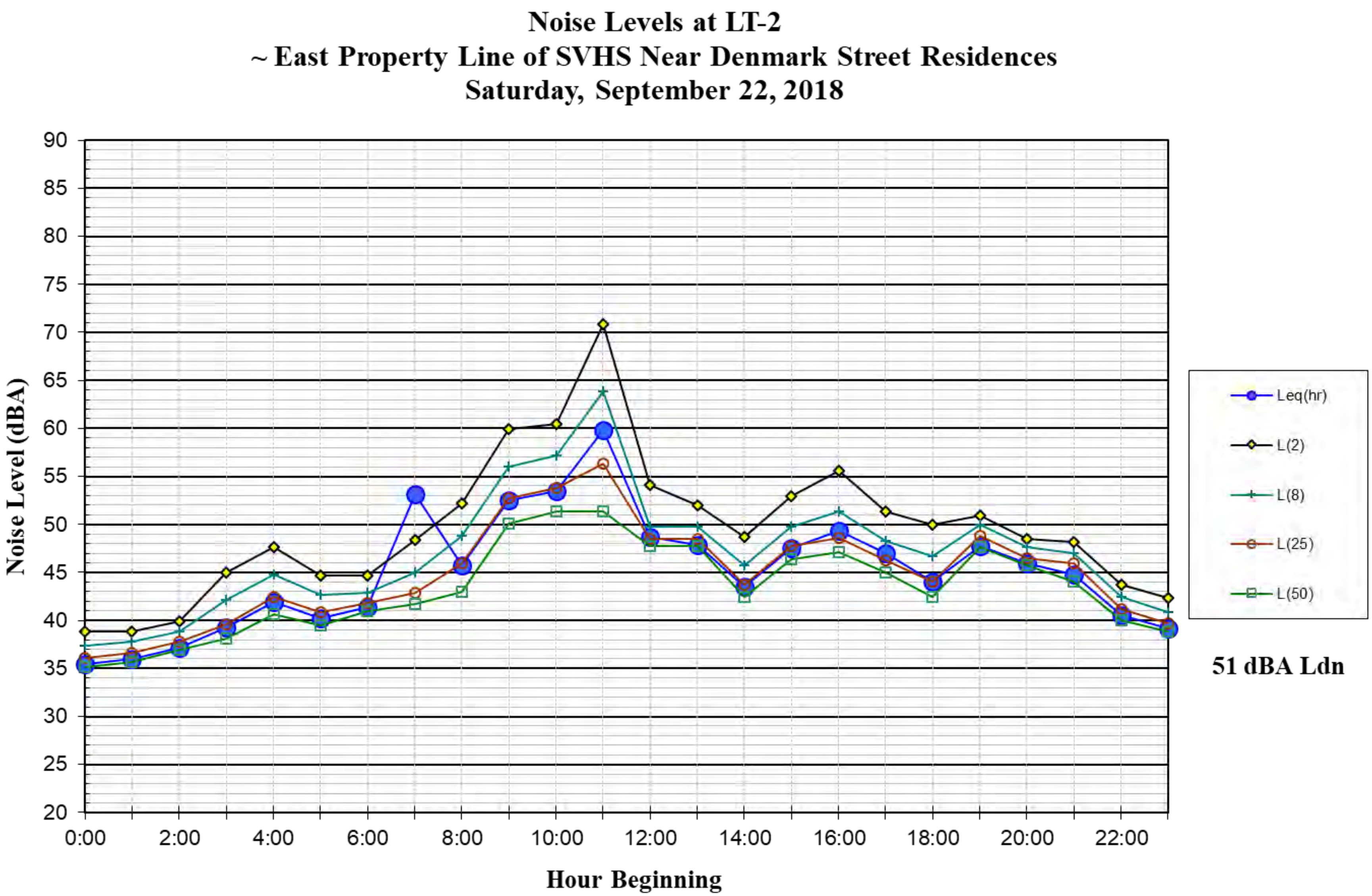


Figure 6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Saturday, September 22, 2018
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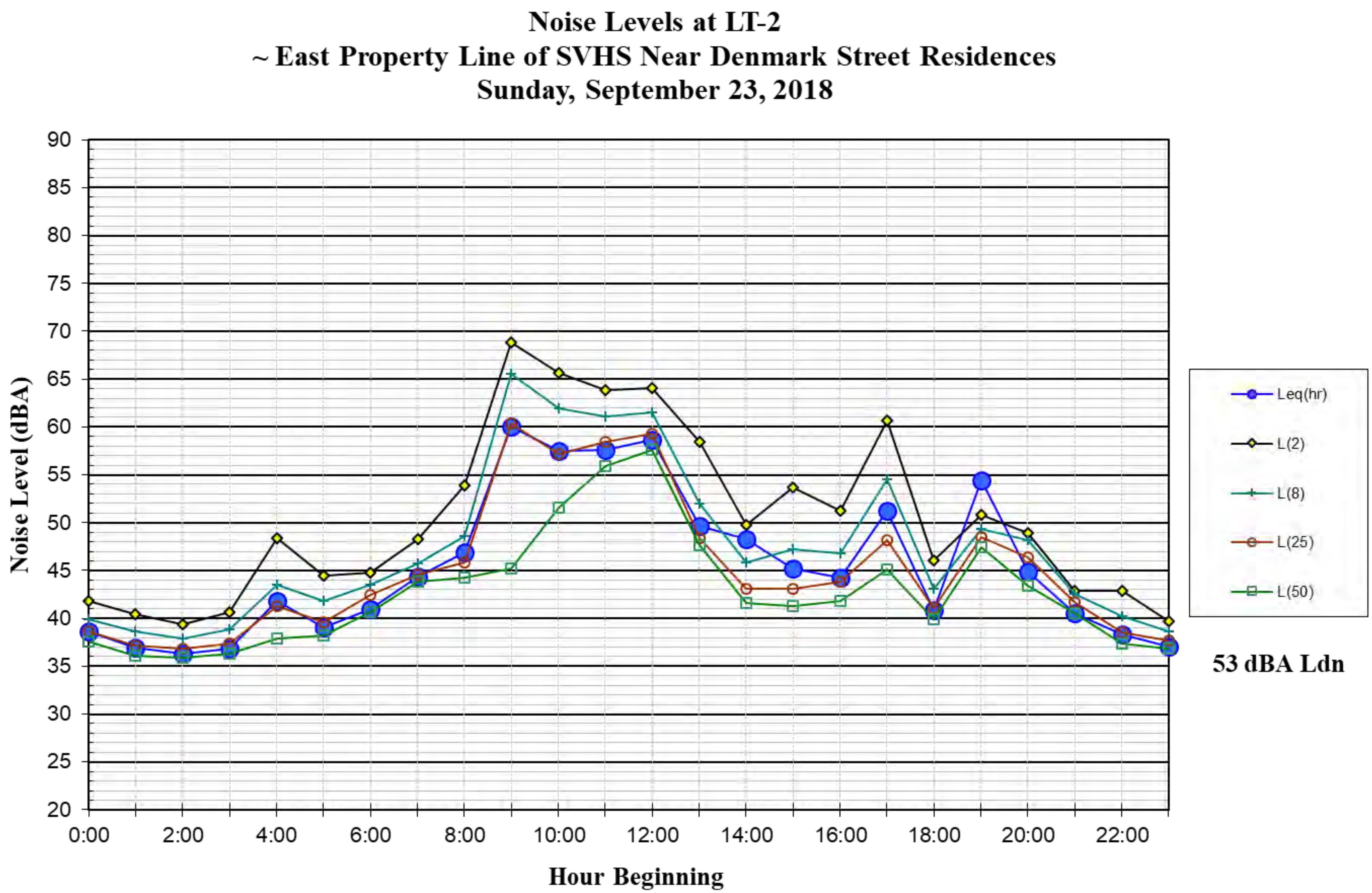
L(2)
L(8)
L(25)
L(50)
51 dBA Ldn

Figure 7


Noise Levels at LT-2
~ East Property Line of SVHS Near Denmark Street Residences
Sunday, September 23, 2018
Noise Level (dBA)
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85
80
75
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65
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50
45
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35
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0:00
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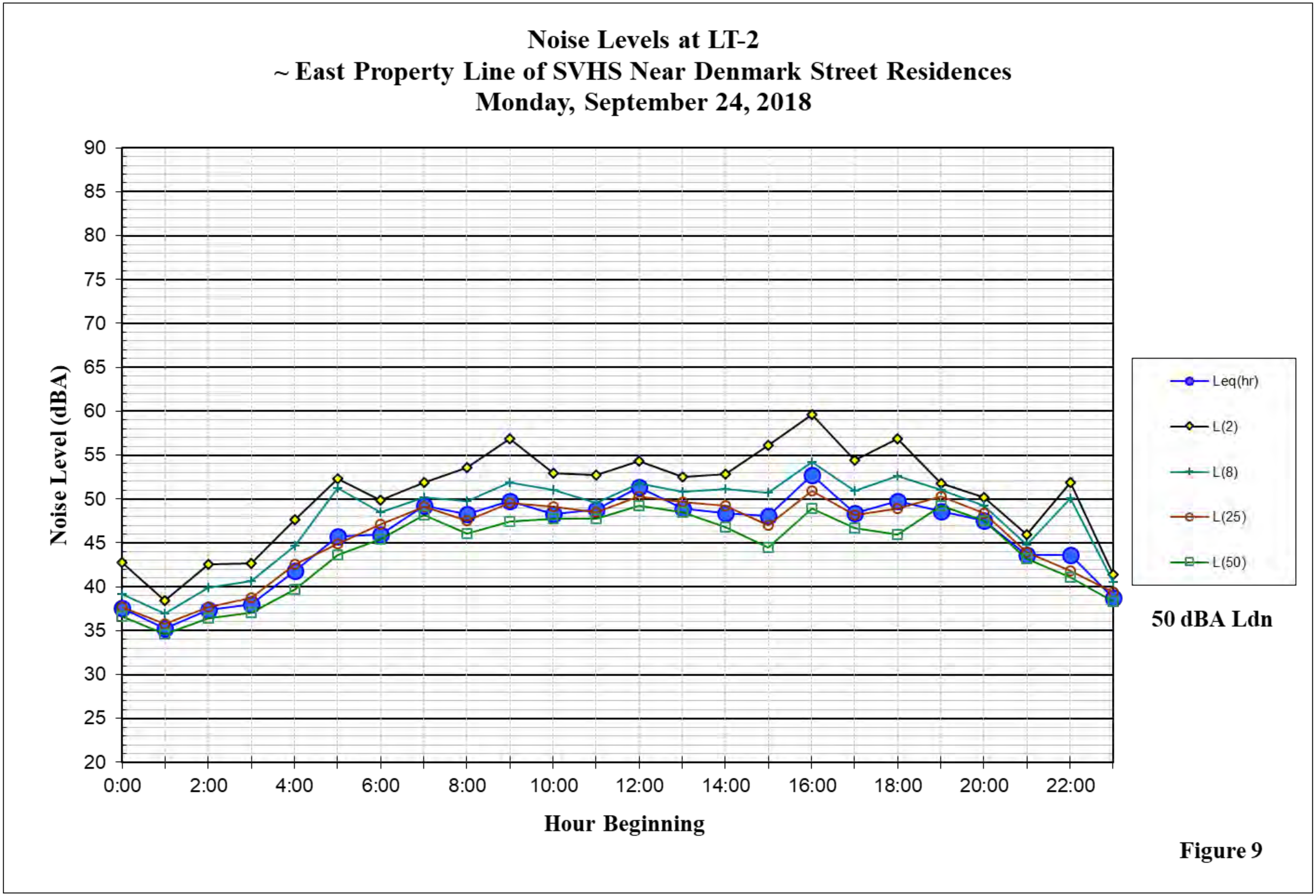
L(25)
L(50)
53 dBA Ldn

Figure 8



Noise Levels at LT-2
~ East Property Line of SVHS Near Denmark Street Residences
Monday, September 24, 2018
Noise Level (dBA)
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85
80
75
70
65
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30
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0:00
2:00
4:00
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12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Leq(hr)
L(2)
L(8)
L(25)
L(50)
50 dBA Ldn

Figure 9

Appendix G Transportation Study

Traffic Impact Study for the SVHS Athletic Fields Renovation Project

Prepared for the Town of Sonoma

Submitted by
W-Trans

October 2, 2019

Table of Contents

Appendices

A. Collision Rate Calculations
B. Intersection Level of Service Calculations
C. TCRPR 112/NCHRPR 562 Pedestrian Crossing Treatment Worksheet
D. Pedestrian Hybrid Beacon (HAWK) Signal Warrant Worksheet

Executive Summary

The proposed Sonoma Valley High School (SVHS) Athletic Fields Renovation Project includes relocation and construction to replace the existing track and field at SVHS, including stadium lighting and seating. In addition, the existing softball, baseball, and soccer fields would be renovated and reconfigured. At this new facility, midweek events with 60 attendees could be expected, along with 1,500-person events on numerous Fridays per year, representing typical football games with 1,300 attendees occurring in conjunction with other uses of up to 200 attendees, and 2,500-person events on two Fridays per year, representing a Homecoming football game and graduation ceremony. These events are expected to generate 60 midweek p.m. peak hour trips, 465 Friday p.m. peak hour trips, and 775 Friday p.m. peak hour trips, respectively.

The study area includes six intersections along Broadway from Napa Street to Leveroni Road-Napa Road and MacArthur Street from Fifth Street West to Fifth Street East. Existing conditions were assessed using traffic volume counts collected while local schools were in session. All study intersections are currently operating acceptably at LOS D or better. All intersections are expected to continue operating at LOS D or better under Future volumes, except for Napa Street/Broadway, which would operate at LOS F during the midweek p.m. peak hour under the anticipated Future volumes without project traffic added. This is considered acceptable, however, as this intersection is specifically exempted from LOS standards by the *City of Sonoma 2020 General Plan*.

Operations at all study intersections would remain acceptable with the addition of trips from either the 60-person or 1,500-person events to Existing or Future volumes. The addition of 2,500-person event traffic would result in unacceptable operations at Newcomb Street/Broadway when added to Existing and Future volumes, and unacceptable operations at MacArthur Street/Broadway under Future volumes. For the anticipated two days per year when there would be a 2,500-person event, implementation of special time-of-day phasing plans to provide extra green time for event attendees or deployment of traffic control/ enforcement personnel is recommended to improve operations to an acceptable level. It is recommended that SVHS provide the City of Sonoma and Caltrans with the dates for Homecoming and graduation once determined each year.

While traffic operation standards do not apply to Napa Street/Broadway, the addition of traffic for a 2,500-person event to Future Friday volumes would more than double the delay at this intersection and degrade operations from Level of Service (LOS) D to LOS F. Deployment of traffic control/enforcement personnel at this location is recommended to improve operations, as is placement of traffic cones to connect the eastbound right-turn lane and outer southbound departure lane to enable westbound drivers to turn right without conflicting with other traffic.

Pedestrian, bicycle, and transit facilities were also reviewed and determined to be adequate, although it is recommended that wayfinding signage be installed to guide event attendees between the parking areas and sports facilities across Nathanson Creek. Installation of a HAWK signal at the crosswalk across the north leg of Malet Street/Broadway or further study into in-roadway warning lights is recommended to accommodate the high number of pedestrians crossing Broadway at this location daily during the school year.

There are currently 710 parking spots available at SVHS, Adele Harrison Middle School, and Prestwood Elementary School, all adjacent to the project site, including 515 spaces in the main High School parking lot. It is anticipated that the parking demand for a 1,300-person event and a concurrent 200-person event, representing a wrestling match, theater production, or other competing use, would be adequately served by the main SVHS lot. The parking demand for a 2,500-person event would surpass the capacity of the 515-stall main SVHS lot but could be accommodated within the capacity of the remaining school parking lots. As concerns have been raised regarding event attendees parking in the residential neighborhoods around the stadium, it is recommended that SVHS staff notify attendees of the availability of the various parking lots as well as posting temporary wayfinding signage and/or personnel before a 2,500-person event to guide attendees to these lots. These personnel should coordinate with any posted traffic control/enforcement personnel to notify attendees of parking availability to avoid unnecessary circulation of full parking lots.

Introduction

This report presents an analysis of the potential traffic impacts that would be associated with the athletic fields renovation project for Sonoma Valley High School (SVHS) located at 20000 Broadway in the City of Sonoma. The traffic study was completed in accordance with the criteria established by Caltrans and the City of Sonoma and is consistent with standard traffic engineering techniques.

Prelude

The purpose of a traffic impact study is to provide policy makers with data they can use to make an informed decision regarding the potential traffic impacts of a proposed project, and any associated improvements that would be required to mitigate these impacts to a level of insignificance as defined by applicable policies. Vehicular traffic impacts are typically evaluated by determining the number of new trips that the proposed use would be expected to generate, distributing these trips to the surrounding street system based on existing travel patterns or anticipated travel patterns specific to the proposed project, then analyzing the impact the new traffic would be expected to have on critical intersections or roadway segments. Impacts relative to access for pedestrians, bicyclists, and to transit are also addressed.

Project Profile

The project as proposed includes renovating the athletic fields east of the high school to accommodate expanded activities, including reconfiguring the softball, baseball, and soccer fields and the addition of stadium lighting and seating. The anticipated events at these facilities include typical Friday night stadium events with an average attendance of 1,500 people, maximum capacity Friday stadium events with up to 2,500 people, and low-intensity midweek events with anticipated attendance of up to 60 people. The project site is located at the Sonoma Valley High School at 20000 Broadway in the City of Sonoma, as shown in Figure 1.

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Traffic Impact Study for the SVHS Athletic Fields Renovation Project

Figure 1 – Study Area and Existing Lane Configurations

W-Trans

Transportation Setting

Operational Analysis

Study Area and Periods

The study area consists of the following intersections:

1. Napa Street/Broadway
2. West MacArthur Street/Fifth Street West
3. MacArthur Street/Broadway
4. East MacArthur Street/Fifth Street East
5. Newcomb Street/Broadway
6. Leveroni Road-Napa Road/Broadway

Operating conditions during the midweek and Friday p.m. peak periods were evaluated to capture the highest potential impacts for the proposed project as well as the highest volumes on the local transportation network. The p.m. peak hour occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion during the homeward bound commute.

Study Intersections

Napa Street/Broadway is a four-way stop controlled intersection with standard crosswalks across all approaches and curb ramps on all corners. The northbound and eastbound approaches, which carry State Route 12 (SR 12), each have two lanes, while the southbound and westbound approaches each have one lane. The Sonoma Plaza is on the north side of the intersection, and the north leg serves as a driveway to City Hall, which is located in the Plaza.

West MacArthur Street/Fifth Street West is a four-way stop-controlled intersection with one approach lane from each direction. All four legs have continental crosswalks and curb ramps. Three legs have bicycle lanes on both sides, while the west leg serves as a residential street.

MacArthur Street/Broadway is a signalized intersection with crosswalks across all four legs. Broadway has two approach lanes and protected left-turn phasing on each approach, whereas MacArthur Street has one approach lane and permissive phasing. Broadway has wide parking lanes that also serve as bicycle lanes, and the west leg of MacArthur Street has dedicated bicycle lanes.

East MacArthur Street/Fifth Street East is a four-way intersection with stop controls on each approach, a standard crosswalk on the north leg of Fifth Street East, and a continental crosswalk on the east leg of East MacArthur Street. All quadrants except the southwest corner have sidewalks and curb ramps.

Newcomb Street/Broadway is a signalized intersection with four legs; the east leg is the main driveway connecting to the student parking lot at SVHS. The approach from this driveway and the northbound approach on Broadway have two lanes, whereas the southbound Broadway approach and eastbound Newcomb Street approach each have one lane. Broadway has protected left-turn phasing in both directions. There are crosswalks on the west, north, and east legs.

Leveroni Road-Napa Road/Broadway is a signalized intersection with two-lane approaches from Broadway, one-lane approaches from Leveroni Road and Napa Road, and protected left-turn phasing on all four approaches.

There are continental crosswalks across all approaches, although only the northwest corner has sidewalks and a curb ramp. There are bicycle lanes on the east leg of Napa Road.

The locations of the study intersections and the existing lane configurations and controls are shown in Figure 1.

Collision History

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates were calculated based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is July 1, 2013 through June 30, 2018.

As presented in Table 1, the calculated collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in *2014 Collision Data on California State Highways*, California Department of Transportation (Caltrans). Out of the six study intersections, four had collision rates higher than the statewide average, although only two (West MacArthur Street/Fifth Street West and Newcomb Street/Broadway) had higher injury rates than the statewide average, and there were no fatalities reported. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates at the Study Intersections

Study Intersection	Number of Collisions (2013-2018)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. Napa St/Broadway	18	**0.78**	0.21
2. W MacArthur St/Fifth St W	6	**0.36**	0.21
3. MacArthur St/Broadway	14	**0.42**	0.27
4. E MacArthur St/Fifth St E	1	0.10	0.21
5. Newcomb St/Broadway	6	0.26	0.27
6. Leveroni Rd-Napa Rd/Broadway	28	**0.74**	0.27

Note: c/mve = collisions per million vehicles entering; **Bold** text = higher collision rate than statewide average

At Napa Street/Broadway, right-of-way violations partially accounted for the above-average collision rate, representing seven out of the 18 collisions, including four involving pedestrians. Other top collision factors include speeding (four collisions), improper turning (two collisions), and drunk driving (two collisions). The largest proportion of collision types were broadsides with seven collisions, followed by four rear-end collisions and three sideswipe collisions. Out of the 18 reported collisions, 14 occurred between 1:00 p.m. and 7:00p p.m., with six occurring between 4:00 p.m. and 6:00 p.m. Due to the combination of right-of-way violations, broadside collision types, and correlation of collisions with peak traffic volumes, it is likely that the higher-than-average collision rate at Napa Street/Broadway is influenced by the large intersection size. At approximately 100 feet in width, the intersection is wider than typical all-way stop-controlled intersections, which could lead to confusion about priority order and a long clearance time for vehicles inside the intersection. As the *City of Sonoma 2020 General Plan* states a desire to avoid signalizing this intersection, the City should consider alternatives such as converting to a roundabout or using bulb-outs and median refuges to decrease the size of the intersection.

Out of the six collisions at West MacArthur Street/Fifth Street West, four were caused by drivers on Fifth Street West failing to stop at the stop sign, resulting in four broadside collisions. Potential countermeasures to reduce the collision rate include installing larger stop signs, installing stop signs with embedded rapidly flashing beacons, or increased enforcement.

Only two collision types accounted for more than one incident at MacArthur Street/Broadway – four collisions resulting from drivers failing to stop at a red light and two collisions resulting from improper turning. As the four red light collisions occurred between May and July, 12 of the 14 collisions occurred between March and September, and half of all collisions at this intersection occurred during the afternoon, there may be a causation between the position of the sun and incidence of collisions. This may be mitigated by replacing the eight-inch signal heads with twelve-inch signal heads and refreshing the black paint on the signal heads and backplates. Additionally, updating the signal timing may reduce the incidence of right-angle and rear-end collisions, which accounted for nine of the 14 collisions at this location.

The largest proportion of collisions at Leveroni Road-Napa Road/Broadway were caused by failure to yield right-of-way, with nine collisions. Seven collisions occurred on the west leg of the intersection, including six of the right-of-way violations. This suggests a safety issue related to the driveway for the southwest quadrant approximately 100 feet west of the intersection. Closing this driveway or installing a median to prevent left-turn ins or outs may reduce this collision pattern. Other top collision factors include eight collisions caused by speeding and three caused by improper turning. Of the eight speeding collisions, four were caused by southbound drivers and two each by eastbound and westbound drivers. Traffic calming measures and/or enforcement may help mitigate this collision factor. As 18 of the 28 collisions at this location were right-angle or rear-end in nature, updating the signal timing may reduce the collision rate by reducing the likelihood of these types of collisions.

Alternative Modes

Pedestrian Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. In general, a network of sidewalks, crosswalks, pedestrian signals, and curb ramps provide access for pedestrians in the vicinity of the proposed project site; however, sidewalk gaps can be found along Broadway south of Clay Street to the south of the SVHS. Existing gaps and obstacles along the connecting roadways impact convenient and continuous access for pedestrians and present safety concerns in those locations where appropriate pedestrian infrastructure would address potential conflict points.

- **Broadway** – Complete sidewalk coverage is provided on Broadway between Napa Street and Clay Street, but there are significant gaps on the east side of the street between Clay Street and Leveroni Road-Napa Road. Sidewalks are provided in front of Friedman's Home Improvement, but not the Sonoma TrainTown Railroad or Salsa Trading Company. At Clay Street, a crosswalk on the south leg of Broadway terminates in a grass berm on the east side of the road. While numerous crosswalks are provided across Broadway, these crossings are often long as Broadway features wide parking lanes, five travel lanes, or both. Pedestrian-scale gaslamp-style streetlights are provided between Napa Street and MacArthur Street, whereas more modern Caltrans Type 15/21 Standard streetlights are provided between MacArthur Street and Clay Street. No streetlighting is provided between Clay Street and Leveroni Road-Napa Road.

- **MacArthur Street** – Continuous sidewalks are provided on both sides of MacArthur Street between Fifth Street West and Fifth Street East, except for a gap on the south side in front of a house next to Prestwood Elementary School and gap in front of a house on the southwest corner of East MacArthur Street/Fifth Street East. Streetlighting is provided throughout this corridor.

Three bridges connect the project site across Nathanson Creek to SVHS, in addition to a series of pathways that connect the site to Second Street East, Denmark Street, the Sonoma City Trail, the SVHS academic facilities, and Adele Harrison Middle School.

Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2017, classifies bikeways into four categories:

- **Class I Multi-Use Path** – a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.
- **Class II Bike Lane** – a striped and signed lane for one-way bike travel on a street or highway.
- **Class III Bike Route** – signing only for shared use with motor vehicles within the same travel lane on a street or highway.
- **Class IV Bikeway** – also known as a separated bikeway, a Class IV Bikeway is for the exclusive use of bicycles and includes a separation between the bikeway and the motor vehicle traffic lane. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

In the project area, Class II bike lanes exist on West MacArthur Street between Fifth Street West and Broadway. Bicyclists ride in the roadway and/or on sidewalks along all other streets within the project study area. Table 2 summarizes the existing and planned bicycle facilities in the project vicinity, as contained in the *City of Sonoma 2020 General Plan: Circulation Element*, City of Sonoma, 2016.

Table 2 – Bicycle Facility Summary

Status Facility	Class	Length (miles)	Begin Point	End Point
Existing				
Nathanson Creek Trail	I	0.43	Dewell Dr	E MacArthur St
SVHS Trail	I	0.13	Nathanson Creek Trail	Prestwood Elementary School
Denmark St Connector	I	0.10	Nathanson Creek Trail	Denmark St
Dewell Dr	II	0.18	Larkin Dr	Fine Ave
W MacArthur St	II	0.55	Fifth St W	Broadway
Second St E	III	0.76	E MacArthur St	Sonoma City Trail
Planned				
Broadway	II	1.12	Napa St	Leveroni Rd-Napa Rd
Newcomb St	III	0.29	Fryer Creek Trail	Broadway
Denmark St*	III	0.90	Denmark St Connector	Eighth St E

Notes: * All or portions of these bikeways are located within unincorporated Sonoma County
Source: *City of Sonoma 2020 General Plan: Circulation Element*, City of Sonoma, 2016

It is noted that the Broadway Streetscape project as proposed would reduce Broadway by one travel lane in each direction, and instead use the cross-sectional width to add Class II bicycle lanes and additional street parking. There may also be new pedestrian amenities such as crossing treatments, however exact details have not been determined.

Transit Facilities

Sonoma County Transit (SCT) provides fixed route bus service in the City of Sonoma. SCT Route 32 provides service to destinations throughout the City and nearby unincorporated communities, with stops along Broadway and West MacArthur Street. Route 32 operates Monday through Friday with nine southbound and twelve northbound trips between 7:30 a.m. and 4:36 p.m. Saturday service operates with three southbound and five northbound trips between 9:00 a.m. and 2:40 p.m.

Routes 40 and 53 provide regional service between the cities of Sonoma and Petaluma with stops along Broadway in the City of Sonoma. These routes provide five eastbound and six westbound weekday trips between 6:30 a.m. and 6:55 p.m. Routes 40 and 53 essentially operate the same route, except that Route 53 provides a connection to the Sonoma-Marin Area Rail Transit (SMART) in Petaluma.

Routes 30 and 34 connect the City of Sonoma to the City of Santa Rosa along SR 12. In the project area, Route 30 stops along Broadway and West MacArthur Street, and Route 34 stops along Broadway, Leveroni Road, and Fifth Street West. Route 30 provides weekday service with one- to two-hour headways between 5:50 a.m. and 9:25 p.m., as well as weekend service with four trips in each direction between 7:25 a.m. and 8:12 p.m. Route 34 provides one a.m. southbound trip and one p.m. northbound trip.

Route 38 provides service between the Oakmont neighborhood of Santa Rosa and downtown San Rafael, including in the project area along Broadway, West MacArthur Street, and Leveroni Road. Weekday service is provided with one southbound a.m. trip and one northbound p.m. trip.

Two or three bicycles can be carried on most SCT buses. Bike rack space is on a first come, first served basis. Additional bicycles are allowed on SCT buses at the discretion of the driver.

Dial-a-ride, also known as paratransit, or door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. Sonoma County Paratransit service is designed to serve the needs of individuals with disabilities within the City of Sonoma and the greater Sonoma County area.

Capacity Analysis

Intersection Level of Service Methodologies

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation.

The study intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2010. This source contains methodologies for various types of intersection control, all of which are related to a measurement of delay in average number of seconds per vehicle.

The study intersections with stop signs on all approaches were analyzed using the "All-Way Stop-Controlled" Intersection methodology from the HCM. This methodology evaluates delay for each approach based on turning movements, opposing and conflicting traffic volumes, and the number of lanes. Average vehicle delay is computed for the intersection as a whole and is then related to a Level of Service.

The study intersections that are currently controlled by a traffic signal, or may be in the future, were evaluated using the signalized methodology from the HCM. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether the signals are coordinated or not, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology. For purposes of this study, delays were calculated using signal timings obtained from Caltrans.

The ranges of delay associated with the various levels of service are indicated in Table 3.

Table 3 – Intersection Level of Service Criteria

LOS	All-Way Stop-Controlled	Signalized
A	Delay of 0 to 10 seconds. Upon stopping, drivers are immediately able to proceed.	Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.
B	Delay of 10 to 15 seconds. Drivers may wait for one or two vehicles to clear the intersection before proceeding from a stop.	Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.
C	Delay of 15 to 25 seconds. Drivers will enter a queue of one or two vehicles on the same approach and wait for vehicle to clear from one or more approaches prior to entering the intersection.	Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.
D	Delay of 25 to 35 seconds. Queues of more than two vehicles are encountered on one or more approaches.	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.
E	Delay of 35 to 50 seconds. Longer queues are encountered on more than one approach to the intersection.	Delay of 55 to 80 seconds. Most, if not all, vehicles must stop, and drivers consider the delay excessive.
F	Delay of more than 50 seconds. Drivers enter long queues on all approaches.	Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.

Reference: *Highway Capacity Manual*, Transportation Research Board, 2010

Traffic Operation Standards

City of Sonoma

In the *2016 Circulation Element* of the *City of Sonoma 2020 General Plan*, the following policy has been adopted:

> ***Policy 1.5**: Establish a motor vehicle Level of Service (LOS) standard of LOS D at intersections. The following shall be taken into consideration in applying this standard:*
>
> - *Efforts to meet the vehicle LOS standard shall not result in diminished safety for other modes including walking, bicycling, or transit (see Policy 1.6).*
> - *The standard shall be applied to the overall intersection operation and not that of any individual approach or movement.*
> - *Consideration shall be given to the operation of the intersection over time, rather than relying exclusively on peak period conditions.*
> - *The five intersections surrounding the historic Sonoma Plaza shall be exempt from vehicle LOS standards in order to maintain the historic integrity of the Plaza and prioritize non-auto modes.*

Caltrans

Although located within Sonoma city limits, Caltrans has jurisdiction over the study intersections along Broadway, including Napa Street, MacArthur Street, Newcomb Street, and Leveroni Road/Napa Road. Caltrans indicates that they endeavor to maintain operation at the transition from LOS C to LOS D. Where intersections are integral to a local jurisdictions transportation system, Caltrans often accepts the operational standard applied by the local agency, in this case, the City of Sonoma.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the midweek and Friday p.m. peak periods. This condition does not include project-generated traffic volumes. Midweek volume data was collected on September 6, 2017, April 12, 2018 and May 8, 2018 when local schools were in session. Friday volume data was collected on October 19, 2018 when local schools were in session.

Intersection Levels of Service

Under existing conditions, all six study intersections are operating acceptably. The existing traffic volumes are shown in Figure 2. A summary of the intersection level of service calculations and peak hours for each intersection is contained in Table 4, and copies of the Level of Service calculations are provided in Appendix B.

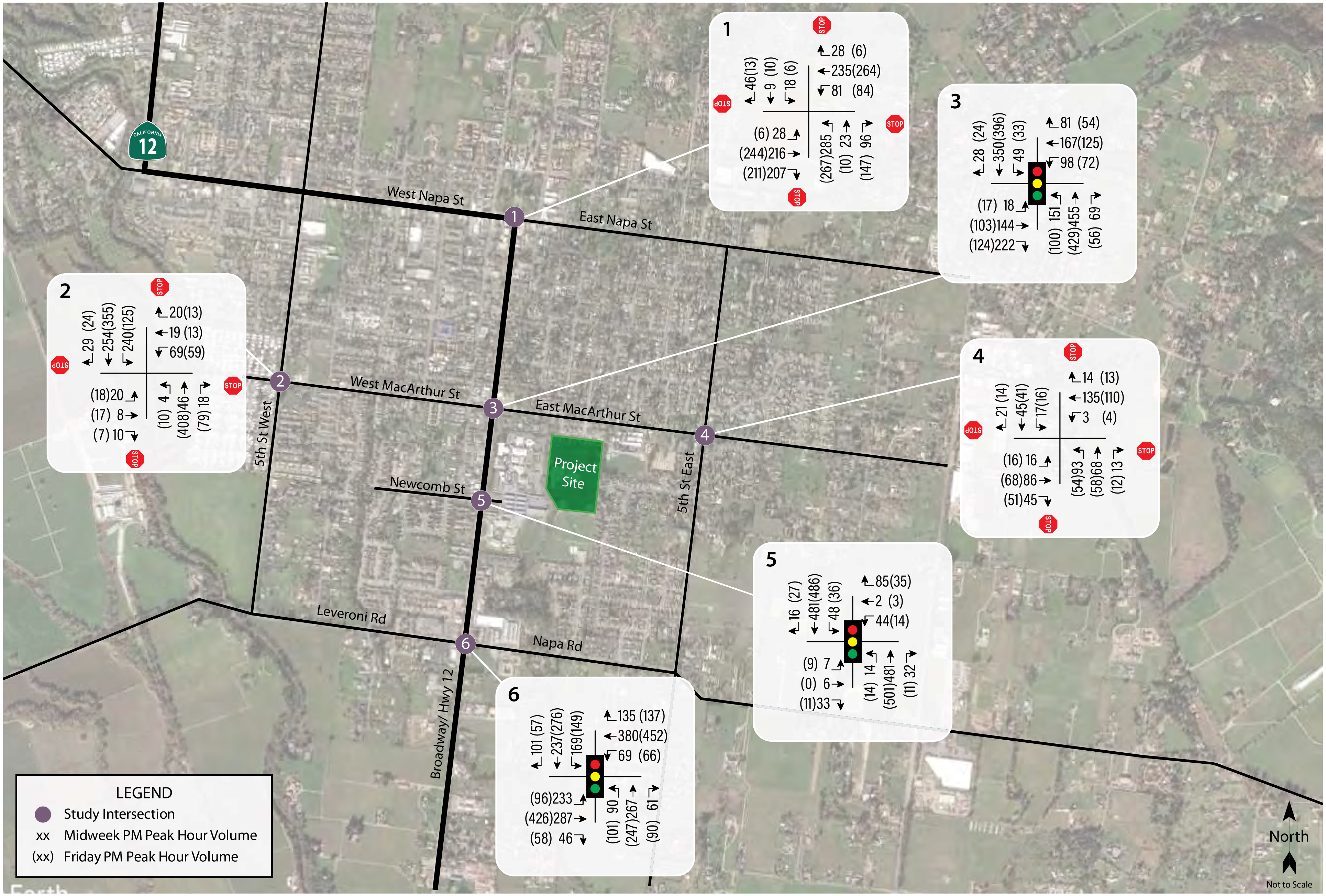

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Figure 2 – Existing Traffic Volumes

W-Trans

Table 4 – Existing Peak Hour Intersection Levels of Service						
Study Intersection	**Midweek PM Peak**			**Friday PM Peak**		
	Peak Hour	**Delay**	**LOS**	**Peak Hour**	**Delay**	**LOS**
1. Napa St/Broadway	4:00 – 5:00 PM	27.0	D	4:45 – 5:45 PM	17.5	C
2. W MacArthur St/Fifth St W	5:00 – 6:00 PM	12.5	B	4:00 – 5:00 PM	21.8	C
3. MacArthur St/Broadway	5:00 – 6:00 PM	25.8	C	4:45 – 5:45 PM	17.2	B
4. E MacArthur St/Fifth St E	4:45 – 5:45 PM	9.0	A	4:30 – 5:30 PM	8.4	A
5. Newcomb St/Broadway	4:30 – 5:30 PM	12.0	B	4:45 – 5:45 PM	9.5	A
6. Leveroni Rd-Napa Rd/Broadway	4:45 – 5:45 PM	34.2	C	4:45 – 5:45 PM	36.7	D

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Future Conditions

The midweek p.m. arrival and departure volumes at each intersection were obtained from the Sonoma County Transportation Authority's (SCTA) regional traffic model for the 2010 and 2040 plan years. The annual growth rate at each study intersection was calculated and applied to the existing volumes collected to grow each volume to anticipated 2040 levels. The intersection of Newcomb Street/Broadway was not included in the model, so future growth at this intersection was assessed using the average growth applied to the other five study intersections. The model does not include specific Friday p.m. volumes, so the calculated midweek p.m. growth rates were applied to the existing Friday p.m. volumes to generate future Friday p.m. volumes.

In the *City of Sonoma 2020 General Plan: Circulation Element*, both widening, and road diets are proposed for Broadway in the study area. However, definitive language and boundaries are not provided so existing geometrics were maintained for the purposes of this analysis. Minor adjustments were made to the signal timing for MacArthur Street/Broadway and Leveroni Road-Napa Road/Broadway while maintaining overall cycle lengths to accommodate the additional side-street traffic predicted in the SCTA regional traffic model.

Under the anticipated Future volumes, the study intersections are expected to continue to operate acceptably. Operating conditions are summarized in Table 5 and Future volumes are shown in Figure 3.

Table 5 – Future Peak Hour Intersection Levels of Service				
Study Intersection	**Midweek PM Peak**		**Friday PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**
1. Napa St/Broadway	59.9	F	29.8	D
2. W MacArthur St/Fifth St W	13.2	B	27.0	C
3. MacArthur St/Broadway	33.4	C	20.1	C
4. E MacArthur St/Fifth St E	11.1	B	9.7	A
5. Newcomb St/Broadway	13.9	B	11.8	B
6. Leveroni Rd-Napa Rd/Broadway	45.4	D	42.6	D

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

While the intersection of Napa Street/Broadway is projected to operate at LOS F during the midweek p.m. peak hour under Future volumes, the City's *General Plan* specifically exempts the intersections around the Sonoma Plaza from LOS standards. Potential signalization or installation of a roundabout is considered in the *General Plan*,

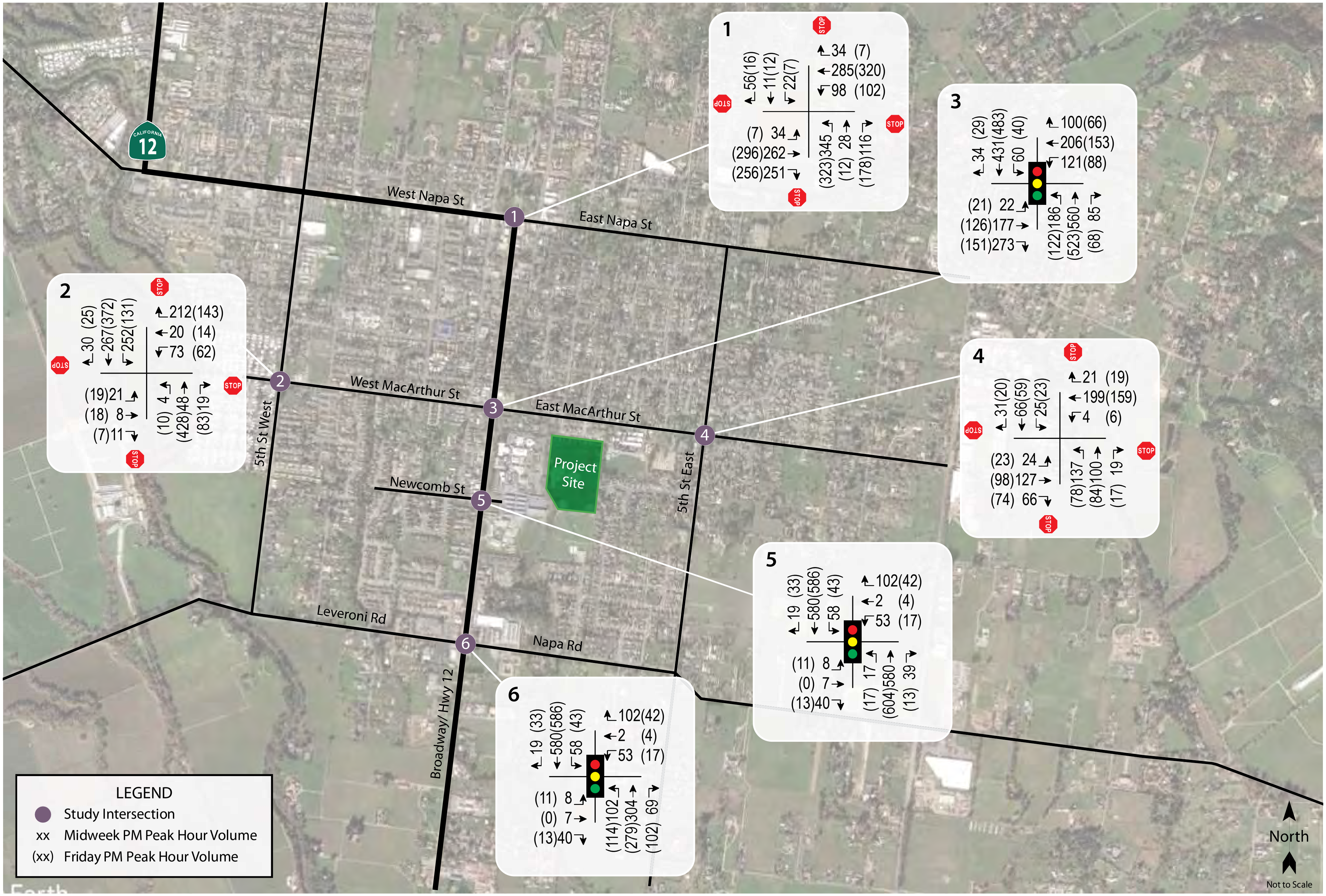

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Figure 3 – Future Traffic Volumes

W-Trans

alongside maintaining the existing all-way stop control. As a specific improvement is not defined, the existing all-way stop control was used in this analysis.

Project Description

The project consists of relocating and expanding the existing track and field facilities at Sonoma Valley High School (SVHS). Currently, SVHS football games are played at Arnold Field on the north side of the City as the SVHS track and field lacks stadium lighting and seating. This project would enable SVHS football games and other events to occur at the site in the evenings. The proposed project site plan is shown in Figure 4.

Vehicle Miles Traveled

A common indicator used to quantify the amount of motor vehicle use in a specified area is Vehicle Miles Traveled, or VMT. VMT represents the total number of daily miles driven by persons traveling to and from a defined geographic area. Many factors affect VMT, including the average distance residents commute to work, school, and shopping, as well as the proportion of trips that are made by non-automobile modes.

This project would enable football games which take place at Arnold Field in the northern part of the City of Sonoma, and other athletic events that occur elsewhere, to instead take place at SVHS, which is relatively centrally located in the City of Sonoma. As this project would not represent new athletic events, but rather the centralization of existing events, it would be expected that this project would result in a net reduction in VMT. It should be noted that standards of significance regarding VMT have not been adopted so this information is provided for informational purposes only.

Trip Generation

Industry standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 10th Edition, 2017 were not used to assess the trip generation of this project, as the specific parameters of this project are not adequately captured by any land use rates in the *Trip Generation Manual*. Instead, a literature review was conducted, and rates were found that were developed for the San Mateo Unified High School District (SMUHSD) for a series of projects to add lighting to five existing high school stadiums in 2016. These rates were later applied to a similar analysis for San Marin High School in Novato, California. This analysis was challenged and the use of the SMUHSD trip generation rates were successfully defended in *Coalition to Save San Marin v. Novato Unified School District*, January 2019.

The SMUHSD rates were developed for the *San Mateo Unified High School District Stadium Lighting Transportation Traffic Impact Analysis*, DKS Associates, 2016, through multiplying together several key assumptions developed with SMUHSD staff. These include an attendee split of 70-percent home and 30-percent visitor, a 97-percent auto mode share (three percent using other modes such as walking or bicycling), and 10 percent of attendees being dropped off compared to 90 percent of attendees arriving in a vehicle that stays on-site for the duration of the event. Together, these assumptions result in 0.31 trips per attendee during the p.m. peak hour with approximately 90 percent of trips entering and 10 percent of trips exiting. These assumptions were compared with other traffic impact studies for high school sports facility projects, which resulted in a range of p.m. peak hour rates from 0.17 trips per attendee to 0.36 trips per attendee.

The peak hour trip generation rate from the SMUHSD analysis was applied to two estimated event thresholds: 1,500-person events representing typical Friday evening football games of 1,300 attendees with concurrent events having up to 200 attendees for wrestling tournaments, theater productions, or other use, as well as 2,500-person events representing either a higher-attended football game, such as Homecoming, or a graduation ceremony. This results in 465 trips during the Friday p.m. peak hour for the 1,500-person event and 775 trips during the Friday p.m. peak hour for the 2,500-person event.

Source: Quattrocchi Kwok Architects 9/19

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Traffic Impact Study for the SVHS Athletic Fields Renovation Project

Figure 4 – Site Plan

In addition, a midweek event with 60 attendees was assessed, representing sports practices. For these practices, it was estimated that each attendee would generate one trip, and that 80 percent of these trips would represent attendees who would park on-site before the peak hour and depart during the peak hour. The other 20 percent of the total trips would represent attendees being picked up, resulting in 10-percent in and 10-percent out trips for these pick-ups. Together, the trip generation rate assessed for the 60-person events results in 60 trips, with 6 arriving and 54 departing the High School during the midweek p.m. peak hour. The expected trip generation potential for the three event magnitudes is indicated in Table 6.

Table 6 – Trip Generation Summary

Event Size (Purpose)	Midweek PM Peak Hour				Friday PM Peak Hour			
	Rate	Trips	In	Out	Rate	Trips	In	Out
60-person Event (Sports Practice)	1.00	60	6	54	-	-	-	-
1,500-person Event (Typical Football Game)	-	-	-	-	0.31	465	420	45
2,500-person Event (Homecoming, Graduation)	-	-	-	-	0.31	775	700	75

Note: Rates are trip-ends per attendee

Trip Distribution

The pattern used to allocate new project trips to the street network was based on the relative catchment area for SVHS, in other words, the areas in which students generally reside. The applied distribution assumptions and resulting peak hour trips are shown in Table 7.

Table 7 – Peak Hour Trip Distribution Assumptions

Route	Percent	60-Person Event Trips	1,500-Person Event Trips	2,500-Person Event Trips
W Napa St west of Broadway	40%	24	186	310
E Napa St east of Broadway	10%	6	47	77
Fifth St W north of W MacArthur St	10%	6	47	77
Fifth St E north of E MacArthur St	10%	6	47	77
Fifth St E south of E MacArthur St	5%	3	23	39
E MacArthur St east of Fifth St E	5%	3	23	39
Newcomb St west of Broadway	5%	3	23	39
Leveroni Rd west of Broadway	5%	3	23	39
Napa Rd east of Broadway	5%	3	23	39
Broadway south of Leveroni Rd-Napa Rd	5%	3	23	39
TOTAL	**100%**	**60**	**465**	**775**

Parking Distribution

For 60-person and 1,500-person events it was assumed that all trips would begin or end in the main SVHS parking lot, accessed from the intersection of Newcomb Street/Broadway, as it is assumed that there would be adequate parking for these events in the main lot. For a 2,500-person event, it is anticipated that the parking demand would be greater than the spaces available in the main lot. It was therefore assumed, based on relative capacities and proximities, that 80 percent of attendees would park in the main lot, 10 percent would park in the lot on the north side of SVHS, five percent would park in the lot for Adele Harrison Middle School, and five percent would park in the lot for Prestwood Elementary School. It was further assumed that half of those parking in these alternative lots would first try the main SVHS lot before leaving and routing to one of the alternative lots.

At the main lot driveway, this methodology translates to 639 entering trips from 500 drivers that enter and park in the main lot, 75 drivers that drop off attendees, and 64 drivers that enter, circulate, and leave to seek parking elsewhere. Departing vehicles would total 139 trips, from the 75 drop-off drivers who leave and route back to their points of origin and 64 vehicles leaving to route to one of the alternative lots. These 64 vehicles would split into 32 vehicles routing to the north SVHS lot, 16 vehicles to the Middle School lot, and 16 vehicles to the Elementary School lot. They would respectively be joined by 31, 15, and 15 drivers driving to each of these lots directly.

Further discussion of the parking capacity of these various lots is contained in the Parking Analysis chapter.

Intersection Operation

Existing Midweek PM Peak plus 60-person Event Conditions

Upon the addition of project-related traffic to the Existing midweek p.m. peak hour volumes, the study intersections are expected to operate acceptably at the same Levels of Service as without project-related traffic. These results are summarized in Table 8. Traffic volumes for events with 60 attendees are shown in Figure 5.

Table 8 – Existing and Existing plus 60-person Event Peak Hour Intersection Levels of Service

Study Intersection	Midweek PM Peak			
	Existing		Existing plus 60-person Event	
	Delay	LOS	Delay	LOS
1. Napa St/Broadway	27.0	D	29.6	D
2. W MacArthur St/Fifth St W	12.5	B	12.6	B
3. MacArthur St/Broadway	25.8	C	25.9	C
4. E MacArthur St/Fifth St E	9.0	A	9.1	A
5. Newcomb St/Broadway	12.0	B	12.5	B
6. Leveroni Rd-Napa Rd/Broadway	34.2	C	34.3	C

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – The study intersections would operate acceptably with the addition of traffic related to a 60-person midweek event.

Existing Friday PM Peak plus 1,500-person Event Conditions

Upon the addition of traffic estimated for a 1,500-person event to the Existing Friday p.m. peak hour volumes, the study intersections are expected to operate acceptably at LOS D or better. Figure 6 shows the estimated traffic volumes for events with 1,500 attendees. These results are summarized in Table 9.

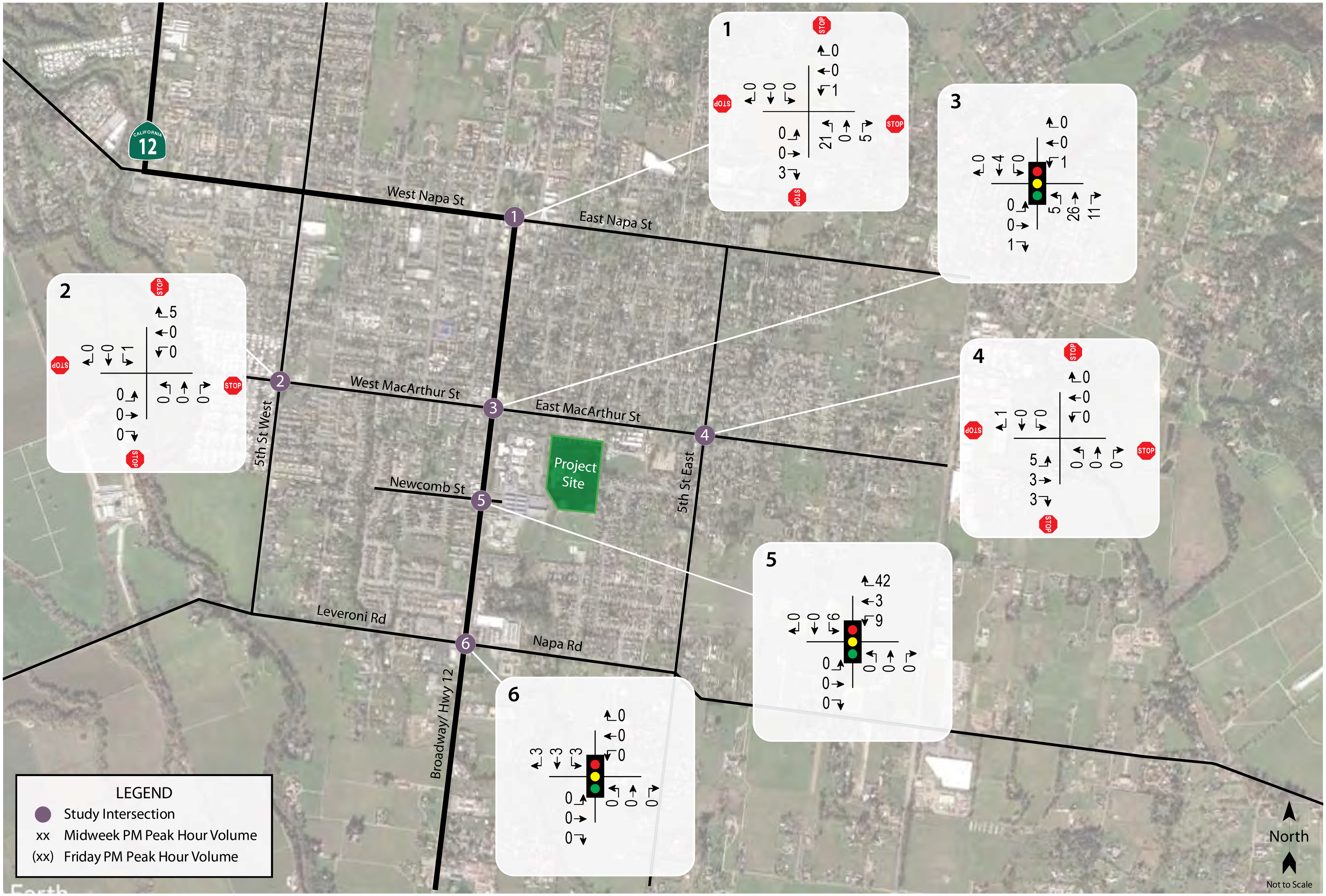

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Figure 5 – 60-Person Midweek Event Traffic Volumes

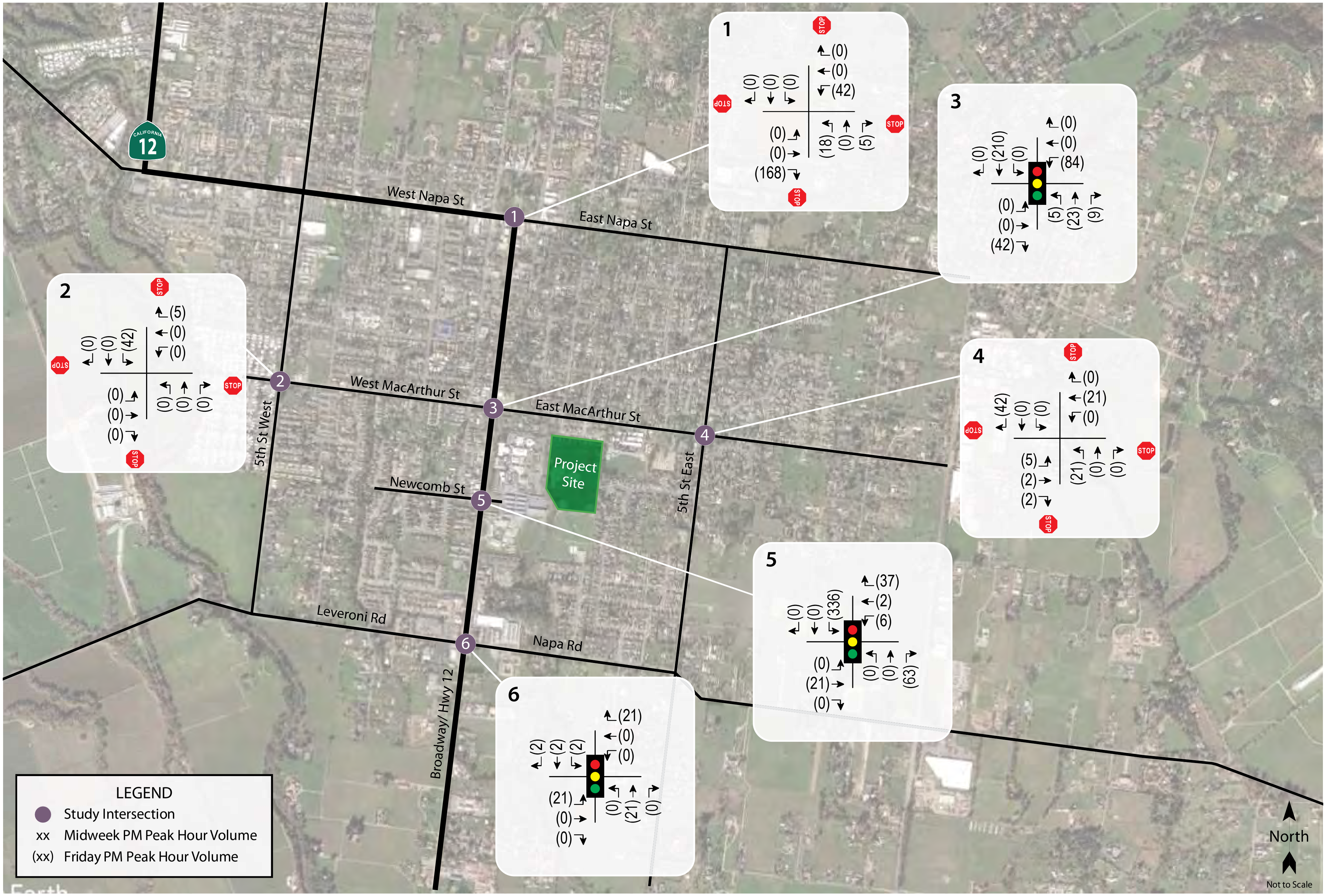

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Figure 6 – 1500-Person Friday Night Event Traffic Volumes

W-Trans

Table 9 – Existing and Existing plus 1,500-person Event Peak Hour Intersection Levels of Service				
Study Intersection	**Friday PM Peak**			
	Existing		**Existing plus 1,500-person Event**	
	Delay	**LOS**	**Delay**	**LOS**
1. Napa St/Broadway	17.5	C	24.4	C
2. W MacArthur St/Fifth St W	21.8	C	22.4	C
3. MacArthur St/Broadway	17.2	B	23.5	C
4. E MacArthur St/Fifth St E	8.4	A	8.9	A
5. Newcomb St/Broadway	9.5	A	20.1	C
6. Leveroni Rd-Napa Rd/Broadway	36.7	D	40.2	D

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – The study intersections would continue to operate acceptably upon adding traffic related to a 1,500-person Friday event to existing volumes.

Existing Friday PM Peak plus 2,500-person Event Conditions

Upon the addition of traffic for a 2,500-person event to the Existing Friday p.m. peak hour volumes, the study intersections are expected to operate acceptably except for Newcomb Street/Broadway, which would degrade to LOS E. For Napa Street/Broadway, LOS E conditions are acceptable as the *General Plan* specifically precludes this location from LOS standards. These results are summarized in Table 10, and the anticipated traffic volumes for a 2,500-person event are shown in Figure 7.

Table 10 – Existing and Existing plus 2,500-person Event Peak Hour Intersection Levels of Service				
Study Intersection	**Friday PM Peak**			
	Existing		**Existing plus 2,500-person Event**	
	Delay	**LOS**	**Delay**	**LOS**
1. Napa St/Broadway	17.5	C	37.0	E
2. W MacArthur St/Fifth St W	21.8	C	22.9	C
3. MacArthur St/Broadway	17.2	B	37.5	D
4. E MacArthur St/Fifth St E	8.4	A	9.2	A
5. Newcomb St/Broadway	9.5	A	**63.7**	**E**
6. Leveroni Rd-Napa Rd/Broadway	36.7	D	43.1	D

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; **Bold** text = deficient operation

Finding – The study intersections are expected to continue operating acceptably upon the addition of project-generated traffic, except Newcomb Street/Broadway, which would degrade to an unacceptable LOS E. It is noted that this condition would be expected to occur at most twice per year, during Homecoming and graduation events at SVHS. Retiming this signal to provide extra time each cycle for traffic entering the main High School parking lot has the potential to reduce delay to LOS C.

Recommendations – To achieve acceptable operation at Newcomb Street/Broadway under volumes projected at the start of a 2500-person event, it is recommended that either a special time-of-day signal timing plan be implemented to increase “green time” for the affected movements or traffic control/ enforcement personnel be

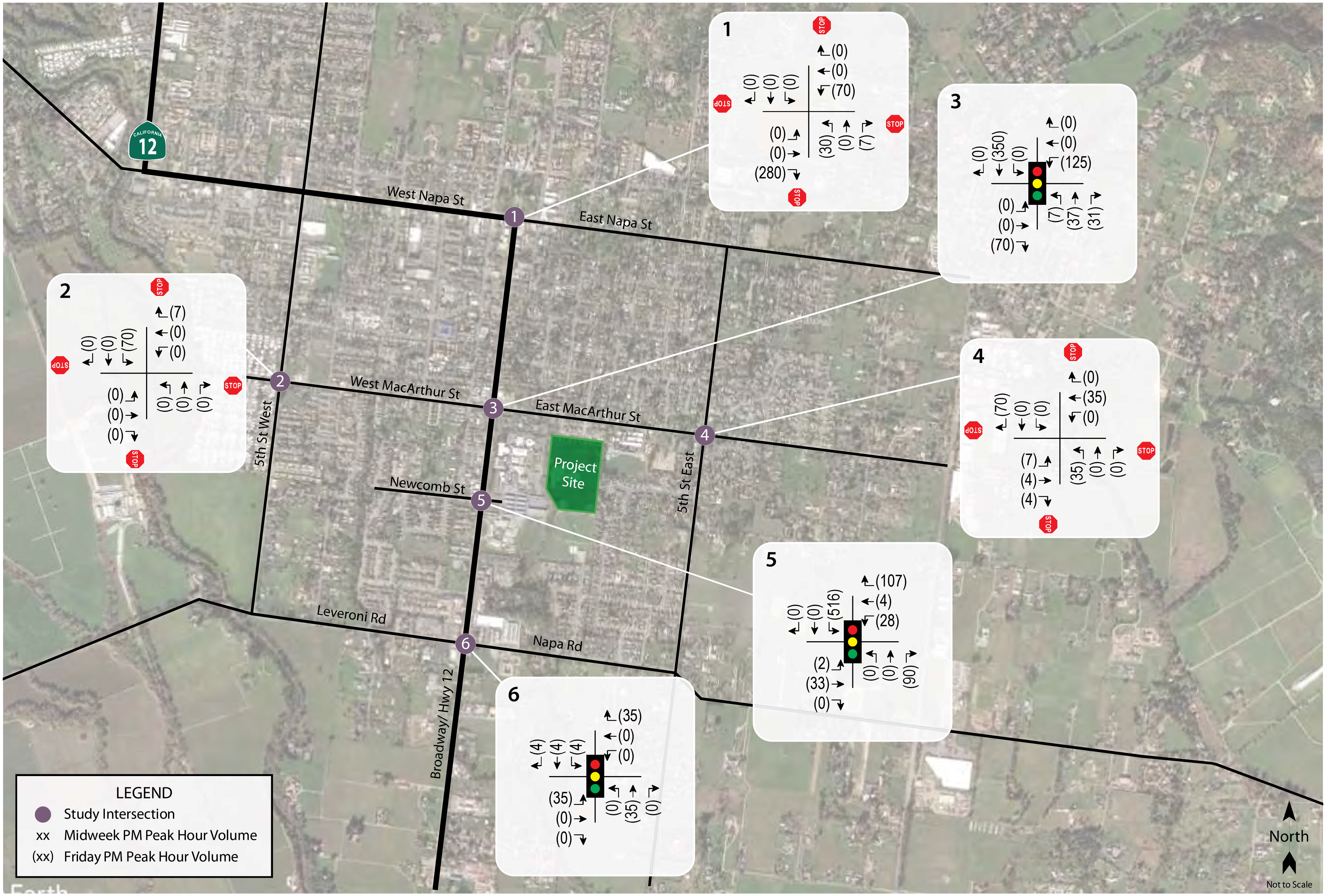

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Figure 7 – 2500-Person Friday Night Event Traffic Volumes

deployed. Public notifications should be released before major events to inform attendees of changes to traffic control and potential congested conditions. It is further recommended that once Homecoming and graduation dates are established, that SVHS alert the City of Sonoma and Caltrans so that appropriate signal timing plans can be scheduled.

Future Midweek PM Peak plus 60-person Event Conditions

Upon the addition of 60-person event traffic to the anticipated Future midweek p.m. peak hour volumes, the study intersections are expected to operate acceptably under the standards applied, with less than significant increases in delay. The Future plus 60-person Event operating conditions are summarized in Table 11.

Table 11 – Future and Future plus 60-person Event Peak Hour Intersection Levels of Service

Study Intersection	Midweek PM Peak			
	Future		Future plus 60-person Event	
	Delay	LOS	Delay	LOS
1. Napa St/Broadway	59.9	F	62.5	F
2. W MacArthur St/Fifth St W	13.2	B	13.3	B
3. MacArthur St/Broadway	33.4	C	34.2	C
4. E MacArthur St/Fifth St E	11.1	B	11.2	B
5. Newcomb St/Broadway	13.9	B	14.3	B
6. Leveroni Rd-Napa Rd/Broadway	45.4	D	45.7	D

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – Operations under volumes resulting from the addition of traffic related to a 60-person midweek event would continue to be acceptable.

Future Friday PM Peak plus 1,500-person Event Conditions

With 1,500-person event traffic added to the Future volumes, the study intersections are expected to operate acceptably. The Future plus 1,500-person Event operating conditions are presented in Table 12.

Table 12 – Future and Future plus 1,500-person Event Peak Hour Intersection Levels of Service

Study Intersection	Friday PM Peak			
	Future		Future plus 1,500-person Event	
	Delay	LOS	Delay	LOS
1. Napa St/Broadway	29.8	D	45.1	E
2. W MacArthur St/Fifth St W	27.0	C	27.9	C
3. MacArthur St/Broadway	20.1	C	40.2	D
4. E MacArthur St/Fifth St E	9.7	A	10.4	B
5. Newcomb St/Broadway	11.8	B	21.4	C
6. Leveroni Rd-Napa Rd/Broadway	42.6	D	46.7	D

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – All six study intersections would continue to operate acceptably under Future volumes with the addition of traffic related to a 1,500-person event. Delay at Napa Street/Broadway would degrade to LOS E, but this intersection is excluded from LOS criteria per the City's *General Plan*.

Future Friday PM Peak plus 2,500-person Event Conditions

Under the highest-intensity events anticipated with 2,500 attendees, delays at several locations would increase significantly as compared to Future volumes. These results are shown in Table 13.

Table 13 – Future and Future plus 2,500-person Event Peak Hour Intersection Levels of Service

Study Intersection	Friday PM Peak			
	Future		Future plus 2,500-person Event	
	Delay	LOS	Delay	LOS
1. Napa St/Broadway	29.8	D	63.7	F
2. W MacArthur St/Fifth St W	27.0	C	28.6	C
3. MacArthur St/Broadway	20.1	C	**65.4**	**E**
4. E MacArthur St/Fifth St E	9.7	A	11.0	B
5. Newcomb St/Broadway	11.8	B	**62.1**	**E**
6. Leveroni Rd-Napa Rd/Broadway	42.6	D	49.9	D

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; **Bold** text = deficient operation

It is noted that slightly improved operations are projected at Newcomb Street/Broadway under Future plus 2,500-person Event traffic volumes as compared to Existing plus 2,500-person Event traffic volumes. This counterintuitive result of having lower delay despite higher traffic volumes estimated under Future volumes is the result of additional northbound and southbound through traffic along Broadway anticipated under Future volumes. As the through movements would have delays which are below the average for the intersection as a whole, this results in a lower average delay than under Existing plus Project conditions where there would be a lower volume for the lower through-movement delay.

Finding – With the addition of traffic related to 2,500-person events to Future volumes, the intersections of MacArthur Street/Broadway and Newcomb Street/Broadway would degrade to an unacceptable LOS E. Additionally, while LOS thresholds of significance do not apply to Napa Street/Broadway, the project would more than double the average delay, deteriorating operation from LOS D to LOS F. These increases in delay are related to the addition of hundreds of project trips routing from west of Napa Street/Broadway to southbound Broadway and into the main High School parking lot. It is noted that these conditions would be expected no more than twice per year.

Recommendation – It is recommended that either special time-of-day plans be implemented, or traffic control/enforcement personnel be deployed at MacArthur Street/Broadway and Newcomb Street/ Broadway. Additional green time allocated during each cycle to drivers approaching the High School via these intersections has the potential to improve operations at each intersection to LOS C. For Napa Street/Broadway, the addition of cones connecting the westbound right-turn lane to the outer southbound departure lane to effectively create a channelized right-turn pocket, as well as deploying traffic control/ enforcement personnel, would reduce delay by preventing the need for every approaching driver to stop and yield. Public notifications should be released in advance of major events to inform attendees of changes to traffic control and potentially congested conditions.

A potential use of traffic delineation cones at Napa Street/Broadway is shown in Plate 1.

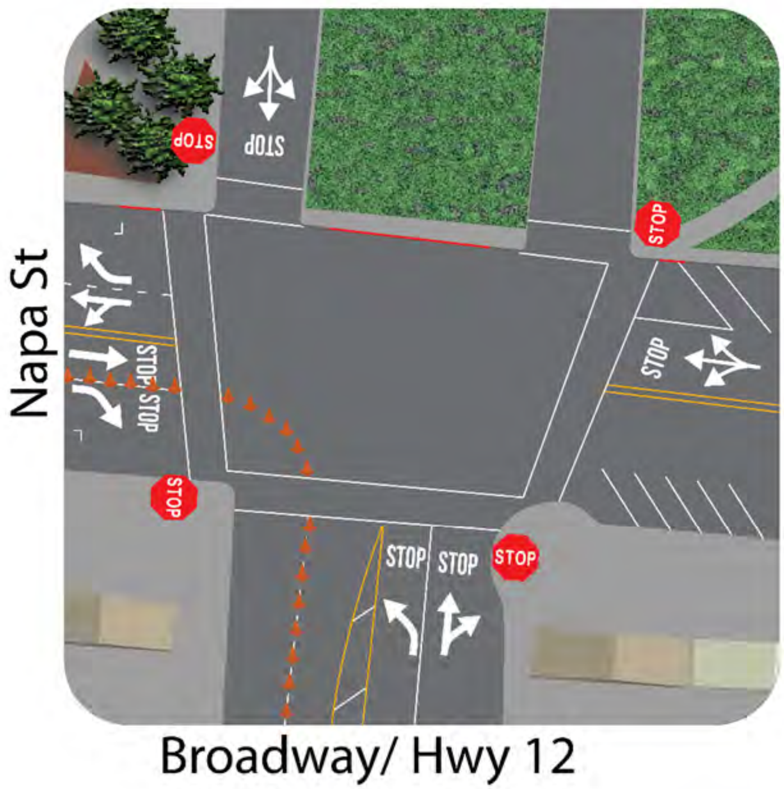

Plate 1 Potential Westbound Right-Turn Lane Delineation using Traffic Cones at Napa Street/Broadway

Once Homecoming and graduation dates are established, it is further recommended that SVHS alert the City of Sonoma and Caltrans so that appropriate signal timing plans or personnel deployments can be scheduled.

Alternative Modes

Given the proximity of SVHS to the surrounding neighborhoods, it is reasonable to assume that some event attendees would want to walk, bicycle, and/or use transit to reach the project site.

Pedestrian Facilities

The project site is bound on several sides by existing pathways that connect the site to Second Street East, Denmark Street, the Sonoma City Trail, the SVHS academic facilities, and Adele Harrison Middle School. However, it is noted that pedestrian access to the stadium area from Denmark Street would be restricted during the largest events in order to discourage parking in the areas around Demark Street. Three bridges connect the project site across Nathanson Creek to SVHS. As Nathanson Creek and its trees may obscure the main parking areas around SVHS from the stadium, it may be desirable to implement wayfinding signage for out-of-town visitors and other attendees unfamiliar with the area.

It is noted that the Broadway Streetscape project may add pedestrian crossing treatments within the study area, including near SVHS.

Finding – Pedestrian facilities serving the project site are adequate, although the bank of trees along Nathanson Creek between the parking lot and project site may hinder wayfinding.

Recommendation – It is recommended that wayfinding signs be installed to guide site users between the High School parking lots and the project facilities.

Bicycle Facilities

Existing bicycle facilities together with shared use of minor streets provide adequate access for bicyclists, along with the use of existing bicycle parking facilities at SVHS, Adele Harrison Middle School, and on the trail adjacent to Nathanson Creek. It is noted that the proposed Broadway Streetscape project would likely add Class II bicycle lanes to Broadway.

Finding – Bicycle facilities serving the project site are adequate.

Transit

Existing transit routes are adequate to accommodate project-generated transit trips. Existing stops are within an acceptable walking distance of the site.

Finding – Transit facilities serving the project site are adequate.

Pedestrian Crossing Treatment Warrant Analysis

A warrant analysis for potential pedestrian crossing treatments was completed for the intersection of Malet Street/ Broadway. This intersection has side-street stop control, a continental crosswalk across the west leg of Malet Street, and a high-visibility striped crosswalk across the north leg of Broadway. This intersection operates as a tee-intersection, although there is a bus loading zone entrance on the east side of the intersection. The crossing of Broadway serves a high number of school-related pedestrian trips, so consideration was given to the potential need for an active warning device at this location.

The pedestrian crossing treatment warrant analysis was based on the *Transportation Cooperative Research Program Report 112/National Cooperative Highway Research Program Report 562* (TCRPR), which identifies thresholds for pedestrian and vehicle volumes, speeds, and compliance indicating potential need for various traffic control devices. Additionally, the option for a pedestrian hybrid beacon was considered using guidelines from the *California Manual on Uniform Traffic Control Devices* (CA-MUTCD), Chapter 4F. The option for in-roadway warning lights was considered using guidelines from the CA-MUTCD, Chapter 4N.

Warrant Criteria for Pedestrian Crossing Treatments

The TCRPR includes information for assessing pedestrian crossing treatments based on a chart of major road vehicle volumes plotted against pedestrian volumes crossing the major street. Depending on the volume of vehicles and pedestrians, the report recommends an increasing intensity of treatment, including crosswalks, rapid rectangular flashing beacons, midblock signals, and High-intensity Activated crossWalKs (HAWKs). The minimum threshold for the installation of any of these devices is 20 pedestrians per hour crossing the major street. The report mentions the possibility of installing passive treatments at locations with fewer than 20 pedestrians per hour, such as curb extensions, median refuges, and other traffic calming devices.

Chapter 4F of the CA-MUTCD provides guidance for the installation of HAWKs based on a chart of major road vehicle volumes plotted against pedestrian volumes crossing the major street, similar to the TCRPR chart. However, the CA-MUTCD chart includes different minimum threshold lines based on the curb-to-curb width that the crossing treatment would occupy, with shorter lengths requiring higher volumes. Like the TCRPR criteria, the CA-MUTCD requires a minimum of 20 pedestrians crossing the major street per hour.

Guidance for the installation of in-roadway warning lights is provided in Chapter 4N of the CA-MUTCD, with at least 40 pedestrians using the crosswalk required during two hours within a 24-hour period, and at least 200 vehicles per hour on the major street during the hour with the highest pedestrian volume, among other requirements such as public education and stopping sight distance.

Data Collection

To assess these warrant criteria, data was collected at the intersection of Malet Street/Broadway on October 18, 2018, a typical weekday during the academic school year. This data collection included vehicle, bicycle, and pedestrian volumes during the a.m. peak period between 7:00 a.m. and 9:00 p.m., and the after-school peak period between 2:00 p.m. and 4:00 p.m. The collected volumes were processed into relevant categories for the warrant criteria, such as the vehicle volume entering the intersection from Broadway and the peak hourly pedestrian volume crossing Broadway. On November 19, 2018, a field visit was conducted to verify details gleaned from aerial imagery. Pictures of the site and notes regarding site conditions were recorded.

Pedestrian Crossing Warrant Findings

The pedestrian counts from the data collection were assessed to determine the hour with the greatest pedestrian volume crossing Broadway, which was 2:45 p.m. to 3:45 p.m. when 226 pedestrians crossed. During this hour, the vehicle volume entering the intersection from Broadway totaled 1,088 vehicles.

The criteria from the TCRPR, CA-MUTCD Chapter 4F, and CA-MUTCD Chapter 4N were applied to these volumes. With 226 pedestrians crossing Broadway, 1,088 entering vehicles on Broadway, a crossing distance of approximately 70 feet, and a speed limit of 35 mph (25 mph when children are present), the TCRPR methodology indicates that installation of a midblock signal, a half-signal, or a HAWK is warranted. This location is not in the middle of a block, and half-signals have been discouraged by the FHWA for decades, leaving the HAWK alternative. The methodology from the CA-MUTCD Chapter 4F also indicates that a HAWK is warranted at Malet Street/Broadway.

The warrants in CA-MUTCD Chapter 4N for in-roadway warning lights require 40 pedestrian crossings over two hours in addition to 200 vehicles per hour through the crossing during the peak one hour of pedestrian crossings. At this location, 66 pedestrians used the crossing between 7:30 a.m. and 226 used the crossing between 2:45 p.m. and 3:45 p.m., for 292 pedestrians total during the two highest-volume hours. During the pedestrian peak hour of 2:45 p.m. to 3:45 p.m., 1,088 vehicles entered from Broadway. As such, the volume-based warrant criteria from the CA-MUTCD Chapter 4N indicating need for in-roadway warning lights are met. However, prior to installation, a study would need to be completed that ascertain the critical speed on Broadway and determine if the in-roadway warning lights are compatible with the safety and operation of nearby intersections, among other considerations.

Warrant worksheets covering the criteria from the TCRPR and CA-MUTCD Chapter 4F are located in Appendix C and Appendix D, respectively.

Finding – With 226 pedestrians and 1,088 entering vehicles during the pedestrian peak hour, a HAWK is warranted based on criteria from the TCRPR and the CA-MUTCD Chapter 4F. Additionally, the volume criteria for the in-roadway warning lights from the CA-MUTCD Chapter 4N are satisfied, although further study would be required regarding the remaining warrants.

Recommendation – Consideration should be given to installing a HAWK at the existing crosswalk at the intersection of Malet Street/Broadway. As another option, in-roadway warning lights may be considered pending study of the remaining warrants from Chapter 4N of the CA-MUTCD.

Parking Analysis

As the proposed project would not increase parking supply and instead use existing parking provided by the various schools around the site, the capacities of these existing lots were compared to the estimated demand to determine if there would be an adequate supply. Only the 1,500-person and 2,500-person events were assessed as a 60-person event is assumed to make use of existing capacity given that these events would likely take place after the school day for which attendees have already parked.

Demand

As with trip generation, industry standard practices are not readily available to determine the parking demand for a high school track and field stadium. Instead, the parking demand was estimated by assuming that the outbound drivers from the trip generation were dropping off attendees, and thus would constitute an equal number of inbound vehicles but no parking demand. The remaining trips generated (all inbound trips minus inbound drop-off trips) were then assumed to represent the parking demand. For a 1,500-person event, this would equal 420 inbound trips minus 45 outbound trips to result in 375 inbound vehicles in need of parking spaces. For a 2,500-person event, this translates to the need for 625 parking spaces, from 700 inbound trips minus 75 outbound trips.

The 2,500-person event is assumed to have no competing uses as this scenario represents Homecoming or graduation which typically occur in isolation. The 1,500-person event represents a football game with 1,300 attendees along with a concurrent wrestling match, theater production, or other use with up to 200 attendees that would compete for the parking supply.

A summary of the expected parking demand is presented in Table 14.

Table 14 – Parking Demand

Event Size (Purpose)	Trip Generation			Trip Type	
	Trips	Ins	Outs	Drop-Offs[1]	Parking Demand[2]
1,500-person Event (Football Game with Concurrent Event)	465	420	45	45	375
2,500-person Event (Homecoming, Graduation)	775	700	75	45	625

Notes: [1] Drop-offs = Outbound Trips ("Outs")
[2] Parking Demand = Inbound Trips ("Ins") – Drop-Offs

Supply

The main High School parking lot has a capacity of 515 vehicles. Other lots include those on the north side of SVHS with 88 spaces, the Adele Harrison Middle School lot with 53 spaces, and the Prestwood Elementary School with 54 spaces. Together, 710 off-street spaces are provided between the three schools.

The 375 spaces needed for a 1,500-person event would be adequately served by the 515-stall main High School parking lot. For a 2,500-person event, some users would need to park elsewhere as the 625-stall demand exceeds the 515-stall supply. The north SVHS, Middle School, and Elementary School parking lots would be able to accommodate this overage. The distribution, as described in the Capacity Analysis chapter, would result in parking demands at the main SVHS lot, north SVHS lots, Middle School lot, and Elementary School lot of 500, 63, 31, and 31 vehicles, respectively. The various parking lot supplies as compared to event demands are summarized in Table 15.

Table 15 – Parking Supply and Demand					
Event Size (Purpose)	**Stalls**	**1,500-person Event**		**2,500-person Event**	
		Demand	**Surplus**	**Demand**	**Surplus**
Sonoma Valley High School (Main Lot)	515	375	140	500	15
Sonoma Valley High School (North Lot)	88	0	88	63	25
Adele Harrison Middle School	53	0	53	31	22
Prestwood Elementary School	54	0	54	31	23
TOTAL	**710**	**375**	**335**	**625**	**85**

Finding – With a demand of 375 stalls for a 1,500-person event, the existing capacity of 515 spaces is adequate. For a 2,500-person event, the 625-space demand would exceed the available supply at the SVHS main lot but could be accommodated within three other lots at the high school and nearby middle and elementary schools. Concerns have been previously expressed regarding event attendees parking on residential streets around the stadium, although the off-street parking supply would be adequate for all events.

Recommendation – To minimize the incidence of attendees parking on residential streets, it is recommended that SVHS notify attendees of their parking options ahead of Homecoming or graduation and post temporary wayfinding signage and/or personnel to help guide attendees into the off-street parking lots. Personnel posted in the parking lots should communicate with traffic control/enforcement personnel posted off-site if a parking lot fills to capacity, to reduce unnecessary circulation of full parking lots.

Conclusions and Recommendations

Conclusions

- The track and field project would be expected to generate 60 trips during the p.m. peak hour for a midweek 60-person event, 465 p.m. peak hour trips for a Friday 1,500-person event, and 775 p.m. peak hour trips for a Friday 2,500-person event.

- The study intersections would continue to operate acceptably with the addition of these event trips to Existing volumes, with the exception of Newcomb Street/Broadway, which would operate at LOS E with the addition of traffic for a 2,500-person event.

- Under Future volumes, the study intersections would operate acceptably with the addition of traffic for a 60-person or 1,500-person event. With the addition of trips for a 2,500-person event, the intersections of MacArthur Street/Broadway and Newcomb Street/Broadway would degrade to LOS E from LOS C and LOS B, respectively. The delay at Napa Street/Broadway would increase sufficiently to cause operation to deteriorate from LOS D to LOS F with the addition of 2,500-person event traffic to Future volumes, although this would not be considered significant as this intersection is exempt from LOS standards under the City's adopted criteria.

- The pedestrian, bicycle, and transit facilities serving the project site are generally adequate, although the foliage along Nathanson Creek may obscure the project site from the High School parking areas.

- A pedestrian crossing analysis was conducted for the existing crosswalk across Broadway at Malet Street. It was determined that, given the high pedestrian volume at this location, installation of a HAWK is warranted. In-roadway warning lights could also be considered pending further study.

- A 1,500-person event would be expected to require 375 parking spaces and a 2,500-person event would require 625 spaces. There is a total supply of 710 parking spaces among the various parking lots of SVHS, Adele Harrison Middle School, and Prestwood Elementary School. The 515-stall main SVHS lot would adequately serve a 1,500-person event and parking for a 2,500-person event could be accommodated through use of the other school parking lots, although concerns have been expressed regarding attendees parking in nearby residential streets.

Recommendations

- To accommodate the bi-annual traffic related to a 2,500-person event under current volumes it is recommended that time-of-day plans be implemented, or traffic control/enforcement personnel be deployed at Newcomb Street/Broadway to reduce delays and improve operations. Public notifications should be released ahead of events to inform attendees of changes to traffic control and potential congested conditions.

- Under Future volumes and with the addition of traffic associated with a 2,500-person event, it is recommended that time-of-day plans be implemented or traffic control/enforcement personnel be deployed at MacArthur Street/Broadway, in addition to at Newcomb Street/Broadway. For Napa Street/ Broadway, deployment of traffic control/enforcement personnel is recommended to enable traffic to operate more efficiently without each driver needing to stop. Attendees should be notified of changes to traffic control and potential congested conditions through informational releases ahead of events.

- Additionally, it is recommended that cones be placed to channelize the eastbound right-turn lane into the outer southbound departure lane to enable the hundreds of project trips turning right at this location to proceed without encountering conflicting traffic.

- It is recommended that SVHS alert the City of Sonoma and Caltrans once upcoming Homecoming and graduation dates are established so that appropriate signal timing plans or traffic control/enforcement personnel can be scheduled.

- The installation of wayfinding signs is recommended to guide site users, particularly out-of-town visitors, between the SVHS parking lots and the project facilities across Nathanson Creek.

- For Homecoming and graduation, it is recommended that SVHS alert attendees of the off-street parking available, in addition to providing temporary wayfinding signage and/or personnel to guide attendees to the parking lots before these events. The parking lot personnel should coordinate with any posted traffic control/enforcement personnel to prevent unnecessary circulation of full parking lots.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
Associate Engineer	Kevin Carstens, PE
Assistant Engineer	Allison Woodworth, EIT
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Editing/Formatting	Alex Scrobonia
Quality Control	Dalene J. Whitlock, PE, PTOE

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Appendix A

Collision Rate Calculations

Intersection Collision Rate Calculations

Sonoma Valley High School Track and Field Renovation Project

Intersection # 1: Broadway & Napa Street
Date of Count: Tuesday, May 8, 2018

Number of Collisions: 18
Number of Injuries: 5
Number of Fatalities: 0
ADT: 12700
Start Date: July 1, 2013
End Date: June 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: 4 Way Stop
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{18 \times 1{,}000{,}000}{12{,}700 \times 365 \times 5}$$

	Collision Rate		Fatality Rate	Injury Rate
Study Intersection	**0.78**	**c/mve**	**0.0%**	**27.8%**
Statewide Average*	**0.21**	**c/mve**	**0.4%**	**35.6%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 2: W MacArthur Street & W 5th Street
Date of Count: Wednesday, September 6, 2017

Number of Collisions: 6
Number of Injuries: 3
Number of Fatalities: 0
ADT: 9200
Start Date: July 1, 2013
End Date: June 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: 4 Way Stop
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{6 \times 1{,}000{,}000}{9{,}200 \times 365 \times 5}$$

	Collision Rate		Fatality Rate	Injury Rate
Study Intersection	**0.36**	**c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.21**	**c/mve**	**0.4%**	**35.6%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

Sonoma Valley High School Track and Field Renovation Project

Intersection # 3: Broadway & MacArthur Street
Date of Count: Wednesday, September 6, 2017

Number of Collisions: 14
Number of Injuries: 5
Number of Fatalities: 0
ADT: 18300
Start Date: July 1, 2013
End Date: June 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{14 \times 1{,}000{,}000}{18{,}300 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.42 c/mve**	**0.0%**	**35.7%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 4: E MacArthur Street & E 5th Street
Date of Count: Wednesday, September 6, 2017

Number of Collisions: 1
Number of Injuries: 0
Number of Fatalities: 0
ADT: 5600
Start Date: July 1, 2013
End Date: June 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: 4 Way Stop
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{1 \times 1{,}000{,}000}{5{,}600 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.10 c/mve**	**0.0%**	**0.0%**
Statewide Average*	**0.21 c/mve**	**0.4%**	**35.6%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Calculaions

Sonoma Valley High School Track and Field Renovation Project

Intersection # 5: Broadway & Newcomb Street
Date of Count: Thursday, April 12, 2018

Number of Collisions: 6
Number of Injuries: 4
Number of Fatalities: 0
ADT: 12500
Start Date: July 1, 2013
End Date: June 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{6 \quad x \quad 1{,}000{,}000}{12{,}500 \quad x \quad 365 \quad x \quad 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.26 c/mve**	**0.0%**	**66.7%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Intersection # 6: Broadway & Leveroni Road-Napa Road
Date of Count: Wednesday, September 6, 2017

Number of Collisions: 28
Number of Injuries: 8
Number of Fatalities: 0
ADT: 20800
Start Date: July 1, 2013
End Date: June 30, 2018
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{collision rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x 365 Days per Year x Number of Years}}$$

$$\text{collision rate} = \frac{28 \quad x \quad 1{,}000{,}000}{20{,}800 \quad x \quad 365 \quad x \quad 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.74 c/mve**	**0.0%**	**28.6%**
Statewide Average*	**0.27 c/mve**	**0.4%**	**41.9%**

ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2013 Collision Data on California State Highways, Caltrans

Appendix B

Intersection Level of Service Calculations

Intersection	
Intersection Delay, s/veh	27
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	28	216	207	81	235	28	285	23	96	18	9	46
Future Vol, veh/h	28	216	207	81	235	28	285	23	96	18	9	46
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	33	254	244	95	276	33	335	27	113	21	11	54
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	18.8	40.4	27	14.1
HCM LOS	C	E	D	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	11%	0%	24%	25%
Vol Thru, %	0%	19%	89%	0%	68%	12%
Vol Right, %	0%	81%	0%	100%	8%	63%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	285	119	244	207	344	73
LT Vol	285	0	28	0	81	18
Through Vol	0	23	216	0	235	9
RT Vol	0	96	0	207	28	46
Lane Flow Rate	335	140	287	244	405	86
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	0.763	0.276	0.608	0.463	0.849	0.21
Departure Headway (Hd)	8.195	7.1	7.624	6.844	7.548	8.803
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	439	504	471	524	478	411
Service Time	5.964	4.867	5.399	4.619	5.617	6.803
HCM Lane V/C Ratio	0.763	0.278	0.609	0.466	0.847	0.209
HCM Control Delay	33	12.6	21.6	15.4	40.4	14.1
HCM Lane LOS	D	B	C	C	E	B
HCM 95th-tile Q	6.4	1.1	4	2.4	8.6	0.8

Intersection	
Intersection Delay, s/veh	12.5
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	8	10	69	19	202	4	46	18	240	254	29
Future Vol, veh/h	20	8	10	69	19	202	4	46	18	240	254	29
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	9	11	74	20	217	4	49	19	258	273	31
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	9.4	12.3	9.6	13.3
HCM LOS	A	B	A	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	53%	24%	100%	0%
Vol Thru, %	0%	72%	21%	7%	0%	90%
Vol Right, %	0%	28%	26%	70%	0%	10%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	64	38	290	240	283
LT Vol	4	0	20	69	240	0
Through Vol	0	46	8	19	0	254
RT Vol	0	18	10	202	0	29
Lane Flow Rate	4	69	41	312	258	304
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.008	0.116	0.068	0.448	0.44	0.469
Departure Headway (Hd)	6.799	6.09	5.95	5.174	6.132	5.554
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	526	588	602	702	588	651
Service Time	4.539	3.829	3.988	3.174	3.857	3.279
HCM Lane V/C Ratio	0.008	0.117	0.068	0.444	0.439	0.467
HCM Control Delay	9.6	9.6	9.4	12.3	13.6	13.1
HCM Lane LOS	A	A	A	B	B	B
HCM 95th-tile Q	0	0.4	0.2	2.3	2.2	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	144	222	98	167	81	151	455	69	49	350	28
Future Volume (veh/h)	18	144	222	98	167	81	151	455	69	49	350	28
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.98
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	19	148	229	101	172	84	156	469	71	51	361	29
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	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	61	189	275	138	191	83	202	1473	222	169	1626	713
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.11	0.48	0.48	0.10	0.46	0.46
Sat Flow, veh/h	41	686	996	282	692	300	1774	3081	464	1774	3539	1552
Grp Volume(v), veh/h	396	0	0	357	0	0	156	268	272	51	361	29
Grp Sat Flow(s),veh/h/ln	1722	0	0	1273	0	0	1774	1770	1775	1774	1770	1552
Q Serve(g_s), s	0.0	0.0	0.0	4.4	0.0	0.0	6.5	7.1	7.2	2.0	4.7	0.8
Cycle Q Clear(g_c), s	16.6	0.0	0.0	21.0	0.0	0.0	6.5	7.1	7.2	2.0	4.7	0.8
Prop In Lane	0.05		0.58	0.28		0.24	1.00		0.26	1.00		1.00
Lane Grp Cap(c), veh/h	524	0	0	412	0	0	202	846	848	169	1626	713
V/C Ratio(X)	0.76	0.00	0.00	0.87	0.00	0.00	0.77	0.32	0.32	0.30	0.22	0.04
Avail Cap(c_a), veh/h	524	0	0	412	0	0	373	846	848	419	1626	713
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.1	0.0	0.0	27.5	0.0	0.0	32.8	12.2	12.3	32.1	12.4	11.3
Incr Delay (d2), s/veh	6.2	0.0	0.0	17.5	0.0	0.0	6.2	1.0	1.0	1.0	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	0.0	0.0	9.4	0.0	0.0	3.5	3.7	3.7	1.1	2.3	0.4
LnGrp Delay(d),s/veh	32.3	0.0	0.0	45.0	0.0	0.0	39.0	13.2	13.2	33.1	12.7	11.4
LnGrp LOS	C			D			D	B	B	C	B	B
Approach Vol, veh/h		396			357			696			441	
Approach Delay, s/veh		32.3			45.0			19.0			15.0	
Approach LOS		C			D			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.3	41.4		24.5	11.7	40.0		24.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	35.0		21.0	16.0	35.0		21.0
Max Q Clear Time (g_c+I1), s	4.0	9.2		18.6	8.5	6.7		23.0
Green Ext Time (p_c), s	0.1	6.5		0.6	0.2	4.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	25.8
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	86	45	3	135	14	93	68	13	17	45	21
Future Vol, veh/h	16	86	45	3	135	14	93	68	13	17	45	21
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	16	89	46	3	139	14	96	70	13	18	46	22
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.8	9	9.4	8.4
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	53%	11%	2%	20%
Vol Thru, %	39%	59%	89%	54%
Vol Right, %	7%	31%	9%	25%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	174	147	152	83
LT Vol	93	16	3	17
Through Vol	68	86	135	45
RT Vol	13	45	14	21
Lane Flow Rate	179	152	157	86
Geometry Grp	1	1	1	1
Degree of Util (X)	0.24	0.194	0.205	0.113
Departure Headway (Hd)	4.822	4.607	4.708	4.773
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	743	776	760	747
Service Time	2.869	2.652	2.752	2.828
HCM Lane V/C Ratio	0.241	0.196	0.207	0.115
HCM Control Delay	9.4	8.8	9	8.4
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.9	0.7	0.8	0.4

5: Broadway & Newcomb St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	7	6	33	44	2	85	14	481	32	48	481	16
Future Volume (veh/h)	7	6	33	44	2	85	14	481	32	48	481	16
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	8	7	36	48	2	92	15	523	35	52	523	17
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	114	95	292	491	18	405	60	1409	94	204	896	29
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.03	0.42	0.42	0.11	0.50	0.50
Sat Flow, veh/h	105	367	1134	1334	68	1573	1774	3367	225	1774	1794	58
Grp Volume(v), veh/h	51	0	0	50	0	92	15	274	284	52	0	540
Grp Sat Flow(s),veh/h/ln	1607	0	0	1402	0	1573	1774	1770	1822	1774	0	1852
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	2.2	0.4	5.1	5.1	1.3	0.0	9.8
Cycle Q Clear(g_c), s	1.1	0.0	0.0	1.0	0.0	2.2	0.4	5.1	5.1	1.3	0.0	9.8
Prop In Lane	0.16		0.71	0.96		1.00	1.00		0.12	1.00		0.03
Lane Grp Cap(c), veh/h	501	0	0	509	0	405	60	741	762	204	0	925
V/C Ratio(X)	0.10	0.00	0.00	0.10	0.00	0.23	0.25	0.37	0.37	0.26	0.00	0.58
Avail Cap(c_a), veh/h	621	0	0	614	0	527	668	741	762	557	0	925
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.6	0.0	0.0	13.6	0.0	14.0	22.5	9.6	9.6	19.3	0.0	8.5
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.3	2.1	1.4	1.4	0.7	0.0	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	0.5	0.0	1.0	0.2	2.7	2.8	0.7	0.0	5.6
LnGrp Delay(d),s/veh	13.7	0.0	0.0	13.6	0.0	14.3	24.6	11.0	11.0	19.9	0.0	11.2
LnGrp LOS	B			B		B	C	B	B	B		B
Approach Vol, veh/h		51			142			573			592	
Approach Delay, s/veh		13.7			14.0			11.3			11.9	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.5	24.0		15.3	4.6	27.9		15.3
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0
Max Q Clear Time (g_c+I1), s	3.3	7.1		3.1	2.4	11.8		4.2
Green Ext Time (p_c), s	0.1	4.7		0.1	0.0	3.5		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	12.0
HCM 2010 LOS	B

Notes

6: Broadway & Leveroni Rd/Napa Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	233	287	46	69	380	135	90	267	61	169	237	101
Future Volume (veh/h)	233	287	46	69	380	135	90	267	61	169	237	101
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.97
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	238	293	47	70	388	138	92	272	62	172	242	103
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	285	600	96	190	433	154	210	478	107	234	438	180
Arrive On Green	0.16	0.38	0.38	0.11	0.33	0.33	0.12	0.17	0.17	0.13	0.18	0.18
Sat Flow, veh/h	1774	1566	251	1774	1313	467	1774	2871	643	1774	2426	997
Grp Volume(v), veh/h	238	0	340	70	0	526	92	166	168	172	174	171
Grp Sat Flow(s),veh/h/ln	1774	0	1818	1774	0	1779	1774	1770	1745	1774	1770	1653
Q Serve(g_s), s	10.6	0.0	11.6	3.0	0.0	22.9	3.9	7.0	7.2	7.6	7.3	7.7
Cycle Q Clear(g_c), s	10.6	0.0	11.6	3.0	0.0	22.9	3.9	7.0	7.2	7.6	7.3	7.7
Prop In Lane	1.00		0.14	1.00		0.26	1.00		0.37	1.00		0.60
Lane Grp Cap(c), veh/h	285	0	697	190	0	587	210	295	291	234	320	299
V/C Ratio(X)	0.84	0.00	0.49	0.37	0.00	0.90	0.44	0.56	0.58	0.73	0.55	0.57
Avail Cap(c_a), veh/h	566	0	697	566	0	676	239	586	578	348	586	547
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	33.2	0.0	19.1	33.8	0.0	26.0	33.5	31.3	31.4	34.0	30.4	30.5
Incr Delay (d2), s/veh	6.4	0.0	0.5	1.2	0.0	13.4	1.4	3.6	3.9	4.4	3.1	3.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	5.9	1.5	0.0	13.4	2.0	3.7	3.8	4.0	3.9	3.8
LnGrp Delay(d),s/veh	39.5	0.0	19.6	35.0	0.0	39.4	34.9	34.8	35.2	38.4	33.5	34.2
LnGrp LOS	D		B	D		D	C	C	D	D	C	C
Approach Vol, veh/h		578			596			426			517	
Approach Delay, s/veh		27.8			38.9			35.0			35.4	
Approach LOS		C			D			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.6	19.7	17.1	31.1	14.8	18.6	12.7	35.5
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2
Max Green Setting (Gmax), s	11.0	27.0	26.0	* 31	16.0	27.0	26.0	* 31
Max Q Clear Time (g_c+I1), s	5.9	9.7	12.6	24.9	9.6	9.2	5.0	13.6
Green Ext Time (p_c), s	0.1	3.3	0.6	1.8	0.2	3.2	0.1	1.9

Intersection Summary	
HCM 2010 Ctrl Delay	34.2
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	17.5
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	244	211	84	264	6	267	10	147	6	10	13
Future Vol, veh/h	6	244	211	84	264	6	267	10	147	6	10	13
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	252	218	87	272	6	275	10	152	6	10	13
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	14.1	23.4	16.8	11.5
HCM LOS	B	C	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	2%	0%	24%	21%
Vol Thru, %	0%	6%	98%	0%	75%	34%
Vol Right, %	0%	94%	0%	100%	2%	45%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	267	157	250	211	354	29
LT Vol	267	0	6	0	84	6
Through Vol	0	10	244	0	264	10
RT Vol	0	147	0	211	6	13
Lane Flow Rate	275	162	258	218	365	30
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	0.571	0.283	0.482	0.363	0.685	0.066
Departure Headway (Hd)	7.471	6.291	6.729	6.002	6.762	7.961
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	482	566	531	594	533	453
Service Time	5.256	4.075	4.52	3.793	4.847	5.961
HCM Lane V/C Ratio	0.571	0.286	0.486	0.367	0.685	0.066
HCM Control Delay	19.8	11.6	15.7	12.2	23.4	11.5
HCM Lane LOS	C	B	C	B	C	B
HCM 95th-tile Q	3.5	1.2	2.6	1.7	5.2	0.2

Intersection	
Intersection Delay, s/veh	21.8
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	17	7	59	13	136	10	408	79	125	355	24
Future Vol, veh/h	18	17	7	59	13	136	10	408	79	125	355	24
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	17	7	60	13	139	10	416	81	128	362	24
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	11	13.1	30.8	17.4
HCM LOS	B	B	D	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	28%	100%	0%
Vol Thru, %	0%	84%	40%	6%	0%	94%
Vol Right, %	0%	16%	17%	65%	0%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	487	42	208	125	379
LT Vol	10	0	18	59	125	0
Through Vol	0	408	17	13	0	355
RT Vol	0	79	7	136	0	24
Lane Flow Rate	10	497	43	212	128	387
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.019	0.827	0.087	0.371	0.234	0.649
Departure Headway (Hd)	6.611	5.988	7.323	6.297	6.592	6.038
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	539	601	492	567	542	596
Service Time	4.386	3.762	5.323	4.39	4.369	3.815
HCM Lane V/C Ratio	0.019	0.827	0.087	0.374	0.236	0.649
HCM Control Delay	9.5	31.2	11	13.1	11.4	19.4
HCM Lane LOS	A	D	B	B	B	C
HCM 95th-tile Q	0.1	8.6	0.3	1.7	0.9	4.7

HCM 2010 Signalized Intersection Summary
3: Broadway & West MacArthur St/East MacArthur St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣		↰	↑↱		↰	↑↑	↱
Traffic Volume (veh/h)	17	103	124	72	125	54	100	429	56	33	396	24
Future Volume (veh/h)	17	103	124	72	125	54	100	429	56	33	396	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.99		0.98	1.00		0.98	1.00		0.99
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	18	111	133	77	134	58	108	461	60	35	426	26
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	68	176	195	144	199	76	200	1677	217	137	1764	780
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.11	0.53	0.53	0.08	0.50	0.50
Sat Flow, veh/h	57	781	864	346	886	338	1774	3143	407	1774	3539	1566
Grp Volume(v), veh/h	262	0	0	269	0	0	108	258	263	35	426	26
Grp Sat Flow(s),veh/h/ln	1703	0	0	1570	0	0	1774	1770	1780	1774	1770	1566
Q Serve(g_s), s	0.0	0.0	0.0	1.2	0.0	0.0	4.0	5.6	5.7	1.3	4.8	0.6
Cycle Q Clear(g_c), s	9.8	0.0	0.0	11.0	0.0	0.0	4.0	5.6	5.7	1.3	4.8	0.6
Prop In Lane	0.07		0.51	0.29		0.22	1.00		0.23	1.00		1.00
Lane Grp Cap(c), veh/h	438	0	0	420	0	0	200	944	950	137	1764	780
V/C Ratio(X)	0.60	0.00	0.00	0.64	0.00	0.00	0.54	0.27	0.28	0.25	0.24	0.03
Avail Cap(c_a), veh/h	559	0	0	531	0	0	404	944	950	455	1764	780
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.9	0.0	0.0	25.2	0.0	0.0	29.4	8.9	9.0	30.5	10.0	9.0
Incr Delay (d2), s/veh	1.3	0.0	0.0	1.7	0.0	0.0	2.3	0.7	0.7	1.0	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.0	0.0	5.1	0.0	0.0	2.1	2.9	3.0	0.7	2.4	0.3
LnGrp Delay(d),s/veh	26.2	0.0	0.0	26.9	0.0	0.0	31.7	9.7	9.7	31.4	10.4	9.1
LnGrp LOS	C			C			C	A	A	C	B	A
Approach Vol, veh/h		262			269			629			487	
Approach Delay, s/veh		26.2			26.9			13.5			11.8	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.4	42.5		19.3	10.9	40.0		19.3
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	35.0		21.0	16.0	35.0		21.0
Max Q Clear Time (g_c+I1), s	3.3	7.7		11.8	6.0	6.8		13.0
Green Ext Time (p_c), s	0.0	6.4		1.0	0.2	5.7		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	17.2
HCM 2010 LOS	B

Notes

HCM 2010 AWSC
4: Fifth St East & East MacArthur St

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	16	68	51	4	110	13	54	58	12	16	41	14
Future Vol, veh/h	16	68	51	4	110	13	54	58	12	16	41	14
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	72	54	4	117	14	57	62	13	17	44	15
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	8.5	8.7	8.2
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	44%	12%	3%	23%
Vol Thru, %	47%	50%	87%	58%
Vol Right, %	10%	38%	10%	20%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	124	135	127	71
LT Vol	54	16	4	16
Through Vol	58	68	110	41
RT Vol	12	51	13	14
Lane Flow Rate	132	144	135	76
Geometry Grp	1	1	1	1
Degree of Util (X)	0.172	0.175	0.17	0.098
Departure Headway (Hd)	4.685	4.382	4.534	4.654
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	765	819	790	769
Service Time	2.718	2.412	2.565	2.69
HCM Lane V/C Ratio	0.173	0.176	0.171	0.099
HCM Control Delay	8.7	8.3	8.5	8.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.6	0.6	0.6	0.3

HCM 2010 Signalized Intersection Summary
5: Broadway & Newcomb St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	0	11	14	3	35	14	501	11	36	486	27
Future Volume (veh/h)	9	0	11	14	3	35	14	501	11	36	486	27
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	10	0	12	15	3	38	15	551	12	40	534	30
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	221	40	165	384	63	313	61	1661	36	173	929	52
Arrive On Green	0.20	0.00	0.20	0.20	0.20	0.20	0.03	0.47	0.47	0.10	0.53	0.53
Sat Flow, veh/h	491	201	830	1149	317	1572	1774	3542	77	1774	1747	98
Grp Volume(v), veh/h	22	0	0	18	0	38	15	275	288	40	0	564
Grp Sat Flow(s),veh/h/ln	1522	0	0	1466	0	1572	1774	1770	1849	1774	0	1845
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.8	0.4	4.2	4.2	0.9	0.0	8.8
Cycle Q Clear(g_c), s	0.4	0.0	0.0	0.3	0.0	0.8	0.4	4.2	4.2	0.9	0.0	8.8
Prop In Lane	0.45		0.55	0.83		1.00	1.00		0.04	1.00		0.05
Lane Grp Cap(c), veh/h	426	0	0	447	0	313	61	830	867	173	0	981
V/C Ratio(X)	0.05	0.00	0.00	0.04	0.00	0.12	0.25	0.33	0.33	0.23	0.00	0.57
Avail Cap(c_a), veh/h	683	0	0	701	0	590	749	830	867	624	0	981
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.9	0.0	0.0	13.8	0.0	14.0	20.1	7.1	7.1	17.8	0.0	6.7
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.0	0.0	0.2	2.1	1.1	1.0	0.7	0.0	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.2	0.0	0.4	0.2	2.2	2.3	0.5	0.0	5.1
LnGrp Delay(d),s/veh	13.9	0.0	0.0	13.8	0.0	14.2	22.1	8.2	8.2	18.5	0.0	9.2
LnGrp LOS	B			B		B	C	A	A	B		A
Approach Vol, veh/h		22			56			578			604	
Approach Delay, s/veh		13.9			14.1			8.5			9.8	
Approach LOS		B			B			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.2	24.0		11.5	4.5	26.7		11.5				
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0				
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0				
Max Q Clear Time (g_c+I1), s	2.9	6.2		2.4	2.4	10.8		2.8				
Green Ext Time (p_c), s	0.0	4.9		0.0	0.0	4.0		0.1				
Intersection Summary												
HCM 2010 Ctrl Delay			9.5									
HCM 2010 LOS			A									
Notes												

HCM 2010 Signalized Intersection Summary
6: Broadway & Leveroni Rd/Napa Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	96	426	58	66	452	137	101	247	90	149	276	57
Future Volume (veh/h)	96	426	58	66	452	137	101	247	90	149	276	57
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.99
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	102	453	62	70	481	146	107	263	96	159	294	61
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	214	615	84	189	507	154	216	437	155	231	523	107
Arrive On Green	0.12	0.38	0.38	0.11	0.37	0.37	0.12	0.17	0.17	0.13	0.18	0.18
Sat Flow, veh/h	1774	1604	220	1774	1373	417	1774	2554	909	1774	2922	597
Grp Volume(v), veh/h	102	0	515	70	0	627	107	180	179	159	176	179
Grp Sat Flow(s),veh/h/ln	1774	0	1824	1774	0	1789	1774	1770	1693	1774	1770	1749
Q Serve(g_s), s	4.4	0.0	20.0	3.0	0.0	28.0	4.6	7.7	8.1	7.1	7.5	7.7
Cycle Q Clear(g_c), s	4.4	0.0	20.0	3.0	0.0	28.0	4.6	7.7	8.1	7.1	7.5	7.7
Prop In Lane	1.00		0.12	1.00		0.23	1.00		0.54	1.00		0.34
Lane Grp Cap(c), veh/h	214	0	700	189	0	661	216	303	290	231	317	313
V/C Ratio(X)	0.48	0.00	0.74	0.37	0.00	0.95	0.49	0.60	0.62	0.69	0.56	0.57
Avail Cap(c_a), veh/h	560	0	700	560	0	673	237	580	555	344	580	573
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	33.8	0.0	21.8	34.2	0.0	25.2	33.8	31.5	31.7	34.3	30.8	30.9
Incr Delay (d2), s/veh	1.6	0.0	4.1	1.2	0.0	22.6	1.7	4.0	4.5	3.6	3.2	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.3	0.0	10.8	1.5	0.0	17.9	2.4	4.1	4.1	3.7	4.0	4.0
LnGrp Delay(d),s/veh	35.5	0.0	25.9	35.4	0.0	47.8	35.5	35.5	36.2	37.9	34.1	34.4
LnGrp LOS	D		C	D		D	D	D	D	D	C	C
Approach Vol, veh/h		617			697			466			514	
Approach Delay, s/veh		27.5			46.5			35.8			35.4	
Approach LOS		C			D			D			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	14.0	19.8	13.9	34.7	14.7	19.1	12.8	35.8				
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2				
Max Green Setting (Gmax), s	11.0	27.0	26.0	* 31	16.0	27.0	26.0	* 31				
Max Q Clear Time (g_c+I1), s	6.6	9.7	6.4	30.0	9.1	10.1	5.0	22.0				
Green Ext Time (p_c), s	0.1	3.4	0.2	0.4	0.2	3.4	0.1	2.2				
Intersection Summary												
HCM 2010 Ctrl Delay			36.7									
HCM 2010 LOS			D									
Notes												

Intersection	
Intersection Delay, s/veh	59.9
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	34	262	251	98	285	34	345	28	116	22	11	56
Future Vol, veh/h	34	262	251	98	285	34	345	28	116	22	11	56
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	40	308	295	115	335	40	406	33	136	26	13	66
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	30.9	114.2	53.9	17.2
HCM LOS	D	F	F	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	11%	0%	24%	25%
Vol Thru, %	0%	19%	89%	0%	68%	12%
Vol Right, %	0%	81%	0%	100%	8%	63%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	345	144	296	251	417	89
LT Vol	345	0	34	0	98	22
Through Vol	0	28	262	0	285	11
RT Vol	0	116	0	251	34	56
Lane Flow Rate	406	169	348	295	491	105
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	0.978	0.358	0.8	0.616	1.136	0.28
Departure Headway (Hd)	9.05	7.945	8.655	7.867	8.336	10.273
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	406	456	421	461	437	352
Service Time	6.75	5.645	6.355	5.567	6.381	8.273
HCM Lane V/C Ratio	1	0.371	0.827	0.64	1.124	0.298
HCM Control Delay	70.1	15	38.1	22.4	114.2	17.2
HCM Lane LOS	F	B	E	C	F	C
HCM 95th-tile Q	11.5	1.6	7.1	4.1	17.7	1.1

Intersection	
Intersection Delay, s/veh	13.2
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	8	11	73	20	212	4	48	19	252	267	30
Future Vol, veh/h	21	8	11	73	20	212	4	48	19	252	267	30
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	23	9	12	78	22	228	4	52	20	271	287	32
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	9.6	13	9.8	14.1
HCM LOS	A	B	A	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	53%	24%	100%	0%
Vol Thru, %	0%	72%	20%	7%	0%	90%
Vol Right, %	0%	28%	28%	70%	0%	10%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	67	40	305	252	297
LT Vol	4	0	21	73	252	0
Through Vol	0	48	8	20	0	267
RT Vol	0	19	11	212	0	30
Lane Flow Rate	4	72	43	328	271	319
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.008	0.124	0.072	0.478	0.467	0.499
Departure Headway (Hd)	6.921	6.209	6.057	5.249	6.208	5.63
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	517	577	591	692	583	642
Service Time	4.663	3.951	4.1	3.249	3.933	3.355
HCM Lane V/C Ratio	0.008	0.125	0.073	0.474	0.465	0.497
HCM Control Delay	9.7	9.8	9.6	13	14.3	13.9
HCM Lane LOS	A	A	A	B	B	B
HCM 95th-tile Q	0	0.4	0.2	2.6	2.5	2.8

HCM 2010 Signalized Intersection Summary
3: Broadway & West MacArthur St/East MacArthur St 08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↑	↱
Traffic Volume (veh/h)	22	177	273	121	206	100	186	560	85	60	431	34
Future Volume (veh/h)	22	177	273	121	206	100	186	560	85	60	431	34
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.98
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	23	182	281	125	212	103	192	577	88	62	444	35
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	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	61	229	334	146	205	90	233	1280	195	182	1371	599
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.13	0.42	0.42	0.10	0.39	0.39
Sat Flow, veh/h	42	680	989	261	607	265	1774	3075	468	1774	3539	1547
Grp Volume(v), veh/h	486	0	0	440	0	0	192	331	334	62	444	35
Grp Sat Flow(s),veh/h/ln	1710	0	0	1133	0	0	1774	1770	1774	1774	1770	1547
Q Serve(g_s), s	0.0	0.0	0.0	5.8	0.0	0.0	8.4	10.8	10.8	2.6	7.0	1.1
Cycle Q Clear(g_c), s	21.2	0.0	0.0	27.0	0.0	0.0	8.4	10.8	10.8	2.6	7.0	1.1
Prop In Lane	0.05		0.58	0.28		0.23	1.00		0.26	1.00		1.00
Lane Grp Cap(c), veh/h	624	0	0	440	0	0	233	736	738	182	1371	599
V/C Ratio(X)	0.78	0.00	0.00	1.00	0.00	0.00	0.82	0.45	0.45	0.34	0.32	0.06
Avail Cap(c_a), veh/h	624	0	0	440	0	0	355	736	738	399	1371	599
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.7	0.0	0.0	28.2	0.0	0.0	33.8	16.8	16.8	33.4	17.2	15.4
Incr Delay (d2), s/veh	6.2	0.0	0.0	42.8	0.0	0.0	9.0	2.0	2.0	1.1	0.6	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.9	0.0	0.0	14.9	0.0	0.0	4.7	5.7	5.7	1.3	3.5	0.5
LnGrp Delay(d),s/veh	30.9	0.0	0.0	71.0	0.0	0.0	42.9	18.8	18.8	34.5	17.8	15.6
LnGrp LOS	C			E			D	B	B	C	B	B
Approach Vol, veh/h		486			440			857			541	
Approach Delay, s/veh		30.9			71.0			24.2			19.6	
Approach LOS		C			E			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.2	38.3		30.5	13.5	36.0		30.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	29.0		27.0	16.0	31.0		27.0
Max Q Clear Time (g_c+I1), s	4.6	12.8		23.2	10.4	9.0		29.0
Green Ext Time (p_c), s	0.1	6.5		1.2	0.2	5.5		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	33.4
HCM 2010 LOS	C

Notes

HCM 2010 AWSC
4: Fifth St East & East MacArthur St 08/28/2019

Intersection	
Intersection Delay, s/veh	11.1
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	24	127	66	4	199	21	137	100	19	25	66	31
Future Vol, veh/h	24	127	66	4	199	21	137	100	19	25	66	31
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	25	131	68	4	205	22	141	103	20	26	68	32
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.8	11.1	12	9.9
HCM LOS	B	B	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	54%	11%	2%	20%
Vol Thru, %	39%	59%	89%	54%
Vol Right, %	7%	30%	9%	25%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	256	217	224	122
LT Vol	137	24	4	25
Through Vol	100	127	199	66
RT Vol	19	66	21	31
Lane Flow Rate	264	224	231	126
Geometry Grp	1	1	1	1
Degree of Util (X)	0.398	0.325	0.342	0.192
Departure Headway (Hd)	5.427	5.233	5.324	5.495
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	662	687	674	652
Service Time	3.465	3.273	3.363	3.542
HCM Lane V/C Ratio	0.399	0.326	0.343	0.193
HCM Control Delay	12	10.8	11.1	9.9
HCM Lane LOS	B	B	B	A
HCM 95th-tile Q	1.9	1.4	1.5	0.7

5: Broadway & Newcomb St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	7	40	53	2	102	17	580	39	58	580	19
Future Volume (veh/h)	8	7	40	53	2	102	17	580	39	58	580	19
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	9	8	43	58	2	111	18	630	42	63	630	21
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	110	92	298	492	15	408	71	1373	91	229	891	30
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.04	0.41	0.41	0.13	0.50	0.50
Sat Flow, veh/h	99	356	1150	1341	56	1573	1774	3367	224	1774	1792	60
Grp Volume(v), veh/h	60	0	0	60	0	111	18	331	341	63	0	651
Grp Sat Flow(s),veh/h/ln	1604	0	0	1398	0	1573	1774	1770	1822	1774	0	1852
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	2.8	0.5	6.7	6.7	1.6	0.0	13.4
Cycle Q Clear(g_c), s	1.4	0.0	0.0	1.3	0.0	2.8	0.5	6.7	6.7	1.6	0.0	13.4
Prop In Lane	0.15		0.72	0.97		1.00	1.00		0.12	1.00		0.03
Lane Grp Cap(c), veh/h	500	0	0	507	0	408	71	721	743	229	0	920
V/C Ratio(X)	0.12	0.00	0.00	0.12	0.00	0.27	0.25	0.46	0.46	0.27	0.00	0.71
Avail Cap(c_a), veh/h	604	0	0	597	0	513	651	721	743	542	0	920
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.0	0.0	0.0	13.9	0.0	14.5	22.8	10.6	10.6	19.3	0.0	9.6
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.4	1.9	2.1	2.0	0.6	0.0	4.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	0.6	0.0	1.2	0.3	3.6	3.7	0.8	0.0	7.9
LnGrp Delay(d),s/veh	14.1	0.0	0.0	14.0	0.0	14.8	24.7	12.7	12.6	19.9	0.0	14.1
LnGrp LOS	B			B		B	C	B	B	B		B
Approach Vol, veh/h		60			171			690			714	
Approach Delay, s/veh		14.1			14.6			13.0			14.7	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.3	24.0		15.7	5.0	28.4		15.7
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0
Max Q Clear Time (g_c+I1), s	3.6	8.7		3.4	2.5	15.4		4.8
Green Ext Time (p_c), s	0.1	5.2		0.2	0.0	2.6		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	13.9
HCM 2010 LOS	B

Notes

HCM 2010 Signalized Intersection Summary
6: Broadway & Leveroni Rd/Napa Rd
08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	265	326	52	78	432	154	102	304	69	192	270	115
Future Volume (veh/h)	265	326	52	78	432	154	102	304	69	192	270	115
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.97
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	270	333	53	80	441	157	104	310	70	196	276	117
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	312	640	102	184	441	157	197	491	109	232	463	191
Arrive On Green	0.18	0.41	0.41	0.10	0.34	0.34	0.11	0.17	0.17	0.13	0.19	0.19
Sat Flow, veh/h	1774	1568	250	1774	1312	467	1774	2875	640	1774	2426	999
Grp Volume(v), veh/h	270	0	386	80	0	598	104	189	191	196	199	194
Grp Sat Flow(s),veh/h/ln	1774	0	1818	1774	0	1779	1774	1770	1745	1774	1770	1655
Q Serve(g_s), s	13.7	0.0	14.7	3.9	0.0	31.0	5.1	9.1	9.4	10.0	9.5	9.9
Cycle Q Clear(g_c), s	13.7	0.0	14.7	3.9	0.0	31.0	5.1	9.1	9.4	10.0	9.5	9.9
Prop In Lane	1.00		0.14	1.00		0.26	1.00		0.37	1.00		0.60
Lane Grp Cap(c), veh/h	312	0	742	184	0	598	197	302	298	232	338	316
V/C Ratio(X)	0.87	0.00	0.52	0.43	0.00	1.00	0.53	0.63	0.64	0.84	0.59	0.61
Avail Cap(c_a), veh/h	500	0	742	500	0	598	212	518	511	308	518	484
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.0	0.0	20.5	38.8	0.0	30.6	38.7	35.5	35.6	39.2	34.0	34.2
Incr Delay (d2), s/veh	9.1	0.0	0.7	1.6	0.0	36.8	2.2	4.5	4.8	14.9	3.5	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.5	0.0	7.5	2.0	0.0	21.2	2.6	4.8	4.9	5.9	5.0	4.9
LnGrp Delay(d),s/veh	46.0	0.0	21.2	40.4	0.0	67.5	40.9	40.0	40.4	54.1	37.5	38.3
LnGrp LOS	D		C	D		F	D	D	D	D	D	D
Approach Vol, veh/h		656			678			484			589	
Approach Delay, s/veh		31.4			64.3			40.3			43.3	
Approach LOS		C			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.2	22.6	20.2	35.2	16.1	20.8	13.6	41.8
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2
Max Green Setting (Gmax), s	11.0	27.0	26.0	* 31	16.0	27.0	26.0	* 31
Max Q Clear Time (g_c+I1), s	7.1	11.9	15.7	33.0	12.0	11.4	5.9	16.7
Green Ext Time (p_c), s	0.1	3.6	0.6	0.0	0.2	3.5	0.2	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	45.4
HCM 2010 LOS	D

Notes

Intersection	
Intersection Delay, s/veh	29.8
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	296	256	102	320	7	323	12	178	7	12	16
Future Vol, veh/h	7	296	256	102	320	7	323	12	178	7	12	16
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	305	264	105	330	7	333	12	184	7	12	16
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	19.9	49.4	25.3	13.1
HCM LOS	C	E	D	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	2%	0%	24%	20%
Vol Thru, %	0%	6%	98%	0%	75%	34%
Vol Right, %	0%	94%	0%	100%	2%	46%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	323	190	303	256	429	35
LT Vol	323	0	7	0	102	7
Through Vol	0	12	296	0	320	12
RT Vol	0	178	0	256	7	16
Lane Flow Rate	333	196	312	264	442	36
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	0.754	0.379	0.65	0.496	0.912	0.091
Departure Headway (Hd)	8.152	6.963	7.495	6.763	7.423	9.101
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	443	517	481	533	491	393
Service Time	5.893	4.704	5.24	4.508	5.462	7.183
HCM Lane V/C Ratio	0.752	0.379	0.649	0.495	0.9	0.092
HCM Control Delay	32	13.9	23.2	16	49.4	13.1
HCM Lane LOS	D	B	C	C	E	B
HCM 95th-tile Q	6.3	1.8	4.6	2.7	10.5	0.3

Intersection	
Intersection Delay, s/veh	27
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	18	7	62	14	143	10	428	83	131	372	25
Future Vol, veh/h	19	18	7	62	14	143	10	428	83	131	372	25
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	19	18	7	63	14	146	10	437	85	134	380	26
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	11.4	14	40.9	20
HCM LOS	B	B	E	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	28%	100%	0%
Vol Thru, %	0%	84%	41%	6%	0%	94%
Vol Right, %	0%	16%	16%	65%	0%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	511	44	219	131	397
LT Vol	10	0	19	62	131	0
Through Vol	0	428	18	14	0	372
RT Vol	0	83	7	143	0	25
Lane Flow Rate	10	521	45	223	134	405
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.019	0.9	0.094	0.407	0.254	0.706
Departure Headway (Hd)	6.839	6.214	7.574	6.551	6.831	6.276
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	526	584	472	550	528	579
Service Time	4.552	3.927	5.637	4.591	4.545	3.99
HCM Lane V/C Ratio	0.019	0.892	0.095	0.405	0.254	0.699
HCM Control Delay	9.7	41.5	11.4	14	11.9	22.7
HCM Lane LOS	A	E	B	B	B	C
HCM 95th-tile Q	0.1	10.8	0.3	2	1	5.7

HCM 2010 Signalized Intersection Summary
3: Broadway & West MacArthur St/East MacArthur St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	126	151	88	153	66	122	523	68	40	483	29
Future Volume (veh/h)	21	126	151	88	153	66	122	523	68	40	483	29
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.99		0.98	1.00		0.98	1.00		0.99
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	23	135	162	95	165	71	131	562	73	43	519	31
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	69	204	227	149	211	81	200	1560	202	154	1666	737
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.11	0.50	0.50	0.09	0.47	0.47
Sat Flow, veh/h	65	781	867	331	808	311	1774	3142	407	1774	3539	1565
Grp Volume(v), veh/h	320	0	0	331	0	0	131	316	319	43	519	31
Grp Sat Flow(s),veh/h/ln	1712	0	0	1450	0	0	1774	1770	1779	1774	1770	1565
Q Serve(g_s), s	0.0	0.0	0.0	3.7	0.0	0.0	5.3	8.1	8.2	1.7	6.8	0.8
Cycle Q Clear(g_c), s	12.6	0.0	0.0	16.3	0.0	0.0	5.3	8.1	8.2	1.7	6.8	0.8
Prop In Lane	0.07		0.51	0.29		0.21	1.00		0.23	1.00		1.00
Lane Grp Cap(c), veh/h	500	0	0	442	0	0	200	879	884	154	1666	737
V/C Ratio(X)	0.64	0.00	0.00	0.75	0.00	0.00	0.65	0.36	0.36	0.28	0.31	0.04
Avail Cap(c_a), veh/h	534	0	0	473	0	0	382	879	884	430	1666	737
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.0	0.0	0.0	26.1	0.0	0.0	31.6	11.5	11.5	31.8	12.2	10.6
Incr Delay (d2), s/veh	2.4	0.0	0.0	6.1	0.0	0.0	3.6	1.1	1.1	1.0	0.5	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.3	0.0	0.0	7.2	0.0	0.0	2.8	4.2	4.3	0.9	3.4	0.4
LnGrp Delay(d),s/veh	27.3	0.0	0.0	32.2	0.0	0.0	35.2	12.6	12.6	32.7	12.7	10.7
LnGrp LOS	C			C			D	B	B	C	B	B
Approach Vol, veh/h		320			331			766			593	
Approach Delay, s/veh		27.3			32.2			16.5			14.0	
Approach LOS		C			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.5	41.9		22.9	11.4	40.0		22.9
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	35.0		21.0	16.0	35.0		21.0
Max Q Clear Time (g_c+I1), s	3.7	10.2		14.6	7.3	8.8		18.3
Green Ext Time (p_c), s	0.1	7.7		1.0	0.2	7.0		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	20.1
HCM 2010 LOS	C

Notes

HCM 2010 AWSC
4: Fifth St East & East MacArthur St

Intersection	
Intersection Delay, s/veh	9.7
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	23	98	74	6	159	19	78	84	17	23	59	20
Future Vol, veh/h	23	98	74	6	159	19	78	84	17	23	59	20
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	24	104	79	6	169	20	83	89	18	24	63	21
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.6	9.8	10	9.1
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	44%	12%	3%	23%
Vol Thru, %	47%	50%	86%	58%
Vol Right, %	9%	38%	10%	20%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	179	195	184	102
LT Vol	78	23	6	23
Through Vol	84	98	159	59
RT Vol	17	74	19	20
Lane Flow Rate	190	207	196	109
Geometry Grp	1	1	1	1
Degree of Util (X)	0.268	0.273	0.266	0.153
Departure Headway (Hd)	5.063	4.731	4.888	5.081
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	703	753	728	698
Service Time	3.145	2.806	2.963	3.172
HCM Lane V/C Ratio	0.27	0.275	0.269	0.156
HCM Control Delay	10	9.6	9.8	9.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.1	1.1	1.1	0.5

HCM 2010 Signalized Intersection Summary
5: Broadway & Newcomb St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	0	13	17	4	42	17	604	13	43	586	33
Future Volume (veh/h)	11	0	13	17	4	42	17	604	13	43	586	33
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	12	0	14	19	4	46	19	664	14	47	644	36
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	230	39	175	395	70	339	75	1596	34	193	903	50
Arrive On Green	0.22	0.00	0.22	0.22	0.22	0.22	0.04	0.45	0.45	0.11	0.52	0.52
Sat Flow, veh/h	516	181	813	1146	323	1572	1774	3544	75	1774	1747	98
Grp Volume(v), veh/h	26	0	0	23	0	46	19	331	347	47	0	680
Grp Sat Flow(s),veh/h/ln	1510	0	0	1469	0	1572	1774	1770	1850	1774	0	1845
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	1.1	0.5	5.6	5.6	1.1	0.0	12.5
Cycle Q Clear(g_c), s	0.5	0.0	0.0	0.4	0.0	1.1	0.5	5.6	5.6	1.1	0.0	12.5
Prop In Lane	0.46		0.54	0.83		1.00	1.00		0.04	1.00		0.05
Lane Grp Cap(c), veh/h	444	0	0	464	0	339	75	797	833	193	0	954
V/C Ratio(X)	0.06	0.00	0.00	0.05	0.00	0.14	0.25	0.42	0.42	0.24	0.00	0.71
Avail Cap(c_a), veh/h	654	0	0	674	0	566	719	797	833	599	0	954
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.9	0.0	0.0	13.8	0.0	14.1	20.6	8.3	8.3	18.1	0.0	8.2
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.0	0.0	0.2	1.7	1.6	1.5	0.6	0.0	4.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	0.2	0.0	0.5	0.3	3.0	3.1	0.6	0.0	7.4
LnGrp Delay(d),s/veh	13.9	0.0	0.0	13.9	0.0	14.3	22.3	9.8	9.8	18.8	0.0	12.7
LnGrp LOS	B			B		B	C	A	A	B		B
Approach Vol, veh/h		26			69			697			727	
Approach Delay, s/veh		13.9			14.1			10.2			13.1	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.8	24.0		12.6	4.9	27.0		12.6
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0
Max Q Clear Time (g_c+I1), s	3.1	7.6		2.5	2.5	14.5		3.1
Green Ext Time (p_c), s	0.1	5.5		0.0	0.0	3.2		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	11.8
HCM 2010 LOS	B

Notes

HCM 2010 Signalized Intersection Summary
6: Broadway & Leveroni Rd/Napa Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	109	482	66	75	511	155	114	279	102	169	312	64
Future Volume (veh/h)	109	482	66	75	511	155	114	279	102	169	312	64
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.99
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	116	513	70	80	544	165	121	297	109	180	332	68
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	198	666	91	183	558	169	200	449	161	216	543	110
Arrive On Green	0.11	0.42	0.42	0.10	0.41	0.41	0.11	0.18	0.18	0.12	0.19	0.19
Sat Flow, veh/h	1774	1605	219	1774	1373	416	1774	2547	915	1774	2928	592
Grp Volume(v), veh/h	116	0	583	80	0	709	121	204	202	180	199	201
Grp Sat Flow(s),veh/h/ln	1774	0	1824	1774	0	1789	1774	1770	1692	1774	1770	1751
Q Serve(g_s), s	5.8	0.0	25.7	4.0	0.0	36.4	6.1	10.1	10.4	9.3	9.7	9.9
Cycle Q Clear(g_c), s	5.8	0.0	25.7	4.0	0.0	36.4	6.1	10.1	10.4	9.3	9.7	9.9
Prop In Lane	1.00		0.12	1.00		0.23	1.00		0.54	1.00		0.34
Lane Grp Cap(c), veh/h	198	0	757	183	0	727	200	312	298	216	328	325
V/C Ratio(X)	0.58	0.00	0.77	0.44	0.00	0.98	0.61	0.65	0.68	0.83	0.61	0.62
Avail Cap(c_a), veh/h	360	0	757	493	0	727	209	511	489	304	511	505
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.5	0.0	23.5	39.4	0.0	27.3	39.5	35.9	36.0	40.2	35.0	35.1
Incr Delay (d2), s/veh	2.7	0.0	4.9	1.7	0.0	27.2	4.6	4.9	5.6	13.0	3.8	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.0	0.0	13.8	2.0	0.0	23.4	3.2	5.4	5.3	5.3	5.0	5.1
LnGrp Delay(d),s/veh	42.2	0.0	28.4	41.1	0.0	54.5	44.1	40.8	41.6	53.2	38.8	39.1
LnGrp LOS	D		C	D		D	D	D	D	D	D	D
Approach Vol, veh/h		699			789			527			580	
Approach Delay, s/veh		30.6			53.1			41.9			43.4	
Approach LOS		C			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.5	22.3	14.5	42.2	15.4	21.5	13.6	43.0
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2
Max Green Setting (Gmax), s	11.0	27.0	19.0	* 38	16.0	27.0	26.0	* 31
Max Q Clear Time (g_c+I1), s	8.1	11.9	7.8	38.4	11.3	12.4	6.0	27.7
Green Ext Time (p_c), s	0.1	3.6	0.2	0.0	0.2	3.6	0.2	1.2

Intersection Summary	
HCM 2010 Ctrl Delay	42.6
HCM 2010 LOS	D

Notes

Intersection	
Intersection Delay, s/veh	29.6
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	28	216	210	82	235	28	306	23	101	18	9	46
Future Vol, veh/h	28	216	210	82	235	28	306	23	101	18	9	46
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	33	254	247	96	276	33	360	27	119	21	11	54
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	19.5	43.3	32	14.4
HCM LOS	C	E	D	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	11%	0%	24%	25%
Vol Thru, %	0%	19%	89%	0%	68%	12%
Vol Right, %	0%	81%	0%	100%	8%	63%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	306	124	244	210	345	73
LT Vol	306	0	28	0	82	18
Through Vol	0	23	216	0	235	9
RT Vol	0	101	0	210	28	46
Lane Flow Rate	360	146	287	247	406	86
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	0.825	0.29	0.62	0.48	0.866	0.214
Departure Headway (Hd)	8.249	7.148	7.773	6.993	7.685	8.983
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	439	500	462	514	471	402
Service Time	6.02	4.918	5.553	4.772	5.758	6.983
HCM Lane V/C Ratio	0.82	0.292	0.621	0.481	0.862	0.214
HCM Control Delay	39.8	12.8	22.5	16.1	43.3	14.4
HCM Lane LOS	E	B	C	C	E	B
HCM 95th-tile Q	7.8	1.2	4.1	2.6	9	0.8

Intersection	
Intersection Delay, s/veh	12.6
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	8	10	69	19	207	4	46	18	241	254	29
Future Vol, veh/h	20	8	10	69	19	207	4	46	18	241	254	29
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	9	11	74	20	223	4	49	19	259	273	31
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	9.4	12.4	9.7	13.4
HCM LOS	A	B	A	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	53%	23%	100%	0%
Vol Thru, %	0%	72%	21%	6%	0%	90%
Vol Right, %	0%	28%	26%	70%	0%	10%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	64	38	295	241	283
LT Vol	4	0	20	69	241	0
Through Vol	0	46	8	19	0	254
RT Vol	0	18	10	207	0	29
Lane Flow Rate	4	69	41	317	259	304
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.008	0.117	0.068	0.456	0.443	0.471
Departure Headway (Hd)	6.818	6.109	5.966	5.176	6.148	5.569
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	525	586	600	701	588	648
Service Time	4.561	3.852	4.006	3.176	3.874	3.296
HCM Lane V/C Ratio	0.008	0.118	0.068	0.452	0.44	0.469
HCM Control Delay	9.6	9.7	9.4	12.4	13.7	13.2
HCM Lane LOS	A	A	A	B	B	B
HCM 95th-tile Q	0	0.4	0.2	2.4	2.3	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	144	223	99	167	81	156	481	80	49	354	28
Future Volume (veh/h)	18	144	223	99	167	81	156	481	80	49	354	28
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.98
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	19	148	230	102	172	84	161	496	82	51	365	29
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	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	61	188	275	139	189	82	203	1453	239	169	1626	713
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.11	0.48	0.48	0.10	0.46	0.46
Sat Flow, veh/h	41	684	998	283	685	297	1774	3038	500	1774	3539	1552
Grp Volume(v), veh/h	397	0	0	358	0	0	161	288	290	51	365	29
Grp Sat Flow(s),veh/h/ln	1722	0	0	1265	0	0	1774	1770	1768	1774	1770	1552
Q Serve(g_s), s	0.0	0.0	0.0	4.3	0.0	0.0	6.7	7.7	7.8	2.0	4.7	0.8
Cycle Q Clear(g_c), s	16.7	0.0	0.0	21.0	0.0	0.0	6.7	7.7	7.8	2.0	4.7	0.8
Prop In Lane	0.05		0.58	0.28		0.23	1.00		0.28	1.00		1.00
Lane Grp Cap(c), veh/h	524	0	0	409	0	0	203	846	846	169	1626	713
V/C Ratio(X)	0.76	0.00	0.00	0.87	0.00	0.00	0.79	0.34	0.34	0.30	0.22	0.04
Avail Cap(c_a), veh/h	524	0	0	409	0	0	372	846	846	419	1626	713
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.1	0.0	0.0	27.6	0.0	0.0	32.9	12.4	12.4	32.1	12.4	11.4
Incr Delay (d2), s/veh	6.3	0.0	0.0	18.5	0.0	0.0	6.9	1.1	1.1	1.0	0.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	0.0	0.0	9.6	0.0	0.0	3.7	4.0	4.0	1.1	2.4	0.4
LnGrp Delay(d),s/veh	32.4	0.0	0.0	46.2	0.0	0.0	39.8	13.5	13.5	33.1	12.7	11.5
LnGrp LOS	C			D			D	B	B	C	B	B
Approach Vol, veh/h		397			358			739			445	
Approach Delay, s/veh		32.4			46.2			19.2			15.0	
Approach LOS		C			D			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.3	41.4		24.5	11.7	40.0		24.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	35.0		21.0	16.0	35.0		21.0
Max Q Clear Time (g_c+I1), s	4.0	9.8		18.7	8.7	6.7		23.0
Green Ext Time (p_c), s	0.1	7.0		0.6	0.2	4.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	25.9
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	9.1
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	89	48	3	135	14	93	68	13	17	45	22
Future Vol, veh/h	21	89	48	3	135	14	93	68	13	17	45	22
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	92	49	3	139	14	96	70	13	18	46	23
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.9	9	9.5	8.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	53%	13%	2%	20%
Vol Thru, %	39%	56%	89%	54%
Vol Right, %	7%	30%	9%	26%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	174	158	152	84
LT Vol	93	21	3	17
Through Vol	68	89	135	45
RT Vol	13	48	14	22
Lane Flow Rate	179	163	157	87
Geometry Grp	1	1	1	1
Degree of Util (X)	0.242	0.209	0.206	0.115
Departure Headway (Hd)	4.852	4.62	4.728	4.798
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	737	774	757	743
Service Time	2.902	2.667	2.775	2.856
HCM Lane V/C Ratio	0.243	0.211	0.207	0.117
HCM Control Delay	9.5	8.9	9	8.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.9	0.8	0.8	0.4

HCM 2010 Signalized Intersection Summary
5: Broadway & Newcomb St

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	7	6	33	53	5	127	14	481	32	54	481	16
Future Volume (veh/h)	7	6	33	53	5	127	14	481	32	54	481	16
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	8	7	36	58	5	138	15	523	35	59	523	17
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	113	96	297	478	36	413	60	1376	92	220	895	29
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.03	0.41	0.41	0.12	0.50	0.50
Sat Flow, veh/h	107	364	1129	1281	135	1573	1774	3367	225	1774	1794	58
Grp Volume(v), veh/h	51	0	0	63	0	138	15	274	284	59	0	540
Grp Sat Flow(s),veh/h/ln	1600	0	0	1416	0	1573	1774	1770	1822	1774	0	1852
Q Serve(g_s), s	0.0	0.0	0.0	0.2	0.0	3.5	0.4	5.3	5.3	1.5	0.0	10.1
Cycle Q Clear(g_c), s	1.2	0.0	0.0	1.4	0.0	3.5	0.4	5.3	5.3	1.5	0.0	10.1
Prop In Lane	0.16		0.71	0.92		1.00	1.00		0.12	1.00		0.03
Lane Grp Cap(c), veh/h	505	0	0	513	0	413	60	724	745	220	0	924
V/C Ratio(X)	0.10	0.00	0.00	0.12	0.00	0.33	0.25	0.38	0.38	0.27	0.00	0.58
Avail Cap(c_a), veh/h	605	0	0	602	0	514	653	724	745	544	0	924
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.7	0.0	0.0	13.8	0.0	14.6	23.0	10.1	10.1	19.4	0.0	8.7
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.5	2.1	1.5	1.5	0.6	0.0	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	0.7	0.0	1.6	0.2	2.9	3.0	0.8	0.0	5.8
LnGrp Delay(d),s/veh	13.8	0.0	0.0	13.9	0.0	15.0	25.2	11.6	11.6	20.1	0.0	11.4
LnGrp LOS	B			B		B	C	B	B	C		B
Approach Vol, veh/h		51			201			573			599	
Approach Delay, s/veh		13.8			14.7			12.0			12.2	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.1	24.0		15.8	4.7	28.4		15.8
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0
Max Q Clear Time (g_c+I1), s	3.5	7.3		3.2	2.4	12.1		5.5
Green Ext Time (p_c), s	0.1	4.6		0.1	0.0	3.4		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	12.5
HCM 2010 LOS	B

Notes

HCM 2010 Signalized Intersection Summary
6: Broadway & Leveroni Rd/Napa Rd

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	233	287	46	69	380	135	90	267	61	172	240	104
Future Volume (veh/h)	233	287	46	69	380	135	90	267	61	172	240	104
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.97
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	238	293	47	70	388	138	92	272	62	176	245	106
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	285	600	96	190	433	154	209	478	107	235	436	182
Arrive On Green	0.16	0.38	0.38	0.11	0.33	0.33	0.12	0.17	0.17	0.13	0.18	0.18
Sat Flow, veh/h	1774	1566	251	1774	1313	467	1774	2871	643	1774	2412	1008
Grp Volume(v), veh/h	238	0	340	70	0	526	92	166	168	176	177	174
Grp Sat Flow(s),veh/h/ln	1774	0	1818	1774	0	1779	1774	1770	1745	1774	1770	1651
Q Serve(g_s), s	10.6	0.0	11.6	3.0	0.0	23.0	3.9	7.0	7.3	7.8	7.4	7.9
Cycle Q Clear(g_c), s	10.6	0.0	11.6	3.0	0.0	23.0	3.9	7.0	7.3	7.8	7.4	7.9
Prop In Lane	1.00		0.14	1.00		0.26	1.00		0.37	1.00		0.61
Lane Grp Cap(c), veh/h	285	0	697	190	0	587	209	295	290	235	320	298
V/C Ratio(X)	0.84	0.00	0.49	0.37	0.00	0.90	0.44	0.56	0.58	0.75	0.55	0.58
Avail Cap(c_a), veh/h	565	0	697	565	0	676	239	586	577	348	586	546
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	33.2	0.0	19.1	33.9	0.0	26.0	33.5	31.3	31.4	34.1	30.4	30.6
Incr Delay (d2), s/veh	6.4	0.0	0.5	1.2	0.0	13.4	1.4	3.6	3.9	5.0	3.2	3.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	5.9	1.5	0.0	13.4	2.0	3.7	3.8	4.1	3.9	3.9
LnGrp Delay(d),s/veh	39.6	0.0	19.6	35.0	0.0	39.5	34.9	34.9	35.2	39.1	33.6	34.4
LnGrp LOS	D		B	D		D	C	C	D	D	C	C
Approach Vol, veh/h		578			596			426			527	
Approach Delay, s/veh		27.8			38.9			35.0			35.7	
Approach LOS		C			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.6	19.7	17.1	31.1	14.8	18.6	12.7	35.5
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2
Max Green Setting (Gmax), s	11.0	27.0	26.0	* 31	16.0	27.0	26.0	* 31
Max Q Clear Time (g_c+I1), s	5.9	9.9	12.6	25.0	9.8	9.3	5.0	13.6
Green Ext Time (p_c), s	0.1	3.4	0.6	1.8	0.2	3.2	0.1	1.9

Intersection Summary	
HCM 2010 Ctrl Delay	34.3
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	24.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	244	379	126	264	6	285	10	152	6	10	13
Future Vol, veh/h	6	244	379	126	264	6	285	10	152	6	10	13
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	252	391	130	272	6	294	10	157	6	10	13
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	20.4	35.8	20.6	12.6
HCM LOS	C	E	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	2%	0%	32%	21%
Vol Thru, %	0%	6%	98%	0%	67%	34%
Vol Right, %	0%	94%	0%	100%	2%	45%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	285	162	250	379	396	29
LT Vol	285	0	6	0	126	6
Through Vol	0	10	244	0	264	10
RT Vol	0	152	0	379	6	13
Lane Flow Rate	294	167	258	391	408	30
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	0.658	0.319	0.511	0.696	0.822	0.073
Departure Headway (Hd)	8.057	6.869	7.141	6.411	7.247	8.788
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	450	524	505	563	502	407
Service Time	5.793	4.604	4.88	4.15	5.281	6.855
HCM Lane V/C Ratio	0.653	0.319	0.511	0.694	0.813	0.074
HCM Control Delay	25	12.8	17.1	22.6	35.8	12.6
HCM Lane LOS	C	B	C	C	E	B
HCM 95th-tile Q	4.6	1.4	2.9	5.5	8	0.2

Intersection	
Intersection Delay, s/veh	22.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	17	7	59	13	141	10	408	79	167	355	24
Future Vol, veh/h	18	17	7	59	13	141	10	408	79	167	355	24
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	17	7	60	13	144	10	416	81	170	362	24
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	11.1	13.4	32.6	17.5
HCM LOS	B	B	D	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	28%	100%	0%
Vol Thru, %	0%	84%	40%	6%	0%	94%
Vol Right, %	0%	16%	17%	66%	0%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	487	42	213	167	379
LT Vol	10	0	18	59	167	0
Through Vol	0	408	17	13	0	355
RT Vol	0	79	7	141	0	24
Lane Flow Rate	10	497	43	217	170	387
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.019	0.84	0.088	0.384	0.314	0.653
Departure Headway (Hd)	6.708	6.084	7.433	6.357	6.635	6.081
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	531	591	485	561	538	592
Service Time	4.487	3.863	5.433	4.452	4.416	3.862
HCM Lane V/C Ratio	0.019	0.841	0.089	0.387	0.316	0.654
HCM Control Delay	9.6	33.1	11.1	13.4	12.5	19.7
HCM Lane LOS	A	D	B	B	B	C
HCM 95th-tile Q	0.1	8.9	0.3	1.8	1.3	4.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↑	↱
Traffic Volume (veh/h)	17	103	166	156	125	54	105	452	65	33	606	24
Future Volume (veh/h)	17	103	166	156	125	54	105	452	65	33	606	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.98	1.00		0.98	1.00		0.99
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	18	111	178	168	134	58	113	486	70	35	652	26
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	64	188	278	211	135	53	191	1532	220	134	1637	724
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.11	0.49	0.49	0.08	0.46	0.46
Sat Flow, veh/h	49	676	1000	507	487	191	1774	3097	444	1774	3539	1565
Grp Volume(v), veh/h	307	0	0	360	0	0	113	277	279	35	652	26
Grp Sat Flow(s),veh/h/ln	1725	0	0	1185	0	0	1774	1770	1771	1774	1770	1565
Q Serve(g_s), s	0.0	0.0	0.0	8.8	0.0	0.0	4.6	7.1	7.2	1.4	9.2	0.7
Cycle Q Clear(g_c), s	12.2	0.0	0.0	21.0	0.0	0.0	4.6	7.1	7.2	1.4	9.2	0.7
Prop In Lane	0.06		0.58	0.47		0.16	1.00		0.25	1.00		1.00
Lane Grp Cap(c), veh/h	529	0	0	399	0	0	191	876	876	134	1637	724
V/C Ratio(X)	0.58	0.00	0.00	0.90	0.00	0.00	0.59	0.32	0.32	0.26	0.40	0.04
Avail Cap(c_a), veh/h	529	0	0	399	0	0	375	876	876	422	1637	724
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.2	0.0	0.0	28.6	0.0	0.0	32.2	11.4	11.5	33.0	13.4	11.1
Incr Delay (d2), s/veh	1.6	0.0	0.0	23.2	0.0	0.0	2.9	0.9	1.0	1.0	0.7	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.9	0.0	0.0	10.0	0.0	0.0	2.4	3.7	3.7	0.7	4.6	0.3
LnGrp Delay(d),s/veh	25.8	0.0	0.0	51.9	0.0	0.0	35.0	12.4	12.4	34.0	14.1	11.2
LnGrp LOS	C			D			D	B	B	C	B	B
Approach Vol, veh/h		307			360			669			713	
Approach Delay, s/veh		25.8			51.9			16.2			15.0	
Approach LOS		C			D			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.7	42.4		24.5	11.2	40.0		24.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	35.0		21.0	16.0	35.0		21.0
Max Q Clear Time (g_c+I1), s	3.4	9.2		14.2	6.6	11.2		23.0
Green Ext Time (p_c), s	0.0	6.8		1.0	0.2	8.5		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	23.5
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	8.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Vol, veh/h	21	70	53	4	131	13	75	58	12	16	41	56
Future Vol, veh/h	21	70	53	4	131	13	75	58	12	16	41	56
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	22	74	56	4	139	14	80	62	13	17	44	60
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.8	9	9.2	8.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	52%	15%	3%	14%
Vol Thru, %	40%	49%	89%	36%
Vol Right, %	8%	37%	9%	50%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	145	144	148	113
LT Vol	75	21	4	16
Through Vol	58	70	131	41
RT Vol	12	53	13	56
Lane Flow Rate	154	153	157	120
Geometry Grp	1	1	1	1
Degree of Util (X)	0.208	0.195	0.207	0.153
Departure Headway (Hd)	4.859	4.59	4.724	4.589
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	736	778	757	778
Service Time	2.909	2.638	2.771	2.641
HCM Lane V/C Ratio	0.209	0.197	0.207	0.154
HCM Control Delay	9.2	8.8	9	8.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.8	0.7	0.8	0.5

5: Broadway & Newcomb St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	21	11	20	5	72	14	501	74	372	486	27
Future Volume (veh/h)	9	21	11	20	5	72	14	501	74	372	486	27
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	10	23	12	22	5	79	15	551	81	409	534	30
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	120	224	97	359	70	338	59	1088	159	458	1006	57
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.03	0.35	0.35	0.26	0.58	0.58
Sat Flow, veh/h	199	1041	451	1137	327	1569	1774	3098	454	1774	1747	98
Grp Volume(v), veh/h	45	0	0	27	0	79	15	314	318	409	0	564
Grp Sat Flow(s),veh/h/ln	1692	0	0	1464	0	1569	1774	1770	1783	1774	0	1845
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	2.4	0.5	8.0	8.0	12.7	0.0	10.6
Cycle Q Clear(g_c), s	1.2	0.0	0.0	0.7	0.0	2.4	0.5	8.0	8.0	12.7	0.0	10.6
Prop In Lane	0.22		0.27	0.81		1.00	1.00		0.25	1.00		0.05
Lane Grp Cap(c), veh/h	441	0	0	430	0	338	59	621	626	458	0	1062
V/C Ratio(X)	0.10	0.00	0.00	0.06	0.00	0.23	0.25	0.51	0.51	0.89	0.00	0.53
Avail Cap(c_a), veh/h	548	0	0	524	0	441	561	621	626	467	0	1062
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.0	0.0	0.0	17.8	0.0	18.5	26.8	14.6	14.6	20.4	0.0	7.4
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.4	2.2	2.9	2.9	19.0	0.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	0.3	0.0	1.1	0.3	4.3	4.4	8.6	0.0	5.9
LnGrp Delay(d),s/veh	18.1	0.0	0.0	17.9	0.0	18.8	29.0	17.5	17.5	39.4	0.0	9.3
LnGrp LOS	B			B		B	C	B	B	D		A
Approach Vol, veh/h		45			106			647			973	
Approach Delay, s/veh		18.1			18.6			17.8			21.9	
Approach LOS		B			B			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	17.7	24.0		15.3	4.9	36.8		15.3
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0
Max Q Clear Time (g_c+I1), s	14.7	10.0		3.2	2.5	12.6		4.4
Green Ext Time (p_c), s	0.1	4.5		0.1	0.0	3.4		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	20.1
HCM 2010 LOS	C

Notes

6: Broadway & Leveroni Rd/Napa Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	117	426	58	66	452	158	101	268	90	151	278	59
Future Volume (veh/h)	117	426	58	66	452	158	101	268	90	151	278	59
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.99
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	124	453	62	70	481	168	107	285	96	161	296	63
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	219	620	85	187	486	170	213	460	152	226	535	112
Arrive On Green	0.12	0.39	0.39	0.11	0.37	0.37	0.12	0.18	0.18	0.13	0.18	0.18
Sat Flow, veh/h	1774	1604	220	1774	1320	461	1774	2611	861	1774	2907	610
Grp Volume(v), veh/h	124	0	515	70	0	649	107	191	190	161	178	181
Grp Sat Flow(s),veh/h/ln	1774	0	1824	1774	0	1781	1774	1770	1702	1774	1770	1747
Q Serve(g_s), s	5.5	0.0	20.3	3.1	0.0	30.5	4.8	8.4	8.7	7.3	7.7	7.9
Cycle Q Clear(g_c), s	5.5	0.0	20.3	3.1	0.0	30.5	4.8	8.4	8.7	7.3	7.7	7.9
Prop In Lane	1.00		0.12	1.00		0.26	1.00		0.51	1.00		0.35
Lane Grp Cap(c), veh/h	219	0	705	187	0	656	213	312	300	226	326	322
V/C Ratio(X)	0.57	0.00	0.73	0.37	0.00	0.99	0.50	0.61	0.63	0.71	0.55	0.56
Avail Cap(c_a), veh/h	548	0	705	548	0	656	232	568	546	337	568	560
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.8	0.0	22.1	35.1	0.0	26.4	34.7	32.0	32.1	35.2	31.2	31.3
Incr Delay (d2), s/veh	2.3	0.0	3.9	1.2	0.0	32.3	1.8	4.1	4.6	4.1	3.1	3.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	0.0	10.9	1.6	0.0	20.9	2.4	4.4	4.4	3.8	4.0	4.1
LnGrp Delay(d),s/veh	37.1	0.0	26.0	36.3	0.0	58.8	36.5	36.1	36.8	39.3	34.2	34.5
LnGrp LOS	D		C	D		E	D	D	D	D	C	C
Approach Vol, veh/h		639			719			488			520	
Approach Delay, s/veh		28.1			56.6			36.5			35.9	
Approach LOS		C			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.1	20.5	14.4	35.2	14.7	19.8	12.9	36.7
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2
Max Green Setting (Gmax), s	11.0	27.0	26.0	* 31	16.0	27.0	26.0	* 31
Max Q Clear Time (g_c+I1), s	6.8	9.9	7.5	32.5	9.3	10.7	5.1	22.3
Green Ext Time (p_c), s	0.1	3.4	0.3	0.0	0.2	3.6	0.1	2.2

Intersection Summary	
HCM 2010 Ctrl Delay	40.2
HCM 2010 LOS	D

Notes

Intersection	
Intersection Delay, s/veh	37
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	244	491	154	264	6	297	10	154	6	10	13
Future Vol, veh/h	6	244	491	154	264	6	297	10	154	6	10	13
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	252	506	159	272	6	306	10	159	6	10	13
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	38.6	50	23.8	13.3
HCM LOS	E	E	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	2%	0%	36%	21%
Vol Thru, %	0%	6%	98%	0%	62%	34%
Vol Right, %	0%	94%	0%	100%	1%	45%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	297	164	250	491	424	29
LT Vol	297	0	6	0	154	6
Through Vol	0	10	244	0	264	10
RT Vol	0	154	0	491	6	13
Lane Flow Rate	306	169	258	506	437	30
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	0.713	0.337	0.527	0.932	0.913	0.078
Departure Headway (Hd)	8.378	7.184	7.363	6.631	7.519	9.374
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	432	500	490	547	481	381
Service Time	6.117	4.923	5.106	4.374	5.557	7.455
HCM Lane V/C Ratio	0.708	0.338	0.527	0.925	0.909	0.079
HCM Control Delay	29.4	13.6	18.1	49.1	50	13.3
HCM Lane LOS	D	B	C	E	E	B
HCM 95th-tile Q	5.5	1.5	3	11.6	10.4	0.3

Intersection	
Intersection Delay, s/veh	22.9
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	17	7	59	13	143	10	408	79	195	355	24
Future Vol, veh/h	18	17	7	59	13	143	10	408	79	195	355	24
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	17	7	60	13	146	10	416	81	199	362	24
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	11.2	13.6	33.8	17.7
HCM LOS	B	B	D	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	27%	100%	0%
Vol Thru, %	0%	84%	40%	6%	0%	94%
Vol Right, %	0%	16%	17%	67%	0%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	487	42	215	195	379
LT Vol	10	0	18	59	195	0
Through Vol	0	408	17	13	0	355
RT Vol	0	79	7	143	0	24
Lane Flow Rate	10	497	43	219	199	387
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.019	0.848	0.089	0.39	0.368	0.656
Departure Headway (Hd)	6.767	6.143	7.499	6.398	6.659	6.105
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	526	586	481	557	537	588
Service Time	4.549	3.924	5.499	4.495	4.441	3.887
HCM Lane V/C Ratio	0.019	0.848	0.089	0.393	0.371	0.658
HCM Control Delay	9.7	34.3	11.2	13.6	13.3	19.9
HCM Lane LOS	A	D	B	B	B	C
HCM 95th-tile Q	0.1	9.1	0.3	1.8	1.7	4.8

HCM 2010 Signalized Intersection Summary
3: Broadway & West MacArthur St/East MacArthur St

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	17	103	194	197	125	54	107	466	87	33	746	24
Future Volume (veh/h)	17	103	194	197	125	54	107	466	87	33	746	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.98	1.00		0.98	1.00		0.99
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	18	111	209	212	134	58	115	501	94	35	802	26
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	63	170	296	213	96	40	192	1468	274	134	1636	723
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.11	0.49	0.49	0.08	0.46	0.46
Sat Flow, veh/h	45	614	1067	507	344	143	1774	2965	553	1774	3539	1564
Grp Volume(v), veh/h	338	0	0	404	0	0	115	298	297	35	802	26
Grp Sat Flow(s),veh/h/ln	1726	0	0	994	0	0	1774	1770	1749	1774	1770	1564
Q Serve(g_s), s	0.0	0.0	0.0	7.3	0.0	0.0	4.7	7.7	7.8	1.4	11.9	0.7
Cycle Q Clear(g_c), s	13.7	0.0	0.0	21.0	0.0	0.0	4.7	7.7	7.8	1.4	11.9	0.7
Prop In Lane	0.05		0.62	0.52		0.14	1.00		0.32	1.00		1.00
Lane Grp Cap(c), veh/h	529	0	0	348	0	0	192	876	866	134	1636	723
V/C Ratio(X)	0.64	0.00	0.00	1.16	0.00	0.00	0.60	0.34	0.34	0.26	0.49	0.04
Avail Cap(c_a), veh/h	529	0	0	348	0	0	375	876	866	422	1636	723
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.8	0.0	0.0	30.3	0.0	0.0	32.2	11.6	11.6	33.0	14.1	11.1
Incr Delay (d2), s/veh	2.6	0.0	0.0	99.2	0.0	0.0	3.0	1.1	1.1	1.0	1.1	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.8	0.0	0.0	16.8	0.0	0.0	2.5	4.0	4.0	0.7	6.0	0.3
LnGrp Delay(d),s/veh	27.4	0.0	0.0	129.5	0.0	0.0	35.2	12.7	12.7	34.0	15.2	11.2
LnGrp LOS	C			F			D	B	B	C	B	B
Approach Vol, veh/h		338			404			710			863	
Approach Delay, s/veh		27.4			129.5			16.3			15.8	
Approach LOS		C			F			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.7	42.5		24.5	11.2	40.0		24.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	35.0		21.0	16.0	35.0		21.0
Max Q Clear Time (g_c+I1), s	3.4	9.8		15.7	6.7	13.9		23.0
Green Ext Time (p_c), s	0.0	7.2		1.0	0.2	9.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	37.5
HCM 2010 LOS	D

Notes

HCM 2010 AWSC
4: Fifth St East & East MacArthur St

08/28/2019

Intersection	
Intersection Delay, s/veh	9.2
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	23	72	55	4	145	13	89	58	12	16	41	84
Future Vol, veh/h	23	72	55	4	145	13	89	58	12	16	41	84
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	24	77	59	4	154	14	95	62	13	17	44	89
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.1	9.4	9.6	8.8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	56%	15%	2%	11%
Vol Thru, %	36%	48%	90%	29%
Vol Right, %	8%	37%	8%	60%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	159	150	162	141
LT Vol	89	23	4	16
Through Vol	58	72	145	41
RT Vol	12	55	13	84
Lane Flow Rate	169	160	172	150
Geometry Grp	1	1	1	1
Degree of Util (X)	0.234	0.21	0.232	0.192
Departure Headway (Hd)	4.977	4.731	4.855	4.615
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	717	753	734	771
Service Time	3.04	2.793	2.918	2.68
HCM Lane V/C Ratio	0.236	0.212	0.234	0.195
HCM Control Delay	9.6	9.1	9.4	8.8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.9	0.8	0.9	0.7

HCM 2010 Signalized Intersection Summary
5: Broadway & Newcomb St

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	33	11	42	7	142	14	501	101	552	486	27
Future Volume (veh/h)	11	33	11	42	7	142	14	501	101	552	486	27
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	12	36	12	46	8	156	15	551	111	607	534	30
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	113	270	77	384	58	355	59	1010	203	457	993	56
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.03	0.34	0.34	0.26	0.57	0.57
Sat Flow, veh/h	173	1191	341	1189	256	1569	1774	2938	590	1774	1747	98
Grp Volume(v), veh/h	60	0	0	54	0	156	15	331	331	607	0	564
Grp Sat Flow(s),veh/h/ln	1705	0	0	1446	0	1569	1774	1770	1759	1774	0	1845
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	5.0	0.5	8.8	8.8	15.0	0.0	11.1
Cycle Q Clear(g_c), s	1.6	0.0	0.0	1.4	0.0	5.0	0.5	8.8	8.8	15.0	0.0	11.1
Prop In Lane	0.20		0.20	0.85		1.00	1.00		0.34	1.00		0.05
Lane Grp Cap(c), veh/h	460	0	0	442	0	355	59	608	605	457	0	1048
V/C Ratio(X)	0.13	0.00	0.00	0.12	0.00	0.44	0.25	0.54	0.55	1.33	0.00	0.54
Avail Cap(c_a), veh/h	539	0	0	510	0	431	549	608	605	457	0	1048
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.0	0.0	0.0	17.9	0.0	19.3	27.4	15.4	15.4	21.6	0.0	7.8
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.9	2.2	3.5	3.5	161.7	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.0	0.7	0.0	2.2	0.3	4.8	4.8	27.8	0.0	6.1
LnGrp Delay(d),s/veh	18.1	0.0	0.0	18.1	0.0	20.2	29.6	18.9	19.0	183.3	0.0	9.8
LnGrp LOS	B			B		C	C	B	B	F		A
Approach Vol, veh/h		60			210			677			1171	
Approach Delay, s/veh		18.1			19.6			19.2			99.7	
Approach LOS		B			B			B			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.0	24.0		16.2	4.9	37.1		16.2
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0
Max Q Clear Time (g_c+I1), s	17.0	10.8		3.6	2.5	13.1		7.0
Green Ext Time (p_c), s	0.0	4.4		0.2	0.0	3.2		0.5

Intersection Summary		
HCM 2010 Ctrl Delay		63.7
HCM 2010 LOS		E

Notes

HCM 2010 Signalized Intersection Summary
6: Broadway & Leveroni Rd/Napa Rd

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	131	426	58	66	452	172	101	282	90	153	280	61
Future Volume (veh/h)	131	426	58	66	452	172	101	282	90	153	280	61
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.99
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	139	453	62	70	481	183	107	300	96	163	298	65
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	221	618	85	186	470	179	212	477	150	225	544	117
Arrive On Green	0.12	0.39	0.39	0.10	0.37	0.37	0.12	0.18	0.18	0.13	0.19	0.19
Sat Flow, veh/h	1774	1604	220	1774	1287	490	1774	2647	831	1774	2893	622
Grp Volume(v), veh/h	139	0	515	70	0	664	107	199	197	163	180	183
Grp Sat Flow(s),veh/h/ln	1774	0	1824	1774	0	1776	1774	1770	1708	1774	1770	1745
Q Serve(g_s), s	6.3	0.0	20.5	3.1	0.0	31.0	4.8	8.8	9.1	7.5	7.8	8.0
Cycle Q Clear(g_c), s	6.3	0.0	20.5	3.1	0.0	31.0	4.8	8.8	9.1	7.5	7.8	8.0
Prop In Lane	1.00		0.12	1.00		0.28	1.00		0.49	1.00		0.36
Lane Grp Cap(c), veh/h	221	0	703	186	0	649	212	319	308	225	333	328
V/C Ratio(X)	0.63	0.00	0.73	0.38	0.00	1.02	0.51	0.62	0.64	0.72	0.54	0.56
Avail Cap(c_a), veh/h	544	0	703	544	0	649	230	563	544	335	563	555
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.3	0.0	22.3	35.4	0.0	26.9	35.0	32.1	32.2	35.6	31.2	31.2
Incr Delay (d2), s/veh	2.9	0.0	4.0	1.3	0.0	41.3	1.9	4.2	4.7	4.4	2.9	3.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	0.0	11.1	1.6	0.0	22.4	2.5	4.7	4.7	3.9	4.1	4.1
LnGrp Delay(d),s/veh	38.2	0.0	26.3	36.7	0.0	68.2	36.9	36.3	36.9	40.0	34.1	34.4
LnGrp LOS	D		C	D		F	D	D	D	D	C	C
Approach Vol, veh/h		654			734			503			526	
Approach Delay, s/veh		28.8			65.2			36.7			36.0	
Approach LOS		C			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.1	20.9	14.6	35.2	14.8	20.3	12.9	36.9
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2
Max Green Setting (Gmax), s	11.0	27.0	26.0	* 31	16.0	27.0	26.0	* 31
Max Q Clear Time (g_c+I1), s	6.8	10.0	8.3	33.0	9.5	11.1	5.1	22.5
Green Ext Time (p_c), s	0.1	3.5	0.3	0.0	0.2	3.7	0.1	2.2

Intersection Summary		
HCM 2010 Ctrl Delay		43.1
HCM 2010 LOS		D

Notes

HCM 2010 Signalized Intersection Summary
5: Broadway & Newcomb St

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	33	11	42	7	142	14	501	101	552	486	27
Future Volume (veh/h)	11	33	11	42	7	142	14	501	101	552	486	27
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	12	36	12	46	8	156	15	551	111	607	534	30
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	114	268	77	383	58	352	59	667	134	664	992	56
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.03	0.23	0.23	0.37	0.57	0.57
Sat Flow, veh/h	171	1194	341	1189	257	1569	1774	2938	590	1774	1747	98
Grp Volume(v), veh/h	60	0	0	54	0	156	15	331	331	607	0	564
Grp Sat Flow(s),veh/h/ln	1706	0	0	1446	0	1569	1774	1770	1759	1774	0	1845
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	4.9	0.5	10.2	10.3	18.6	0.0	10.9
Cycle Q Clear(g_c), s	1.5	0.0	0.0	1.4	0.0	4.9	0.5	10.2	10.3	18.6	0.0	10.9
Prop In Lane	0.20		0.20	0.85		1.00	1.00		0.34	1.00		0.05
Lane Grp Cap(c), veh/h	458	0	0	441	0	352	59	402	399	664	0	1048
V/C Ratio(X)	0.13	0.00	0.00	0.12	0.00	0.44	0.25	0.82	0.83	0.91	0.00	0.54
Avail Cap(c_a), veh/h	462	0	0	444	0	356	557	402	399	743	0	1048
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	17.8	0.0	0.0	17.8	0.0	19.1	27.0	21.1	21.1	17.0	0.0	7.7
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.9	2.2	17.3	17.8	14.9	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.0	0.7	0.0	2.2	0.3	6.9	6.9	11.8	0.0	6.1
LnGrp Delay(d),s/veh	18.0	0.0	0.0	17.9	0.0	20.0	29.2	38.3	38.9	31.9	0.0	9.7
LnGrp LOS	B			B		C	C	D	D	C		A
Approach Vol, veh/h		60			210			677			1171	
Approach Delay, s/veh		18.0			19.5			38.4			21.2	
Approach LOS		B			B			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	24.4	17.0		15.8	4.9	36.5		15.8
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	24.0	13.0		13.0	18.0	19.0		13.0
Max Q Clear Time (g_c+I1), s	20.6	12.3		3.5	2.5	12.9		6.9
Green Ext Time (p_c), s	0.8	0.4		0.1	0.0	2.9		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	26.4
HCM 2010 LOS	C

Notes

HCM 2010 AWSC
1: Broadway & West Napa St/East Napa St

08/28/2019

Intersection	
Intersection Delay, s/veh	62.5
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	34	262	254	99	285	34	366	28	121	22	11	56
Future Vol, veh/h	34	262	254	99	285	34	366	28	121	22	11	56
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	40	308	299	116	335	40	431	33	142	26	13	66
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	31.1	112.9	63	17.4
HCM LOS	D	F	F	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	11%	0%	24%	25%
Vol Thru, %	0%	19%	89%	0%	68%	12%
Vol Right, %	0%	81%	0%	100%	8%	63%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	366	149	296	254	418	89
LT Vol	366	0	34	0	99	22
Through Vol	0	28	262	0	285	11
RT Vol	0	121	0	254	34	56
Lane Flow Rate	431	175	348	299	492	105
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	1.026	0.366	0.798	0.622	1.131	0.282
Departure Headway (Hd)	9.048	7.939	8.736	7.948	8.462	10.346
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	405	456	418	457	433	350
Service Time	6.748	5.639	6.436	5.648	6.462	8.346
HCM Lane V/C Ratio	1.064	0.384	0.833	0.654	1.136	0.3
HCM Control Delay	82.5	15.2	38.1	22.9	112.9	17.4
HCM Lane LOS	F	C	E	C	F	C
HCM 95th-tile Q	13	1.7	7.1	4.1	17.4	1.1

HCM 2010 AWSC
2: Fifth St West & West MacArthur St

Intersection	
Intersection Delay, s/veh	13.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	8	11	73	20	217	4	48	19	253	267	30
Future Vol, veh/h	21	8	11	73	20	217	4	48	19	253	267	30
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	23	9	12	78	22	233	4	52	20	272	287	32
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	9.6	13.1	9.9	14.1
HCM LOS	A	B	A	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	53%	24%	100%	0%
Vol Thru, %	0%	72%	20%	6%	0%	90%
Vol Right, %	0%	28%	28%	70%	0%	10%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	67	40	310	253	297
LT Vol	4	0	21	73	253	0
Through Vol	0	48	8	20	0	267
RT Vol	0	19	11	217	0	30
Lane Flow Rate	4	72	43	333	272	319
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.008	0.125	0.073	0.486	0.47	0.501
Departure Headway (Hd)	6.94	6.228	6.071	5.253	6.222	5.645
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	515	575	589	690	579	639
Service Time	4.688	3.976	4.118	3.253	3.952	3.374
HCM Lane V/C Ratio	0.008	0.125	0.073	0.483	0.47	0.499
HCM Control Delay	9.7	9.9	9.6	13.1	14.4	13.9
HCM Lane LOS	A	A	A	B	B	B
HCM 95th-tile Q	0	0.4	0.2	2.7	2.5	2.8

HCM 2010 Signalized Intersection Summary
3: Broadway & West MacArthur St/East MacArthur St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	177	274	122	206	100	191	586	96	60	435	34
Future Volume (veh/h)	22	177	274	122	206	100	191	586	96	60	435	34
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.99	1.00		0.98
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	23	182	282	126	212	103	197	604	99	62	448	35
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	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	61	228	333	145	202	88	238	1270	208	182	1366	597
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.13	0.42	0.42	0.10	0.39	0.39
Sat Flow, veh/h	42	679	990	260	600	262	1774	3040	497	1774	3539	1546
Grp Volume(v), veh/h	487	0	0	441	0	0	197	351	352	62	448	35
Grp Sat Flow(s),veh/h/ln	1710	0	0	1122	0	0	1774	1770	1768	1774	1770	1546
Q Serve(g_s), s	0.0	0.0	0.0	5.7	0.0	0.0	8.7	11.6	11.6	2.6	7.1	1.1
Cycle Q Clear(g_c), s	21.3	0.0	0.0	27.0	0.0	0.0	8.7	11.6	11.6	2.6	7.1	1.1
Prop In Lane	0.05		0.58	0.29		0.23	1.00		0.28	1.00		1.00
Lane Grp Cap(c), veh/h	622	0	0	435	0	0	238	739	739	182	1366	597
V/C Ratio(X)	0.78	0.00	0.00	1.01	0.00	0.00	0.83	0.47	0.48	0.34	0.33	0.06
Avail Cap(c_a), veh/h	622	0	0	435	0	0	354	739	739	398	1366	597
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.8	0.0	0.0	28.3	0.0	0.0	33.8	17.0	17.0	33.5	17.3	15.5
Incr Delay (d2), s/veh	6.4	0.0	0.0	46.7	0.0	0.0	9.8	2.2	2.2	1.1	0.6	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.1	0.0	0.0	15.2	0.0	0.0	4.9	6.1	6.1	1.3	3.6	0.5
LnGrp Delay(d),s/veh	31.3	0.0	0.0	75.0	0.0	0.0	43.6	19.2	19.2	34.6	18.0	15.7
LnGrp LOS	C			F			D	B	B	C	B	B
Approach Vol, veh/h		487			441			900			545	
Approach Delay, s/veh		31.3			75.0			24.5			19.7	
Approach LOS		C			E			C			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.2	38.5		30.5	13.8	36.0		30.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	29.0		27.0	16.0	31.0		27.0
Max Q Clear Time (g_c+I1), s	4.6	13.6		23.3	10.7	9.1		29.0
Green Ext Time (p_c), s	0.1	6.7		1.1	0.2	5.5		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	34.2
HCM 2010 LOS	C

Notes

HCM 2010 AWSC
4: Fifth St East & East MacArthur St

08/28/2019

Intersection	
Intersection Delay, s/veh	11.2
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	29	130	69	4	199	21	137	100	19	25	66	32
Future Vol, veh/h	29	130	69	4	199	21	137	100	19	25	66	32
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	134	71	4	205	22	141	103	20	26	68	33
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	11	11.2	12.1	9.9
HCM LOS	B	B	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	54%	13%	2%	20%
Vol Thru, %	39%	57%	89%	54%
Vol Right, %	7%	30%	9%	26%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	256	228	224	123
LT Vol	137	29	4	25
Through Vol	100	130	199	66
RT Vol	19	69	21	32
Lane Flow Rate	264	235	231	127
Geometry Grp	1	1	1	1
Degree of Util (X)	0.401	0.343	0.343	0.195
Departure Headway (Hd)	5.465	5.249	5.353	5.533
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	657	684	670	647
Service Time	3.504	3.291	3.396	3.58
HCM Lane V/C Ratio	0.402	0.344	0.345	0.196
HCM Control Delay	12.1	11	11.2	9.9
HCM Lane LOS	B	B	B	A
HCM 95th-tile Q	1.9	1.5	1.5	0.7

HCM 2010 Signalized Intersection Summary
5: Broadway & Newcomb St

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	7	40	62	5	144	17	580	39	64	580	19
Future Volume (veh/h)	8	7	40	62	5	144	17	580	39	64	580	19
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	9	8	43	67	5	157	18	630	42	70	630	21
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	109	92	299	477	31	411	71	1351	90	243	893	30
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.04	0.40	0.40	0.14	0.50	0.50
Sat Flow, veh/h	99	353	1145	1293	118	1572	1774	3367	224	1774	1792	60
Grp Volume(v), veh/h	60	0	0	72	0	157	18	331	341	70	0	651
Grp Sat Flow(s),veh/h/ln	1598	0	0	1411	0	1572	1774	1770	1822	1774	0	1852
Q Serve(g_s), s	0.0	0.0	0.0	0.2	0.0	4.1	0.5	6.9	6.9	1.8	0.0	13.6
Cycle Q Clear(g_c), s	1.4	0.0	0.0	1.6	0.0	4.1	0.5	6.9	6.9	1.8	0.0	13.6
Prop In Lane	0.15		0.72	0.93		1.00	1.00		0.12	1.00		0.03
Lane Grp Cap(c), veh/h	501	0	0	508	0	411	71	710	731	243	0	923
V/C Ratio(X)	0.12	0.00	0.00	0.14	0.00	0.38	0.25	0.47	0.47	0.29	0.00	0.71
Avail Cap(c_a), veh/h	592	0	0	590	0	505	641	710	731	534	0	923
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	14.1	0.0	0.0	14.2	0.0	15.1	23.2	11.0	11.0	19.3	0.0	9.7
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.6	1.9	2.2	2.1	0.6	0.0	4.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	0.8	0.0	1.8	0.3	3.7	3.8	0.9	0.0	8.0
LnGrp Delay(d),s/veh	14.2	0.0	0.0	14.3	0.0	15.7	25.1	13.2	13.1	20.0	0.0	14.2
LnGrp LOS	B			B		B	C	B	B	B		B
Approach Vol, veh/h		60			229			690			721	
Approach Delay, s/veh		14.2			15.3			13.5			14.8	
Approach LOS		B			B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.8	24.0		16.0	5.0	28.8		16.0
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0
Max Q Clear Time (g_c+I1), s	3.8	8.9		3.4	2.5	15.6		6.1
Green Ext Time (p_c), s	0.1	5.1		0.2	0.0	2.5		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	14.3
HCM 2010 LOS	B

Notes

HCM 2010 Signalized Intersection Summary
6: Broadway & Leveroni Rd/Napa Rd

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	265	326	52	78	432	154	102	304	69	195	273	118
Future Volume (veh/h)	265	326	52	78	432	154	102	304	69	195	273	118
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.97
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	270	333	53	80	441	157	104	310	70	199	279	120
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	312	639	102	184	440	157	196	491	109	235	465	194
Arrive On Green	0.18	0.41	0.41	0.10	0.34	0.34	0.11	0.17	0.17	0.13	0.19	0.19
Sat Flow, veh/h	1774	1568	250	1774	1312	467	1774	2875	640	1774	2414	1009
Grp Volume(v), veh/h	270	0	386	80	0	598	104	189	191	199	202	197
Grp Sat Flow(s),veh/h/ln	1774	0	1818	1774	0	1779	1774	1770	1745	1774	1770	1653
Q Serve(g_s), s	13.7	0.0	14.8	3.9	0.0	31.0	5.1	9.2	9.4	10.1	9.6	10.1
Cycle Q Clear(g_c), s	13.7	0.0	14.8	3.9	0.0	31.0	5.1	9.2	9.4	10.1	9.6	10.1
Prop In Lane	1.00		0.14	1.00		0.26	1.00		0.37	1.00		0.61
Lane Grp Cap(c), veh/h	312	0	740	184	0	596	196	302	298	235	341	318
V/C Ratio(X)	0.87	0.00	0.52	0.43	0.00	1.00	0.53	0.63	0.64	0.85	0.59	0.62
Avail Cap(c_a), veh/h	499	0	740	499	0	596	211	517	509	307	517	483
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.1	0.0	20.6	38.9	0.0	30.7	38.9	35.6	35.7	39.2	34.0	34.2
Incr Delay (d2), s/veh	9.1	0.0	0.7	1.6	0.0	37.5	2.2	4.5	4.8	15.5	3.5	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.5	0.0	7.5	2.0	0.0	21.3	2.6	4.8	5.0	6.0	5.1	5.0
LnGrp Delay(d),s/veh	46.2	0.0	21.3	40.5	0.0	68.3	41.1	40.1	40.5	54.7	37.6	38.4
LnGrp LOS	D		C	D		F	D	D	D	D	D	D
Approach Vol, veh/h		656			678			484			598	
Approach Delay, s/veh		31.5			65.0			40.5			43.5	
Approach LOS		C			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.2	22.8	20.2	35.2	16.3	20.8	13.6	41.9
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2
Max Green Setting (Gmax), s	11.0	27.0	26.0	* 31	16.0	27.0	26.0	* 31
Max Q Clear Time (g_c+I1), s	7.1	12.1	15.7	33.0	12.1	11.4	5.9	16.8
Green Ext Time (p_c), s	0.1	3.6	0.6	0.0	0.2	3.5	0.2	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	45.7
HCM 2010 LOS	D

Notes

HCM 2010 AWSC
1: Broadway & West Napa St/East Napa St

08/28/2019

Intersection	
Intersection Delay, s/veh	45.1
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	296	424	144	320	7	341	12	183	7	12	16
Future Vol, veh/h	7	296	424	144	320	7	341	12	183	7	12	16
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	305	437	148	330	7	352	12	189	7	12	16
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	31.9	83.4	31.3	14
HCM LOS	D	F	D	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	2%	0%	31%	20%
Vol Thru, %	0%	6%	98%	0%	68%	34%
Vol Right, %	0%	94%	0%	100%	1%	46%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	341	195	303	424	471	35
LT Vol	341	0	7	0	144	7
Through Vol	0	12	296	0	320	12
RT Vol	0	183	0	424	7	16
Lane Flow Rate	352	201	312	437	486	36
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	0.824	0.405	0.664	0.841	1.049	0.097
Departure Headway (Hd)	8.592	7.395	7.842	7.108	7.774	9.958
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	425	491	462	511	471	362
Service Time	6.292	5.095	5.542	4.808	5.774	7.958
HCM Lane V/C Ratio	0.828	0.409	0.675	0.855	1.032	0.099
HCM Control Delay	40.6	15	24.7	37	83.4	14
HCM Lane LOS	E	B	C	E	F	B
HCM 95th-tile Q	7.7	1.9	4.8	8.6	15	0.3

Intersection	
Intersection Delay, s/veh	27.9
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	18	7	62	14	148	10	428	83	173	372	25
Future Vol, veh/h	19	18	7	62	14	148	10	428	83	173	372	25
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	19	18	7	63	14	151	10	437	85	177	380	26
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	11.6	14.4	43.7	20.1
HCM LOS	B	B	E	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	28%	100%	0%
Vol Thru, %	0%	84%	41%	6%	0%	94%
Vol Right, %	0%	16%	16%	66%	0%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	511	44	224	173	397
LT Vol	10	0	19	62	173	0
Through Vol	0	428	18	14	0	372
RT Vol	0	83	7	148	0	25
Lane Flow Rate	10	521	45	229	177	405
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.02	0.915	0.096	0.42	0.338	0.712
Departure Headway (Hd)	6.942	6.317	7.683	6.61	6.883	6.328
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	518	579	465	544	524	575
Service Time	4.658	4.033	5.75	4.654	4.598	4.043
HCM Lane V/C Ratio	0.019	0.9	0.097	0.421	0.338	0.704
HCM Control Delay	9.8	44.4	11.6	14.4	13.1	23.2
HCM Lane LOS	A	E	B	B	B	C
HCM 95th-tile Q	0.1	11.3	0.3	2.1	1.5	5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	126	193	172	153	66	127	546	77	40	693	29
Future Volume (veh/h)	21	126	193	172	153	66	127	546	77	40	693	29
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.98	1.00		0.98	1.00		0.99
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	23	135	208	185	165	71	137	587	83	43	745	31
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	66	190	270	186	120	48	198	1509	213	153	1630	720
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.11	0.49	0.49	0.09	0.46	0.46
Sat Flow, veh/h	57	686	979	425	434	174	1774	3104	438	1774	3539	1564
Grp Volume(v), veh/h	366	0	0	421	0	0	137	334	336	43	745	31
Grp Sat Flow(s),veh/h/ln	1722	0	0	1033	0	0	1774	1770	1772	1774	1770	1564
Q Serve(g_s), s	0.0	0.0	0.0	6.0	0.0	0.0	5.6	9.1	9.1	1.7	10.9	0.8
Cycle Q Clear(g_c), s	15.0	0.0	0.0	21.0	0.0	0.0	5.6	9.1	9.1	1.7	10.9	0.8
Prop In Lane	0.06		0.57	0.44		0.17	1.00		0.25	1.00		1.00
Lane Grp Cap(c), veh/h	526	0	0	354	0	0	198	860	861	153	1630	720
V/C Ratio(X)	0.70	0.00	0.00	1.19	0.00	0.00	0.69	0.39	0.39	0.28	0.46	0.04
Avail Cap(c_a), veh/h	526	0	0	354	0	0	373	860	861	420	1630	720
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.4	0.0	0.0	30.0	0.0	0.0	32.5	12.4	12.4	32.5	14.0	11.3
Incr Delay (d2), s/veh	4.0	0.0	0.0	110.4	0.0	0.0	4.2	1.3	1.3	1.0	0.9	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.6	0.0	0.0	18.2	0.0	0.0	3.0	4.7	4.8	0.9	5.5	0.4
LnGrp Delay(d),s/veh	29.4	0.0	0.0	140.4	0.0	0.0	36.7	13.7	13.7	33.5	14.9	11.4
LnGrp LOS	C			F			D	B	B	C	B	B
Approach Vol, veh/h		366			421			807			819	
Approach Delay, s/veh		29.4			140.4			17.6			15.8	
Approach LOS		C			F			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.6	41.9		24.5	11.5	40.0		24.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	35.0		21.0	16.0	35.0		21.0
Max Q Clear Time (g_c+I1), s	3.7	11.1		17.0	7.6	12.9		23.0
Green Ext Time (p_c), s	0.1	8.1		0.8	0.2	9.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	40.2
HCM 2010 LOS	D

Notes

HCM 2010 AWSC
4: Fifth St East & East MacArthur St
08/28/2019

Intersection	
Intersection Delay, s/veh	10.4
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	28	100	76	6	180	19	99	84	17	23	59	62
Future Vol, veh/h	28	100	76	6	180	19	99	84	17	23	59	62
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	106	81	6	191	20	105	89	18	24	63	66
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.3	10.6	10.9	9.7
HCM LOS	B	B	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	49%	14%	3%	16%
Vol Thru, %	42%	49%	88%	41%
Vol Right, %	9%	37%	9%	43%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	200	204	205	144
LT Vol	99	28	6	23
Through Vol	84	100	180	59
RT Vol	17	76	19	62
Lane Flow Rate	213	217	218	153
Geometry Grp	1	1	1	1
Degree of Util (X)	0.317	0.306	0.315	0.221
Departure Headway (Hd)	5.367	5.069	5.206	5.201
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	670	710	691	689
Service Time	3.398	3.099	3.237	3.235
HCM Lane V/C Ratio	0.318	0.306	0.315	0.222
HCM Control Delay	10.9	10.3	10.6	9.7
HCM Lane LOS	B	B	B	A
HCM 95th-tile Q	1.4	1.3	1.3	0.8

HCM 2010 Signalized Intersection Summary
5: Broadway & Newcomb St
08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	21	13	23	6	79	17	604	76	379	586	33
Future Volume (veh/h)	11	21	13	23	6	79	17	604	76	379	586	33
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	12	23	14	25	7	87	19	664	84	416	644	36
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	129	209	104	349	85	342	73	1099	139	463	991	55
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.04	0.35	0.35	0.26	0.57	0.57
Sat Flow, veh/h	232	960	477	1090	388	1569	1774	3162	400	1774	1747	98
Grp Volume(v), veh/h	49	0	0	32	0	87	19	371	377	416	0	680
Grp Sat Flow(s),veh/h/ln	1669	0	0	1478	0	1569	1774	1770	1792	1774	0	1845
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	2.6	0.6	10.0	10.0	13.0	0.0	14.5
Cycle Q Clear(g_c), s	1.3	0.0	0.0	0.8	0.0	2.6	0.6	10.0	10.0	13.0	0.0	14.5
Prop In Lane	0.24		0.29	0.78		1.00	1.00		0.22	1.00		0.05
Lane Grp Cap(c), veh/h	441	0	0	433	0	342	73	615	623	463	0	1047
V/C Ratio(X)	0.11	0.00	0.00	0.07	0.00	0.25	0.26	0.60	0.60	0.90	0.00	0.65
Avail Cap(c_a), veh/h	538	0	0	520	0	436	555	615	623	463	0	1047
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.1	0.0	0.0	17.9	0.0	18.6	26.7	15.5	15.5	20.5	0.0	8.5
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.4	1.9	4.3	4.3	20.2	0.0	3.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	0.4	0.0	1.2	0.3	5.6	5.7	9.0	0.0	8.1
LnGrp Delay(d),s/veh	18.2	0.0	0.0	18.0	0.0	19.0	28.6	19.8	19.8	40.8	0.0	11.7
LnGrp LOS	B			B		B	C	B	B	D		B
Approach Vol, veh/h		49			119			767			1096	
Approach Delay, s/veh		18.2			18.7			20.0			22.7	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.0	24.0		15.5	5.4	36.6		15.5
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0
Max Q Clear Time (g_c+I1), s	15.0	12.0		3.3	2.6	16.5		4.6
Green Ext Time (p_c), s	0.0	4.4		0.1	0.0	2.1		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	21.4
HCM 2010 LOS	C

Notes

HCM 2010 Signalized Intersection Summary

6: Broadway & Leveroni Rd/Napa Rd

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	130	482	66	75	511	176	114	300	102	171	314	66
Future Volume (veh/h)	130	482	66	75	511	176	114	300	102	171	314	66
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.99
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	138	513	70	80	544	187	121	319	109	182	334	70
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	201	662	90	181	532	183	198	472	158	217	562	116
Arrive On Green	0.11	0.41	0.41	0.10	0.40	0.40	0.11	0.18	0.18	0.12	0.19	0.19
Sat Flow, veh/h	1774	1605	219	1774	1326	456	1774	2599	871	1774	2915	603
Grp Volume(v), veh/h	138	0	583	80	0	731	121	215	213	182	201	203
Grp Sat Flow(s),veh/h/ln	1774	0	1824	1774	0	1782	1774	1770	1700	1774	1770	1749
Q Serve(g_s), s	7.1	0.0	26.2	4.0	0.0	38.0	6.2	10.7	11.1	9.5	9.8	10.0
Cycle Q Clear(g_c), s	7.1	0.0	26.2	4.0	0.0	38.0	6.2	10.7	11.1	9.5	9.8	10.0
Prop In Lane	1.00		0.12	1.00		0.26	1.00		0.51	1.00		0.34
Lane Grp Cap(c), veh/h	201	0	752	181	0	715	198	321	309	217	341	337
V/C Ratio(X)	0.69	0.00	0.78	0.44	0.00	1.02	0.61	0.67	0.69	0.84	0.59	0.60
Avail Cap(c_a), veh/h	356	0	752	487	0	715	206	505	485	300	505	499
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	40.4	0.0	24.0	40.0	0.0	28.4	40.1	36.1	36.2	40.6	34.8	34.9
Incr Delay (d2), s/veh	4.2	0.0	5.1	1.7	0.0	39.4	4.9	5.1	5.7	13.8	3.4	3.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.0	14.2	2.1	0.0	26.3	3.3	5.7	5.7	5.5	5.1	5.2
LnGrp Delay(d),s/veh	44.5	0.0	29.1	41.7	0.0	67.7	45.1	41.2	42.0	54.5	38.3	38.6
LnGrp LOS	D		C	D		F	D	D	D	D	D	D
Approach Vol, veh/h		721			811			549			586	
Approach Delay, s/veh		32.1			65.2			42.3			43.4	
Approach LOS		C			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.5	23.3	14.7	42.2	15.6	22.2	13.7	43.2
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2
Max Green Setting (Gmax), s	11.0	27.0	19.0	* 38	16.0	27.0	26.0	* 31
Max Q Clear Time (g_c+I1), s	8.2	12.0	9.1	40.0	11.5	13.1	6.0	28.2
Green Ext Time (p_c), s	0.1	3.6	0.2	0.0	0.2	3.7	0.2	1.1

Intersection Summary	
HCM 2010 Ctrl Delay	46.7
HCM 2010 LOS	D

Notes

HCM 2010 AWSC

1: Broadway & West Napa St/East Napa St

08/28/2019

Intersection	
Intersection Delay, s/veh	63.7
Intersection LOS	F

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	7	296	536	172	320	7	353	12	185	7	12	16
Future Vol, veh/h	7	296	536	172	320	7	353	12	185	7	12	16
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
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	7	305	553	177	330	7	364	12	191	7	12	16
Number of Lanes	0	1	1	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	2
HCM Control Delay	63.2	100.3	34.5	14.4
HCM LOS	F	F	D	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1
Vol Left, %	100%	0%	2%	0%	34%	20%
Vol Thru, %	0%	6%	98%	0%	64%	34%
Vol Right, %	0%	94%	0%	100%	1%	46%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	353	197	303	536	499	35
LT Vol	353	0	7	0	172	7
Through Vol	0	12	296	0	320	12
RT Vol	0	185	0	536	7	16
Lane Flow Rate	364	203	312	553	514	36
Geometry Grp	7	7	7	7	6	6
Degree of Util (X)	0.853	0.411	0.663	1.064	1.101	0.097
Departure Headway (Hd)	8.769	7.569	7.953	7.217	7.93	10.337
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	415	479	456	508	463	349
Service Time	6.469	5.269	5.653	4.917	5.93	8.337
HCM Lane V/C Ratio	0.877	0.424	0.684	1.089	1.11	0.103
HCM Control Delay	45.2	15.4	25	84.8	100.3	14.4
HCM Lane LOS	E	C	C	F	F	B
HCM 95th-tile Q	8.3	2	4.7	16.2	16.9	0.3

HCM 2010 AWSC
2: Fifth St West & West MacArthur St

08/28/2019

Intersection	
Intersection Delay, s/veh	28.6
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	19	18	7	62	14	150	10	428	83	201	372	25
Future Vol, veh/h	19	18	7	62	14	150	10	428	83	201	372	25
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	19	18	7	63	14	153	10	437	85	205	380	26
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	11.7	14.6	45.6	20.3
HCM LOS	B	B	E	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	43%	27%	100%	0%
Vol Thru, %	0%	84%	41%	6%	0%	94%
Vol Right, %	0%	16%	16%	66%	0%	6%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	511	44	226	201	397
LT Vol	10	0	19	62	201	0
Through Vol	0	428	18	14	0	372
RT Vol	0	83	7	150	0	25
Lane Flow Rate	10	521	45	231	205	405
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.02	0.924	0.097	0.426	0.394	0.715
Departure Headway (Hd)	7.004	6.378	7.747	6.649	6.909	6.354
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	513	568	461	542	523	571
Service Time	4.72	4.094	5.815	4.694	4.625	4.069
HCM Lane V/C Ratio	0.019	0.917	0.098	0.426	0.392	0.709
HCM Control Delay	9.9	46.3	11.7	14.6	14.1	23.4
HCM Lane LOS	A	E	B	B	B	C
HCM 95th-tile Q	0.1	11.5	0.3	2.1	1.9	5.8

HCM 2010 Signalized Intersection Summary
3: Broadway & West MacArthur St/East MacArthur St

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	126	221	213	153	66	129	560	99	40	833	29
Future Volume (veh/h)	21	126	221	213	153	66	129	560	99	40	833	29
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.98	1.00		0.98	1.00		0.99
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	23	135	238	229	165	71	139	602	106	43	896	31
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	65	176	287	185	84	36	199	1457	256	153	1629	720
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.11	0.49	0.49	0.09	0.46	0.46
Sat Flow, veh/h	53	636	1038	415	304	130	1774	2997	526	1774	3539	1564
Grp Volume(v), veh/h	396	0	0	465	0	0	139	355	353	43	896	31
Grp Sat Flow(s),veh/h/ln	1727	0	0	850	0	0	1774	1770	1754	1774	1770	1564
Q Serve(g_s), s	0.0	0.0	0.0	4.4	0.0	0.0	5.7	9.8	9.8	1.7	13.9	0.8
Cycle Q Clear(g_c), s	16.6	0.0	0.0	21.0	0.0	0.0	5.7	9.8	9.8	1.7	13.9	0.8
Prop In Lane	0.06		0.60	0.49		0.15	1.00		0.30	1.00		1.00
Lane Grp Cap(c), veh/h	527	0	0	305	0	0	199	860	853	153	1629	720
V/C Ratio(X)	0.75	0.00	0.00	1.52	0.00	0.00	0.70	0.41	0.41	0.28	0.55	0.04
Avail Cap(c_a), veh/h	527	0	0	305	0	0	373	860	853	420	1629	720
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.0	0.0	0.0	30.8	0.0	0.0	32.5	12.6	12.6	32.5	14.8	11.3
Incr Delay (d2), s/veh	6.0	0.0	0.0	251.3	0.0	0.0	4.4	1.5	1.5	1.0	1.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	0.0	0.0	27.7	0.0	0.0	3.1	5.1	5.1	0.9	7.0	0.4
LnGrp Delay(d),s/veh	32.0	0.0	0.0	282.1	0.0	0.0	36.9	14.0	14.1	33.5	16.2	11.4
LnGrp LOS	C			F			D	B	B	C	B	B
Approach Vol, veh/h		396			465			847			970	
Approach Delay, s/veh		32.0			282.1			17.8			16.8	
Approach LOS		C			F			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.6	42.0		24.5	11.5	40.0		24.5
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	35.0		21.0	16.0	35.0		21.0
Max Q Clear Time (g_c+I1), s	3.7	11.8		18.6	7.7	15.9		23.0
Green Ext Time (p_c), s	0.1	8.5		0.6	0.2	10.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	65.4
HCM 2010 LOS	E

Notes

HCM 2010 AWSC
4: Fifth St East & East MacArthur St

08/28/2019

Intersection	
Intersection Delay, s/veh	11
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	102	78	6	194	19	113	84	17	23	59	90
Future Vol, veh/h	30	102	78	6	194	19	113	84	17	23	59	90
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	32	109	83	6	206	20	120	89	18	24	63	96
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.8	11.3	11.5	10.3
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	53%	14%	3%	13%
Vol Thru, %	39%	49%	89%	34%
Vol Right, %	8%	37%	9%	52%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	214	210	219	172
LT Vol	113	30	6	23
Through Vol	84	102	194	59
RT Vol	17	78	19	90
Lane Flow Rate	228	223	233	183
Geometry Grp	1	1	1	1
Degree of Util (X)	0.349	0.326	0.348	0.268
Departure Headway (Hd)	5.523	5.252	5.376	5.27
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	651	684	669	681
Service Time	3.567	3.297	3.42	3.317
HCM Lane V/C Ratio	0.35	0.326	0.348	0.269
HCM Control Delay	11.5	10.8	11.3	10.3
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.6	1.4	1.6	1.1

HCM 2010 Signalized Intersection Summary
5: Broadway & Newcomb St

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	33	13	45	8	149	17	604	103	559	586	33
Future Volume (veh/h)	13	33	13	45	8	149	17	604	103	559	586	33
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	14	36	14	49	9	164	19	664	113	614	644	36
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	120	254	84	382	61	356	73	1040	177	457	979	55
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.04	0.34	0.34	0.26	0.56	0.56
Sat Flow, veh/h	198	1117	368	1181	269	1569	1774	3027	515	1774	1747	98
Grp Volume(v), veh/h	64	0	0	58	0	164	19	388	389	614	0	680
Grp Sat Flow(s),veh/h/ln	1684	0	0	1449	0	1569	1774	1770	1772	1774	0	1845
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	5.3	0.6	10.7	10.8	15.0	0.0	14.9
Cycle Q Clear(g_c), s	1.7	0.0	0.0	1.5	0.0	5.3	0.6	10.7	10.8	15.0	0.0	14.9
Prop In Lane	0.22		0.22	0.84		1.00	1.00		0.29	1.00		0.05
Lane Grp Cap(c), veh/h	458	0	0	443	0	356	73	608	609	457	0	1034
V/C Ratio(X)	0.14	0.00	0.00	0.13	0.00	0.46	0.26	0.64	0.64	1.34	0.00	0.66
Avail Cap(c_a), veh/h	534	0	0	510	0	431	549	608	609	457	0	1034
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	18.0	0.0	0.0	18.0	0.0	19.4	27.1	16.1	16.1	21.6	0.0	8.9
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.1	0.0	0.9	1.9	5.1	5.1	168.6	0.0	3.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.0	0.8	0.0	2.4	0.3	6.0	6.0	28.6	0.0	8.3
LnGrp Delay(d),s/veh	18.2	0.0	0.0	18.1	0.0	20.4	29.0	21.1	21.2	190.2	0.0	12.2
LnGrp LOS	B			B		C	C	C	C	F		B
Approach Vol, veh/h		64			222			796			1294	
Approach Delay, s/veh		18.2			19.8			21.3			96.6	
Approach LOS		B			B			C			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.0	24.0		16.2	5.4	36.6		16.2
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	15.0	20.0		16.0	18.0	20.0		16.0
Max Q Clear Time (g_c+I1), s	17.0	12.8		3.7	2.6	16.9		7.3
Green Ext Time (p_c), s	0.0	4.2		0.2	0.0	1.9		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	62.1
HCM 2010 LOS	E

Notes

HCM 2010 Signalized Intersection Summary
6: Broadway & Leveroni Rd/Napa Rd

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	144	482	66	75	511	190	114	314	102	173	316	68
Future Volume (veh/h)	144	482	66	75	511	190	114	314	102	173	316	68
Number	3	8	18	7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		0.99
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	1900	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	153	513	70	80	544	202	121	334	109	184	336	72
Adj No. of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	201	658	90	180	516	192	196	487	156	219	575	122
Arrive On Green	0.11	0.41	0.41	0.10	0.40	0.40	0.11	0.19	0.19	0.12	0.20	0.20
Sat Flow, veh/h	1774	1605	219	1774	1296	481	1774	2631	844	1774	2903	614
Grp Volume(v), veh/h	153	0	583	80	0	746	121	223	220	184	203	205
Grp Sat Flow(s),veh/h/ln	1774	0	1824	1774	0	1778	1774	1770	1706	1774	1770	1747
Q Serve(g_s), s	8.0	0.0	26.5	4.1	0.0	38.0	6.2	11.2	11.5	9.7	9.9	10.2
Cycle Q Clear(g_c), s	8.0	0.0	26.5	4.1	0.0	38.0	6.2	11.2	11.5	9.7	9.9	10.2
Prop In Lane	1.00		0.12	1.00		0.27	1.00		0.49	1.00		0.35
Lane Grp Cap(c), veh/h	201	0	747	180	0	708	196	328	316	219	350	346
V/C Ratio(X)	0.76	0.00	0.78	0.44	0.00	1.05	0.62	0.68	0.70	0.84	0.58	0.59
Avail Cap(c_a), veh/h	353	0	747	483	0	708	204	500	482	297	500	494
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	41.1	0.0	24.4	40.4	0.0	28.7	40.5	36.3	36.4	40.9	34.7	34.8
Incr Delay (d2), s/veh	5.9	0.0	5.3	1.7	0.0	49.0	5.2	5.2	5.8	14.5	3.2	3.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.2	0.0	14.4	2.1	0.0	28.1	3.3	5.9	6.0	5.6	5.2	5.2
LnGrp Delay(d),s/veh	46.9	0.0	29.7	42.1	0.0	77.7	45.7	41.5	42.2	55.4	37.9	38.2
LnGrp LOS	D		C	D		F	D	D	D	E	D	D
Approach Vol, veh/h		736			826			564			592	
Approach Delay, s/veh		33.3			74.3			42.7			43.5	
Approach LOS		C			E			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.6	23.9	14.8	42.2	15.8	22.7	13.7	43.3
Change Period (Y+Rc), s	4.0	5.0	4.0	* 4.2	4.0	5.0	4.0	* 4.2
Max Green Setting (Gmax), s	11.0	27.0	19.0	* 38	16.0	27.0	26.0	* 31
Max Q Clear Time (g_c+I1), s	8.2	12.2	10.0	40.0	11.7	13.5	6.1	28.5
Green Ext Time (p_c), s	0.1	3.7	0.2	0.0	0.2	3.8	0.2	1.0

Intersection Summary	
HCM 2010 Ctrl Delay	49.9
HCM 2010 LOS	D

Notes

HCM 2010 Signalized Intersection Summary
3: Broadway & West MacArthur St/East MacArthur St

08/28/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	21	126	221	213	153	66	129	560	99	40	833	29
Future Volume (veh/h)	21	126	221	213	153	66	129	560	99	40	833	29
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		0.97	1.00		0.98
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	1900	1863	1900	1900	1863	1900	1863	1863	1900	1863	1863	1863
Adj Flow Rate, veh/h	23	135	238	229	165	71	139	602	106	43	896	31
Adj No. of Lanes	0	1	0	0	1	0	1	2	0	1	2	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	67	277	451	297	188	76	180	1026	180	146	1146	504
Arrive On Green	0.44	0.44	0.44	0.44	0.44	0.44	0.10	0.34	0.34	0.08	0.32	0.32
Sat Flow, veh/h	50	631	1026	532	428	173	1774	2992	525	1774	3539	1556
Grp Volume(v), veh/h	396	0	0	465	0	0	139	355	353	43	896	31
Grp Sat Flow(s),veh/h/ln	1707	0	0	1133	0	0	1774	1770	1748	1774	1770	1556
Q Serve(g_s), s	0.0	0.0	0.0	19.2	0.0	0.0	6.5	14.1	14.2	1.9	19.5	1.2
Cycle Q Clear(g_c), s	14.8	0.0	0.0	34.0	0.0	0.0	6.5	14.1	14.2	1.9	19.5	1.2
Prop In Lane	0.06		0.60	0.49		0.15	1.00		0.30	1.00		1.00
Lane Grp Cap(c), veh/h	795	0	0	561	0	0	180	607	599	146	1146	504
V/C Ratio(X)	0.50	0.00	0.00	0.83	0.00	0.00	0.77	0.59	0.59	0.29	0.78	0.06
Avail Cap(c_a), veh/h	860	0	0	612	0	0	208	607	599	375	1146	504
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	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.5	0.0	0.0	24.1	0.0	0.0	37.3	23.0	23.1	36.8	26.1	19.9
Incr Delay (d2), s/veh	0.5	0.0	0.0	8.7	0.0	0.0	14.2	4.1	4.2	1.1	5.3	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.9	0.0	0.0	11.8	0.0	0.0	3.9	7.5	7.6	1.0	10.3	0.5
LnGrp Delay(d),s/veh	18.0	0.0	0.0	32.8	0.0	0.0	51.5	27.1	27.3	37.9	31.5	20.1
LnGrp LOS	B			C			D	C	C	D	C	C
Approach Vol, veh/h		396			465			847			970	
Approach Delay, s/veh		18.0			32.8			31.2			31.4	
Approach LOS		B			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	34.2		41.0	11.7	32.6		41.0
Change Period (Y+Rc), s	3.0	5.0		3.5	3.0	5.0		3.5
Max Green Setting (Gmax), s	18.0	19.6		40.9	10.0	27.6		40.9
Max Q Clear Time (g_c+I1), s	3.9	16.2		16.8	8.5	21.5		36.0
Green Ext Time (p_c), s	0.1	2.0		2.7	0.0	4.2		1.5

Intersection Summary	
HCM 2010 Ctrl Delay	29.6
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	33	13	45	8	149	17	604	103	559	586	33
Future Volume (veh/h)	13	33	13	45	8	149	17	604	103	559	586	33
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		0.99	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	1900	1863	1900	1900	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	14	36	14	49	9	164	19	664	113	614	644	36
Adj No. of Lanes	0	1	0	0	1	1	1	2	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	105	220	72	335	53	308	71	829	141	669	1068	60
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.04	0.27	0.27	0.38	0.61	0.61
Sat Flow, veh/h	196	1120	368	1187	271	1567	1774	3027	515	1774	1747	98
Grp Volume(v), veh/h	64	0	0	58	0	164	19	388	389	614	0	680
Grp Sat Flow(s),veh/h/ln	1684	0	0	1458	0	1567	1774	1770	1772	1774	0	1845
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	6.2	0.7	13.4	13.4	21.7	0.0	14.9
Cycle Q Clear(g_c), s	2.0	0.0	0.0	1.8	0.0	6.2	0.7	13.4	13.4	21.7	0.0	14.9
Prop In Lane	0.22		0.22	0.84		1.00	1.00		0.29	1.00		0.05
Lane Grp Cap(c), veh/h	398	0	0	388	0	308	71	484	485	669	0	1127
V/C Ratio(X)	0.16	0.00	0.00	0.15	0.00	0.53	0.27	0.80	0.80	0.92	0.00	0.60
Avail Cap(c_a), veh/h	400	0	0	389	0	310	486	484	485	783	0	1127
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	0.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	22.0	0.0	0.0	21.9	0.0	23.7	30.6	22.2	22.2	19.5	0.0	7.9
Incr Delay (d2), s/veh	0.2	0.0	0.0	0.2	0.0	1.7	2.0	13.0	13.1	14.3	0.0	2.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.0	0.9	0.0	2.8	0.4	8.2	8.3	13.2	0.0	8.1
LnGrp Delay(d),s/veh	22.2	0.0	0.0	22.1	0.0	25.4	32.6	35.2	35.3	33.8	0.0	10.3
LnGrp LOS	C			C		C	C	D	D	C		B
Approach Vol, veh/h		64			222			796			1294	
Approach Delay, s/veh		22.2			24.5			35.2			21.4	
Approach LOS		C			C			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	27.8	22.0		15.9	5.6	44.2		15.9
Change Period (Y+Rc), s	3.0	4.0		3.0	3.0	4.0		3.0
Max Green Setting (Gmax), s	29.0	18.0		13.0	18.0	29.0		13.0
Max Q Clear Time (g_c+I1), s	23.7	15.4		4.0	2.7	16.9		8.2
Green Ext Time (p_c), s	1.1	1.7		0.1	0.0	6.0		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	26.4
HCM 2010 LOS	C

Notes

Appendix C

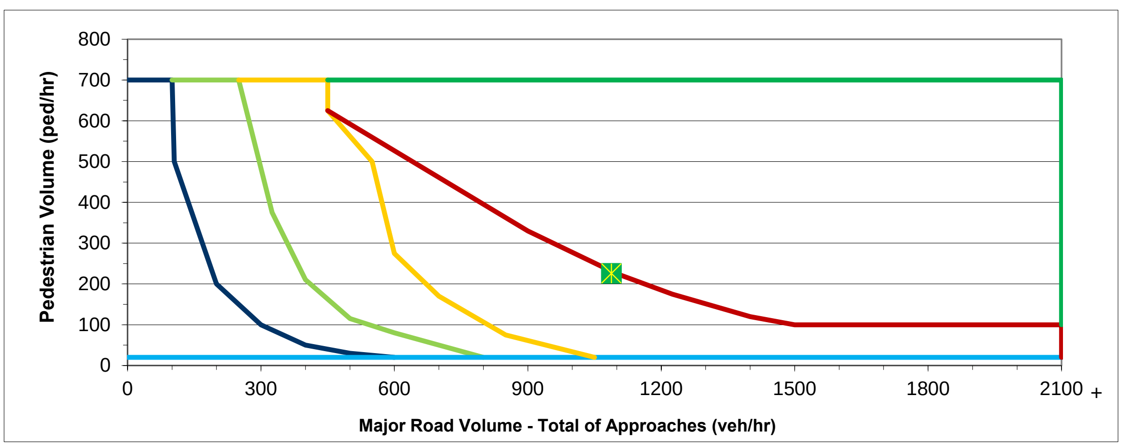
TCRPR 112/NCHRPR 562 Pedestrian Crossing Treatment Worksheet

TCRP Report 112 - NCHRP Report 562 - Pedestrian Crossing Treatment Worksheet
Worksheet 1: Peak-Hour, 35 MPH or Less

Analyst and Site Information			
Analyst:	KRC	Major Street:	Broadway
Analysis Date:	12/6/2018	Minor Street or Location:	Malet Street
Data Collection Date:	10/18/2018	Peak Hour:	3:00pm-4:00pm
Step 1: Select worksheet (speed reflects posted or statutory speed limit or 85th percentile speed on the major street):			
a) Worksheet 1 - 35 mph or less			
b) Worksheet 2- exceeds 35 mph, communities with less than 10,000, or where major transit stop exists			
Step 2: Does the crossing meet minimum pedestrian volumes to be considered for a TCD type of treatment?			
Peak-hour pedestrian volume (ped/h), vp		2a	226
If 2a ≥ 20 ped/h, then go to Step 3.			
If 2a < 20 ped/h, then consider median refuge islands, curb extensions, traffic calming, etc. as feasible.			
Step 3: Does the crossing meet the pedestrian volume warrant for a traffic signal?			
Major road volume, total of both approaches during peak hour (veh/h), V maj-s		3a	1088
Minimum signal warrant volume for peak hour (use 3a for Vmaj-s), SC SC = 0.00021 Vmaj-s² - 0.74072 Vmaj-s + 734.125)/0.75 OR [(0.00021 3a² - 0.74072 3a + 734.125)/0.75]		3b	235.74384
If 3b< 133, then enter 133. If 3b ≥ 133, then enter 3b.		3c	235.74384
If 15th percentile crossing speed of pedestrians is less than 3.5 ft/s (1.1 m/s), then reduce 3c by up to 50 percent; otherwise enter 3c.		3d	235.74384
If 2a ≥ 3d, then the warrant has been met and a traffic signal should be considered if not within 300 ft of another traffic signal. Otherwise, the warrant has not been met. Go to Step 4.			
Step 4: Estimate pedestrian delay.			
Pedestrian crossing distance, curb to curb (ft), L		4a	70
Pedestrian walking speed (ft.s), Sp		4b	3.5
Pedestrian start-up time and end clearance time (s), ts		4c	4
Critical gap required for crossing pedestrian (s), tc= (L/Sp) + ts OR [(4a/4b) + 4c)]		4d	24
Major road volume, total of both approaches or approach being crossed if median refuge island is present during peak hour (veh.h), Vmaj-d		4e	1088
Major road flow rate (veh/s), v = Vmaj-d/3600 OR [4e/3600]		4f	0.302222222
Average pedestrian delay (s/person), dp = ($e^{v\ tc}$ - v tc - 1) / v OR [($e^{4f \times 4d}$-4f x 4d - 1) / 4f]		4g	4647.418111
Total pedestrian delay (h), Dp=(dp x Vp) / 3600 OR [(4g x 2a) / 3600] (this is estimated delayfor all pedestrians crossing the major roadway without a crossing treatment - assumes 05 compliance). This calculated value can be replaced with the actual total pedestrian delay measured at the site.		4h	291.7545814
Step 5: Select treatment based upon total pedestrian delay and expected motorist compliance.			
Expected motorist compliance at pedestrian crossings in region, Comp = high or low		5a	HIGH

Total Pedestrian Delay, Dp (from 4h) and Motorist Compliance, Comp (from 5a)	**Treatment Category** (see Descriptions of Sample Treatments for examples)
Dp ≥21.3h (Comp = high or low) OR 5.3h≤Dp<21.3 h and Comp = low	USE RED
1.3h ≤ Dp < 21.3h and Comp = high or low) OR 5.3 ≤ Dp < 21.3 h and Comp = high	DO NOT USE ACTIVE OR ENHANCED
Dp < 1.3 h (Comp = high or low)	DO NOT USE CROSSWALK

Roadway Configuration: 72' Wide, <35 mph, Vped=3.5 ft/s



Legend:
Study Intersection
Striped Crosswalk
Enhanced-High Visibility/Active when Present
Red
Enhanced-High Visibility/Active when Present (if high compliance expected) OR Red (if low compliance expected)
Signal
No Treatment

Description of Treatment Types:		
Red:	Enhanced-High Visibility/Active when Present	
	Active When Present	*Enhanced/High Visibility*
Midblock Signal	In Roadway Warning Lights	In-Street Crossing Signs
Half Signal		High Visibility Signs/Markings
HAWK	Passive/Pushbutton Flashing Beacons	Pedestrian Refuge Islands
		Raised Crosswalks
	Pedestrian Crossing Flags	Curb Extensions
		Advanced Signage
	Rapid Rectangular Flashing Beacons	Advanced Stop/Yield Lines
		Constant Flashing Yellow Beacons

Appendix D

Pedestrian Hybrid Beacon (HAWK) Signal Warrant Worksheet

Pedestrian Hybrid Beacon (HAWK) Signal Warrant

Low-Speed Roadway

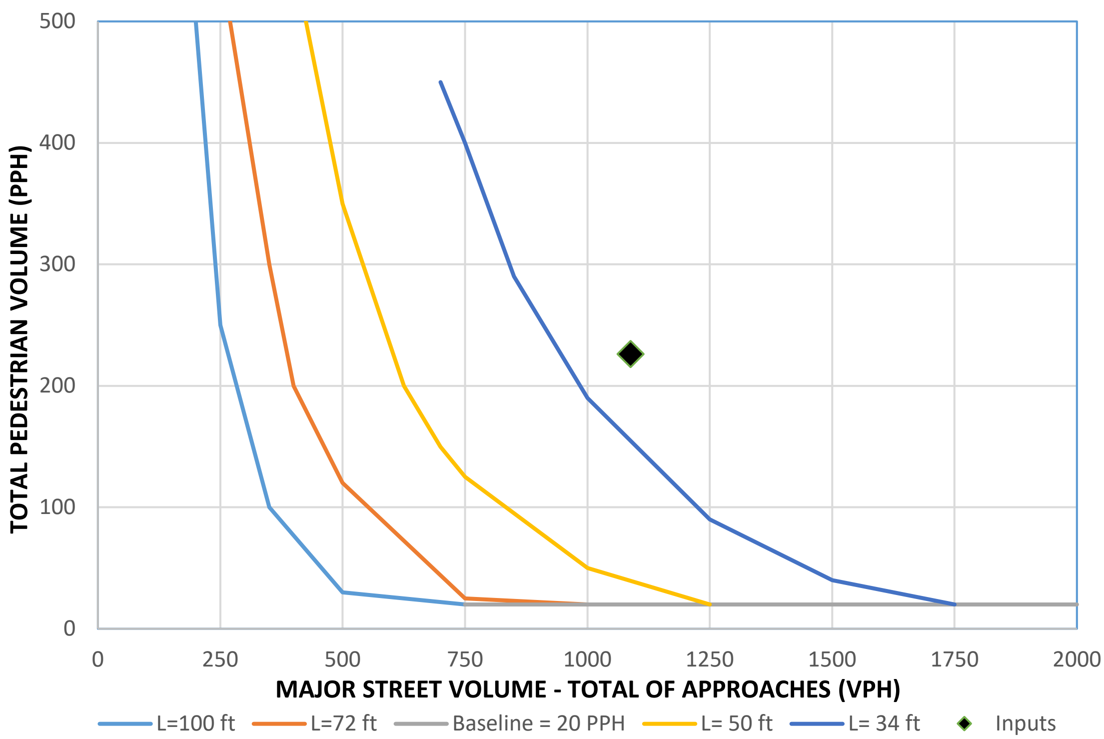
Project Name: SVHS Track and Field Renovation Project

Scenario: Existing
Location: Malet Street/Broadway
Date of Count: Thursday, October 18, 2018

Speed Limit: 35 mph
Crosswalk Length: 70 feet

Major Street Approach Volume: 1,088 VPH
Pedestrians Crossing: 226 PPH

WARRANT MET? **Yes**



Note: Installation of a HAWK Singal is warranted when the plotted point (see graph above) falls above the curve representing the corresponding crosswalk length (L).

If the length (L) of the crosswalk does not match one displayed on the graph, interpolate between existing curves to find the position of the curve representing the crosswalk length being analyzed.

Reference: California Manual on Uniform Traffic Control Devices (MUTCD) 2014 Edition