CITY OF REDDING
Development Services Planning Division
777 Cypress Avenue, Redding, CA 96001
P.O. Box 496071, Redding, CA 96049-6071
Phone: 530-225-4022
cityofredding.gov

MITIGATED NEGATIVE DECLARATION

Permit No. SDP-2023-00085
State Clearinghouse No. ____________

SUBJECT

Canby Apartments

PROJECT DESCRIPTION

The Project applicant, Danco Communities, is requesting approval of Site Development Permit Application SDP-2023-00085 to construct a 100 percent affordable housing facility with one hundred and twenty (120) units of affordable housing in ten separate two- and three-story structures on an eight-acre site spanning two parcels located at the northwest corner of Canby Road and Browning Street, addressed as 990 and 930 Canby Road. A single-story community building is also proposed that will include the leasing office, a commons room, a kitchen, a laundry facility, and an exercise room. Other site amenities such as a children's playground, a basketball court, and a central courtyard are proposed. The development is proposed in two phases that will total one hundred and twenty (120) units upon completion. The first phase of development would consist of sixty-two (62) multifamily units and the second phase, as proposed, would consist of fifty-eight (58) units.

All street and utility improvements will connect to existing systems located adjacent to the Project boundaries. The storm drain system will connect to Little Churn Creek (on-site) in the northeast corner of the site after any required on-site water treatment. Public improvements along both of the Project's frontages and right of way dedication would be required.

ENVIRONMENTAL SETTING

The Project consists of approximately eight (8) acres of land. The site is moderately sloped with elevation ranging from approximately 605 to 640 feet above mean sea level (MSL) and primarily composed of oak woodland and grassland with some riparian habitat. Little Churn Creek runs through the northeast corner of the site. The Project site is currently vacant and surrounded by multi-family residential development to the north and west, commercial development to the south and west along Browning Street (including the Kohl's shopping center), and vacant multi-family zoned land to the east.

FINDINGS AND DETERMINATION

The City of Redding conducted an Initial Study (attached), which determined that the proposed project could have significant environmental effects. Subsequent revisions to the project proposal create the specific mitigation measures identified below. The project, as revised and as agreed to by the applicant, avoids or mitigates the potentially significant environmental effects identified, and the preparation of an environmental impact report will not be required. There is no substantial evidence, in light of the whole record before the City, that the project as revised may have a significant effect on the environment. If there are substantial changes that alter the character or impacts of the proposed project, another environmental impact determination will be necessary.

The project includes measures to mitigate potentially significant impacts of development on biological resources and noise.

Prior to approval of the project, the lead agency may conclude, at a public hearing, that certain mitigation measures identified in the Mitigated Negative Declaration are infeasible or undesirable. In accordance with CEQA Section 15074.1, the lead agency may delete those mitigation measures and substitute other measures which it determines are equivalent or more effective. The lead agency would adopt written findings that the new measure is equivalent or more effective in mitigating or avoiding potential significant effects and that it, in itself, would not cause any potentially significant effect on the environment.

1. **Based on the whole record (including the Initial Study and any supporting documentation) and the mitigation measures incorporated into the project, the City of Redding has determined that a Mitigated Negative Declaration is appropriate. All potentially significant impacts would be reduced to less than significant.**

2. **The Mitigated Negative Declaration, with its supporting documentation, fully incorporated herein, reflects the independent judgment and analysis of the lead agency, which is the City of Redding.**

DOCUMENTATION

The attached Initial Study documents the reasons to support the above determination.

MITIGATION MEASURES

Bio-1: Prior to grading or construction, consultation with the California Department of Fish and Wildlife (CDFW) shall be conducted to develop a mitigation and/or avoidance strategy for Redding checkerbloom. This may include transplanting the plant population, compensation, or other measures established by that agency. Possible avoidance measures may include fencing populations before construction, exclusion of project activities from the fenced-off areas, construction monitoring by a qualified botanist to keep construction crews away from the population, and monitoring and reporting requirements for populations to be preserved on site.

Bio-2: Prior to the commencement of construction within the onsite drainage or within 100 feet of the onsite drainage, a pre-construction survey for foothill yellow-legged frog (FYLF) shall be conducted within the onsite intermittent drainage and immediate surrounding areas, initially seven days prior to the commencement of any ground-disturbing activities and again no more than 24 hours prior to ground-disturbing activities. If there are negative findings for this species during the survey, no further action is required. If this species is observed during the survey, CDFW should be consulted prior to ground disturbance regarding the potential for the project to result in take of FYLF, and any avoidance measures or mitigation measures required by CDFW shall be implemented.

Bio-3: A Qualified Biologist shall conduct a pre-construction survey within 14 days prior to the start of ground disturbance within 500 feet of riparian habitat or the intermittent drainage. If no western pond turtles are observed, then a letter report documenting the results of the survey shall be provided to the City, and no additional measures are required. If construction does not commence within 14 days of the pre-construction survey, or halts for more than 14 days, a new survey shall be completed. If western pond turtles are found, a Qualified Biologist shall conduct a pre-construction survey within 24 hours prior to commencement of construction activities and be present on the site during grading activities within 500 feet of the intermittent drainage and its surrounding riparian habitat. The biologist shall establish a no-disturbance buffer around any individual western pond turtle, allowing the turtle to continue downstream, offsite, on its own accord. If the turtle does not self-relocate within a reasonable amount of time established by the biologist, CDFW shall be consulted on next steps.

Bio-4: If feasible, vegetation removal and/or construction shall be conducted between September 1 and January 31. If vegetation removal and/or construction activities are to occur during the nesting season (February 1 through August 31), a Qualified Biologist shall conduct a preconstruction survey no more than seven days before vegetation removal or construction activities begin. If an active nest is found, a no-disturbance buffer shall be established by a Qualified Biologist in coordination with CDFW. Construction may resume once the young have left the nest or as approved by the Qualified Biologist. The survey shall be provided to the CDFW. If construction activities cease for a period greater than seven days, additional preconstruction surveys will be required.

Bio-5: If vegetation removal and/or construction activities are to occur during the bat roosting season (March 1 through August 31), a Qualified Biologist shall conduct a preconstruction survey no more than seven days before vegetation removal or construction activities begin. If an active roost is found, a no-disturbance buffer shall be established for a distance of 500 feet around the nest unless a smaller buffer zone is approved by CDFW. Construction may resume once the young have left the nest or as approved by the Qualified Biologist. The survey shall be provided to the CDFW. If a lapse in construction activities of 14 days or more occurs during the roosting season, an additional roost survey is required to ensure no roosts were established in the area while construction was on hold. Minimum qualifications for a Qualified Biologist include a bachelor's degree in biological or environmental science, natural resources management, or related discipline; field experience in the habitat types that may occur at the project site; familiarity with the Covered Species (or closely related species) that may occur at the project site; and prior preconstruction survey, construction monitoring, or construction oversight experience (if and as relevant to the activity to be conducted).

Noi-1: Prior to issuance of a grading permit, the applicant or designated contractor shall provide evidence to the City (via testing data or calculations from a qualified expert), demonstrating that the vibratory rollers to be used on the Project site would produce less than 75 VdB at nearby occupied residences, or all vibratory rollers shall be used in static mode only (no vibrations) when operating within 110 feet of an occupied residence.

PUBLIC REVIEW DISTRIBUTION

Draft copies or notice of this Mitigated Negative Declaration were distributed to:

- State Clearinghouse

- Shasta County Clerk
- U.S. Army Corp of Engineers, Redding
- California Department of Fish and Wildlife, Redding
- Central Valley Regional Water Quality Control Board, Redding
- California Native Plant Society, Shasta County
- Shasta Environmental Alliance
- Redding Rancheria
- Wintu Tribe of Northern California
- All property owners within 300 feet of the property boundary
- Applicant
- Property Owner, if not applicant
- Representative

PUBLIC REVIEW

(X) Draft document referred for comments March 3, 2025.

( ) No comments were received during the public review period.

( ) Comments were received but did not address the draft Mitigated Negative Declaration findings or the accuracy/completeness of the Initial Study. No response is necessary. The letters are attached.

( ) Comments addressing the findings of the draft Mitigated Negative Declaration and/or accuracy or completeness of the Initial Study were received during the public review period. The letters and responses follow (see Response to Comments, attached).

The draft Mitigated Negative Declaration, Initial Study, Mitigated Negative Declaration, and other information concerning the project are available for public review Monday through Friday from 8:00 a.m. to 3:00 p.m., at the Planning Division of the Development Services Department, City of Redding, 777 Cypress Avenue, Redding, CA 96001, and online on the Development Services' City Planning Projects page of the City's website at http://www.cityofredding.gov. If you have any questions or wish to submit comments, please contact Danny Castro, Associate Planner, at dcastro@cityofredding.org, or by telephone at (530) 225-4471.

Lily Toy, Planning Manager

March 3, 2025
Date

Date of Final Report

Attachments:
A. Location map
B. Initial Study
C. Mitigation Monitoring Program

N
W E
S

GIS DIVISION
INFORMATION TECHNOLOGY DEPARTMENT

DATE PRODUCED:
FEBRUARY 26, 2025

0 200 400 Feet

P:\Planning\ProProjects\SDP\SDP-2023-00085.aprx

LOCATION MAP

SDP-2023-00085
DANCO COMMUNITIES
930 & 990 CANBY ROAD
AP# 117-200-005 & -006

MTG. DATE:

ITEM:

ATTACHMENT:

ENVIRONMENTAL INITIAL STUDY

INITIAL STUDY CHECKLIST
References and Documentation
Canby Apartments
Site Development Permit

Prepared by:
CITY OF REDDING
Development Services Department
Planning Division
777 Cypress Avenue
Redding, California 96001

March 3, 2025

CITY OF REDDING
ENVIRONMENTAL CHECKLIST FORM

1. **Project Title:**

   Canby Apartments

2. **Lead agency name and address**:

   CITY OF REDDING
   Development Services Department
   Planning Division
   777 Cypress Avenue
   Redding, CA 96001

3. **Contact Person and Phone Number:**

   Danny Castro, (530) 225-4471

4. **Project Location:**

   990 and 930 Canby Road
   Redding, CA 87047

5. **Applicant's Name and Address:**

   Danco Communities
   5251 Ericson Way
   Arcata, CA 95521

   Representative's Name and Address:

   Douglas L. Gibson
   430 E. State Street, Suite 100
   Eagle, ID 83616

6. **General Plan Designation:** Residential 10 to 20 Units per Acre

7. **Zoning:** "RM-12" Residential Multiple-Family District

8. **Description of Project:**

   The Project applicant, Danco Communities, is requesting approval of Site Development Permit Application SDP-2023-00085 to construct a 100 percent affordable housing facility with one hundred and twenty (120) units of affordable housing in ten separate two- and three-story structures on an eight-acre site spanning two parcels located at the northwest corner of Canby Road and Browning Street, addressed as 990 and 930 Canby Road. A single-story community building is also proposed that will include the leasing office, a commons room, a kitchen, a laundry facility, and an exercise room. Other site amenities such as a children's playground, a basketball court, and a central courtyard are proposed. The development is proposed in two phases that will total one hundred and twenty (120) units upon completion. The first phase of development would consist of sixty-two (62) multifamily units and the second phase, as proposed, would consist of fifty-eight (58) units.

   All street and utility improvements will connect to existing systems located adjacent to the Project boundaries. The storm drain system will connect to Little Churn Creek (onsite) in the northeast corner of the site after any required on-site water treatment.

Public improvements along both of the Project's frontages and right-of-way dedication would be required.

9. Surrounding Land Uses and Setting:

The Project consists of approximately eight (8) acres of land. The site is moderately sloped with elevation ranging from approximately 605 to 640 feet above mean sea level (MSL) and primarily composed of oak woodland and grassland with some riparian habitat. Little Churn Creek runs through the northeast corner of the site. The Project site is currently vacant and surrounded by multi-family residential development to the north and west, commercial development to the south and west along Browning Street (including the Kohl's shopping center), and vacant multi-family zoned land to the east.

10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement):

California Regional Water Quality Control Board
California Department of Fish and Wildlife
United States Army Corps of Engineers

11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of significance of impacts to tribal cultural resources, procedures regarding confidentiality, etc.?

The Redding Rancheria and the Wintu Tribe of Northern California were noticed about this project and the preparation of its associated initial study. No California Native American tribes requested consultation pursuant to Public Resources Code section 21080.3.1.

Note: *Conducting consultation early in the CEQA process allows tribal governments, lead agencies, and project proponents to discuss the level of environmental review, identify and address potential adverse impacts to tribal cultural resources, and reduce the potential for delay and conflict in the environmental review process. (See Public Resources Code section 21080.3.2.) Information may also be available from the California Native American Heritage Commission's Sacred Lands File per Public Resources Code section 5097.96 and the California Historical Resources Information System administered by the California Office of Historic Preservation. Please also note that Public Resources Code section 21082.3(c) contains provisions specific to confidentiality.*

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact or Potentially Significant Unless Mitigation Incorporated" as indicated by the checklist on the following pages.

	Aesthetics		Agricultural and Forestry Resources		Air Quality
X	Biological Resources		Cultural Resources		Energy
	Geology / Soils		Greenhouse Gas Emissions		Hazards & Hazardous Materials
	Hydrology / Water Quality		Land Use / Planning		Mineral Resources
X	Noise		Population / Housing		Public Services
	Recreation		Transportation		Tribal Cultural Resources
	Utilities / Service Systems		Wildfire		Mandatory Findings of Significance

DETERMINATION: (To be completed by the Lead Agency)

On the basis of the initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR of NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Copies of the Initial Study and related materials and documentation may be obtained at the Planning Division of the Development Services Department, 777 Cypress Avenue, Redding, CA 96001. Contact Danny Castro at (530) 225-4471.

Danny Castro, Associate Planner Development Services Department	March 3, 2025 Date

EVALUATION OF ENVIRONMENTAL IMPACTS:

This section analyzes the potential environmental impacts associated with the proposed project. The issue areas evaluated in this Initial Study include:

- Aesthetics
- Agricultural and Forestry Resources
- Air Quality
- Biological Resources
- Cultural Resources
- Energy
- Geology/Soils
- Greenhouse Gas Emissions
- Hazards & Hazardous Materials
- Hydrology/Water Quality
- Land Use/Planning
- Mineral Resources
- Noise
- Population/Housing
- Public Services
- Recreation
- Transportation
- Tribal Cultural Resources
- Utilities/Service Systems
- Wildfire
- Mandatory Findings of Significance

The environmental analysis in this section is patterned after the Initial Study Checklist recommended by the State *CEQA Guidelines* and used by the City of Redding in its environmental review process. For the preliminary environmental assessment undertaken as part of this Initial Study's preparation, a determination that there is a potential for significant effects indicates the need to more fully analyze the development’s impacts and to identify mitigation.

For the evaluation of potential impacts, the questions in the Initial Study Checklist are stated and an answer is provided according to the analysis undertaken as part of the Initial Study. The analysis considers the long-term, direct, indirect, and cumulative impacts of the development. To each question, there are four possible responses:

- **No Impact.** The development will not have any measurable environmental impact on the environment.

- **Less Than Significant Impact.** The development will have the potential for impacting the environment, although this impact will be below established thresholds that are considered to be significant.

- **Potentially Significant Impact Unless Mitigation Incorporated.** The development will have the potential to generate impacts which may be considered as a significant effect on the environment, although mitigation measures or changes to the development’s physical or operational characteristics can reduce these impacts to levels that are less than significant.

- **Potentially Significant Impact**. The development will have impacts which are considered significant, and additional analysis is required to identify mitigation measures that could reduce these impacts to less than significant levels.

Where potential impacts are anticipated to be significant, mitigation measures will be required, so that impacts may be avoided or reduced to insignificant levels.

Prior environmental evaluations applicable to all or part of the Project site:

- *City of Redding General Plan* 2045
- *City of Redding General Plan Update Final Environmental Impact Report*, 2024, SCH #2022050300
- CEQA Findings of Fact and Statement of Overriding Considerations for the *City of Redding General Plan Update Final Environmental Impact Report*, as adopted by the Redding City Council on March 13, 2024, by Resolution 2024-027

List of attachments/references:

Attachment A –
Figure 1 – Location Map
Figure 2 – Architectural Site Plan
Figure 3 – Preliminary Grading Plan
Figure 4 – Preliminary Utility Plan

All technical reports listed below are on file and available in the Development Services Department, Planning Division.

Attachment B – *A Cultural Resources Evaluation of 900-930 Canby Road, Redding, Shasta County, California*, Archaeological Resource Service, August 2022
Attachment C – *Aquatic Resource Delineation Report for the Property at 930 – 990 Canby Road*, Redding, California, Natural Investigations Company, Inc., February 28, 2022
Attachment D – *Canby Apartments Entitlement Storm Drainage Analysis*, Sharrah Dunlap Sawyer, Inc., September 19, 2023
Attachment E – *Noise Technical Report for the Redding Canby Apartments Project*, Helix Environmental Planning, October 2024
Attachment F – *Redding Canby Apartments Project Revised Biological Resources Assessment*, Helix Environmental Planning, October 2024
Attachment G – *Transportation Impact Study for the Redding Canby Apartments,* W-Trans, February 27, 2023
Attachment H – *Tree Identification and Evaluation for 900 & 930 Canby Road, Redding, California*, Natural Investigations Company, June 2022
Attachment I – *Crotch's Bumble Bee Technical Assistance Memo for the Canby Apartments Project*, Redding, Shasta County, California, Gallaway Enterprises, February 2025

I. AESTHETICS*:* *Except as provided in Public Resources Code Section 21099, would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Have a substantial adverse effect on a scenic vista?			X	
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway?			X	
c) In nonurbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? *(Public views are those that area experienced from publicly accessible vantage point).* If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?			X	
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?			X	

Discussion:

a) Scenic resources identified in the General Plan Environmental Impact Report include the Sacramento River and its tributaries; mountains and foothill; and open hillsides. Development of the Project would not obstruct a scenic vista identified in the *City of Redding General Plan 2045* and would be consistent with the development pattern established on nearby properties. Although new development would alter the appearance of the existing conditions, it would not create a substantial adverse impact on scenic vistas or degrade the City's visual character or quality due to the existing urbanized character of the City. The Project will comply with the City's development ordinances, including the Zoning Ordinance and Subdivision Ordinance. The proposed Project would not represent a significant change to the overall scenic quality of the area.

b) The Project site is not located adjacent to a state-designated scenic highway. In addition, the Project would be consistent with the surrounding land uses and the Project would not substantially obstruct, interrupt, or detract from identified scenic resources. There are not prominent rock outcroppings, visually-significant tree stands, or historic buildings in the vicinity of the Project.

c) The Project will be compatible with the existing developed visual character of the adjacent/nearby development and the Project site is located within an area which is developed with similar uses. The location, size, and design of the proposed housing facility would be compatible with the residential and commercial uses in the immediate area.

d) The Project would generate light that is customary for development and comply with the Zoning Ordinance light standards. There would not be an adverse effect on day or nighttime views in the area.

Documentation:
City of Redding General Plan 2045, Community Development and Design Element 2045
City of Redding General Plan 2045, Natural Resources Element 2045
City of Redding Zoning Ordinance, Chapter 18.40.090

Mitigation:
None necessary.

II. AGRICULTURE RESOURCES: *In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural, Land Evaluation and Site Assessment Mode (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided bin Forest Protocols adopted by the California Air Resources Board. Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Convert Prime Farmland, Unique Farmland, or Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?			**X**	
b) Conflict with existing zoning for agricultural use, or a Williamson Act Contract?				**X**
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 5110(g))?				**X**
d Result in the loss of forest land or conversion of forest land to non-forest use?				**X**
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use or conversion of forest land to non-forest land?				**X**

Discussion:

a-e) The Project site contains soils that consist of Redding gravelly loam 3 to 8 percent slopes, Newtown gravelly loam 15 to 30 percent slopes, and Churn gravelly loam, deep, 0 to 3 percent slopes. The portion of land containing Churn gravelly loam, deep, 0 to 3 percent slopes is within an area identified by the California Department of Conservation's Important Farmland Series Mapping and Monitoring Program as meeting the criteria for *Prime Farmland if irrigated.* However, under this classification, these soils must have been cultivated and irrigated with crops within the past three years, which is not the case. According to the General Plan Background Report, prime agricultural soils in the Planning Area are limited to Churn Creek Bottom and pockets of land along Stillwater Creek in the vicinity of Shasta College. Therefore, because the site has not historically been used for agricultural purposes, it does not contain soils that are prime for agricultural production. The Project site is not under Williamson Act contract and does not contain forest land, or timberlands. The Project would not convert or rezone any farmland to non-agricultural use, or any forest land to non-forest use.

Documentation:
City of Redding General Plan 2045, Natural Resources Element 2045
California Department of Conservation's Farmland Mapping and Monitoring Program
United States Department of Agriculture, Soil Conservation Service and Forest Service, Soil Survey of Shasta County Area.

Mitigation:
None necessary.

III. <u>AIR QUALITY</u>: *Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to make the following determinations. Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Conflict with or obstruct implementation of the applicable air quality plan?			X	
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable Federal or State ambient air quality standard			X	
c) Expose sensitive receptors to substantial pollutant concentrations?				X
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?				X

Discussion:

a) Shasta County, including the far northern Sacramento Valley, currently exceeds the state's ambient standards for ozone (smog) and particulates (fine, airborne particles). Consequently, these pollutants are the focus of local air quality policy, especially when related to land use and transportation planning. Even with application of measures to reduce emissions for individual projects, cumulative impacts are unavoidable when ozone and/or particulate emissions are involved. For example, the primary source of emissions contributing to ozone is from vehicles. Any project that generates vehicle trips has the potential of contributing incrementally to the problem.

The City of Redding General Plan (GP) Environmental Impact Report (EIR) concluded that cumulative impacts would be significant and unavoidable *on a City-wide basis* and those impacts are addressed in the adopted CEQA Findings of Fact and Statement of Overriding Considerations. The GP EIR estimated areawide and mobile source emissions under the General Plan 2045 and compared the estimates to the estimated area and mobile source emissions projected in the 2021 Air Quality Attainment Plan (AQAP) for year 2025, which is the time horizon of the AQAP. The analysis concluded that the *cumulative* ROG and NOX emissions that would be generated by activity under the GP in 2045 would exceed the projections in the AQAP for year 2025 resulting in a very conservative determination. The GP EIR mirrors GP policies by requiring Mitigation Measures AQ-1 and AQ-2. AQ-1 requires that “Standard Mitigation Measures” (SMMs) be applied to all discretionary projects. AQ-2 requires the use of Best Available Mitigation Measures (BAMMs) recommended by SCAQMD which has the ability to provide recommendations for each discretionary project. The requirement of SMMs is also required by the City’s Standard Conditions of Approval (SCOA) for discretionary projects. Because the Project would generate the type of construction and traffic emissions projected for the land use types and density set forth for the Project site by the GP EIR, the Project would not conflict with the SCAQMD plans and impacts would be less than significant.

b) The GP EIR concluded that cumulative impacts would be significant and unavoidable on a City-wide basis and those impacts are addressed in the adopted CEQA Findings of Fact and Statement of Overriding Considerations. The GP EIR concluded that implementation of the GP would cumulatively generate construction-related emissions of criteria air pollutants and precursors, including ROG, NOX, PM10, and PM2.5 from site preparation (e.g., excavation, clearing), off-road equipment, material delivery, worker commute trips, and other activities (e.g., building construction, asphalt paving, application of architectural coatings). Implementation of the construction-related SMMs as required by the City’s SCOA for discretionary projects would reduce construction-generated emissions of criteria air pollutants and precursors. However, due to Shasta County’s nonattainment-transitional status for ozone, construction activities associated with the Project would add to the cumulative impacts, and the GP EIR acknowledges that implementation of the GP may result in adverse air quality impacts to surrounding land uses and may contribute to the existing air quality condition in the City. There are no components of the proposed Project that would result in increased construction-related air quality emissions beyond what was previously evaluated and disclosed by the GP EIR for the Project site. Nonetheless, and consistent with the findings of the GP EIR, Project-related air quality emissions during construction activities would contribute to the significant and unavoidable construction-related air quality impact identified by the GP EIR (Impact AQ-2). However, the Project would not result in increased impacts or increased cumulatively-considerable impacts due to construction-related emissions beyond what was evaluated and disclosed by the GP EIR and would not exceed the thresholds established by the GP.

The *City of Redding General Plan 2045*, Natural Resources Element 2045 establishes emission thresholds that have been adopted by regional agencies when determining air quality impacts of discretionary projects for the important regional/local pollutants, including Reactive Organic Gases (ROG) and Oxides of Nitrogen (NOx), which are ozone precursors, and Inhalable Particulate Matter, 10 Micron (PM_{10}) and 2.5 Micron ($PM_{2.5}$) as follows:

Level "A"	**Level "B"**
25 pounds per day of NOx	137 pounds per day of NOx
25 pounds per day of ROG	137 pounds per day of ROG
80 pounds per day of PM_{10}	137 pounds per day of PM_{10}
80 pounds per day of $PM_{2.5}$	

The process of applying SMM and BAMM is to apply appropriate SMM to all projects based on potential air quality impacts and to help contribute to reducing cumulative impacts. If the project exceeds Level "A" thresholds, then BAMM will be applied based on the unique characteristics of the project selected from a list of measures provided by AQMD. If a project exceeds Level "B" thresholds, SMM, BAMM, and appropriate special BAMM would be applied and the City will seek recommendations of the AQMD regarding the efficiency of proposed emissions measures beyond BAMM. If a project's emission cannot be reduced to below Level "B" thresholds, emission offsets will be required. If, after applying emission offsets, the project still exceeds the Level "B" threshold, then an Environmental Impact Report is required.

The current Project has the potential to impact air quality primarily in two ways: (1) the Project would generate vehicle trip emissions (with NOx, ROG, and PM_{10}) that contribute cumulatively to local and regional air quality conditions; and (2) fugitive dust (particulate/PM_{10} and $PM_{2.5}$) emissions are possible during construction activities. As a residential development, the Project does not have the potential to generate significant emission concentrations of other pollutants subject to state and federal ambient air quality standards and no recommendations for BAMM were made by the SCAQMD.

Application of the SMMs outlined below would reduce the Project's potential air quality impacts to a level less than significant.

1. Apply nontoxic soil stabilizers according to manufacturer's specification to all inactive construction areas (previously-graded areas inactive for ten (10) days or more).
2. Reestablish ground cover on the construction site through seeding and watering prior to final occupancy.
3. All grading operations shall be suspended by the City Engineer when winds (as instantaneous gusts) exceed 20 miles per hour as directed by the AQMD.
4. Provide temporary traffic control as appropriate during all phases of construction to improve traffic flow (e.g. flag person) as approved by the City Engineer.
5. Schedule construction activities that affect traffic flow to off-peak hours as determined by the City Engineer.
6. Water active construction sites at least twice daily or as directed by the Public Works Department.
7. All truck hauling dirt, sand, soil, or other loose materials shall be covered or maintain at least two feet (2') of freeboard (i.e., minimum vertical distance between top of the load and the trailer) in accordance with the requirements of CVC Section 23114. This provision is enforced by local law enforcement agencies.
8. Sweep streets at the end of the day if visible soil materials are carried onto adjacent public paved roads (recommend water sweeper with reclaimed water).
9. Install wheel washers where vehicles enter and exit unpaved roads onto paved roads, or wash off trucks and any equipment leaving the site each trip.

In addition to the requirements of the California Building Code, the following operational SMMs will be applied as appropriate to as recommended by the Shasta County Air Quality Management District:

1. Provide energy-efficient process systems, such as water heaters, furnaces, and boiler units.
2. All new wood burning devices shall be EPA Phase II certified.
3. Large residential, commercial, and industrial projects should include bus shelters at transit access points.
4. Contribute to traffic-flow improvements that reduce emissions and are not growth-inducing (e.g., right-of-way, capital improvements, etc.)
5. Install an electrical outlet at the front and back of all residential units for electrical yard equipment.

6. Streets should be designed to maximize pedestrian access to transit stops.

c-d) The GP EIR concluded that cumulative impacts would be significant and unavoidable on a City-wide basis and those are addressed in the adopted CEQA Findings of Fact and Statement of Overriding Considerations. However, the document notes that the SCAQMD identified the following types of land use conflicts that could result in the exposure of sensitive receptors to excessive pollutant concentrations in their CEQA Land Use Protocol Guidelines:

- Development projects with sensitive receptors in close proximity to a congested intersection or roadway with high levels of emissions from motor vehicles. High concentrations of carbon monoxide, fine particulate matter, or toxic air contaminants are the most common concerns.
- Development projects with sensitive receptors close to an industrial source of toxic air contaminants.
- Development projects with sensitive receptors close to a source of odorous emissions. Although odors generally do not pose a health risk, they can be quite unpleasant and often lead to citizen complaints to the District and to local governments.

The Project does not meet any of these criteria. Further, the Project is not located in proximity to any of the land uses types noted.

Documentation:
City of Redding General Plan 2045, Natural Resources Element 2045
City of Redding General Plan Update Final Environmental Impact Report, 2024, SCH #2022050300
CEQA Findings of Fact and Statement of Overriding Considerations for the *City of Redding General Plan Update Final Environmental Impact Report*, as adopted by the Redding City Council on March 13, 2024, by Resolution 2024-027

Mitigation:
None necessary.

IV. BIOLOGICAL RESOURCES: *Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?		X		
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local of regional plans, policies, regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?			X	
c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?			X	
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?			X	
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?				X
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community, Conservation Plan, or other approved local, regional, or State habitat conservation plan?				X

Discussion:

a) The information below is based on the survey results documented in the Revised Biological Resource Assessment prepared by Helix Environmental Planning for the project, a technical memo prepared by Gallaway Enterprises for the project, and the Aquatic Resource Delineation Report prepared by Natural Investigations Company for the project.

Plants

A total of four terrestrial vegetation communities were documented as occurring within the Study Area, including annual grassland, blue oak woodland, developed/disturbed, and riparian.

Annual Grassland: There are approximately 4.23 acres of annual grassland distributed throughout the Study Area, intermixed with primarily blue oak woodland. This vegetation community appears to be routinely maintained as vegetation heights ranged from 2 and 12 inches. This vegetation community was dominated by non-native and native species including purple sanicle (Sanicula bipinnatifida), broadleaf filaree (Erodium botrys), shining pepperweed (Lepidium nitidum), Italian ryegrass (Festuca perennis), annual vernal grass (Anthoxanthum aristatum), foxtail barley (Hordeum murinum), and wild oat (Avena fatua).

Blue Oak Woodland: Approximately 3.39 acres of the Study Area is comprised of blue oak woodland. This vegetation community occurs primarily within the center portion of the site extending to the northwest. This community has a canopy density of approximately 30 to 40 percent with an understory dominated by annual grassland and forb species. The dominant tree species includes blue oak (Quercus douglasii), with a single common lilac (Syringa vulgaris) and a cypress tree (Hesperocyparis sp.). Dominant understory vegetation consisted of foxtail barley, cutleaf geranium (Geranium dissectum), common bedstraw (Galium aparine), annual vernal grass, wild oat, and poison oak (Toxicodendron diversilobum).

Developed/Disturbed: There is approximately 0.61 acre of developed/disturbed land positioned along the eastern and southern boundaries of the Study Area. These areas include portions of Canby Road along the eastern boundary and portions of Browning Street along the southern boundary. The southern boundary also includes some highly disturbed ground composed of a remnant access road and a slope cut adjacent to Browning Street. These disturbed areas are characterized by heavy disturbance by past or ongoing human activities but retain a soil substrate. These disturbed areas are sparsely to densely vegetated, but do not support a recognizable community or species assemblage. Vegetative cover is herbaceous and dominated by a wide variety of weedy non-native species or a few ruderal native species. Some of the species in this area include wild oats, ripgut brome (Bromus diandrus), soft chess (Bromus hordeaceus), common vetch (Vicia sativa), and cut-leaf geranium.

Riparian: Approximately 0.20 acre of riparian habitat occurs in the northeast corner of the Study Area, surrounding the onsite drainage. This habitat is relatively degraded due to being impacted by foot traffic and the establishment of invasive plants. The riparian habitat on the south side of the intermittent drainage is highly disturbed due to ground compaction from foot traffic, evident by the presence of a social trail. A multifamily development abuts this area to the north. The riparian habitat occurring on the north side the intermittent drainage is overgrown with Himalayan blackberry and is intermixed with various tree species. Trees occurring within this riparian habitat consist of interior live oak (Quercus wislizeni), blue oak, eucalyptus (Eucalyptus sp.), grey pine (Pinus sabiniana), and willow (Salix sp.). The understory is dominated by common bog rush (Juncus effusus), dallisgrass (Paspalum dilatatum), pennyroyal (Mentha pulegium), curly dock (Rumex crispus), Himalayan blackberry (Rubus armeniacus), and St. John’s wort (Hypericum sp.).

As discussed in the biological resources assessment, a total of nine special-status plant species have the potential of occurring on the Project site. These nine plant species include Henderson’s bent grass (Agrostis hendersonii), big-scale balsamroot (Balsamorhiza macrolepis), silky cryptantha (Cryptantha crinita), mountain lady’s slipper (Cypripedium montanum), dubious pea (Lathyrus sulphureus var. argillaceus), broad-lobed leptosiphon (Leptosiphon latisectus), Ahart’s paronychia (Paronychia ahartii), Sanford’s arrowhead (Sagittaria sanfordii), and Redding checkerbloom (Sidalcea celata). After focused botanical surveys within the identified blooming period for each species were conducted, only one of these nine species was found to be onsite: Redding checkerbloom.

Redding checkerbloom is a perennial herb in the mallow family (Malvaceae) that is classified with a California Rare Plant Rank of 3 by the California Native Plant Society (CNPS). This species is endemic to California and is found in cismontane woodlands from 135 to 1,525 meters above sea level. Other ecological preferences of this species include sometimes growing in serpentine soils. The blooming period for this species is from April to August. No California Natural Diversity Database (CNDDB) occurrences of this species were documented within five miles of the Study Area, however, CNPS documents this plant as occurring within Plumas, Shasta, Siskiyou, and Tehama Counties. The majority of the documented CNPS occurrences occur in Shasta County, with most occurrences concentrated primarily within the Redding area and areas immediately to the south. This species was observed within the northern half of the Project site within the understory of the blue oak woodland during the May 2023 survey, where 10 to 15 individual Redding checkerbloom plants were observed in flower. These plants have the potential to be affected by development of the Project site which is considered a potentially significant impact. Mitigation Measure Bio-1 below would reduce or eliminate project-associated impacts to the Redding checkerbloom to less than significant.

Animals

As discussed in the biological resources assessment, a total of six special-status animal species have the potential to occur on the Project site and/or be impacted with development of the site. These six animal species include north coast foothill yellow-legged frog (Rana boylii, pop. 1; FYLF), western pond turtle (Emys marmorata), tricolored blackbird (Agelaius tricolor), pallid bat (Antrozous pallidus), western red bat (Lasiurus frantzii), and Crotch's bumble bee (Bombus crotchii). In addition to these special-status wildlife species, other migratory birds and raptors protected under federal, state, and local laws/policies also have the potential to occur within the Project site.

The **foothill yellow legged frog (FYLF)** range extends from the Transverse Mountains in southern California, north to the Oregon border along the Coast Ranges in California. The elevational range of FYLF extends from sea level up to 6,370 feet above sea level. Suitable aquatic habitat consists of streams flowing through a variety of vegetation communities, such as valley foothill hardwood, riparian, hardwood-conifer, chaparral, wet meadow, ponderosa pine and mixed pine. This species was not observed in the Study Area during the biological survey conducted by HELIX in April or May 2023. At the time of the April and May surveys, the drainage had flowing water present. A total of two CNDDB records were documented within five miles of the Study Area for this species, although no occurrences have been documented within five miles of the Study Area in over 47 years. The on-site intermittent drainage provides habitat suitable to support this species but in a foraging capacity only. The habitat available onsite is marginal due to an adjacent human created social trail which has caused significant disturbance along the southern bank of the drainage. Undercut banks and cobble present within the drainage provide potential refugia habitat for this species but lacks breeding habitat due to the intermittent nature of this drainage. There is refugia habitat present within the onsite drainage suitable to support this species, however, given the lack in abundance of recent CNDDB occurrences within five miles of the Study Area, this species has a low potential to occur. Mitigation Measure Bio-2 below would reduce or eliminate project-associated impacts to the foothill yellow legged frog to less than significant.

Western pond turtles are found along ponds, marshes, rivers, streams, and irrigation ditches that typically have muddy or rocky bottoms and grow aquatic vegetation. This subspecies requires basking sites such as logs or mats of emergent vegetation. It prefers habitats with stable banks and open areas to bask in, as well as the underwater cover provided by logs, large rocks, bulrushes, or other vegetation. This subspecies generally leaves the aquatic site only to reproduce and hibernate. Elevation range extends from near sea level to 4690 feet above sea level in association with permanent or nearly permanent water in a wide variety of habitat types. Western pond turtle was not observed on the Project site during biological surveys conducted in April and May of 2023. At the time of both surveys, the drainage had flowing water present with a relatively shallow pool (approximately 12 inches) located at the eastern end of the drainage prior to entering the culvert positioned under Canby Road. A total of three CNDDB records were documented within five miles of the Project site, with the nearest occurrence, documented in 2015, located approximately 1.13 miles to the northwest. Additionally, an occurrence was documented in 2007 located within Salt Creek. Though flowing water was present during the April and May 2023 surveys, the water within the onsite drainage is intermittent with seasonal flows. The lack of perennial waters does not allow for a population of this species to be sustained. Due to the lack of perennial waters, impacts to nests are not foreseen, however, nesting could not be completely ruled out due to the presence of water within the intermittent drainage at the time of the surveys and the presence of upland habitat suitable for nesting. Due to the presence of CNDDB occurrences within vicinity of the site, the presence of flowing water within the onsite drainage, and the presence of upland habitat marginally suitable for nesting, this species has the potential of utilizing the Project site in a foraging and nesting capacity. Therefore, direct impacts such as clearing and grubbing, grading, other earthwork, and tree removal have the potential of impacting this species. Mitigation Measure Bio-3 would reduce or eliminate project-associated impacts to the western pond turtle to less than significant.

The **tricolored blackbird** is a colonial nester of marshy areas throughout the Central Valley and coastal California. It can be observed in the Central Valley year-round and is typically a resident throughout its range, however tricolored blackbirds that occur in northeastern California have been known to migrate south during fall and winter months. Tricolored blackbirds breed near freshwater, preferably in emergent marsh areas with tall, dense cattails, but will also nest in willow thickets. Nests are usually located a few feet over water or may be hidden on the ground in vegetation. Blackbirds build nests of mud and plant material. Blackbirds are highly colonial; nesting areas must be large enough to support a minimum colony of at least 50 pairs. Tricolored blackbirds are omnivorous and often shift their diet from insects and spiders during the spring season, to seeds, cultivated grains, rice and oats during fall and winter months. Blackbirds forage on the ground in croplands, grassy fields, and flooded rice fields.

This species was not observed in the Study Area during biological surveys conducted by HELIX in April and May of 2023. No CNDDB occurrences were documented within five miles of the Study Area. The closest CNDDB occurrence, documented in 1932, is located approximately 5.1 miles to the southwest. At this occurrence location, a colony of approximately 100 nests were observed. This colony is presumed extirpated. Though no CNDDB occurrence have be documented in recent years within five miles of the Project site, this species was determined to have a low potential to occur due to the presence of suitable habitat. Mitigation Measure Bio-4 would reduce or eliminate project associated impacts to the tricolored blackbird to less than significant.

The **pallid bat** occurs from the desert southwest and semiarid lands from Mexico and north throughout the west coast. This is one of the most common species at low elevations throughout the southwest. It favors habitat with rocky outcrops with desert scrub and is also commonly found in forested oak and pine regions. Common roost sites are rock crevices, old buildings, bridges, caves, mines, and hollow trees. No CNDDB occurrences were documented within five miles of the Project site. The closest CNDDB occurrence, documented in 2016, is located approximately 8.69 miles to the northeast. The trees in the vicinity of the onsite drainage provide potentially suitable roosting habitat for this species. This species was not observed on the Project site during biological surveys conducted by HELIX in April and May of 2023 and no bats or bat sign (e.g., scat and prey remains) of any species were observed. Due to the lack of occurrences of this species within five miles of the site, this species is not likely to occur. However, the potential for this species to occur could not be completely ruled out based on the presence of suitable roosting habitat. Mitigation Measure Bio-5 would reduce or eliminate project related impacts to the pallid bat to less than significant.

The **western red bat** occurs from Shasta County to the Mexican border, west of the Sierra Nevada/Cascade crest and deserts. The winter range includes western lowlands and coastal regions south of San Francisco Bay. Roosting habitat includes forests and woodlands from sea level up through mixed conifer forests. Roosting primarily occurs in trees, less often in shrubs. Roosting sites are often in edge habitats adjacent to streams, fields, or urban areas. This species was not observed onsite during biological surveys conducted by HELIX in April and May of 2023. No CNDDB occurrences were documented within the five miles of the Project site. Only one CNDDB occurrence was recorded within the nine-quad CNDDB search. This one occurrence was documented in 1999, located approximately 40 miles to the south. Given the presence of the onsite intermittent drainage, the surrounding onsite trees provide potentially suitable roosting habitat, though no bats or bat sign (e.g., scat and prey remains) of any species were observed. Due to the lack of occurrences of this species within five miles of the site, this species is not likely to occur. However, the potential for this species to occur could not be completely ruled out based on the presence of suitable roosting habitat. Mitigation Measure Bio-5 would reduce or eliminate project related impacts to the western bat to less than significant.

Crotch's bumble bee is a California Endangered Species Act (CESA) candidate species that occurs in grassland and scrub habitats. New colonies are initiated by solitary queens, generally in the early spring, and typically occupy abandoned rodent burrows. This species is a generalist forager and has been reported to visit a wide variety of flowering plants. This species is rare throughout its range and in decline in the Central Valley and southern California. The annual grassland community and rodent burrows within the Project site provide suitable nesting habitat for this species. However, according to a technical memo written for the Project by Gallaway Enterprises, the approximately 4 acres of annual grassland onsite do not support bountiful floristic resources that would sustain Crotch's bumble bee foraging within range of a nesting colony. Given that there are no CNDDB occurrences within a 25-mile radius of the Project site and no current CNDDB occurrences within a 60-mile radius of the Project site and the suitable habitat elements within and adjacent to the Project site are very limited (the lack of availability of nectar and pollen from floral resources throughout the duration of the colony period [spring, summer, and fall]) it is not likely that Crotch's bumble bee would occur within the Project site. Impacts to this species are anticipated to be less than significant.

The Study Area and immediate vicinity provide nesting and foraging habitat for a variety of **common raptors and other migratory bird species** such as mourning dove (Zenaida macroura), house finch (Haemorphous mexicanus), and red-shouldered hawk (Buteo lineatus). Active nests were not observed during surveys. However, a variety of birds have the potential to nest in and adjacent to the site, in trees, shrubs, and on the ground in vegetation. Project activities such as clearing and grubbing during the avian breeding season (generally February 1 through August 31) could result in injury or mortality of eggs and chicks directly through destruction or indirectly through forced nest abandonment due to noise and other disturbances. Mitigation measure MM-Bio-4 would reduce or eliminate project related impacts to nesting migratory birds and raptors to less than significant.

b, c) Approximately 0.20 acre of the Project site is comprised of riparian habitat associated with Little Churn Creek, an intermittent drainage feature, located within the northeast corner of the site. Drainage enters the Project site on the north side of the site, flowing in a southeast direction, and leaves the site along the eastern boundary, eventually flowing from Little Churn Creek into Churn Creek. This intermittent stream bed is composed of a mix of cobble, gravel, and organic material. While many streams and tributaries within City limits are required to be protected per General Plan Policy NR4A, Little Churn Creek is not among them. Furthermore, Little Churn Creek is not listed in Schedule 18.48.020-A in Chapter 18.48, *River/Creek Corridor Development*, of the Zoning Ordinance as having a required waterway corridor setback requirement. No special status riparian species or sensitive natural communities were identified in the biological resource assessment as having the potential to occur onsite, including in Little Churn Creek. Impacts to riparian habitat and sensitive natural communities are anticipated to be less than significant.

In the Aquatic Resource Delineation Report completed by Natural Investigations Company, two isolated wetlands totaling 0.18 acres and one channel totaling 0.02 acres were delineated. No other wetlands or channels were detected within the Project site.

The two wetland features occur in poorly-defined depressions that fill primarily with surface flow after rain. The soil in the seasonal wetlands has a much greater clay content than the surrounding uplands. None of the wetlands had vernal pool indicator plants.

The Aquatic Resource Delineation Report was unable to determine if the delineated wetlands and channel would be subject to United States Army Corps of Engineers (USACE) jurisdiction. The wetlands are isolated, and do not have connectivity to downstream waters of the U.S. The delineated channel (Little Churn Creek) may be subject to Federal jurisdiction because it has connectivity with downstream waters of the U. S. The same delineated features (two wetlands, one channel) were determined to be potentially subject to State jurisdiction.

While the removal of these two depressions and alteration of one open drainage channel are expected to constitute a less than significant impact, these wetland features are potentially jurisdictional. The aquatic resources delineation report indicates that they would likely fall under State jurisdiction. By law, the filling of Waters of the U.S. or waters of the State requires a permit from the USACE or a permit from the State Water Resources Control Board (SWRCB). Additionally, permission for work in the “stream zone” (Little Churn Creek) may also be required from the California Department of Fish and Wildlife (CDFW). The applicant would be required to do any mitigation required by one of those permits. While mitigation measures are not necessary for the purposes of this environmental document, acquisition of the required permits will be a part of the Project’s conditions of approval in addition to the law.

d) The Project site is surrounded by existing development to the north, west, and south with an undeveloped but previously disturbed parcel to the east. The Project would leave Little Churn Creek intact, thus preserving any functioning of the drainage channel as a wildlife corridor intact (such a function was not identified in the Biological Resource Assessment or Aquatic Resource Delineation Report for the Project). The remainder of the site does not serve as a wildlife movement corridor as it does not link together areas of suitable habitat that are otherwise separated by rugged terrain, changes in vegetation, or human development. While the site contains trees that could be used for nesting migratory birds, it is not anticipated to substantially interfere with the migration of birds. Impacts with regards to the functioning of the site for the movement of wildlife is considered to be less than significant.

e) The City has adopted a Tree Management Ordinance (Chapter 18.45 of the Redding Municipal Code) that promotes the conservation of mature, healthy trees in the design of new development. The ordinance also recognizes that the preservation of trees will sometimes conflict with necessary land-development requirements. The *City’s General Plan EIR* further acknowledges that preservation of native trees will sometimes conflict with normal land development and that implementation of the *General Plan* will ultimately set aside over 7,000 acres of open space, much of which contains oak habitat. But efforts must still be made to retain existing trees if reasonably possible, and to sufficiently plant new trees in the context of the new development. A tree survey is required to identify natural trees and tree groups most suitable for preservation or "candidate trees/groups." Where all identified candidate trees/groups cannot be preserved, the set-aside of a natural area (or areas) within a project site that is particularly suitable for the planting, retention, and/or natural regeneration of trees is considered to be a desirable means of accomplishing the goals of the ordinance.

An arborist report dated June 16, 2022 was provided by Natural Investigations Company for the Project site. The study identified a total of 279 trees that measured over six inches in diameter at breast height (DBH). Tree species identified on site included ornamental pine, eucalyptus, cypress, gray pine, Chinese tallow, black walnut, and interior live oak with the vast majority of trees being blue oak. Most trees were deemed to be in good condition. Fifty-two of the trees over six inches DBH are proposed to be preserved, with 227 to be removed. The remaining 218 trees to be removed are directly in the areas proposed for development with little to no opportunity to integrate them into the design of the Project: The trees are mostly in the flat areas where the buildings need to go. Furthermore, the density required by the General Plan anticipates large building areas and impervious surfacing.

City staff have not identified any candidate trees with the potential to be preserved, and the removal of trees is permitted with an approved grading or building permit. However, the Project will be replanting approximately 130 trees as shown on the preliminary landscape plan with 69 of them being oak trees. Therefore, the removal of trees would be considered a less than significant impact as it would not conflict with the City’s Tree Management Ordinance.

f) No habitat conservation plans or other similar plans have been adopted for the area of the Project site proposed for development. No impact would occur in this regard.

Documentation:

City of Redding General Plan 2045, Natural Resources Element 2045

City of Redding General Plan Update Final Environmental Impact Report, 2024, SCH #2022050300*City of Redding Municipal Code*, Chapter 18.45, Tree Management Ordinance
California Department of Fish and Wildlife: Natural Diversity Data Base
Redding Canby Apartments Project Revised Biological Resources Assessment, Helix Environmental Planning, October 2024
Aquatic Resource Delineation Report for the Property at 930 – 990 Canby Road, Redding, California, Natural Investigations Company, Inc., February 28, 2022
Tree Identification and Evaluation for 900 & 930 Canby Road, Redding, California, Natural Investigations Company, June 2022
Crotch's Bumble Bee Technical Assistance Memo for the Canby Apartments Project, Redding, Shasta County, California, Gallaway Enterprises, February 2025

Mitigation:

Bio-1: Prior to grading or construction, consultation with CDFW shall be conducted to develop a mitigation and/or avoidance strategy for Redding checkerbloom. This may include transplanting the plant population, compensation, or other measures established by that agency. Possible avoidance measures may include; fencing populations before construction; exclusion of project activities from the fenced-off areas; construction monitoring by a qualified botanist to keep construction crews away from the population, and; monitoring and reporting requirements for populations to be preserved on site.

Bio-2: Prior to the commencement of construction within the on-site drainage or within 100 feet of the on-site drainage, a pre-construction survey for foothill yellow-legged frog (FYLF) shall be conducted within the on-site intermittent drainage and immediate surrounding areas, initially seven days prior to the commencement of any ground-disturbing activities and again no more than 24 hours prior to ground-disturbing activities. If there are negative findings for this species during the survey, no further action is required. If this species is observed during the survey, CDFW should be consulted prior to ground disturbance regarding the potential for the Project to result in take of FYLF, and any avoidance measures or mitigation measures required by CDFW shall be implemented.

Bio-3: A Qualified Biologist shall conduct a pre-construction survey within 14 days prior to the start of ground disturbance within 500 feet of riparian habitat or the intermittent drainage. If no western pond turtles are observed, then a letter report documenting the results of the survey shall be provided to the City, and no additional measures are required. If construction does not commence within 14 days of the pre-construction survey, or halts for more than 14 days, a new survey shall be completed. If western pond turtles are found, a Qualified Biologist shall conduct a pre-construction survey within 24 hours prior to commencement of construction activities and be present on the site during grading activities within 500 feet of the intermittent drainage and its surrounding riparian habitat. The biologist shall establish a no-disturbance buffer around any individual western pond turtle, allowing the turtle to continue downstream, offsite, on its own accord. If the turtle does not self-relocate within a reasonable amount of time established by the biologist, CDFW shall be consulted on next steps.

Bio-4: If feasible, vegetation removal and/or construction shall be conducted between September 1 and January 31. If vegetation removal and/or construction activities is to occur during the nesting season (February 1 through August 31), a Qualified Biologist shall conduct a preconstruction survey no more than seven days before vegetation removal or construction activities begin. If an active nest is found, a no-disturbance buffer shall be established by a Qualified Biologist in coordination with CDFW. Construction may resume once the young have left the nest or as approved by the Qualified Biologist. The survey shall be provided to the CDFW. If construction activities cease for a period greater than seven days, additional preconstruction surveys will be required.

Bio-5: If vegetation removal and/or construction activities are to occur during the bat roosting season (March 1 through August 31), a Qualified Biologist shall conduct a preconstruction survey no more than seven days before vegetation removal or construction activities begin. If an active roost is found, a no-disturbance buffer shall be established for a distance of 500 feet around the nest unless a smaller buffer zone is approved by CDFW. Construction may resume once the young have left the nest or as approved by the Qualified Biologist. The survey shall be provided to the CDFW. If a lapse in construction activities of 14 days or more occurs during the roosting season, an additional roost survey is required to ensure no roosts were established in the area while construction was on hold. Minimum qualifications for a Qualified Biologist include a bachelor's degree in biological or environmental science, natural resources management, or related discipline; field experience in the habitat types that may occur at the Project site; familiarity with the Covered Species (or closely related species) that may occur at the Project site; and prior preconstruction survey, construction monitoring, or construction oversight experience (if and as relevant to the activity to be conducted).

V. CULTURAL RESOURCES: *Would the project:*	Potentially Significant Impact	Less-Than-Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource pursuant to Section 15064.5?			X	
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?			X	
c) Disturb any human remains, including those interred outsides of dedicated cemeteries?			X	

Discussion

a-c) An archaeological evaluation of the Project site was conducted by Archaeological Resource Service with the results documented in a report dated August 8, 2022. Resources consulted included the National Register of Historic Places, the California Register of Historic Places, the list of National Historic Landmarks, the list of California Historical Landmarks, the list of California Points of Historical Interest, the Northeast Information Center at Chico State University, and the Native American Heritage Commission. No cultural resources were reported in the Project area with a literature check initiated through the Northeast Information Center, and the Native American Heritage Commission indicated that no sacred places are reported in or near the Project site. A field investigation was also undertaken that resulted in a negative finding: No artifacts or potentially significant cultural features were observed.

According to the report, no significant or potentially significant cultural resources would be impacted by the development of this Project. No evidence of cultural deposits from the prehistoric or historic eras was observed at any location on the site. The evaluation did not produce any indication that the site was occupied or heavily utilized by Native populations. Historic era use of the site appears to have been agricultural or vacant over most of the 20th century.

The report concludes that no significant or potentially significant cultural deposits are present in the subject property. It was observed that the property has been graded and that the original surface is no longer extant. Any subtle cultural features that might have been present would have been removed by this process. More substantial resources, such as a settlement site, would have been damaged, but would still be visible if they were present. None were observed. Since the property is an alluvial soil deposit, a potential exists for the discovery of deeply buried cultural resources that have been naturally covered by soil development processes. This potential is less than significant. If buried resources were close to the surface evidence would have been seen in rodent burrows throughout the property.

Documentation:

City of Redding General Plan 2045, Natural Resources Element 2045

A Cultural Resources Evaluation of 900-930 Canby Road, Redding, Shasta County, California, Archaeological Resource Service, August 2022

Mitigation:

None necessary.

VI. Energy: *Would the project:*	Potentially Significant Impact	Less-Than-Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?			X	
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?				X

Discussion

a) The Project would not result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation. Direct energy use would involve the short-term use of energy for construction activities. Project construction would primarily consume diesel and gasoline through operation of construction equipment, material deliveries, and debris hauling. Construction is estimated to result in a short-term consumption of energy, representing a small demand on local and regional fuel supplies that would be easily accommodated and would be temporary. Long-term use of electricity for domestic purposes such a lighting, and heating and cooling of homes is expected to be less than significant and in line with what is anticipated by the General Plan due to the residential nature of the Project.

b) The Project will not conflict with any State or local plans for renewable energy or energy efficiency. All construction would be subject to the Building Energy Efficiency Standards for Residential and Nonresidential Buildings (Title 24) of the California Building Code (CBC).

Documentation:
City of Redding General Plan 2045, Natural Resources Element 2045

Mitigation:
None necessary.

VII. GEOLOGY AND SOILS: *Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving: i) Rupture of a known earthquake, fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publications 42. ii) Strong seismic ground shaking? iii) Seismic-related ground failure, including liquefaction? iv) Landslides?			X	
b) Result in substantial soil erosion or the loss of topsoil?			X	
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?			X	
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?			X	
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of waste water?				X
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?			X	

Discussion:

a, c, d)There are no Alquist-Priolo earthquake faults designated in the Redding area of Shasta County. There are no other documented earthquake faults in the immediate vicinity that pose a significant risk, and the site is located in an area designated in the Health and Safety Element of the *General Plan* as having a moderately low ground-shaking potential. The Project is not located on or near any documented landslide hazard areas, and there is no evidence of ground slippage or subsidence occurring naturally on the site. The Project site is identified as having a low potential for liquefaction and the soil has a low to moderate shrink-swell potential. No portion of the site falls within the 100-year floodplain of the Sacramento River or any creek.

b) The Project site contains soils that consist of Redding gravelly loam 3 to 8 percent slopes, Newtown gravelly loam 15 to 30 percent slopes, and Churn gravelly loam, deep, 0 to 3 percent slopes. The Redding gravelly loam has very slow permeability and runoff is slow to medium with the hazard of erosion being slight to moderate. The Newtown gravelly loam has slow permeability and runoff is medium to rapid with the hazard of erosion being moderate to high. The Churn gravelly loam is well drained and has moderately slow permeability. Runoff is slow and the hazard of erosion is none to slight.

The Project is subject to certain erosion-control requirements mandated by existing City and State regulations. These requirements include:

- *City of Redding Grading Ordinance.* This ordinance requires the application of "Best Management Practices" (BMPs) in accordance with the City Erosion and Sediment Control Standards Design Manual (Redding Municipal Code Section 16.12.060, Subsections C, D, E). In practice, specific erosion-control measures are determined upon review of the final project improvement plans and are tailored to project-specific grading impacts.
- *California Regional Water Quality Board "Construction Activity Storm Water Permit.*" This permit somewhat overlaps the City's Grading Ordinance provision by applying state standards for erosion-control measures during construction of the project.
- *California Regional Water Quality Control Board "Project Storm Water Pollution Prevention Plan (SWPPP).*" This plan emphasizes stormwater best management practices and is required as part of the Construction Activity Storm Water Permit. The objectives of the SWPPP are to identify the sources of sediment and other pollutants that affect the quality of stormwater discharges and to describe and ensure the implementation of practices to reduce sediment and other pollutants in stormwater discharges.
- *California Department of Fish and Wildlife "1600 Agreement."* This notification is required for any work within a defined streambed and will be applicable to impacts to Little Churn Creek.
- *U.S. Army corps of Engineers Nationwide Permit.* Any appropriate permits required from the U.S. Army Corps of Engineers to address impacts to jurisdictional waters.

Actions for compliance with these regulations are addressed under standard conditions of approval, which are uniformly applied to all land development projects. Since the project is subject to uniformly applied ordinances and policies to address soil erosion related to development and is required to obtain any necessary permits from the USACE and CDFW by law, potential impacts related to soil erosion and sedimentation are anticipated to be less than significant.

e) The use of septic tanks or alternative wastewater disposal systems are not proposed with this Project as sewer is available for the disposal of waste water. There is no issue of having soils incapable of adequately supporting the use of septic tanks with this Project and no impacts are anticipated in this regard.

f) No unique geologic features, fossil-bearing strata, or paleontological sites are known to exist on the Project site.

Documentation:

City of Redding General Plan 2045, Public Safety Element 2045*, Figures PS-1 (Ground Shaking Potential) and PS-2 (Liquefaction Potential)*
City of Redding General Plan Update Final Environmental Impact Report, 2024, SCH #2022050300
City of Redding Grading Ordinance, Redding Municipal Code Chapter 16.12
City of Redding Standard Specifications, Grading Practices
City of Redding Standard Development Conditions for Discretionary Approvals
Soil Survey of Shasta County Area, United States Department of Agriculture, Soil Conservation Service and Forest Service, August 1974

Division of Mines and Geology Special Publication 42

State Regional Water Quality Control Board, Central Valley Region, *Regulations Related to Construction Activity Storm Water Permits* and *Storm Water Pollution Prevention Plans*

Mitigation:

None necessary.

VIII. GREENHOUSE GAS EMISSIONS: *Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?			**X**	
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?			**X**	

Discussion:

a, b) The City of Redding General Plan (GP) and Environmental Impact Report (EIR) concluded this impact is cumulatively significant and unavoidable as pertains to buildout of the GP and is addressed in the GP EIR's CEQA Findings of Fact and Statement of Overriding Considerations. The EIR indicates that greenhouse gas (GHG) emissions are projected to result in a slight decrease in emissions from the CEQA baseline established by the GP EIR but not result in the 85 percent reduction from existing conditions necessary to ensure the City is on a trajectory to achieve the long-term reductions goals of AB 1279 and substantial progress toward the State's carbon neutrality goals for year 2045.

The City has not adopted a numerical significance threshold for assessing impacts related to GHG emissions. Similarly, neither the South Coast Air Quality Management District (SCAQMD), California Air Resources Board (CARB), nor any other state or regional agency has yet adopted a numerical significance threshold for assessing GHG emissions that applies to the Project. Since there is no applicable adopted or accepted numerical threshold of significance for GHG emissions, the methodology for evaluating the Project's impacts related to GHG emissions focuses on its consistency with statewide, regional, and local plans adopted for the purpose of reducing and/or mitigating GHG emissions. This consistency with such plans is the sole basis for determining the significance of the project's GHG-related impacts on the environment.

The Project is consistent with numerous policies of the GP that address lowering Vehicle Miles Traveled (VMT) through infill development, including but not limited to the following:

- Increasing residential densities along transit corridors.
- Prioritizing infill development.
- Working to complete the City's "Complete Streets" system to provide multimodal transportation opportunities.
- Strategically locating parks, trails, and similar facilities throughout the community to result in such facilities being located within ¼ mile of residents.

The Project is also consistent with the applicable Shasta Regional Transportation Agency's Regional Transportation Plan's goals, including:

- Encouraging transportation-efficient growth and development where it is supported by current or planned mobility options.

With regard to consistency with the California Air Resources Board's 2017 Scoping Plan, the Scoping Plan addresses a broad range of actions and strategies intended to reduce greenhouse gases such as increasing stringency of carbon fuel standards, adding additional zero-emission vehicles on the state's roadways, and similar broad-based programs which are not applicable to the Project.

As demonstrated by the above and the analysis provided in the GP EIR, the Project complies with or exceeds the plans, policies, regulations and GHG reduction actions/strategies outlined in the GP, the Shasta Regional Transportation Agency Regional Transportation Plan, and CARB's 2017 Scoping Plan. Therefore, the Project would not conflict with any applicable plan, policy, or regulation of an agency adopted for the purpose of reducing emissions of GHGs.

Documentation:
City of Redding General Plan 2045, Natural Resources Element 2045

Mitigation:
None necessary.

IX. **HAZARDS AND HAZARDOUS MATERIALS**: *Would the project:*	Potentially Significant Impact	Less-Than-Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?				X
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?				X
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?			X	
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?				X
e) For a project located within 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, would the project result in a safety hazard or excessive noise for people residing or working in the project area?				X
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?				X
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?			X	

Discussion:

a-d) The nature of the Project as a multiple family residential facility does not present a significant risk related to hazardous materials or emissions. There are no documented hazardous material sites located on or near the Project.

e) The Project is not located within an airport land use plan or within two miles of a public airport or public use airport and would not result in a safety hazard for people residing or working in the Project area. There would be no impact on public safety.

f) The Project does not involve a use or activity that could interfere with emergency-response or emergency-evacuation plans for the area.

g) The Project site does not have a wildland fire-hazard potential. The site is an infill site outside of the high fire severity zone and is substantially surrounded by other urban uses.

Documentation:
City of Redding General Plan 2045, Public Safety Element, 2045, *including figures PS-4 (Very High Fire Severity Zone) and PS-6 (Wildfire Evacuation Routes)*

Mitigation:
None necessary.

X. **HYDROLOGY AND WATER QUALITY**: *Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?			X	
b) Substantially decease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?			X	
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:			X	
i) Result in substantial erosion or siltation on- or off-site;				
ii) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;				
iii) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or				
iv) Impede or redirect flood flows?				
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?				X
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?				X

Discussion:

a) Since the Project would be served by City sanitary sewer service, the Project would not involve any unpermitted discharges of waste material into ground or surface waters. Construction and operation of the Project would not violate any water quality standards established by the Central Valley Regional Water Quality Control Board (RWQCB) in its Basin Plan for the Sacramento River and San Joaquin River Basins. Water pollution best management practices are required and will be incorporated into the improvement plans for the Project. The City's construction standards require that all projects prepare an erosion and sediment control plan (ESCP) prior to construction to address water pollution control. The ESCP will ensure that water quality standards are not substantially affected by the Project during construction.

b) The Project would utilize City water service for domestic uses and fire protection and would not impact groundwater supplies.

c) The Project is subject to standard requirements defined under Section VII, *Geology and Soils*, that minimize the potential for erosion or siltation on- or off-site. The final improvement plans for the Project must also incorporate specific design measures intended to limit pollutant discharges in stormwater from urban improvements as established under the State's National Pollutant Elimination System (NPDES) general permit, which the City is now obligated to follow in accordance with State Water Quality Control Order No. 2003-0005-DWQ. Feasible Best Management Practices (BMPs) would be incorporated in the final design of the Project's storm-drain system, as approved by the City Engineer, based on the BMPs listed in the latest edition of the California Storm Water Quality Association Storm Water Best Management Practices Handbook.

The majority of stormwater runoff from the site would be directed to a storm water detention basin before being discharged into Little Churn Creek. City of Redding Policy 1806 requires that all subdivision development include stormwater detention facilities designed to maintain existing predevelopment rates of runoff during a 10-, 25-, and 100-year storm event with a six-hour duration. The Project application includes a stormwater hydrology analysis prepared by Sharrah Dunlap Sawyer and dated September 19, 2023 that concludes that the Canby Apartments project can manage the storm water runoff in a way that maintains or reduces pre-project runoff volumes in the post-project condition as required by the City of Redding.

d) The Project site is not located in a flood hazard, tsunami or seiche zone.

e) The Project would not conflict with a water quality control plan or groundwater management plan

Documentation:
City of Redding General Plan 2045, Natural Resources Element 2045
City of Redding General Plan 2045, Public Safety Element 2045
Canby Apartments Entitlement Storm Drainage Analysis, Sharrah Dunlap Sawyer, Inc., September 19, 2023
Federal Emergency Management Agency Floodplain regulations, FIRM maps 06089C1551G and 06089C1553G, dated March 17, 2011
City of Redding Storm Drain Master Plan, Montgomery-Watson Engineers 1993

Mitigation:
None necessary.

XI. <u>LAND USE AND PLANNING</u>: *Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Physically divide an established community?				**X**
b) Cause a significant environmental impact due to conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?				**X**

Discussion:

a) The Project does not have the potential to physically divide an established community. It is on an undeveloped parcel flanked by arterial roadways that will continue to support the movement of people within the community.

b) The Project is compatible with the applicable policies and regulations of the City General Plan and Zoning Ordinance and is not in conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect.

Documentation:
City of Redding General Plan 2045, Community Development and Design Element, 2045
City of Redding General Plan 2045, Natural Resources Element, 2045

Mitigation:
None necessary.

XII. <u>MINERAL RESOURCES</u>: *Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?				**X**
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local General Plan, specific plan or other land use plan?				**X**

Discussion:

a, b) The Project site is not identified in the General Plan as having any known mineral-resource value or as being located within any "Critical Mineral Resource Overlay" area.

Documentation:
City of Redding General Plan 2045, Natural Resources Element, 2045City of Redding General Plan Land Use 2045 Diagram

Mitigation:
None necessary.

XIII. NOISE: *Would the project result in:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
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?			X	
b) Generation of excessive ground-borne vibration or ground-borne noise levels?		X		
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, would the project expose people residing or working in the project area to excessive noise levels?				X

Discussion:

a) A noise report for the Project was completed by Helix Environmental Planning. Anticipated construction activities would generate temporarily elevated noise levels for residences north and west of the Project site; however, the proposed construction equipment would not exceed the noise level criteria provided by the City of Redding's General Plan. Construction would also occur during the hours permitted in the City Municipal Code: The City's Grading Ordinance (Redding Municipal Code Chapter 16.12.120.H) limits grading-permit-authorized activities to between the hours of 7:00 a.m. and 7:00 p.m., Monday through Saturday with no work allowed on Sunday.

The Project's heating, ventilation, and air conditioning systems would not exceed the City's noise ordinance limits at the nearest property lines. The Project would add trips to nearby roadways but would not result in perceptible increases in traffic noise.

b) Vibration from construction would not exceed thresholds for structural damage but may result in human annoyance. Mitigation Measure Noi-1 would be required to prevent use of equipment exceeding 75 vibration decibels at nearby residences. No permanent sources of substantial vibration would be installed by the Project. With the implementation of Mitigation Measure Noi-1, vibration impacts due to construction of the Project would be less than significant.

c) The Project site is located approximately 2.9 miles northeast of Benton Airpark and 6 miles northwest of the Redding Regional Airport. The Project site is outside of the noise contours and airport influence areas related to these airports. Therefore, while the Project site may be subject to some distant aircraft noise, it would not be subject to excessive noise from airport operations and impacts would be less than significant.

Documentation:
City of Redding General Plan 2045, Noise Element, 2045*City of Redding General Plan 2045*, Transportation Element, 2045
City of Redding Zoning Ordinance Redding Municipal Code, Section 18.40.100
City of Redding Grading Ordinance Redding Municipal Code, Section 16.12.120
City of Redding Municipal Airport Area Plan
Noise Technical Report for the Redding Canby Apartments Project, Helix Environmental Planning, October 2024

Mitigation:

Noi-1: Prior to issuance of a grading permit, the applicant or designated contractor shall provide evidence to the City (via testing data or calculations from a qualified expert), demonstrating that the vibratory rollers to be used on the Project site would produce less than 75 VdB at nearby occupied residences, or all vibratory rollers shall be used in static mode only (no vibrations) when operating within 110 feet of an occupied residence.

XIV. POPULATION AND HOUSING: *Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Induce substantial unplanned population growth in an area, either directly *(for example, by proposing new homes and businesses)* or indirectly *(for example, through extension of roads or other infrastructure)*?				**X**
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?				**X**

Discussion:

a, b) The Project would create opportunity for the construction of new residential units as planned and anticipated by the Redding General Plan. The Project is similar in character to that in the surrounding area. The Project would not induce unplanned population growth and does not propose the extension of any new roads or utilities not anticipated by the General Plan. The Project does not displace any people or housing. The Project will provide housing.

Documentation:
City of Redding General Plan 2045, Housing Element, 2020-2028

Mitigation:
None necessary.

XV. PUBLIC SERVICES: *Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
Fire Protection?			**X**	
Police Protection?			**X**	
Schools?			**X**	
Parks?			**X**	
Other public facilities?			**X**	

Discussion:

Fire and Police Protection:

The City would provide police and fire protection to the Project from existing facilities and under existing service levels. The size of the Project would not mandate the need for additional police or fire facilities.

The Project is subject to Chapter 16.20 of the Redding Municipal Code, which requires new development to pay a citywide fire facilities-impact fee calculated to mitigate a Project's fair share of cumulative impacts to the City's fire-protection infrastructure based upon improvements necessary to accommodate new development under the City's *General Plan*.

Schools:

The Project is located in the Enterprise Elementary School District and Shasta Union High School District and may contribute to the total student enrollment in these districts. However, a school-facility impact (in-lieu) fee exists, as provided under State law that is paid prior to the issuance of a building permit for each residential unit to address school-facility funding necessitated by the effects of growth citywide.

Parks:

The Project will not cause a physical deterioration of an existing park facility or cause an adverse physical impact associated with a new park facility. On campus outdoor recreation facilities are planned with the Project. The Project is subject to Chapter 16.20 of the Redding Municipal Code, which requires new residential development to pay a citywide park and recreation-facilities impact fee calculated to mitigate a project's fair share of cumulative impacts to the City's parks and recreation infrastructure based upon improvements necessary to accommodate new development under the City's General Plan. See discussion under Item XVI (Recreation) below.

Other public facilities:

See discussion under Item XIX (Utilities and Service Systems) below.

Documentation:
City of Redding General Plan 2045, Public Facilities and Services Element 2045

Mitigation:
None necessary.

XVI. RECREATION:	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?			**X**	
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?				**X**

Discussion:

a) The Project will not cause a physical deterioration of an existing recreation facility or cause an adverse physical impact associated with a new recreation facility. There are no neighborhood or regional parks in the vicinity of this Project. Residents do have the potential to utilize other parks within the City outside the vicinity of the Project. Recreational development fees are collected by the City at the time of issuance of a building permit to offset any impacts to regional park facilities and to raise funds to provide for new recreational facilities. There would not be any potentially significant impacts to recreation associated with the Project.

b) The Project proposes to construct common outdoor recreational facilities intended for use by the residents of the facility. These outdoor amenities include a central courtyard in the middle of the Project with a children's playground, benches, a covered pergola with picnic tables, and barbeques. A half-court basketball court is also proposed on the Project site. These amenities would be integrated into the Project and are not expected to have an adverse physical effect on the environment.

Documentation:
City of Redding General Plan 2045, Natural Resources Element, 2045
City of Redding General Plan, Parks, Trails, and Recreation Element, 2045
City of Redding General Plan 2045, Public Facilities and Services Element, 2045

Mitigation:
None necessary.

XVII. <u>TRANSPORTATION</u>: *Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?				**X**
b) Conflict or be inconsistent with CEQA Guidelines Section 15064.3, Subdivision (b)?				**X**
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?				**X**
d) Result in inadequate emergency access?				**X**

Discussion:

a) Access to the Project would be derived from Canby Road and Browning Street. Regardless of traffic impacts, the development of the vacant site triggers frontage improvement requirements. The development also triggers the need for right-of-way acquisition along Browning Street in order to widen the north side of the street with an additional travel lane. The City's Traffic Engineer has determined that the number of average vehicle trips that would be generated with development of the Project would not trigger any requirements in addition to what is already required by the development of the Project. Planned and existing circulation system infrastructure is sufficient to support the negligible number of added peak hour trips attributable to the Project. Pedestrian, bicycle, and transit facilities serving the proposed Project site are adequate except for gaps in the existing sidewalk network on Browning Street and Canby Street. Installation of sidewalks to fill in the existing gaps along the Project frontages and new ADA-compliant curb ramps on the northwest corner of the Browning Street/Canby Road intersection for a continuous pedestrian path of travel to and from surrounding sites would be required of the Project. No significant impacts to a program plan, ordinance, or policy addressing the circulation system are anticipated.

b) The potential for the Project to conflict or be inconsistent with CEQA Guidelines §15064.3, subdivision (b) was evaluated based the Project's anticipated Vehicle Miles Traveled (VMT). Senate Bill (SB) 743 established VMT as the metric to be applied for determining transportation impacts associated with development projects. Like many other jurisdictions in California, the City of Redding has not yet adopted a policy or thresholds of significance regarding VMT, so the project-related VMT impacts were assessed based on guidance provided by the California Governor's Office of Planning and Research (OPR) in the publication *Technical Advisory on Evaluating Transportation Impacts (SB 743) CEQA Guidelines Update and Technical Advisory, 2018*. This document identifies several criteria that may be used by jurisdictions to identify certain types of projects that are unlikely to have a VMT impact and can be "screened" from further VMT analysis. Based on state guidance provided in the publication, the Project would be presumed to have a less-than-significant impact on vehicle miles traveled (VMT) as it would screen out as an affordable housing development. As stated above, the City's Traffic Engineer has determined that the number of average vehicle trips that would be generated with development of the Project would not have the potential to cause a significant impact. The Project would not conflict with any program, plan, ordinance, or policy addressing the circulation system. Therefore, the Project will not conflict with CEQA guidelines section 15064.3(b).

c) The driveway approaches and public improvements proposed with the Project do not include sharp curves or dangerous intersections. Such hazardous design features are not proposed by or required from the Project. The site is in an area zoned for residential and commercial development. The entering and exiting of vehicles such as cars and pickup trucks is an existing condition that is expected for this area. No significant increase in transportation related hazards is expected.

d) Access to the site is provided by way of a right-in/right-out driveway approach on Browning Street and a driveway approach on Canby Road. The Redding Fire Marshal has deemed this to be adequate access for emergency access and fire protection. With the parking lot design proposed with the Project, there will be adequate space to maneuver emergency service vehicles and access all buildings of the housing facility. *General Plan* Public Safety Policies PS4K and PS4L generally require that residential developments having 50 or more dwelling units have at least two points of public-street access and that dead-end street lengths not exceed 600 feet. The Project proposes two points of public-street access and does not have any dead ends in excess of 600 feet. Traffic from the proposed development is expected to have a less than significant impact on emergency response times.

Documentation:
City of Redding General Plan 2045, Transportation Element, 2045
City of Redding General Plan 2045, Parks, Trails, and Recreation Element 2045
City of Redding Parks, Trails, and Open Space Master Plan, Update
City of Redding Traffic Impact Fee Program
City of Redding Active Transportation Plan, 2018
Redding Area Bus Authority Short Range Transit Plan, January 2024
Transportation Impact Study for the Redding Canby Apartments, W-Trans, February 27, 2023

Mitigation:
None necessary.

XVIII. TRIBAL CULTURAL RESOURCES: *Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or			**X**	
b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.			**X**	

Discussion:

a, b) Correspondence with the Native American Heritage Commission (NAHC) and with all appropriate Native American organizations or individuals designated by the Native American Heritage Commission as interested parties for the Project area was conducted in association with the cultural resources evaluation completed by Archaeological Resource Service for the Project. The NAHC indicated that no sacred places had been reported in the Project vicinity. Contacts for fifteen potentially interested tribes that might have additional information about the Project site were provided to Archaeological Resource Service. All were contacted but no response has been received. Additionally, the City of Redding referred the Project out to the appropriate tribal entities under California State Assembly Bill AB 52 but no request for consultation was received. As concluded in the cultural resources evaluation, no impacts to any cultural resources, including tribal cultural resources, by the development of the Project site are anticipated.

Documentation:
Letters sent to Redding Rancheria and the Wintu Tribe of Northern California dated April 24, 2023.
A Cultural Resources Evaluation of 900-930 Canby Road, Redding, Shasta County, California, Archaeological Resource Service, August 8, 2022

Mitigation:
None necessary.

XIX. UTILITIES AND SERVICE SYSTEMS: *Would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Require or result in the relocation or construction of new or expanded water or wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?				**X**
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?				**X**
c) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?				**X**
d) Generate solid waste in excess of State or local standards, or infrastructure, or otherwise impair the attainment of solid waste reduction goals?				**X**
e) Comply with Federal, State, and local management and reduction statutes and regulations related to solid waste?				**X**

Discussion:

a) The proposed development does not generate the need for relocation or construction of new or expanded water or wastewater treatment or stormwater drainage, electric power, natural gas, or telecommunications facilities.

b) Potable water is available from the City to serve the Project with adequate pressure and flows for fire suppression. The demands of the Project can be accommodated within the City's existing water resources. Sufficient water supplies are available to serve the Project and reasonably foreseeable future development during normal, dry, and multiple dry years.

c) The Project will utilize the City's sanitary sewer system to dispose of wastewater. Adequate sewer capacity and wastewater treatment is available in the City's existing system.

d) The Project would not generate solid waste in excess of State or local standards, or infrastructure, or otherwise impair the attainment of solid waste reduction goals. The City provides solid waste disposal service which the residential housing facility would utilize. Adequate capacity is available to serve the needs of the Project without need of special accommodation.

e) The Project will comply with Federal, State, and local management and reduction statutes and regulations related to solid waste. The City regulates and operates programs that promote the proper disposal of toxic and hazardous materials from households, including those created by the Project.

Documentation:
City of Redding General Plan 2045, Public Facilities and Services Element, 2045
City of Redding Water and Sewer Atlas

Mitigation:
None necessary.

XX. <u>WILDFIRE</u>: *If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:*	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Substantially impair an adopted emergency response plan or emergency evacuation Plan?				**X**
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose projects occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of wildfire?			**X**	
c) Require installation or maintenance of associated infrastructure (such as roads, fuel sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?				**X**
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result, post-fire slope instability, or drainage changes?			**X**	

Discussion:

a) The Project site is not located within the Very High Fire Severity Zone and is not adjacent to areas with significant fuel loads. It is an infill site that does not interface with the wildland urban interface. It is located in an area of the City with a high level of connectivity and would not impair any adopted emergency response plan or emergency evacuation plan.

b) The Project site is surrounded on three sides by existing development and, while there is a moderate slope onsite, there is relatively flat topography within the immediate vicinity of the site. The Project would not exacerbate wildfire risks or expose Project occupants to pollutant concentrations from a wildfire as it is not located near or adjacent to wildlands.

c) The Project would not require the installation or maintenance of any roads, fuel sources, power lines or other utilities that could exacerbate wildfire risks. The site is located in an area that is already adequately served by utilities and improvements. It would not require the installation of any additional off-site utilities or access roads through vegetated lands or wildlands.

d) The Project site has moderate slopes and would not be expected to result in post-fire slope instability. Proper site drainage to storm drain infrastructure is proposed and required with development. The Project is not expected to expose people or structures to downstream flooding or landslides.

Documentation:
City of Redding General Plan 2045, Public Safety Element 2045

Mitigation:
None necessary.

XXI. <u>MANDATORY FINDINGS OF SIGNIFICANCE</u>:	**Potentially Significant Impact**	**Less-Than-Significant with Mitigation Incorporated**	**Less-Than-Significant Impact**	**No Impact**
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below the self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?		**X**		

XXI. MANDATORY FINDINGS OF SIGNIFICANCE:	Potentially Significant Impact	Less-Than-Significant with Mitigation Incorporated	Less-Than-Significant Impact	No Impact
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?			X	
c) Does the project have potential environmental effects which may cause substantial adverse effects on human beings, either directly or indirectly?		X		

Discussion:

Based on the analysis undertaken as part of this Initial Study, the following findings can be made:

a) If unmitigated, the Project has the potential to impact special-status species (Redding checkerbloom, north coast foothill yellow-legged frog, western pond turtle, tricolored blackbird, pallid bat, and western red bat) as well as species of migratory birds and raptors. Mitigation Measures Bio-1, Bio-2, Bio-3, Bio-4, Bio-5, and Bio-6 are established to reduce potential impacts to less than significant. The Project has the potential to degrade wildlife habitat in general due to erosion and sedimentation resulting from grading and construction of project infrastructure. However, the Project conditions as identified under *Hydrology/Water Quality* have been established to reduce potential impacts to a level less than significant.

b) As discussed in Item III, the Project will contribute to regionwide cumulative air quality impacts. However, under policy of the *General Plan*, application of Standard Mitigation Measures (SMMs) and Best Available Mitigation Measures (BAMMS) will reduce potential impacts from this Project to a level less than significant.

c) If unmitigated, the Project has potential short-term environmental effects which may indirectly cause substantial adverse effects on human beings. Mitigation Measure Noi-1 is established to reduce potential impacts due to the generation of excessive ground-borne vibration or ground-born noise levels during construction to less than significant.

Documentation:
See all Sections above.

Mitigation:

Bio-1: Prior to grading or construction, consultation with CDFW shall be conducted to develop a mitigation and/or avoidance strategy for Redding checkerbloom. This may include transplanting the plant population, compensation, or other measures established by that agency. Possible avoidance measures may include fencing populations before construction, exclusion of project activities from the fenced-off areas, construction monitoring by a qualified botanist to keep construction crews away from the population, and monitoring and reporting requirements for populations to be preserved on site.

Bio-2: Prior to the commencement of construction within the on-site drainage or within 100 feet of the on-site drainage, a pre-construction survey for foothill yellow-legged frog (FYLF) shall be conducted within the on-site intermittent drainage and immediate surrounding areas; initially seven days prior to the commencement of any ground-disturbing activities and again no more than 24 hours prior to ground-disturbing activities. If there are negative findings for this species during the survey, no further action is required. If this species is observed during the survey, CDFW should be consulted prior to ground disturbance regarding the potential for the Project to result in take of FYLF, and any avoidance measures or mitigation measures required by CDFW shall be implemented.

Bio-3: A Qualified Biologist shall conduct a pre-construction survey within 14 days prior to the start of ground disturbance within 500 feet of riparian habitat or the intermittent drainage. If no western pond turtles are observed, then a letter report documenting the results of the survey shall be provided to the City, and no additional measures are required. If construction does not commence within 14 days of the pre-construction survey, or halts for more than 14 days, a new survey shall be completed. If western pond turtles are found, a

Qualified Biologist shall conduct a pre-construction survey within 24 hours prior to commencement of construction activities and be present on the site during grading activities within 500 feet of the intermittent drainage and its surrounding riparian habitat. The biologist shall establish a no-disturbance buffer around any individual western pond turtle, allowing the turtle to continue downstream, offsite, on its own accord. If the turtle does not self-relocate within a reasonable amount of time established by the biologist, CDFW shall be consulted on next steps.

Bio-4: If feasible, vegetation removal and/or construction shall be conducted between September 1 and January 31. If vegetation removal and/or construction activities are to occur during the nesting season (February 1 through August 31), a Qualified Biologist shall conduct a preconstruction survey no more than seven days before vegetation removal or construction activities begin. If an active nest is found, a no-disturbance buffer shall be established by a Qualified Biologist in coordination with CDFW. Construction may resume once the young have left the nest or as approved by the Qualified Biologist. The survey shall be provided to the CDFW. If construction activities cease for a period greater than seven days, additional preconstruction surveys will be required.

Bio-5: If vegetation removal and/or construction activities are to occur during the bat roosting season (March 1 through August 31), a Qualified Biologist shall conduct a preconstruction survey no more than seven days before vegetation removal or construction activities begin. If an active roost is found, a no-disturbance buffer shall be established for a distance of 500 feet around the nest unless a smaller buffer zone is approved by CDFW. Construction may resume once the young have left the nest or as approved by the Qualified Biologist. The survey shall be provided to the CDFW. If a lapse in construction activities of 14 days or more occurs during the roosting season, an additional roost survey is required to ensure no roosts were established in the area while construction was on hold. Minimum qualifications for a Qualified Biologist include a bachelor’s degree in biological or environmental science, natural resources management, or related discipline; field experience in the habitat types that may occur at the Project site; familiarity with the Covered Species (or closely related species) that may occur at the Project site; and prior preconstruction survey, construction monitoring, or construction oversight experience (if and as relevant to the activity to be conducted).

Noi-1: Prior to issuance of a grading permit, the applicant or designated contractor shall provide evidence to the City (via testing data or calculations from a qualified expert), demonstrating that the vibratory rollers to be used on the Project site would produce less than 75 VdB at nearby occupied residences, or all vibratory rollers shall be used in static mode only (no vibrations) when operating within 110 feet of an occupied residence.

List of Attachments

Attachment A
Figure 1 – Location Map
Figure 2 – Architectural Site Plan
Figure 3 – Preliminary Grading Plan
Figure 4 – Preliminary Utility Plan

All technical reports listed below are on file and available in the Development Services Department, Planning Division.

Attachment B
A Cultural Resources Evaluation of 900-930 Canby Road

Attachment C
Aquatic Resource Delineation Report for the Property at 930 – 990 Canby Road

Attachment D
Canby Apartments Entitlement Storm Drainage Analysis

Attachment E
Noise Technical Report for the Redding Canby Apartments Project

Attachment F
Redding Canby Apartments Project Revised Biological Resources Assessment

Attachment G
Transportation Impact Study for the Redding Canby Apartments

Attachment H
Tree Identification and Evaluation for 900 & 930 Canby Road

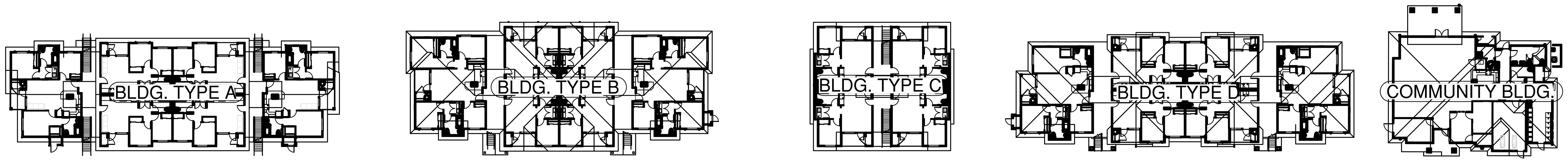
Attachment I
Crotch's Bumble Bee Technical Assistance Memo for the Canby Apartments Project

Attachment A

Figure 1 – Location Map
Figure 2 – Architectural Site Plan
Figure 3 – Preliminary Grading Plan
Figure 4 – Preliminary Utility Plan

N W E S	**GIS DIVISION** INFORMATION TECHNOLOGY DEPARTMENT	**LOCATION MAP**	MTG. DATE:
	DATE PRODUCED: FEBRUARY 26, 2025	SDP-2023-00085 DANCO COMMUNITIES 930 & 990 CANBY ROAD AP# 117-200-005 & -006	ITEM: ATTACHMENT:
	0 200 400 Feet		

P:\Planning\ProProjects\SDP\SDP-2023-00085.aprx



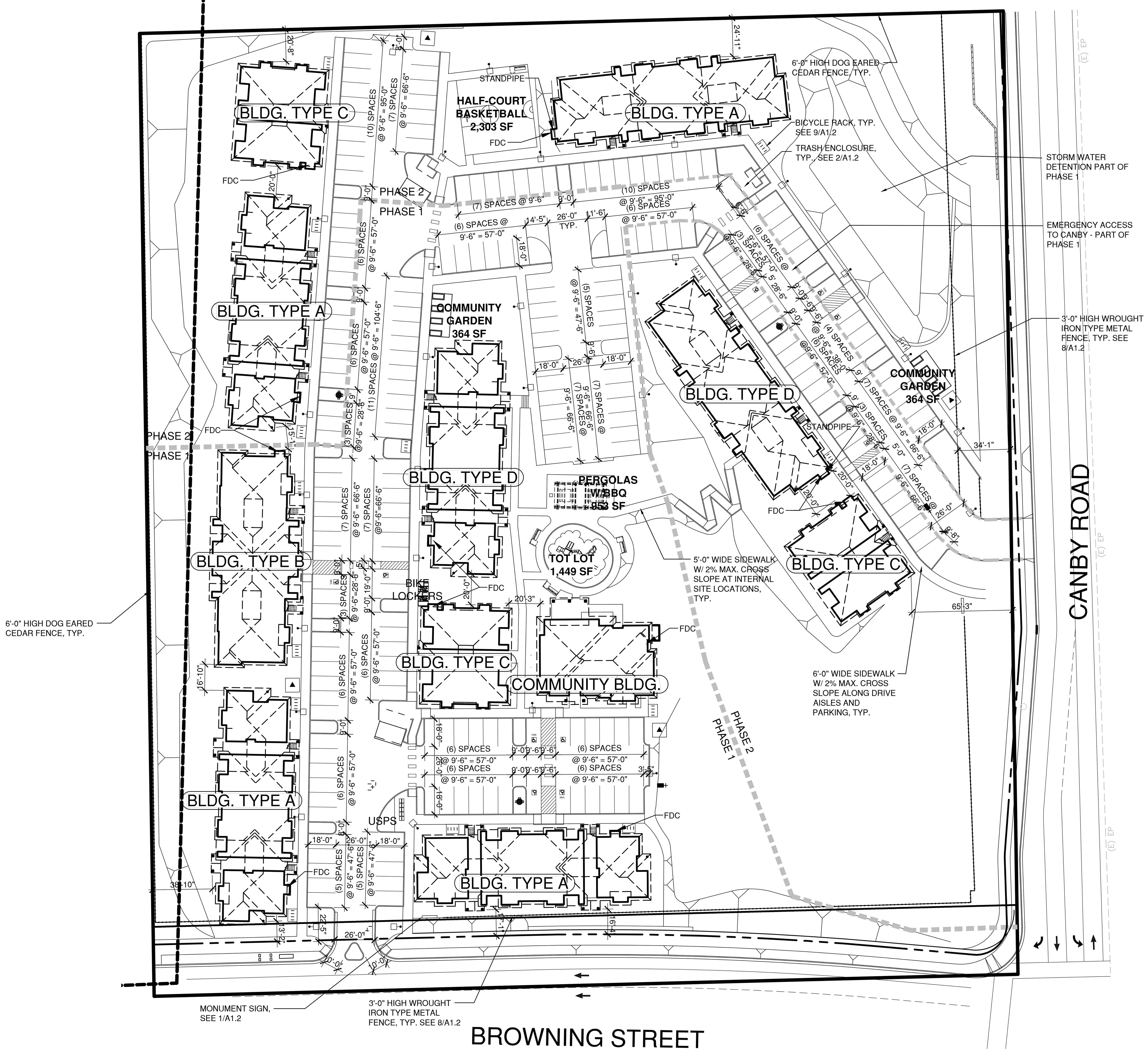
BUILDING A
(4) BUILDINGS TOTAL
(8) 2-BDRM UNITS & (4) 3-BDRM UNITS
FOOTPRINT - 6,509 S.F.
MAXIMUM HEIGHT - 29'-0"± (2) STORY
OCCUPANCY R-2
FULLY SPRIKLERED PER NFPA 13R
CONSTRUCTION TYPE: VB

BUILDING B
(1) BUILDING TOTAL
(8) 1-BDRM UNITS & (4) 4-BDRM UNITS
FOOTPRINT - 6,597 S.F.
MAXIMUM HEIGHT - 30'-4"± (2) STORY
OCCUPANCY R-2
FULLY SPRIKLERED PER NFPA 13R
CONSTRUCTION TYPE: VB

BUILDING C
(3) BUILDINGS TOTAL
(8) 1-BDRM UNITS
FOOTPRINT - 3,427 S.F.
MAXIMUM HEIGHT - 30'-4"± (2) STORY
OCCUPANCY R-2
FULLY SPRIKLERED PER NFPA 13R
CONSTRUCTION TYPE: VB

BUILDING D
(2) BUILDINGS TOTAL
(12) 2-BDRM UNITS & (6) 3-BDRM UNITS
FOOTPRINT - 6,509 S.F.
MAXIMUM HEIGHT -40'-0"± (3) STORY
OCCUPANCY R-2
FULLY SPRIKLERED PER NFPA 13
CONSTRUCTION TYPE: VB

COMMUNITY BUILDING
(1) BUILDING TOTAL
FOOTPRINT - 3,498 S.F.
MAXIMUM HEIGHT - 21'-0"± (1) STORY
OCCUPANCY B/A-3
FULLY SPRIKLERED PER NFPA 13
CONSTRUCTION TYPE: VB



SITE PLAN
SCALE: 1" = 40'-0"

APPLICANT
DANCO GROUP
CHRIS DART
5251 ERICSON WAY
ARCATA, CALIFORNIA 95521
(707) 822-9000

ARCHITECT
DG GROUP ARCHITECTURE, PLLC
DOUGLAS GIBSON, CALIFORNIA ARCHITECT C29792
430 E. STATE STREET, SUITE 100
EAGLE, IDAHO 83616
(208)-461-0022 X3021

ACCESSIBILITY PHASE I

	# OF UNITS	PERCENTAGE
ACCESSIBLE UNITS (15% TOTAL)	10	15.00%
SENSORY IMPAIRED UNITS (10% TOTAL)	7	10.00%

ACCESSIBILITY PHASE II

	# OF UNITS	PERCENTAGE
ACCESSIBLE UNITS (15% TOTAL)	9	15.00%
SENSORY IMPAIRED UNITS (10% TOTAL)	6	10.00%

UNIT MIX SUMMARY PHASE I

		CONDITIONED SQ. FOOTAGES
(16) 1-BEDROOM UNITS	(16) x 551 S.F. =	8,816 S.F.
(28) 2-BEDROOM UNITS	(28) x 636 S.F. =	17,808 S.F.
(14) 3-BEDROOM UNITS	(14) x 1,068 S.F. =	14,952 S.F.
(4) 4-BEDROOM UNITS	(4) x 1,260 S.F. =	5,040 S.F.
(62) UNITS TOTAL		46,616 S.F.
COMMUNITY BUILDING		3,277 S.F.
TOTAL		49,893 S.F.

UNIT MIX SUMMARY PHASE II

		CONDITIONED SQ. FOOTAGES
(16) 1-BEDROOM UNITS	(16) x 551 S.F. =	8,816 S.F.
(28) 2-BEDROOM UNITS	(28) x 636 S.F. =	17,808 S.F.
(14) 3-BEDROOM UNITS	(14) x 1,068 S.F. =	14,952 S.F.
(58) UNITS TOTAL		41,576 S.F.

FIRE SPRINKLER
AUTOMATIC FULLY SPRINKLERED SYSTEM WITH CENTRAL CALL STATION, OFF-SITE MONITORING AND FDC'S

SITE SIZE
350,141 S.F.± (8.04 ACRES* ±)
14.93 DWELLING UNITS/ACRE (A CA STATE DENSITY BONUS IS REQUESTED ABOVE 12 DWELLING UNITS/ACRE, AS ALL UNITS WILL BE RENTED AT OR BELOW 60% AMI AND WILL COMPLY WITH ALL STATE AND FEDERAL LOW-INCOME HOUSING FINANCE REQUIREMENTS. ONE MANAGER UNIT WILL BE RENTED AT MARKET RATE)

SITE COVERAGE PHASE I

	SQ. FT.	PERCENTAGE
BUILDING FOOTPRINTS	29,551 S.F.	16.99%
ON-SITE ASPHALT CONCRETE PAVING	36,382 S.F.	20.92%
SITE AMENITIES (PERGOLAS, TOT LOT, COMMUNITY GARDEN)	2,766 S.F.	1.59%
CONCRETE WALKS & PADS	11,320 S.F.	6.50%
LANDSCAPE, OPEN SPACE	93,920 S.F.	53.99%
TOTAL AREA	173,939 S.F.	100%

SITE COVERAGE PHASE II

	SQ. FT.	PERCENTAGE
BUILDING FOOTPRINTS	26,469 S.F.	15.02%
ON-SITE ASPHALT CONCRETE PAVING	37,625 S.F.	21.36%
SITE AMENITIES (HALF COURT BASKETBALL, COMMUNITY GARDEN)	2,667 S.F.	1.51%
CONCRETE WALKS & PADS	11,975 S.F.	6.79%
LANDSCAPE, OPEN SPACE	97,452 S.F.	55.23%
TOTAL AREA	176,188 S.F.	100%

NOTE: * ALL NUMBERS PROVIDED ARE **ESTIMATED** FOR SITE COVERAGE

SITE DENSITY (NET)

SITE AREA =	8.04 AC±
SITE AREA ON SLOPES OVER 20% =	0.28 AC±
SITE BUILDABLE AREA =	7.76 AC±
NUMBER OF UNITS =	120
120 UNITS / 7.76 AC	15.46 UNITS PER ACRE

PARKING SUMMARY

TOTAL MULTI-FAMILY REQUIRED BY CITY OF REDDING 18.41.040:

PHASE I
(16) 1-BDRM UNITS X 1.5 = 24 SPACES REQUIRED
(28) 2-BDRM UNITS X 1.75 = 49 SPACES REQUIRED
(14) 3-BDRM UNITS X 2 = 28 SPACES REQUIRED
(4) 4-BDRM UNITS X 2 = 8 SPACES REQUIRED
TOTAL SPACES REQUIRED: 109 SPACES + 40 / 5 OR 6 GUEST = 115 TOTAL REQUIRED

PHASE II
(16) 1-BDRM UNITS X 1.5 = 24 SPACES REQUIRED
(28) 2-BDRM UNITS X 1.75 = 49 SPACES REQUIRED
(14) 3-BDRM UNITS X 2 = 28 SPACES REQUIRED
TOTAL SPACES REQUIRED: 101 SPACES + 40 / 5 OR 6 GUEST = 107 TOTAL REQUIRED

CALIFORNIA DENSITY BONUS PARKING CONCESSION REQUESTED:
(32) 1-BDRM UNITS X 1 = 32 SPACES REQUIRED
(56) 2-BDRM UNITS X 1.5 = 84 SPACES REQUIRED
(28) 3-BDRM UNITS X 1.5 = 42 SPACES REQUIRED
(4) 4-BDRM UNITS X 2.5 = 10 SPACES REQUIRED
TOTAL SPACES REQUIRED: 168 SPACES REQUIRED

TOTAL PROVIDED: 209 (INCLUDING 10 ADA SPACES)

BICYCLE PARKING: 90 SHORT TERM BIKE RACK SPACES PROVIDED
10 LONG TERM BICYCLE LOCKER SPACES PROVIDED

2022 CALGREEN EV PARKING REQUIREMENTS:

PER CALGREEN 4.106.4.2.2(1), 10% OF TOTAL NUMBER OF PARKING SPACES SHALL BE FUTURE EVCS, OR (212) X 0.10 = (22) TOTAL EV CAPABLE FOR FUTURE LEVEL 2 EVSE TO BE PROVIDED.

PER CALGREEN 4.106.4.2.2(2), 25% OF TOTAL NUMBER OF PARKING SPACES SHALL BE EQUIPPED WITH LOWER POWER LEVEL 2 EV CHARGING RECEPTACLES, OR (212) X 0.25 = (53) TOTAL LEVEL 2 EV CHARGING RECEPTACLES MOUNTED BETWEEN 15" & 48" ABOVE GRADE FOR ACCESSIBLE ACCESS TO BE PROVIDED.

PER CALGREEN 4.106.4.2.2(3), 5% OF TOTAL NUMBER OF PARKING SPACES SHALL BE EQUIPPED WITH LEVEL 2 EVSE, OR (212) X 0.5 = (11) TOTAL LEVEL 2 EVSE TO BE PROVIDED.

DENSITY BONUS CONCESSIONS REQUESTED:

1. PARKING REDUCTION.
2. REDUCTION OF DEPTH AND SQUARE FOOTAGE OF UNIT PATIOS.
3. REDUCTION OF THE MINIMUM SEPARATION DISTANCE BETWEEN STRUCTURES.

REVISIONS

COPYRIGHT DATE
05/31/24

DRAWN BY
DG/BP/DE/JS

PROJECT #
DNG21-32

DG GROUP ARCHITECTURE PLLC
430 E. STATE STREET, SUITE 100
EAGLE, IDAHO 83616
(208) 908-4871
(208) 392-1269 FAX
ALASKA - ARIZONA - CALIFORNIA - COLORADO - HAWAII - IDAHO - LOUISIANA - MONTANA - NEVADA - NEW MEXICO - NORTH DAKOTA - OREGON - SOUTH DAKOTA - U.S.V.I. - UTAH - WASHINGTON - WYOMING

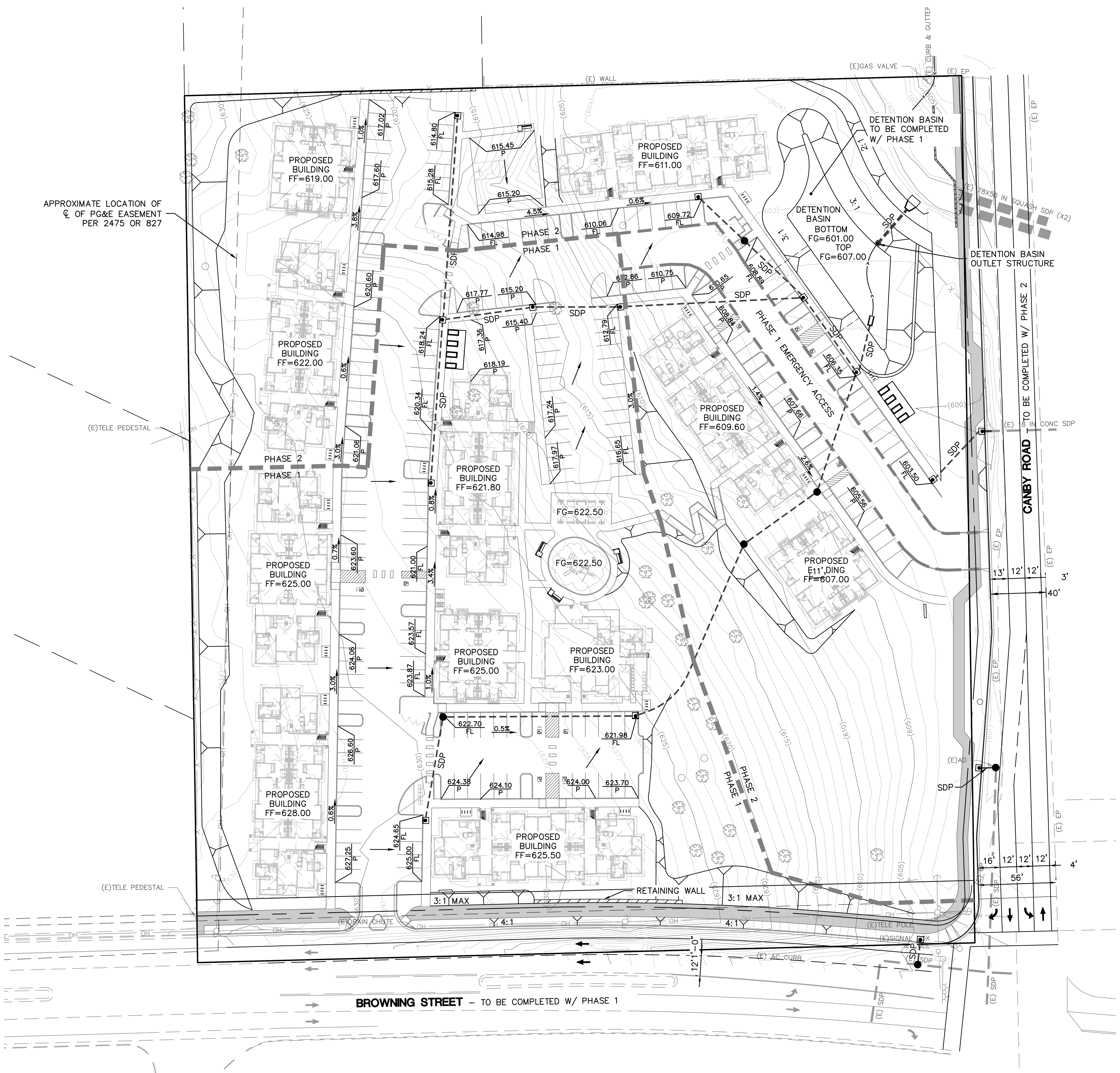
PROJECT
REDDING CANBY APARTMENTS
CANBY ROAD & BROWNING STREET
REDDING, CA

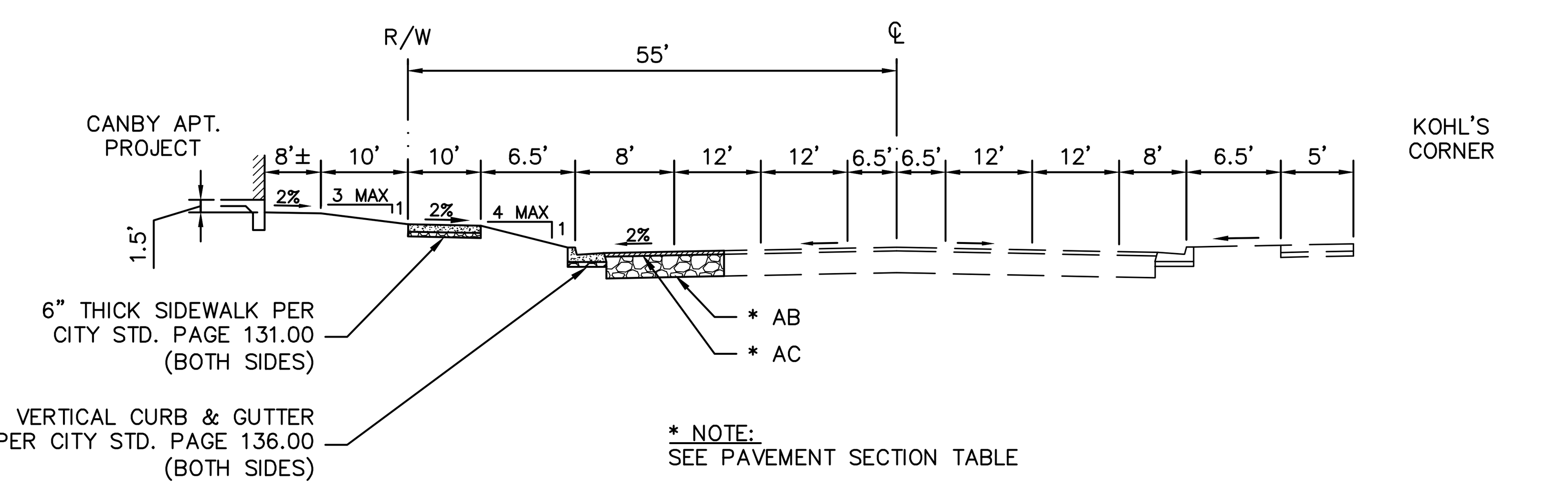
A1.1
ARCHITECTURAL SITE PLAN

ENTITLEMENT APPLICATION

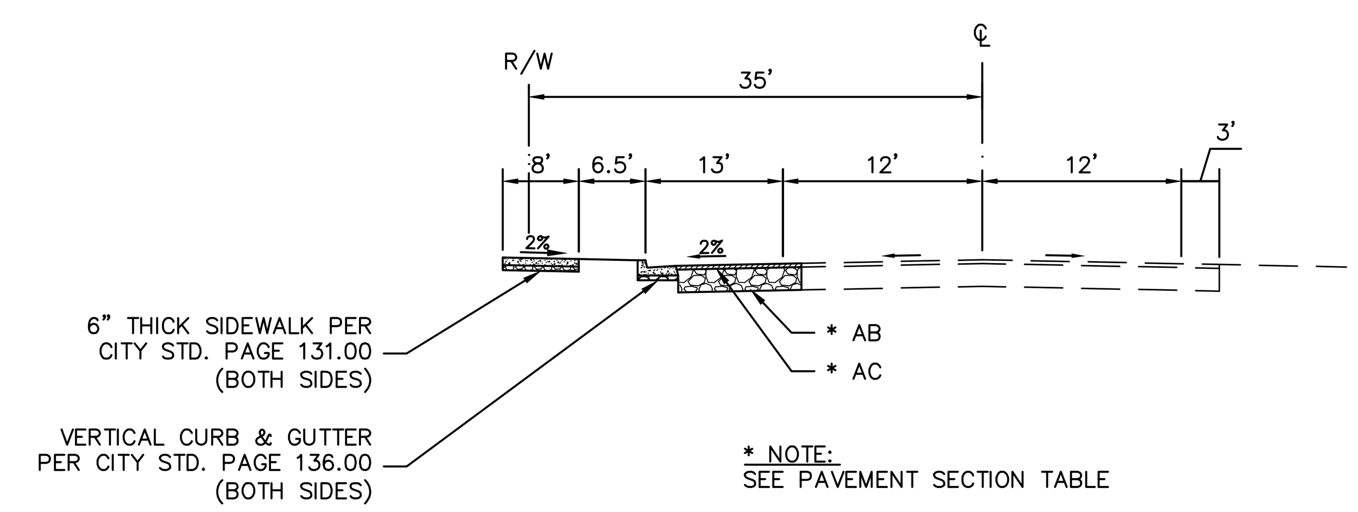
LEGEND

(dashed line)	STORM DRAIN PIPE
FF	FINISHED FLOOR
FG	FINISHED GRADE
FL	FLOWLINE
P	FINISH SURFACE
(arrow)	FLOW





BROWNING STREET SECTION
N.T.S.



CANBY ROAD SECTION
N.T.S.

40 0 20 40
1 INCH = 40 FEET

CANBY APARTMENTS
PRELIMINARY GRADING PLAN

BEING A PORTION OF THE SOUTHEAST ONE-QUARTER OF THE SOUTHEAST ONE-QUARTER OF SECTION 30, TOWNSHIP 32 NORTH, RANGE 4 WEST, MOUNT DIABLO BASE AND MERIDIAN, CITY OF REDDING, COUNTY OF SHASTA, STATE OF CALIFORNIA

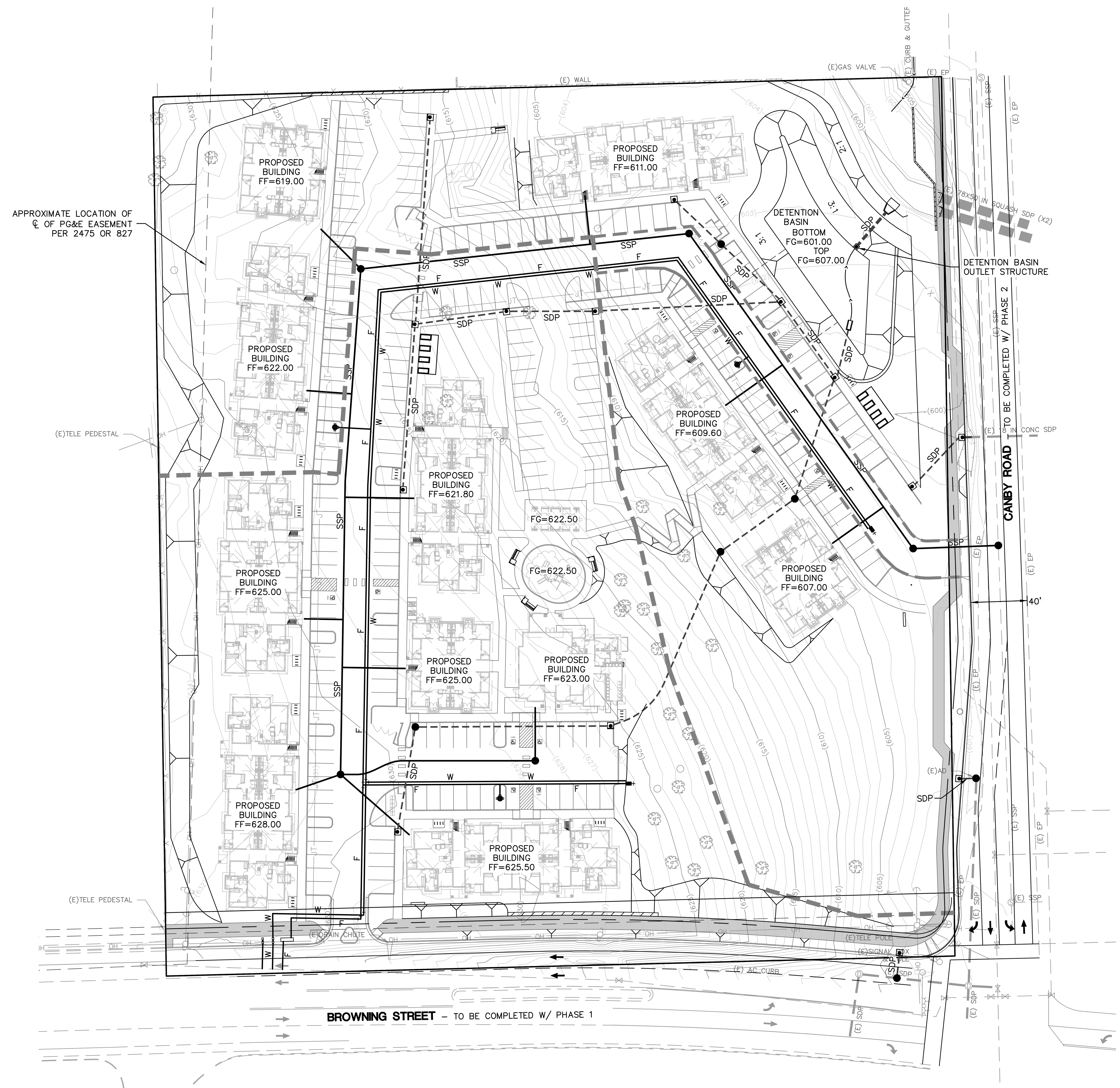
FOR

DG GROUP ARCHITECTURE PLLC

BY

SHARRAH DUNLAP SAWYER, INC.
Civil Engineering • Land Planning • Surveying & Mapping
Landscape Architecture • Presentation Graphics
320 Hartnell Avenue, Redding, CA 96002
530.221.1792 voice • info@sdsengineering.com

DATE:	DECEMBER, 2024	SCALE: 1"=40'	SHEET 1 OF 5
"GR"-C5	p:\proj\p\22116\dwg\22116up.dwg		22.0116

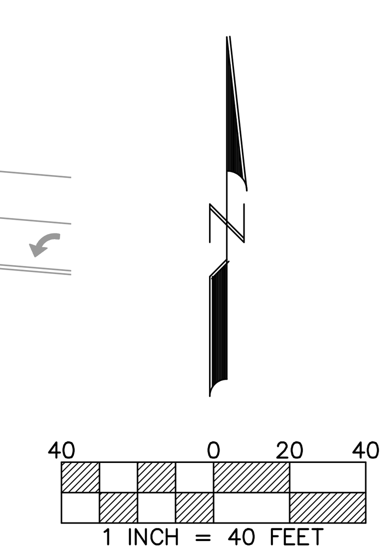


LEGEND

EXISTING	PROPOSED	
(E) SDP	SDP	STORM DRAIN LINE
(E) SSP	SSP	SANITARY SEWER LINE
W	W	DOMESTIC WATER LINE
	F	FIRE LINE
	JT	JOINT TRENCH
	SDMH	STORM DRAIN MANHOLE
	SSMH	SANITARY SEWER MANHOLE
		STORM DRAIN CATCH BASIN
		STORM DRAIN OUTFALL STRUCTURE
		FIRE HYDRANT
		WATER VALVE
	FF	FINISHED FLOOR
	FG	FINISHED GRADE
	SDP	STORM DRAIN PIPE
	SSP	SANITARY SEWER PIPE

PHASING NOTES:

1. ALL SANITARY SEWER TO BE COMPLETED W/ PHASE 1.
2. ALL STORM DRAIN AND DETENTION BASIS TO BE BUILT W/ PHASE 1.
3. FIRE AND DOMESTIC WATER WITHIN LIMITS OF PHASE 1 ONLY TO BE BUILT W/ PHASE 1.



CANBY APARTMENTS
PRELIMINARY UTILITY PLAN

BEING A PORTION OF THE SOUTHEAST ONE-QUARTER OF THE SOUTHEAST ONE-QUARTER OF SECTION 30, TOWNSHIP 32 NORTH, RANGE 4 WEST, MOUNT DIABLO BASE AND MERIDIAN, CITY OF REDDING, COUNTY OF SHASTA, STATE OF CALIFORNIA

FOR

DG GROUP ARCHITECTURE PLLC

BY

SHARRAH DUNLAP SAWYER, INC.
Civil Engineering • Land Planning • Surveying & Mapping
Landscape Architecture • Presentation Graphics
320 Hartnell Avenue, Redding, CA 96002
530.221.1792 voice • info@sdsengineering.com

DATE: DECEMBER, 2024 SCALE: 1"=40' SHEET 2 OF 5

"GR"-CS p:\proj\p\22116\dwg\22116up.dwg 22.0116

Attachment B

Cultural Resources Evaluation of 900-930 Canby Road

Attachment B

Cultural Resources Evaluation of 900-930 Canby Road

NOTE TO REVIEWER: Information contained in the *Cultural Resources Evaluation* for Canby Apartments related to the specific location of prehistoric and historic sites is confidential and exempt from the Freedom of Information Act (FOIA) and the California Public Records Act (CPRA); therefore, site specific cultural resource investigations are not appended to this Initial Study. Professionally qualified individuals, as determined by the California Office of Historic Preservation, may contact the City of Redding Development Services Department, Planning Division directly in order to inquire about its availability.

Attachment C

Aquatic Resource Delineation for the Property at 930-990 Canby Road

AEI Consultants

February 28, 2022

George Schmidbauer
Danco Group
5251 Ericson Way
Arcata, CA 95521

RE: Wetland Delineation
930-990 Canby Road, Redding, CA 96003
AEI Project No. 455830

Dear Mr. Schmidbauer,

AEI Consultants (AEI) is pleased to provide the Wetland Delineation for the proposed multi-family residential development located at 930-990 Canby Road, Redding, CA. The Wetland Delineation assessed the 8-acre Project Area.

The report includes the review of hydrophytic vegetation, hydric soils, and water features that are subject to federal jurisdiction, and defines the boundary of each water feature identified within the Project Area. If you have any additional questions or would like clarifications, please contact me at johni.etheridge@aeiconsultants.com or 831.524.1153.

Sincerely,

Johni Etheridge

Johni Etheridge
Senior Project Manager
AEI Consultants
Phone: 831.524.1153
Email: johni.etheridge@aeiconsultants.com

AQUATIC RESOURCE DELINEATION REPORT
FOR THE PROPERTY AT
930 - 990 CANBY ROAD, REDDING, CALIFORNIA

February 28, 2022

Prepared by:

Natural Investigations Company, Inc.
3104 O Street, #221, Sacramento, CA 95816

NATURAL INVESTIGATIONS CO.
WWW.NATURALINVESTIGATIONS.COM

CONTENTS

1.0 INTRODUCTION

Natural Investigations Co. conducted a formal delineation of jurisdictional water bodies on an 8-acre property that consists of 2 parcels (APNs: 117-200-005-000 and 117-200-006-000), located at 930 and 990 Canby Road, Redding, in Shasta County, California. This report presents the results of the field survey conducted in accordance with the USACE Wetlands Delineation Manual to determine which portions of this property may qualify as potentially jurisdictional waters of the United States (including wetlands). USACE is ultimately responsible for determining the limits of their jurisdiction, and this report has been prepared to assist the USACE with their determination. This report also identifies which portions of this property may qualify as potentially jurisdictional waters of the State of California (including isolated wetlands and riparian zones). The State of California is ultimately responsible for determining the limits of their jurisdiction, and this report has also been prepared to assist State agencies with their determination.

The property is located on the northwest corner of Browning Street and Canby Road, in Redding, California. The Study Area was defined as the property boundary of the 8-acre parcel (see Exhibits). The proposed project is a residential facility for multi-family housing with parking and ornamental landscaping.

1.1 REGULATORY SETTING

Real property in California that contains water resources is subject to various federal and state regulations, and activities occurring in these water resources may require permits, licenses, variances, or similar authorization from federal, state and local agencies. Following is a brief, but not exhaustive, summary of such regulations, as they apply particularly to field delineations of jurisdictional waterbodies.

1.1.1 Federal Regulations

At the federal level, the Federal Water Pollution Control Act, more commonly referred to as the Clean Water Act (CWA) (33 United States Code [USC] 1344), is the primary law regulating wetlands and surface waters. In Section 404 of the CWA, waters of the US are defined as: all waters used in interstate or foreign commerce; all interstate waters including interstate wetlands; all other waters such as intrastate lakes, rivers, streams (including intermittent and ephemeral streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes or natural ponds, where the use, degradation, or destruction of which could affect interstate commerce; impoundments of these waters; tributaries of these waters; or wetlands adjacent to these waters (33 CFR Part 328). With non-tidal waters, in the absence of adjacent wetlands, the extent of federal jurisdiction is defined by the ordinary high water mark - the line on the shore established by the fluctuations of water, and indicated by a clear, natural line impressed on the bank, shelving, changes in soil character, destruction of terrestrial vegetation, or the presence of litter and debris. Wetlands are defined as: "…*those areas that are inundated or saturated by surface or ground water 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*." (Federal Register 1980, 1982).

Any person, firm, or agency planning to alter of work in navigable waterbodies, including the discharge of dredged or fill material, must first obtain authorization from the United States Army Corps of Engineers (USACE). Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) prohibits the obstruction or alteration of navigable waters of the US without a permit from USACE. Section 301 of the Federal Water Pollution Control Act, as amended ("Clean Water Act") prohibits the discharge of pollutants, including dredged or fill material, into waters of the US without a Section 404 permit from USACE (33 USC 1344). If the proposed project involves species (or their habitat) listed under the federal Endangered Species

Act of 1973, USACE must initiate consultation with USFWS or National Marine Fisheries Service pursuant to Section 7 (16 USC 1536; 40 CFR Part 402). Wetland features that exhibit vernal pool characteristics may be protected under the federal Endangered Species Act or California Endangered Species Act, because several crustaceans listed as threatened or endangered are dependent upon vernal pool habitat.

Under CWA Section 401, every applicant for a federal permit or license for any activity which may result in a discharge to a water body must obtain certification that the proposed activity will comply with State water quality standards. The applicable Regional Water Quality Control Board must certify that a USACE Section 404 Permit action meets state water quality objectives by issuing a Water Quality Certification. California Department of Fish and Game provides comment on USACE permit actions under the Fish and Wildlife Coordination Act. Under CWA Section 402, any construction project that disturbs at least one acre of land requires enrollment in the State's construction general permitting program under the National Pollutant Discharge Elimination System and implementation of a storm water pollution prevention plan.

The United States Environmental Protection Agency (USEPA) and USACE (2008) issued joint guidance regarding Clean Water Act jurisdiction following the decision in the consolidated cases of Rapanos v. United States and Carabell v. United States. USACE and USEPA will assert jurisdiction over traditional navigable waters, and non-navigable tributaries that have relatively permanent flow, and adjacent wetlands. The agencies will decide jurisdiction on a case-by-case basis for non-navigable tributaries that do not have relatively permanent flow, and adjacent wetlands, based upon significant nexus criteria (Kennedy Test, Scalia Test). The agencies generally will not assert jurisdiction over ditches, swales or other erosional features, or isolated wetlands.

1.1.2 State Regulations

Waters of the State are regulated primarily under the California Water Code and the California Code of Regulations Title 23: Water and Title 27: Environmental Protection. All water features in California, on public and private lands, in both natural and artificial channels, including isolated wetland features and impermanent drainages that are not claimed as waters of the US, are considered waters of the State. Waters of the State are protected under the Porter-Cologne Water Quality Control Act (California Water Code, Division 7: Water Quality) and are regulated by the State Water Resources Control Board (SWRCB) and its 9 Regional Water Quality Control Boards.
All parties proposing to discharge materials that could affect waters of the State must file a report of waste discharge with the appropriate regional board. The regional board will then respond to the report by issuing waste discharge requirements (WDRs) in a public hearing, or by waiving WDRs (with or without conditions) for that proposed discharge. Both of the terms "discharge of waste" and "waters of the State" are broadly defined in the Porter-Cologne Act, such that discharges of waste include fill, any material resulting from human activity (including construction), or any other "discharge" that may directly or indirectly impact waters of the State.

Additional statewide regulations that protect wetlands and riparian areas include the Wetlands Conservation Policy (Executive Order W-59-93), also known as the State's "No Net Loss" Policy for Wetlands; and the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (State Water Board Resolution No. 2004-0030).

California Fish and Game Code (§1600-1607, 5650F) protects fishery resources by regulating "...*any activity that may substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake*." California Department of Fish and Wildlife (CDFW) requires notification prior to project commencement, and issuance of a Lake or Streambed Alteration Agreement, if a proposed project will result in the alteration or degradation of waters of the State. The limit of CDFW jurisdiction is currently interpreted to be the "stream zone", defined as "*that portion of the stream channel that restricts lateral movement of water*" and delineated at "*the top of the bank or the outer edge of any riparian vegetation, whichever is more landward*". CDFW reviews the proposed actions and, if necessary, submits to the applicant a proposal for measures to protect affected fish and wildlife resources. The final proposal that is mutually agreed upon by the CDFW and the applicant is the Streambed Alteration Agreement.

The California Coastal Act requires that most development avoid and buffer wetland resources (California Coastal Commission 2004, 2006). Policies include:

- Section 30231, which requires the maintenance and restoration (if feasible) of the biological productivity and quality of wetlands appropriate to maintain optimum populations of marine organisms and for the protection of human health.
- Section 30233, which limits the filling of wetlands to identified high priority uses, including certain boating facilities, public recreational piers, restoration, nature study, and incidental public services (such as burying cables or pipes). Any wetland fill must be avoided unless there is no feasible less environmentally damaging alternative, and authorized fill must be fully mitigated.

The California Coastal Commission (CCC)'s regulations establish a "one parameter definition" that only requires evidence of 1 of the 3 USACE parameters to establish wetland conditions:

> "*Wetland shall be defined as land where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent and drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salts or other substances in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deep-water habitats*." (14 CCR Section 13577).

1.2 ENVIRONMENTAL SETTING

The Study Area and vicinity is in climate Zone 9 "Thermal Belts of California's Central Valley", with topography that allows winter cold air to flow to adjacent cold air basins (Brenzel 2007). This region has a Mediterranean-type climate, characterized by distinct seasons of hot, dry summers and wet, moderately- cold winters. The topography of the Study Area is hilly with gentle east-facing slopes (see Exhibits). The elevation ranges from approximately 605 feet to 640 feet above mean sea level. The Study Area is located within the Churn Creek watershed. The land use of the Study Area is open space. The surrounding land uses are as follows: multi-family residential housing, commercial, public park and open space.

2.0 METHODOLOGY

The delineation was conducted in accordance with the:

- 1987 Corps of Engineers Wetland Delineation Manual
- 2008 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0) and
- 2008 A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States.
- 2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0). U.S. Army Engineer Research and Development Center Environmental Laboratory, Vicksburg, MS. 153 pp.

Methodology followed USACE and USEPA guidelines, and consisted of preliminary data gathering and research, field surveys, digital mapping, and documentation of final boundary determinations.

2.1 PRELIMINARY DATA GATHERING AND SYNTHESIS

Prior to conducting the field delineation the following information sources were reviewed:

- Client's engineering or design drawings (where available);
- United States Geologic Survey (USGS) 7.5-degree minute topographic quadrangle maps and aerial photography;
- United States Department of Agriculture Natural Resources Conservation Service (NRCS) soil survey maps;
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate (Flood Hazard Boundary) Maps;
- United States Fish and Wildlife Service (USFWS) National Wetland Inventory Maps; and
- Any readily-available studies performed previously.

2.2 DETERMINATION PROCEDURES

The purpose of the field determination was to: 1) identify any and all water features that are subject to federal jurisdiction (*i.e.*, waters of the US) within the Study Area; and 2) if present, determine the boundary of each water feature. The entire study area was assessed in such a manner as to view all areas to the degree necessary to determine the vegetation community types and the presence or absence of jurisdictional water features. Wetland field determination procedures followed the USACE *Wetlands Delineation Manual* technical guidelines for a Level 2 Routine Field Determination (Environmental Laboratory 1987). Additionally, the appropriate USACE regional supplement was also consulted.

The diagnostic environmental characteristics of hydrophytic vegetation, hydric soils, and wetland hydrology (i.e., 3-parameter approach) were used as the standard for determining if specific areas qualified as wetlands (Environmental Laboratory 1987). A subject area was determined to be a wetland if all 3 requisite characteristics were present; as a general rule, evidence of a minimum of one positive indicator for each parameter must be found in order to make a positive wetland determination.

Hydrophytic vegetation is defined as "...*the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils sufficient in duration to exert a controlling influence on the plant species present*." (Environmental Laboratory 1987). Hydrophytic vegetation indicators included: prevalence of vegetation; majority of dominant plant species are obligate or facultative wetland plants (hydrophytes); morphological or physiological adaptations to saturated soil conditions; and species listed on the *National List of Plant Species that Occur in Wetlands* (USFWS 2006a) and the *Regional List* (Region 10) (USFWS 2006b). This National List divides plant species into categories based upon their frequency of occurrence in wetlands. These categories are: OBL = obligate wetland plants that occur almost always in wetlands under natural conditions (estimated probability greater than 99%); FACW = facultative wetland plants that usually occur in wetlands, but occasionally occur in non-wetlands (estimated probability 67 – 99%); FAC = facultative wetland plants that are equally likely to occur in wetlands or non-wetlands (estimated probability 34 – 66 %); FACU – facultative upland plants that usually occur in non-wetlands, but occasionally are found in wetlands (estimated probability 1 – 33 %); UPL = obligate upland plants that almost always occur in non-wetlands (estimated probability greater than 99%); NI and UNK = insufficient information to determine status; NL = not listed; NA = no agreement by Regional Panel on status; NO =

species does not occur in specified region; * (asterisk) indicates tentative assignment; + (positive) or – (negative) sign indicates higher or lower frequency in its category, respectively. During field investigations, the percentage of hydrophytic plant coverage was determined based on the ratio of wetland indicator species coverage present to the total plant coverage present. More than 50 percent of the dominant plant species cover must be FAC, FACW, or OBL to meet the hydrophytic vegetation criterion.

Hydric soils are defined as soils that are "...*formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part*." (Environmental Laboratory 1987). A minimum one week of inundation or 14 consecutive days of saturation during the growing season is a typical requirement. The criteria for establishing the presence of hydric soils vary among different soil types and drainage classes. Hydric soil indicators include evidence of reducing or redoximorphic conditions (including sulfidic odor, organic streaking), gleyed, mottled, or low-chroma soils, iron and manganese concretions, and low dissolved oxygen concentration (aquic moisture regime); organic soils (histosols); or mineral soils saturated and rich in organics (histic epipedon) (NRCS 2006a). Richardson and Vepraskas (2001) present a thorough discussion of wetland soil science. In the absence of visible field indicators, hydric soil conditions may be determined according to two criteria: 1) all dominant plant species have an indicator status of OBL and/or FACW (at least one dominant plant species must be OBL); and 2) areas below the level of ordinary high water are frequently flooded for long duration or very long duration during the growing season and possess and aquic (reducing) moisture regime. Soils are also classified as hydric on non-hydric by NRCS (2006b).

Wetland hydrology "...*encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season*" (Environmental Laboratory 1987). Many factors influence site-specific hydrology, including the precipitation, stratigraphy, topography, soil permeability, and plant cover of the site. In general, inundation or saturation must occur for at least 5 percent of the growing season to qualify as wetland hydrology. The degree of inundation or saturation at the subject site can vary widely from year to year depending on rainfall patterns within the watershed. Primary wetland hydrology indicators include visual observations of inundation or soil saturation, water marks and water-stained leaves, sediment deposits, drift lines, and drainage patterns in wetlands.

Sampling locations were established within potential wetland areas and within adjacent uplands, where present, to determine the boundary of wetlands. At each sampling point, the location was georeferenced using a GPS receiver and marked on an aerial photograph; a numbered pin flag or lathe was placed, where necessary, to assist other surveyors. Information on vegetation, soils, and hydrology was recorded on a USACE *Routine Wetland Determination Data Form*.

Dominant and subdominant plant species in each vegetative stratum (e.g., tree, shrub, forb) that occurred within approximately 5 to 10 feet of the sampling point were identified and recorded, and their wetland indicator status determined. All visible flora observed were recorded in a field notebook, and identified to the lowest possible taxon; a hand lens was used where necessary. When a specimen could not be identified *in situ*, a photograph or voucher specimen (depending upon scientific permit requirements) was taken and identified later in the laboratory using a dissecting scope where necessary. Taxonomic determinations and nomenclature followed these references: plants—Pavlik (1991), Brenzel (2007), Stuart and Sawyer (2001), Lanner (2002), Baldwin et al. (2012), Calflora (2022), University of California at Berkeley (2022a,b).

Where necessary, a soil pit was dug with a spade to expose at least 16 inches of soil profile, and the sample evaluated for hydric soil indicators. Munsell Soil Color Charts (2000 edition, Gretagmacbeth, Inc.) were used to determine soil matrix and mottle color (hue, value, and chroma), and soil type and particle size was also noted. NRCS (1999) Soil Taxonomy handbook was referenced for soil classification where necessary. Based on the results of the 3-parameter test, the extent of each potential wetland was mapped in the field using a GPS receiver capable of submeter accuracy and/or demarcated on aerial photographs for later “heads-up” digitization. Wetlands and other aquatic habitats were classified using the USFWS “*Classification System for Wetland and Deepwater Habitats*”, or “Cowardin class” (Cowardin *et al*., 1979; USFWS 2014). A determination was made whether normal environmental conditions exist; atypical conditions followed a modified procedure described in the USACE Manual (Environmental Laboratory 1987). Geographic analyses, including acreage calculations, were performed using geographical information system software (ArcGIS 10, ESRI, Inc.).

For identification of water features other than wetlands that are subject to federal or State jurisdiction, 2 principal field characteristics were evaluated: 1) the presence of a channel; and 2) the presence of an ordinary high water mark. The ordinary high water mark is defined in 33 CFR Part 329.11 as the line on the shore established by the fluctuations of water, and indicated by a clear, natural line impressed on the bank, shelving, changes in soil character, destruction of terrestrial vegetation, or the presence of litter and debris. Other characteristics were noted, where possible: description of hydrologic feature type, length, approximate discharge volume, gradient, range between low and high water mark, width of riparian vegetation, etc. For determination of whether these water bodies constituted waters of the US, USACE regulations (33 CRF 328) were consulted. Data sheets for these non-wetland water bodies were completed at representative locations and were included in the Appendix.

A joint USEPA/USACE memorandum dated 2008 provided guidance to implementing the Supreme Court’s decision in the consolidated cases Rapanos v. United States and Carabell v. United States (hereafter referred to simply as “Rapanos”) which addressed the jurisdiction over waters of the United States under the Clean Water Act. In Rapanos, the Supreme Court restricted where the federal government can apply the Clean Water Act, specifically by determining whether a wetland or tributary is a “water of the United States.” According to USEPA & USACE (2008), jurisdiction will continue to be asserted over “all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.” These waters are referred to as traditional navigable waters. The agencies will also continue to assert jurisdiction over wetlands adjacent to traditional navigable waters, where “adjacent” means “bordering, contiguous, or neighboring.” Finding a continuous surface connection is not required to establish adjacency under this definition (USEPA & USACE 2008).

A non-navigable tributary of a traditional navigable water is a non-navigable water body whose waters flow into a traditional navigable water either directly or indirectly by means of other tributaries. Clean Water Act jurisdiction will continue to be held over non-navigable tributaries that are “relatively permanent” – waters that typically (e.g., except due to drought) flow year-round or waters that have a continuous flow at least seasonally (e.g., typically three months). Justice Scalia emphasizes that relatively permanent waters do not include tributaries “*whose flow is ‘coming and going at intervals...broken, fitful*.’” Therefore, “relatively permanent” waters do not include ephemeral tributaries which flow only in response to precipitation and intermittent streams which do not typically flow year-round or have continuous flow at least seasonally (USEPA & USACE 2008). However, CWA jurisdiction over these waters will be evaluated under the significant nexus standard described next.

The agencies will assert jurisdiction over the following types of waters when they have a significant nexus with a traditional navigable water: (1) non-navigable tributaries that are not relatively permanent, (2) wetlands adjacent to non-navigable tributaries that are not relatively permanent, and (3) wetlands adjacent to, but not directly abutting, a relatively permanent tributary (e.g., separated from it by uplands, a berm, dike or similar feature). The agencies will assess the flow characteristics and functions of the tributary itself, together with the functions performed by any wetlands adjacent to that tributary, to determine whether collectively they have a significant nexus with traditional navigable waters. A waterbody possesses the requisite nexus, and thus becomes jurisdictional, if the waterbody, either alone or in combination with similarly situated lands in the region, significantly affects the chemical, physical, and biological integrity of other covered waters more readily understood as 'navigable' (USEPA & USACE 2008).

To assist in the interpretation of the Rapanos criteria, the USACE Jurisdictional Determination Form Instructional Guidebook was consulted (USACE & USEPA 2007).

3.0 RESULTS

3.1 FIELD SURVEY AND CONDITIONS

Tim Nosal, M.S. conducted the field assessment on February 7, 2022. Weather conditions were warm and sunny. A complete coverage, variable-intensity pedestrian survey was performed of the Study Area, modified to account for differences in terrain, vegetation density, and visibility. Sampling points were established at key locations and analyzed for the presence or absence of wetland (or for channels, ordinary high water mark) indicators; these points are documented in the Data Sheets in the Appendix. The results of the analyses of Study Area vegetation, soils, and hydrology are presented in the following sections, followed by the recommended jurisdictional determination.

3.2 VEGETATION

The Study Area is located within the Sacramento Valley geographic subregion, which is contained within the Great Central Valley geographic subdivision of the larger California Floristic Province (Baldwin et al. 2012). The Study Area currently contains two terrestrial natural community/habitat types: annual grassland and blue oak woodland. Flora sighted within the Study Area during the field survey are listed in the following table. Obligate wetland plants <u>are</u> present within the Study Area.

Table 1. List of All Plants Identified During the Field Survey

Scientific Name	Common Name	Status[1&2]
Avena fatua	Wild oat	UPL
Brodiaea sp.	Brodiaea	FACU
Bromus diandrus	Ripgut brome	UPL
Bromus hordeaceus	Soft chess	FACU-
Carex sp.	Sedge	FACW
Chlorogalum pomeridianum	Wavy leaf soap plant	-
Cyperus eragrostis	Tall flatsedge	FACW
Dichelostemma sp.	Wild hyacinth	-
Elymus caput-medusae	Medusa-head grass	UPL
Epilobium brachycarpum	Tall willowherb	UPL
Erodium botrys	Broad leaved filaree	UPL
Eucalyptus sp.	Gum tree	-
Festuca perennis	Italian ryegrass	FAC*
Ficus carica	Edible fig	-
Fraxinus latifolia	Oregon ash	FACW
Geranium dissectum	Cutleaf geranium	UPL
Hordeum marinum ssp. gussoneanum	Mediterranean barley	FAC
Hordeum murinum	Wall barley	NI
Hypochaeris sp.	Cat's ear	-
Juncus bufonius	Toad rush	FACW+
Juncus sp.	Rush	FACW
Juncus xiphioides	Iris-leaved rush	OBL
Lactuca serriola	Prickly lettuce	FAC
Leontodon saxatilis	Hawkbit	FACU
Lonicera hispidula	Pink honeysuckle	-
Lupinus bicolor	Miniature lupine	-
Lupinus sp.	Lupine	-
Lythrum hyssopifolia	Hyssop loosestrife	FACW
Pinus sabiniana	Gray pine	-
Prunus dulcis	Almond	-
Quercus douglasii	Blue oak	-
Quercus wislizeni	Interior live oak	-
Ranunculus californicus	California buttercup	FAC
Rubus armeniacus	Himalayan blackberry	FACW*
Rumex crispus	Curly dock	FACW
Salix laevigata	Red willow	FACW
Salix sp.	Willow	FACW
Toxicodendron diversilobum	Poison oak	-
Triteleia sp.	Wild hyacinth	FAC
Typha latifolia	Broad leaved cattail	OBL

Scientific Name	Common Name	Status[1&2]
Verbascum blattaria	Moth mullein	FACW
Vicia sativa	Spring vetch	FACU
Vicia villosa	Winter vetch	NI
Vitis californicus	California grape	FACW

[1]Reed, P.B. 1988. National List of Plant Species That Occur in Wetlands: California (Region 0). Biological Report 88(26.10) May 1988. National Ecology Research Center, National Wetland Inventory, U. S. Fish and Wildlife Service, St. Petersburg, Fl.

[2]OBL – Obligate, FACW = Facultative Wetland, FAC = Facultative, FACU – Facultative upland, UPL = upland; and NI = no indicator.

3.3 SOIL TYPES

Digital soil survey maps from NRCS' SSURGO 2.2 Database were consulted for this study (NRCS 2017), and mapped soil units occurring within the Study Area are listed and described in the following table and mapped in the Exhibits, as needed. No mapped soil units within the Study Area were found to be designated "hydric" by NRCS. NRCS provides this disclaimer: "*Lists of hydric soils along with soil survey maps are good off-site ancillary tools to assist in wetland determinations, but they are not a substitute for observations made during on-site investigations*." (http://soils.usda.gov/use/hydric/overview.html).

Mapped Soil Units Within The Study Area

Unit #	Unit Name	Taxonomic Group	Drainage Class	Runoff Class	Hydric?
CfA	Churn gravelly loam, 0-3 percent slopes	Ultic Haploxeralfs	Well drained	Medium	No
NeD	Newtown gravelly loam, 15 to 30% slopes	Ultic Haploxeralfs	Well drained	Very high	No
RdB	Redding gravelly loam, 0 to 15 percent slopes	Abruptic Durixeralfs	Moderately well drained	Very high	No
Data from NRCS SSURGO 2.2 Database/SoilWeb					

Wetland soils were darker and more grayish (Munsell matrix color of Gley 1 3/10Y), and consisted of clayey loams, with some gleying or mottling. Upland soils were lighter and more reddish (Munsell matrix color of 7.5 YR 4/4), and consisted of sandy loams, with cobbles at deeper levels

3.4 HYDROLOGY

The general direction of surface runoff in the Study Area is to the east and south into an unnamed watercourse (see Exhibits). Drainage from this region flows south to Churn Creek, which is tributary to the Sacramento River. Annual precipitation averages approximately 39.23 inches (Western Regional Climate Center 2022).

According to the FEMA Flood Hazard Boundary Map of the region, the property is not located within a flood zone (see Exhibits). The zone codes are as follows: Zone A – inside the 100-year floodplain; Zone X - outside the 500-year floodplain; Zone X500 - outside the 100-year floodplain but within the 500-year floodplain; Zone ANI – area not included in the mapping program. Because wetlands often occur within floodplains, these FEMA Flood Hazard Boundary Maps may assist the delineator in determining if wetland hydrology exists within the Study Area.

3.5 NATIONAL WETLANDS INVENTORY / PREVIOUS DELINEATIONS

The USFWS National Wetland Inventory (NWI) digital maps of the Study Area were consulted. Regional mapped wetland features are shown in the Exhibits, where illustrative. One NWI riverine feature was mapped within the Study Area. No other NWI features were mapped within the Study Area. No wetland features were mapped on adjacent properties. Note, however, that this database was not used to conclude that a wetland was present or absent in the Study Area. No previous wetland delineations were made known to the author.

3.6 DELINEATION RESULTS AND JURISDICTIONAL RECOMMENDATIONS

All hydrologic features were identified and mapped within the Study Area, and subjected to the delineation criteria set forth by each regulatory agency. These features are summarized in the following tables and mapped in the Exhibits. This map has not been verified by USACE or SWRCB, and thus represents an unofficial demarcation of the potential limits of jurisdiction. Various survey points were established for the delineation of this Study Area, and corresponding data sheets can be found in the Appendix.

All identified hydrologic features were subjected to the 3-parameter test, and the following features were delineated:

- 2 isolated wetlands totaling 7,974 square feet (0.184 acres)
- 1 channel totaling 949 square feet (0.023 acres)

No other wetlands were detected within the Study Area. No other data points and their test pits gave indications of hydric soils, and hydrophytes were generally lacking.

The 2 wetland features occur in poorly-defined depressions that fill primarily with surface flow after rain. The soil in the seasonal wetlands has a much greater clay content that the surrounding uplands. The Cowardin Class is PUB3EO. During the field survey, the ground in these areas was saturated although measurable rain had not fallen in the last month. Much of the vegetation was in early vegetative growth and difficult to discern. Vegetation that was identifiable was primarily Italian ryegrass (*Festuca perennis*), curly dock (*Rumex crispus*), Himalayan blackberry (*Rubus armeniacus*), willow (*Salix* sp.) and tall flatsedge (*Cyperus eragrostis*). None of the wetlands had vernal pool indicator plants. Some of the surrounding uplands were dominated by wetland vegetation, however the soil was sandy and well drained and failed the hydric soils test (and hydrology test).

One channel is present within the Study Area—an unnamed seasonal drainage labeled as “Channel 1” on the included map. This feature originates from north of the Study Area. Drainage from this feature flows southeast before exiting the parcel. Approximately 115 linear feet of channel is present, with an area of 949 square feet (0.0019 acre). The channel has an average width of 8 feet, and a depth of 8 inches. Flowing water was present in the channel at the time of the site visit. Ordinary High Water Mark indicators for this drainage include: inundation; shelving; stained leaves; drift lines; destruction of vegetation; exposed cobble; and litter/debris packing. No other channels are present within the Study Area.

Summary Table of Delineated Aquatic Resources

Aquatic Resource Name		Aquatic Resources Classification		Aquatic Resource Size		
		Cowardin	Location (Lat/Long)	(sq. ft.)	(acre)	(linear feet)
Channels	Channel 1	R4UB1	40.594663°/-122.353824°	949	0.022	115
			Total Channels	949	0.022	115
Wetlands	SW1	PUB3E0	40.594452°/-122.355616°	992	0.023	
	SW2	PUB3E0	40.594239°/-122.353846°	6,982	0.161	
			Total Wetlands	7,974	0.184	

3.6.1 Water Resources Potentially Subject to Federal Jurisdiction

All identified hydrologic features were subjected to the 3-parameter test, the Hydrology Criterion (Scalia Test), and the Significant Nexus (Kennedy) Test. Based upon these criteria, the 2 delineated wetlands may or may not be potentially subject to USACE jurisdiction. The wetlands are isolated, and do not have connectivity to downstream waters of the U.S. The delineated channel may be potentially subject to USACE jurisdiction because it does have connectivity with downstream waters of the U. S.

3.6.2 Upland Features Not Expected to Be Subject to Federal Regulation

There are two low-lying areas within the Study Area that collect water and support some wetland vegetation, but these features did not have hydric soils. Roadside ditches are also present. These features are understood to not be jurisdictional (see Exhibits). They fail the Scalia Test for relatively permanent flow. The features also fail the connectivity criterion. They all fall under the category described by USEPA & USACE (2008) as:

> "*Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow) are generally not waters of the United States because they are not tributaries or they do not have a significant nexus to downstream traditional navigable waters. In addition, ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water are generally not waters of the United States because they are not tributaries or they do not have a significant nexus to downstream traditional navigable waters*."

3.6.3 Water Resources Potentially Subject to State Jurisdiction

All identified hydrologic features were subjected to the 3-parameter test, the broad (and vague) definition of waters of the State as currently enforced by SWRCB, and the "stream zone" as currently enforced by CDFW. Based upon these criteria, the same delineated features (2 wetlands, 1 channel) were determined to be potentially subject to State jurisdiction. These isolated wetland features may be subject to State Water Resources Control Board control (via the Porter-Cologne Act).

3.6.4 Upland Features Not Expected to Be Subject to State Regulation

Two low-lying areas were observed within the Study Area are not expected to be subject to state regulation. Although these features appear to have wetland hydrology, they differ from the seasonal wetlands by possessing well-drained soils that are lower in clay and are not hydric. Roadside ditches are also present. These features are not expected to be subject to state regulation.

4.0 REFERENCES

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, and T. J. Rosatti, editors. 2012. The Jepson Manual: Vascular Plants of California, second edition, thoroughly revised and expanded. University of California Press, Berkeley, California. 1,600 pp.

Brenzel, K. N., editor. 2007. Sunset Western Garden Book, revised edition. Sunset Publishing Corporation, Menlo, California. 768 pp.

Calflora. 2022. Calflora, the on-line gateway to information about native and introduced wild plants in California. Internet database available at http://www.calflora.org/index0.html.

California Coastal Commission. 2004. Procedural guidance for the review of wetland projects in California's Coastal Zone. Available electronically at http://www.coastal.ca.gov/wetrev/wettc.html.

California Coastal Commission. 2006. Definition and delineation of wetlands in the Coastal Zone. California Coastal Commission Wetlands Workshop Handout Final 11.15.06. Available electronically at http://documents.coastal.ca.gov/reports/2006/11/Th3-11-2006.pdf.

California Department of Fish and Wildlife. 2022. The Vegetation Classification and Mapping Program, Biogeographic Data Branch, Sacramento, California. http://www.dfg.ca.gov/biogeodata/vegcamp/.

Cowardin, L. M., V. Carter, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. Office of Biological Services, U. S. Fish and Wildlife Service, Washington, District of Columbia. 45 pp. Available electronically on the Internet at http://www.fws.gov/nwi/Pubs_Reports/Class_Manual/class_titlepg.htm.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. 92 pp. Available electronically on the Internet at http://el.erdc.usace.army.mil/index.cfm.

Federal Emergency Management Agency. 2022. Digital Q3 Flood Data, "California." Flood Insurance Rate Maps, digital product. National Flood Insurance Program, Map Service Center. Available electronically at http://www.fema.gov/hazard/flood/index.shtm.

Federal Register. 1980. "40 CFR Part 230: Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material," U.S. Government Printing Office, Washington, D.C., 45(249), 85,352-85,353.

Federal Register. 1982. "Title 33: Navigation and Navigable Waters; Chapter 2. Regulatory Programs of the Corps of Engineers," U.S. Government Printing Office, Washington, DC, 47(138), 31,810.

Lanner, R. M. 2002. Conifers of California. Cachuma Press, Los Olivos, California. 274 pp.

National Resources Conservation Service. 2002. Field Book for Sampling and Describing Soils, Version 2.0. Edited by P. J. Schoeneberger, D. A. Wysocki, E. C. Benham, and W. D. Broderson. National Soil Survey Center, Lincoln, Nebraska. 227 pp.

Natural Resources Conservation Service. 2006a. Field Indicators of Hydric Soils in the United States: A guide for identifying and delineating hydric soils, Version 6.0 (2006). Published in cooperation with the National Technical Committee for Hydric Soils. NRCS Soils Website. Available electronically on the Internet at http://soils.usda.gov/use/hydric/.

Natural Resources Conservation Service. 2006b. 2006 National List of Hydric Soils. NRCS Soils Website. Available electronically on the Internet at http://soils.usda.gov/use/hydric/.

Natural Resources Conservation Service. 2022. Web Soil Survey version 3.3. National Cooperative Soil Survey, U.S. Department of Agriculture. NRCS Soils Website (Internet database and digital maps) available at https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

Pavlik, B. M., P. C. Muick, S. G. Johnson, and M. Popper. 1991. Oaks of California. Cachuma Press and the California Oak Foundation. Los Olivos, California. 184 pp.

Richardson, J.L., and M.J. Vepraskas, editors. 2001. Wetland soils: genesis, hydrology, landscapes, and classification. Lewis Publishers, Boca Raton, Florida.

Sawyer, J. O., and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento, California. Available electronically at http://davisherb.ucdavis.edu/cnpsActiveServer/index.html.

Stuart, J. D., and J. O. Sawyer. 2001. Trees and shrubs of California. California Natural History Guides. University of California Press, Berkeley, California. 467 pp.

Western Regional Climate Center. 2022. Desert Research Institute, Reno, Nevada. Internet database available at http://www.wrcc.dri.edu/CLIMATEDATA.html.

United States Army Corps of Engineers. 2001. Final Summary Report: Guidelines for jurisdictional determinations for waters of the United States in the arid Southwest. South Pacific Division. 12 pp. Available electronically at http://www.spl.usace.army.mil/regulatory/.

United States Environmental Protection Agency and United States Army Corps of Engineers. 2008. Revised Guidance on Clean Water Act Jurisdiction Following the Supreme Court Decision in Rapanos v. U.S. and Carabell v. U.S. Memorandum available online at http://www.usace.army.mil/cw/cecwo/reg/cwa_guide/cwa_juris_2dec08.pdf.

United States Fish and Wildlife Service. 2006a. National List of Vascular Plant Species That Occur in Wetlands: 1996 National Summary, draft Revision. National Wetland Inventory. Available electronically at http://www.fws.gov/nwi/bha/list96.html.

United States Fish and Wildlife Service. 2006b. Regional List of Vascular Plant Species That Occur in Wetlands: Region 10, draft form. National Wetland Inventory. Available electronically at http://www.fws.gov/nwi/bha/list88.html.

United States Fish and Wildlife Service. 2022. Wetlands Digital Data. National Wetlands Inventory Center. Digital maps downloaded from the Internet at http://www.fws.gov/wetlands/data/DataDownload.html.

University of California at Berkeley. 2022a. Jepson Online Interchange for California Floristics. Jepson Flora Project, University Herbarium and Jepson Herbarium, University of California at Berkeley. http://ucjeps.berkeley.edu/interchange.html.

University of California at Berkeley. 2022b. CalPhotos. Biodiversity Sciences Technology Group, University of California at Berkeley. Internet database available at http://calphotos.berkeley.edu/.

5.0 QUALIFICATIONS OF SURVEYORS AND REPORT PREPARERS

TIMOTHY R. D. NOSAL, M.S.

Mr. Nosal holds a B.S. and M.S. in Biological Sciences. Mr. Nosal has statewide experience performing sensitive plant and animal surveys in addition to terrestrial vegetation investigations. Mr. Nosal has over 30 years of experience in botanical surveys, environmental assessment, and teaching with employers that include California Department of Fish and Wildlife, State Water Resources Control Board, American River College, MTI College and Pacific Municipal Consultants. Mr. Nosal has intensive experience with the flora of the region including the implementation of numerous wetland delineations.

G.O. GRAENING, Ph.D.

G. O. Graening holds a Ph.D. in Biological Sciences and a Master of Science in Biological Engineering, and is a certified arborist (International Society of Arboriculture) and certified professional in storm water quality (EnviroCert Int'l). Dr. Graening has 13 years of experience in environmental assessment and research, including the performance of numerous wetland delineations and aquatic restoration projects. Dr. Graening also serves as an adjunct professor of biology at California State University Sacramento and is an active researcher in the area of conservation biology and groundwater ecology.

6.0 EXHIBITS

Study Area

930 & 990 Canby Road
Study Area Location Map

0 0.25 0.5 Miles

1:24,000

Natural Investigations Company

Map Date 2/1/2022

Enterprise 2018 Quadrangle:Township 32N, Range 4W, Section 30

Map Date 2/1/2022

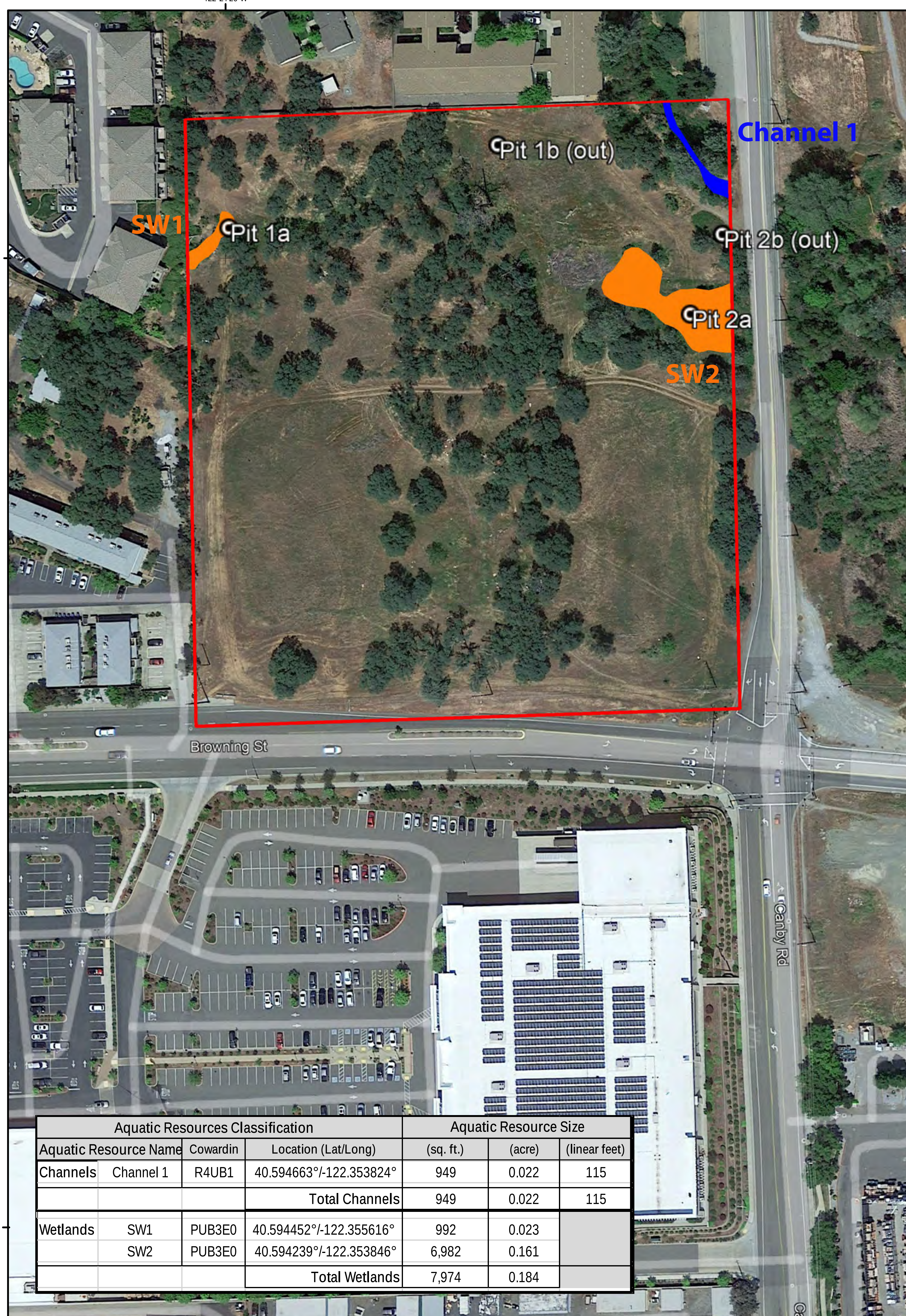
Enterprise 2018 Quadrangle:Township 32N, Range 4W, Section 30

930 & 990 Canby Road
USDA Soils Map

Natural Investigations Company

Map Date 2/1/2022

Enterprise 2018 Quadrangle:Township 32N, Range 4W, Section 30



Aquatic Resources Classification				Aquatic Resource Size		
Aquatic Resource Name		Cowardin	Location (Lat/Long)	(sq. ft.)	(acre)	(linear feet)
Channels	Channel 1	R4UB1	40.594663°/-122.353824°	949	0.022	115
			Total Channels	949	0.022	115
Wetlands	SW1	PUB3E0	40.594452°/-122.355616°	992	0.023	
	SW2	PUB3E0	40.594239°/-122.353846°	6,982	0.161	
			Total Wetlands	7,974	0.184	

Data Points
Parcel Boundary
Channel
Wetland

0 75 150 Feet

N

Aquatic Resources Delineation Map
930 & 990 Canby Road, Redding

Delineator: Dr. G.O. Graening, Jan. 14, 2022

Natural Investigations Company

7.0 APPENDIX A – WETLAND DELINEATION FIELD DATA SHEETS

DATA SHEET - ROUTINE DETERMINATION: NON-WETLAND WATERS OF US

Project ID: 900 & 930 Canby Road, Redding
Client:
Investigator: Tim Nosal
Do normal circumstances exist on the site? Yes
Is it an atypical situation? No
Is the area a potential problem area? No

Date: February 7, 2022
State: California
County: Shasta
Township, Range, Section: T32N R4W SE 1/4 SEC 30 MDBM
Plant Community:
Sample Plot: Channel 1

VEGETATION

Species	% Cover	Dominant?	Indicator Status	Species	% Cover	Dominant?	Indicator Status
Salix	30%	Y	FACW	Carex	10	Y	FACW
Quercus wis	5		—	Juncus	10	Y	FACW
Fraxinus lat	5%		FACW	Typha	5		OBL
Eucalyptus	5		—	Rubus	10	Y	FACW*
Pinus Sab	10%	Y	—				

Width of Riparian Vegetation: 5'-20'

Comments/Notes:

SOILS

Mapped Soil Unit: Cfa: Churn gravelly loam, deep, 0 to 3 % slopes
Taxonomy: Ultic Haploxeralfs
Drainage Class: well drained
Matches Profile? Yes
On hydric soils list? No

Comments/Notes:

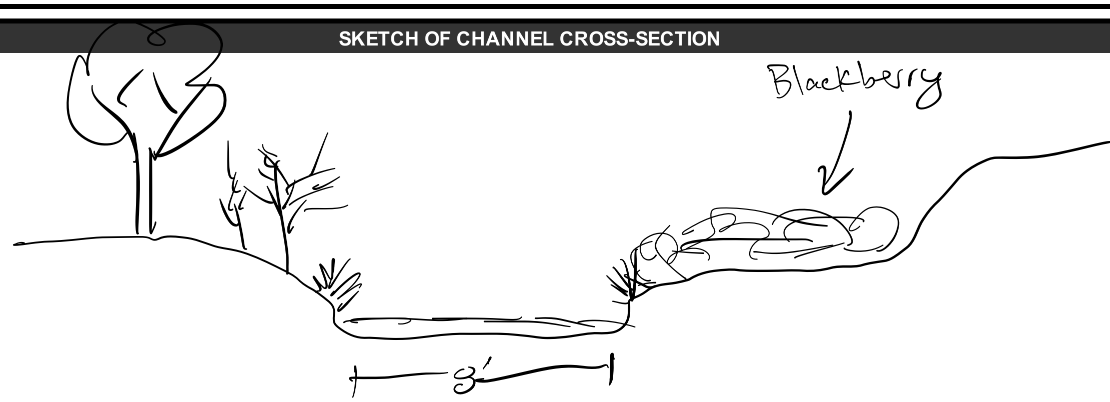
HYDROLOGY

Is water present? Y
Depth of surface water: 8"
Flow rate: n/a
Or depth to saturated soil:
Is a channel present? Yes
Channel width: 8'

Ordinary High Water Mark Indicators Present:			
Y	Inundated		
Y	Shelving	Y	Destruction of vegetation
Y	Water marks / stained leaves	Y	Exposed cobble / bedrock
Y	Drift lines	Y	Litter/debris present
	Sediment deposits		Recent bank erosion

Comments/Notes:

SKETCH OF CHANNEL CROSS-SECTION



WATERS OF THE US DETERMINATION

OHWM Present? Y
Hydrophytic Vegetation? Y
Wetland Hydrology? Y

Is this feature a potential Waters of the US? Yes

Comments/Notes:

DATA FORM - ROUTINE WETLAND DETERMINATION

Project ID: 900 & 930 Canby Rd, Redding
Client:
Investigator: Tim Nosal
Do normal circumstances exist on the site? Yes
Is it an atypical situation? No
Is the area a potential problem area? No

Date: February 7, 2022
State: CA
County: Shasta
Township, Range, Section: T32N R4W SE1/4 Sec30 MDBM
Plant Community: Oak Woodland
Sample Plot: 1a Seasonal Wetland 1

VEGETATION

Tree stratum	% Cover	Dominant?	Indicator status
Salix	20	Y	
Quercus	5		

Shrub stratum	% Cover	Dominant?	Indicator status

Hebaceous stratum	% Cover	Dominant?	Indicator status
Rumex crispus	5		FACW
Festuca per	20	Y	FAC*
Un Id grass	20	Y	-
Cyperus	5		FACW

Percent of dominant species that are OBL, FACW, or FAC (excluding FAC-): 2 of 3 = 67 %

Comments:

HYDROLOGY

Depth of surface water: -
Depth to free water in pit: -
Depth to saturated soil: -

Primary Indicators:		Secondary Indicators:	
	Inundated	✓	Oxidized rhizosphere in upper 12 in.
	Saturated in upper 12 in.		
	Water marks	✓	Water-stained leaves
	Drift lines		Local soil survey data
	Sediment deposits		FAC neutral test
✓	Drainage patterns in wetlands		Other

Comments:

SOILS

Mapped Soil Unit: NeD: Newtown Gravelly Loam, 15 to 30 % Slopes
Taxonomy: Ultic Haploxeralfs
Matches Profile? Yes
Drainage Class: Well drained

Depth	Matrix Color	Mottle Color	Mottle Abundance, Size, Contrast	Soil Texture
0-3	10YR 4/4	-	-	Sandy-silty-clayey Loam
3-12	10YR 3/3	2.5YR 4/8	Common	Silty-clay-Loam

	Histol		Reducing conditions (test)	✓	Gleyed
	Histic epipedon		High organic content surface layer		Organic streaking
	Sulfidic odor	✓	Redox concentrations (w/in 10")		Organic pan
✓	Probable aquic moisture regime		Concretions (w/in 3", >2mm)	No	On hydric soils list

Comments:

WETLAND DETERMINATION

Hydrophytic Vegetation? Y
Hydric Soils? Y
Wetland Hydrology? Y

Is this sample plot within a wetland? Yes

Comments:

DATA FORM - ROUTINE WETLAND DETERMINATION

Project ID: 900 & 930 Canby Road, Redding
Client:
Investigator: Tim Nosal
Do normal circumstances exist on the site? Yes
Is it an atypical situation? No
Is the area a potential problem area? No

Date: February 7, 2022
State: CA
County: Shasta
Township, Range, Section: T32N R4W SE1/4 Sec 30 MDBM
Plant Community: Annual Grassland
Sample Plot: 1b upland

VEGETATION

Tree stratum	% Cover	Dominant?	Indicator status

Shrub stratum	% Cover	Dominant?	Indicator status

Hebaceous stratum	% Cover	Dominant?	Indicator status
Festuca per	50	Y	FAC+
Hypochaeris	5		–
Lythrum	<5		FACW
Juncus bufo	5		FACW+
Rumex crispus	5		FACW
Verbascum blat	5		FACW

Percent of dominant species that are OBL, FACW, or FAC (excluding FAC-): ____ of ____ = ____%

Comments:

HYDROLOGY

Depth of surface water: –
Depth to free water in pit: –
Depth to saturated soil: –

Primary Indicators:		Secondary Indicators:	
	Inundated		Oxidized rhizosphere in upper 12 in.
	Saturated in upper 12 in.		
✓	Water marks		Water-stained leaves
	Drift lines		Local soil survey data
✓	Sediment deposits	✓	FAC neutral test
	Drainage patterns in wetlands		Other Veg destruction

Comments:

SOILS

Mapped Soil Unit: CfA Churn Gravelly Loam, deep, 0 to 3 % slope
Taxonomy: Ultic Haploxeralfs
Matches Profile? Yes
Drainage Class: well drained

Depth	Matrix Color	Mottle Color	Mottle Abundance, Size, Contrast	Soil Texture
0-6	7.5YR 4/4	None	None	Sandy-silty loam
6+	very rocky			

	Histol		Reducing conditions (test)		Gleyed
	Histic epipedon		High organic content surface layer		Organic streaking
	Sulfidic odor		Redox concentrations (w/in 10")		Organic pan
	Probable aquic moisture regime		Concretions (w/in 3", >2mm)	No	On hydric soils list

Comments: Not a wetland soil

WETLAND DETERMINATION

Hydrophytic Vegetation? Y
Hydric Soils? N
Wetland Hydrology? Y

Is this sample plot within a wetland? No

Comments:

DATA FORM - ROUTINE WETLAND DETERMINATION

Project ID: 900 & 930 Carby Road, Redding
Client:
Investigator: Tim Nosal
Do normal circumstances exist on the site? Yes
Is it an atypical situation? No
Is the area a potential problem area? No

Date: February 7, 2022
State: CA
County: Shasta
Township, Range, Section: T32N R4W SE1/4 Sec30 MDBM
Plant Community: Annual Grassland
Sample Plot: 2a Seasonal Wetland 2

VEGETATION

Tree stratum	% Cover	Dominant?	Indicator status
Salix	10		

Shrub stratum	% Cover	Dominant?	Indicator status
Rubus arm	15		

Hebaceous stratum	% Cover	Dominant?	Indicator status
Festuca per	60	Y	FAC*
Rumex cr	5		FACW
Cyperus			FACW
Juncus			FACW

Percent of dominant species that are OBL, FACW, or FAC (excluding FAC-): 1 of 1 = 100 %

Comments:

HYDROLOGY

Depth of surface water:
Depth to free water in pit:
Depth to saturated soil: 10"

Primary Indicators:		Secondary Indicators:	
	Inundated		Oxidized rhizosphere in upper 12 in.
	Saturated in upper 12 in.		
✓	Water marks	✓	Water-stained leaves
✓	Drift lines		Local soil survey data
✓	Sediment deposits		FAC neutral test
✓	Drainage patterns in wetlands		Other

Comments:

SOILS

Mapped Soil Unit: CfA: Churn Gravelly Loam, deep, 0 to 3% slopes
Taxonomy: Ultic Haploxeralfs
Matches Profile? Yes
Drainage Class: Well drained

Depth	Matrix Color	Mottle Color	Mottle Abundance, Size, Contrast	Soil Texture
0-4	Gley 1 3/10y	-		Sandy-Clay-Loam
4-18	5YR 4/3			Sandy-Clay-Loam

	Histol		Reducing conditions (test)	✓	Gleyed
	Histic epipedon		High organic content surface layer		Organic streaking
	Sulfidic odor		Redox concentrations (w/in 10")		Organic pan
	Probable aquic moisture regime		Concretions (w/in 3", >2mm)	No	On hydric soils list

Comments:

WETLAND DETERMINATION

Hydrophytic Vegetation? ✓
Hydric Soils? ✓
Wetland Hydrology? ✓

Is this sample plot within a wetland? Yes

Comments:

DATA FORM - ROUTINE WETLAND DETERMINATION

Project ID: 900 & 930 Canby Road, Redding
Client:
Investigator: Tim Nosal
Do normal circumstances exist on the site? Yes
Is it an atypical situation? No
Is the area a potential problem area? No

Date: February 7, 2022
State: CA
County: Shasta
Township, Range, Section: T32N R4W SE1/4 Sec30 MDBM
Plant Community: Oak Woodland
Sample Plot: 2b Upland

VEGETATION

Tree stratum	% Cover	Dominant?	Indicator status

Shrub stratum	% Cover	Dominant?	Indicator status
Rubus arm	100		FACW*

Hebaceous stratum	% Cover	Dominant?	Indicator status

Percent of dominant species that are OBL, FACW, or FAC (excluding FAC-): 1 of 1 = 100 %

Comments:

HYDROLOGY

Depth of surface water:
Depth to free water in pit:
Depth to saturated soil:

Primary Indicators:		Secondary Indicators:	
	Inundated		Oxidized rhizosphere in upper 12 in.
	Saturated in upper 12 in.		
	Water marks		Water-stained leaves
	Drift lines		Local soil survey data
	Sediment deposits		FAC neutral test
	Drainage patterns in wetlands		Other

Comments:

SOILS

Mapped Soil Unit: CfA: Churn Gravelly Loam, deep, 0 to 3 % Slopes
Taxonomy: Ultic Haploxeralfs
Matches Profile? Yes
Drainage Class: Well drained

Depth	Matrix Color	Mottle Color	Mottle Abundance, Size, Contrast	Soil Texture
0-12	7.5 YR 4/4	–	–	Sandy silty loam

	Histol		Reducing conditions (test)		Gleyed
	Histic epipedon		High organic content surface layer		Organic streaking
	Sulfidic odor		Redox concentrations (w/in 10")		Organic pan
	Probable aquic moisture regime		Concretions (w/in 3", >2mm)	No	On hydric soils list

Comments: Sandy soil, well drained

WETLAND DETERMINATION

Hydrophytic Vegetation? Y
Hydric Soils? NO
Wetland Hydrology? No

Is this sample plot within a wetland? NO

Comments:

DATA FORM - ROUTINE WETLAND DETERMINATION

Project ID: ______
Client: ______
Investigator: Tim Nosal
Do normal circumstances exist on the site? ______
Is it an atypical situation? ______
Is the area a potential problem area? ______

Date: ______
State: CA
County: ______
Township, Range, Section: ______
Plant Community: ______
Sample Plot: ______

VEGETATION

Tree stratum	% Cover	Domi-nant?	Indicator status		Hebaceous stratum	% Cover	Domi-nant?	Indicator status
Shrub stratum	% Cover	Domi-nant?	Indicator status					

Percent of dominant species that are OBL, FACW, or FAC (excluding FAC-): ______ of ______ = ______ %

Comments:

HYDROLOGY

Depth of surface water: ______
Depth to free water in pit: ______
Depth to saturated soil: ______

Primary Indicators:		Secondary Indicators:	
	Inundated		Oxidized rhizosphere in upper 12 in.
	Saturated in upper 12 in.		
	Water marks		Water-stained leaves
	Drift lines		Local soil survey data
	Sediment deposits		FAC neutral test
	Drainage patterns in wetlands		Other

Comments:

SOILS

Mapped Soil Unit: ______
Taxonomy: ______
Matches Profile?
Drainage Class: ______

Depth	Matrix Color	Mottle Color	Mottle Abundance, Size, Contrast	Soil Texture

______ Histol
______ Histic epipedon
______ Sulfidic odor
______ Probable aquic moisture regime
______ Reducing conditions (test)
______ High organic content surface layer
______ Redox concentrations (w/in 10")
______ Concretions (w/in 3", >2mm)
______ Gleyed
______ Organic streaking
______ Organic pan
______ On hydric soils list

Comments:

WETLAND DETERMINATION

Hydrophytic Vegetation? ______
Hydric Soils? ______
Wetland Hydrology? ______

Is this sample plot within a wetland? ______

Comments:

8.0 APPENDIX B – PHOTOS FROM FIELD DELINEATION

























Attachment D

Canby Apartments Entitlement Storm Drainage Analysis

CANBY APARTMENTS

APN: 117-200-005/117-200-006
REDDING, CA

ENTITLEMENT STORM DRAINAGE ANALYSIS

Prepared by

SHARRAH DUNLAP SAWYER, INC.
320 HARTNELL AVE.
REDDING CA, 96002
PHONE: 530-221-1792
FAX: 530-221-8369
WWW.SDSENGINEERING.COM

This report was written by or under the direct supervision of:

Ian T. Stripling, P.E.
Civil Engineer

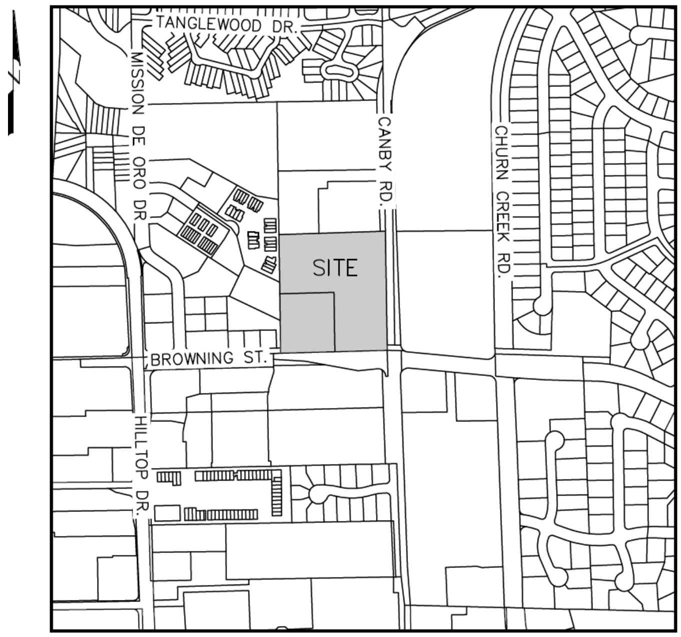
9/19/23
Date

REGISTERED PROFESSIONAL ENGINEER
IAN T. STRIPLING
No. 70840
EXP. 6/30/25
CIVIL
STATE OF CALIFORNIA

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Canby Apartments project is a proposed multifamily residential campus. The site is made up of two Parcels (APN 117-200-005 & 117-200-006) and is located northeast of the Canby Road and Browning Street intersection. The following report provides a preliminary analysis to show that the Canby Apartments project can manage the storm water runoff in a way that maintains or reduces pre-project runoff volumes in the post-project condition as required by the City of Redding.



VICINITY MAP

DESIGN CRITERIA

To meet City Council Policy 1806, and City of Redding Engineering Division requirements for protection of floodplains and downstream drainage concerns, the design is required to maintain or reduce pre-project peak flows for the 10-, 25-, and 100-year design storm events. This report compares the pre-project condition, when the lot was undeveloped, against the post-project condition when construction is complete. To meet these requirements, the post-project peak runoff flows must be equal to, or less than, the pre-project peak runoff flows.

The project consists of two drainage basins, the largest of which is less than 10 acres. Per the City of Redding Construction Standards (CORCS) 200.00, the rational method shall be used to calculate, route, and compare the runoff for the project.

Per the CORCS, a 100-year design storm shall be used to size the detention basin to ensure that the project complies with City Council Policy 1806 and the City of Redding Engineering Division requirements.

The Intensity-Depth-Frequency curve used for this location was generated within the City of Redding FLOW program. See the *City of Redding HEC-1 Processor Documentation (January 16, 2006)* for details. The hydrologic soil groups used in this report were taken from the *USDA NRCS Web Soil Survey of the Shasta County Area.* See Appendix A for site specific details.

PRE-PROJECT CONDITION

The project is located northeast of the Canby Road and Browning Street intersection. The pre-project condition consists of a vacant lot with natural grass vegetated ground cover and few trees. The site receives run on from the developed area to the west.

In the pre-project condition, the site includes two drainage basins as shown in the Pre-Project Basin Map in Appendix 'B'. Basin PRE1 is 7.7 acres and consists of the northern portion of the site. This area is tributary to the two northeastern culverts. Basin PRE2 is 2.0 acres and consists of the southern portion of the site. This area is tributary to the existing southeastern storm drain system.

Pre-project 'C' values have been derived from Table 819.2A from the Caltrans Highway Design Manual (HDM). See Appendix 'B' for the Pre-Project Basin Map, pre-project basin data and the pre-project calculations.

POST-PROJECT CONDITION

In the post-project condition, the site includes two drainage basins as shown in the Post-Project Basin Map in Appendix 'C'. Basin POST1 is 6.7 acres and includes the portion of the development that is tributary to the detention basin. Basin UNDET1 is 3.1 acres and includes area that is not tributary to the detention basin (undetained).

Post-project 'C' values have been derived from Table 819.2B from the Caltrans Highway Design Manual (HDM). See Appendix 'C' for the Post-Project Basin Map, post-project basin data and the post-project calculations.

Detention Basin

The proposed detention basin is an above ground detention basin with 3:1 slopes located in the northeastern portion of the site. The detention basin outlet structure is an area drain with two openings and a spillway with a teepee grate. See the table below containing the details, pre-project, and post-project flows for the site and the proposed detention basin.

Per the City of Redding's MS4 requirements, the 2-year peak flow rate must not exceed pre-project flow rates in the post-project condition. The Drainage Summary Table below shows that the peak flow rate in the 2-year storm has not increased.

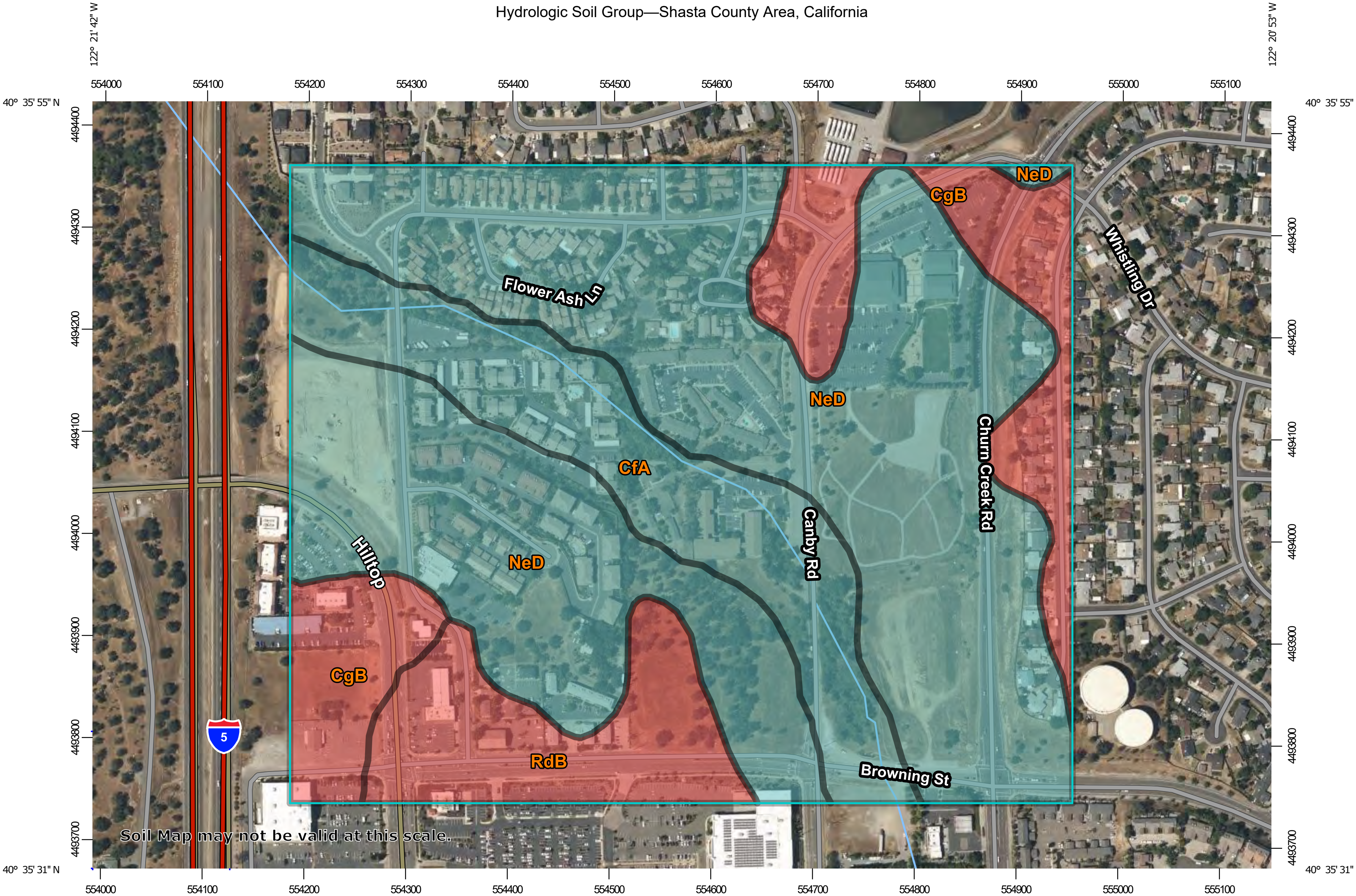
Canby Apartments Detention Basin: Drainage Summary				
Top elevation: 607.00 Bottom elevation: 601.00 100-year WSE: 605.35		Bottom Opening: 8.5" Diameter Circle Invert: 601.00		2nd Opening: 11in. x 7in. Weir Invert: 603.50
	Pre-Project ($Q_{PRE1+PRE2}$)	Future-Undetained (Q_{UNDET})	Post-Detained (Q_{OUT})	Post-Project (Q_{OUT} + Q_{UNDET})
2-year	**6.8**	4.2	2.5 cfs	**6.7**
10-year	**9.5**	5.7	3.4 cfs	**9.1**
25-year	**12.7**	7.4	4.8 cfs	**12.2**
100-year	**19.0**	10.6	8.3 cfs	**18.9**

CONCLUSION

As described above, the project's storm drain system manages the storm water runoff in a way that maintains or reduces pre-project runoff volumes in the post-project condition. The proposed storm drain design complies with City Council Policy 1806, and City of Redding Engineering Division requirements for protection of floodplains and downstream drainage concerns.

APPENDIX A
SITE DETAILS

Hydrologic Soil Group—Shasta County Area, California



Map Scale: 1:5,300 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 250, 500, 1000, 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Shasta County Area, California
Survey Area Data: Version 18, Sep 2, 2022

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

Date(s) aerial images were photographed: May 8, 2019—Jun 21, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CfA	Churn gravelly loam, deep, 0 to 3 percent slopes	C	18.2	15.3%
CgB	Clough gravelly loam, 3 to 8 percent slopes	D	17.1	14.3%
NeD	Newtown gravelly loam, 15 to 30 percent slopes	C	72.8	61.1%
RdB	Redding gravelly loam, 0 to 15 percent slopes, moist, MLRA 17	D	11.2	9.4%
Totals for Area of Interest			**119.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Rainfall Intensity Equations For the Redding Area

Depth-Duration-Frequency Data (in inches)
Per The City of Redding HEC-1 Processor Documentation (January 16, 2006)

			Table 1a Redding 5 SSE 510 ft					Table 1b Shasta Dam 1075 ft				
Duration Days	Duration Minutes	Duration Hours	2 YR	5 YR	10 YR	25 YR	100 YR	2 YR	5 YR	10 YR	25 YR	100 YR
-	5	0.08	0.31	0.36	0.40	0.46	0.58	0.46	0.54	0.60	0.70	0.89
-	10	0.17	0.41	0.48	0.54	0.61	0.76	0.63	0.74	0.82	0.96	1.21
-	15	0.25	0.49	0.56	0.63	0.72	0.90	0.76	0.89	0.98	1.15	1.46
-	30	0.5	0.64	0.74	0.84	0.95	1.19	1.03	1.21	1.34	1.58	1.99
-	60	1	0.85	0.98	1.11	1.26	1.57	1.41	1.66	1.84	2.15	2.73
-	120	2	1.13	1.3	1.47	1.67	2.09	1.93	2.27	2.51	2.95	3.73
-	180	3	1.33	1.53	1.73	1.97	2.46	2.32	2.73	3.02	3.54	4.47
-	360	6	1.76	2.03	2.29	2.60	3.25	3.17	3.73	4.12	4.83	6.11
-	720	12	2.33	2.69	3.03	3.45	4.31	4.33	5.09	5.64	6.61	8.36
1	1440	24	3.08	3.56	4.01	4.56	5.71	5.93	6.96	7.71	9.03	11.43

Calculated Intensity-Duration-Frequency Data

Elev	620 ft					
Duration Days	Duration Minutes	Duration Hours	2 YR in/hr	10 YR in/hr	25 YR in/hr	100 YR in/hr
-	5	0.08	4.07	5.27	6.08	7.68
-	10	0.17	2.72	3.57	4.07	5.09
-	15	0.25	2.17	2.79	3.21	4.04
-	30	0.5	1.43	1.87	2.15	2.69
-	60	1	0.96	1.25	1.43	1.80
-	120	2	0.64	0.84	0.96	1.20
-	180	3	0.51	0.66	0.76	0.95
0.25	360	6	0.34	0.44	0.51	0.63
0.5	720	12	0.23	0.29	0.34	0.42
1	1440	24	0.15	0.20	0.23	0.28

Intensity (in/hr)=IF(C26<=1075,IF(C26>=425,((C26-425)/(1075-425))*((G8/C8)-(D8/C8))+(D8/C8),"ERROR"),"ERROR")			
C26=Input Elevation	C8=Duration in Hours	D8=Inches at Redding 5 SSE	G8=inches at Shasta Dam

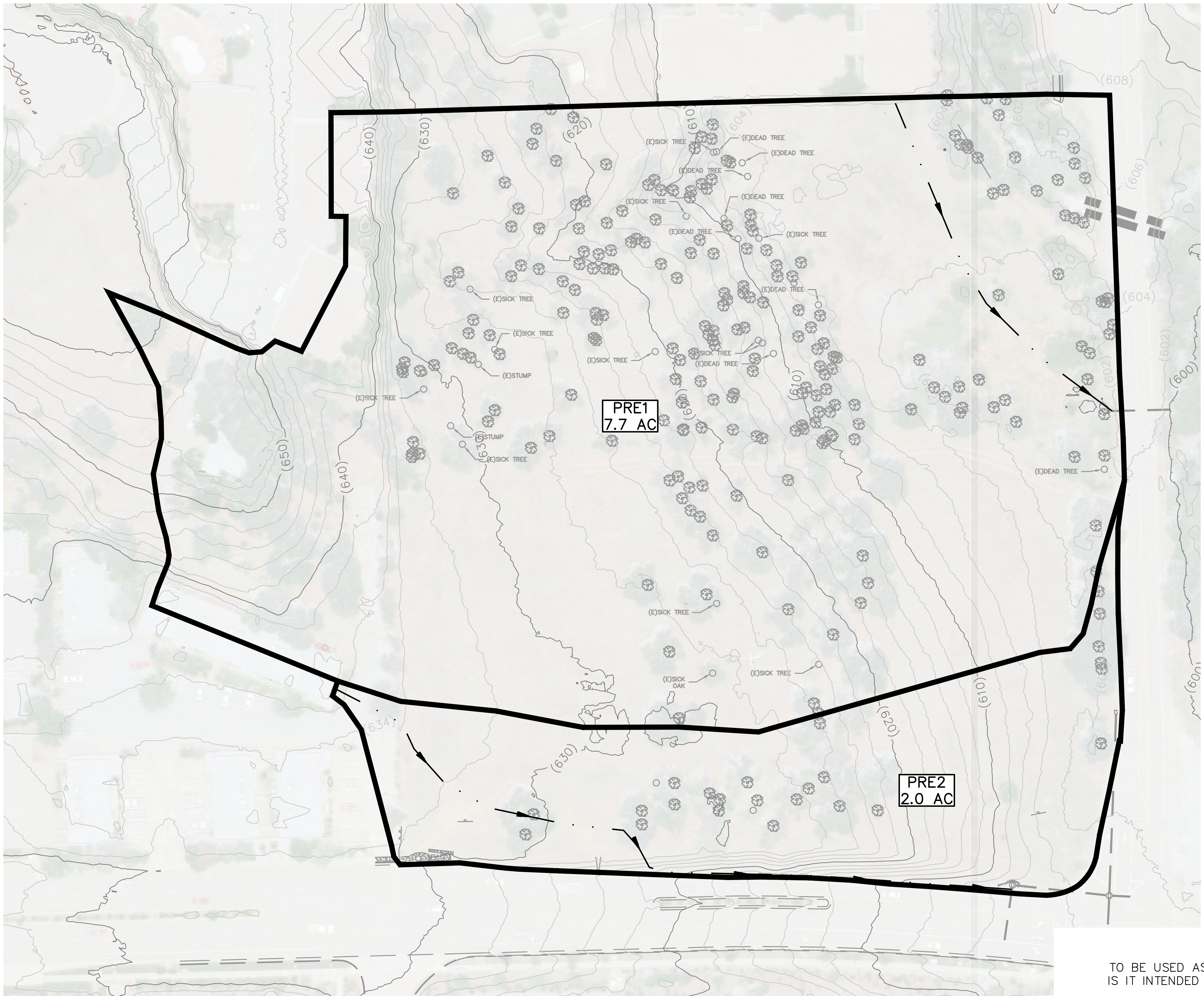
Intensity Equations

Intensity Equation: $i=FCT*t^{PWR}$
t=Time in **Minutes**

	FCT Value	PWR Value
2 YR	10.39	-0.58
10 YR	13.51	-0.58
25 YR	15.50	-0.58
100 YR	19.48	-0.58

FCT=ROUND(EXP(INDEX(LINEST(LN(<Intensity (y) Values>),LN(<Duration (x) Values>)),1,2)),2)
PWR=ROUND(INDEX(LINEST(LN(<Intensity (y) Values>),LN(<IDuration (x) Values>)),1),2)

APPENDIX B
PRE-PROJECT CONDITION



80 0 40 80

1 INCH = 80 FEET

PRE–PROJECT BASIN MAP

CANBY APARTMENTS

CHURN CREEK WATERSHED

BY

SHARRAH DUNLAP SAWYER, INC.

Civil Engineering • Land Planning • Surveying & Mapping
Landscape Architecture • Presentation Graphics

320 Hartnell Avenue, Redding, CA 96002
530.221.1792 voice • info@sdsengineering.com

TO BE USED AS A VISUAL AID ONLY. LINEWORK DOES NOT REPRESENT, NOR IS IT INTENDED TO REPLACE SURVEY OR RECORDED PROPERTY INFORMATION.

DATE: MARCH, 2023 SCALE: 1"=80' SHEET 1 OF 1

RTT "P:\proj\p\22116\Dwg\22116det-ent.dwg JOB#:22.0116

Stormwater Runoff Coefficient for Undeveloped Areas

Calculate composite runoff coefficient using the formula:

$$C\ ave = \frac{A_1{*}C_1 + A_2{*}C_2 + A_3{*}C_3 + A_4{*}C_4 + A_5{*}C_5}{A_T}$$

C-values obtained from Table 819.2A (Caltrans Highway Design Manual)		"C" values		
Surface Type		10-yr	25-yr	100-yr
Relief	7% average fall across sub-basin	0.16		
Soil Infiltration	28% Type 'D' / 72% Type 'C' Gravelly Loam	0.10		
Vegetal Cover	Grassland with Few Trees	0.08		
Surface Storage	Low	0.08	10-yr x 1.1	10-yr x 1.25
		0.42	0.46	0.53

Stormwater Runoff Calculation

Basin: PRE1

Calculate composite post-development runoff coefficient using formula:

$$C\ ave = \frac{A_1*C_1 + A_2*C_2 + A_3*C_3 + A_4*C_4 + A_5*C_5}{A_T}$$

C-values obtained using Table 819.2B (Caltrans Highway Design Manual)			"C" values		
Surface Type	Areas	%	10-yr	25-yr	100-yr
Undeveloped Area		95.0%	0.42	0.46	0.53
Impervious Area		5.0%	0.90	0.99	1.00
Total Basin Area =	7.7 ac	100.0%	0.44	0.49	0.55

Time of Concentration (Overland) i = FCT * (Tc) ^ PWR $Tco = (0.66\ L^{0.5}\ n^{0.52}) / (S^{0.31}\ i^{0.38})$

COR Hydro Manual pg. C-14	Estimated	Calculated		
Tco_2 = 28.6 min	i_2 = 1.49 in/hr	1.49 in/hr	L = 300 ft	Length of Flowpath
Tco_{10} = 25.2 min	i_{10} = 2.08 in/hr	2.08 in/hr	S = 0.010 ft/ft	Average Slope of Flowpath
Tco_{25} = 23.5 min	i_{25} = 2.48 in/hr	2.48 in/hr	n = 0.50	v trees/natural grass, Table C-9
Tco_{100} = 21.0 min	i_{100} = 3.33 in/hr	3.33 in/hr	Elev = 620 ft	Site Elevation
			Tco_{min} = 5.0 min	

Time of Concentration (Shallow Concentrated Flow) **N/A** Tcg = (L / V)

L = Length of Flowpath

Time of Concentration (Gutter Flow) **N/A** Tcg = (L / V)

L = Length of Flowpath

Time of Concentration (Pipes/Channels) **N/A** Tcs = (L / V)

L = Length of Flowpath

Total Rainfall Intensity i = FCT * (Tc) ^ PWR

Rainfall intensity equation compiled from data obtained from The City of Redding HEC-1 Processor Documentation (January 16, 2006).

ΣTc_2 = 28.6 min	ΣTc_{10} = 25.2 min	ΣTc_{25} = 23.5 min	ΣTc_{100} = 21.0 min
FCT = 10.39	FCT = 13.51	FCT = 15.50	FCT = 19.48
PWR = -0.58	PWR = -0.58	PWR = -0.58	PWR = -0.58
i_2 = 1.49 in/hr	i_{10} = 2.08 in/hr	i_{25} = 2.48 in/hr	i_{100} = 3.33 in/hr

Basin Runoff Flow Q = C * i * A

2-year	C_2= 0.44	i_2= 1.49 in/hr	A_2= 7.7 ac	**Q_2 = 5.0 cfs**
10-year	C_{10}= 0.44	i_{10}= 2.08 in/hr	A_{10}= 7.7 ac	**Q_{10} = 7.0 cfs**
25-year	C_{25}= 0.49	i_{25}= 2.48 in/hr	A_{25}= 7.7 ac	**Q_{25} = 9.4 cfs**
100-year	C_{100}= 0.55	i_{100}= 3.33 in/hr	A_{100}= 7.7 ac	**Q_{100} = 14.1 cfs**

Stormwater Runoff Calculation

Basin: PRE2

Calculate composite post-development runoff coefficient using formula:

$$C\ ave = \frac{A_1{*}C_1 + A_2{*}C_2 + A_3{*}C_3 + A_4{*}C_4 + A_5{*}C_5}{A_T}$$

C-values obtained using Table 819.2B (Caltrans Highway Design Manual)			"C" values		
Surface Type	Areas	%	10-yr	25-yr	100-yr
Undeveloped Area		96.0%	0.42	0.46	0.53
Impervious Area		4.0%	0.90	0.99	1.00
Total Basin Area =	2.0 ac	100.0%	0.44	0.48	0.54

Time of Concentration (Overland) i = FCT * (Tc) ^ PWR $Tco = (0.66\ L^{0.5}\ n^{0.52}) / (S^{0.31}\ i^{0.38})$

COR Hydro Manual pg. C-14

	Estimated	Calculated		
Tco_2 = 14.7 min	i_2 = 2.19 in/hr	2.19 in/hr	L = 300 ft	Length of Flowpath
Tco_{10} = 13.0 min	i_{10} = 3.05 in/hr	3.05 in/hr	S = 0.053 ft/ft	Average Slope of Flowpath
Tco_{25} = 12.1 min	i_{25} = 3.65 in/hr	3.65 in/hr	n = 0.50	v trees/natural grass, Table C-9
Tco_{100} = 10.8 min	i_{100} = 4.90 in/hr	4.90 in/hr	Elev = 620 ft	Site Elevation
			Tco_{min} = 5.0 min	

Time of Concentration (Shallow Concentrated Flow) **N/A** Tcg = (L / V)

L = Length of Flowpath

Time of Concentration (Gutter Flow) Tcg = (L / V)

COR Hydro Manual pg. C-15

$V_{gutter} = (1.12/n)\ S_x^{0.67}\ S^{0.5}\ T^{0.67}$	L = 300 ft	Length of Flowpath
V_{gutter} = 3.5 ft/s	S_{ave} = 0.055 ft/ft	Average Longitudinal Slope
Tc_{gutter} = L / (60 V) = 1.4 min	Sx = 0.02 ft/ft	Cross Slope
	T = 7 ft	Spread of Flow
	n = 0.020	Concrete Gutter

Time of Concentration (Pipes/Channels) **N/A** Tcs = (L / V)

L = Length of Flowpath

Total Rainfall Intensity i = FCT * (Tc) ^ PWR

Rainfall intensity equation compiled from data obtained from The City of Redding HEC-1 Processor Documentation (January 16, 2006).

ΣTc_2 = 16.1 min	ΣTc_{10} = 14.4 min	ΣTc_{25} = 13.5 min	ΣTc_{100} = 12.2 min
FCT = 10.39	FCT = 13.51	FCT = 15.50	FCT = 19.48
PWR = -0.58	PWR = -0.58	PWR = -0.58	PWR = -0.58
i_2 = 2.07 in/hr	i_{10} = 2.88 in/hr	i_{25} = 3.43 in/hr	i_{100} = 4.57 in/hr

Basin Runoff Flow Q = C * i * A

2-year	C_2= 0.44	i_2= 2.07 in/hr	A_2= 2.0 ac	**Q_2 = 1.8 cfs**
10-year	C_{10}= 0.44	i_{10}= 2.88 in/hr	A_{10}= 2.0 ac	**Q_{10} = 2.5 cfs**
25-year	C_{25}= 0.48	i_{25}= 3.43 in/hr	A_{25}= 2.0 ac	**Q_{25} = 3.3 cfs**
100-year	C_{100}= 0.54	i_{100}= 4.57 in/hr	A_{100}= 2.0 ac	**Q_{100} = 4.9 cfs**

APPENDIX C

POST-PROJECT CONDITION

POST-PROJECT BASIN MAP

CANBY APARTMENTS

CHURN CREEK WATERSHED

BY

SHARRAH DUNLAP SAWYER, INC.

Civil Engineering • Land Planning • Surveying & Mapping
Landscape Architecture • Presentation Graphics

320 Hartnell Avenue, Redding, CA 96002
530.221.1792 voice • info@sdsengineering.com

TO BE USED AS A VISUAL AID ONLY. LINEWORK DOES NOT REPRESENT, NOR IS IT INTENDED TO REPLACE SURVEY OR RECORDED PROPERTY INFORMATION.

DATE: MARCH, 2023 SCALE: 1"=80' SHEET 1 OF 1

RTT "P:\proj\p\22116\Dwg\22116det-ent.dwg JOB#:22.0116

Stormwater Runoff Calculation

Basin: POST1

Calculate composite post-development runoff coefficient using formula:

$$C\ ave = \frac{A_1{*}C_1 + A_2{*}C_2 + A_3{*}C_3 + A_4{*}C_4 + A_5{*}C_5}{A_T}$$

C-values obtained using Table 819.2B (Caltrans Highway Design Manual)

Surface Type	Areas	%	"C" values 10-yr	25-yr	100-yr
Undeveloped Area		11.3%	0.42	0.46	0.53
Impervious Area		3.2%	0.90	0.99	1.00
Developed Area: multi-units, attached		85.5%	0.65	0.72	0.81
		0.0%	0.00	0.00	0.00
		0.0%	0.00	0.00	0.00
Total Basin Area =	6.7 ac	100.0%	0.63	0.70	0.79

Time of Concentration (Overland) i = FCT * (Tc) ^ PWR $Tco = (0.66\ L^{0.5}\ n^{0.52}) / (S^{0.31}\ i^{0.38})$

COR Hydro Manual pg. C-14	Estimated	Calculated		
Tco_2 = 11.4 min	i_2 = 2.53 in/hr	2.53 in/hr	L = 300 ft	Length of Flowpath
Tco_{10} = 10.1 min	i_{10} = 3.53 in/hr	3.53 in/hr	S = 0.100 ft/ft	Average Slope of Flowpath
Tco_{25} = 9.4 min	i_{25} = 4.23 in/hr	4.23 in/hr	n = 0.50	v trees/natural grass, Table C-9
Tco_{100} = 8.4 min	i_{100} = 5.67 in/hr	5.67 in/hr	Elev = 620 ft	Site Elevation
			Tco_{min} = 5.0 min	

Time of Concentration (Shallow Concentrated Flow) Tcg = (L / V)

Hydraulic Design Series No. 2 pg. 2-24		
	L = 100 ft	Length of Flowpath
$V_{shallow} = \alpha\kappa S^{0.5}$	S_{ave} = 0.005 ft/ft	Average Longitudinal Slope
$V_{shallow}$ = 1.1 ft/s	κ = 0.491	Unpaved
$Tc_{Shallow}$ = L / (60 V) = 1.5 min	α = 33	Unit Conversion (33)

Time of Concentration (Gutter Flow) Tcg = (L / V)

COR Hydro Manual pg. C-15		
	L = 150 ft	Length of Flowpath
$V_{gutter} = (1.12/n)\ S_x^{0.67}\ S^{0.5}\ T^{0.67}$	S_{ave} = 0.005 ft/ft	Average Longitudinal Slope
V_{gutter} = 2.5 ft/s	Sx = 0.02 ft/ft	Cross Slope
Tc_{gutter} = L / (60 V) = 1.0 min	T = 25 ft	Spread of Flow
	n = 0.020	Concrete Gutter

Time of Concentration (Pipes/Channels) Tcs = (L / V)

COR Hydro Manual pg. C-15		
	L = 370 ft	Length of Flowpath
$V_{mann} = (1.49/n)\ R^{0.67}\ S^{0.5}$	S_{ave} = 0.030 ft/ft	Average Longitudinal Slope
R= A / P = 0.50 ft	n = 0.013	HDPE
V_{mann} = 12.5 ft/s	A = 1.5 sf	Area of Flow
Tc_{mann} = L / (60 V)= 0.5 min	P = 3 ft	Wetted Perimeter

Total Rainfall Intensity i = FCT * (Tc) ^ PWR

Rainfall intensity equation compiled from data obtained from The City of Redding HEC-1 Processor Documentation (January 16, 2006).

ΣTc_2 = 14.4 min	ΣTc_{10} = 13.1 min	ΣTc_{25} = 12.4 min	ΣTc_{100} = 11.4 min
FCT = 10.39	FCT = 13.51	FCT = 15.50	FCT = 19.48
PWR = -0.58	PWR = -0.58	PWR = -0.58	PWR = -0.58
i_2 = 2.21 in/hr	i_{10} = 3.04 in/hr	i_{25} = 3.60 in/hr	i_{100} = 4.75 in/hr

Basin Runoff Flow Q = C * i * A

2-year	C_2= 0.63	i_2= 2.21 in/hr	A_2= 6.7 ac	**Q_2 = 9.3 cfs**
10-year	C_{10}= 0.63	i_{10}= 3.04 in/hr	A_{10}= 6.7 ac	**Q_{10} = 12.8 cfs**
25-year	C_{25}= 0.70	i_{25}= 3.60 in/hr	A_{25}= 6.7 ac	**Q_{25} = 16.9 cfs**
100-year	C_{100}= 0.79	i_{100}= 4.75 in/hr	A_{100}= 6.7 ac	**Q_{100} = 25.1 cfs**

Stormwater Runoff Calculation

Basin: UNDET1

Calculate composite post-development runoff coefficient using formula:

$$C\ ave = \frac{A_1 * C_1 + A_2 * C_2 + A_3 * C_3 + A_4 * C_4 + A_5 * C_5}{A_T}$$

C-values obtained using Table 819.2B (Caltrans Highway Design Manual)

Surface Type	Areas	%	"C" values 10-yr	25-yr	100-yr
Undeveloped Area		40.0%	0.42	0.46	0.53
Impervious Area		31.4%	0.90	0.99	1.00
Developed Area: multi-units, attached		28.6%	0.65	0.72	0.81
		0.0%	0.00	0.00	0.00
		0.0%	0.00	0.00	0.00
Total Basin Area =	3.1 ac	100.0%	0.64	0.70	0.76

Time of Concentration (Overland) i = FCT * (Tc) ^ PWR $Tco = (0.66\ L^{0.5}\ n^{0.52}) / (S^{0.31}\ i^{0.38})$

COR Hydro Manual pg. C-14	Estimated	Calculated		
Tco_2 = 12.8 min	i_2 = 2.37 in/hr	2.37 in/hr	L = 300 ft	Length of Flowpath
Tco_{10} = 11.3 min	i_{10} = 3.31 in/hr	3.31 in/hr	S = 0.075 ft/ft	Average Slope of Flowpath
Tco_{25} = 10.5 min	i_{25} = 3.96 in/hr	3.96 in/hr	n = 0.50	v trees/natural grass, Table C-9
Tco_{100} = 9.4 min	i_{100} = 5.31 in/hr	5.31 in/hr	Elev = 620 ft	Site Elevation
			Tco_{min} = 5.0 min	

Time of Concentration (Shallow Concentrated Flow) Tcg = (L / V)

Hydraulic Design Series No. 2 pg. 2-24		
	L = 275 ft	Length of Flowpath
$V_{shallow} = \alpha \kappa S^{0.5}$	S_{ave} = 0.030 ft/ft	Average Longitudinal Slope
$V_{shallow}$ = 3.5 ft/s	κ = 0.619	Paved
$Tc_{Shallow}$ = L / (60 V) = 1.3 min	α = 33	Unit Conversion (33)

Time of Concentration (Gutter Flow) Tcg = (L / V)

COR Hydro Manual pg. C-15		
	L = 500 ft	Length of Flowpath
$V_{gutter} = (1.12/n)\ S_x^{0.67}\ S^{0.5}\ T^{0.67}$	S_{ave} = 0.050 ft/ft	Average Longitudinal Slope
V_{gutter} = 4.8 ft/s	Sx = 0.02 ft/ft	Cross Slope
Tc_{gutter} = L / (60 V) = 1.7 min	T = 12 ft	Spread of Flow
	n = 0.020	Concrete Gutter

Time of Concentration (Pipes/Channels) **N/A** Tcs = (L / V)

L = Length of Flowpath

Total Rainfall Intensity i = FCT * (Tc) ^ PWR

Rainfall intensity equation compiled from data obtained from The City of Redding HEC-1 Processor Documentation (January 16, 2006).

ΣTc_2 = 15.8 min	ΣTc_{10} = 14.3 min	ΣTc_{25} = 13.5 min	ΣTc_{100} = 12.4 min
FCT = 10.39	FCT = 13.51	FCT = 15.50	FCT = 19.48
PWR = -0.58	PWR = -0.58	PWR = -0.58	PWR = -0.58
i_2 = 2.10 in/hr	i_{10} = 2.89 in/hr	i_{25} = 3.43 in/hr	i_{100} = 4.52 in/hr

Basin Runoff Flow Q = C * i * A

2-year	C_2= 0.64	i_2= 2.10 in/hr	A_2= 3.1 ac	**Q_2 = 4.2 cfs**
10-year	C_{10}= 0.64	i_{10}= 2.89 in/hr	A_{10}= 3.1 ac	**Q_{10} = 5.7 cfs**
25-year	C_{25}= 0.70	i_{25}= 3.43 in/hr	A_{25}= 3.1 ac	**Q_{25} = 7.4 cfs**
100-year	C_{100}= 0.76	i_{100}= 4.52 in/hr	A_{100}= 3.1 ac	**Q_{100} = 10.6 cfs**

APPENDIX D

DETENTION CALCULATIONS

<u>Stage-Storage</u>

Canby Apartments Detention Basin

DETENTION BASIN - STAGE STORAGE TABLE					
ELEV	AREA (sq. ft.)	DEPTH (ft)	AVG END INC. VOL. (cu. ft.)	AVG END TOTAL VOL. (cu. ft.)	
601.00	4,241.00	0.00	0	0	
602.00	5,357.00	1.00	4,799	4,799	
603.00	6,530.00	1.00	5,944	10,743	
<u>603.50</u>	**<u>7,245.77</u>**	0.50	3,444	14,186	
604.00	7,760.00	0.50	3,751	17,938	
605.00	9,049.00	1.00	8,405	26,342	
<u>605.23</u>	**<u>9,424.39</u>**	0.23	2,124	28,467	
606.00	10,394.00	0.77	7,630	36,097	
607.00	11,797.00	1.00	11,096	47,192	

Detention Stage-Storage-Discharge Calculation

Canby Apartments Detention Basin

Top Orifice					
Cook 18" x 18" Area Drain w/ teepee grate				A =	2.250 sf
cl elev =	605.23 ft	inv elev =	605.23 ft	L =	5.00 ft

2nd Opening					
11in. x 7in. Weir w =	11.0 in	h =	7.0 in	A =	0.535 sf
cl elev =	603.79 ft	inv elev =	603.50 ft	L =	0.92 ft

1st Opening					
8.5" Diameter Circle		d =	8.50 in	A =	0.394 sf
cl elev =	601.35 ft	inv elev =	601.00 ft		

Orifice equation = C*A*(2g*deltaH)^0.5
C = 0.6
2g = 64.4

Weir equation = C*L*H^1.5
C = 3.2

	1st Opening		2nd Opening - NOT USED				Top Opening				
	cl depth	orifice outflow	wier depth	wier outflow	cl depth	orifice outflow	weir depth	weir outflow	cl depth	orifice outflow	Detention Discharge
Elev	ft	cfs	ft	cfs	ft	cfs	ft	cfs	ft	cfs	cfs
601.00											
602.00	0.65	1.5									1.5
603.00	1.65	2.4									2.4
603.50	2.15	2.8									2.8
604.00	2.65	3.1	0.50	1.0	0.21	1.2					4.1
605.00	3.65	3.6	1.50	5.4	1.21	2.8					6.4
605.23	3.88	3.7	1.73	6.7	1.44	3.1					6.8
606.00	4.65	4.1	2.50	11.6	2.21	3.8	0.8	10.80	0.77	9.50	17.4
607.00	5.65	4.5	3.50	19.2	3.21	4.6	1.8	37.70	1.77	14.40	23.5

** Note: Per Urban Drainage Design Manual Publication No. FHWA-NHI-01-021 August 2001 "*The Flow Condition, orifice or weir, producing the lowest discharge for a given stage defines the controlling relationship.*"

Area Drain Length & Area Calc's

Cook 18" x 18" Area Drain
W/ Teepee Grate

Length of Box (Length of Bars) (L)=	18.000 inch
Width of Box (Length of Rods) (W)=	18.000 inch
Number of Rods (including end bars) (R)=	8
Number of Bearing Bars (B)=	8
Rod and End Bar Width (R_W)=	0.375 inch
Bar Width (B_W)=	0.375 inch
Length=[2L+2W]-[2(B_W*B)+2(R_W*R)]	
Total Perimeter Length=	60.000 inch
	5.00 ft
Area=[L*W]	
Total Area=	324.00 sq in
	2.25 sq ft

Detention Stage-Storage-Discharge Summary

Canby Apartments Detention Basin

Stage (ft)	Vol_{Total} (ft^3)	Q_{out} (cfs)
601.00	0	0.0
602.00	4,799	1.5
603.00	10,743	2.4
603.50	14,186	2.8
604.00	17,938	4.1
605.00	26,342	6.4
605.23	28,467	6.8
606.00	36,097	17.4
607.00	47,192	23.5

Underground Detention?	No

Pre-project Flow = PRE1+PRE2
Undetained Flow = UNDET

2-Year

Pre-project Flow = 6.8 cfs
Undetained Flow = 4.2 cfs
Detained Flow= 2.5 cfs
Post Peak Flow = 6.7 cfs
Time of Peak Flow = 12.25 hrs
Max Stage = 603.18 ft

10-Year

Pre-project Flow = 9.5 cfs
Undetained Flow= 5.7 cfs
Detained Flow= 3.4 cfs
Post Peak Flow = 9.1 cfs
Time of Peak Flow = 12.25 hrs
Max Stage = 603.73 ft

25-Year

Pre-project Flow = 12.7 cfs
Undetained Flow= 7.4 cfs
Detained Flow= 4.8 cfs
Post Peak Flow = 12.2 cfs
Time of Peak Flow = 12.17 hrs
Max Stage = 604.30 ft

100-Year

Pre-project Flow = 19.0 cfs
Undetained Flow= 10.6 cfs
Detained Flow= 8.3 cfs
Post Peak Flow = 18.9 cfs
Time of Peak Flow = 12.17 hrs
Max Stage = 605.35 ft

Detention Equations and Methodology

PI values are derived from the PI record from HEC-1. PI record values from HEC-1 are in 5-minute increments. Further information on how the PI record is calculated can be found the HEC-1 Flood Hydrograph Package User's Manual.

$i = PI \div 5\text{ min}$

$Qin = CiA$

$Vol_{in} = Q_{in}$ * time (5 min)

$Vol_{out} = Q_{out}$ (from the previous time increment) * time (5 min)

$\Delta Vol = Vol_{in} - Vol_{out}$

$Vol_{Total} = Vol_{Total}$ (from the previous time increment) + ΔVol

Peak Stage is calculated by using the total volume from the current time increment to linearly interpolate an elevation from the Stage-Storage table.

Avg Stage = Peak stage (from the previous time increment) + Peak stage (from the current time increment)

Q_{out} is calculated by using the average stage from the current time increment to interpolate a peak flow from the Stage-Storage table.

Detention Stage-Storage-Discharge Calculation

Canby Apartments Detention Basin

2-year

Detention and Basin Parameters

Total 24-hr rainfall= 3.64 in

Area = 6.7 ac
C = 0.63
Elev = 620

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
0	0.00	0.005	0.06	0.25	76.0	0.0	0.0	0.0	601.00	0	0.00
5	0.08	0.005	0.06	0.25	76.0	0.0	76.0	76.0	601.02	601.01	0.01
10	0.17	0.005	0.06	0.25	76.0	3.6	72.4	148.4	601.03	601.02	0.04
15	0.25	0.005	0.06	0.25	76.0	10.5	65.5	213.9	601.04	601.04	0.06
20	0.33	0.005	0.06	0.25	76.0	17.0	59.0	272.8	601.06	601.05	0.08
25	0.42	0.005	0.06	0.25	76.0	22.8	53.2	326.0	601.07	601.06	0.09
30	0.50	0.005	0.06	0.25	76.0	28.1	47.9	373.9	601.08	601.07	0.11
35	0.58	0.006	0.07	0.30	91.2	32.8	58.4	432.3	601.09	601.08	0.13
40	0.67	0.006	0.07	0.30	91.2	37.8	53.4	485.6	601.10	601.1	0.14
45	0.75	0.006	0.07	0.30	91.2	43.0	48.1	533.8	601.11	601.11	0.16
50	0.83	0.006	0.07	0.30	91.2	47.8	43.4	577.2	601.12	601.12	0.17
55	0.92	0.006	0.07	0.30	91.2	52.1	39.1	616.2	601.13	601.12	0.19
60	1.00	0.006	0.07	0.30	91.2	56.0	35.2	651.5	601.14	601.13	0.20
65	1.08	0.006	0.07	0.30	91.2	59.4	31.7	683.2	601.14	601.14	0.21
70	1.17	0.006	0.07	0.30	91.2	62.6	28.6	711.8	601.15	601.15	0.22
75	1.25	0.006	0.07	0.30	91.2	65.4	25.8	737.6	601.15	601.15	0.23
80	1.33	0.006	0.07	0.30	91.2	68.0	23.2	760.8	601.16	601.16	0.23
85	1.42	0.006	0.07	0.30	91.2	70.3	20.9	781.7	601.16	601.16	0.24
90	1.50	0.006	0.07	0.30	91.2	72.3	18.9	800.6	601.17	601.16	0.25
95	1.58	0.006	0.07	0.30	91.2	74.2	17.0	817.6	601.17	601.17	0.25
100	1.67	0.006	0.07	0.30	91.2	75.9	15.3	832.9	601.17	601.17	0.26
105	1.75	0.006	0.07	0.30	91.2	77.4	13.8	846.7	601.18	601.17	0.26
110	1.83	0.006	0.07	0.30	91.2	78.7	12.4	859.1	601.18	601.18	0.27
115	1.92	0.006	0.07	0.30	91.2	80.0	11.2	870.3	601.18	601.18	0.27
120	2.00	0.006	0.07	0.30	91.2	81.1	10.1	880.4	601.18	601.18	0.27
125	2.08	0.006	0.07	0.30	91.2	82.1	9.1	889.5	601.19	601.18	0.28
130	2.17	0.006	0.07	0.30	91.2	83.0	8.2	897.7	601.19	601.19	0.28
135	2.25	0.006	0.07	0.30	91.2	83.8	7.4	905.1	601.19	601.19	0.28
140	2.33	0.006	0.07	0.30	91.2	84.5	6.7	911.7	601.19	601.19	0.28
145	2.42	0.006	0.07	0.30	91.2	85.2	6.0	917.7	601.19	601.19	0.29
150	2.50	0.006	0.07	0.30	91.2	85.8	5.4	923.1	601.19	601.19	0.29
155	2.58	0.006	0.07	0.30	91.2	86.3	4.9	928.0	601.19	601.19	0.29
160	2.67	0.006	0.07	0.30	91.2	86.8	4.4	932.4	601.19	601.19	0.29
165	2.75	0.006	0.07	0.30	91.2	87.2	4.0	936.3	601.20	601.19	0.29
170	2.83	0.006	0.07	0.30	91.2	87.6	3.6	939.9	601.20	601.2	0.29
175	2.92	0.006	0.07	0.30	91.2	88.0	3.2	943.1	601.20	601.2	0.29
180	3.00	0.006	0.07	0.30	91.2	88.3	2.9	946.0	601.20	601.2	0.30
185	3.08	0.006	0.07	0.30	91.2	88.6	2.6	948.6	601.20	601.2	0.30
190	3.17	0.006	0.07	0.30	91.2	88.8	2.3	950.9	601.20	601.2	0.30
195	3.25	0.006	0.07	0.30	91.2	89.1	2.1	953.0	601.20	601.2	0.30
200	3.33	0.006	0.07	0.30	91.2	89.3	1.9	954.9	601.20	601.2	0.30
205	3.42	0.006	0.07	0.30	91.2	89.5	1.7	956.7	601.20	601.2	0.30
210	3.50	0.007	0.08	0.35	106.4	89.6	16.7	973.4	601.20	601.2	0.30
215	3.58	0.007	0.08	0.35	106.4	90.5	15.9	989.3	601.21	601.2	0.31

Input			Calculated						Interpolated		
Time (min)	**Time (hr)**	**PI (in)**	**i (in/hr)**	**Q_{in} (cfs)**	**Vol_{in} (ft^3)**	**Vol_{out} (ft^3)**	**ΔVol (ft^3)**	**Vol_{Total} (ft^3)**	**Peak Stage (ft)**	**Avg Stage (ft)**	**Q_{out} (cfs)**
220	3.67	0.007	0.08	0.35	106.4	92.0	14.3	1003.6	601.21	601.21	0.31
225	3.75	0.007	0.08	0.35	106.4	93.4	12.9	1016.6	601.21	601.21	0.32
230	3.83	0.007	0.08	0.35	106.4	94.7	11.7	1028.2	601.21	601.21	0.32
235	3.92	0.007	0.08	0.35	106.4	95.9	10.5	1038.7	601.22	601.22	0.32
240	4.00	0.007	0.08	0.35	106.4	96.9	9.5	1048.2	601.22	601.22	0.33
245	4.08	0.007	0.08	0.35	106.4	97.8	8.5	1056.7	601.22	601.22	0.33
250	4.17	0.007	0.08	0.35	106.4	98.7	7.7	1064.4	601.22	601.22	0.33
255	4.25	0.007	0.08	0.35	106.4	99.4	6.9	1071.3	601.22	601.22	0.33
260	4.33	0.007	0.08	0.35	106.4	100.1	6.2	1077.5	601.22	601.22	0.34
265	4.42	0.007	0.08	0.35	106.4	100.7	5.6	1083.2	601.23	601.23	0.34
270	4.50	0.007	0.08	0.35	106.4	101.3	5.1	1088.2	601.23	601.23	0.34
275	4.58	0.007	0.08	0.35	106.4	101.8	4.6	1092.8	601.23	601.23	0.34
280	4.67	0.007	0.08	0.35	106.4	102.3	4.1	1096.9	601.23	601.23	0.34
285	4.75	0.007	0.08	0.35	106.4	102.7	3.7	1100.6	601.23	601.23	0.34
290	4.83	0.007	0.08	0.35	106.4	103.0	3.3	1104.0	601.23	601.23	0.34
295	4.92	0.007	0.08	0.35	106.4	103.4	3.0	1107.0	601.23	601.23	0.35
300	5.00	0.007	0.08	0.35	106.4	103.7	2.7	1109.7	601.23	601.23	0.35
305	5.08	0.007	0.08	0.35	106.4	103.9	2.4	1112.1	601.23	601.23	0.35
310	5.17	0.007	0.08	0.35	106.4	104.2	2.2	1114.3	601.23	601.23	0.35
315	5.25	0.007	0.08	0.35	106.4	104.4	2.0	1116.3	601.23	601.23	0.35
320	5.33	0.008	0.10	0.41	121.6	104.6	17.0	1133.3	601.24	601.23	0.35
325	5.42	0.008	0.10	0.41	121.6	105.5	16.1	1149.4	601.24	601.24	0.36
330	5.50	0.008	0.10	0.41	121.6	107.0	14.5	1163.9	601.24	601.24	0.36
335	5.58	0.008	0.10	0.41	121.6	108.5	13.1	1177.0	601.25	601.24	0.37
340	5.67	0.008	0.10	0.41	121.6	109.8	11.8	1188.8	601.25	601.25	0.37
345	5.75	0.008	0.10	0.41	121.6	110.9	10.6	1199.5	601.25	601.25	0.37
350	5.83	0.008	0.10	0.41	121.6	112.0	9.6	1209.1	601.25	601.25	0.38
355	5.92	0.008	0.10	0.41	121.6	112.9	8.6	1217.7	601.25	601.25	0.38
360	6.00	0.008	0.10	0.41	121.6	113.8	7.8	1225.5	601.26	601.25	0.38
365	6.08	0.008	0.10	0.41	121.6	114.5	7.0	1232.5	601.26	601.26	0.38
370	6.17	0.008	0.10	0.41	121.6	115.2	6.3	1238.8	601.26	601.26	0.39
375	6.25	0.008	0.10	0.41	121.6	115.9	5.7	1244.5	601.26	601.26	0.39
380	6.33	0.008	0.10	0.41	121.6	116.4	5.1	1249.7	601.26	601.26	0.39
385	6.42	0.008	0.10	0.41	121.6	116.9	4.6	1254.3	601.26	601.26	0.39
390	6.50	0.008	0.10	0.41	121.6	117.4	4.2	1258.5	601.26	601.26	0.39
395	6.58	0.008	0.10	0.41	121.6	117.8	3.8	1262.2	601.26	601.26	0.39
400	6.67	0.009	0.11	0.46	136.8	118.2	18.6	1280.8	601.27	601.26	0.40
405	6.75	0.009	0.11	0.46	136.8	119.2	17.5	1298.3	601.27	601.27	0.40
410	6.83	0.009	0.11	0.46	136.8	120.9	15.8	1314.2	601.27	601.27	0.41
415	6.92	0.009	0.11	0.46	136.8	122.5	14.3	1328.4	601.28	601.28	0.41
420	7.00	0.009	0.11	0.46	136.8	123.9	12.9	1341.3	601.28	601.28	0.42
425	7.08	0.009	0.11	0.46	136.8	125.2	11.6	1352.9	601.28	601.28	0.42
430	7.17	0.009	0.11	0.46	136.8	126.3	10.4	1363.3	601.28	601.28	0.42
435	7.25	0.009	0.11	0.46	136.8	127.3	9.4	1372.7	601.29	601.29	0.43
440	7.33	0.009	0.11	0.46	136.8	128.3	8.5	1381.2	601.29	601.29	0.43
445	7.42	0.009	0.11	0.46	136.8	129.1	7.6	1388.9	601.29	601.29	0.43
450	7.50	0.009	0.11	0.46	136.8	129.9	6.9	1395.8	601.29	601.29	0.44
455	7.58	0.010	0.12	0.51	152.0	130.6	21.4	1417.2	601.30	601.29	0.44
460	7.67	0.010	0.12	0.51	152.0	131.9	20.1	1437.2	601.30	601.3	0.45
465	7.75	0.010	0.12	0.51	152.0	133.8	18.1	1455.4	601.30	601.3	0.45
470	7.83	0.010	0.12	0.51	152.0	135.6	16.3	1471.7	601.31	601.3	0.46
475	7.92	0.010	0.12	0.51	152.0	137.2	14.7	1486.4	601.31	601.31	0.46
480	8.00	0.010	0.12	0.51	152.0	138.7	13.3	1499.7	601.31	601.31	0.47

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
485	8.08	0.010	0.12	0.51	152.0	140.0	12.0	1511.6	601.31	601.31	0.47
490	8.17	0.010	0.12	0.51	152.0	141.2	10.8	1522.4	601.32	601.32	0.47
495	8.25	0.010	0.12	0.51	152.0	142.3	9.7	1532.1	601.32	601.32	0.48
500	8.33	0.011	0.13	0.56	167.2	143.2	23.9	1556.1	601.32	601.32	0.48
505	8.42	0.011	0.13	0.56	167.2	144.8	22.4	1578.4	601.33	601.33	0.49
510	8.50	0.011	0.13	0.56	167.2	147.0	20.2	1598.6	601.33	601.33	0.50
515	8.58	0.011	0.13	0.56	167.2	149.0	18.2	1616.8	601.34	601.34	0.50
520	8.67	0.011	0.13	0.56	167.2	150.8	16.4	1633.2	601.34	601.34	0.51
525	8.75	0.011	0.13	0.56	167.2	152.4	14.8	1648.0	601.34	601.34	0.51
530	8.83	0.012	0.14	0.61	182.3	153.8	28.5	1676.5	601.35	601.35	0.52
535	8.92	0.012	0.14	0.61	182.3	155.9	26.5	1703.0	601.35	601.35	0.53
540	9.00	0.012	0.14	0.61	182.3	158.4	23.9	1726.9	601.36	601.36	0.54
545	9.08	0.012	0.14	0.61	182.3	160.8	21.5	1748.4	601.36	601.36	0.54
550	9.17	0.012	0.14	0.61	182.3	162.9	19.4	1767.8	601.37	601.37	0.55
555	9.25	0.013	0.16	0.66	197.5	164.9	32.7	1800.5	601.38	601.37	0.56
560	9.33	0.013	0.16	0.66	197.5	167.3	30.2	1830.7	601.38	601.38	0.57
565	9.42	0.013	0.16	0.66	197.5	170.3	27.3	1858.0	601.39	601.38	0.58
570	9.50	0.013	0.16	0.66	197.5	172.9	24.6	1882.6	601.39	601.39	0.58
575	9.58	0.014	0.17	0.71	212.7	175.4	37.4	1920.0	601.40	601.4	0.59
580	9.67	0.014	0.17	0.71	212.7	178.3	34.5	1954.4	601.41	601.4	0.61
585	9.75	0.014	0.17	0.71	212.7	181.7	31.1	1985.5	601.41	601.41	0.62
590	9.83	0.014	0.17	0.71	212.7	184.7	28.0	2013.5	601.42	601.42	0.62
595	9.92	0.015	0.18	0.76	227.9	187.5	40.4	2054.0	601.43	601.42	0.64
600	10.00	0.015	0.18	0.76	227.9	190.7	37.2	2091.2	601.44	601.43	0.65
605	10.08	0.015	0.18	0.76	227.9	194.3	33.6	2124.8	601.44	601.44	0.66
610	10.17	0.016	0.19	0.81	243.1	197.7	45.5	2170.3	601.45	601.45	0.67
615	10.25	0.016	0.19	0.81	243.1	201.4	41.8	2212.0	601.46	601.46	0.68
620	10.33	0.017	0.20	0.86	258.3	205.5	52.9	2264.9	601.47	601.47	0.70
625	10.42	0.017	0.20	0.86	258.3	209.9	48.4	2313.3	601.48	601.48	0.72
630	10.50	0.018	0.22	0.91	273.5	214.6	58.9	2372.2	601.49	601.49	0.73
635	10.58	0.018	0.22	0.91	273.5	219.7	53.8	2426.0	601.51	601.5	0.75
640	10.67	0.019	0.23	0.96	288.7	225.0	63.8	2489.8	601.52	601.51	0.77
645	10.75	0.020	0.24	1.01	303.9	230.5	73.4	2563.2	601.53	601.53	0.79
650	10.83	0.021	0.25	1.06	319.1	236.9	82.2	2645.4	601.55	601.54	0.81
655	10.92	0.022	0.26	1.11	334.3	244.2	90.1	2735.5	601.57	601.56	0.84
660	11.00	0.023	0.28	1.16	349.5	252.3	97.2	2832.7	601.59	601.58	0.87
665	11.08	0.024	0.29	1.22	364.7	261.1	103.6	2936.4	601.61	601.6	0.90
670	11.17	0.025	0.30	1.27	379.9	270.5	109.4	3045.8	601.63	601.62	0.93
675	11.25	0.027	0.32	1.37	410.3	280.5	129.8	3175.6	601.66	601.65	0.97
680	11.33	0.029	0.35	1.47	440.7	291.7	149.0	3324.6	601.69	601.68	1.02
685	11.42	0.031	0.37	1.57	471.1	304.8	166.3	3490.9	601.73	601.71	1.07
690	11.50	0.034	0.41	1.72	516.7	319.5	197.1	3688.0	601.77	601.75	1.12
695	11.58	0.038	0.46	1.92	577.4	336.6	240.9	3928.8	601.82	601.79	1.19
700	11.67	0.044	0.53	2.23	668.6	357.1	311.5	4240.3	601.88	601.85	1.28
705	11.75	0.053	0.64	2.68	805.4	383.0	422.4	4662.7	601.97	601.93	1.39
710	11.83	0.068	0.82	3.44	1033.3	417.4	615.9	5278.6	602.08	602.03	1.52
715	11.92	0.114	1.37	5.77	1732.3	457.1	1275.2	6553.8	602.30	602.19	1.67
720	12.00	0.337	4.04	17.07	5120.9	500.8	4620.2	11174.0	603.06	602.68	2.11
725	12.08	0.083	1.00	4.20	1261.2	633.3	627.9	11801.9	603.15	603.11	2.49
730	12.17	0.059	0.71	2.99	896.5	746.0	150.6	11952.5	603.18	603.16	2.53
735	12.25	0.048	0.58	2.43	729.4	759.5	-30.1	11922.3	603.17	603.17	2.54
740	12.33	0.041	0.49	2.08	623.0	761.6	-138.6	11783.7	603.15	603.16	2.53
745	12.42	0.036	0.43	1.82	547.0	758.7	-211.7	11572.0	603.12	603.14	2.51

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
750	12.50	0.033	0.40	1.67	501.5	752.6	-251.1	11320.9	603.08	603.1	2.48
755	12.58	0.030	0.36	1.52	455.9	744.5	-288.7	11032.2	603.04	603.06	2.45
760	12.67	0.028	0.34	1.42	425.5	735.1	-309.6	10722.6	603.00	603.02	2.42
765	12.75	0.026	0.31	1.32	395.1	724.6	-329.6	10393.0	602.94	602.97	2.37
770	12.83	0.024	0.29	1.22	364.7	711.6	-346.9	10046.1	602.88	602.91	2.32
775	12.92	0.023	0.28	1.16	349.5	696.2	-346.7	9699.4	602.82	602.85	2.27
780	13.00	0.022	0.26	1.11	334.3	680.5	-346.2	9353.2	602.77	602.8	2.22
785	13.08	0.021	0.25	1.06	319.1	664.8	-345.6	9007.5	602.71	602.74	2.16
790	13.17	0.020	0.24	1.01	303.9	649.0	-345.1	8662.4	602.65	602.68	2.11
795	13.25	0.019	0.23	0.96	288.7	633.3	-344.6	8317.8	602.59	602.62	2.06
800	13.33	0.019	0.23	0.96	288.7	617.7	-329.0	7988.8	602.54	602.56	2.01
805	13.42	0.018	0.22	0.91	273.5	602.4	-328.9	7660.0	602.48	602.51	1.96
810	13.50	0.018	0.22	0.91	273.5	587.4	-313.9	7346.1	602.43	602.45	1.91
815	13.58	0.017	0.20	0.86	258.3	572.8	-314.5	7031.5	602.38	602.4	1.86
820	13.67	0.017	0.20	0.86	258.3	558.6	-300.2	6731.3	602.33	602.35	1.82
825	13.75	0.016	0.19	0.81	243.1	544.6	-301.5	6429.8	602.27	602.3	1.77
830	13.83	0.016	0.19	0.81	243.1	530.9	-287.8	6142.0	602.23	602.25	1.73
835	13.92	0.015	0.18	0.76	227.9	517.5	-289.6	5852.4	602.18	602.2	1.68
840	14.00	0.015	0.18	0.76	227.9	504.4	-276.5	5575.9	602.13	602.15	1.64
845	14.08	0.015	0.18	0.76	227.9	491.6	-263.6	5312.3	602.09	602.11	1.60
850	14.17	0.014	0.17	0.71	212.7	479.3	-266.6	5045.7	602.04	602.06	1.56
855	14.25	0.014	0.17	0.71	212.7	467.3	-254.5	4791.2	602.00	602.02	1.52
860	14.33	0.014	0.17	0.71	212.7	455.4	-242.6	4548.5	601.95	601.97	1.46
865	14.42	0.013	0.16	0.66	197.5	437.9	-240.3	4308.2	601.90	601.92	1.38
870	14.50	0.013	0.16	0.66	197.5	415.2	-217.7	4090.5	601.85	601.88	1.31
875	14.58	0.013	0.16	0.66	197.5	393.8	-196.2	3894.3	601.81	601.83	1.25
880	14.67	0.013	0.16	0.66	197.5	374.4	-176.8	3717.4	601.77	601.79	1.19
885	14.75	0.012	0.14	0.61	182.3	356.9	-174.5	3542.9	601.74	601.76	1.13
890	14.83	0.012	0.14	0.61	182.3	340.4	-158.1	3384.9	601.71	601.72	1.08
895	14.92	0.012	0.14	0.61	182.3	324.8	-142.5	3242.4	601.68	601.69	1.04
900	15.00	0.012	0.14	0.61	182.3	310.7	-128.4	3114.0	601.65	601.66	0.99
905	15.08	0.012	0.14	0.61	182.3	298.0	-115.7	2998.4	601.62	601.64	0.96
910	15.17	0.011	0.13	0.56	167.2	286.6	-119.4	2878.9	601.60	601.61	0.92
915	15.25	0.011	0.13	0.56	167.2	275.6	-108.4	2770.5	601.58	601.59	0.88
920	15.33	0.011	0.13	0.56	167.2	264.9	-97.7	2672.8	601.56	601.57	0.85
925	15.42	0.011	0.13	0.56	167.2	255.2	-88.1	2584.7	601.54	601.55	0.82
930	15.50	0.011	0.13	0.56	167.2	246.5	-79.3	2505.4	601.52	601.53	0.80
935	15.58	0.011	0.13	0.56	167.2	238.7	-71.5	2433.9	601.51	601.51	0.77
940	15.67	0.011	0.13	0.56	167.2	231.6	-64.4	2369.5	601.49	601.5	0.75
945	15.75	0.010	0.12	0.51	152.0	225.2	-73.2	2296.2	601.48	601.49	0.73
950	15.83	0.010	0.12	0.51	152.0	218.8	-66.8	2229.4	601.46	601.47	0.71
955	15.92	0.010	0.12	0.51	152.0	212.2	-60.2	2169.2	601.45	601.46	0.69
960	16.00	0.010	0.12	0.51	152.0	206.2	-54.3	2114.9	601.44	601.45	0.67
965	16.08	0.010	0.12	0.51	152.0	200.9	-48.9	2066.0	601.43	601.44	0.65
970	16.17	0.010	0.12	0.51	152.0	196.0	-44.1	2022.0	601.42	601.43	0.64
975	16.25	0.010	0.12	0.51	152.0	191.7	-39.7	1982.3	601.41	601.42	0.63
980	16.33	0.010	0.12	0.51	152.0	187.7	-35.8	1946.5	601.41	601.41	0.61
985	16.42	0.009	0.11	0.46	136.8	184.2	-47.4	1899.0	601.40	601.4	0.60
990	16.50	0.009	0.11	0.46	136.8	180.3	-43.5	1855.5	601.39	601.39	0.59
995	16.58	0.009	0.11	0.46	136.8	176.0	-39.3	1816.2	601.38	601.38	0.57
1000	16.67	0.009	0.11	0.46	136.8	172.1	-35.4	1780.8	601.37	601.37	0.56
1005	16.75	0.009	0.11	0.46	136.8	168.6	-31.9	1749.0	601.36	601.37	0.55
1010	16.83	0.009	0.11	0.46	136.8	165.5	-28.7	1720.2	601.36	601.36	0.54

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
1015	16.92	0.009	0.11	0.46	136.8	162.7	-25.9	1694.3	601.35	601.36	0.53
1020	17.00	0.009	0.11	0.46	136.8	160.1	-23.3	1671.0	601.35	601.35	0.53
1025	17.08	0.009	0.11	0.46	136.8	157.8	-21.0	1650.0	601.34	601.35	0.52
1030	17.17	0.009	0.11	0.46	136.8	155.7	-18.9	1631.0	601.34	601.34	0.51
1035	17.25	0.009	0.11	0.46	136.8	153.8	-17.1	1614.0	601.34	601.34	0.51
1040	17.33	0.009	0.11	0.46	136.8	152.1	-15.4	1598.6	601.33	601.33	0.50
1045	17.42	0.008	0.10	0.41	121.6	150.6	-29.1	1569.5	601.33	601.33	0.50
1050	17.50	0.008	0.10	0.41	121.6	148.5	-27.0	1542.6	601.32	601.32	0.49
1055	17.58	0.008	0.10	0.41	121.6	145.9	-24.3	1518.2	601.32	601.32	0.48
1060	17.67	0.008	0.10	0.41	121.6	143.5	-21.9	1496.3	601.31	601.31	0.47
1065	17.75	0.008	0.10	0.41	121.6	141.3	-19.8	1476.5	601.31	601.31	0.46
1070	17.83	0.008	0.10	0.41	121.6	139.4	-17.8	1458.7	601.30	601.31	0.46
1075	17.92	0.008	0.10	0.41	121.6	137.6	-16.1	1442.6	601.30	601.3	0.45
1080	18.00	0.008	0.10	0.41	121.6	136.0	-14.5	1428.2	601.30	601.3	0.45
1085	18.08	0.008	0.10	0.41	121.6	134.6	-13.0	1415.1	601.29	601.3	0.44
1090	18.17	0.008	0.10	0.41	121.6	133.3	-11.7	1403.4	601.29	601.29	0.44
1095	18.25	0.008	0.10	0.41	121.6	132.1	-10.6	1392.8	601.29	601.29	0.44
1100	18.33	0.008	0.10	0.41	121.6	131.1	-9.5	1383.3	601.29	601.29	0.43
1105	18.42	0.008	0.10	0.41	121.6	130.2	-8.6	1374.7	601.29	601.29	0.43
1110	18.50	0.008	0.10	0.41	121.6	129.3	-7.7	1366.9	601.28	601.29	0.43
1115	18.58	0.008	0.10	0.41	121.6	128.5	-7.0	1360.0	601.28	601.28	0.43
1120	18.67	0.007	0.08	0.35	106.4	127.9	-21.5	1338.5	601.28	601.28	0.42
1125	18.75	0.007	0.08	0.35	106.4	126.5	-20.1	1318.3	601.27	601.28	0.42
1130	18.83	0.007	0.08	0.35	106.4	124.6	-18.2	1300.1	601.27	601.27	0.41
1135	18.92	0.007	0.08	0.35	106.4	122.8	-16.4	1283.7	601.27	601.27	0.40
1140	19.00	0.007	0.08	0.35	106.4	121.1	-14.8	1269.0	601.26	601.27	0.40
1145	19.08	0.007	0.08	0.35	106.4	119.7	-13.3	1255.7	601.26	601.26	0.39
1150	19.17	0.007	0.08	0.35	106.4	118.4	-12.0	1243.7	601.26	601.26	0.39
1155	19.25	0.007	0.08	0.35	106.4	117.2	-10.8	1232.9	601.26	601.26	0.39
1160	19.33	0.007	0.08	0.35	106.4	116.1	-9.7	1223.1	601.25	601.26	0.38
1165	19.42	0.007	0.08	0.35	106.4	115.1	-8.8	1214.3	601.25	601.25	0.38
1170	19.50	0.007	0.08	0.35	106.4	114.3	-7.9	1206.4	601.25	601.25	0.38
1175	19.58	0.007	0.08	0.35	106.4	113.5	-7.1	1199.3	601.25	601.25	0.38
1180	19.67	0.007	0.08	0.35	106.4	112.8	-6.4	1192.9	601.25	601.25	0.37
1185	19.75	0.007	0.08	0.35	106.4	112.2	-5.8	1187.1	601.25	601.25	0.37
1190	19.83	0.007	0.08	0.35	106.4	111.6	-5.2	1181.9	601.25	601.25	0.37
1195	19.92	0.007	0.08	0.35	106.4	111.1	-4.7	1177.2	601.25	601.25	0.37
1200	20.00	0.007	0.08	0.35	106.4	110.6	-4.2	1172.9	601.24	601.24	0.37
1205	20.08	0.007	0.08	0.35	106.4	110.2	-3.8	1169.1	601.24	601.24	0.37
1210	20.17	0.007	0.08	0.35	106.4	109.8	-3.4	1165.7	601.24	601.24	0.36
1215	20.25	0.007	0.08	0.35	106.4	109.5	-3.1	1162.6	601.24	601.24	0.36
1220	20.33	0.007	0.08	0.35	106.4	109.2	-2.8	1159.8	601.24	601.24	0.36
1225	20.42	0.007	0.08	0.35	106.4	108.9	-2.5	1157.3	601.24	601.24	0.36
1230	20.50	0.007	0.08	0.35	106.4	108.6	-2.3	1155.0	601.24	601.24	0.36
1235	20.58	0.006	0.07	0.30	91.2	108.4	-17.2	1137.8	601.24	601.24	0.36
1240	20.67	0.006	0.07	0.30	91.2	107.5	-16.3	1121.5	601.23	601.24	0.35
1245	20.75	0.006	0.07	0.30	91.2	105.9	-14.7	1106.7	601.23	601.23	0.35
1250	20.83	0.006	0.07	0.30	91.2	104.5	-13.3	1093.4	601.23	601.23	0.34
1255	20.92	0.006	0.07	0.30	91.2	103.2	-12.0	1081.4	601.23	601.23	0.34
1260	21.00	0.006	0.07	0.30	91.2	102.0	-10.8	1070.6	601.22	601.22	0.34
1265	21.08	0.006	0.07	0.30	91.2	100.9	-9.7	1060.9	601.22	601.22	0.33
1270	21.17	0.006	0.07	0.30	91.2	99.9	-8.8	1052.1	601.22	601.22	0.33
1275	21.25	0.006	0.07	0.30	91.2	99.1	-7.9	1044.3	601.22	601.22	0.33

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
1280	21.33	0.006	0.07	0.30	91.2	98.3	-7.1	1037.1	601.22	601.22	0.33
1285	21.42	0.006	0.07	0.30	91.2	97.6	-6.4	1030.7	601.21	601.22	0.32
1290	21.50	0.006	0.07	0.30	91.2	97.0	-5.8	1024.9	601.21	601.21	0.32
1300	21.67	0.006	0.07	0.30	91.2	96.4	-5.2	1019.7	601.21	601.21	0.32
1305	21.75	0.006	0.07	0.30	91.2	95.9	-4.7	1015.0	601.21	601.21	0.32
1310	21.83	0.006	0.07	0.30	91.2	95.4	-4.2	1010.8	601.21	601.21	0.32
1315	21.92	0.006	0.07	0.30	91.2	95.0	-3.8	1007.0	601.21	601.21	0.32
1320	22.00	0.006	0.07	0.30	91.2	94.6	-3.4	1003.6	601.21	601.21	0.31
1325	22.08	0.006	0.07	0.30	91.2	94.3	-3.1	1000.5	601.21	601.21	0.31
1330	22.17	0.006	0.07	0.30	91.2	94.0	-2.8	997.7	601.21	601.21	0.31
1335	22.25	0.006	0.07	0.30	91.2	93.7	-2.5	995.2	601.21	601.21	0.31
1340	22.33	0.006	0.07	0.30	91.2	93.4	-2.3	992.9	601.21	601.21	0.31
1345	22.42	0.006	0.07	0.30	91.2	93.2	-2.0	990.9	601.21	601.21	0.31
1350	22.50	0.006	0.07	0.30	91.2	93.0	-1.8	989.1	601.21	601.21	0.31
1355	22.58	0.006	0.07	0.30	91.2	92.8	-1.7	987.4	601.21	601.21	0.31
1360	22.67	0.006	0.07	0.30	91.2	92.7	-1.5	985.9	601.21	601.21	0.31
1365	22.75	0.006	0.07	0.30	91.2	92.5	-1.3	984.6	601.21	601.21	0.31
1370	22.83	0.006	0.07	0.30	91.2	92.4	-1.2	983.3	601.20	601.21	0.31
1375	22.92	0.006	0.07	0.30	91.2	92.3	-1.1	982.3	601.20	601.2	0.31
1380	23.00	0.006	0.07	0.30	91.2	92.2	-1.0	981.3	601.20	601.2	0.31
1385	23.08	0.006	0.07	0.30	91.2	92.1	-0.9	980.4	601.20	601.2	0.31
1390	23.17	0.006	0.07	0.30	91.2	92.0	-0.8	979.6	601.20	601.2	0.31
1395	23.25	0.006	0.07	0.30	91.2	91.9	-0.7	978.9	601.20	601.2	0.31
1400	23.33	0.006	0.07	0.30	91.2	91.8	-0.6	978.2	601.20	601.2	0.31
1405	23.42	0.006	0.07	0.30	91.2	91.8	-0.6	977.6	601.20	601.2	0.31
1410	23.50	0.006	0.07	0.30	91.2	91.7	-0.5	977.1	601.20	601.2	0.31
1415	23.58	0.005	0.06	0.25	76.0	91.6	-15.7	961.4	601.20	601.2	0.30
1420	23.67	0.005	0.06	0.25	76.0	90.9	-14.9	946.5	601.20	601.2	0.30
1425	23.75	0.005	0.06	0.25	76.0	89.5	-13.5	933.1	601.19	601.2	0.29
1430	23.83	0.005	0.06	0.25	76.0	88.1	-12.1	920.9	601.19	601.19	0.29
1435	23.92	0.005	0.06	0.25	76.0	86.9	-10.9	910.0	601.19	601.19	0.29
1440	24.00	0.005	0.06	0.25	76.0	85.8	-9.9	900.1	601.19	601.19	0.28

Detention Stage-Storage-Discharge Calculation

Canby Apartments Detention Basin

10-year

Detention and Basin Parameters

Total 24-hr rainfall= 4.74 in

Area = 6.7 ac
C = 0.63
Elev = 620

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
0	0.00	0.007	0.08	0.35	106.4	0.0	0.0	0.0	601.00	0	0.00
5	0.08	0.007	0.08	0.35	106.4	0.0	106.4	106.4	601.02	601.01	0.02
10	0.17	0.007	0.08	0.35	106.4	5.0	101.4	207.8	601.04	601.03	0.05
15	0.25	0.007	0.08	0.35	106.4	14.7	91.6	299.4	601.06	601.05	0.08
20	0.33	0.007	0.08	0.35	106.4	23.8	82.6	382.0	601.08	601.07	0.11
25	0.42	0.007	0.08	0.35	106.4	31.9	74.4	456.4	601.10	601.09	0.13
30	0.50	0.007	0.08	0.35	106.4	39.3	67.1	523.5	601.11	601.1	0.15
35	0.58	0.007	0.08	0.35	106.4	45.9	60.4	583.9	601.12	601.12	0.17
40	0.67	0.007	0.08	0.35	106.4	51.9	54.5	638.3	601.13	601.13	0.19
45	0.75	0.007	0.08	0.35	106.4	57.3	49.1	687.4	601.14	601.14	0.21
50	0.83	0.007	0.08	0.35	106.4	62.2	44.2	731.6	601.15	601.15	0.22
55	0.92	0.007	0.08	0.35	106.4	66.5	39.8	771.5	601.16	601.16	0.23
60	1.00	0.007	0.08	0.35	106.4	70.5	35.9	807.4	601.17	601.16	0.25
65	1.08	0.007	0.08	0.35	106.4	74.0	32.3	839.7	601.17	601.17	0.26
70	1.17	0.007	0.08	0.35	106.4	77.2	29.1	868.9	601.18	601.18	0.27
75	1.25	0.007	0.08	0.35	106.4	80.1	26.3	895.1	601.19	601.18	0.28
80	1.33	0.007	0.08	0.35	106.4	82.7	23.7	918.8	601.19	601.19	0.28
85	1.42	0.007	0.08	0.35	106.4	85.0	21.3	940.1	601.20	601.19	0.29
90	1.50	0.008	0.10	0.41	121.6	87.2	34.4	974.5	601.20	601.2	0.30
95	1.58	0.008	0.10	0.41	121.6	89.8	31.8	1006.3	601.21	601.21	0.31
100	1.67	0.008	0.10	0.41	121.6	92.9	28.7	1035.0	601.22	601.21	0.32
105	1.75	0.008	0.10	0.41	121.6	95.7	25.9	1060.9	601.22	601.22	0.33
110	1.83	0.008	0.10	0.41	121.6	98.3	23.3	1084.2	601.23	601.22	0.34
115	1.92	0.008	0.10	0.41	121.6	100.6	21.0	1105.2	601.23	601.23	0.34
120	2.00	0.008	0.10	0.41	121.6	102.6	18.9	1124.1	601.23	601.23	0.35
125	2.08	0.008	0.10	0.41	121.6	104.5	17.0	1141.1	601.24	601.24	0.35
130	2.17	0.008	0.10	0.41	121.6	106.2	15.4	1156.5	601.24	601.24	0.36
135	2.25	0.008	0.10	0.41	121.6	107.7	13.8	1170.3	601.24	601.24	0.36
140	2.33	0.008	0.10	0.41	121.6	109.1	12.5	1182.8	601.25	601.25	0.37
145	2.42	0.008	0.10	0.41	121.6	110.3	11.2	1194.0	601.25	601.25	0.37
150	2.50	0.008	0.10	0.41	121.6	111.4	10.1	1204.2	601.25	601.25	0.37
155	2.58	0.008	0.10	0.41	121.6	112.4	9.1	1213.3	601.25	601.25	0.38
160	2.67	0.008	0.10	0.41	121.6	113.3	8.2	1221.5	601.25	601.25	0.38
165	2.75	0.008	0.10	0.41	121.6	114.2	7.4	1228.9	601.26	601.26	0.38
170	2.83	0.008	0.10	0.41	121.6	114.9	6.7	1235.6	601.26	601.26	0.39
175	2.92	0.008	0.10	0.41	121.6	115.5	6.0	1241.6	601.26	601.26	0.39
180	3.00	0.008	0.10	0.41	121.6	116.1	5.4	1247.0	601.26	601.26	0.39
185	3.08	0.008	0.10	0.41	121.6	116.7	4.9	1251.9	601.26	601.26	0.39
190	3.17	0.008	0.10	0.41	121.6	117.2	4.4	1256.3	601.26	601.26	0.39
195	3.25	0.008	0.10	0.41	121.6	117.6	4.0	1260.3	601.26	601.26	0.39
200	3.33	0.008	0.10	0.41	121.6	118.0	3.6	1263.9	601.26	601.26	0.39
205	3.42	0.008	0.10	0.41	121.6	118.3	3.2	1267.1	601.26	601.26	0.40
210	3.50	0.009	0.11	0.46	136.8	118.7	18.1	1285.2	601.27	601.27	0.40
215	3.58	0.009	0.11	0.46	136.8	119.7	17.1	1302.3	601.27	601.27	0.40

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
220	3.67	0.009	0.11	0.46	136.8	121.3	15.4	1317.7	601.27	601.27	0.41
225	3.75	0.009	0.11	0.46	136.8	122.8	13.9	1331.7	601.28	601.28	0.41
230	3.83	0.009	0.11	0.46	136.8	124.2	12.5	1344.2	601.28	601.28	0.42
235	3.92	0.009	0.11	0.46	136.8	125.5	11.3	1355.5	601.28	601.28	0.42
240	4.00	0.009	0.11	0.46	136.8	126.6	10.2	1365.7	601.28	601.28	0.43
245	4.08	0.009	0.11	0.46	136.8	127.6	9.2	1374.9	601.29	601.29	0.43
250	4.17	0.009	0.11	0.46	136.8	128.5	8.3	1383.1	601.29	601.29	0.43
255	4.25	0.009	0.11	0.46	136.8	129.3	7.5	1390.6	601.29	601.29	0.43
260	4.33	0.009	0.11	0.46	136.8	130.0	6.7	1397.3	601.29	601.29	0.44
265	4.42	0.009	0.11	0.46	136.8	130.7	6.1	1403.4	601.29	601.29	0.44
270	4.50	0.009	0.11	0.46	136.8	131.3	5.5	1408.8	601.29	601.29	0.44
275	4.58	0.009	0.11	0.46	136.8	131.8	4.9	1413.7	601.29	601.29	0.44
280	4.67	0.009	0.11	0.46	136.8	132.3	4.4	1418.1	601.30	601.3	0.44
285	4.75	0.009	0.11	0.46	136.8	132.8	4.0	1422.1	601.30	601.3	0.44
290	4.83	0.009	0.11	0.46	136.8	133.2	3.6	1425.7	601.30	601.3	0.45
295	4.92	0.009	0.11	0.46	136.8	133.5	3.2	1429.0	601.30	601.3	0.45
300	5.00	0.010	0.12	0.51	152.0	133.8	18.1	1447.1	601.30	601.3	0.45
305	5.08	0.010	0.12	0.51	152.0	134.8	17.1	1464.2	601.31	601.3	0.45
310	5.17	0.010	0.12	0.51	152.0	136.5	15.5	1479.7	601.31	601.31	0.46
315	5.25	0.010	0.12	0.51	152.0	138.0	13.9	1493.6	601.31	601.31	0.46
320	5.33	0.010	0.12	0.51	152.0	139.4	12.6	1506.1	601.31	601.31	0.47
325	5.42	0.010	0.12	0.51	152.0	140.6	11.3	1517.5	601.32	601.32	0.47
330	5.50	0.010	0.12	0.51	152.0	141.8	10.2	1527.7	601.32	601.32	0.48
335	5.58	0.010	0.12	0.51	152.0	142.8	9.2	1536.8	601.32	601.32	0.48
340	5.67	0.010	0.12	0.51	152.0	143.7	8.3	1545.1	601.32	601.32	0.48
345	5.75	0.010	0.12	0.51	152.0	144.5	7.5	1552.6	601.32	601.32	0.48
350	5.83	0.010	0.12	0.51	152.0	145.2	6.7	1559.3	601.32	601.32	0.49
355	5.92	0.010	0.12	0.51	152.0	145.9	6.1	1565.4	601.33	601.33	0.49
360	6.00	0.010	0.12	0.51	152.0	146.5	5.5	1570.8	601.33	601.33	0.49
365	6.08	0.010	0.12	0.51	152.0	147.0	4.9	1575.7	601.33	601.33	0.49
370	6.17	0.011	0.13	0.56	167.2	147.5	19.6	1595.4	601.33	601.33	0.50
375	6.25	0.011	0.13	0.56	167.2	148.7	18.5	1613.8	601.34	601.33	0.50
380	6.33	0.011	0.13	0.56	167.2	150.5	16.7	1630.5	601.34	601.34	0.51
385	6.42	0.011	0.13	0.56	167.2	152.1	15.0	1645.6	601.34	601.34	0.51
390	6.50	0.011	0.13	0.56	167.2	153.6	13.6	1659.1	601.35	601.34	0.52
395	6.58	0.011	0.13	0.56	167.2	154.9	12.2	1671.3	601.35	601.35	0.52
400	6.67	0.011	0.13	0.56	167.2	156.1	11.0	1682.3	601.35	601.35	0.52
405	6.75	0.011	0.13	0.56	167.2	157.2	9.9	1692.2	601.35	601.35	0.53
410	6.83	0.011	0.13	0.56	167.2	158.2	8.9	1701.2	601.35	601.35	0.53
415	6.92	0.011	0.13	0.56	167.2	159.1	8.1	1709.2	601.36	601.36	0.53
420	7.00	0.012	0.14	0.61	182.3	159.9	22.5	1731.7	601.36	601.36	0.54
425	7.08	0.012	0.14	0.61	182.3	161.3	21.0	1752.7	601.37	601.36	0.54
430	7.17	0.012	0.14	0.61	182.3	163.4	19.0	1771.7	601.37	601.37	0.55
435	7.25	0.012	0.14	0.61	182.3	165.2	17.1	1788.8	601.37	601.37	0.56
440	7.33	0.012	0.14	0.61	182.3	166.9	15.4	1804.2	601.38	601.37	0.56
445	7.42	0.012	0.14	0.61	182.3	168.5	13.9	1818.1	601.38	601.38	0.57
450	7.50	0.012	0.14	0.61	182.3	169.8	12.5	1830.6	601.38	601.38	0.57
455	7.58	0.012	0.14	0.61	182.3	171.1	11.3	1841.9	601.38	601.38	0.57
460	7.67	0.013	0.16	0.66	197.5	172.2	25.4	1867.3	601.39	601.39	0.58
465	7.75	0.013	0.16	0.66	197.5	173.9	23.6	1890.9	601.39	601.39	0.59
470	7.83	0.013	0.16	0.66	197.5	176.2	21.3	1912.2	601.40	601.4	0.59
475	7.92	0.013	0.16	0.66	197.5	178.3	19.2	1931.5	601.40	601.4	0.60
480	8.00	0.013	0.16	0.66	197.5	180.2	17.3	1948.8	601.41	601.4	0.61

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
485	8.08	0.013	0.16	0.66	197.5	181.9	15.6	1964.4	601.41	601.41	0.61
490	8.17	0.013	0.16	0.66	197.5	183.5	14.1	1978.5	601.41	601.41	0.62
495	8.25	0.014	0.17	0.71	212.7	184.9	27.9	2006.4	601.42	601.42	0.62
500	8.33	0.014	0.17	0.71	212.7	186.8	25.9	2032.3	601.42	601.42	0.63
505	8.42	0.014	0.17	0.71	212.7	189.4	23.4	2055.7	601.43	601.43	0.64
510	8.50	0.014	0.17	0.71	212.7	191.7	21.1	2076.7	601.43	601.43	0.65
515	8.58	0.014	0.17	0.71	212.7	193.7	19.0	2095.7	601.44	601.43	0.65
520	8.67	0.015	0.18	0.76	227.9	195.6	32.3	2128.0	601.44	601.44	0.66
525	8.75	0.015	0.18	0.76	227.9	198.0	29.9	2157.9	601.45	601.45	0.67
530	8.83	0.015	0.18	0.76	227.9	200.9	27.0	2184.9	601.46	601.45	0.68
535	8.92	0.015	0.18	0.76	227.9	203.6	24.3	2209.2	601.46	601.46	0.69
540	9.00	0.016	0.19	0.81	243.1	206.0	37.1	2246.4	601.47	601.46	0.70
545	9.08	0.016	0.19	0.81	243.1	208.9	34.2	2280.6	601.48	601.47	0.71
550	9.17	0.016	0.19	0.81	243.1	212.2	30.9	2311.5	601.48	601.48	0.72
555	9.25	0.016	0.19	0.81	243.1	215.3	27.8	2339.3	601.49	601.48	0.73
560	9.33	0.017	0.20	0.86	258.3	218.1	40.3	2379.6	601.50	601.49	0.74
565	9.42	0.017	0.20	0.86	258.3	221.2	37.1	2416.7	601.50	601.5	0.75
570	9.50	0.017	0.20	0.86	258.3	224.9	33.5	2450.1	601.51	601.51	0.76
575	9.58	0.018	0.22	0.91	273.5	228.2	45.3	2495.5	601.52	601.52	0.77
580	9.67	0.018	0.22	0.91	273.5	231.9	41.6	2537.1	601.53	601.52	0.79
585	9.75	0.018	0.22	0.91	273.5	236.0	37.6	2574.7	601.54	601.53	0.80
590	9.83	0.019	0.23	0.96	288.7	239.7	49.1	2623.7	601.55	601.54	0.81
595	9.92	0.019	0.23	0.96	288.7	243.7	45.0	2668.7	601.56	601.55	0.83
600	10.00	0.020	0.24	1.01	303.9	248.1	55.8	2724.5	601.57	601.56	0.84
605	10.08	0.020	0.24	1.01	303.9	252.9	51.1	2775.5	601.58	601.57	0.86
610	10.17	0.021	0.25	1.06	319.1	257.9	61.2	2836.8	601.59	601.58	0.88
615	10.25	0.021	0.25	1.06	319.1	263.1	56.0	2892.8	601.60	601.6	0.90
620	10.33	0.022	0.26	1.11	334.3	268.6	65.7	2958.4	601.62	601.61	0.91
625	10.42	0.023	0.28	1.16	349.5	274.3	75.2	3033.6	601.63	601.62	0.94
630	10.50	0.023	0.28	1.16	349.5	280.9	68.6	3102.2	601.65	601.64	0.96
635	10.58	0.024	0.29	1.22	364.7	287.7	77.0	3179.2	601.66	601.65	0.98
640	10.67	0.025	0.30	1.27	379.9	294.5	85.4	3264.6	601.68	601.67	1.01
645	10.75	0.026	0.31	1.32	395.1	302.1	93.0	3357.5	601.70	601.69	1.03
650	10.83	0.027	0.32	1.37	410.3	310.5	99.8	3457.4	601.72	601.71	1.07
655	10.92	0.028	0.34	1.42	425.5	319.5	106.0	3563.3	601.74	601.73	1.10
660	11.00	0.029	0.35	1.47	440.7	329.2	111.5	3674.8	601.77	601.75	1.13
665	11.08	0.031	0.37	1.57	471.1	339.4	131.7	3806.5	601.79	601.78	1.17
670	11.17	0.033	0.40	1.67	501.5	350.8	150.7	3957.2	601.82	601.81	1.21
675	11.25	0.035	0.42	1.77	531.8	364.0	167.8	4125.1	601.86	601.84	1.26
680	11.33	0.037	0.44	1.87	562.2	378.9	183.3	4308.4	601.90	601.88	1.32
685	11.42	0.041	0.49	2.08	623.0	395.4	227.6	4536.0	601.95	601.92	1.38
690	11.50	0.045	0.54	2.28	683.8	414.7	269.1	4805.1	602.00	601.97	1.46
695	11.58	0.050	0.60	2.53	759.8	437.9	321.9	5127.0	602.06	602.03	1.53
700	11.67	0.057	0.68	2.89	866.1	457.6	408.6	5535.6	602.12	602.09	1.58
705	11.75	0.068	0.82	3.44	1033.3	474.2	559.1	6094.7	602.22	602.17	1.65
710	11.83	0.089	1.07	4.51	1352.4	496.2	856.2	6950.9	602.36	602.29	1.76
715	11.92	0.148	1.78	7.50	2248.9	528.3	1720.6	8671.6	602.65	602.51	1.96
720	12.00	0.438	5.26	22.19	6655.7	586.8	6068.8	14740.4	603.57	603.11	2.49
725	12.08	0.109	1.31	5.52	1656.3	747.0	909.3	15649.7	603.70	603.63	3.15
730	12.17	0.077	0.92	3.90	1170.1	944.9	225.2	15874.9	603.73	603.71	3.35
735	12.25	0.062	0.74	3.14	942.1	1003.8	-61.7	15813.2	603.72	603.72	3.37
740	12.33	0.053	0.64	2.68	805.4	1012.3	-207.0	15606.2	603.69	603.7	3.33
745	12.42	0.047	0.56	2.38	714.2	998.4	-284.2	15322.1	603.65	603.67	3.24

Input			Calculated						Interpolated		
Time (min)	**Time (hr)**	**PI (in)**	**i (in/hr)**	**Q_{in} (cfs)**	**Vol_{in} (ft^3)**	**Vol_{out} (ft^3)**	**ΔVol (ft^3)**	**Vol_{Total} (ft^3)**	**Peak Stage (ft)**	**Avg Stage (ft)**	**Q_{out} (cfs)**
750	12.50	0.042	0.50	2.13	638.2	972.8	-334.6	14987.5	603.61	603.63	3.14
755	12.58	0.039	0.47	1.98	592.6	940.7	-348.0	14639.4	603.56	603.58	3.02
760	12.67	0.036	0.43	1.82	547.0	905.2	-358.1	14281.3	603.51	603.54	2.89
765	12.75	0.034	0.41	1.72	516.7	868.5	-351.8	13929.4	603.46	603.49	2.79
770	12.83	0.032	0.38	1.62	486.3	837.0	-350.8	13578.7	603.41	603.44	2.75
775	12.92	0.030	0.36	1.52	455.9	824.9	-369.1	13209.6	603.36	603.38	2.71
780	13.00	0.029	0.35	1.47	440.7	812.4	-371.7	12837.9	603.30	603.33	2.66
785	13.08	0.027	0.32	1.37	410.3	799.5	-389.2	12448.7	603.25	603.28	2.62
790	13.17	0.026	0.31	1.32	395.1	786.2	-391.1	12057.5	603.19	603.22	2.58
795	13.25	0.025	0.30	1.27	379.9	772.6	-392.7	11664.8	603.13	603.16	2.53
800	13.33	0.024	0.29	1.22	364.7	759.0	-394.3	11270.5	603.08	603.11	2.48
805	13.42	0.024	0.29	1.22	364.7	745.3	-380.6	10889.9	603.02	603.05	2.44
810	13.50	0.023	0.28	1.16	349.5	731.8	-382.3	10507.7	602.96	602.99	2.39
815	13.58	0.022	0.26	1.11	334.3	717.6	-383.3	10124.4	602.90	602.93	2.34
820	13.67	0.022	0.26	1.11	334.3	700.6	-366.3	9758.1	602.83	602.87	2.28
825	13.75	0.021	0.25	1.06	319.1	683.6	-364.5	9393.6	602.77	602.8	2.22
830	13.83	0.020	0.24	1.01	303.9	667.0	-363.1	9030.5	602.71	602.74	2.17
835	13.92	0.020	0.24	1.01	303.9	650.5	-346.6	8683.9	602.65	602.68	2.11
840	14.00	0.019	0.23	0.96	288.7	634.4	-345.6	8338.3	602.60	602.62	2.06
845	14.08	0.019	0.23	0.96	288.7	618.6	-329.9	8008.4	602.54	602.57	2.01
850	14.17	0.019	0.23	0.96	288.7	603.3	-314.6	7693.8	602.49	602.51	1.96
855	14.25	0.018	0.22	0.91	273.5	588.6	-315.1	7378.7	602.43	602.46	1.91
860	14.33	0.018	0.22	0.91	273.5	574.3	-300.8	7077.9	602.38	602.41	1.87
865	14.42	0.017	0.20	0.86	258.3	560.4	-302.0	6775.8	602.33	602.36	1.82
870	14.50	0.017	0.20	0.86	258.3	546.7	-288.3	6487.5	602.28	602.31	1.78
875	14.58	0.017	0.20	0.86	258.3	533.3	-274.9	6212.6	602.24	602.26	1.73
880	14.67	0.016	0.19	0.81	243.1	520.5	-277.3	5935.2	602.19	602.21	1.69
885	14.75	0.016	0.19	0.81	243.1	507.9	-264.8	5670.4	602.15	602.17	1.65
890	14.83	0.016	0.19	0.81	243.1	495.6	-252.5	5418.0	602.10	602.13	1.61
895	14.92	0.016	0.19	0.81	243.1	483.9	-240.7	5177.2	602.06	602.08	1.58
900	15.00	0.015	0.18	0.76	227.9	472.7	-244.7	4932.5	602.02	602.04	1.54
905	15.08	0.015	0.18	0.76	227.9	461.6	-233.7	4698.8	601.98	602	1.50
910	15.17	0.015	0.18	0.76	227.9	450.2	-222.3	4476.6	601.93	601.96	1.43
915	15.25	0.015	0.18	0.76	227.9	430.2	-202.3	4274.3	601.89	601.91	1.37
920	15.33	0.014	0.17	0.71	212.7	410.3	-197.5	4076.8	601.85	601.87	1.31
925	15.42	0.014	0.17	0.71	212.7	391.5	-178.8	3898.0	601.81	601.83	1.25
930	15.50	0.014	0.17	0.71	212.7	373.9	-161.2	3736.8	601.78	601.8	1.19
935	15.58	0.014	0.17	0.71	212.7	358.0	-145.2	3591.6	601.75	601.76	1.15
940	15.67	0.014	0.17	0.71	212.7	343.6	-130.9	3460.7	601.72	601.73	1.10
945	15.75	0.014	0.17	0.71	212.7	330.6	-117.9	3342.8	601.70	601.71	1.06
950	15.83	0.013	0.16	0.66	197.5	319.0	-121.4	3221.4	601.67	601.68	1.03
955	15.92	0.013	0.16	0.66	197.5	307.8	-110.2	3111.2	601.65	601.66	0.99
960	16.00	0.013	0.16	0.66	197.5	296.9	-99.4	3011.8	601.63	601.64	0.96
965	16.08	0.013	0.16	0.66	197.5	287.1	-89.5	2922.3	601.61	601.62	0.93
970	16.17	0.013	0.16	0.66	197.5	278.2	-80.7	2841.6	601.59	601.6	0.90
975	16.25	0.013	0.16	0.66	197.5	270.2	-72.7	2768.9	601.58	601.58	0.88
980	16.33	0.012	0.14	0.61	182.3	263.0	-80.7	2688.2	601.56	601.57	0.85
985	16.42	0.012	0.14	0.61	182.3	255.9	-73.5	2614.7	601.54	601.55	0.83
990	16.50	0.012	0.14	0.61	182.3	248.6	-66.3	2548.4	601.53	601.54	0.81
995	16.58	0.012	0.14	0.61	182.3	242.1	-59.7	2488.7	601.52	601.52	0.79
1000	16.67	0.012	0.14	0.61	182.3	236.2	-53.8	2434.9	601.51	601.51	0.77
1005	16.75	0.012	0.14	0.61	182.3	230.8	-48.5	2386.4	601.50	601.5	0.75
1010	16.83	0.012	0.14	0.61	182.3	226.0	-43.7	2342.7	601.49	601.49	0.74

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
1015	16.92	0.012	0.14	0.61	182.3	221.7	-39.4	2303.3	601.48	601.48	0.73
1020	17.00	0.011	0.13	0.56	167.2	217.8	-50.7	2252.6	601.47	601.47	0.71
1025	17.08	0.011	0.13	0.56	167.2	213.6	-46.5	2206.2	601.46	601.46	0.70
1030	17.17	0.011	0.13	0.56	167.2	209.1	-41.9	2164.3	601.45	601.46	0.68
1035	17.25	0.011	0.13	0.56	167.2	204.9	-37.8	2126.5	601.44	601.45	0.67
1040	17.33	0.011	0.13	0.56	167.2	201.2	-34.0	2092.5	601.44	601.44	0.66
1045	17.42	0.011	0.13	0.56	167.2	197.8	-30.7	2061.9	601.43	601.43	0.65
1050	17.50	0.011	0.13	0.56	167.2	194.8	-27.6	2034.2	601.42	601.43	0.64
1055	17.58	0.011	0.13	0.56	167.2	192.0	-24.9	2009.3	601.42	601.42	0.63
1060	17.67	0.011	0.13	0.56	167.2	189.6	-22.4	1986.9	601.41	601.42	0.62
1065	17.75	0.011	0.13	0.56	167.2	187.4	-20.2	1966.7	601.41	601.41	0.62
1070	17.83	0.011	0.13	0.56	167.2	185.4	-18.2	1948.5	601.41	601.41	0.61
1075	17.92	0.010	0.12	0.51	152.0	183.6	-31.6	1916.9	601.40	601.4	0.60
1080	18.00	0.010	0.12	0.51	152.0	181.2	-29.3	1887.6	601.39	601.4	0.59
1085	18.08	0.010	0.12	0.51	152.0	178.4	-26.4	1861.2	601.39	601.39	0.59
1090	18.17	0.010	0.12	0.51	152.0	175.8	-23.8	1837.4	601.38	601.39	0.58
1095	18.25	0.010	0.12	0.51	152.0	173.4	-21.5	1815.9	601.38	601.38	0.57
1100	18.33	0.010	0.12	0.51	152.0	171.3	-19.3	1796.6	601.37	601.38	0.56
1105	18.42	0.010	0.12	0.51	152.0	169.4	-17.4	1779.2	601.37	601.37	0.56
1110	18.50	0.010	0.12	0.51	152.0	167.7	-15.7	1763.5	601.37	601.37	0.55
1115	18.58	0.010	0.12	0.51	152.0	166.1	-14.1	1749.4	601.36	601.37	0.55
1120	18.67	0.010	0.12	0.51	152.0	164.7	-12.7	1736.6	601.36	601.36	0.54
1125	18.75	0.010	0.12	0.51	152.0	163.4	-11.5	1725.1	601.36	601.36	0.54
1130	18.83	0.010	0.12	0.51	152.0	162.3	-10.3	1714.8	601.36	601.36	0.54
1135	18.92	0.010	0.12	0.51	152.0	161.3	-9.3	1705.5	601.36	601.36	0.53
1140	19.00	0.009	0.11	0.46	136.8	160.4	-23.6	1681.9	601.35	601.35	0.53
1145	19.08	0.009	0.11	0.46	136.8	158.8	-22.1	1659.8	601.35	601.35	0.52
1150	19.17	0.009	0.11	0.46	136.8	156.7	-19.9	1639.9	601.34	601.34	0.52
1155	19.25	0.009	0.11	0.46	136.8	154.7	-17.9	1621.9	601.34	601.34	0.51
1160	19.33	0.009	0.11	0.46	136.8	152.9	-16.2	1605.8	601.33	601.34	0.50
1165	19.42	0.009	0.11	0.46	136.8	151.3	-14.6	1591.2	601.33	601.33	0.50
1170	19.50	0.009	0.11	0.46	136.8	149.9	-13.1	1578.1	601.33	601.33	0.50
1175	19.58	0.009	0.11	0.46	136.8	148.6	-11.8	1566.2	601.33	601.33	0.49
1180	19.67	0.009	0.11	0.46	136.8	147.4	-10.7	1555.6	601.32	601.33	0.49
1185	19.75	0.009	0.11	0.46	136.8	146.4	-9.6	1546.0	601.32	601.32	0.48
1190	19.83	0.009	0.11	0.46	136.8	145.4	-8.7	1537.3	601.32	601.32	0.48
1195	19.92	0.009	0.11	0.46	136.8	144.6	-7.8	1529.5	601.32	601.32	0.48
1200	20.00	0.009	0.11	0.46	136.8	143.8	-7.0	1522.5	601.32	601.32	0.48
1205	20.08	0.009	0.11	0.46	136.8	143.1	-6.3	1516.2	601.32	601.32	0.47
1210	20.17	0.009	0.11	0.46	136.8	142.5	-5.7	1510.5	601.31	601.32	0.47
1215	20.25	0.009	0.11	0.46	136.8	141.9	-5.1	1505.3	601.31	601.31	0.47
1220	20.33	0.009	0.11	0.46	136.8	141.4	-4.6	1500.7	601.31	601.31	0.47
1225	20.42	0.009	0.11	0.46	136.8	140.9	-4.2	1496.5	601.31	601.31	0.47
1230	20.50	0.008	0.10	0.41	121.6	140.5	-19.0	1477.5	601.31	601.31	0.46
1235	20.58	0.008	0.10	0.41	121.6	139.4	-17.9	1459.7	601.30	601.31	0.46
1240	20.67	0.008	0.10	0.41	121.6	137.7	-16.1	1443.5	601.30	601.3	0.45
1245	20.75	0.008	0.10	0.41	121.6	136.1	-14.6	1429.0	601.30	601.3	0.45
1250	20.83	0.008	0.10	0.41	121.6	134.7	-13.1	1415.9	601.30	601.3	0.44
1255	20.92	0.008	0.10	0.41	121.6	133.4	-11.8	1404.1	601.29	601.29	0.44
1260	21.00	0.008	0.10	0.41	121.6	132.2	-10.6	1393.4	601.29	601.29	0.44
1265	21.08	0.008	0.10	0.41	121.6	131.2	-9.6	1383.8	601.29	601.29	0.43
1270	21.17	0.008	0.10	0.41	121.6	130.2	-8.6	1375.2	601.29	601.29	0.43
1275	21.25	0.008	0.10	0.41	121.6	129.4	-7.8	1367.4	601.28	601.29	0.43

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
1280	21.33	0.008	0.10	0.41	121.6	128.6	-7.0	1360.4	601.28	601.28	0.43
1285	21.42	0.008	0.10	0.41	121.6	127.9	-6.3	1354.0	601.28	601.28	0.42
1290	21.50	0.008	0.10	0.41	121.6	127.3	-5.7	1348.3	601.28	601.28	0.42
1300	21.67	0.008	0.10	0.41	121.6	126.7	-5.1	1343.2	601.28	601.28	0.42
1305	21.75	0.008	0.10	0.41	121.6	126.2	-4.6	1338.6	601.28	601.28	0.42
1310	21.83	0.008	0.10	0.41	121.6	125.7	-4.2	1334.4	601.28	601.28	0.42
1315	21.92	0.008	0.10	0.41	121.6	125.3	-3.8	1330.6	601.28	601.28	0.42
1320	22.00	0.008	0.10	0.41	121.6	125.0	-3.4	1327.3	601.28	601.28	0.42
1325	22.08	0.008	0.10	0.41	121.6	124.6	-3.1	1324.2	601.28	601.28	0.41
1330	22.17	0.008	0.10	0.41	121.6	124.3	-2.7	1321.5	601.28	601.28	0.41
1335	22.25	0.008	0.10	0.41	121.6	124.0	-2.5	1319.0	601.27	601.28	0.41
1340	22.33	0.008	0.10	0.41	121.6	123.8	-2.2	1316.8	601.27	601.27	0.41
1345	22.42	0.008	0.10	0.41	121.6	123.6	-2.0	1314.7	601.27	601.27	0.41
1350	22.50	0.008	0.10	0.41	121.6	123.4	-1.8	1312.9	601.27	601.27	0.41
1355	22.58	0.008	0.10	0.41	121.6	123.2	-1.6	1311.3	601.27	601.27	0.41
1360	22.67	0.007	0.08	0.35	106.4	123.0	-16.7	1294.6	601.27	601.27	0.41
1365	22.75	0.007	0.08	0.35	106.4	122.2	-15.8	1278.8	601.27	601.27	0.40
1370	22.83	0.007	0.08	0.35	106.4	120.7	-14.3	1264.5	601.26	601.26	0.40
1375	22.92	0.007	0.08	0.35	106.4	119.2	-12.9	1251.7	601.26	601.26	0.39
1380	23.00	0.007	0.08	0.35	106.4	118.0	-11.6	1240.1	601.26	601.26	0.39
1385	23.08	0.007	0.08	0.35	106.4	116.8	-10.5	1229.6	601.26	601.26	0.39
1390	23.17	0.007	0.08	0.35	106.4	115.8	-9.4	1220.2	601.25	601.26	0.38
1395	23.25	0.007	0.08	0.35	106.4	114.9	-8.5	1211.7	601.25	601.25	0.38
1400	23.33	0.007	0.08	0.35	106.4	114.0	-7.6	1204.0	601.25	601.25	0.38
1405	23.42	0.007	0.08	0.35	106.4	113.3	-6.9	1197.2	601.25	601.25	0.38
1410	23.50	0.007	0.08	0.35	106.4	112.6	-6.2	1190.9	601.25	601.25	0.37
1415	23.58	0.007	0.08	0.35	106.4	112.0	-5.6	1185.3	601.25	601.25	0.37
1420	23.67	0.007	0.08	0.35	106.4	111.4	-5.0	1180.3	601.25	601.25	0.37
1425	23.75	0.007	0.08	0.35	106.4	110.9	-4.5	1175.8	601.25	601.25	0.37
1430	23.83	0.007	0.08	0.35	106.4	110.5	-4.1	1171.7	601.24	601.24	0.37
1435	23.92	0.007	0.08	0.35	106.4	110.1	-3.7	1168.0	601.24	601.24	0.37
1440	24.00	0.007	0.08	0.35	106.4	109.7	-3.3	1164.7	601.24	601.24	0.36

Detention Stage-Storage-Discharge Calculation

Canby Apartments Detention Basin

25-year

Detention and Basin Parameters

Total 24-hr rainfall= 5.44 in

Area = 6.7 ac
C = 0.70
Elev = 620

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
0	0.00	0.008	0.10	0.45	135.1	0.0	0.0	0.0	601.00	0	0.00
5	0.08	0.008	0.10	0.45	135.1	0.0	135.1	135.1	601.03	601.01	0.02
10	0.17	0.008	0.10	0.45	135.1	6.3	128.7	263.8	601.05	601.04	0.06
15	0.25	0.008	0.10	0.45	135.1	18.7	116.4	380.2	601.08	601.07	0.10
20	0.33	0.008	0.10	0.45	135.1	30.2	104.9	485.1	601.10	601.09	0.14
25	0.42	0.008	0.10	0.45	135.1	40.6	94.5	579.6	601.12	601.11	0.17
30	0.50	0.008	0.10	0.45	135.1	49.9	85.2	664.7	601.14	601.13	0.19
35	0.58	0.008	0.10	0.45	135.1	58.3	76.7	741.5	601.15	601.15	0.22
40	0.67	0.008	0.10	0.45	135.1	65.9	69.1	810.6	601.17	601.16	0.24
45	0.75	0.008	0.10	0.45	135.1	72.8	62.3	872.9	601.18	601.18	0.26
50	0.83	0.008	0.10	0.45	135.1	78.9	56.1	929.0	601.19	601.19	0.28
55	0.92	0.008	0.10	0.45	135.1	84.5	50.6	979.6	601.20	601.2	0.30
60	1.00	0.008	0.10	0.45	135.1	89.5	45.6	1025.2	601.21	601.21	0.31
65	1.08	0.008	0.10	0.45	135.1	94.0	41.1	1066.3	601.22	601.22	0.33
70	1.17	0.008	0.10	0.45	135.1	98.1	37.0	1103.3	601.23	601.23	0.34
75	1.25	0.009	0.11	0.51	152.0	101.7	50.2	1153.5	601.24	601.24	0.35
80	1.33	0.009	0.11	0.51	152.0	105.8	46.1	1199.7	601.25	601.25	0.37
85	1.42	0.009	0.11	0.51	152.0	110.3	41.6	1241.3	601.26	601.25	0.38
90	1.50	0.009	0.11	0.51	152.0	114.4	37.5	1278.8	601.27	601.26	0.39
95	1.58	0.009	0.11	0.51	152.0	118.2	33.8	1312.6	601.27	601.27	0.40
100	1.67	0.009	0.11	0.51	152.0	121.5	30.5	1343.1	601.28	601.28	0.42
105	1.75	0.009	0.11	0.51	152.0	124.5	27.4	1370.5	601.29	601.28	0.42
110	1.83	0.009	0.11	0.51	152.0	127.2	24.7	1395.3	601.29	601.29	0.43
115	1.92	0.009	0.11	0.51	152.0	129.7	22.3	1417.5	601.30	601.29	0.44
120	2.00	0.009	0.11	0.51	152.0	131.9	20.1	1437.6	601.30	601.3	0.45
125	2.08	0.009	0.11	0.51	152.0	133.9	18.1	1455.7	601.30	601.3	0.45
130	2.17	0.009	0.11	0.51	152.0	135.7	16.3	1472.0	601.31	601.31	0.46
135	2.25	0.009	0.11	0.51	152.0	137.3	14.7	1486.7	601.31	601.31	0.46
140	2.33	0.009	0.11	0.51	152.0	138.7	13.2	1499.9	601.31	601.31	0.47
145	2.42	0.009	0.11	0.51	152.0	140.0	11.9	1511.9	601.32	601.31	0.47
150	2.50	0.009	0.11	0.51	152.0	141.2	10.7	1522.6	601.32	601.32	0.47
155	2.58	0.009	0.11	0.51	152.0	142.3	9.7	1532.3	601.32	601.32	0.48
160	2.67	0.009	0.11	0.51	152.0	143.2	8.7	1541.0	601.32	601.32	0.48
165	2.75	0.009	0.11	0.51	152.0	144.1	7.9	1548.9	601.32	601.32	0.48
170	2.83	0.009	0.11	0.51	152.0	144.9	7.1	1556.0	601.32	601.32	0.49
175	2.92	0.009	0.11	0.51	152.0	145.6	6.4	1562.4	601.33	601.32	0.49
180	3.00	0.009	0.11	0.51	152.0	146.2	5.8	1568.1	601.33	601.33	0.49
185	3.08	0.010	0.12	0.56	168.8	146.8	22.1	1590.2	601.33	601.33	0.49
190	3.17	0.010	0.12	0.56	168.8	148.1	20.8	1610.9	601.34	601.33	0.50
195	3.25	0.010	0.12	0.56	168.8	150.1	18.8	1629.7	601.34	601.34	0.51
200	3.33	0.010	0.12	0.56	168.8	151.9	16.9	1646.6	601.34	601.34	0.51
205	3.42	0.010	0.12	0.56	168.8	153.6	15.2	1661.8	601.35	601.34	0.52
210	3.50	0.010	0.12	0.56	168.8	155.1	13.7	1675.6	601.35	601.35	0.52
215	3.58	0.010	0.12	0.56	168.8	156.5	12.4	1687.9	601.35	601.35	0.53

Input			Calculated						Interpolated		
Time (min)	**Time (hr)**	**PI (in)**	**i (in/hr)**	**Q_{in} (cfs)**	**Vol_{in} (ft^3)**	**Vol_{out} (ft^3)**	**ΔVol (ft^3)**	**Vol_{Total} (ft^3)**	**Peak Stage (ft)**	**Avg Stage (ft)**	**Q_{out} (cfs)**
220	3.67	0.010	0.12	0.56	168.8	157.7	11.1	1699.1	601.35	601.35	0.53
225	3.75	0.010	0.12	0.56	168.8	158.8	10.0	1709.1	601.36	601.36	0.53
230	3.83	0.010	0.12	0.56	168.8	159.8	9.0	1718.2	601.36	601.36	0.54
235	3.92	0.010	0.12	0.56	168.8	160.7	8.2	1726.3	601.36	601.36	0.54
240	4.00	0.010	0.12	0.56	168.8	161.5	7.3	1733.7	601.36	601.36	0.54
245	4.08	0.010	0.12	0.56	168.8	162.2	6.6	1740.3	601.36	601.36	0.54
250	4.17	0.010	0.12	0.56	168.8	162.9	6.0	1746.2	601.36	601.36	0.54
255	4.25	0.010	0.12	0.56	168.8	163.5	5.4	1751.6	601.36	601.36	0.55
260	4.33	0.010	0.12	0.56	168.8	164.0	4.8	1756.5	601.37	601.37	0.55
265	4.42	0.010	0.12	0.56	168.8	164.5	4.4	1760.8	601.37	601.37	0.55
270	4.50	0.010	0.12	0.56	168.8	164.9	3.9	1764.8	601.37	601.37	0.55
275	4.58	0.011	0.13	0.62	185.7	165.3	20.4	1785.2	601.37	601.37	0.55
280	4.67	0.011	0.13	0.62	185.7	166.4	19.3	1804.5	601.38	601.37	0.56
285	4.75	0.011	0.13	0.62	185.7	168.3	17.4	1821.9	601.38	601.38	0.57
290	4.83	0.011	0.13	0.62	185.7	170.0	15.7	1837.6	601.38	601.38	0.57
295	4.92	0.011	0.13	0.62	185.7	171.6	14.1	1851.7	601.39	601.38	0.58
300	5.00	0.011	0.13	0.62	185.7	173.0	12.7	1864.5	601.39	601.39	0.58
305	5.08	0.011	0.13	0.62	185.7	174.2	11.5	1876.0	601.39	601.39	0.58
310	5.17	0.011	0.13	0.62	185.7	175.4	10.4	1886.3	601.39	601.39	0.59
315	5.25	0.011	0.13	0.62	185.7	176.4	9.3	1895.7	601.40	601.39	0.59
320	5.33	0.011	0.13	0.62	185.7	177.3	8.4	1904.1	601.40	601.4	0.59
325	5.42	0.011	0.13	0.62	185.7	178.1	7.6	1911.6	601.40	601.4	0.60
330	5.50	0.011	0.13	0.62	185.7	178.9	6.8	1918.5	601.40	601.4	0.60
335	5.58	0.011	0.13	0.62	185.7	179.6	6.1	1924.6	601.40	601.4	0.60
340	5.67	0.012	0.14	0.68	202.6	180.2	22.4	1947.0	601.41	601.4	0.61
345	5.75	0.012	0.14	0.68	202.6	181.5	21.1	1968.1	601.41	601.41	0.61
350	5.83	0.012	0.14	0.68	202.6	183.6	19.0	1987.2	601.41	601.41	0.62
355	5.92	0.012	0.14	0.68	202.6	185.4	17.2	2004.3	601.42	601.42	0.62
360	6.00	0.012	0.14	0.68	202.6	187.1	15.5	2019.8	601.42	601.42	0.63
365	6.08	0.012	0.14	0.68	202.6	188.7	13.9	2033.7	601.42	601.42	0.63
370	6.17	0.012	0.14	0.68	202.6	190.0	12.6	2046.3	601.43	601.43	0.64
375	6.25	0.012	0.14	0.68	202.6	191.3	11.3	2057.6	601.43	601.43	0.64
380	6.33	0.012	0.14	0.68	202.6	192.4	10.2	2067.8	601.43	601.43	0.64
385	6.42	0.012	0.14	0.68	202.6	193.4	9.2	2077.0	601.43	601.43	0.65
390	6.50	0.013	0.16	0.73	219.5	194.3	25.2	2102.2	601.44	601.44	0.65
395	6.58	0.013	0.16	0.73	219.5	195.9	23.6	2125.7	601.44	601.44	0.66
400	6.67	0.013	0.16	0.73	219.5	198.2	21.3	2147.0	601.45	601.45	0.67
405	6.75	0.013	0.16	0.73	219.5	200.3	19.2	2166.2	601.45	601.45	0.67
410	6.83	0.013	0.16	0.73	219.5	202.2	17.3	2183.4	601.45	601.45	0.68
415	6.92	0.013	0.16	0.73	219.5	203.9	15.6	2199.0	601.46	601.46	0.68
420	7.00	0.013	0.16	0.73	219.5	205.5	14.0	2213.0	601.46	601.46	0.69
425	7.08	0.013	0.16	0.73	219.5	206.9	12.6	2225.6	601.46	601.46	0.69
430	7.17	0.014	0.17	0.79	236.4	208.1	28.3	2253.9	601.47	601.47	0.70
435	7.25	0.014	0.17	0.79	236.4	210.0	26.4	2280.3	601.48	601.47	0.71
440	7.33	0.014	0.17	0.79	236.4	212.6	23.8	2304.1	601.48	601.48	0.72
445	7.42	0.014	0.17	0.79	236.4	214.9	21.4	2325.5	601.48	601.48	0.72
450	7.50	0.014	0.17	0.79	236.4	217.1	19.3	2344.8	601.49	601.49	0.73
455	7.58	0.014	0.17	0.79	236.4	219.0	17.4	2362.2	601.49	601.49	0.74
460	7.67	0.014	0.17	0.79	236.4	220.7	15.7	2377.9	601.50	601.49	0.74
465	7.75	0.015	0.18	0.84	253.3	222.2	31.0	2408.9	601.50	601.5	0.75
470	7.83	0.015	0.18	0.84	253.3	224.4	28.8	2437.8	601.51	601.5	0.76
475	7.92	0.015	0.18	0.84	253.3	227.2	26.0	2463.8	601.51	601.51	0.77
480	8.00	0.015	0.18	0.84	253.3	229.8	23.5	2487.2	601.52	601.52	0.77

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
485	8.08	0.015	0.18	0.84	253.3	232.1	21.1	2508.4	601.52	601.52	0.78
490	8.17	0.015	0.18	0.84	253.3	234.2	19.0	2527.4	601.53	601.52	0.79
495	8.25	0.016	0.19	0.90	270.1	236.1	34.0	2561.5	601.53	601.53	0.80
500	8.33	0.016	0.19	0.90	270.1	238.6	31.6	2593.0	601.54	601.54	0.81
505	8.42	0.016	0.19	0.90	270.1	241.7	28.5	2621.5	601.55	601.54	0.81
510	8.50	0.016	0.19	0.90	270.1	244.5	25.7	2647.2	601.55	601.55	0.82
515	8.58	0.017	0.20	0.96	287.0	247.0	40.0	2687.2	601.56	601.56	0.83
520	8.67	0.017	0.20	0.96	287.0	250.1	36.9	2724.1	601.57	601.56	0.85
525	8.75	0.017	0.20	0.96	287.0	253.7	33.3	2757.4	601.57	601.57	0.86
530	8.83	0.017	0.20	0.96	287.0	257.0	30.0	2787.4	601.58	601.58	0.87
535	8.92	0.018	0.22	1.01	303.9	260.0	43.9	2831.4	601.59	601.59	0.88
540	9.00	0.018	0.22	1.01	303.9	263.4	40.5	2871.9	601.60	601.59	0.89
545	9.08	0.018	0.22	1.01	303.9	267.4	36.5	2908.4	601.61	601.6	0.90
550	9.17	0.018	0.22	1.01	303.9	271.0	32.9	2941.3	601.61	601.61	0.91
555	9.25	0.019	0.23	1.07	320.8	274.3	46.5	2987.8	601.62	601.62	0.93
560	9.33	0.019	0.23	1.07	320.8	278.0	42.8	3030.6	601.63	601.63	0.94
565	9.42	0.019	0.23	1.07	320.8	282.2	38.6	3069.3	601.64	601.64	0.95
570	9.50	0.020	0.24	1.13	337.7	286.0	51.7	3120.9	601.65	601.64	0.97
575	9.58	0.020	0.24	1.13	337.7	290.2	47.5	3168.4	601.66	601.66	0.98
580	9.67	0.021	0.25	1.18	354.6	294.9	59.7	3228.1	601.67	601.67	1.00
585	9.75	0.021	0.25	1.18	354.6	299.9	54.7	3282.8	601.68	601.68	1.02
590	9.83	0.022	0.26	1.24	371.4	305.3	66.2	3348.9	601.70	601.69	1.04
595	9.92	0.022	0.26	1.24	371.4	310.9	60.5	3409.5	601.71	601.7	1.06
600	10.00	0.023	0.28	1.29	388.3	316.9	71.5	3480.9	601.73	601.72	1.08
605	10.08	0.023	0.28	1.29	388.3	323.1	65.3	3546.2	601.74	601.73	1.10
610	10.17	0.024	0.29	1.35	405.2	329.5	75.8	3622.0	601.75	601.75	1.12
615	10.25	0.024	0.29	1.35	405.2	336.1	69.1	3691.1	601.77	601.76	1.14
620	10.33	0.025	0.30	1.41	422.1	342.9	79.2	3770.3	601.79	601.78	1.17
625	10.42	0.026	0.31	1.46	439.0	349.8	89.2	3859.5	601.80	601.79	1.19
630	10.50	0.027	0.32	1.52	455.9	357.7	98.1	3957.6	601.82	601.81	1.22
635	10.58	0.028	0.34	1.58	472.8	366.5	106.2	4063.9	601.85	601.84	1.25
640	10.67	0.029	0.35	1.63	489.6	376.1	113.5	4177.4	601.87	601.86	1.29
645	10.75	0.030	0.36	1.69	506.5	386.4	120.1	4297.6	601.90	601.88	1.32
650	10.83	0.031	0.37	1.74	523.4	397.3	126.1	4423.6	601.92	601.91	1.36
655	10.92	0.032	0.38	1.80	540.3	408.9	131.4	4555.0	601.95	601.94	1.40
660	11.00	0.034	0.41	1.91	574.1	421.0	153.1	4708.1	601.98	601.97	1.45
665	11.08	0.036	0.43	2.03	607.8	434.3	173.5	4881.6	602.01	602	1.50
670	11.17	0.038	0.46	2.14	641.6	448.9	192.7	5074.4	602.05	602.03	1.53
675	11.25	0.040	0.48	2.25	675.4	458.1	217.2	5291.6	602.08	602.06	1.56
680	11.33	0.043	0.52	2.42	726.0	467.4	258.6	5550.2	602.13	602.1	1.59
685	11.42	0.047	0.56	2.65	793.5	478.3	315.3	5865.5	602.18	602.15	1.64
690	11.50	0.051	0.61	2.87	861.1	491.3	369.8	6235.3	602.24	602.21	1.69
695	11.58	0.057	0.68	3.21	962.4	506.8	455.5	6690.8	602.32	602.28	1.75
700	11.67	0.066	0.79	3.71	1114.3	525.6	588.8	7279.5	602.42	602.37	1.83
705	11.75	0.079	0.95	4.45	1333.8	549.3	784.5	8064.1	602.55	602.48	1.94
710	11.83	0.102	1.22	5.74	1722.2	580.5	1141.7	9205.7	602.74	602.65	2.08
715	11.92	0.170	2.04	9.57	2870.3	624.3	2246.0	11451.8	603.10	602.92	2.33
720	12.00	0.502	6.02	28.25	8475.8	699.0	7776.8	19228.5	604.15	603.63	3.13
725	12.08	0.125	1.50	7.04	2110.5	940.0	1170.5	20399.0	604.29	604.22	4.61
730	12.17	0.088	1.06	4.95	1485.8	1384.0	101.8	20500.8	604.30	604.3	4.79
735	12.25	0.071	0.85	4.00	1198.8	1436.2	-237.5	20263.3	604.28	604.29	4.77
740	12.33	0.061	0.73	3.43	1029.9	1430.7	-400.7	19862.6	604.23	604.25	4.68
745	12.42	0.054	0.65	3.04	911.7	1404.5	-492.7	19369.8	604.17	604.2	4.56

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
750	12.50	0.049	0.59	2.76	827.3	1367.8	-540.5	18829.4	604.11	604.14	4.42
755	12.58	0.045	0.54	2.53	759.8	1325.4	-565.6	18263.8	604.04	604.07	4.27
760	12.67	0.042	0.50	2.36	709.1	1280.0	-570.8	17692.9	603.97	604	4.11
765	12.75	0.039	0.47	2.19	658.5	1232.1	-573.6	17119.3	603.89	603.93	3.92
770	12.83	0.037	0.44	2.08	624.7	1174.7	-550.0	16569.3	603.82	603.85	3.72
775	12.92	0.035	0.42	1.97	590.9	1116.3	-525.4	16043.9	603.75	603.78	3.53
780	13.00	0.033	0.40	1.86	557.2	1060.4	-503.2	15540.7	603.68	603.71	3.36
785	13.08	0.032	0.38	1.80	540.3	1006.9	-466.7	15074.0	603.62	603.65	3.19
790	13.17	0.030	0.36	1.69	506.5	956.5	-450.0	14624.0	603.56	603.59	3.03
795	13.25	0.029	0.35	1.63	489.6	908.9	-419.2	14204.8	603.50	603.53	2.88
800	13.33	0.028	0.34	1.58	472.8	863.7	-390.9	13813.8	603.45	603.47	2.78
805	13.42	0.027	0.32	1.52	455.9	833.8	-377.9	13435.9	603.39	603.42	2.73
810	13.50	0.026	0.31	1.46	439.0	820.4	-381.4	13054.4	603.34	603.36	2.69
815	13.58	0.025	0.30	1.41	422.1	807.2	-385.1	12669.3	603.28	603.31	2.65
820	13.67	0.025	0.30	1.41	422.1	793.8	-371.7	12297.6	603.23	603.25	2.60
825	13.75	0.024	0.29	1.35	405.2	780.7	-375.4	11922.1	603.17	603.2	2.56
830	13.83	0.023	0.28	1.29	388.3	767.6	-379.3	11542.8	603.12	603.14	2.51
835	13.92	0.023	0.28	1.29	388.3	754.5	-366.2	11176.7	603.06	603.09	2.47
840	14.00	0.022	0.26	1.24	371.4	741.5	-370.1	10806.6	603.01	603.04	2.43
845	14.08	0.022	0.26	1.24	371.4	728.7	-357.2	10449.4	602.95	602.98	2.38
850	14.17	0.021	0.25	1.18	354.6	714.6	-360.0	10089.3	602.89	602.92	2.33
855	14.25	0.021	0.25	1.18	354.6	698.5	-343.9	9745.4	602.83	602.86	2.28
860	14.33	0.020	0.24	1.13	337.7	682.5	-344.8	9400.6	602.77	602.8	2.22
865	14.42	0.020	0.24	1.13	337.7	666.9	-329.2	9071.4	602.72	602.75	2.17
870	14.50	0.020	0.24	1.13	337.7	651.6	-313.9	8757.5	602.67	602.69	2.12
875	14.58	0.019	0.23	1.07	320.8	637.0	-316.2	8441.3	602.61	602.64	2.08
880	14.67	0.019	0.23	1.07	320.8	622.6	-301.8	8139.5	602.56	602.59	2.03
885	14.75	0.019	0.23	1.07	320.8	608.6	-287.8	7851.7	602.51	602.54	1.98
890	14.83	0.018	0.22	1.01	303.9	595.2	-291.3	7560.4	602.46	602.49	1.94
895	14.92	0.018	0.22	1.01	303.9	582.1	-278.1	7282.2	602.42	602.44	1.90
900	15.00	0.018	0.22	1.01	303.9	569.1	-265.2	7017.0	602.37	602.4	1.86
905	15.08	0.017	0.20	0.96	287.0	556.8	-269.8	6747.3	602.33	602.35	1.82
910	15.17	0.017	0.20	0.96	287.0	544.6	-257.6	6489.6	602.28	602.31	1.78
915	15.25	0.017	0.20	0.96	287.0	532.7	-245.6	6244.0	602.24	602.26	1.74
920	15.33	0.017	0.20	0.96	287.0	521.2	-234.2	6009.8	602.20	602.22	1.70
925	15.42	0.016	0.19	0.90	270.1	510.3	-240.2	5769.6	602.16	602.18	1.67
930	15.50	0.016	0.19	0.90	270.1	499.5	-229.4	5540.2	602.12	602.14	1.63
935	15.58	0.016	0.19	0.90	270.1	488.9	-218.7	5321.5	602.09	602.11	1.60
940	15.67	0.016	0.19	0.90	270.1	478.7	-208.6	5112.9	602.05	602.07	1.56
945	15.75	0.016	0.19	0.90	270.1	469.0	-198.9	4914.1	602.02	602.04	1.53
950	15.83	0.015	0.18	0.84	253.3	459.7	-206.5	4707.6	601.98	602	1.50
955	15.92	0.015	0.18	0.84	253.3	450.0	-196.8	4510.8	601.94	601.96	1.44
960	16.00	0.015	0.18	0.84	253.3	432.2	-178.9	4331.9	601.90	601.92	1.38
965	16.08	0.015	0.18	0.84	253.3	414.6	-161.3	4170.5	601.87	601.89	1.33
970	16.17	0.015	0.18	0.84	253.3	398.6	-145.4	4025.2	601.84	601.85	1.28
975	16.25	0.014	0.17	0.79	236.4	384.3	-147.9	3877.3	601.81	601.82	1.24
980	16.33	0.014	0.17	0.79	236.4	370.5	-134.1	3743.2	601.78	601.79	1.19
985	16.42	0.014	0.17	0.79	236.4	357.3	-120.9	3622.3	601.75	601.77	1.15
990	16.50	0.014	0.17	0.79	236.4	345.3	-109.0	3513.3	601.73	601.74	1.12
995	16.58	0.014	0.17	0.79	236.4	334.5	-98.2	3415.1	601.71	601.72	1.08
1000	16.67	0.014	0.17	0.79	236.4	324.8	-88.5	3326.7	601.69	601.7	1.05
1005	16.75	0.014	0.17	0.79	236.4	316.1	-79.7	3247.0	601.68	601.68	1.03
1010	16.83	0.013	0.16	0.73	219.5	308.2	-88.7	3158.2	601.66	601.67	1.00

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
1015	16.92	0.013	0.16	0.73	219.5	300.3	-80.8	3077.4	601.64	601.65	0.97
1020	17.00	0.013	0.16	0.73	219.5	292.4	-72.9	3004.6	601.63	601.63	0.95
1025	17.08	0.013	0.16	0.73	219.5	285.2	-65.7	2938.9	601.61	601.62	0.93
1030	17.17	0.013	0.16	0.73	219.5	278.7	-59.2	2879.7	601.60	601.61	0.91
1035	17.25	0.013	0.16	0.73	219.5	272.8	-53.3	2826.4	601.59	601.59	0.89
1040	17.33	0.013	0.16	0.73	219.5	267.5	-48.0	2778.4	601.58	601.58	0.88
1045	17.42	0.013	0.16	0.73	219.5	262.8	-43.3	2735.1	601.57	601.57	0.86
1050	17.50	0.012	0.14	0.68	202.6	258.5	-55.9	2679.2	601.56	601.56	0.85
1055	17.58	0.012	0.14	0.68	202.6	253.8	-51.2	2628.0	601.55	601.55	0.83
1060	17.67	0.012	0.14	0.68	202.6	248.8	-46.2	2581.7	601.54	601.54	0.81
1065	17.75	0.012	0.14	0.68	202.6	244.3	-41.6	2540.1	601.53	601.53	0.80
1070	17.83	0.012	0.14	0.68	202.6	240.1	-37.5	2502.6	601.52	601.53	0.79
1075	17.92	0.012	0.14	0.68	202.6	236.4	-33.8	2468.8	601.51	601.52	0.78
1080	18.00	0.012	0.14	0.68	202.6	233.1	-30.5	2438.3	601.51	601.51	0.77
1085	18.08	0.012	0.14	0.68	202.6	230.1	-27.5	2410.8	601.50	601.51	0.76
1090	18.17	0.012	0.14	0.68	202.6	227.3	-24.7	2386.1	601.50	601.5	0.75
1095	18.25	0.012	0.14	0.68	202.6	224.9	-22.3	2363.8	601.49	601.49	0.74
1100	18.33	0.012	0.14	0.68	202.6	222.7	-20.1	2343.7	601.49	601.49	0.74
1105	18.42	0.011	0.13	0.62	185.7	220.7	-35.0	2308.7	601.48	601.48	0.73
1110	18.50	0.011	0.13	0.62	185.7	218.1	-32.4	2276.3	601.47	601.48	0.72
1115	18.58	0.011	0.13	0.62	185.7	215.0	-29.2	2247.1	601.47	601.47	0.71
1120	18.67	0.011	0.13	0.62	185.7	212.1	-26.4	2220.7	601.46	601.47	0.70
1125	18.75	0.011	0.13	0.62	185.7	209.5	-23.7	2197.0	601.46	601.46	0.69
1130	18.83	0.011	0.13	0.62	185.7	207.1	-21.4	2175.6	601.45	601.46	0.68
1135	18.92	0.011	0.13	0.62	185.7	205.0	-19.3	2156.3	601.45	601.45	0.68
1140	19.00	0.011	0.13	0.62	185.7	203.1	-17.4	2138.9	601.45	601.45	0.67
1145	19.08	0.011	0.13	0.62	185.7	201.4	-15.7	2123.3	601.44	601.44	0.67
1150	19.17	0.011	0.13	0.62	185.7	199.8	-14.1	2109.2	601.44	601.44	0.66
1155	19.25	0.011	0.13	0.62	185.7	198.4	-12.7	2096.4	601.44	601.44	0.66
1160	19.33	0.011	0.13	0.62	185.7	197.2	-11.5	2085.0	601.43	601.44	0.65
1165	19.42	0.011	0.13	0.62	185.7	196.0	-10.3	2074.7	601.43	601.43	0.65
1170	19.50	0.010	0.12	0.56	168.8	195.0	-26.2	2048.5	601.43	601.43	0.64
1175	19.58	0.010	0.12	0.56	168.8	193.3	-24.5	2024.0	601.42	601.42	0.64
1180	19.67	0.010	0.12	0.56	168.8	190.9	-22.1	2001.9	601.42	601.42	0.63
1185	19.75	0.010	0.12	0.56	168.8	188.8	-19.9	1982.0	601.41	601.42	0.62
1190	19.83	0.010	0.12	0.56	168.8	186.8	-17.9	1964.1	601.41	601.41	0.62
1195	19.92	0.010	0.12	0.56	168.8	185.0	-16.2	1947.9	601.41	601.41	0.61
1200	20.00	0.010	0.12	0.56	168.8	183.4	-14.6	1933.3	601.40	601.4	0.61
1205	20.08	0.010	0.12	0.56	168.8	182.0	-13.1	1920.2	601.40	601.4	0.60
1210	20.17	0.010	0.12	0.56	168.8	180.7	-11.8	1908.4	601.40	601.4	0.60
1215	20.25	0.010	0.12	0.56	168.8	179.5	-10.7	1897.7	601.40	601.4	0.59
1220	20.33	0.010	0.12	0.56	168.8	178.4	-9.6	1888.1	601.39	601.39	0.59
1225	20.42	0.010	0.12	0.56	168.8	177.5	-8.7	1879.4	601.39	601.39	0.59
1230	20.50	0.010	0.12	0.56	168.8	176.6	-7.8	1871.6	601.39	601.39	0.59
1235	20.58	0.010	0.12	0.56	168.8	175.9	-7.0	1864.6	601.39	601.39	0.58
1240	20.67	0.010	0.12	0.56	168.8	175.2	-6.3	1858.3	601.39	601.39	0.58
1245	20.75	0.010	0.12	0.56	168.8	174.5	-5.7	1852.6	601.39	601.39	0.58
1250	20.83	0.010	0.12	0.56	168.8	174.0	-5.1	1847.4	601.38	601.39	0.58
1255	20.92	0.009	0.11	0.51	152.0	173.5	-21.5	1825.9	601.38	601.38	0.57
1260	21.00	0.009	0.11	0.51	152.0	172.2	-20.3	1805.6	601.38	601.38	0.57
1265	21.08	0.009	0.11	0.51	152.0	170.3	-18.3	1787.3	601.37	601.37	0.56
1270	21.17	0.009	0.11	0.51	152.0	168.5	-16.5	1770.8	601.37	601.37	0.56
1275	21.25	0.009	0.11	0.51	152.0	166.8	-14.9	1756.0	601.37	601.37	0.55

Input			Calculated						Interpolated		
Time (min)	**Time (hr)**	**PI (in)**	**i (in/hr)**	**Q_{in} (cfs)**	**Vol_{in} (ft^3)**	**Vol_{out} (ft^3)**	**ΔVol (ft^3)**	**Vol_{Total} (ft^3)**	**Peak Stage (ft)**	**Avg Stage (ft)**	**Q_{out} (cfs)**
1280	21.33	0.009	0.11	0.51	152.0	165.4	-13.4	1742.6	601.36	601.36	0.55
1285	21.42	0.009	0.11	0.51	152.0	164.0	-12.1	1730.5	601.36	601.36	0.54
1290	21.50	0.009	0.11	0.51	152.0	162.8	-10.9	1719.6	601.36	601.36	0.54
1300	21.67	0.009	0.11	0.51	152.0	161.8	-9.8	1709.8	601.36	601.36	0.54
1305	21.75	0.009	0.11	0.51	152.0	160.8	-8.8	1701.0	601.35	601.36	0.53
1310	21.83	0.009	0.11	0.51	152.0	159.9	-8.0	1693.0	601.35	601.35	0.53
1315	21.92	0.009	0.11	0.51	152.0	159.1	-7.2	1685.9	601.35	601.35	0.53
1320	22.00	0.009	0.11	0.51	152.0	158.4	-6.5	1679.4	601.35	601.35	0.53
1325	22.08	0.009	0.11	0.51	152.0	157.8	-5.8	1673.6	601.35	601.35	0.52
1330	22.17	0.009	0.11	0.51	152.0	157.2	-5.2	1668.3	601.35	601.35	0.52
1335	22.25	0.009	0.11	0.51	152.0	156.7	-4.7	1663.6	601.35	601.35	0.52
1340	22.33	0.009	0.11	0.51	152.0	156.2	-4.3	1659.3	601.35	601.35	0.52
1345	22.42	0.009	0.11	0.51	152.0	155.8	-3.8	1655.5	601.34	601.35	0.52
1350	22.50	0.009	0.11	0.51	152.0	155.4	-3.5	1652.0	601.34	601.34	0.52
1355	22.58	0.009	0.11	0.51	152.0	155.1	-3.1	1648.9	601.34	601.34	0.52
1360	22.67	0.009	0.11	0.51	152.0	154.8	-2.8	1646.1	601.34	601.34	0.51
1365	22.75	0.009	0.11	0.51	152.0	154.5	-2.5	1643.6	601.34	601.34	0.51
1370	22.83	0.009	0.11	0.51	152.0	154.2	-2.3	1641.3	601.34	601.34	0.51
1375	22.92	0.008	0.10	0.45	135.1	154.0	-18.9	1622.4	601.34	601.34	0.51
1380	23.00	0.008	0.10	0.45	135.1	153.0	-17.9	1604.4	601.33	601.34	0.50
1385	23.08	0.008	0.10	0.45	135.1	151.3	-16.2	1588.2	601.33	601.33	0.50
1390	23.17	0.008	0.10	0.45	135.1	149.7	-14.6	1573.6	601.33	601.33	0.49
1395	23.25	0.008	0.10	0.45	135.1	148.2	-13.2	1560.4	601.33	601.33	0.49
1400	23.33	0.008	0.10	0.45	135.1	146.9	-11.9	1548.6	601.32	601.32	0.49
1405	23.42	0.008	0.10	0.45	135.1	145.8	-10.7	1537.9	601.32	601.32	0.48
1410	23.50	0.008	0.10	0.45	135.1	144.7	-9.6	1528.2	601.32	601.32	0.48
1415	23.58	0.008	0.10	0.45	135.1	143.8	-8.7	1519.5	601.32	601.32	0.48
1420	23.67	0.008	0.10	0.45	135.1	142.9	-7.8	1511.7	601.32	601.32	0.47
1425	23.75	0.008	0.10	0.45	135.1	142.1	-7.0	1504.7	601.31	601.31	0.47
1430	23.83	0.008	0.10	0.45	135.1	141.4	-6.4	1498.3	601.31	601.31	0.47
1435	23.92	0.008	0.10	0.45	135.1	140.8	-5.7	1492.6	601.31	601.31	0.47
1440	24.00	0.008	0.10	0.45	135.1	140.2	-5.2	1487.4	601.31	601.31	0.47

Detention Stage-Storage-Discharge Calculation

Canby Apartments Detention Basin

100-year

Detention and Basin Parameters

Total 24-hr rainfall= 6.82 in

Area = 6.7 ac
C = 0.79
Elev = 620

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
0	0.00	0.010	0.12	0.64	190.5	0.0	0.0	0.0	601.00	0	0.00
5	0.08	0.010	0.12	0.64	190.5	0.0	190.5	190.5	601.04	601.02	0.03
10	0.17	0.010	0.12	0.64	190.5	8.9	181.6	372.2	601.08	601.06	0.09
15	0.25	0.010	0.12	0.64	190.5	26.4	164.2	536.3	601.11	601.09	0.14
20	0.33	0.010	0.12	0.64	190.5	42.6	148.0	684.3	601.14	601.13	0.19
25	0.42	0.010	0.12	0.64	190.5	57.2	133.3	817.6	601.17	601.16	0.23
30	0.50	0.010	0.12	0.64	190.5	70.4	120.1	937.7	601.20	601.18	0.27
35	0.58	0.010	0.12	0.64	190.5	82.3	108.2	1046.0	601.22	601.21	0.31
40	0.67	0.010	0.12	0.64	190.5	93.0	97.5	1143.5	601.24	601.23	0.34
45	0.75	0.010	0.12	0.64	190.5	102.7	87.9	1231.4	601.26	601.25	0.37
50	0.83	0.010	0.12	0.64	190.5	111.3	79.2	1310.6	601.27	601.26	0.40
55	0.92	0.011	0.13	0.70	209.6	119.2	90.4	1401.0	601.29	601.28	0.42
60	1.00	0.011	0.13	0.70	209.6	127.1	82.5	1483.5	601.31	601.3	0.45
65	1.08	0.011	0.13	0.70	209.6	135.2	74.4	1557.9	601.32	601.32	0.48
70	1.17	0.011	0.13	0.70	209.6	142.6	67.0	1624.9	601.34	601.33	0.50
75	1.25	0.011	0.13	0.70	209.6	149.2	60.4	1685.3	601.35	601.34	0.52
80	1.33	0.011	0.13	0.70	209.6	155.2	54.4	1739.7	601.36	601.36	0.54
85	1.42	0.011	0.13	0.70	209.6	160.6	49.0	1788.7	601.37	601.37	0.55
90	1.50	0.011	0.13	0.70	209.6	165.4	44.2	1832.9	601.38	601.38	0.57
95	1.58	0.011	0.13	0.70	209.6	169.8	39.8	1872.7	601.39	601.39	0.58
100	1.67	0.008	0.10	0.51	152.4	173.7	-21.3	1851.4	601.39	601.39	0.58
105	1.75	0.011	0.13	0.70	209.6	174.6	35.0	1886.4	601.39	601.39	0.58
110	1.83	0.011	0.13	0.70	209.6	175.2	34.4	1920.7	601.40	601.4	0.59
115	1.92	0.011	0.13	0.70	209.6	178.5	31.1	1951.8	601.41	601.4	0.61
120	2.00	0.011	0.13	0.70	209.6	181.6	28.0	1979.9	601.41	601.41	0.61
125	2.08	0.011	0.13	0.70	209.6	184.3	25.3	2005.1	601.42	601.42	0.62
130	2.17	0.011	0.13	0.70	209.6	186.8	22.8	2027.9	601.42	601.42	0.63
135	2.25	0.011	0.13	0.70	209.6	189.1	20.5	2048.4	601.43	601.42	0.64
140	2.33	0.011	0.13	0.70	209.6	191.1	18.5	2066.9	601.43	601.43	0.64
145	2.42	0.011	0.13	0.70	209.6	192.9	16.7	2083.6	601.43	601.43	0.65
150	2.50	0.011	0.13	0.70	209.6	194.6	15.0	2098.6	601.44	601.44	0.65
155	2.58	0.012	0.14	0.76	228.7	196.1	32.6	2131.2	601.44	601.44	0.66
160	2.67	0.012	0.14	0.76	228.7	198.3	30.3	2161.5	601.45	601.45	0.67
165	2.75	0.012	0.14	0.76	228.7	201.3	27.4	2188.9	601.46	601.45	0.68
170	2.83	0.012	0.14	0.76	228.7	204.0	24.7	2213.6	601.46	601.46	0.69
175	2.92	0.012	0.14	0.76	228.7	206.4	22.2	2235.8	601.47	601.46	0.70
180	3.00	0.012	0.14	0.76	228.7	208.6	20.0	2255.9	601.47	601.47	0.70
185	3.08	0.012	0.14	0.76	228.7	210.6	18.1	2273.9	601.47	601.47	0.71
190	3.17	0.012	0.14	0.76	228.7	212.4	16.3	2290.2	601.48	601.48	0.71
195	3.25	0.012	0.14	0.76	228.7	214.0	14.7	2304.9	601.48	601.48	0.72
200	3.33	0.012	0.14	0.76	228.7	215.4	13.2	2318.1	601.48	601.48	0.72
205	3.42	0.012	0.14	0.76	228.7	216.7	11.9	2330.0	601.49	601.48	0.73
210	3.50	0.012	0.14	0.76	228.7	217.9	10.7	2340.8	601.49	601.49	0.73
215	3.58	0.012	0.14	0.76	228.7	219.0	9.7	2350.4	601.49	601.49	0.73

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
220	3.67	0.012	0.14	0.76	228.7	219.9	8.7	2359.1	601.49	601.49	0.74
225	3.75	0.012	0.14	0.76	228.7	220.8	7.9	2367.0	601.49	601.49	0.74
230	3.83	0.013	0.16	0.83	247.7	221.6	26.1	2393.1	601.50	601.5	0.74
235	3.92	0.013	0.16	0.83	247.7	223.2	24.5	2417.7	601.50	601.5	0.75
240	4.00	0.013	0.16	0.83	247.7	225.6	22.2	2439.8	601.51	601.51	0.76
245	4.08	0.013	0.16	0.83	247.7	227.7	20.0	2459.8	601.51	601.51	0.77
250	4.17	0.013	0.16	0.83	247.7	229.7	18.0	2477.8	601.52	601.51	0.77
255	4.25	0.013	0.16	0.83	247.7	231.5	16.2	2494.0	601.52	601.52	0.78
260	4.33	0.013	0.16	0.83	247.7	233.1	14.6	2508.6	601.52	601.52	0.78
265	4.42	0.013	0.16	0.83	247.7	234.5	13.2	2521.8	601.53	601.52	0.79
270	4.50	0.013	0.16	0.83	247.7	235.8	11.9	2533.6	601.53	601.53	0.79
275	4.58	0.013	0.16	0.83	247.7	237.0	10.7	2544.3	601.53	601.53	0.79
280	4.67	0.013	0.16	0.83	247.7	238.1	9.6	2554.0	601.53	601.53	0.80
285	4.75	0.013	0.16	0.83	247.7	239.0	8.7	2562.6	601.53	601.53	0.80
290	4.83	0.014	0.17	0.89	266.8	239.9	26.9	2589.5	601.54	601.54	0.81
295	4.92	0.014	0.17	0.89	266.8	241.6	25.2	2614.7	601.54	601.54	0.81
300	5.00	0.014	0.17	0.89	266.8	244.0	22.8	2637.5	601.55	601.55	0.82
305	5.08	0.014	0.17	0.89	266.8	246.2	20.5	2658.0	601.55	601.55	0.83
310	5.17	0.014	0.17	0.89	266.8	248.3	18.5	2676.5	601.56	601.56	0.83
315	5.25	0.014	0.17	0.89	266.8	250.1	16.7	2693.2	601.56	601.56	0.84
320	5.33	0.014	0.17	0.89	266.8	251.8	15.0	2708.2	601.56	601.56	0.84
325	5.42	0.014	0.17	0.89	266.8	253.2	13.5	2721.7	601.57	601.57	0.85
330	5.50	0.014	0.17	0.89	266.8	254.6	12.2	2733.9	601.57	601.57	0.85
335	5.58	0.014	0.17	0.89	266.8	255.8	11.0	2744.9	601.57	601.57	0.86
340	5.67	0.015	0.18	0.95	285.8	256.9	29.0	2773.8	601.58	601.57	0.86
345	5.75	0.015	0.18	0.95	285.8	258.7	27.1	2800.9	601.58	601.58	0.87
350	5.83	0.015	0.18	0.95	285.8	261.4	24.5	2825.4	601.59	601.59	0.88
355	5.92	0.015	0.18	0.95	285.8	263.8	22.0	2847.4	601.59	601.59	0.89
360	6.00	0.015	0.18	0.95	285.8	266.0	19.9	2867.2	601.60	601.6	0.89
365	6.08	0.015	0.18	0.95	285.8	267.9	17.9	2885.1	601.60	601.6	0.90
370	6.17	0.015	0.18	0.95	285.8	269.7	16.1	2901.3	601.60	601.6	0.90
375	6.25	0.015	0.18	0.95	285.8	271.3	14.5	2915.8	601.61	601.61	0.91
380	6.33	0.015	0.18	0.95	285.8	272.7	13.1	2928.9	601.61	601.61	0.91
385	6.42	0.016	0.19	1.02	304.9	274.0	30.9	2959.7	601.62	601.61	0.92
390	6.50	0.016	0.19	1.02	304.9	276.1	28.8	2988.5	601.62	601.62	0.93
395	6.58	0.016	0.19	1.02	304.9	278.9	26.0	3014.5	601.63	601.63	0.94
400	6.67	0.016	0.19	1.02	304.9	281.5	23.4	3037.9	601.63	601.63	0.95
405	6.75	0.016	0.19	1.02	304.9	283.8	21.1	3059.1	601.64	601.64	0.95
410	6.83	0.016	0.19	1.02	304.9	285.9	19.0	3078.1	601.64	601.64	0.96
415	6.92	0.016	0.19	1.02	304.9	287.7	17.1	3095.2	601.64	601.64	0.96
420	7.00	0.017	0.20	1.08	323.9	289.4	34.5	3129.7	601.65	601.65	0.97
425	7.08	0.017	0.20	1.08	323.9	291.9	32.1	3161.8	601.66	601.66	0.98
430	7.17	0.017	0.20	1.08	323.9	295.0	29.0	3190.7	601.66	601.66	0.99
435	7.25	0.017	0.20	1.08	323.9	297.8	26.1	3216.8	601.67	601.67	1.00
440	7.33	0.017	0.20	1.08	323.9	300.4	23.5	3240.4	601.68	601.67	1.01
445	7.42	0.017	0.20	1.08	323.9	302.7	21.2	3261.5	601.68	601.68	1.02
450	7.50	0.018	0.22	1.14	343.0	304.8	38.1	3299.7	601.69	601.68	1.03
455	7.58	0.018	0.22	1.14	343.0	307.6	35.4	3335.1	601.69	601.69	1.04
460	7.67	0.018	0.22	1.14	343.0	311.1	31.9	3367.0	601.70	601.7	1.05
465	7.75	0.018	0.22	1.14	343.0	314.2	28.8	3395.7	601.71	601.7	1.06
470	7.83	0.018	0.22	1.14	343.0	317.1	25.9	3421.7	601.71	601.71	1.07
475	7.92	0.019	0.23	1.21	362.0	319.6	42.4	3464.1	601.72	601.72	1.08
480	8.00	0.019	0.23	1.21	362.0	322.8	39.2	3503.3	601.73	601.73	1.09

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
485	8.08	0.019	0.23	1.21	362.0	326.7	35.4	3538.6	601.74	601.73	1.10
490	8.17	0.019	0.23	1.21	362.0	330.2	31.9	3570.5	601.74	601.74	1.11
495	8.25	0.020	0.24	1.27	381.1	333.3	47.8	3618.3	601.75	601.75	1.12
500	8.33	0.020	0.24	1.27	381.1	337.0	44.0	3662.4	601.76	601.76	1.14
505	8.42	0.020	0.24	1.27	381.1	341.4	39.7	3702.1	601.77	601.77	1.15
510	8.50	0.020	0.24	1.27	381.1	345.3	35.8	3737.9	601.78	601.78	1.16
515	8.58	0.021	0.25	1.33	400.2	348.8	51.3	3789.2	601.79	601.78	1.18
520	8.67	0.021	0.25	1.33	400.2	352.9	47.2	3836.5	601.80	601.79	1.19
525	8.75	0.021	0.25	1.33	400.2	357.5	42.6	3879.1	601.81	601.8	1.21
530	8.83	0.022	0.26	1.40	419.2	361.7	57.5	3936.6	601.82	601.81	1.22
535	8.92	0.022	0.26	1.40	419.2	366.4	52.8	3989.3	601.83	601.83	1.24
540	9.00	0.022	0.26	1.40	419.2	371.6	47.6	4036.9	601.84	601.84	1.25
545	9.08	0.023	0.28	1.46	438.3	376.3	62.0	4098.9	601.85	601.85	1.27
550	9.17	0.023	0.28	1.46	438.3	381.4	56.8	4155.7	601.87	601.86	1.29
555	9.25	0.024	0.29	1.52	457.3	387.0	70.3	4226.0	601.88	601.87	1.31
560	9.33	0.024	0.29	1.52	457.3	393.0	64.3	4290.3	601.89	601.89	1.33
565	9.42	0.024	0.29	1.52	457.3	399.3	58.0	4348.4	601.91	601.9	1.35
570	9.50	0.025	0.30	1.59	476.4	405.0	71.3	4419.7	601.92	601.91	1.37
575	9.58	0.025	0.30	1.59	476.4	411.1	65.3	4485.0	601.93	601.93	1.39
580	9.67	0.026	0.31	1.65	495.4	417.5	77.9	4562.9	601.95	601.94	1.41
585	9.75	0.026	0.31	1.65	495.4	424.2	71.2	4634.1	601.97	601.96	1.44
590	9.83	0.027	0.32	1.71	514.5	431.2	83.3	4717.4	601.98	601.97	1.46
595	9.92	0.028	0.34	1.78	533.5	438.4	95.1	4812.5	602.00	601.99	1.49
600	10.00	0.028	0.34	1.78	533.5	446.7	86.8	4899.4	602.02	602.01	1.51
605	10.08	0.029	0.35	1.84	552.6	452.6	100.0	4999.4	602.03	602.03	1.52
610	10.17	0.030	0.36	1.91	571.6	456.8	114.8	5114.2	602.05	602.04	1.54
615	10.25	0.031	0.37	1.97	590.7	461.7	129.0	5243.2	602.07	602.06	1.56
620	10.33	0.031	0.37	1.97	590.7	467.2	123.5	5366.6	602.10	602.09	1.58
625	10.42	0.032	0.38	2.03	609.8	473.0	136.8	5503.4	602.12	602.11	1.60
630	10.50	0.033	0.40	2.10	628.8	478.9	149.9	5653.3	602.14	602.13	1.62
635	10.58	0.035	0.42	2.22	666.9	485.4	181.5	5834.8	602.17	602.16	1.64
640	10.67	0.036	0.43	2.29	686.0	492.9	193.0	6027.9	602.21	602.19	1.67
645	10.75	0.037	0.44	2.35	705.0	501.4	203.6	6231.4	602.24	602.22	1.70
650	10.83	0.039	0.47	2.48	743.1	510.4	232.7	6464.1	602.28	602.26	1.73
655	10.92	0.041	0.49	2.60	781.2	520.4	260.9	6725.0	602.32	602.3	1.77
660	11.00	0.042	0.50	2.67	800.3	531.6	268.7	6993.8	602.37	602.35	1.81
665	11.08	0.045	0.54	2.86	857.5	543.6	313.9	7307.6	602.42	602.4	1.86
670	11.17	0.047	0.56	2.99	895.6	556.8	338.7	7646.4	602.48	602.45	1.91
675	11.25	0.050	0.60	3.18	952.7	571.7	381.1	8027.5	602.54	602.51	1.96
680	11.33	0.054	0.65	3.43	1029.0	588.0	441.0	8468.4	602.62	602.58	2.02
685	11.42	0.059	0.71	3.75	1124.2	606.7	517.6	8986.0	602.70	602.66	2.09
690	11.50	0.064	0.77	4.07	1219.5	628.4	591.1	9577.0	602.80	602.75	2.18
695	11.58	0.072	0.86	4.57	1371.9	653.6	718.3	10295.3	602.92	602.86	2.28
700	11.67	0.082	0.98	5.21	1562.5	683.4	879.1	11174.5	603.06	602.99	2.39
705	11.75	0.099	1.19	6.29	1886.4	718.3	1168.1	12342.6	603.23	603.15	2.52
710	11.83	0.128	1.54	8.13	2439.0	755.4	1683.6	14026.2	603.48	603.35	2.68
715	11.92	0.213	2.56	13.53	4058.7	805.1	3253.6	17279.8	603.91	603.69	3.31
720	12.00	0.630	7.56	40.02	12004.5	991.7	11012.8	28292.6	605.21	604.56	5.39
725	12.08	0.156	1.87	9.91	2972.5	1617.6	1355.0	29647.5	605.35	605.28	7.49
730	12.17	0.111	1.33	7.05	2115.1	2247.1	-132.0	29515.5	605.34	605.34	8.35
735	12.25	0.089	1.07	5.65	1695.9	2504.6	-808.7	28706.8	605.25	605.3	7.70
740	12.33	0.076	0.91	4.83	1448.2	2308.6	-860.4	27846.4	605.16	605.21	6.76
745	12.42	0.068	0.82	4.32	1295.7	2028.8	-733.1	27113.4	605.08	605.12	6.61

Input			Calculated						Interpolated		
Time (min)	**Time (hr)**	**PI (in)**	**i (in/hr)**	**Q_{in} (cfs)**	**Vol_{in} (ft^3)**	**Vol_{out} (ft^3)**	**ΔVol (ft^3)**	**Vol_{Total} (ft^3)**	**Peak Stage (ft)**	**Avg Stage (ft)**	**Q_{out} (cfs)**
750	12.50	0.061	0.73	3.87	1162.3	1984.3	-821.9	26291.5	604.99	605.04	6.47
755	12.58	0.056	0.67	3.56	1067.1	1940.2	-873.1	25418.3	604.89	604.94	6.27
760	12.67	0.052	0.62	3.30	990.8	1880.0	-889.1	24529.2	604.78	604.84	6.03
765	12.75	0.049	0.59	3.11	933.7	1807.6	-874.0	23655.3	604.68	604.73	5.78
770	12.83	0.046	0.55	2.92	876.5	1735.3	-858.7	22796.5	604.58	604.63	5.55
775	12.92	0.044	0.53	2.79	838.4	1664.1	-825.7	21970.8	604.48	604.53	5.32
780	13.00	0.041	0.49	2.60	781.2	1595.0	-813.7	21157.0	604.38	604.43	5.09
785	13.08	0.040	0.48	2.54	762.2	1527.7	-765.5	20391.5	604.29	604.34	4.88
790	13.17	0.038	0.46	2.41	724.1	1462.9	-738.8	19652.8	604.20	604.25	4.67
795	13.25	0.037	0.44	2.35	705.0	1401.1	-696.1	18956.7	604.12	604.16	4.47
800	13.33	0.035	0.42	2.22	666.9	1342.2	-675.3	18281.4	604.04	604.08	4.29
805	13.42	0.034	0.41	2.16	647.9	1285.9	-638.1	17643.3	603.96	604	4.10
810	13.50	0.033	0.40	2.10	628.8	1230.6	-601.7	17041.6	603.88	603.92	3.89
815	13.58	0.032	0.38	2.03	609.8	1168.1	-558.3	16483.2	603.81	603.84	3.69
820	13.67	0.031	0.37	1.97	590.7	1107.8	-517.1	15966.1	603.74	603.77	3.51
825	13.75	0.030	0.36	1.91	571.6	1051.9	-480.3	15485.9	603.67	603.71	3.33
830	13.83	0.029	0.35	1.84	552.6	1000.1	-447.5	15038.4	603.61	603.64	3.17
835	13.92	0.029	0.35	1.84	552.6	951.8	-399.2	14639.2	603.56	603.59	3.03
840	14.00	0.028	0.34	1.78	533.5	907.8	-374.3	14264.9	603.51	603.54	2.89
845	14.08	0.027	0.32	1.71	514.5	867.6	-353.1	13911.8	603.46	603.49	2.79
850	14.17	0.027	0.32	1.71	514.5	836.5	-322.0	13589.8	603.41	603.44	2.75
855	14.25	0.026	0.31	1.65	495.4	824.8	-329.4	13260.4	603.37	603.39	2.71
860	14.33	0.026	0.31	1.65	495.4	813.5	-318.0	12942.3	603.32	603.34	2.67
865	14.42	0.025	0.30	1.59	476.4	802.2	-325.8	12616.5	603.27	603.3	2.64
870	14.50	0.025	0.30	1.59	476.4	791.0	-314.6	12301.9	603.23	603.25	2.60
875	14.58	0.024	0.29	1.52	457.3	779.8	-322.5	11979.4	603.18	603.2	2.56
880	14.67	0.024	0.29	1.52	457.3	768.7	-311.4	11668.0	603.13	603.16	2.53
885	14.75	0.023	0.28	1.46	438.3	757.7	-319.4	11348.6	603.09	603.11	2.49
890	14.83	0.023	0.28	1.46	438.3	746.7	-308.4	11040.2	603.04	603.07	2.45
895	14.92	0.023	0.28	1.46	438.3	735.7	-297.5	10742.7	603.00	603.02	2.42
900	15.00	0.022	0.26	1.40	419.2	725.2	-306.0	10436.7	602.95	602.97	2.38
905	15.08	0.022	0.26	1.40	419.2	713.1	-293.9	10142.8	602.90	602.92	2.33
910	15.17	0.015	0.18	0.95	285.8	699.4	-413.6	9729.2	602.83	602.86	2.28
915	15.25	0.021	0.25	1.33	400.2	683.4	-283.2	9446.0	602.78	602.81	2.23
920	15.33	0.021	0.25	1.33	400.2	667.5	-267.4	9178.6	602.74	602.76	2.18
925	15.42	0.021	0.25	1.33	400.2	655.0	-254.9	8923.8	602.69	602.72	2.14
930	15.50	0.020	0.24	1.27	381.1	643.2	-262.1	8661.7	602.65	602.67	2.10
935	15.58	0.020	0.24	1.27	381.1	631.4	-250.3	8411.4	602.61	602.63	2.07
940	15.67	0.020	0.24	1.27	381.1	619.8	-238.7	8172.7	602.57	602.59	2.03
945	15.75	0.020	0.24	1.27	381.1	608.7	-227.6	7945.1	602.53	602.55	1.99
950	15.83	0.019	0.23	1.21	362.0	598.1	-236.0	7709.0	602.49	602.51	1.96
955	15.92	0.019	0.23	1.21	362.0	587.6	-225.5	7483.5	602.45	602.47	1.92
960	16.00	0.019	0.23	1.21	362.0	577.1	-215.0	7268.5	602.42	602.43	1.89
965	16.08	0.019	0.23	1.21	362.0	567.1	-205.0	7063.5	602.38	602.4	1.86
970	16.17	0.018	0.22	1.14	343.0	557.5	-214.5	6848.9	602.34	602.36	1.83
975	16.25	0.018	0.22	1.14	343.0	548.0	-205.0	6643.9	602.31	602.33	1.79
980	16.33	0.018	0.22	1.14	343.0	538.5	-195.5	6448.4	602.28	602.29	1.76
985	16.42	0.018	0.22	1.14	343.0	529.4	-186.4	6262.0	602.25	602.26	1.74
990	16.50	0.018	0.22	1.14	343.0	520.7	-177.7	6084.3	602.22	602.23	1.71
995	16.58	0.017	0.20	1.08	323.9	512.4	-188.5	5895.8	602.18	602.2	1.68
1000	16.67	0.017	0.20	1.08	323.9	504.1	-180.2	5715.7	602.15	602.17	1.65
1005	16.75	0.017	0.20	1.08	323.9	495.7	-171.8	5543.9	602.13	602.14	1.63
1010	16.83	0.017	0.20	1.08	323.9	487.7	-163.8	5380.0	602.10	602.11	1.60

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
1015	16.92	0.017	0.20	1.08	323.9	480.1	-156.2	5223.9	602.07	602.08	1.58
1020	17.00	0.017	0.20	1.08	323.9	472.8	-148.9	5074.9	602.05	602.06	1.55
1025	17.08	0.016	0.19	1.02	304.9	465.9	-161.0	4913.9	602.02	602.03	1.53
1030	17.17	0.016	0.19	1.02	304.9	458.9	-154.0	4759.9	601.99	602.01	1.51
1035	17.25	0.016	0.19	1.02	304.9	451.5	-146.6	4613.3	601.96	601.98	1.46
1040	17.33	0.016	0.19	1.02	304.9	439.5	-134.6	4478.7	601.93	601.95	1.42
1045	17.42	0.016	0.19	1.02	304.9	426.3	-121.4	4357.3	601.91	601.92	1.38
1050	17.50	0.016	0.19	1.02	304.9	414.3	-109.4	4247.9	601.89	601.9	1.34
1055	17.58	0.016	0.19	1.02	304.9	403.5	-98.6	4149.3	601.86	601.87	1.31
1060	17.67	0.015	0.18	0.95	285.8	393.7	-107.9	4041.4	601.84	601.85	1.28
1065	17.75	0.015	0.18	0.95	285.8	384.0	-98.2	3943.2	601.82	601.83	1.25
1070	17.83	0.015	0.18	0.95	285.8	374.4	-88.5	3854.7	601.80	601.81	1.22
1075	17.92	0.015	0.18	0.95	285.8	365.6	-79.8	3774.9	601.79	601.79	1.19
1080	18.00	0.015	0.18	0.95	285.8	357.7	-71.9	3703.0	601.77	601.78	1.17
1085	18.08	0.015	0.18	0.95	285.8	350.6	-64.8	3638.2	601.76	601.76	1.15
1090	18.17	0.015	0.18	0.95	285.8	344.2	-58.4	3579.9	601.75	601.75	1.13
1095	18.25	0.015	0.18	0.95	285.8	338.4	-52.6	3527.3	601.74	601.74	1.11
1100	18.33	0.014	0.17	0.89	266.8	333.2	-66.5	3460.8	601.72	601.73	1.09
1105	18.42	0.014	0.17	0.89	266.8	327.6	-60.9	3400.0	601.71	601.71	1.07
1110	18.50	0.014	0.17	0.89	266.8	321.7	-54.9	3345.1	601.70	601.7	1.05
1115	18.58	0.014	0.17	0.89	266.8	316.2	-49.5	3295.6	601.69	601.69	1.04
1120	18.67	0.014	0.17	0.89	266.8	311.3	-44.6	3251.0	601.68	601.68	1.02
1125	18.75	0.014	0.17	0.89	266.8	306.9	-40.2	3210.8	601.67	601.67	1.01
1130	18.83	0.014	0.17	0.89	266.8	303.0	-36.2	3174.6	601.66	601.67	1.00
1135	18.92	0.014	0.17	0.89	266.8	299.4	-32.6	3142.0	601.65	601.66	0.99
1140	19.00	0.014	0.17	0.89	266.8	296.2	-29.4	3112.6	601.65	601.65	0.98
1145	19.08	0.014	0.17	0.89	266.8	293.2	-26.5	3086.2	601.64	601.65	0.97
1150	19.17	0.013	0.16	0.83	247.7	290.6	-42.9	3043.2	601.63	601.64	0.96
1155	19.25	0.013	0.16	0.83	247.7	287.4	-39.7	3003.6	601.63	601.63	0.95
1160	19.33	0.013	0.16	0.83	247.7	283.5	-35.8	2967.8	601.62	601.62	0.93
1165	19.42	0.013	0.16	0.83	247.7	280.0	-32.3	2935.5	601.61	601.62	0.92
1170	19.50	0.013	0.16	0.83	247.7	276.8	-29.1	2906.5	601.61	601.61	0.91
1175	19.58	0.013	0.16	0.83	247.7	273.9	-26.2	2880.3	601.60	601.6	0.90
1180	19.67	0.013	0.16	0.83	247.7	271.3	-23.6	2856.7	601.60	601.6	0.90
1185	19.75	0.013	0.16	0.83	247.7	269.0	-21.3	2835.4	601.59	601.59	0.89
1190	19.83	0.013	0.16	0.83	247.7	266.9	-19.2	2816.3	601.59	601.59	0.88
1195	19.92	0.013	0.16	0.83	247.7	265.0	-17.3	2799.0	601.58	601.59	0.88
1200	20.00	0.013	0.16	0.83	247.7	263.3	-15.6	2783.4	601.58	601.58	0.87
1205	20.08	0.013	0.16	0.83	247.7	261.7	-14.0	2769.4	601.58	601.58	0.87
1210	20.17	0.013	0.16	0.83	247.7	260.3	-12.6	2756.8	601.57	601.58	0.86
1215	20.25	0.012	0.14	0.76	228.7	259.1	-30.4	2726.3	601.57	601.57	0.86
1220	20.33	0.012	0.14	0.76	228.7	257.1	-28.4	2697.9	601.56	601.57	0.85
1225	20.42	0.012	0.14	0.76	228.7	254.3	-25.7	2672.3	601.56	601.56	0.84
1230	20.50	0.012	0.14	0.76	228.7	251.8	-23.1	2649.1	601.55	601.55	0.83
1235	20.58	0.012	0.14	0.76	228.7	249.5	-20.8	2628.3	601.55	601.55	0.82
1240	20.67	0.012	0.14	0.76	228.7	247.4	-18.8	2609.5	601.54	601.55	0.82
1245	20.75	0.012	0.14	0.76	228.7	245.6	-16.9	2592.6	601.54	601.54	0.81
1250	20.83	0.012	0.14	0.76	228.7	243.9	-15.2	2577.4	601.54	601.54	0.81
1255	20.92	0.012	0.14	0.76	228.7	242.4	-13.7	2563.6	601.53	601.54	0.80
1260	21.00	0.012	0.14	0.76	228.7	241.0	-12.4	2551.3	601.53	601.53	0.80
1265	21.08	0.012	0.14	0.76	228.7	239.8	-11.2	2540.1	601.53	601.53	0.80
1270	21.17	0.012	0.14	0.76	228.7	238.7	-10.1	2530.1	601.53	601.53	0.79
1275	21.25	0.012	0.14	0.76	228.7	237.7	-9.1	2521.0	601.53	601.53	0.79

Input			Calculated						Interpolated		
Time (min)	Time (hr)	PI (in)	i (in/hr)	Q_{in} (cfs)	Vol_{in} (ft^3)	Vol_{out} (ft^3)	ΔVol (ft^3)	Vol_{Total} (ft^3)	Peak Stage (ft)	Avg Stage (ft)	Q_{out} (cfs)
1280	21.33	0.012	0.14	0.76	228.7	236.8	-8.2	2512.8	601.52	601.52	0.79
1285	21.42	0.012	0.14	0.76	228.7	236.0	-7.4	2505.5	601.52	601.52	0.78
1290	21.50	0.011	0.13	0.70	209.6	235.3	-25.7	2479.8	601.52	601.52	0.78
1300	21.67	0.011	0.13	0.70	209.6	233.7	-24.1	2455.7	601.51	601.51	0.77
1305	21.75	0.011	0.13	0.70	209.6	231.4	-21.8	2433.9	601.51	601.51	0.76
1310	21.83	0.011	0.13	0.70	209.6	229.2	-19.6	2414.2	601.50	601.51	0.76
1315	21.92	0.011	0.13	0.70	209.6	227.3	-17.7	2396.5	601.50	601.5	0.75
1320	22.00	0.011	0.13	0.70	209.6	225.6	-15.9	2380.6	601.50	601.5	0.75
1325	22.08	0.011	0.13	0.70	209.6	224.0	-14.4	2366.2	601.49	601.49	0.74
1330	22.17	0.011	0.13	0.70	209.6	222.6	-13.0	2353.3	601.49	601.49	0.74
1335	22.25	0.011	0.13	0.70	209.6	221.3	-11.7	2341.6	601.49	601.49	0.73
1340	22.33	0.011	0.13	0.70	209.6	220.1	-10.5	2331.1	601.49	601.49	0.73
1345	22.42	0.011	0.13	0.70	209.6	219.1	-9.5	2321.6	601.48	601.48	0.73
1350	22.50	0.011	0.13	0.70	209.6	218.1	-8.5	2313.1	601.48	601.48	0.72
1355	22.58	0.011	0.13	0.70	209.6	217.3	-7.7	2305.4	601.48	601.48	0.72
1360	22.67	0.011	0.13	0.70	209.6	216.5	-6.9	2298.4	601.48	601.48	0.72
1365	22.75	0.011	0.13	0.70	209.6	215.8	-6.2	2292.2	601.48	601.48	0.72
1370	22.83	0.011	0.13	0.70	209.6	215.2	-5.6	2286.6	601.48	601.48	0.72
1375	22.92	0.011	0.13	0.70	209.6	214.7	-5.1	2281.5	601.48	601.48	0.71
1380	23.00	0.011	0.13	0.70	209.6	214.2	-4.6	2276.9	601.47	601.47	0.71
1385	23.08	0.011	0.13	0.70	209.6	213.7	-4.1	2272.8	601.47	601.47	0.71
1390	23.17	0.010	0.12	0.64	190.5	213.3	-22.8	2250.0	601.47	601.47	0.71
1395	23.25	0.010	0.12	0.64	190.5	212.1	-21.5	2228.5	601.46	601.47	0.70
1400	23.33	0.010	0.12	0.64	190.5	210.0	-19.4	2209.1	601.46	601.46	0.69
1405	23.42	0.010	0.12	0.64	190.5	208.1	-17.5	2191.6	601.46	601.46	0.69
1410	23.50	0.010	0.12	0.64	190.5	206.3	-15.8	2175.8	601.45	601.46	0.68
1415	23.58	0.010	0.12	0.64	190.5	204.8	-14.2	2161.6	601.45	601.45	0.68
1420	23.67	0.010	0.12	0.64	190.5	203.4	-12.8	2148.8	601.45	601.45	0.67
1425	23.75	0.010	0.12	0.64	190.5	202.1	-11.5	2137.2	601.45	601.45	0.67
1430	23.83	0.010	0.12	0.64	190.5	201.0	-10.4	2126.8	601.44	601.44	0.67
1435	23.92	0.010	0.12	0.64	190.5	199.9	-9.4	2117.5	601.44	601.44	0.66
1440	24.00	0.010	0.12	0.64	190.5	199.0	-8.4	2109.0	601.44	601.44	0.66

APPENDIX F
REFERENCE MATERIALS

Shallow Concentrated Overland Flow

U DOT: Hydraulic Design Series No. 2, Second Edition pg. 2-24

2.6.2.2 Shallow Concentrated Flow

After short distances, sheet flow tends to concentrate in rills and then gullies of increasing proportions. Such flow is usually referred to as shallow concentrated flow. The velocity of such flow can be estimated using an empirical relationship between the velocity and the slope:

$$V = \alpha \kappa S^{0.5}$$

Where,
V=Velocity (ft/s)
S=slope (ft/ft)
κ=dimensionless function of land cover
α=unit conversion (33)

Table 2.2. Intercept Coefficients for
Velocity vs. Slope Relationship (McCuen, 1989)

k	Land Cover/Flow Regime
0.076	Forest with heavy ground litter; hay meadow (overland flow)
0.152	Trash fallow or minimum tillage cultivation; contour or strip cropped; woodland (overland flow)
0.213	Short grass pasture (overland flow)
0.274	Cultivated straight row (overland flow)
0.305	Nearly bare and untilled (overland flow); alluvial fans in western mountain regions
0.457	Grassed waterway (shallow concentrated flow)
0.491	Unpaved (shallow concentrated flow)
0.619	Paved area (shallow concentrated flow); small upland gullies

Manning's n Values	
Ven Te Chow, Ph.D, *Open Channel Hydraulics* , McGraw-Hill Publishing Company. Table 5-6 Values of The Roughness Coefficient	
Surface Description	n
A. Closed Conduits	-
Cast Iron	0.013
HDPE	0.013
Cement	0.013
B. Lined Channels	-
Gravel bottom with rip-rap sides	0.033
Concrete with float finish	0.015
Concrete with gravel bottom	0.017
Asphalt - smooth	0.013
Asphalt - rough	0.016
Vegetal lining	0.030
D. Natural Streams	-
Clean, straight natural stream	0.030
Straight stream w/ stones or weeds	0.035
Clean, winding natural stream	0.040
Winding stream w/ stones or weeds	0.045
Sluggish stream, weedy with pools	0.070
Very weedy with deep pools	0.100
Gravel, cobbles & few boulders	0.040
Cobbles with large boulders	0.050
D-2. Flood plains	-
Pasture, no brush	0.030
Scattered Brush, heavy weeds	0.050
Light brush and trees	0.050
Dense brush	0.070

City of Redding - Hydrology Manual		
Table C-9 Parameters for Overland Flow		
Surface Description	n	dist
Pavement - smooth, Table C-9	0.02	50-200
Pavement - rough, Table C-9	0.05	50-200
Bare soil/newly graded, Table C-9	0.1	100-300
Range - heavily grazed, Table C-9	0.15	100-300
lawns/golf course, Table C-9	0.2	100-300
parks/medians/pasture, Table C-9	0.3	200-500
natural grassland, Table C-9	0.4	200-500
Residential landscaping, Table C-9	0.4	100-300
Few trees/natural grass, Table C-9	0.5	300-600
Scattered trees/shrubs, Table C-9	0.6	300-600
Numerous trees/dense, Table C-9	0.8	300-600

Figure 819.2A

Runoff Coefficients for Undeveloped Areas

Watershed Types

	Extreme	High	Normal	Low
Relief	.28 -.35 Steep, rugged terrain with average slopes above 30%	.20 -.28 Hilly, with average slopes of 10 to 30%	.14 -.20 Rolling, with average slopes of 5 to 10%	.08 -.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	.12 -.16 No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	.08 -.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity, imperfectly or poorly drained	.06 -.08 Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	.04 -.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	.12 -.16 No effective plant cover, bare or very sparse cover	.08 -.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	.06 -.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	.04 -.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface Storage	.10 -.12 Negligible surface depression few and shallow; drainageways steep and small, no marshes	.08 -.10 Low; well defined system of small drainageways; no ponds or marshes	.06 -.08 Normal; considerable surface depression storage; lakes and pond marshes	.04 -.06 High; surface storage, high; drainage system not sharply defined; large floodplain storage or large number of ponds or marshes

Given	An undeveloped watershed consisting of; 1) rolling terrain with average slopes of 5%, 2) clay type soils, 3) good grassland area, and 4) normal surface depressions.	Solution: Relief 0.14 Soil Infiltration 0.08 Vegetal Cover 0.04 Surface Storage 0.06 C = 0.32
Find	The runoff coefficient, C, for the above watershed.	

Table 819.2B

Runoff Coefficients for Developed Areas (1)

Type of Drainage Area	Runoff Coefficient
Business:	
Downtown areas	0.70 - 0.95
Neighborhood areas	0.50 - 0.70
Residential:	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartment dwelling areas	0.50 - 0.70
Industrial:	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90
Parks, cemeteries:	0.10 - 0.25
Playgrounds:	0.20 - 0.40
Railroad yard areas:	0.20 - 0.40
Unimproved areas:	0.10 - 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 - 0.10
Sandy soil, average, 2-7%	0.10 - 0.15
Sandy soil, steep, 7%	0.15 - 0.20
Heavy soil, flat, 2%	0.13 - 0.17
Heavy soil, average, 2-7%	0.18 - 0.22
Heavy soil, steep, 7%	0.25 - 0.35
Streets:	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Drives and walks	0.75 - 0.85
Roofs:	0.75 - 0.95

NOTES:
(1) From HDS No. 2.

regression equations are considered the best estimates of flood frequency and are used to reduce the time-sampling error that may occur in a station flood-frequency estimate.

(d) The flood-frequency flows and the maximum peak discharges at several stations in a region should be used whenever possible for comparison with the peak discharge estimated at an ungaged site using a rainfall-runoff approach or regional regression equation. The watershed characteristics at the ungaged and gaged sites should be similar.

(4) *National Resources Conservation Service (NRCS) Methods.* The Soil Conservation Service's SCS (former title) National Engineering Handbook, 1972, and their 1975, "Urban Hydrology for Small Watersheds", Technical Release 55 (TR-55), present a graphical method for estimating peak discharge. Most NRCS equations and curves provide results in terms of inches of runoff for unit hydrograph development and are not applicable to the estimation of a peak design discharge unless the design hydrograph is first developed in accordance with prescribed NRCS procedures. NRCS methods and procedures are applicable to drainage areas less than 3 square miles (approx. 2,000 acres) and result in a design hydrograph and design discharge that are functionally acceptable to form the basis for the design of highway drainage facilities.

819.3 Statistical Methods

Statistical methods of predicting stream discharge utilize numerical data to describe the process. Statistical methods, in general, do not require as much subjective judgment to apply as the previously described deterministic methods. They are usually well documented mathematical procedures which are applied to measured or observed data. The accuracy of statistical methods can also be measured quantitatively. However, to assure that statistical method results are valid, the method and procedures used should be verified by an experienced engineer with a thorough knowledge of engineering statistics.

Attachment E

Noise Technical Report for Canby Apartments Project

Redding Canby Apartments Project

Noise Technical Report

October 2024 | 08391.00002.001

Prepared for:

The DANCO Group
5251 Ericson Way
Arcata, CA 95521

Prepared by:

HELIX Environmental Planning, Inc.
1677 Eureka Road, Suite 100
Roseville, CA 95661

This page intentionally left blank

Table of Contents

Table of Contents (cont.)

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

Acronyms and Abbreviations

ADT	average daily trips
ANSI	American National Standards Institute
CadnaA	Computer Aided Noise Abatement
Caltrans	California Department of Transportation
CBC	California Building Code
CEQA	California Environmental Quality Act
City	City of Redding
CNEL	Community Noise Equivalent Level
dB	decibel
dBA	A-weighted decibel
FTA	Federal Transit Administration
HVAC	heating, ventilation, and air conditioning
Hz	hertz
I-	Interstate
in	inch
kHz	kilohertz
L_{DN}	Day Night sound level
L_{EQ}	time-averaged noise level
µPa	micro-Pascals
NSLU	noise-sensitive land use
PPV	peak particle velocity
RMS	root mean squared
sec	second
SPL	sound pressure level
USDOT	U.S. Department of Transportation
VdB	vibration decibels

This page intentionally left blank

EXECUTIVE SUMMARY

This report assesses potential noise impacts associated with the proposed Redding Canby Apartments Project (project). The project is located at the northwest corner of the intersection of Browning Street and Canby Road in the City of Redding (City), California. The project involves the construction of an affordable housing residential infill development consisting of 120 multi-family residential units in ten separate two- and three-story structures.

Anticipated construction activities would generate temporarily elevated noise levels for residences north and west of the project site; however, the proposed construction equipment would not exceed the noise level criteria provided by the City General Plan. Construction would also occur during the hours permitted in the City Municipal Code. The impact would be less than significant.

The project's heating, ventilation, and air conditioning systems would not exceed the City's noise ordinance limits at the nearest property lines. The project would add trips to nearby roadways but would not result in perceptible increases in traffic noise. Operational noise impacts would be less than significant.

Vibration from construction would not exceed thresholds for either structural damage but may result in human annoyance. Mitigation measure NOI-1 would be required to prevent use of equipment exceeding 75 vibration decibels at nearby residences. No permanent sources of substantial vibration would be installed by the project. With the implementation of mitigation measure NOI-1, vibration impacts would be less than significant.

The project would be exposed to noise from nearby roadways but does not propose outdoor use areas that would be exposed to traffic noise in excess of a 65 decibel Community Noise Equivalent Level (CNEL). The project is also anticipated to comply with the state requirement for interior noise levels in habitable rooms to be below 45 CNEL with use of conventional building materials.

This page intentionally left blank

1.0 INTRODUCTION

This report analyzes potential noise and vibration impacts associated with the proposed Redding Canby Apartments Project (project). The analysis includes a description of existing conditions in the project vicinity and an assessment of potential impacts associated with project implementation. Analysis within this report addresses the relevant issues listed in the Noise and Land Use sections of Appendix G of the California Environmental Quality Act (CEQA) Guidelines.

1.1 PROJECT LOCATION

The project is proposed at the northwest corner of the intersection of Browning Street and Canby Road in the City of Redding (City), Shasta County, California. The site consists of two parcels, Assessor's Parcel Numbers (APNs) 117-200-006-000 and 117-200-005-000, located at 930 and 990 Canby Road. The project site is approximately 8.04 acres and is currently vacant. See Figure 1, *Regional Location*, and Figure 2, *Aerial Photograph*.

1.2 PROJECT DESCRIPTION

The project proposes the construction of an affordable housing residential infill development consisting of 120 multi-family residential units in ten separate two- and three-story structures. The project would include 32 one-bedroom units, 56 two-bedroom units, 28 three-bedroom units, and 4 four-bedroom units. The project would also include a community building, on-site manager's unit, courtyard, and children's playground area. There would be a total of 212 parking spaces also made available, located throughout the site. Access to the project site would occur via one driveway on Canby Road and one driveway on Browning Street. See Figure 3, *Site Plan*.

1.3 NOISE AND VIBRATION DESCRIPTORS AND TERMINOLOGY

1.3.1 Noise Descriptors

All noise level or sound level values presented herein are expressed in terms of decibels (dB), with A-weighting (dBA) to approximate the hearing sensitivity of humans. Time-averaged noise levels are expressed by the symbol L_{EQ}, with a specified duration. The Community Noise Equivalent Level (CNEL) is a 24-hour average, where noise levels during the evening hours of 7:00 p.m. to 10:00 p.m. have an added 5 dBA weighting, and noise levels during the nighttime hours of 10:00 p.m. to 7:00 a.m. have an added 10 dBA weighting. This is similar to the Day Night sound level (L_{DN}), which is a 24-hour average with an added 10 dBA weighting on the same nighttime hours but no added weighting on the evening hours. Sound levels expressed in CNEL are always based on dBA. These metrics are used to express noise levels for both measurement and municipal regulations, as well as for land use guidelines and enforcement of noise ordinances.

1.3.2 Noise Terminology

1.3.2.1 Sound, Noise, and Acoustics

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is defined as loud, unexpected, or annoying sound. In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver determines the sound level and characteristics of the noise perceived by the receiver. The field of acoustics deals primarily with the propagation and control of sound.

1.3.2.2 Frequency

Continuous sound can be described by frequency (pitch) and amplitude (loudness). A low-frequency sound is perceived as low in pitch. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hertz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

1.3.2.3 Sound Pressure Levels and Decibels

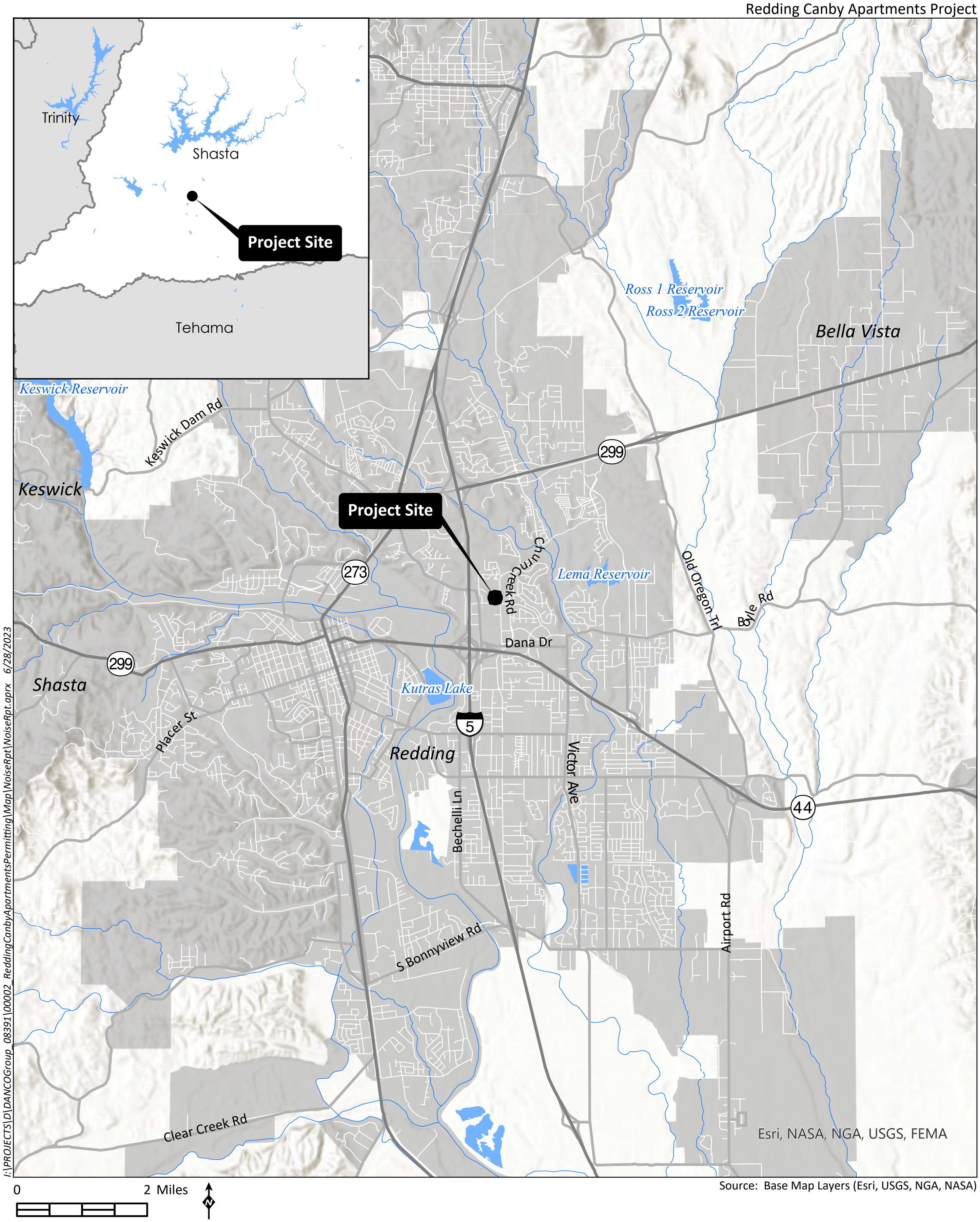
The amplitude of pressure waves generated by a sound source determines the loudness of that source. Sound pressure amplitude is measured in micro-Pascals (µPa). One µPa is approximately one hundred billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to 100,000,000 µPa. Because of this wide range of values, sound is rarely expressed in terms of µPa. Instead, a logarithmic scale is used to describe sound pressure level (SPL) in terms of dBA. The threshold of hearing for the human ear is about 0 dBA, which corresponds to 20 µPa.

1.3.2.4 Addition of Decibels

Because decibels are logarithmic units, SPL cannot be added or subtracted through standard arithmetic. Under the decibel scale, a doubling of sound energy corresponds to a 3 dBA increase. In other words, when two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dBA higher than from one source under the same conditions. For example, if one automobile produces an SPL of 70 dB when it passes an observer, two cars passing simultaneously would not produce 140 dBA—rather, they would combine to produce 73 dBA. Under the decibel scale, three sources of equal loudness together produce a sound level 5 dBA louder than one source.

Under controlled conditions in an acoustical laboratory, the trained, healthy human ear can discern 1 dBA changes in sound levels, when exposed to steady, single-frequency (“pure-tone”) signals in the mid-frequency (1,000 Hz to 8,000 Hz) range. In typical noisy environments, changes in noise of 1 to 2 dBA are generally not perceptible. It is widely accepted, however, that people begin to detect sound level increases of 3 dBA in typical noisy environments. Further, a 5 dBA increase is generally perceived as a distinctly noticeable increase, and a 10 dBA increase is generally perceived as a doubling of loudness.

No known studies have directly correlated the ability of a healthy human ear to discern specific levels of change in traffic noise over 24 hours. Many ordinances, however, specify a change of 3 CNEL as the significant impact threshold. This is based on the concept of a doubling in noise energy resulting in a 3 dBA change in noise, which is the amount of change in noise necessary for the increase to be perceptible to the average healthy human ear.



Source: Base Map Layers (Esri, USGS, NGA, NASA)

HELIX
Environmental Planning

Regional Location

Figure 1

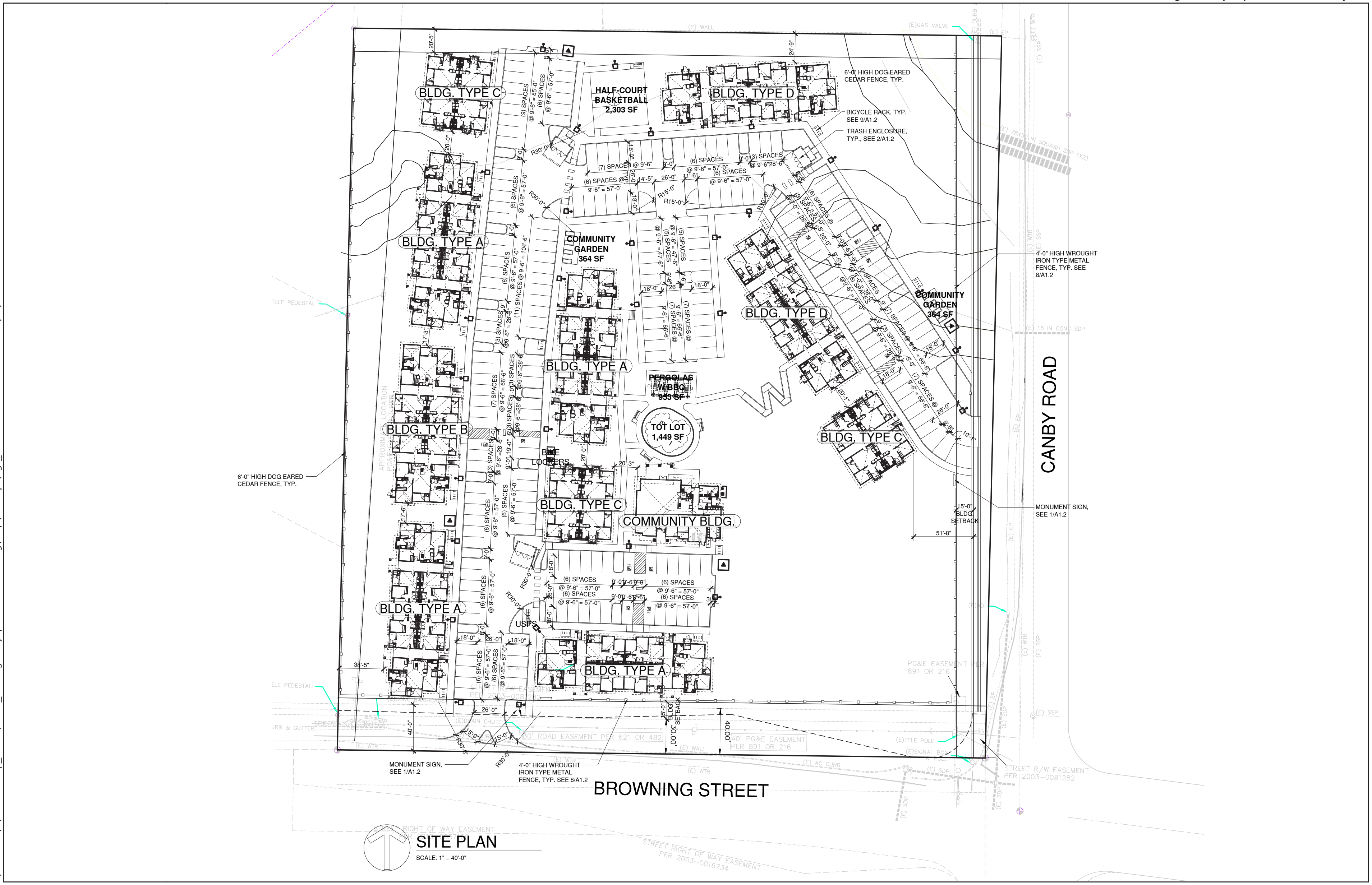
I:\PROJECTS\D\DANCOGroup_08391\00002_ReddingCanbyApartmentsPermitting\Map\NoiseRpt\NoiseRpt.aprx 6/28/2023

Source: Aerial (City of Redding, 5/27/2020)

HELIX
Environmental Planning

Aerial Photograph

Figure 2



Source: DG Group Architecture , 2023

I:\PROJECTS\D\DANCOGroup_08391\00002_ReddingCanbyApartmentsPermitting\Map\NoiseRpt\Fig3_SitePlan.indd 08391.00002.001 06/28/2023-DY

HELIX Environmental Planning

Site Plan

Figure 3

1.3.3 Groundborne Vibration Descriptors and Terminology

Vibration is measured in feet or inches (in). Acceleration is measured by comparing acceleration to that of the Earth's gravity, and this unit is "G." These units of acceleration or velocity are relative to time in seconds (sec) and are noted as in/sec^2 for acceleration and in/sec for velocity. Displacement is not relative to time and is only shown as inches.

Vibration effects can be described by its peak and root mean square (RMS) amplitudes. Building damage is often discussed in terms of peak velocity, or peak particle velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration signal. PPV is related to the stresses that are experienced by buildings; it is often used in monitoring of blasting vibration and to discuss construction vibration.

The RMS amplitude is useful for assessing human annoyance. Because the net average of a vibration signal is zero, the RMS amplitude is used to describe the "smoothed" vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal. The RMS amplitude is always less than the PPV and is always positive. The RMS average is typically calculated over one second.

Although it is not universally accepted, decibel notation is in common use for vibration. Decibel notation serves to compress the range of numbers required to describe vibration. The vibration velocity level in decibels is defined as $L_V=20 \times LOG_{10}(V/V_{REF})$, where "$L_V$" is the velocity level in decibels, "V" is the RMS velocity amplitude, and "V_{REF}" is the reference velocity amplitude. The reference must be specified whenever a quantity is expressed in terms of decibels. Vibration levels may also be referenced to 1×10^6 in/sec as vibration decibels (VdB).

1.4 NOISE-SENSITIVE LAND USES

Noise-sensitive land uses (NSLUs) are land uses that may be subject to stress and/or interference from excessive noise, including residences, hospitals, schools, hotels, resorts, libraries, sensitive wildlife habitat, or similar facilities where quiet is an important attribute of the environment. Noise receptors are individual locations that may be affected by noise. NSLUs in the project vicinity include the residential land uses adjacent to the north and northwest of the project site and the residences east of Churn Creek Road.

1.5 REGULATORY FRAMEWORK

1.5.1 California Noise Control Act

The California Noise Control Act is a section within the California Health and Safety Code that describes excessive noise as a serious hazard to public health and welfare and that exposure to certain levels of noise can result in physiological, psychological, and economic damage. It also finds that there is a continuous and increasing bombardment of noise in the urban, suburban, and rural areas. The California Noise Control Act declares that the State of California has a responsibility to protect the health and welfare of its citizens by the control, prevention, and abatement of noise. It is the policy of the State to provide an environment for all Californians free from noise that jeopardizes their health or welfare.

1.5.2 California Building Code

The California Building Code (CBC) sets forth building design and construction requirements relating to fire and life safety, structural safety, and access compliance. Title 24, Part 2, Section 1206, Sound Transmission, requires interior noise levels in habitable rooms do not exceed 45 dB. The 45 dB requirement may be measured as either the L_{DN} or CNEL, as used in the applicable general plan noise element.

1.5.3 City of Redding General Plan Noise Element

The City’s General Plan Noise Element provides a description of noise conditions within the City and considerations for development planning related to noise exposure. The City is currently in the process of developing a new General Plan that will update the Noise Element based on growth that has occurred in the City in the time since the existing General Plan was adopted and growth that is projected to occur over the following 20 years.

Multiple policies are included in the Noise Element with the goal of protecting residents from exposure to excessive noise. As a residential development, the project would be subject to the noise limits from transportation sources of 60 CNEL for outdoor activity areas and 45 CNEL for interior spaces. The Noise Element notes that it may not be possible to locate all outdoor activity areas where noise levels are below 60 CNEL; therefore, higher exterior noise levels may be allowed provided that practical exterior noise-level reduction measures have been implemented and interior noise levels comply with the 45 CNEL limit.

For non-transportation noise sources, the Noise Element specifies hourly standards of 55 dBA L_{EQ} for the hours of 7:00 a.m. to 10:00 p.m. and 45 dBA L_{EQ} for the hours of 10:00 p.m. to 7:00 a.m.

While not adopted, a draft Noise Element for the updated General Plan has been made available for public review and proposes changes to some of the noise standards applicable to the project (City 2024). The maximum exterior noise level for transportation sources at a multi-family residential use is proposed to be increased to 65 CNEL and 50 dBA L_{EQ} from 10:00 p.m. to 7:00 a.m. The non-transportation exterior noise limit is also proposed to be increased for residential uses to levels of 60 CNEL and 50 dBA L_{EQ} for the hours of 10:00 p.m. to 7:00 a.m.

The proposed Noise Element also states construction that would result in 75 dBA or greater at the property line should consider methods of reducing noise impacts to the land uses near the construction. A policy is proposed to limit vibration levels to 75 VdB at the property line of NSLUs.

1.5.4 City of Redding Municipal Code

The City's noise standards are codified in Redding Municipal Code Section 18.40.100. Exterior noise limits for noise generated by on-site sources at a neighboring property line vary depending on the receiving land use and time of day. These limits are provided in Table 1, *City of Redding Exterior Noise Standards*, as provided by Redding Municipal Code Section 18.40.100-A. If the measured ambient level is above the standard, the allowable noise exposure standard is increased to reflect the actual ambient noise level.

Table 1
CITY OF REDDING EXTERIOR NOISE STANDARDS

Receiving Land Use Category	Time Period	Hourly Noise Level (dBA L_{EQ})
Residential	10:00 p.m. to 7:00 a.m.	45
	7:00 a.m. to 10:00 p.m.	55
Office/Commercial	10:00 p.m. to 7:00 a.m.	55
	7:00 a.m. to 10:00 p.m.	65
Industrial	10:00 p.m. to 7:00 a.m.	N/A[1]
	7:00 a.m. to 10:00 p.m.	N/A[1]

Source: Redding Municipal Code Section 18.40.100-A
[1] Industrial Noise shall be measured at the property line of any non-industrial district.
dBA = A-weighted decibel; L_{EQ} = time-averaged noise level

As it relates to construction, Redding Municipal Code Section 18.40.100-F.2 prohibits the operation of any tools or equipment used in construction, drilling, repair, alteration, or demolition work in or within 500 feet of a residential district such that the sound creates a noise disturbance across a property line during the following times:

1. May 15 through September 15: Between the weekday hours of 7:00 p.m. and 6:00 a.m. and weekends and holidays between 8:00 p.m. and 9:00 a.m.

2. September 16 through May 14: Between the weekday hours of 7:00 p.m. and 7:00 a.m. and weekends and holidays between 8:00 p.m. and 9:00 a.m.

2.0 ENVIRONMENTAL SETTING

2.1 SURROUNDING LAND USES

Adjacent land uses surrounding the project site include multi-family and senior apartments to the north; vacant land across Canby Road to the east; commercial development across Browning Street to the south; and multi-family residences to the west (Figure 2). The project site is bordered by Browning Street on the South and Canby Road on the east. Interstate (I-) 5 is located approximately 1,300 feet west of the project site.

The project site and the parcels surrounding it to the north, east and west are zoned Residential Multiple-Family 12 Unit per Acre (RM-12) and have a General Plan land use designation of Residential – 10 to 20 Dwelling Units per Acre. The parcels south of the project site and south of Browning Street have zoning and General Plan land use designations of Regional Commercial (RC).

2.2 EXISTING NOISE ENVIRONMENT

The existing noise environment is dominated by traffic noise from Browning Street and Canby Road with more distant noise from I-5. The project site may be subject to some distant aircraft noise, though the site is not located within the noise contours for any active airport.

2.2.1 On-site Survey

Two 15-minute noise measurements were taken at the project site to document existing conditions. The first noise measurement was recorded along Browning Street at the southern edge of the project site. The second measurement was taken along Canby Road in the eastern portion of the site. The measured noise levels are shown in Table 2, *Noise Measurement Results.* Measurement locations are shown on Figure 4, *Measurement and Receiver Locations*.

Table 2
NOISE MEASUREMENT RESULTS

Measurement 1	
Date:	May 12, 2023
Time:	10:51 a.m. – 11:04 a.m.
Location:	Browning Street, southern border of project site.
Measured Noise Level:	67.1 dBA L_{EQ}
Notes:	Noise primarily from vehicular traffic on Browning Street, distant traffic noise from I-5 and other local roadways.
Measurement 2	
Date:	May 12, 2023
Time:	11:07 a.m. – 11:22 a.m.
Location:	Canby Road, eastern border in central portion of project site.
Measured Noise Level:	63.5 dBA L_{EQ}
Notes:	Noise primarily from vehicular traffic on Canby Road and Browning Street, distant traffic noise from I-5 and other local roadways.

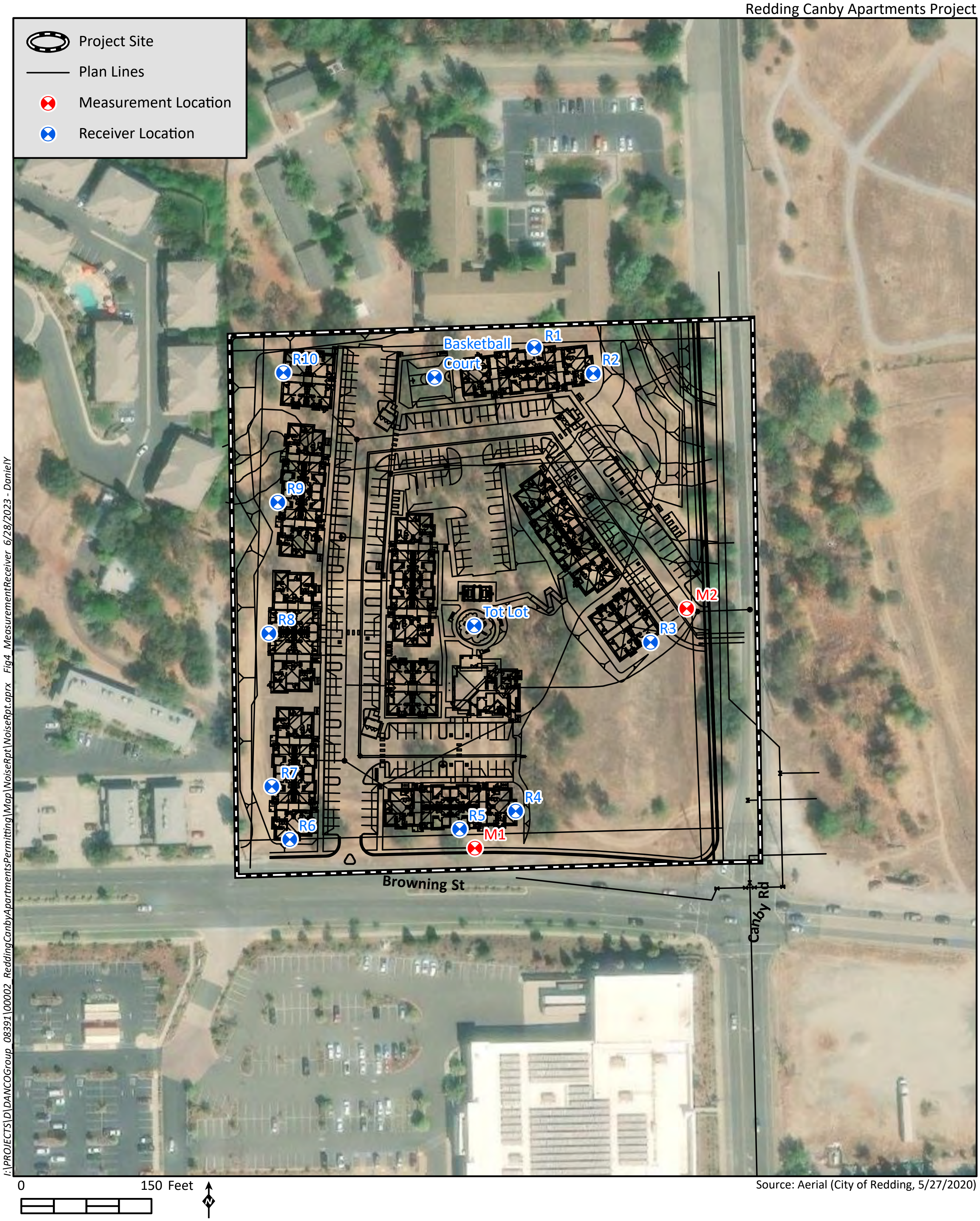
dBA = A-weighted decibel; L_{EQ} = time-averaged noise level

Traffic counts were conducted during the noise measurements to estimate the breakdown of heavy trucks (three or more axles), medium trucks (double tires/two axles), and automobiles along Browning Street and Canby Road. Traffic counts for the timed measurements and the one-hour equivalent volumes are shown in Table 3, *Recorded Traffic Volume and Vehicle Mix*.

Table 3
RECORDED TRAFFIC VOLUME AND VEHICLE MIX

Measurement	Roadway	Traffic	Autos	MT[1]	HT[2]
M1	Browning Street	15-minute count	195	1	0
		One-hour equivalent	780	4	0
		Percent	99.5%	0.5%	0%
M2	Canby Road	15-minute count	79	1	0
		One-hour equivalent	316	4	0
		Percent	98.7%	1.3%	0%

[1] Medium Trucks (double tires/two axles)
[2] Heavy Trucks (three or more axles)



Source: Aerial (City of Redding, 5/27/2020)

HELIX Environmental Planning

Measurement and Receiver Locations

Figure 4

3.0 ANALYSIS, METHODOLOGY, AND ASSUMPTIONS

3.1 METHODOLOGY

3.1.1 Ambient Noise Survey

The following equipment was used to measure existing noise levels at the project site:

- Piccolo II Noise Meter
- Larson Davis Model CAL150 Calibrator
- Windscreen and tripod for the noise meter

The sound level meter was calibrated prior to the noise measurements to ensure accuracy. All sound level measurements conducted and presented in this report were made with a sound level meter that conforms to the American National Standards Institute (ANSI) specifications for sound level meters (ANSI SI.4-1983 R2006). All instruments were maintained with National Institute of Standards and Technology traceable calibration per the manufacturers' standards.

3.1.2 Noise Modeling Software

Modeling of the exterior noise environment for this report was accomplished using the computer noise model Computer Aided Noise Abatement (CadnaA) version 2022. CadnaA is a model-based computer program developed by DataKustik for predicting noise impacts in a wide variety of conditions. CadnaA assists in the calculation, presentation, assessment, and mitigation of noise exposure. It allows for the input of project related information, such as noise source data, barriers, structures, and topography to create a detailed CadnaA model, and uses the most up-to-date calculation standards to predict outdoor noise impacts. CadnaA traffic noise prediction is based on the data and methodology used in the Traffic Noise Model released by the U.S. Department of Transportation (USDOT).

Peak-hour traffic volumes are estimated based on the assumption that approximately 10 percent of the average daily traffic would occur during a peak hour. The one-hour L_{EQ} noise level is calculated utilizing peak-hour traffic. Peak hour L_{EQ} can be converted to CNEL using the following equation, where $L_{EQ}(h)pk$ is the peak hour L_{EQ}, P is the peak hour volume percentage of the average daily trips (ADT), d and e are divisions of the daytime fraction of ADT to account for daytime and evening hours, and N is the nighttime fraction of ADT:

$$CNEL = L_{EQ}(h)pk + 10\log10\ 4.17/P + 10\log10(d + 4.77e + 10N)$$

The model-calculated one-hour L_{EQ} noise output is therefore approximately equal to the CNEL (California Department of Transportation [Caltrans] 2013). Project construction noise was analyzed using the Roadway Construction Noise Model (USDOT 2008), which utilizes estimates of sound levels from standard construction equipment.

3.2 ASSUMPTIONS

3.2.1 Construction

Construction would require the use of equipment throughout the estimated 18-month construction period. General project construction activities are anticipated to include grading, physical building construction, paving, and application of architectural coatings. As details regarding specific construction equipment is not yet available at the time of this analysis, standard equipment associated with residential construction was assumed to generate estimated noise levels. This includes construction equipment such as graders, dozers, loaders, and rollers. No soil import or export, rock crushing or blasting are anticipated to be required for grading of the project site.

3.2.2 Operations

The proposed project's operational noise sources are anticipated to include heating, ventilation, and air conditioning (HVAC) systems and vehicular traffic. During operations, the project would also be exposed to vehicular traffic noise.

3.2.2.1 Heating, Ventilation, and Air Conditioning Units

The specific HVAC systems and locations that would be installed for the project have not been identified at this stage of project design. This analysis assumes the building design would use one typical to larger-sized residential condenser for each unit and that units would be mounted on rooftop pads and rooftop parapets would be 3 feet in height. The unit used in this analysis is a Carrier model 38BRC-024-34 2-ton split system, which has a sound power level of 76 dBA (Carrier 2005). The manufacturer's noise data for the HVAC units is provided below in Table 4, *HVAC Condenser Noise Data*.

Table 4
HVAC CONDENSER NOISE DATA

Noise Levels in Decibels[1] (dB) Measured at Octave Frequencies							Overall Noise Level in A-weighted Scale (dBA)[1]
125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz	
55.5	62.5	68.0	70.0	67.0	61.5	57.5	76.0

[1] Sound Power Level (S_{WL})
HZ = Hertz; KHz = kilohertz

3.2.2.2 Vehicular Traffic

Information related to the project's trip generation and existing traffic environment was based on the project's transportation impact study prepared by W-Trans (W-Trans 2023). The project is estimated to generate 577 ADT, including 43 trips during the a.m. peak hour and 55 trips during the p.m. peak hour. Table 5, *PM Peak Hour Roadway Segment Volumes*, summarizes the p.m. peak hour segment volume data for roadways in the project vicinity.

Table 5
PM PEAK HOUR ROADWAY SEGMENT VOLUMES

Roadway Segment	Existing Traffic Volume	Project-Generated Trips	Existing + Project Traffic Volume
Browning Street			
Hilltop Drive to Canby Road	1,360	22	1,382
Canby Road to Churn Creek Road	967	17	984
East of Churn Creek Road	625	2	627
Canby Road			
Churn Creek Road to Browning Street	341	29	370
Browning Street to Old Alturas Road	818	8	826
Churn Creek Road			
North of Canby Road	1,217	8	1,225
Canby Road to Browning Street	1,083	0	1,083
Browning Street to Old Alturas Road	1,072	14	1,086
Hilltop Drive			
North of Browning Street	1,661	8	1,669
South of Browning Street	1,758	14	1,772

Source: W-Trans 2023

According to Caltrans data, I-5 west of the project site carries approximately 60,000 ADT, 10 percent of which is assumed to occur during the peak hour. These trips were modeled to consist of 3.5 percent medium trucks and 10.5 percent heavy trucks based on the typical vehicle breakdown on this segment of I-5 (Caltrans 2021). Based on the site visit and typical traffic distributions, this analysis assumed a conservative vehicle breakdown of 97 percent automobiles, 2 percent medium trucks, and 1 percent heavy trucks for local roadways.

3.3 GUIDELINES FOR THE DETERMINATION OF SIGNIFICANCE

Based on Appendix G of the CEQA Guidelines, implementation of the project would result in a significant adverse impact if it would:

Threshold 1: *Generate 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.*

In accordance with the Redding Municipal Code, stationary noise impacts would be significant if the project would generate noise levels at adjacent residential property lines exceeding 55 dBA L_{EQ} from 7:00 a.m. to 10:00 p.m. or 45 dBA L_{EQ} from 10:00 p.m. to 7:00 a.m. At a commercial property line, impacts would be considered significant if the project would generate noise levels exceeding 65 dBA L_{EQ} from 7:00 a.m. to 10:00 p.m. or 55 dBA L_{EQ} from 10:00 p.m. to 7:00 a.m. For traffic-related noise, impacts would be considered significant if the project would cause traffic noise levels to increase by 3 CNEL or more in residential outdoor use areas.

The Redding Municipal Code prohibits construction within 500 feet of a residential district such that the sound creates a noise disturbance across a property line during the nighttime hours specified in Municipal Code Section 18.40.100-F.2. The proposed update to the General Plan Noise Element suggests a policy that construction resulting in noise levels of 75 dBA or greater at the property line should consider methods of reducing noise impacts to the land uses near the construction. For the purposes of this analysis, construction noise impacts would be considered significant if construction would occur outside of the permitted hours or would result in noise levels exceeding a one-hour average of 75 dBA L_{EQ} at residential property lines.

Threshold 2: *Generate excessive groundborne vibration or groundborne noise levels.*

In the absence of an adopted regulation related to vibration, vibration levels exceeding 75 VdB at a NSLU would be considered significant for human response, as proposed in the update to the General Plan Noise Element. For building damage, a significant impact would occur if the project would generate vibration levels exceeding the Federal Transit Administration (FTA) criteria of 0.3 in/sec PPV for engineered buildings.

Threshold 3: *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 use airport or private airstrip, expose people residing or working in the project area to excessive noise.*

Excessive noise exposure from airport activity is defined as noise levels that exceed the standards in the City General Plan Noise Element for the associated land use.

Threshold 4: *Conflict with the General Plan Noise Element standards for proposed uses.*

The City's General Plan Noise Element establishes a typical standard of 60 CNEL for outdoor activity areas. In accordance with the CBC, interior noise levels within habitable spaces for multi-family residential uses must demonstrate that noise levels would be below 45 CNEL.

4.0 IMPACT ANALYSIS

4.1 ISSUE 1: EXCESSIVE NOISE LEVELS

Would the project generate 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?

4.1.1 Construction Noise Generation

Redding Municipal Code Section 18.40.100-F.2 prohibits construction within 500 feet of a residential district such that the sound creates a noise disturbance across a property line during the following times:

1. May 15 through September 15: Between the weekday hours of 7:00 p.m. and 6:00 a.m. and weekends and holidays between 8:00 p.m. and 9:00 a.m.

2. September 16 through May 14: Between the weekday hours of 7:00 p.m. and 7:00 a.m. and weekends and holidays between 8:00 p.m. and 9:00 a.m.

Construction of the project is anticipated to occur during daytime hours, as allowed by the municipal code, and no conflicts with this section would occur. A quantitative threshold of 75 dBA L_{EQ} at residential land uses is considered in the following analysis based on the policy in the proposed update to the General Plan Noise Element.

Construction of the project would require grading, physical building construction, architectural coating application, and paving. Equipment anticipated to be required for these activities is based on typical equipment associated with residential construction since the specific equipment has not yet been determined by the project applicant. The magnitude of resulting construction noise would vary throughout the construction period depending on the type of construction activity, equipment, duration of each construction phase, the distance between the noise source and receiver, and any intervening structures.

Construction equipment would not all operate at the same time or location and would be moving across the site. To account for the daily movement of construction activity, equipment was analyzed at a 150-foot average distance from the nearest residences to the north and west. Table 6, *Construction Equipment Noise Levels*, provides the 150-foot distance noise levels for equipment anticipated to be used during project construction. It should be noted that RCNM does not consider topography or intervening structures that would attenuate noise. The full modeling results can be found in Appendix A, *Construction Noise Model Output.*

Table 6
CONSTRUCTION EQUIPMENT NOISE LEVELS

Unit	Percent Operating Time	L_{MAX} at150 Feet	dBA L_{EQ} at 150 Feet
Air Compressor	40	68.1	64.1
Backhoe	40	68.0	64.0
Concrete Pump Truck	20	71.9	64.9
Crane	16	71.0	63.0
Dozer	40	72.1	68.1
Excavator	40	71.2	67.2
Front End Loader	40	69.6	65.6
Generator	50	71.1	68.1
Grader	40	75.5	71.5
Paver	50	67.7	64.7
Roller	20	70.5	63.5
Welder	40	64.5	60.5

Source: USDOT 2008; Appendix A
Note: Modeling results do not include intervening structures that would attenuate noise levels further.
L_{MAX} = maximum noise level; dBA = A-weighted decibel; L_{EQ} = time-averaged (1-hour) noise level

As shown in Table 6, a grader would be the loudest piece of construction equipment and would generate an hourly noise level of 71.5 dBA L_{EQ} at 150 feet. The construction equipment anticipated to be required for project construction would not result in noise levels exceeding the Noise Element's suggested standard of 75 dBA L_{EQ}. As discussed in Section 3.2.1., no soil import or export is anticipated to be required for project grading; therefore, no substantial increase in traffic noise levels would occur as a result of haul truck trips. Construction would also occur within the daytime hours allowed by the Municipal Code. Therefore, impacts related to construction noise would be less than significant.

4.1.2 Operational On-site Noise Generation

The Redding Municipal Code prohibits stationary noise levels at adjacent residential property lines to exceed 55 dBA L_{EQ} from 7:00 a.m. to 10:00 p.m. or 45 dBA L_{EQ} from 10:00 p.m. to 7:00 a.m. At the commercial property lines south of the project site, the applicable noise limits are 65 dBA L_{EQ} from 7:00 a.m. to 10:00 p.m. and 55 dBA L_{EQ} from 10:00 p.m. to 7:00 a.m.

As described in Section 3.2.2.1, the project is anticipated to include a Carrier model 38BRC-024-34 2-ton split system HVAC unit on building rooftops. These units were modeled in CadnaA with rooftop parapets of 3 feet and the resulting noise levels were calculated at heights of 5 feet. Noise levels were calculated to be 40.1 dBA L_{EQ} at the northern residential property line and 43.1 dBA L_{EQ} at the western property line. Therefore, the project would not conflict with the residential property line limit of 45 dBA L_{EQ} during the nighttime hours. At the commercial property line south of the project site, noise levels were calculated to be 29.5 dBA L_{EQ}, which would not exceed the commercial nighttime noise limit of 55 dBA L_{EQ}. As the project would not conflict with the property line limits for residential or commercial properties adjacent the project site, impacts would be less than significant.

4.1.3 Operational Off-site Transportation Noise Generation

According to the project's transportation impact study, the project would generate 577 ADT, including 43 trips during the a.m. peak hour and 55 trips during the p.m. peak hour. As shown in Table 5, the project's p.m. peak hour trips would be spread across roadway segments carrying between 341 and 1,758 p.m. peak hour trips under existing conditions. The largest increase in project-added trips would occur on Canby Road where 29 p.m. peak-hour trips would be added to 341 existing p.m. peak-hour trips (W-Trans 2023).

As noted in Section 1.3.2.4, a doubling of sound energy corresponds to a 3 dBA increase. Therefore, to result in a perceptible increase (3 dBA) in traffic noise levels, traffic volumes generally need to double along a given roadway segment. As the project would not result in a doubling of traffic volumes on nearby roadways, the project would not result in perceptible increases in traffic noise levels. Impacts related to off-site traffic noise would be less than significant.

4.2 ISSUE 2: EXCESSIVE VIBRATION

Would the project expose persons to or generate excessive groundborne vibration or noise levels?

4.2.1 Construction Vibration

A significant impact related to structural damage would occur if vibration levels exceed 0.3 in/sec PPV at an engineered building (FTA 2018). For human receptors, a significant impact related to vibration would occur if vibration levels exceed 75 VdB at an NSLU. The nearest NSLU to the proposed building footprints is the residence approximately 35 feet to the north.

The anticipated project construction equipment with the highest potential vibration level would be a vibratory roller, which may be used for compaction of soil beneath building foundations. A vibratory roller creates approximately 0.210 in/sec PPV and 94 VdB at a distance of 25 feet (FTA 2018). A vibratory roller would result in approximately 0.127 in/sec PPV and 90 VdB at a distance of 35 feet.[1] This would not exceed the FTA's building damage threshold of 0.3 in/sec PPV and no damage to structures is anticipated to occur. The threshold for human response to vibration at an NSLU would be exceeded and impacts would be potentially significant. It should be noted that exposure to such groundborne vibration would be temporary as it would be limited to the short-term construction period and would not be concentrated in one location within the site throughout the construction period. Mitigation measure NOI-1, below, would require vibratory rollers to be used in static mode within 110 feet of residences (the distance at which the vibration level would be below 75 VdB) or documentation that vibratory rollers selected for use on the project site would comply with the limit of 75 VdB at nearby residences. With the implementation of mitigation measure NOI-1, impacts associated with a vibratory roller (and other potential equipment) would be less than significant.

NOI-1 **Vibratory Roller Usage Limits.** The applicant or designated contractor shall provide evidence to the City (via testing data or calculations from a qualified expert), demonstrating that the vibratory rollers to be used on the project site would produce less than 75 VdB at nearby occupied residences, or all vibratory rollers shall be used in static mode only (no vibrations) when operating within 110 feet of an occupied residence. The City shall specify vibratory roller model, size, or operating mode restrictions on all demolition, grading, and construction permits.

4.2.2 Operational Vibration

As a residential development, the project would not generate excessive groundborne vibration during operations; therefore, no impact would occur.

4.3 ISSUE 3: AIRPORT NOISE EXPOSURE

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 use airport or private airstrip, would the project expose people residing or working in the project area to excessive noise?

4.3.1 Aircraft Noise

The project site is located approximately 2.9 miles northeast of Benton Airpark and 6 miles northwest of the Redding Regional Airport. The project site is outside of the noise contours and airport influence areas related to these airports (City 2024). Therefore, while the project site may be subject to some distant aircraft noise, it would not be subject to excessive noise from airport operations and impacts would be less than significant.

[1] Equipment PPV = Reference PPV * $(25/D)^n$ (inches per second), where Reference PPV is PPV at 25 feet, D is distance from equipment to the receiver in feet, and n = 1.5. L_V = Reference L_V – 30*log (D/25) (VdB), where Reference L_V is L_V at 25 feet and D is distance from equipment to the receiver in feet. Formulas from FTA2018.

4.4 ISSUE 4: LAND USE COMPATIBILITY

Would the project conflict with the General Plan Noise Element standards for proposed uses?

4.4.1 Exterior Noise Levels

As noted in the Land Use section of the CEQA Guidelines Appendix G questions, a project may result in a significant impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect. The General Plan Noise Element includes noise and land use compatibility standards to ensure that proposed land uses do not result in excessive noise exposure. Therefore, an analysis of consistency with the Noise Element is included in this analysis. The General Plan Noise Element states that outdoor activity areas within residential development should achieve noise levels of 60 CNEL. However, the Noise Element notes that this standard may not be achievable in some cases and residential construction may still proceed given feasible mitigation is installed and interior areas comply with the CBC requirements.

Outdoor use areas proposed by the project include a basketball court at the northern edge of the property and a tot lot with adjacent barbeques in the center of the project site. Existing plus project traffic volumes during the p.m. peak hour along adjacent roadways and ten percent of ADT on I-5 were modeled in CadnaA. Noise receivers at heights of five feet were placed within the proposed outdoor use areas at the locations shown in Figure 4. Noise levels at the basketball court were modeled to be 44.6 CNEL and within the tot lot area were modeled to be 50.8 CNEL. As these noise levels would not exceed 60 CNEL, the project would comply with the General Plan policies for siting of outdoor use areas.

4.4.2 Interior Noise Levels

The CBC requires that noise levels in habitable interior spaces for multi-family uses do not exceed 45 CNEL. Traditional architectural materials are conservatively estimated to attenuate noise levels by 15 CNEL; therefore, if exterior noise levels at building façades exceed 60 CNEL, interior noise levels may exceed the 45 CNEL limit and further analysis would be warranted.

As described above, existing plus project traffic volumes during the p.m. peak hour along adjacent roadways and ten percent of ADT on I-5 were modeled in CadnaA. Receivers were placed at building façades at the locations shown in Figure 4 at heights of 5, 15, and 25 feet, as applicable for the floors of each building. The resulting noise levels at each receiver and floor are provided in Table 7, *Calculated Noise Levels at Project Façades*.

Table 7
CALCULATED NOISE LEVELS AT PROJECT FAÇADES

Receiver	Floor (CNEL)		
	1	2	3
R1	48.2	50.2	51.3
R2	51.8	52.6	53.2
R3	53.2	54.6	55.3
R4	52.2	53.9	-
R5	54.0	58.2	-
R6	64.4	65.6	-
R7	55.0	57.3	-
R8	40.5	44.8	-
R9	40.1	42.2	-
R10	42.0	48.1	-

Note: Noise levels are not provided where a third floor of residential units is not proposed.
CNEL = Community Noise Equivalent Level

As shown in Table 7, most building façades would be exposed to noise levels below 60 CNEL and interior noise levels can be assumed to comply with the interior noise requirement of 45 CNEL based on the use of typical construction materials.

However, due to the widening of Browning Street, the first and second floors of the southwestern most building (location of receiver R6), noise levels would exceed 60 CNEL; therefore, an interior analysis was completed based on the specific floor plan proposed at this location. Two bedrooms within the proposed second-story unit would face Browning Street. The interior noise analysis requires information regarding wall heights/lengths, room volumes, window/door sizes, as well as information on any other openings in the building shell for the habitable residential rooms. The room specifications used in this analysis were based on floor plans provided by the project applicant. See Appendix B, *Interior Noise Calculations*.

Using the modeled exterior façade noise level from receiver R6 and assuming standard building materials including STC 28 windows, the exterior-to-interior noise analysis concluded that interior noise levels would be below 45 CNEL when the windows are closed. Appropriate means of air circulation and provision of fresh air in compliance with CBC Section 1202 or the California Mechanical Code would be required to allow windows to remain closed for extended intervals of time so that acceptable levels of noise can be maintained on the interior. Based on current building plans, it is anticipated that interior noise levels for proposed residential units would achieve the 45 CNEL standard required by Title 24.

5.0 LIST OF PREPARERS

HELIX Environmental Planning, Inc.
1677 Eureka Road, Suite 100
Roseville, CA 95661

Jafar Al-Khalaf, Senior Noise Specialist
Shelby Bocks, Noise Specialist
Joanne Dramko, AICP, Principal Noise Specialist

6.0 REFERENCES

California Department of Transportation (Caltrans). 2021. Traffic Census Program.

2013. Technical Noise Supplement to the Traffic Noise Analysis Protocol. September.

Carrier. 2005. Product Data 38BRC (60 Hz) 12 SEER Air Conditioner. Available at: https://www.shareddocs.com/hvac/docs/1009/Public/02/38BRC-14PD.pdf.

Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. September.

Redding, City of (City). 2024. General Plan 2045. March 26.

U.S. Department of Transportation (USDOT). 2008. Roadway Construction Noise Model. Version 1.1. December 8.

W-Trans. 2023. Draft Transportation Impact Study for the Redding Canby Apartments. February 27.

This page intentionally left blank

Appendix A

Construction Noise Model Output

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 6/22/2023
Case Description: Redding Canby Apartments

---- Receptor #1 ----

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Residences	Residential	60	60	60

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Backhoe	No	40		77.6	150	0
Compressor (air)	No	40		77.7	150	0
Concrete Pump Truck	No	20		81.4	150	0
Crane	No	16		80.6	150	0
Dozer	No	40		81.7	150	0
Excavator	No	40		80.7	150	0
Front End Loader	No	40		79.1	150	0
Generator	No	50		80.6	150	0
Grader	No	40	85		150	0
Paver	No	50		77.2	150	0
Roller	No	20		80	150	0
Welder / Torch	No	40		74	150	0

Results
Calculated (dBA)

Equipment	*Lmax	Leq
Backhoe	68	64
Compressor (air)	68.1	64.1
Concrete Pump Truck	71.9	64.9
Crane	71	63
Dozer	72.1	68.1
Excavator	71.2	67.2
Front End Loader	69.6	65.6
Generator	71.1	68.1
Grader	75.5	71.5
Paver	67.7	64.7
Roller	70.5	63.5
Welder / Torch	64.5	60.5

Appendix B

Interior Noise Calculations

EXTERIOR TO INTERIOR NOISE REDUCTION ANALYSIS

Project Name: Redding Canby

Wall 1 of 2

Room Name: Building A SW Bedroom - Second Floor

Room Type : **Moderate**

	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Reverberation Time (sec) :	1.2	1.2	1.2	1.2	1.0	1.0	: Moderately Reflective Room
Room Absorption (Sabins) :	68	68	68	68	85	85	

		Noise Level		125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Source 1:	**Traffic**	**65.6**	**CNEL**	48.9	54.4	56.9	60.9	60.9	54.9	: Traffic Spectrum
Source 2:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 3:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 4:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Overall:		**65.6**	**CNEL**	48.9	54.4	56.9	60.9	60.9	54.9	: Effective Noise Spectrum

Assembly Type	Open	Width	Height	Qty	Total Area	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz
STC 46 Typical Exterior Wall	N	13	10	1	122.5	29	40	46	46	44	53
STC 28 1/2-inch Dual Insulating Window	N	2.5	3	1	7.5	23	23	22	32	43	37
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0

Room Depth: **13** ft **Overall Area:** **130** ft²

Volume: **1690** ft³

Number of Impacted Walls: **2**

Windows Closed
Interior Noise Level: 34.5 CNEL

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
48.9	54.4	56.9	60.9	60.9	54.9	: Exterior Wall Noise Exposure
28.3	34.1	34.2	42.4	43.9	48.1	: Transmission Loss
7.1	12.9	13.1	21.3	22.8	27.0	: Noise Reduction
18.3	18.3	18.3	18.3	19.3	19.3	: Absorption
23.5	23.2	25.6	21.3	18.9	8.7	: Noise Level

30.0 **CNEL** WINDOWS OPEN

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
48.9	54.4	56.9	60.9	60.9	54.9	: Exterior Wall Noise Exposure
28.3	34.1	34.2	42.4	43.9	48.1	: Transmission Loss
7.1	12.9	13.1	21.3	22.8	27.0	: Noise Reduction
18.3	18.3	18.3	18.3	19.3	19.3	: Absorption
23.5	23.2	25.6	21.3	18.9	8.7	: Noise Level

30.0 **CNEL** WINDOWS CLOSED

EXTERIOR TO INTERIOR NOISE REDUCTION ANALYSIS

Project Name: Redding Canby **Wall 2 of 2**
0
Room Name: Building A SW Bedroom - Second Floor

		Noise Level		125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Source 1:	Traffic	65.6	CNEL	48.9	54.4	56.9	60.9	60.9	54.9	: Traffic Spectrum
Source 2:	<N/A>	0.0	CNEL	0.0	0.0	0.0	0.0	0.0	0.0	
Source 3:	<N/A>	0.0	CNEL	0.0	0.0	0.0	0.0	0.0	0.0	
Source 4:	<N/A>	0.0	CNEL	0.0	0.0	0.0	0.0	0.0	0.0	
Overall:		65.6	CNEL	48.9	54.4	56.9	60.9	60.9	54.9	: Effective Noise Spectrum

Assembly Type	Open	Width	Height	Qty	Total Area	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz
STC 46 Typical Exterior Wall	N	13	10	1	112.5	29	40	46	46	44	53
STC 28 1/2-inch Dual Insulating Window	N	5	3.5	1	17.5	23	23	22	32	43	37
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0

Overall Area: 130 ft²

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
48.9	54.4	56.9	60.9	60.9	54.9	: Exterior Wall Noise Exposure
27.5	31.1	30.7	40.0	43.8	45.3	: Transmission Loss
6.3	9.9	9.5	18.8	22.6	24.2	: Noise Reduction
18.3	18.3	18.3	18.3	19.3	19.3	: Absorption
24.3	26.2	29.1	23.8	19.0	11.4	: Noise Level

32.6 **CNEL** WINDOWS OPEN

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
48.9	54.4	56.9	60.9	60.9	54.9	: Exterior Wall Noise Exposure
27.5	31.1	30.7	40.0	43.8	45.3	: Transmission Loss
6.3	9.9	9.5	18.8	22.6	24.2	: Noise Reduction
18.3	18.3	18.3	18.3	19.3	19.3	: Absorption
24.3	26.2	29.1	23.8	19.0	11.4	: Noise Level

32.6 **CNEL** WINDOWS CLOSED

EXTERIOR TO INTERIOR NOISE REDUCTION ANALYSIS

Project Name: Redding Canby

Wall 1 of 2

Room Name: Building A SE Bedroom - Second Floor

Room Type : Moderate

	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Reverberation Time (sec) :	1.2	1.2	1.2	1.2	1.0	1.0	: Moderately Reflective Room
Room Absorption (Sabins) :	50	50	50	50	62	62	

		Noise Level		125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Source 1:	**Traffic**	**65.6**	**CNEL**	48.9	54.4	56.9	60.9	60.9	54.9	: Traffic Spectrum
Source 2:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 3:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 4:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Overall:		**65.6**	**CNEL**	48.9	54.4	56.9	60.9	60.9	54.9	: Effective Noise Spectrum

Assembly Type	Open	Width	Height	Qty	Total Area	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz
STC 46 Typical Exterior Wall	N	11.36	10	1	96.1	29	40	46	46	44	53
STC 28 1/2-inch Dual Insulating Window	N	5	3.5	1	17.5	23	23	22	32	43	37
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0

Room Depth: 11 ft

Overall Area: 113.6 ft²

Volume: 1250 ft³

Number of Impacted Walls: 2

Windows Closed
Interior Noise Level: 35.7 CNEL

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
48.9	54.4	56.9	60.9	60.9	54.9	: Exterior Wall Noise Exposure
27.3	30.6	30.1	39.5	43.8	44.8	: Transmission Loss
6.8	10.0	9.6	19.0	23.2	24.3	: Noise Reduction
17.0	17.0	17.0	17.0	18.0	18.0	: Absorption
25.2	27.4	30.4	24.9	19.8	12.7	: Noise Level

33.8 **CNEL** WINDOWS OPEN

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
48.9	54.4	56.9	60.9	60.9	54.9	: Exterior Wall Noise Exposure
27.3	30.6	30.1	39.5	43.8	44.8	: Transmission Loss
6.8	10.0	9.6	19.0	23.2	24.3	: Noise Reduction
17.0	17.0	17.0	17.0	18.0	18.0	: Absorption
25.2	27.4	30.4	24.9	19.8	12.7	: Noise Level

33.8 **CNEL** WINDOWS CLOSED

EXTERIOR TO INTERIOR NOISE REDUCTION ANALYSIS

Project Name: Redding Canby **Wall 2 of 2**
0
Room Name: Building A SE Bedroom - Second Floor

		Noise Level		125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
Source 1:	**Traffic**	**65.6**	**CNEL**	48.9	54.4	56.9	60.9	60.9	54.9	: Traffic Spectrum
Source 2:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 3:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Source 4:	**<N/A>**	**0.0**	**CNEL**	0.0	0.0	0.0	0.0	0.0	0.0	
Overall:		**65.6**	**CNEL**	48.9	54.4	56.9	60.9	60.9	54.9	: Effective Noise Spectrum

Assembly Type	Open	Width	Height	Qty	Total Area	125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz
STC 46 Typical Exterior Wall	N	11.9	10	1	111.5	29	40	46	46	44	53
STC 28 1/2-inch Dual Insulating Window	N	2.5	3	1	7.5	23	23	22	32	43	37
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0
<N/A>	N	0	0	0	0.0	0	0	0	0	0	0

Overall Area: **119** ft²

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
48.9	54.4	56.9	60.9	60.9	54.9	: Exterior Wall Noise Exposure
28.2	33.8	33.8	42.2	43.9	47.9	: Transmission Loss
7.5	13.0	13.1	21.4	23.1	27.1	: Noise Reduction
17.0	17.0	17.0	17.0	18.0	18.0	: Absorption
24.4	24.4	26.8	22.5	19.8	9.8	: Noise Level
31.2	**CNEL**	WINDOWS OPEN				

125 Hz	250 Hz	500 Hz	1KHz	2KHz	4KHz	
48.9	54.4	56.9	60.9	60.9	54.9	: Exterior Wall Noise Exposure
28.2	33.8	33.8	42.2	43.9	47.9	: Transmission Loss
7.5	13.0	13.1	21.4	23.1	27.1	: Noise Reduction
17.0	17.0	17.0	17.0	18.0	18.0	: Absorption
24.4	24.4	26.8	22.5	19.8	9.8	: Noise Level
31.2	**CNEL**	WINDOWS CLOSED				

Attachment F

Redding Canby Apartments Project Revised Biological Resources Assessment

Redding Canby Apartments Project

Revised Biological Resources Assessment

October 2024 | 08183.00002.001

Prepared for:

The DANCO Group
5251 Ericson Way
Arcata, CA 95521

Prepared by:

HELIX Environmental Planning, Inc.
1677 Eureka Road, Suite 100
Roseville, CA 95661

This page intentionally left blank

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS (cont.)

Section **Page**

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

AMSL	above mean sea level
BRA	Biological Resources Assessment
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRLF	California red-legged frog
CRPR	California Rare Plant Rank
CWA	Clean Water Act
DPS	Distinct Population Segment
FESA	Federal Endangered Species Act
GPS	Global Positioning System
HELIX	HELIX Environmental Planning, Inc.
IPaC	Information for Planning and Consultation
ITP	Incidental Take Permit
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPPA	Native Plant Protection Act
NRCS	Natural Resource Conservation Service
NWPR	Navigable Waters Protection Rule
OHWM	ordinary high-water mark
Porter-Cologne	Porter-Cologne Water Quality Control Act
project	Redding Canby Apartments Project
RWQCB	Regional Water Quality Control Board
SAA	Streambed Alteration Agreement
SCGP	Sonoma County General Plan
SSC	Species of Special Concern
SWRCB	State Water Resources Control Board

ACRONYMS AND ABBREVIATIONS (cont.)

USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDR	Waste Discharge Requirements
WQB	Water Quality Certification

EXECUTIVE SUMMARY

HELIX Environmental Planning, Inc. (HELIX) prepared a Revised Biological Resources Assessment (BRA) for the Redding Canby Apartments Project (Study Area) occurring north of Browning Street and west of Canby Road in the City of Redding, Shasta County, California. The site is located at located at 930 and 990 Canby Road and is depicted on the U.S. Geological Survey (USGS) *Enterprise, California* 7.5-minute quadrangle map (Figure 1), NAD 1983 State Plane CA Zone II (USGS 2023). The approximate center of the Study Area is at latitude 40.5940967° and longitude -122.3545178°, NAD 83.

The purpose of this Revised BRA is to assess the general biological resources on the site, to assess the suitability of the site to support special-status species and sensitive vegetation communities or habitats, and to provide recommendations for mitigation as well as any regulatory permitting or further analysis that may be required prior to development activities occurring on the site.

The approximately 8.65-acre Study Area is composed of open space. The surrounding land uses include multi-family residential housing, commercial developments, a public park, and open space. Two isolated seasonal wetlands and a small portion of intermittent drainage are present within the Study Area. The intermittent drainage enters the property near the northeast corner and flows in the southeast direction, exiting the site through two approximately 48-inch culverts, flowing under Canby Road and onto the adjacent property.

Known or potential biological constraints in the Study Area include:

- Potential habitat for foothill yellow-legged frog, western pond turtle, pallid bat, western red bat, and Crotch's bumble bee;
- Potential nesting and foraging habitat for nesting migratory birds and raptors;
- Redding checkerbloom (*Sidalcea celata*) is present in the Study Area;
- Potential waters of the U.S. and State; and
- Trees were identified within the Study Area as protected and subject to mitigation or replacement under the City's ordinance.

This page intentionally left blank

1.0 INTRODUCTION

This report summarizes the findings of a Biological Resources Assessment (BRA) completed by HELIX Environmental Planning, Inc. (HELIX) for the Redding Canby Apartments Project (project; Study Area). The approximately 8.65-acre Study Area is located at 930 and 990 Canby Road, Redding, in Shasta County, California. This document addresses the on-site physical features, plant communities present, and the common plant and wildlife species occurring or potentially occurring in the Study Area. In addition, HELIX analyzed the suitability of the Study Area to support special-status species and sensitive habitats (including wetlands or other aquatic resources) and proposed mitigation measures to reduce impacts to special-status species and habitats that would occur as a result of potential future development of the site.

2.0 DESRIPTION OF THE STUDY AREA

2.1 PROJECT LOCATION

The ±8.65-acre Study Area is square in shape and is located at 930 and 990 Canby Road, Redding, in Shasta County, California (Figure 1 of Appendix A, *Figures*). The site is depicted on the U.S. Geological Survey (USGS) *Enterprise, California* 7.5-minute quadrangle map (Figure 2 of Appendix A). The approximate center of the Study Area is at latitude 40.5940967° and longitude -122.3545178°, NAD 83, and is located at an elevation between 605 feet (184 meters) and 640 feet (195 meters) above mean sea level (AMSL). An aerial map of the Study Area can be found in Figure 3 of Appendix A.

2.2 EXISTING CONDITIONS

The land use within the Study Area consists of undeveloped land dominated by annual grassland and blue oak woodlands. The surrounding land uses include multi-family residential housing to the north and west, Browning Street abutting to the south followed by commercial development, and open space to the east. An aerial map of the Study Area is included as Figure 2 of Appendix A.

2.3 PROJECT DESCRIPTION

The DANCO Group proposes to construct an affordable housing residential infill development consisting of 120 multifamily residential units in ten separate two- and three-story structures. The project will include 32 one-bedroom units, 56 two-bedroom units, 28 three-bedroom units, and 4 four-bedroom units. The project will also include a community building, onsite manager’s unit, courtyard, and children’s playground area. There will be a total of 212 parking spaces located throughout the site.

3.0 REGULATORY FRAMEWORK

Federal, State, and local environmental laws, regulations, and policies relevant to the California Environmental Quality Act (CEQA) review process are summarized below. Applicable CEQA significance criteria are also addressed in this section.

3.1 FEDERAL REGULATIONS

3.1.1 Federal Endangered Species Act

The U.S. Fish and Wildlife Service (USFWS) enforces the provisions stipulated within the Federal Endangered Species Act of 1973 (FESA; 16 USC 1531 et seq.). Species identified as federally threatened or endangered (50 CFR 17.11, and 17.12) are protected from take, defined as direct or indirect harm, unless a Section 10 permit is granted to an entity other than a federal agency; or a Biological Opinion with incidental take provisions is rendered to a federal lead agency via a Section 7 consultation. Pursuant to the requirements of FESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed species may be present in the study area and determine whether the proposed project will jeopardize the continued existence of or result in the destruction or adverse modification of critical habitat of such species (16 USC 1536 (a)[3], [4]). Other federal agencies designate species of concern (species that have the potential to become listed), which are evaluated during an environmental review under the National Environmental Protection Act (NEPA) or CEQA, if they are not otherwise protected under FESA.

3.1.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 established federal responsibilities for the protection of nearly all species of birds, their eggs, and nests. The Migratory Bird Treaty Reform Act of 2004 further defined species protected under the act and excluded all non-native species. Section 16 U.S.C. 703–712 of the Act states, "unless and except as permitted by regulations, it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill" a migratory bird. A migratory bird is any species or family of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle. Currently, there are 836 migratory birds protected nationwide by the Migratory Bird Treaty Act, of which 58 are legal to hunt. The U.S. Court of Appeals for the 9th Circuit (with jurisdiction over California) has ruled that the MBTA does not prohibit incidental take (952 F 2d 297 – Court of Appeals, 9th Circuit 1991).

3.1.3 Jurisdictional Waters

On May 25, 2023, the United States Supreme Court issued a decision in the case of *Sackett v. Environmental Protection Agency* (Supreme Court of the United States, 2023) which will ultimately influence how federal waters are defined. The May 25, 2023, Supreme Court decision in *Sackett v. Environmental Protection Agency* determined that "the CWA extends to only those 'wetlands with a continuous surface connection to bodies that are "waters of the United States" in their own right,' so that they are 'indistinguishable' from those waters." The United States Environmental Protection Agency and the United States Army Corps of Engineers are reviewing the decision to determine next steps.

Unless considered an exempt activity under Section 404(f) of the Federal Clean Water Act, any person, firm, or agency planning to alter or work in "waters of the U.S.," including the discharge of dredged or fill material, must first obtain authorization from the USACE under Section 404 of the Clean Water Act (CWA; 33 USC 1344). Permits, licenses, variances, or similar authorization may also be required by other federal, state, and local statutes. Section 10 of the Rivers and Harbors Act prohibits the obstruction or alteration of navigable waters of the U.S. without a permit from USACE (33 USC 403). Activities exempted under Section 404(f) are not exempted within navigable waters under Section 10.

The Clean Water Act (33 United States Code (USC) 1251-1376) provides guidance for the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters.

Section 401 requires that an applicant for a federal license or permit that allows activities resulting in a discharge to waters of the U.S. obtain a state certification that the discharge complies with other provisions of CWA. The Regional Water Quality Control Board (RWQCB) administers the certification program in California and may require State Water Quality Certification before other permits are issued.

Section 402 establishes a permitting system for the discharge of any pollutant (except dredged or fill material) into waters of the U.S.

Section 404 establishes a permit program administered by USACE that regulates the discharge of dredged or fill material into waters of the U.S. (including wetlands). Implementing regulations by USACE are found at 33 CFR Parts 320-332. The Section 404 (b)(1) Guidelines were developed by the USEPA in conjunction with USACE (40 CFR Part 230), allowing the discharge of dredged or fill material for non-water dependent uses into special aquatic sites only if there were no practicable alternative that would have less adverse impacts.

3.2 STATE JURISDICTION

3.2.1 California Endangered Species Act

The California Endangered Species Act (CESA) (California Fish and Game Code Sections 2050 to 2097) is similar to the FESA. The California Fish and Wildlife Commission is responsible for maintaining lists of threatened and endangered species under CESA. CESA prohibits the take of listed and candidate (petitioned to be listed) species. "Take" under California law means to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch capture, or kill (California Fish and Game Code, Section 86). The California Department of Fish and Wildlife (CDFW) can authorize take of a state-listed species under Section 2081 of the California Fish and Game Code if the take is incidental to an otherwise lawful activity, the impacts are minimized and fully mitigated, funding is ensured to implement and monitor mitigation measures, and CDFW determines that issuance would not jeopardize the continued existence of the species. A CESA permit must be obtained if a project will result in the "take" of listed species, either during construction or over the life of the project. For species listed under both FESA and CESA requiring a Biological Opinion under Section 7 of the FESA, CDFW may also authorize impacts to CESA species by issuing a Consistency Determination under Section 2080.1 of the Fish and Game Code.

3.2.2 California Code of Regulations Title 14 and California Fish and Game Code

The official listing of endangered and threatened animals and plants is contained in the California Code of Regulations Title 14 §670.5. A state candidate species is one that the California Fish and Game Code has formally noticed as being under review by CDFW to include in the state list pursuant to Sections 2074.2 and 2075.5 of the California Fish and Game Code.

Legal protection is also provided for wildlife species in California identified as "fully protected animals." These species are protected under Sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish) of the California Fish and Game Code. These statutes prohibit take or possession of fully protected species at any time. CDFW is unable to authorize incidental take of fully protected species unless any such take authorization is issued in conjunction with the approval of a Natural Community Conservation Plan that covers the fully protected species (California Fish and Game Code Section 2835).

3.2.3 California Environmental Quality Act

Under the California Environmental Quality Act of 1970 (Public Resources Code Section 21000 et seq.), lead agencies analyze whether projects would have a substantial adverse effect on a candidate, sensitive, or special-status species (Public Resources Code Section 21001I). These “special-status” species generally include those listed under FESA and CESA, and species that are not currently protected by statute or regulation, but would be considered rare, threatened, or endangered under the criteria included in CEQA Guidelines Section 15380. Therefore, species considered rare are addressed under CEQA regardless of whether they are afforded protection through any other statute or regulation. The California Native Plant Society (CNPS) inventories the native flora of California and ranks species according to rarity; plants ranked as 1A, 1B, 2A, 2B, and 3 are generally considered special-status species under CEQA.[1]

Although threatened and endangered species are protected by specific federal and state statutes, CEQA Guidelines Section 15380(d) provides that a species not listed on the federal or state list of protected species may be considered rare if it can be shown to meet certain specified criteria. These criteria have been modeled after the definition in FESA and the section of the California Fish and Game Code dealing with rare or endangered plants and animals. Section 15380(d) allows a public agency to undertake a review to determine if a significant effect on species that have not yet been listed by either the USFWS or CDFW (i.e., candidate species) would occur.

3.2.4 Native Plant Protection Act

The California Native Plant Protection Act of 1977 (California Fish and Game Code Sections 1900-1913) empowers the Fish and Game Commission to list native plant species, subspecies, or varieties as endangered or rare following a public hearing. To the extent that the location of such plants is known, CDFW must notify property owners that a listed plant is known to occur on their property. Where a property owner has been so notified by CDFW, the owner must notify CDFW at least 10 days in advance of any change in land use (other than changing from one agricultural use to another), in order that CDFW may salvage listed plants that would otherwise be destroyed. Currently, 64 taxa of native plants have been listed as rare under the act.

3.2.5 Nesting Birds

California Fish and Game Code Subsections 3503 and 3800 prohibit the possession, take, or needless destruction of birds, their nests, and eggs, and the salvage of dead nongame birds. California Fish and Game Code Subsection 3503.5 protects all birds in the orders of Falconiformes and Strigiformes (birds of prey). Fish and Game Code Subsection 3513 states that it is unlawful to take or possess any migratory nongame bird as designated in the Migratory Bird Treaty Act or any part of such migratory nongame bird except as provided by rules and regulations adopted by the Secretary of the Interior under provisions of the Migratory Bird Treaty Act. The Attorney General of California has released an opinion that the Fish and Game Code prohibits incidental take.

[1] The California Rare Plant Rank system can be found online at http://www.cnps.org/cnps/rareplants/ranking.php.

3.2.6 Regional Water Quality Control Board

Any action requiring a CWA Section 404 permit, or a Rivers and Harbors Act Section 10 permit, must also obtain a CWA Section 401 Water Quality Certification. The State of California Water Quality Certification (WQC) Program was formally initiated by the State Water Resources Control Board (SWRCB) in 1990 under the requirements stipulated by Section 401 of the Federal Clean Water Act. Although the Clean Water Act is a Federal law, Section 401 of the CWA recognizes that states have the primary authority and responsibility for setting water quality standards. In California, under Section 401, the State and Regional Water Boards are the authorities that certify that issuance of a federal license or permit does not violate California's water quality standards (i.e., that they do not violate Porter-Cologne and the Water Code). The WQC Program currently issues the WQC for discharges requiring USACE permits for fill and dredge discharges within Waters of the United States, and now also implements the State's wetland protection and hydromodification regulation program under the Porter Cologne Water Quality Control Act.

On May 28, 2020, the SWRCB implemented the State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State (Procedures) for inclusion in the forthcoming Water Quality Control Plan for Inland Surface Waters and Enclosed Bays and Estuaries and Ocean Waters of California (SWRCB 2019). The Procedures consist of four major elements:

I. A wetland definition;
II. A framework for determining if a feature that meets the wetland definition is a water of the state;
III. Wetland delineation procedures; and
IV. Procedures for the submittal, review, and approval of applications for Water Quality Certifications and Waste Discharge Requirements for dredge or fill activities.

Under the Procedures and the State Water Code (Water Code §13050(e)), "Waters of the State" are defined as "any surface water or groundwater, including saline waters, within the boundaries of the state." "Waters of the State" includes all "Waters of the U.S."

More specifically, a wetland is defined as: *"An area is wetland if, under normal circumstances, (1) the area has continuous or recurrent saturation of the upper substrate caused by groundwater, or shallow surface water, or both; (2) the duration of such saturation is sufficient to cause anaerobic conditions in the upper substrate; and (3) the area's vegetation is dominated by hydrophytes or the area lacks vegetation."* The wetland definition encompasses the full range of wetland types commonly recognized in California, including some features not protected under federal law, and reflects current scientific understanding of the formation and functioning of wetlands (SWRCB 2019).

Unless excluded by the Procedures, any activity that could result in discharge of dredged or fill material to Waters of the State, which includes Waters of the U.S. and non-federal Waters of the State, requires filing of an application under the Procedures.

3.3 LOCAL REGULATIONS/GUIDELINES

3.3.1 City of Redding General Plan

The City of Redding General Plan 2000-2020 (General Plan; City of Redding 2000) is a comprehensive planning document guiding future development related to a multitude of aspects of community life within the City of Redding. It includes maps that show where agricultural, residential, commercial, and other land uses will be located, and a series of policies that guide future decisions about growth, development, and conservation of resources.

The General Plan provides the basis for development while considering biological and wildlife resources within the Redding Planning Area. The following habitat types are considered sensitive and require special consideration while developing within or in proximity of them: riparian, vernal pools, and wetlands. Applicable policies to this project within the General Plan relevant to preserving and protecting creek corridors, riparian areas, vernal pools, and wetlands are stated below.

Policy NR6A. Preserve watercourses, vernal pools, riparian habitat, and wetlands in their natural state to the extent feasible. Fully mitigate unavoidable adverse impacts such as wetland filling or disturbance.

Policy NR6B. Provide adequate buffering of sensitive habitats wherever necessary. Buffer size should be based upon the type of habitat as well as its size and habitat value.

Policy NR6C. Ensure that uses allowed within riparian corridors:

- Minimize the creation of erosion, sedimentation, and increased runoff.
- Emphasize retention and enhancement of natural riparian vegetation.
- Provide for unimpaired passage of fish and wildlife.
- Avoid activities or development of new features that result in disturbance or dispersal of wildlife.
- Avoid channelization.
- Avoid substantial interference with surface and subsurface flows.
- Incorporate natural vegetation buffers

Policy NR6D. Continue to require new development to provide minimum river and creek-corridor development setbacks (buffer areas) in accordance with Figure 3-3 and Zoning Code Chapter 18.48. These setbacks may be modified based on project/resources-specific circumstances and appropriate mitigation. These buffer areas should be dedicated to a permanent conservation easement granted to the City as a condition of development approval (City of Redding, 2022).

3.3.1.1 City of Redding Municipal Code Chapter 18.48 River Creek Corridor Development

River and creek corridor habitats support a great diversity of plants and animals, recharge aquifers, and filter some pollutants. These corridors are valuable as open-space areas and are of recreational and scenic interest. The purpose of this chapter is to provide adequate buffer areas between creek corridors and adjacent development to protect this valuable community resource as a natural, scenic and recreational amenity.

Waterways identified for protection in the General Plan and their corresponding average buffer widths (setbacks) are provided in Schedule 18.48.020-A (Waterway Corridor Setback Requirements) under Section 18.48.020 of the Redding, California Municipal Code (Redding Municipal Code). In accordance with Figure 3-3, River and Creek Corridor Buffer widths, included in the City of Redding 2000-2020 General Plan, the onsite portion of intermittent drainage is considered a secondary tributary to Churn Creek which requires a 25-foot setback from the riparian drip line or 50 feet from the top of bank, whichever is greater.

As per Section 18.48.030 of the Redding Municipal Code, the following requirements pertain to all new developments along the waterways identified in Schedule 18.48.020-A (exceptions to the required buffer area are described in Section 18.48.0400 [Reduced Setback]):

A. Setbacks, easements, or in-fee dedications are required for the stream corridor and buffer areas as follows:
    1. Ministerial projects (building permit; zoning clearance): development setbacks only. At the request of the property owner, the city may accept an offer of dedication and accept fee title to the buffer area.
    2. Discretionary land-use entitlements (site development permits; use permits): dedicated to the city as an open-space easement.
    3. Subdivision maps: dedicated to the city as an open-space easement or dedicated “in fee” to the city.
B. The average buffer widths depicted in Schedule 18.20.020-A may be increased by the approving authority if necessary to protect environmental resources as determined through the project environmental impact determination process.
C. Where Chapter 18.51 (“FP” Floodplain Overlay District) of this title, requires greater setbacks or dedications than shown in Schedule 18.20.020-A, the greater setbacks or dedications shall prevail.
D. No structure, parking access, parking space, paved area, fence, swimming pool, structure or other improvements shall be constructed within a buffer area except the installation of approved public facility infrastructure.
E. It is intended that buffer areas be maintained in a natural state and not be landscaped. Removal of vegetation as may be required by the fire marshal or by authorized public improvements is acceptable, subject to review of environmental impacts and identification of any necessary mitigation measures.
F. Where constructed drainage devices and improvements are required, they shall be placed in the least visible locations and naturalized through the use of river rock, earth-tone concrete and/or native plant materials.

3.3.2 City of Redding Tree Protection

The City of Redding regulates trees within their jurisdiction via the Redding Municipal Code Title 13 – Streets and Sidewalks, Chapter 13.40 – Trees and Shrubs and Chapter 18.45 Tree Management (Tree Preservation Ordinance) and the Comprehensive Tree Plan (City of Redding, 2020). This comprehensive tree plan regulates spacing of street trees, distance trees may be planted from curb lines and sidewalks, distances from street corners and fire hydrants, underground utilities, and overhead utilities. This plan also outlines conditions regarding public tree care, private tree care, removal of stumps, trimming of roots, and street tree removal.

3.3.2.1 Redding Municipal Code Chapter 18.45 Tree Management (Tree Preservation Ordinance)

The city council finds that trees contribute in many ways to the health, safety, and general welfare of all Redding's citizens (City of Redding 2023). Trees, in addition to their aesthetic benefits and temperature moderation, are of benefit to fisheries, riparian habitat, wildlife, energy conservation, and the ecology of the area. However, the city also recognizes that even with the identification, evaluation, protection, and maintenance provisions of this chapter, it may not be possible to preserve all healthy trees within new development projects. Given these recognized contributions and constraints, the intent and objectives of this chapter are to:

A. Protect and enhance the aesthetic qualities of the community provided by native and nonnative trees;
B. Promote a healthy and attractive urban landscape as the community grows;
C. Recognize the importance of trees as a visual and physical buffer;
D. Preserve the city's valuable natural features;
E. Require the replacement of trees that are removed, where appropriate;
F. Establish a program for the planting of trees in new developments;
G. Protect trees on undeveloped properties until such time as a development plan/building permit is approved.

To accomplish the preservation purposes of this chapter, candidate trees in the city are afforded special protections. The regulations require that a tree removal permit be obtained for removal of trees on vacant/undeveloped lands in order to ensure that trees can be identified and considered as candidates for preservation during the development process.

As described in Section 18.61.020 of the Redding Municipal Code, a candidate tree is defined as a single healthy tree or group of healthy trees warranting consideration for preservation by virtue of its value to the community, the immediate neighborhood, or the natural environment in recognition of the existence of one or more of the following attributes:

- It is an outstanding specimen of its species in terms of aesthetic quality as determined by shape and branch structure;
- It is one of the largest or oldest trees in Redding that also has historical or neighborhood interest;
- It adds significantly to the environment of the city because of its location, distinct form, unique species, or other identifying characteristics;
- It is in a location which is connected to a larger natural woodland system, such as a permanent open-space area, and which is likely to be self-supporting over time;
- It serves a desirable function, such as buffering dissimilar land uses, or is a component of an overall landscape plan.

Per Section 18.40.030 of the Redding Municipal Code, no tree, regardless of species, that exceeds six inches at diameter breast height on any developed or undeveloped/vacant property in the city shall be destroyed, killed, or removed unless a tree removal permit is first obtained under the provisions of this chapter, except as may be permitted pursuant to the terms of Section 18.45.070 (Discretionary permits), or as may be expressly exempted under Section 18.45.040 (Exemptions).

Tree planting provisions, described in Section 18.45.120 of the Redding Municipal Code and provided below, shall apply to all new construction and to those parcels which have been granted a tree removal permit. The trees shall be planted prior to the issuance of an occupancy permit in those instances where planting is in conjunction with construction under a valid building permit.

A. Residential Development. One 15-gallon tree shall be planted for every 500 square feet of enclosed gross living area, 2 of which shall be planted in the front yard. At least one of the trees must be planted within 7 feet of the sidewalk, or otherwise required by a tree planting plan established with approval of the development.
B. Commercial Development (Retail, Office, Heavy Commercial Uses). One 15-gallon tree shall be planted for every 1,000 square feet of gross floor area or covered space.
C. Industrial Development. One 15-gallon tree shall be planted for every 2,000 square feet of gross floor area or covered space.

Where the number of trees required to be planted under this section differs from the number required to be planted by Chapters 13.40 and 18.41, Off-Street Parking and Loading, of the Redding Municipal Code (if applicable), the higher number shall apply. If the number of trees required above contains a fraction, such number shall be increased to the next highest whole number. Each existing, preserved tree on a parcel may be counted as 2 trees for the purpose of the above planting requirements; however, this credit shall not reduce the number of trees required by Chapters 13.40 or 18.41 of the Redding Municipal Code applicable to the project except as may be provided for in those code sections.

3.3.3 California Department of Fish and Wildlife

The CDFW is a trustee agency that has jurisdiction under Section 1600 et seq. of the California Fish and Game Code. Under Sections 1602 and 1603, a private party must notify CDFW if a proposed project will "substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of streambeds…except when the department has been notified pursuant to Section 1601." Additionally, CDFW asserts jurisdiction over native riparian habitat adjacent to aquatic features, including native trees over four inches in diameter at breast height. If an existing fish or wildlife resource may be substantially adversely affected by the activity, CDFW may propose reasonable measures that will allow the protection of those resources. If these measures are agreeable to the parties involved, they may enter into an agreement with CDFW identifying the approved activities and associated mitigation measures. Generally, CDFW recommends submitting an application for a Streambed Alteration Agreement (SAA) for any work done within the lateral limit of water flow or the edge of riparian vegetation, whichever is greater.

3.4 CEQA SIGNIFICANCE

Section 15064.7 of the State CEQA Guidelines encourages local agencies to develop and publish the thresholds that the agency uses in determining the significance of environmental effects caused by projects under its review. However, agencies may also rely upon the guidance provided by the expanded Initial Study Checklist included in Appendix G of the State CEQA Guidelines. Appendix G provides examples of impacts that would normally be considered significant. Based on these examples, impacts to biological resources would normally be considered significant if the project would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFW or USFWS;
- Have a substantial adverse effect on State or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; and
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

An evaluation of whether or not an impact on biological resources would be substantial must consider both the resource itself and how that resource fits into a regional or local context. Substantial impacts would be those that would diminish or result in the loss of an important biological resource, or those that would obviously conflict with local, state, or federal resource conservation plans, goals, or regulations. Impacts are sometimes locally important but not significant, according to CEQA. The reason for this is that although the impacts would result in an adverse alteration of existing conditions, they would not substantially diminish, or result in the permanent loss of, an important resource on a population-wide or region-wide basis.

3.4.1 California Native Plant Society

The CNPS maintains a rank of plant species native to California that have low population numbers, limited distribution, or are otherwise threatened with extinction. This information is published in the *Inventory of Rare and Endangered Vascular Plants of California*. Potential impacts to populations of CNPS-ranked plants receive consideration under CEQA review. The following identifies the definitions of the CNPS Rare Plant Ranking System:

Rank 1A: Plants presumed Extinct in California and either rare or extinct elsewhere

Rank 1B: Plants Rare, Threatened, or Endangered in California and elsewhere

Rank 2A: Plants presumed extirpated in California but common elsewhere

Rank 2B: Plants Rare, Threatened, or Endangered in California, but more common elsewhere

Rank 3: Plants about which we need more information – A Review List

Rank 4: Plants of limited distribution – A Watch List

All plants appearing on CNPS Rank 1 or 2 are considered to meet CEQA Guidelines Section 15380 criteria. While only some of the plants ranked 3 and 4 meet the definitions of threatened or endangered species, the CNPS recommends that all Rank 3 and Rank 4 plants be evaluated for consideration under CEQA. Furthermore, the CNPS Rare Plant Rankings include levels of threat for each species. These threat ranks include the following:

0.1 - Seriously threatened in California (over 80 percent of occurrences threatened/high degree and immediacy of threat);

0.2 - Moderately threatened in California (20 to 80 percent occurrences threatened/moderate degree and immediacy of threat); and

0.3 - Not very threatened in California (less than 20 percent of occurrences threatened/low degree and immediacy of threat or no current threats known).

Threat ranks do not designate a change of environmental protections, so that each species (i.e., California Rare Plant Rank [CRPR] 1B.1, CRPR 1B.2, CRPR 1B.3, etc.) be fully considered during the preparation of environmental documents under CEQA.

3.4.2 California Department of Fish and Wildlife Species of Concern

Additional fish, amphibian, reptile, bird, and mammal species may receive consideration by CDFW and lead agencies during the CEQA process, in addition to species that are formally listed under FESA and CESA or listed as fully protected. These species are included on the *Special Animals List*, which is maintained by CDFW. This list tracks species in California whose numbers, reproductive success, or habitat may be in decline. In addition to “Species of Special Concern” (SSC), the *Special Animals List* includes species that are tracked in the California Natural Diversity Database (CNDDB) but warrant no legal protection. These species are identified as “California Special Animals.”

4.0 METHODOLOGY

Biological studies conducted for this report consisted of a special-status species evaluation that included a desktop review and database searches to identify known biological resources in the Study Area and vicinity as well as biological field surveys, including a focused botanical survey.

4.1 SPECIAL-STATUS SPECIES EVALUATION

For the purposes of this report, special-status species are those that fall into one or more of the following categories, including those:

- Listed as endangered or threatened under the FESA (including candidates and species proposed for listing);
- Listed as endangered or threatened under the CESA; including candidates and species proposed for listing);
- Designated as rare, protected, or fully protected pursuant to California Fish and Game Code;

- Designated as SSC by the CDFW;
- Considered by CDFW to be a Watch List species with potential to become an SSC;
- Defined as rare or endangered under Section 15380 of the CEQA; or
- Having a CRPR of 1A, 1B, 2A, 2B, or 3.

In order to evaluate special-status species and/or their habitats with the potential to occur in the Study Area and/or be impacted by the proposed project, HELIX conducted a nine-quad search, obtaining lists of regionally occurring special-status species from the following information sources:

- California Department of Fish and Wildlife (CDFW). 2024. *California Natural Diversity Database* (CNDDB); For: *Bella Vista, Balls Ferry, Cottonwood, Enterprise, Palo Cedro, Shasta Dam, Olinda, Project City, and Redding* USGS 7.5-minute series quadrangles, Enterprise, CA. Accessed [October 8, 2024];
- California Native Plant Society (CNPS). 2022. *Inventory of Rare and Endangered Plants* (online edition, v8-03 0.39) For: *Bella Vista, Balls Ferry, Cottonwood, Enterprise, Palo Cedro, Shasta Dam, Olinda, Project City,* and *Redding* USGS 7.5-minute series quadrangles, Enterprise, CA. Accessed [April 11, 2023]; and
- U.S. Fish and Wildlife Service (USFWS). 2023. *Information for Planning and Consultation* (IPaC) for the *Redding Canby Apartments Project.* Accessed [April 11, 2023].

Appendix B, *USFWS, CNDDB, and CNPS Lists of Regionally Occurring Special-Status Species* includes these lists of special-status plant and animal species occurring in the project region; Appendix C, *Potential for Special-Status Species in the Region to Occur in the Study Area* includes an evaluation of the potential for these species to occur in the Study Area.

4.2 BIOLOGICAL RECONNAISSANCE SURVEY

The biological surveys at the site consisted of a biological reconnaissance survey and a focused botanical survey.

4.2.1 Biological Reconnaissance Survey

The biological reconnaissance survey was conducted on April 14, 2023, by HELIX biologist Josh Goodwin. The weather during the field survey consisted of clear skies, winds between 0-5 miles per hour, and temperatures ranging from 49°-64° Fahrenheit. The Study Area was systematically surveyed on foot to ensure total search coverage, with special attention given to portions of the Study Area with the potential to support special-status species and sensitive habitats. Binoculars were used to further extend site coverage and identify species observed. All plant and animal species observed on-site during the surveys were recorded (Appendix D**,** *Plant and Wildlife Species Observed in the Study Area*), and all biological communities occurring on-site were characterized. All resources of interest were mapped with Global Positioning System (GPS)-capable tablets equipped with GPS receivers running ESRI Collector for ArcGIS version 10.7.1 software. Following the field survey, the potential for each species identified in the database query to occur within the Study Area was determined based on the site survey, soils, habitats present within the Study Area, and species-specific information, as shown in Appendix C.

4.2.2 Focused Botanical Survey

A botanical inventory was conducted during the biological reconnaissance survey on April 14, 2023, and an additional focused botanical survey of the site was conducted on May 31, 2023, by HELIX Biologist Josh Goodwin. The focused botanical surveys were conducted according to CNPS botanical survey guidelines (https://cnps.org/wp-content/uploads/2018/03/cnps_survey_guidelines.pdf) and CDFW *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018). The focused botanical survey letter report can be found in Appendix E, *Rare Plant Letter Report*. The entire site was surveyed, and all plant species were identified to the level necessary to determine if they were special-status species. Intensive surveys were conducted within the seasonal wetland features.

4.3 DELINEATION OF AQUATIC RESOURCES

Aquatic resources within the Study Area are documented in the *Wetland Delineation for the ±8.65-Acre Redding Canby Apartments Project Study Area, Shasta County, CA*, prepared for The DANCO Group (Natural Investigations Company, Inc., 2022), which will be submitted to the USACE in support of a request for a Preliminary Jurisdictional Determination. The results of the delineation are summarized in this report.

5.0 RESULTS

5.1 PHYSICAL FEATURES

5.1.1 Topography and Drainage

The Study Area has varying topography, composed of gradually sloping hills, increasing in elevation from east to west. The elevation is 608 feet (185 meters) above mean sea level (AMSL) at the northeast corner of the Study Area, 605 feet (184 meters) AMSL at the southeast corner, 631 feet (192 meters) AMSL at the southwest corner, and 637 feet (194) AMSL at the northwest corner favoring a drainage pattern to the southeast. The Study Area is located in the Churn-Creek-Sacramento River watershed Hydrologic Unit Code (HUC) 18020151. The site is dominated by annual grassland and blue oak woodland habitat. An intermittent drainage enters the property at the northeast corner of the site, flowing through the northeast corner of the Study Area for approximately 115 linear feet before exiting the site. The drainage flows through a pair of approximately 48-inch metal corrugated culverts positioned under Canby Road. The drainage is a tributary of Churn Creek which eventually enters the Sacramento River.

5.1.2 Soils

The Natural Resources Conservation Service (NRCS) has mapped three soil units within the Study Area (Figure 4 of Appendix A,) consisting of Churn gravelly loam, 0 to 3 percent slopes, Newton gravelly loam, 15 to 30 percent slopes, and Redding gravelly loam, 0 to 15 percent slopes (USDA 2023). These soil units are explained in further detail below:

- Churn gravelly loam, 0 to 3 percent slopes, occurs on the thread of stream terraces between 400 and 800 feet (122 to 244 meters) AMSL and consists of alluvium. This is a well-drained soil with more than 80 inches to the restrictive layer. Water is available between 0 to 60 inches. This soil type is classified as being in Hydrologic Soil Group C, having a moderately high runoff potential when thoroughly wet. Churn gravelly loam is not considered a hydric soil (NRCS 2023).

- Newton gravelly loam, 15 to 30 percent slopes, occurs on the riser of fan remnants between 600 and 1,000 feet (183 to 305 meters) AMSL and consists of alluvium. This is a well-drained soil, with more than 80 inches in depth to the restrictive layer. This soil type is classified as being in Hydrologic Soil Group C, having a moderately high runoff potential when thoroughly wet. Newton gravelly loam is not considered a hydric soil (NRCS 2023).

- Redding gravelly loam, 0 to 15 percent slopes, occurs on the thread of fan remnants between 430 and 1,100 feet (131 to 335 meters) AMSL and consists of loamy alluvium derived from igneous, metamorphic, and sedimentary rock over clayey alluvium derived from igneous, metamorphic, and sedimentary rock over cemented alluvium derived from igneous, metamorphic, and sedimentary rock over Tehama formation. This is a moderately well-drained soil, with more than 80 inches in depth to the restrictive layer and 10 to 20 inches to duripan. This soil type is classified as being in Hydrologic Soil Group D, having a high runoff potential when thoroughly wet. Newton gravelly loam is not considered a hydric soil (NRCS 2023).

5.2 VEGETATION COMMUNITIES

A total of four terrestrial vegetation communities were documented as occurring within the Study Area, including blue oak woodland, annual grassland, developed/disturbed, and riparian (Figure 5 of Appendix A,). These habitat types are discussed below. A comprehensive list of all plant and wildlife species observed within the Study Area is provided in Appendix D. Representative site photographs are included in Appendix F, Representative Site Photographs.

5.2.1 Annual Grassland

There are approximately 4.23 acres of annual grassland distributed throughout the Study Area, intermixed with primarily blue oak woodland (Appendix F, photos 1 and 2). The acreage of this vegetation community was calculated based on large open areas of this community, not including small in-between/understory grassland areas within the blue oak community. This vegetation community appears to be routinely maintained as vegetation heights ranged from 2 and 12 inches. This vegetation community was dominated by non-native and native species including purple sanicle (*Sanicula bipinnatifida*), broadleaf filaree (*Erodium botrys*), shining pepperweed (*Lepidium nitidum*), Italian ryegrass (*Festuca perennis*), annual vernal grass (*Anthoxanthum aristatum*), foxtail barley (*Hordeum murinum*), and wild oat (*Avena fatua*).

5.2.2 Blue Oak Woodland

Approximately 3.39 acres of the Study Area is comprised of blue oak woodland. This vegetation community occurs primarily within the center portion of the site extending to the northwest (Appendix F, photo 3). This community has a canopy density of approximately 30 to 40 percent with an understory dominated by annual grassland and forb species. The dominant tree species includes blue oak (*Quercus douglasii*), with a single common lilac (*Syringa vulgaris*) and a cypress tree (*Hesperocyparis* sp.)

observed. Dominant understory vegetation consisted of foxtail barley, cutleaf geranium (*Geranium dissectum*), common bedstraw (*Galium aparine*), annual vernal grass, wild oat, and poison oak (*Toxicodendron diversilobum*).

5.2.3 Developed/Disturbed

There is approximately 0.61 acre of developed/developed land, positioned along the eastern and southern boundaries of the Study Area (Appendix F, photo 4 and 5). These areas include portions of Canby Road along the eastern boundary and portions of Browning Street along the southern boundary. The southern boundary also includes some highly disturbed ground composed of a remnant access road and a slope cut adjacent to Browning Street. These disturbed areas are characterized by heavy disturbance by past or ongoing human activities but retain a soil substrate. These disturbed areas are sparsely to densely vegetated, but do not support a recognizable community or species assemblage. Vegetative cover is herbaceous and dominated by a wide variety of weedy non-native species or a few ruderal native species.

The disturbed habitat in the Action Area consists of upland vegetation including wild oats, ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), common vetch (*Vicia sativa*), and cut-leaf geranium.

5.2.4 Riparian

Approximately 0.20 acre of riparian habitat occurs in the northeast corner of the Study Area, surrounding the onsite drainage (Appendix F, photos 6 and 7). This habitat is relatively degraded due to being impacted by foot traffic and the establishment of invasive plants. The riparian habitat on the south side of the intermittent drainage is highly disturbed due to ground compaction from foot traffic, evident by the presence of a social trail. A multifamily development abuts this area to the north. The riparian habitat occurring on the north side the intermittent drainage is overgrown with Himalayan blackberry and is intermixed with various tree species. Trees occurring within this riparian habitat consist of interior live oak (*Quercus wislizeni*), blue oak, eucalyptus (*Eucalyptus* sp.), grey pine (*Pinus sabiniana*), and willow (Salix *sp.)*. The understory is dominated by common bog rush (*Juncus effusus*), dallisgrass (*Paspalum dilatatum*), penny royal (*Mentha pulegium*), curly dock (*Rumex crispus*), Himalayan blackberry (*Rubus armeniacus*), and St. John’s wort (*Hypericum* sp.).

5.3 AQUATIC RESOURCES

A total of two aquatic resource types were documented as occurring within the Study Area, including one intermittent drainage and two seasonal wetland features (Figure 5 of Appendix A,). There is an addendum to the Aquatic Resource Delineation, which includes an expanded area. These Aquatic resources are discussed below.

5.3.1 Intermittent Drainage

There is approximately 0.02 acre of intermittent drainage (115 linear feet) within the Study Area that is located within the northeast corner of the Study Area (Appendix F, photos 6-8). Water depths of this feature ranged from 3 to 12 inches, with a width ranging from 3 to 10 feet. The drainage enters the Study Area near the northeast corner of the site, flowing in the southeast direction, and leaves the site along the eastern boundary, eventually flowing into Churn Creek. The intermittent stream bed is composed of a mix of cobble, gravel, and organic material. Active flow was present at the time of the

April 14 and May 31 surveys. Narrow leaf cattail (*Typha angustifolia*) occurs at the far east end of the drainage, in close proximity to the culverts, prior to flowing under Canby Road.

5.3.2 Seasonal Wetland

Approximately 0.20 acre of the Study Area is comprised of seasonal wetland habitat, made up of two separate and distinct wetlands (Appendix F, photos 9-11). The smaller of the two seasonal wetland features occurs along the western boundary of the Study Area, near the northwest corner. This seasonal wetland is positioned in a northeast orientation located between two gently sloped hills. The source of water appears to be from direct precipitation and possibly runoff from the adjacent development to the east. The larger wetland feature gently slopes to the east, occurring closer to the eastern boundary of the site, near the northeast corner. Water collected by this larger wetland feature drains into a culvert positioned under Canby Road, which then flows to an offsite creek channel. Dominant vegetation occurring within the smaller wetland feature includes wild oat, spring vetch (*Vicia sativa*), Italian ryegrass, Mediterranean barley (*Hordeum marinum*), curly dock, and willow. No standing water was present within this feature at the time of the survey. The larger seasonal wetland is dominated by vegetation consisting of pennyroyal, tall flatsedge (*Cyperus eragrostis*), Himalayan blackberry, Mediterranean barley, yellow rocket (*Barbarea vulgaris*), and willow. No standing water was present within this feature, but the ground was saturated in some areas.

5.4 SPECIAL-STATUS SPECIES

A total of 33 regionally occurring special-status plant species and 29 regionally occurring special-status wildlife species were identified during the database queries and desktop review as having the potential to occur in the Study Area and surrounding areas and are evaluated in Appendix C.

5.4.1 Listed and Special-Status Plants

Based on the literature review, published information, and soil types present in the Study Area, a total of nine special-status plant species have the potential of occurring within the Study Area (Appendix C). These nine plant species include Henderson's bent grass (*Agrostis hendersonii*), big-scale balsamroot (*Balsamorhiza macrolepis*), silky cryptantha (*Cryptantha crinita*), mountain lady's slipper (*Cypripedium montanum*), dubious pea (*Lathyrus sulphureus* var. *argillaceus*), broad-lobed leptosiphon (*Leptosiphon latisectus*), Ahart's paronychia (*Paronychia ahartii*), Sanford's arrowhead (*Sagittaria sanfordii*), and Redding checkerbloom (*Sidalcea celata*). Species determined to have no potential to occur in the Study Area or be impacted by any future development (Appendix C) are not discussed further in this document.

5.4.1.1 Henderson's Bent Grass

Federal status – None
State status – None
CNPS – 3.2

Henderson's bent grass is an annual herb in the grass family (Poaceae) that is classified with a California Rare Plant Rank (CRPR) of 3.2 by the CNPS, which are plants about which more information is needed to assign them to one of the other ranks. This species is native to northern California and Oregon, where it is a rare member of the flora in scattered vernal pool habitats ranging from 70 to 305 meters above msl.

This species occurs within mesic valley and foothill grassland and vernal pools and has a bloom period from April to June (CNPS 2023).

This species was not observed during the April and May focused plant surveys. A total of three CNDDB records were documented within five miles of the Study Area for this species, with the nearest occurrence (occurrence #21), located approximately 2.6 miles to the northeast found within a vernal pool. This occurrence was made in 2006 and was documented as occurring southeast of Gold Hills Country Club, about 0.9-mile northwest of Shasta College. This species was not identified during the focused botanical surveys conducted within the identified blooming period for this species. This species is presumed absent from the survey area and therefore would not be expected to be impacted by the proposed development.

5.4.1.2 Big-Scale Balsamroot

Federal status – None
State status – None
CNPS – 1.B2

Big-scale balsamroot is a perennial herb in the sunflower family (Asteraceae) that is classified with a CRPR of 1B.2 by the CNPS which are plants considered to be rare, threatened, or endangered in California and elsewhere. This species is endemic to California and grows in dry, open habitat, mostly in mountainous areas, mostly in the western foothills of the Sierra Nevada and in the eastern Coast Ranges near San Francisco Bay from 45 to 1,555 meters above msl. It occurs in chaparral, cismontane woodland, and valley and foothill grassland habitats that are occasionally in serpentine soils and has a bloom period from March to June. This plant is a taprooted perennial herb growing erect 20 to 60 centimeters tall. The large lobed leaves are lance-shaped to oval and the largest, generally toward the base of the plant, may approach 50 centimeters in length (CNPS 2023).

This species was not observed during the 2023 April and May focused botanical surveys, both conducted during its recognized blooming period. No CNDDB occurrences were documented within five miles of the Study Area. This species is presumed absent from the Study Area and therefore would not be expected to be impacted by future development of the site.

5.4.1.3 Mountain Lady's Slipper

Federal status – None
State status – None
CNPS – 4.2

Mountain lady's slipper is a perennial rhizomatous herb in the orchid family (Orchidaceae) that is classified with a CRPR of 4.2 by the CNPS which are plants of limited distribution whose status should be monitored regularly. This species can be found in the northwestern United States and western Canada. It is usually found at high elevation (185-2225 meters) in open woods and subalpine slopes occurring in broadleafed upland forests, cismontane woodland, lower montane coniferous forest, and north coast coniferous forest. This species has a bloom period from March to August (CNPS 2023).

This species was not observed during the April and May 2023 focused botanical surveys, both conducted during its recognized blooming period. No CNDDB occurrences were documented within five miles of the Study Area. This species is presumed absent from the Study Area and therefore would not be expected to be impacted by future development of the site.

5.4.1.4 Silky Cryptantha

Federal status – None
State status – None
CNPS – 1B.2

Silky cryptantha is an annual herb in the borage family (Boraginaceae) that is classified with a CRPR of 1B.2 by the CNPS. It is an annual herb in the borage family (Boraginaceae) and is endemic to California. This species is found in cismontane woodlands, lower montane coniferous forests, riparian forests, riparian woodlands, and valley and foothill grasslands from 61 to 1,215 meters above msl. Other ecological preferences of this species include growing in gravelly streambeds. The blooming period for this species is from April to May (CNPS 2023).

This species was not observed during the April and May 2023 focused botanical surveys, both conducted during its recognized blooming period. A total of four CNDDB occurrences were documented within five miles of the Study Area, however the most recent occurrence (CNDDB occurrence #9) was documented over 40 years ago occurring approximately 2.9 miles to the southeast. This species is presumed absent from the Study Area and therefore would not be expected to be impacted by future development of the site.

5.4.1.5 Dubious Pea

Federal status – None
State status – None
CNPS – 3

Dubious pea is a perennial herb in the legume family (Fabaceae) that is classified with a CRPR of 3 by the CNPS. This species is endemic to California and is found in cismontane woodlands, lower and upper montane coniferous forests from 150 to 930 meters above msl. The blooming period for this species is from April to May (CNPS 2023).

This species was not observed during the May 2023 focused botanical survey, conducted during its recognized blooming period. One CNDDB occurrence was documented within five miles of the Study Area, however the most recent occurrence (CNDDB occurrence #9) was documented over 100 years ago to the west, in an area which has since been heavily developed. This species is presumed absent from the Study Area and therefore would not be expected to be impacted by future development of the site.

5.4.1.6 Broad-Lobed Leptosiphon

Federal status – None
State status – None
CNPS – 4.3

Broad-lobed leptosiphon is an annual herb in the phlox family (Polemoniaceae) that is classified with a CRPR of 4.3 by the CNPS. This species is endemic to California and is found in broadleafed upland forests and cismontane woodlands from 170 to 1,500 meters above msl. The blooming period for this species is from April to June (CNPS 2023).

This species was not observed during the April and May 2023 focused botanical surveys, both conducted during its recognized blooming period. No CNDDB occurrences were documented within five miles of the Study Area. This species is presumed absent from the Study Area and therefore would not be expected to be impacted by future development of the site.

5.4.1.7 Ahart's Paronychia

Federal status – None
State status – None
CNPS – 1B.1

Ahart's paronychia is an annual herb in the pink family (Caryophyllaceae) that is classified with a CRPR of 1B.1 by the CNPS. This species is endemic to California and is found in cismontane woodlands, valley and foothill grasslands, and vernal pools from 30 to 510 meters above msl (CNPS 2023). The blooming period for this species is from February to June (CNPS 2023).

This species was not observed during the April and May 2023 focused botanical surveys, both conducted during its recognized blooming period. No CNDDB occurrences were documented within five miles of the Study Area. This species is presumed absent from the Study Area and therefore would not be expected to be impacted by future development of the site.

5.4.1.8 Sanford's Arrowhead

Federal status – None
State status – None
CNPS – 1B.2

Sanford's arrowhead is a perennial, rhizomatous (emergent) herb in the water-plantain family (Alismataceae) that is classified with a CRPR of 1B.2 by the CNPS. This species is endemic to California and is found in marshes, swamps, and assorted shallow freshwater habitats from 0 to 300 meters above msl. The blooming period for this species is from May to October (November) (CNPS 2023).

This species was not observed during the focused botanical surveys, with the May survey being conducted during its recognized blooming period. No CNDDB occurrences were documented within five miles of the Study Area. This species is presumed absent from the Study Area and therefore would not be expected to be impacted by future development of the site.

5.4.1.9 Redding Checkerbloom

Federal status – None
State status – None
CNPS – 3

Redding checkerbloom is a perennial herb in the mallow family (Malvaceae) that is classified with a CRPR of 3 by the CNPS. This species is endemic to California and is found in cismontane woodlands from 135 to 1,525 meters above msl (CNPS 2023). Other ecological preferences of this species include sometimes growing in serpentine soils. The blooming period for this species is from April to August (CNPS 2023).

No CNDDB occurrences of this species were documented within five miles of the Study Area, however, California Native Plant Society documents this plant as occurring within Plumas, Shasta, Siskiyou, and Tehama Counties. The majority of the documented CNPS occurrences occur in Shasta County, with most occurrences concentrated primarily within the Redding area and areas immediately to the south. This species was observed within the northern half of the Study Area within the understory of the blue oak woodland during the May 2023 survey, where 10 to 15 individual Redding checkerbloom plants were observed in flower (Appendix F, photos 15 and 16). A map detailing the locations of the Redding checkerbloom within the Study Area can be seen on Figure 6 of Appendix A.

5.4.2 Listed and Special-Status Wildlife

According to the database queries, 29 listed and/or special-status wildlife species have the potential to occur in the region of the Study Area (CDFW 2024; USFW 2023). Based on field observations, published information, and literature review, a total of six special-status wildlife species have the potential to occur in the Study Area and/or be impacted if any future development were to occur: north coast foothill yellow-legged frog (*Rana boylii*, pop. 1; FYLF), western pond turtle (*Emys marmorata*), tricolored blackbird (*Agelaius* tricolor), pallid bat (*Antrozous pallidus*), western red bat (*Lasiurus frantzii*), and Crotch's bumble bee (*Bombus crotchii*). These species are discussed in more detail below. In addition to these special-status wildlife species, other migratory birds and raptors protected under federal, state, and local laws/policies also have the potential to occur within the Study Area. Species determined to have no potential to occur in the Study Area or be impacted by any future development (Appendix C) are not discussed further in this document.

5.4.2.1 Foothill Yellow-Legged Frog – North Coast DPS

Federal status – None
State status – CDFW Species of Special Concern

The FYLF range extends from the Transverse Mountains in southern California, north to the Oregon border along the Coast Ranges in California (Zeiner et al. 2000). The range of FYLF in the Sierra Nevada extends from the Cascade crest and along the western side of the Sierra Nevada to Kern County. Isolated records of the FYLF are known from San Joaquin County and Los Angeles County. The elevational range of FYLF extends from sea level up to 6,370 feet above mean sea level (Zeiner et al. 2000). Suitable aquatic habitat consists of streams flowing through a variety of vegetation communities, such as valley foothill hardwood, riparian, hardwood-conifer, chaparral, wet meadow, ponderosa pine and mixed pine (Hayes et al. 2016). FYLF prefer stream habitat with some shading, greater than 20 percent, but seem to be absent from streams with a canopy closure of 90 percent or more (Hayes et al. 2016). The most important characteristics to FYLF habitat include the stream order, minimum temperatures, frequency of precipitation, stream gradient, and elevation (Hayes et al. 2016). Breeding and rearing habitat is generally located in gently flowing, low-gradient streams with variable substrates dominated by cobble and boulders (Hayes et al. 2016). In larger streams, breeding sites are usually in depositional areas at the tail end of pools or near tributary confluences (Hayes et al. 2016). In smaller streams, egg masses are placed in similar locations amongst cobble in depositional areas near pools (Hayes et al. 2016). Egg masses are typically attached to leeward sides of boulders or cobbles to avoid exposure to high velocity flows (Hayes et al. 2016). Tadpoles tend to also occupy similar sites as the egg masses, which are typically more protected from scouring events (Hayes et al. 2016). The presence of sediment may reduce refugia for tadpoles and increase the likelihood they will be washed downstream during periods of high flow (Hayes et al. 2016).

Breeding typically starts in spring after high velocity flows begin to subside and air and water temperatures begin to increase (Hayes et al. 2016). FYLF typically lay eggs as early as March, but as late as June at higher elevations in the Sierra Nevada (Hayes et al. 2016). Eggs typically hatch after one to three weeks, which is dependent upon the temperature, with cooler temperatures decreasing the hatching time. Larvae metamorphose in 3 to 4 months and cooler water also delays larval metamorphosis. Growth rates and timing of development are dependent on location, which varies with temperature and flow velocities (Hayes et al. 2016).

This species was not observed in the Study Area during the biological survey conducted by HELIX in April or May 2023. At the time of the April and May surveys, the drainage had flowing water present. A total of two CNDDB records were documented within five miles of the Study Area for this species, with the nearest occurrence (occurrence #650), located approximately 1.14 miles to the west along the Sacramento River, with an accuracy rating of two miles. This occurrence was made in 1976 and the location for the occurrence was only specified as occurring in Redding along the Sacramento River. According to Jennings, FYLF is extirpated from the vicinity (CDFW 2024). The second occurrence (Occurrence #651) was made in 1953, occurring approximately 2.85 miles to the northeast. No additional details were given regarding this occurrence. No occurrences have been documented within five miles of the Study Area in over 47 years. The on-site intermittent drainage provides habitat suitable to support this species in a foraging capacity only. During the April survey, flows within the drainage were observed to be slow, with depths ranging from 3 to 12 inches. Flows during the May survey were slightly reduced. The habitat available within the Study Area is marginal due to human impact due to an adjacent social trail which has caused significant disturbance along the southern bank of the drainage. Undercut banks and cobble present within the drainage provides potential refugia habitat for this species but lacks breeding habitat due to the intermittent nature of this drainage. There is refugia habitat present within the onsite drainage suitable to support this species, however, given the lack in abundance of recent CNDDB occurrences within five miles of the Study Area, this species has a low potential to occur.

5.4.2.2 Western Pond Turtle

Federal status – none
State status – CDFW Species of Special Concern

Western pond turtles are found along ponds, marshes, rivers, streams, and irrigation ditches that typically have muddy or rocky bottoms and grow aquatic vegetation. This subspecies requires basking sites such as logs or mats of emergent vegetation. It prefers habitats with stable banks and open areas to bask in, as well as the underwater cover provided by logs, large rocks, bulrushes, or other vegetation. This subspecies generally leaves the aquatic site only to reproduce and hibernate. Hibernation typically takes place from October or November to March or April. Egg-laying typically occurs in May and June (Jennings and Hayes 1994). This species is uncommon to common in suitable aquatic habitat throughout California, west of the Sierra-Cascade crest, and absent from desert regions except in the Mojave Desert along the Mojave River and its tributaries. Elevation range extends from near sea level to 1430 meters (4690 feet), Associated with permanent or nearly permanent water in a wide variety of habitat types (Jennings and Hayes 1994).

This species was not observed in the Study Area during biological surveys conducted by HELIX in April and May of 2023. At the time of both surveys, the drainage had flowing water present, with a relatively shallow pool (approximately 12 inches) located at the eastern end of the drainage prior to entering the culvert positioned under Canby Road. A total of three CNDDB records were documented within five miles of the Study Area, with the nearest occurrence (occurrence #657), documented in 2015, located approximately 1.13 miles to the northwest observed within a man-made pond. At this occurrence location, one adult was observed basking on a log. Additionally, occurrence #656 was documented in 2007, located within Salt Creek which a Tributary to Churn Creek, where five adults were observed within various stretches of the Creek. Though flowing water was present during the April and May 2023 surveys, the water within the onsite drainage is intermittent with seasonal flows. The lack of perennial waters does not allow for a population of this species to be sustained. Due to the lack of perennial waters, impacts to nests are not foreseen, however, nesting could not completely be ruled out due to the presence of water within the intermittent drainage at the time of the surveys and the presence of upland habitat suitable for nesting. Due to the presence of CNDDB occurrences within vicinity of the Study Area, the presence of flowing water within the onsite drainage, and the presence of marginally suitable upland habitat suitable for nesting, this species has the potential of utilizing the Study Area in a foraging and nesting capacity. Therefore, direct impacts such as clearing and grubbing, grading, other earthwork, and tree removal have the potential of impacting this species.

5.4.2.3 Tricolored Blackbird

Federal status – None
State status – Threatened

The tricolored blackbird is a colonial nester of marshy areas throughout the Central Valley and coastal California. It can be observed in the Central Valley year-round and is typically a resident throughout its range, however tricolored blackbirds that occur in northeastern California have been known to migrate south during fall and winter months. Tricolored blackbirds breed near freshwater, preferably in emergent marsh areas with tall, dense cattails (*Typha* spp.) but will also nest in willow (*Salix* spp.) thickets. Nests are usually located a few feet over water or may be hidden on the ground in vegetation. Blackbirds build nests of mud and plant material. Blackbirds are highly colonial; nesting areas must be large enough to support a minimum colony of at least 50 pairs. Tricolored blackbirds are omnivorous and often shift their diet from insects and spiders during the spring season, to seeds, cultivated grains, rice and oats during fall and winter months. Blackbirds forage on the ground in croplands, grassy fields, and flooded rice fields (Zeiner et al 1990).

This species was not observed in the Study Area during biological surveys conducted by HELIX in April and May of 2023. No CNDDB occurrences were documented within five miles of the Study Area. The closest CNDDB occurrence (Occurrence # 810), documented in 1932, is located approximately 5.1 miles to the southwest. This colony was only described as "six miles south of Redding." The exact location is unknown. At this occurrence location, a colony of approximately 100 nests were observed. This colony is presumed extirpated. Though no CNDDB occurrence have be documented in recent years within five miles of the Study Area, this species was determined to have a low potential to occur due to the presence of suitable habitat. Vegetation removal has the potential to impact nesting habitat suitable to support this species.

5.4.2.4 Pallid Bat

Federal status – none
State status – CDFW Species of Special Concern

The pallid bat occurs from the desert southwest and semiarid lands from Mexico and north throughout the west coast. This is one of the most common species at low elevations throughout the southwest. It favors habitat with rocky outcrops with desert scrub and is also commonly found in forested oak and pine regions (Barbour and Davis 1969). This species has one of the most unique feeding habits of any other North American bat; their prey is taken primarily from the ground. They prefer food items such as Jerusalem crickets, grasshoppers, scorpions, June beetles, and ground beetles. This species is primarily a crevice roosting species and selects daytime roosting sites where they can retreat from view. Common roost sites are rock crevices, old buildings, bridges, caves, mines, and hollow trees (Barbour and Davis 1969). Typically found near water since it is poor at concentrating its urine. Maternity roosts are typically in warm sites. Hibernation sites are typically cold, but not freezing. This species is extremely sensitive to disturbance and may abandon its roost after one visit (Zeiner et al. 1988-1990). Copulation occurs in autumn and females store the sperm until spring, when they emerge from hibernation and go through estrus (Beasley et al. 1984). The female bat gives birth to one or two pups during early June; they weigh about 3 to 3.5 g (0.11 to 0.12 oz) at birth and in four or five weeks are capable of making short flights. Pups are weaned after 40 to 45 days (Bassett 1984).

This species was not observed in the Study Area during biological surveys conducted by HELIX in April and May of 2023. No CNDDB occurrences were documented within five miles of the Study Area. The closest CNDDB occurrence (Occurrence # 428), documented in 2016, is located approximately 8.69 miles to the northeast. At this occurrence location, a night roost was observed beneath a bridge, identified by fecal pellets, urine staining, and insect prey remains. The trees in the vicinity of the onsite drainage provide potentially suitable roosting habitat for this species. No bats or bat sign (e.g., scat and prey remains) of any species were observed. Due to the lack of occurrences of this species within five miles of the site, this species is not likely to occur. However, the potential for this species to occur could not be completely ruled out based on the presence of suitable roosting habitat.

5.4.2.5 Western Red Bat

Federal status – none
State status – CDFW Species of Special Concern

The western red bat is locally common in some areas of California, occurring from Shasta County to the Mexican border, west of the Sierra Nevada/Cascade crest and deserts. The winter range includes western lowlands and coastal regions south of San Francisco Bay. Roosting habitat includes forests and woodlands from sea level up through mixed conifer forests. They feed over a wide range of habitats including grasslands, shrublands, open woodlands and forest, and cropland. Roosting primarily occurs in trees, less often in shrubs. Roosting sites are often in edge habitats adjacent to streams, fields, or urban areas. Preferred roost sites are protected from above, and below, and located above dark groundcover. Roosts may be from 0.6-13 meters (2-40 feet) above ground level (Zeiner et all. 1988-1990). Mating occurs in August and September. After delayed fertilization there is an 80–90-day gestation. Births are from late May through early July. Most females bear 2 or 3 young, though the single litter may have 1-5. Lactation lasts 4-6 weeks and the young are capable of flight between 3-6 weeks of age. Females may move the young between roost sites (Zeiner et all. 1988-1990).

This species was not observed in the Study Area during biological surveys conducted by HELIX in April and May of 2023. No CNDDB occurrences were documented within the five miles of the Study Area. Only one CNDDB occurrence was recorded within the nine-quad CNDDB search. This one occurrence (occurrence # 48) was documented in 1999, located approximately 40 miles to the south. At this occurrence location, one juvenile female was hand captured. Given the presence of the onsite intermittent drainage, the surrounding onsite trees provide potentially suitable roosting habitat, though no bats or bat sign (e.g., scat and prey remains) of any species were observed. Due to the lack of occurrences of this species within five miles of the site, this species is not likely to occur. However, the potential for this species to occur could not be completely ruled out based on the presence of suitable roosting habitat.

5.4.2.6 Crotch's Bumble Bee (CESA Candidate Endangered)

Crotch's bumble bee is a CESA candidate species that occurs in grassland and scrub habitats. New colonies are initiated by solitary queens, generally in the early spring, which typically occupy abandoned rodent burrows (CDFW 2019). This species is a generalist forager and has been reported to visit a wide variety of flowering plants. Food plants include *Asclepias* spp., *Antirrhinum* spp., *Clarkia* spp., *Eschscholzia* spp., *Eriogonum* spp., *Chaenactis* spp., *Lupinus* spp., *Medicago* spp., *Phacelia* spp., and *Salvia* spp. (Koch et al. 2012). The flight period for queens in California is from February to October. New queens hibernate over the winter and initiate a new colony the following spring (CDFW 2019). This species is rare throughout its range and in decline in the Central Valley and southern California (CDFW 2019).

The annual grassland community within the Study Area provides suitable habitat for this species. Rodent burrows within the Study Area provide suitable nesting habitat for this species, and floral resources within the Study Area provide foraging habitat. There are no CNDDB occurrences reported within the surrounding nine USGS topographic quadrangles. The nearest CNDDB occurrence (Occurrence #4) was documented approximately 28 miles to the south of the Study Area and reported in 1956 (CDFW 2023). However, the Study Area occurs within the northern portion of the current and historic range for this species and, therefore, this species may occur within the Study Area.

5.4.2.7 Nesting Migratory Birds and Raptors

The Study Area and immediate vicinity provide nesting and foraging habitat for a variety of common raptors and other migratory birds species such as mourning dove (*Zenaida macroura*), house finch (*Haemorphous mexicanus*), and red-shouldered hawk (*Buteo lineatus*). Active nests were not observed during surveys. However, a variety of birds have the potential to nest in and adjacent to the site, in trees, shrubs, and on the ground in vegetation.

Project activities such as clearing and grubbing during the avian breeding season (generally February 1 through August 31) could result in injury or mortality of eggs and chicks directly through destruction or indirectly through forced nest abandonment due to noise and other disturbances.

5.5 SENSITIVE HABITATS

Sensitive habitats include those that are of special concern to resource agencies or those that are protected under CEQA, Section 1600 of the California Fish and Game Code (i.e., riparian areas) and/or Sections 401 and 404 of the Clean Water Act, which includes wetlands and other waters of the U.S. Sensitive habitats identified within the Study Area are discussed below.

5.5.1 Potential Waters of the U.S. and State

A total of 0.22 acre of aquatic resources in the form of a single intermittent drainage and two seasonal wetlands are present in the Study Area. The intermittent drainage flows to the east and exits the Study Area along the eastern boundary of the site, continuing under Broadway/Highway 12, via a box culvert. The intermittent creek is a tributary to Churn Creek.

5.5.2 Riparian

Approximately 0.20 acre of the Study Area is comprised of riparian habitat. This community is associated with the intermittent drainage located in the northwest corner of the Study Area.

5.5.3 Wildlife Migration Corridors

Wildlife corridors link areas of suitable wildlife habitat that are otherwise separated by rugged terrain, changes in vegetation, or human disturbance. This fragmentation of habitat can also occur when a portion of one or more habitats is converted into another habitat; for instance, when woodland or scrub habitat is altered or converted into grasslands after a disturbance such as fire, mudslide, or construction activities. Wildlife corridors mitigate the effects of this fragmentation by (1) allowing animals to move between remaining habitats thereby permitting depleted populations to be replenished and promoting genetic exchange; (2) providing escape routes from fire, predators, and human disturbances, thus reducing the risk of catastrophic events (such as fire or disease) on population or local species extinction; and (3) serving as travel routes for individual animals as they move within their home ranges in search of food, water, mates, and other needs.

The Study Area is surrounded by development on the north, west, and south sides. Canby Road borders the site to the east, followed by a small parcel of open space. Both the Study Area and the open space parcel are completely surrounded by residential and commercial development. Although the onsite portion of intermittent drainage may have previously served as a viable wildlife corridor, both the upstream and downstream portions of the drainage are surrounded by development, and it do not connect suitable wildlife habitats that are otherwise separated. The downstream portion of the drainage is largely underground or conveyed through concrete lined channels. This prevents the site from being used as a corridor for terrestrial wildlife species. There are no wildlife migration corridors within the Study Area or adjacent to the Study Area.

6.0 RECOMMENDED AVOIDANCE AND MINIMIZATION MEASURES

The following measures are recommended for project construction based on the potential for special-status wildlife to occur on-site and sensitive habitats (intermittent drainage) present within the Study Area.

6.1.1 Worker Environmental Awareness Training Program

Prior to the issuance of grading or building permits, and for the duration of project activities, the project proponent/operator shall demonstrate that it has in place a Construction Worker Environmental

Awareness Training Program for all new construction workers at the Study Area. It is recommended that all construction workers attend the Program prior to participating in construction activities.

Information on the life history of foothill yellow-legged frog, western pond turtle, pallid bat, western red bat, and Crotch's bumble bee as well as other wildlife and the Redding checkerbloom that may be encountered during construction activities, and the legal protection status of each species (including nesting birds), shall be included in the Program as well as the mitigation measures related to biological resources. Sign-in sheets documenting the training of each worker shall be maintained and provided to the City at the commencement of construction.

6.2 SPECIAL-STATUS SPECIES MEASURES

6.2.1 Special-Status Plant Species

During the May 31, 2023, botanical survey, approximately 10-15 individual Redding checkerbloom plants were observed within the understory of the blue oak woodland (Appendix F, photos 15 and 16), located within the northern portion of the Study Area (Figure 6 of Appendix A).

The onsite Redding checkerbloom plants should be avoided to the greatest extent feasible. However, if project-related impacts to this species are anticipated, consultation with CDFW shall be conducted to develop a mitigation strategy, which may include but is not limited to, development of a plan to collect and relocate special-status plants and/or seed to a suitable location outside of the impact area and monitoring the relocated population to demonstrate transplant success, or preservation of this species or its habitat at an on or offsite location, or other measures deemed appropriate by CDFW. A mitigation and monitoring plan (plan) shall be developed providing a complete description of the location, size, and condition of the occurrence, and the extent of project-related impacts and shall be submitted to the City of Redding prior to any vegetation removal or any ground-disturbing activity within 250 feet of the onsite Redding Checkerbloom plants. The plan shall be submitted concurrently to CDFW for review and approval. The plan shall require maintaining viable plant populations on-site and shall identify avoidance measures for any existing population(s) to be retained and compensatory measures for any populations directly affected. Possible avoidance measures include fencing populations before construction and exclusion of project activities from the fenced-off areas, and construction monitoring by a qualified botanist to keep construction crews away from the population. The plan shall also include monitoring and reporting requirements for populations to be preserved on site or protected or enhanced off site, as applicable.

6.2.2 Foothill Yellow-Legged Frog

Prior to the commencement of construction within the on-site drainage or within 100 feet of the on-site drainage, a pre-construction survey for FYLF should be conducted within the on-site intermittent drainage and immediate surrounding areas, initially seven days prior to the commencement of any ground-disturbing activities and again no more than 24 hours prior to ground-disturbing activities. If there are negative findings for this species during the survey, no further action is required. If this species is observed during the survey, CDFW should be consulted prior to ground disturbance regarding the potential for the project to result in take of FYLF, and any avoidance measures or mitigation measures suggested by CDFW should be implemented.

6.2.3 Western Pond Turtle

The intermittent drainage provides aquatic habitat suitable to support this species, with marginal upland habitat also present. A qualified biologist should conduct a pre-construction survey within 14 days prior to the start of ground disturbance within 500 feet of riparian habitat or the intermittent drainage. If no western pond turtles are observed, then a letter report documenting the results of the survey should be provided to the project proponent for their records, and no additional measures are recommended. If construction does not commence within 14 days of the pre-construction survey, or halts for more than 14 days, a new survey is recommended.

If western pond turtles are found, additional avoidance measures are recommended, including having a qualified biologist conduct a pre-construction survey within 24 hours prior to commencement of construction activities, performing a Worker Awareness Training to all construction workers, and being present on the site during grading activities within 500 feet of the intermittent drainage and its surrounding riparian habitat for the purpose of establishing a no disturbance buffer around the individual, allowing the turtle to continue downstream, offsite, on its own accord. If the turtle does not self-relocate, CDFW should be consulted on next steps.

6.2.4 Pallid Bat and Western Red Bat

Prior to ground disturbance, a qualified biologist should conduct a pre-construction survey for special-status bats within 14 days prior to construction, surveying trees containing cavities, crevices and/or exfoliating bark. If no special-status bats are observed roosting, then a letter report documenting the results of the survey should be provided to the project proponent for their records, and no additional measures are recommended. If tree removal does not commence within 14 days of the pre-construction survey, or halts for more than 14 days, a new survey is recommended. If bats are found in trees anticipated for removal, consultation with the CDFW is recommended to determine avoidance measures. Recommended avoidance measures include establishing an exclusion buffer around the roost tree until it is no longer occupied.

6.2.4.1 Crotch's Bumble Bee

The Study Area contains suitable nesting, foraging, and overwintering habitat for Crotch's bumble bee. To avoid potential impacts to this species, the following mitigation measures derived from the CDFW Survey Considerations for California Endangered Species Act (CESA) Candidate Bumble Species (CDFW 2023) are recommended:

A qualified biologist familiar with California bumble bee species should conduct preconstruction surveys to confirm the presence or absence of Crotch's bumble bee before the implementation of project-related activities. Surveys should be conducted during the Colony Active Period (April to August) and when floral resources are present, ideally during peak bloom.

- Before project implementation, at least three on-site surveys should take place, and each survey should ideally be spaced two to four weeks apart during the Colony Active Period (April to August). Surveys should occur during the day (at least an hour after sunrise and at least two hours before sunset, though ideally between 9:00 am to 1:00 pm) on warm but not hot, sunny days (65 to 90 degrees Fahrenheit), with low wind (less than eight miles per hour). Specific survey protocols should follow industry standards from related published protocols and can include modified implementation of the USFWS rusty patched bumble bee protocol and/or California Bumble Bee Atlas non-lethal protocol. Survey methodology should remain consistent with the Survey Considerations for California Endangered Species Act (CESA) Candidate Bumble Species (CDFW 2023). Even if surveys from a particular project site failed to detect bumble bees one year, project proponents should perform a full round of surveys in each year that project activities will occur, or assume presence.

- If Crotch's bumble bee is not found during the multiple rounds of focused surveys within suitable nesting, foraging, and/or overwintering habitat, it is recommended that a biological monitor be on-site during initial vegetation removal or ground disturbing activities that take place during any of the Queen and Gyne Flight Period and Colony Active Period (April to October for Crotch's bumble bee).

If a CESA-protected bumble bee individual or colony is identified in the Study Area or within 25 feet, the project proponent may propose site-specific measures to avoid take (such as work-exclusion buffers) or consult with the CDFW to obtain an Incidental Take Permit (ITP) if take of CESA-protected bumble bees may occur and be impacted by project activities.

6.2.5 Nesting Migratory Birds and Raptors.

If project activities such as vegetation removal activities or ground disturbance commence during the avian breeding season (February 1 through August 31), a qualified biologist should conduct a pre-construction nesting bird survey no more than 14 days prior to initiation of project activities. The survey area should include suitable raptor nesting habitat within 500 feet of the project boundary (inaccessible areas outside of the Study Area can be surveyed from the site or from public roads using binoculars or spotting scopes). Pre-construction surveys are not required in areas where project activities have been continuous prior to February 1, as determined by a qualified biologist. Areas that have been inactive for more than 14 days during the avian breeding season should be re-surveyed prior to the resumption of project activities. If no active nests are identified, no further mitigation is required. If active nests are identified, the following measure should be implemented:

- A suitable buffer (according to species and existing surrounding land uses) should be established by a qualified biologist around active nests and no construction activities within the buffer should be allowed until a qualified biologist has determined that the nest is no longer active (i.e., the nestlings have fledged and are no longer reliant on the nest, or the nest has failed). Encroachment into the buffer may occur at the discretion of a qualified biologist. Any encroachment into the buffer should be monitored by a qualified biologist to determine whether nesting birds are being impacted.

6.2.6 Aquatic Resources

A total of 0.02 acre of intermittent drainage and 0.20 acre of seasonal wetlands occurs within the Study Area. Prior to initiation of any construction activities which could result in impacts to potentially regulated aquatic features, the extent of the features within the Study Area should be verified by the USACE and applicable permits should be prepared and submitted to the appropriate regulatory agencies for any project-related impacts to these features. Any conditions included in the final permits, including prescribed mitigation measures, would be required to be implemented prior to filling or impacting these features.

Section 404 authorization from the USACE and a Section 401 Water Quality Certification from the RWQCB may be required prior to the start of construction that will impact any waters of the U.S. Any waters of the U.S. or jurisdictional wetlands that would be lost or disturbed should be replaced or rehabilitated on a “no-net-loss” basis in accordance with the USACE mitigation guidelines and City of Redding requirements. Habitat restoration, rehabilitation, and/or replacement should be at a location and by methods agreeable to the agencies.

If a 404 permit is required for the proposed project, then water quality concerns during construction would be addressed in the Section 401 water quality certification from the Regional Water Quality Control Board. A Storm Water Pollution Prevention Plan (SWPPP) would also be required during construction activities. SWPPPs are required in issuance of a National Pollutant Discharge Elimination System (NPDES) construction discharge permit by the U.S. Environmental Protection Agency. Implementation of Best Management Practices (BMPs) during construction is standard in most SWPPPs and water quality certifications. Examples of BMPs include stockpiling of debris away from regulated wetlands and waterways; immediate removal of debris piles from the site during the rainy season; use of silt fencing and construction fencing around regulated waterways; and use of drip pans under work vehicles and containment of fuel waste throughout the site during construction.

If the aquatic features are determined to not be subject to federal jurisdiction, then these features may still be subject to waste discharge requirements under the Porter-Cologne Water Quality Control Act. Section 13260(a) of the Porter-Cologne Water Quality Control Act (contained in the California Water Code) which requires any person discharging waste or proposing to discharge waste, other than to a community sewer system, within any region that could affect the quality of the waters of the State (all surface and subsurface waters) to file a report of waste discharge. The discharge of dredged or fill material into the ditches may constitute a discharge of waste that could affect the quality of waters of the State. A report of waste discharge will be filed for impacts to non-federal waters, if required.

The disturbed riparian habitat may also be regulated under CDFW Section 1600.

6.2.7 Riparian

This habitat is present within the Study Area and is subject to CDFW jurisdiction under section 1600 of the Fish and Game Code. In the event that riparian vegetation needs to be removed, the project proponent shall apply for the appropriate permits for impacts to this habitat, and the conditions contained in the permit will require implementation, including the required mitigation. In accordance with Figure 3-3, River and Creek Corridor Buffer widths, included in the City of Redding 2000-2020 General Plan, the onsite portion of intermittent drainage is considered a secondary tributary to Churn Creek which requires a 25-foot setback from the riparian drip line or 50 feet from the top of bank, whichever is greater (City of Redding 2000).

As per Section 18.48.040 - Reduced Setbacks (City of Redding, 2023), of the Redding Municipal Code, for existing parcels the director or in the case of site development permits or use permits, the board of administrative review and planning commission, respectively, may reduce the buffer area required by this chapter for nonexempt parcels created prior to adoption of this code. The reduction shall not be more than one-half the distance indicated on Schedule 18.48.020-A. Submission of a biological report prepared in accordance with this section and making the findings enumerated below is required.

For new parcels, a variance must be approved in accordance with the procedures established in Chapter 18.16 (Variances) of this title, for reduced buffer areas on parcels created after adoption of this code.

A. Biological Report. The director shall require the applicant to submit a biological report prior to development review prepared by a qualified biologist for projects proposed within the buffer areas for the streams identified in Schedule 18.48.020-A.

   1. Exceptions. The director finds that significant alteration of naturally occurring vegetation within the affected corridor area has resulted from any of the following actions:

      a. The stream adjacent to the proposed development has been channelized.
      b. A levee has been constructed to contain flood flows.
      c. Significant fill material has been placed within the buffer area.
      d. Development has already occurred that alters the characteristics of the required buffer areas.

   2. Report Contents. The report shall describe and map (as appropriate) the flora and fauna located within the area proposed for development that is also within a required buffer, including any rare or endangered species found at the site. Appropriate mitigation measures shall be proposed as necessary.

B. Required Findings. To approve a reduced setback, the approving authority shall make the following findings:

   1. The reduced setback avoids, to the extent feasible, riparian vegetation;
   2. Any impacts to state or federally listed plant or animal species will be fully mitigated;
   3. The reduced setback will not pose a threat to streambank stability or increase sediment in the stream;
   4. The ability to provide public access is not compromised if the master trail plan, or similar document, delineates the creek corridor for trail construction.

C. Appeals. Appeals of setback determinations shall be conducted in accordance with the provisions of Section 18.11.090 (Appeals) of this title.

6.2.8 Tree Removal

Any tree removal occurring within the Study Area will abide by the City of Redding tree ordinance and will obtain a tree removal permit including any required tree mitigation as specified by the City.

7.0 REFERENCES

Barbour, R.W. and W.H. Davis. 1969. *Bats of America.* The University Press of Kentucky, Lexington;

*Bassett, John E. (31 May 1984). "*Litter Size and Postnatal Growth Rate in the Pallid Bat, Antrozous pallidus*." Journal of Mammalogy. 65(2): 317–319.* Available at https://academic.oup.com/jmammal/article-abstract/65/2/317/869330?redirectedFrom=fulltext. Accessed June 6, 2023

Beasley, L. J.; Smale, L.; Smith, E. R. (March 1984). "Melatonin influences the reproductive physiology of male pallid bats." Biology of Reproduction. 30 (2): 300–305. Available at https://doi.org/10.1095/biolreprod30.2.300. Accessed June 6, 2023.

California Department of Fish and Wildlife (CDFW). 2024. California Natural Diversity Database (For: *Bella Vista, Balls Ferry, Cottonwood, Enterprise, Palo Cedro, Shasta Dam, Olinda, Project City,* and *Redding* USGS 7.5-minute series quadrangles). Accessed on October 8, 2024.

2023. Survey Considerations for California Endangered Species Act (CESA) Candidate Bumble Bee Species. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=213150&inline.

2019. Report to the Fish and Game Commission: Evaluation of the Petition from the Xerces Society, Defenders of Wildlife and the Center for Food Safety to List Four Species of Bumble Bees as Endangered Under the California Endangered Species Act. April 2019. Special California Department of Fish and Wildlife, Sacramento, California, USA.

California Native Plant Society (CNPS). 2023. Inventory of Rare and Endangered Plants (online edition, v8-03 0.39) For: *Bella Vista, Balls Ferry, Cottonwood, Enterprise, Palo Cedro, Shasta Dam, Olinda, Project City,* and *Redding* USGS 7.5-minute series quadrangles. Accessed on April 11, 2023.

City of Redding. 2000. City of Redding General Plan. General Plan adopted October 3, 2000. Available at General Plan & Development Guidelines (cityofredding.org). Accessed April 12, 2023.

2020. City of Redding, Comprehensive Tree Plan. Accessed April 21, 2023. Available at: https://files.cityofredding.gov/Document%20Center/Departments/Development%20Services/Planning/Planning%20Resources%20and%20Learning/Topic%20Related%20Handouts/2024/Comprehensive%20Tree%20Plan%202024.pdf .

2023. Code of Ordinances, City of Redding, California Codified through Ordinance No. 2657, passed December 6, 2022 (Supp. No. 42); Chapter 18.45 – Tree Management. Accessed April 21, 2023. Available at https://library.municode.com/ca/redding/codes/code_of_ordinances?nodeId=16572.

Google Earth, version 7.3.6 (April 5, 2022). Aerial Imagery of the Redding Canby Apartment Project Study Area. Approximate centroid of the site is located at -122.3545178, 40.5940987. Accessed April 21, 2023.

Hatfield, R.G. and LeBuhn, G. (2007). "Patch and landscape factors shape community assemblage of bumble bees, Bombus spp. (Hymenoptera: Apidae), in montane meadows." Biological Conservation. 139: 150–158.

Hayes, Marc P.; Wheeler, Clara A.; Lind, Amy J.; Green, Gregory A.; Macfarlane, Diane C., tech. coords. 2016. Foothill yellow-legged frog conservation assessment in California. Gen. Tech. Rep. PSW-GTR-248. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 193 p.

Jennings, M.R. and M.P. Hayes. 1994. Amphibian and Reptile Species of Special Concern in California. Final Report submitted to the California Department of Fish and [Wildlife], Inland Fisheries Division.

Jennings, M.R. 1996. Status of amphibians. In: SNEP Science Team, eds. Sierra Nevada ecosystem project: final report to Congress. Vol. II: Assessments and scientific basis for management options. Report No. 37. Davis, CA: Centers for Water and Wildland Resources, University of California–Davis: 921–944. Chapter 31.

Koch, J., J. Strange, and P. Williams. 2012. Bumble bees of the Western United States. USDA-Forest Service, Pollinator Partnership. Washington, DC. 144 pp.

Lind, A.J. 2005. Reintroduction of a declining amphibian: determining an ecologically feasible approach for the foothill yellow-legged frog (Rana boylii) through analysis of decline factors, genetic structure, and habitat associations. Davis, CA: University of California. 169 p. Ph.D. dissertation.

National Oceanic and Atmospheric Administration (NOAA). 2023. NMFS ESA Critical Habitat Mapper. Available at https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=68d8df16b39c48fe9f60640692d0e318. Accessed April 11, 2023.

Natural Investigations Company, Inc. 2022. Aquatic Resource Delineation Report For the Property at 930-990 Canby Road, Redding, California.

Schroeder, P. 2006. Personal communication with Robbin Thorp.

Shuford, W.D., and T. Gardali, editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Supreme Court of the United States, 2023. *Sackett ET UX v. Environmental Protection Agency et al*. Certiorari to the United States Court of Appeals for the Ninth Circuit. No. 21-454. Argued October 3, 2022 – Decided May 25, 2023. Available at: https://www.supremecourt.gov/opinions/22pdf/21-454_4g15.pdf. Accessed June 21, 2023.

Sweet, Samuel S. 1983. Mechanics of a natural extinction event: Rana boylii in southern California. Abstract of a paper presented at the 26th annual meeting of the Society for the Study of Amphibians and Rep tiles, and the 31st annual meeting of the Herpetologists' League, University of Utah, August 7-12, 1983.

Thorp, R. W., D. S Horning and L. L. Dunning. 1983. Bumble bees and cuckoo bumble bees of California (Hymenoptera: Apidae). Bulletin of the California Insect Survey 23: viii.

U.S. Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS). 2023. *Web Soil Survey*. Available online at: http://websoilsurvey.sc.egov.usda.gov. Accessed April 11, 2023.

U.S. Fish and Wildlife Service (USFWS). 2021. Special Status Assessment (SSA) Report for the Shasta Salamander Complex (Hydromantes shastae, H. samweli, and H. wintu). Available at: https://ecos.fws.gov/ServCat/DownloadFile/204457. Accessed April 27, 2023.

2023. Information for Planning and Consultation (IPaC) Trust Resource Report: Shasta County, California. Accessed on April 11, 2022.

U.S. Geological Survey (USGS). 2023. *Enterprise, California*. 7.5 -minute series topographic quadrangle. U.S. Department of the Interior.

Zeiner, D.C., et al. 2000. California's Wildlife. Volume 1, Amphibians and Reptiles. Wildlife and Habitat Data Analysis Branch, California Department of Fish and Game. Borisenko, A.N.; Hayes, M.P. 1999. Status of the foothill yellow-legged frog (Rana boylii) in Oregon. Portland, OR: U.S. Department of the Interior, Fish and Wildlife Service; final report; contracts ORFO080197-1 and 1448-13420-7-M262.

Zeiner, D.C., W.R. Laudenslayer Jr., K.E. Mayer, and M. White, eds. 1990. California's Wildlife Volume II: Birds, State of California: The Resource Agency, Department of Fish and Game, Sacramento, CA

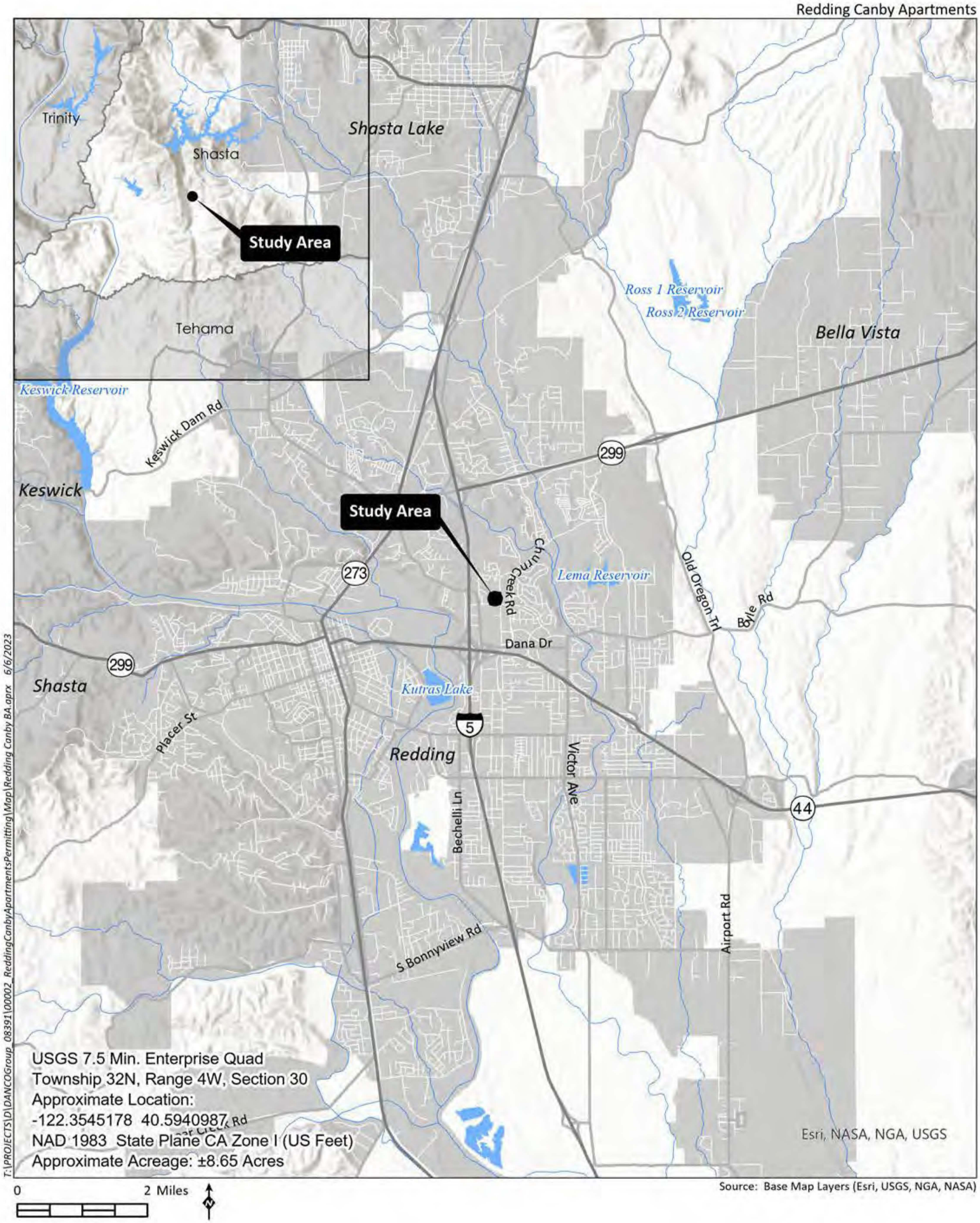
Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White, eds. 1988-1990. California's Wildlife. Vol. I-III. California Depart. of Fish and Game, Sacramento, California.

Zielinski, W. J. 2014. The forest carnivores: marten and fisher. General Technical Report: PSW-GTR-247. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

This page intentionally left blank

Appendix A

Figures

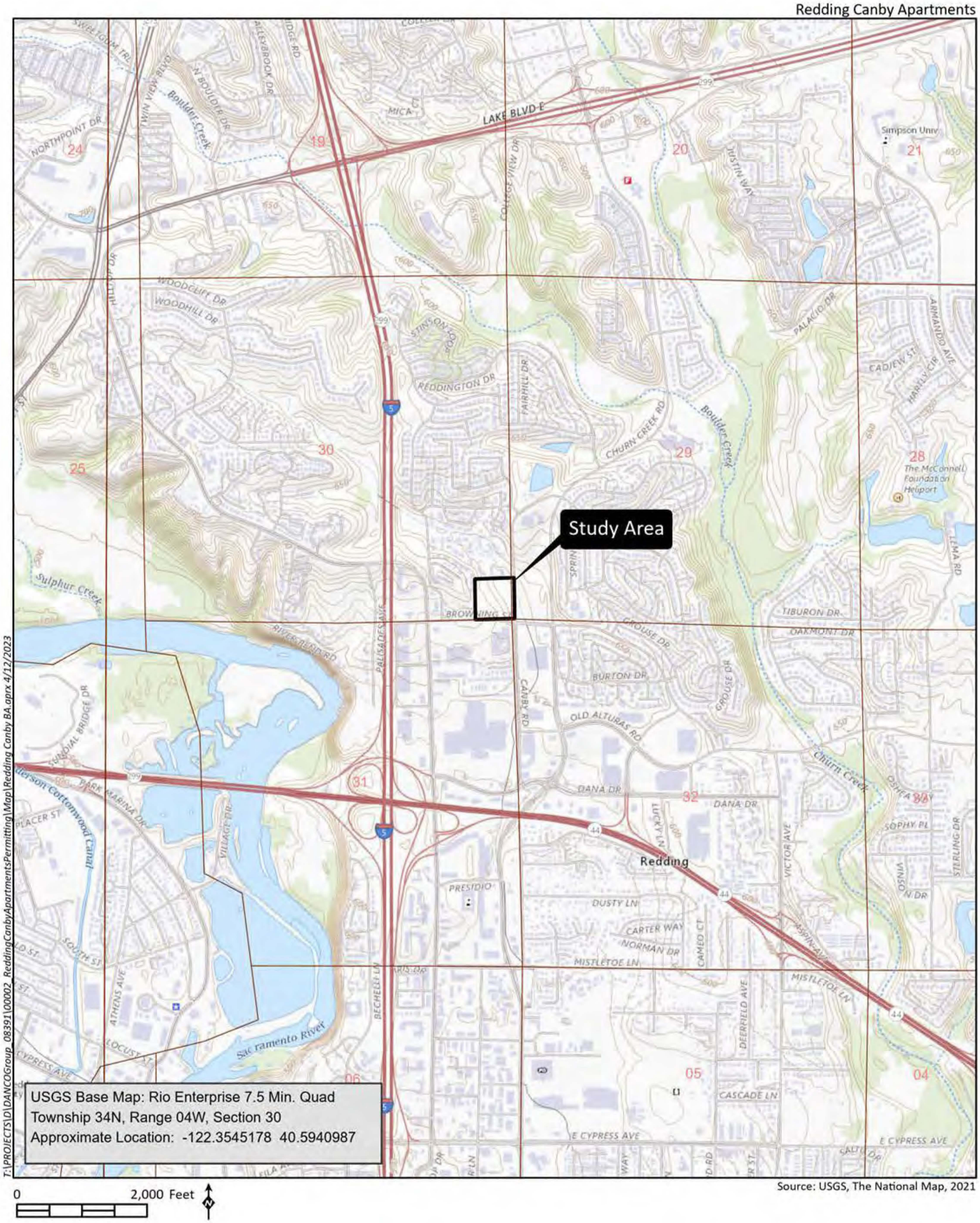


Source: Base Map Layers (Esri, USGS, NGA, NASA)

HELIX Environmental Planning

Site and Vicinity Map

Figure 1



Source: USGS, The National Map, 2021

T:\PROJECTS\D\DANCOGroup_08391\00002_ReddingCanbyApartmentsPermitting\Map\Redding Canby BA.aprx 4/12/2023

HELIX
Environmental Planning

USGS Topographic Map

Figure 2

Source: Aerial (City of Redding, 5/27/2020)

HELIX
Environmental Planning

Aerial Map

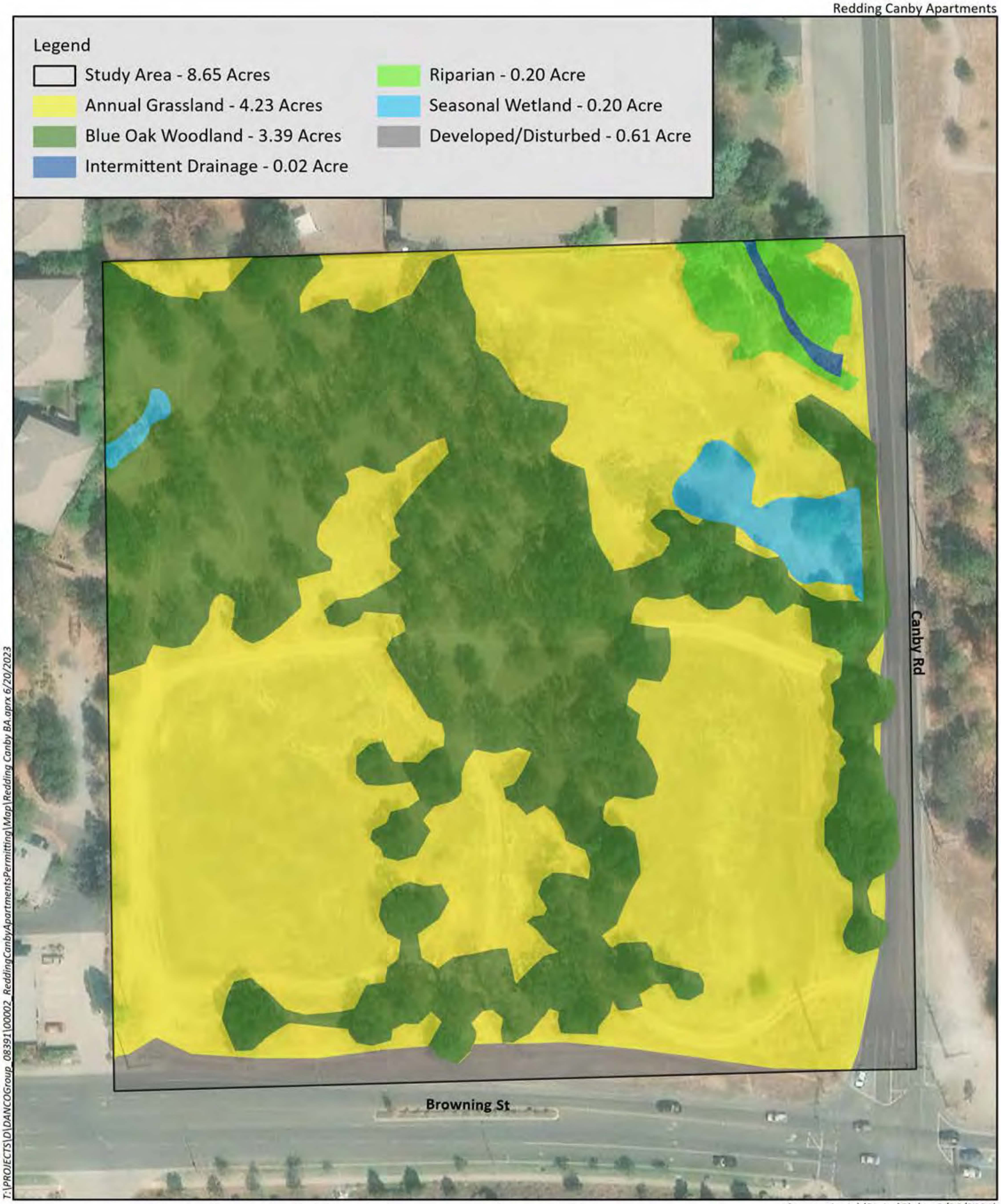
Figure 3

Source: NRCS, 2022; Aerial (DigitalGlobe, 3/04/2021)

HELIX Environmental Planning

Soils Map

Figure 4



T:\PROJECTS\D\DANCOGroup_08391\00002_ReddingCanbyApartmentsPermitting\Map\Redding Canby BA.aprx 6/20/2023

0 50 100 Feet

Source: Aerial (DigitalGlobe, 3/26/2021)

HELIX
Environmental Planning

Biological Communities

Figure 5

Source: Aerial (DigitalGlobe, 3/26/2021)

HELIX Environmental Planning

Redding Checkerbloom Locations Map

Figure 6

Appendix B

USFWS, CNDDB, and CNPS Lists of Regionally Occurring Special-Status Species

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Bella Vista (4012262) OR Balls Ferry (4012242) OR Cottonwood (4012243) OR Enterprise (4012253) OR Palo Cedro (4012252) OR Shasta Dam (4012264) OR Olinda (4012244) OR Project City (4012263) OR Redding (4012254))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Acipenser medirostris pop. 1 green sturgeon - southern DPS	AFCAA01031	Threatened	None	G2T1	S1	SSC
Actinemys marmorata northwestern pond turtle	ARAAD02031	Proposed Threatened	None	G2	SNR	SSC
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G1G2	S2	SSC
Agrostis hendersonii Henderson's bent grass	PMPOA040K0	None	None	G2Q	S2	3.2
Anthicus antiochensis Antioch Dunes anthicid beetle	IICOL49020	None	None	G3	S3	
Anthicus sacramento Sacramento anthicid beetle	IICOL49010	None	None	G4	S4	
Antrozous pallidus pallid bat	AMACC10010	None	None	G4	S3	SSC
Ardea alba great egret	ABNGA04040	None	None	G5	S4	
Balsamorhiza macrolepis big-scale balsamroot	PDAST11061	None	None	G2	S2	1B.2
Bombus pensylvanicus American bumble bee	IIHYM24260	None	None	G3G4	S2	
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Brasenia schreberi watershield	PDCAB01010	None	None	G5	S3	2B.3
Brodiaea matsonii Sulphur Creek brodiaea	PMLIL0C0H0	None	None	G1	S1	1B.1
Castilleja rubicundula var. rubicundula pink creamsacs	PDSCR0D482	None	None	G5T2	S2	1B.2
Clarkia borealis ssp. borealis northern clarkia	PDONA05062	None	None	G3T4	S4	4.3
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G4	S2	SSC
Cryptantha crinita silky cryptantha	PDBOR0A0Q0	None	None	G2	S2	1B.2
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T3	S3	
Entosphenus tridentatus Pacific lamprey	AFBAA02100	None	None	G4	S3	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Erethizon dorsatum North American porcupine	AMAFJ01010	None	None	G5	S3	
Euderma maculatum spotted bat	AMACC07010	None	None	G4	S3	SSC
Fluminicola seminalis nugget pebblesnail	IMGASG3110	None	None	G2	S3	
Gratiola heterosepala Boggs Lake hedge-hyssop	PDSCR0R060	None	Endangered	G2	S2	1B.2
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Great Valley Mixed Riparian Forest Great Valley Mixed Riparian Forest	CTT61420CA	None	None	G2	S2.2	
Great Valley Valley Oak Riparian Forest Great Valley Valley Oak Riparian Forest	CTT61430CA	None	None	G1	S1.1	
Great Valley Willow Scrub Great Valley Willow Scrub	CTT63410CA	None	None	G3	S3.2	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Helminthoglypta hertleini Oregon shoulderband	IMGASC2280	None	None	G3Q	S1S2	
Hydromantes shastae Shasta salamander	AAAAD09030	None	Threatened	G3	S3	
Juncus leiospermus var. leiospermus Red Bluff dwarf rush	PMJUN011L2	None	None	G2T2	S2	1B.1
Lanx patelloides kneecap lanx	IMGASL7030	None	None	G2?	S2	
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G3G4	S3S4	
Lasiurus cinereus hoary bat	AMACC05032	None	None	G3G4	S4	
Lasiurus frantzii western red bat	AMACC05080	None	None	G4	S3	SSC
Lathyrus sulphureus var. argillaceus dubious pea	PDFAB25101	None	None	G5T1T2Q	S1S2	3
Legenere limosa legenere	PDCAM0C010	None	None	G2	S2	1B.1
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G3	S3	
Limnanthes floccosa ssp. bellingeriana Bellinger's meadowfoam	PDLIM02041	None	None	G4T3	S1	1B.2
Limnanthes floccosa ssp. floccosa woolly meadowfoam	PDLIM02043	None	None	G4T4	S3	4.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Margaritifera falcata western pearlshell	IMBIV27020	None	None	G3G4	S1S2	
Monadenia troglodytes wintu Wintu sideband	IMGASC7092	None	None	G2T2	S2	
Myotis yumanensis Yuma myotis	AMACC01020	None	None	G5	S4	
Navarretia leucocephala ssp. bakeri Baker's navarretia	PDPLM0C0E1	None	None	G4T2	S2	1B.1
Neviusia cliftonii Shasta snow-wreath	PDROS14020	None	Threatened	G2	S2	1B.2
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	SSC
Oncorhynchus tshawytscha pop. 11 chinook salmon - Central Valley spring-run ESU	AFCHA0205L	Threatened	Threatened	G5T2Q	S2	
Oncorhynchus tshawytscha pop. 7 chinook salmon - Sacramento River winter-run ESU	AFCHA0205B	Endangered	Endangered	G5T1Q	S2	
Orcuttia tenuis slender Orcutt grass	PMPOA4G050	Threatened	Endangered	G2	S2	1B.1
Pandion haliaetus osprey	ABNKC01010	None	None	G5	S4	WL
Paronychia ahartii Ahart's paronychia	PDCAR0L0V0	None	None	G3	S3	1B.1
Pekania pennanti Fisher	AMAJF01020	None	None	G5	S2S3	SSC
Progne subis purple martin	ABPAU01010	None	None	G5	S3	SSC
Rana boylii pop. 1 foothill yellow-legged frog - north coast DPS	AAABH01051	None	None	G3T4	S4	SSC
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S3	
Sagittaria sanfordii Sanford's arrowhead	PMALI040Q0	None	None	G3	S3	1B.2
Spea hammondii western spadefoot	AAABF02020	Proposed Threatened	None	G2G3	S3S4	SSC
Trifolium piorkowskii maverick clover	PDFAB40410	None	None	G2	S2	1B.2
Trilobopsis roperi Shasta chaparral	IMGASA2030	None	None	G2	S1	
Trilobopsis tehamana Tehama chaparral	IMGASA2040	None	None	G2	S1	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Vaccinium shastense ssp. shastense Shasta huckleberry	PDERI181Z1	None	None	G4T3	S3	1B.3
Vespericola shasta Shasta hesperian	IMGASA4070	None	None	G3	S3	
Viburnum ellipticum oval-leaved viburnum	PDCPR07080	None	None	G4G5	S3	2B.3

Record Count: 64

CALIFORNIA NATIVE PLANT SOCIETY

Search Results

34 matches found. Click on scientific name for details

Search Criteria: CRPR is one of [**1A:1B:2A:2B:3:4**] , 9-Quad include [**4012262:4012242:4012243:4012253:4012252:4012264:4012244:4012263:4012254**]

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	CA RARE PLANT RANK
Adiantum shastense	Shasta maidenhair fern	Pteridaceae	perennial herb	Apr-Aug	None	None	4.3
Agrostis hendersonii	Henderson's bent grass	Poaceae	annual herb	Apr-Jun	None	None	3.2
Allium sanbornii var. *sanbornii*	Sanborn's onion	Alliaceae	perennial bulbiferous herb	May-Sep	None	None	4.2
Arctostaphylos malloryi	Mallory's manzanita	Ericaceae	perennial evergreen shrub	Apr-Jul	None	None	4.3
Arnica venosa	Shasta County arnica	Asteraceae	perennial rhizomatous herb	May-Jul(Sep)	None	None	4.2
Astragalus pauperculus	depauperate milk-vetch	Fabaceae	annual herb	Mar-Jun	None	None	4.3
Balsamorhiza macrolepis	big-scale balsamroot	Asteraceae	perennial herb	Mar-Jun	None	None	1B.2
Brasenia schreberi	watershield	Cabombaceae	perennial rhizomatous herb (aquatic)	Jun-Sep	None	None	2B.3
Brodiaea matsonii	Sulphur Creek brodiaea	Themidaceae	perennial bulbiferous herb	May-Jun	None	None	1B.1
Bulbostylis capillaris	thread-leaved beakseed	Cyperaceae	annual herb	Jun-Aug	None	None	4.2
Castilleja rubicundula var. *rubicundula*	pink creamsacs	Orobanchaceae	annual herb (hemiparasitic)	Apr-Jun	None	None	1B.2
Clarkia borealis ssp. *borealis*	northern clarkia	Onagraceae	annual	Jun-Sep	None	None	4.3
Cryptantha crinita	silky cryptantha	Boraginaceae	annual herb	Apr-May	None	None	1B.2
Cypripedium montanum	mountain lady's-slipper	Orchidaceae	perennial rhizomatous herb	Mar-Aug	None	None	4.2
Eriogonum tripodum	tripod buckwheat	Polygonaceae	perennial deciduous shrub	May-Jul	None	None	4.2
Erythranthe glaucescens	shield-bracted monkeyflower	Phrymaceae	annual herb	Feb-Aug(Sep)	None	None	4.3
Gratiola heterosepala	Boggs Lake hedge-hyssop	Plantaginaceae	annual herb	Apr-Aug	None	CE	1B.2
Iris bracteata	Siskiyou iris	Iridaceae	perennial rhizomatous herb	May-Jun	None	None	3.3
Juncus leiospermus var. *leiospermus*	Red Bluff dwarf rush	Juncaceae	annual herb	Mar-Jun	None	None	1B.1
Lathyrus sulphureus var. *argillaceus*	dubious pea	Fabaceae	perennial herb	Apr-May	None	None	3

Legenere limosa	legenere	Campanulaceae	annual herb	Apr-Jun	None	None	1B.1
Leptosiphon latisectus	broad-lobed leptosiphon	Polemoniaceae	annual herb	Apr-Jun	None	None	4.3
Limnanthes floccosa ssp. *bellingeriana*	Bellinger's meadowfoam	Limnanthaceae	annual herb	Apr-Jun	None	None	1B.2
Limnanthes floccosa ssp. *floccosa*	woolly meadowfoam	Limnanthaceae	annual herb	Mar-May(Jun)	None	None	4.2
Navarretia leucocephala ssp. *bakeri*	Baker's navarretia	Polemoniaceae	annual herb	Apr-Jul	None	None	1B.1
Neviusia cliftonii	Shasta snow-wreath	Rosaceae	perennial deciduous shrub	Apr-Jun	None	CC	1B.2
Orcuttia tenuis	slender Orcutt grass	Poaceae	annual herb	May-Sep(Oct)	FT	CE	1B.1
Paronychia ahartii	Ahart's paronychia	Caryophyllaceae	annual herb	Feb-Jun	None	None	1B.1
Sagittaria sanfordii	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb (emergent)	May-Oct(Nov)	None	None	1B.2
Sidalcea celata	Redding checkerbloom	Malvaceae	perennial herb	Apr-Aug	None	None	3
Trifolium piorkowskii	maverick clover	Fabaceae	annual herb	Apr-May	None	None	1B.2
Vaccinium shastense ssp. *shastense*	Shasta huckleberry	Ericaceae	perennial deciduous shrub	(Jun-Sep)Dec-May	None	None	1B.3
Viburnum ellipticum	oval-leaved viburnum	Viburnaceae	perennial deciduous shrub	May-Jun	None	None	2B.3
Wolffia brasiliensis	Brazilian watermeal	Araceae	perennial herb (aquatic)	Apr-Dec	None	None	2B.3

Showing 1 to 34 of 34 entries

Suggested Citation:
California Native Plant Society, Rare Plant Program. 2023. Rare Plant Inventory (online edition, v9.5). Website https://www.rareplants.cnps.org [accessed 11 April 2023].

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: April 11, 2023
Project Code: 2023-0067484
Project Name: Redding Canby Apartments

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

PROJECT SUMMARY

Project Code: 2023-0067484
Project Name: Redding Canby Apartments
Project Type: Residential Construction
Project Description: Multi-family residential housing construction
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@40.59394275,-122.35462414666372,14z

Counties: Shasta County, California

ENDANGERED SPECIES ACT SPECIES

There is a total of 7 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

BIRDS

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850	Threatened

CRUSTACEANS

NAME	STATUS
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

FLOWERING PLANTS

NAME	STATUS
Slender Orcutt Grass *Orcuttia tenuis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1063	Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

IPAC USER CONTACT INFORMATION

Agency: HELIX Environmental Planning, Inc.
Name: Nicole Tamura
Address: 1677 Eureka Road, Suite 100
City: Roseville
State: CA
Zip: 95661
Email nicolet@helixepi.com
Phone: 3105296481

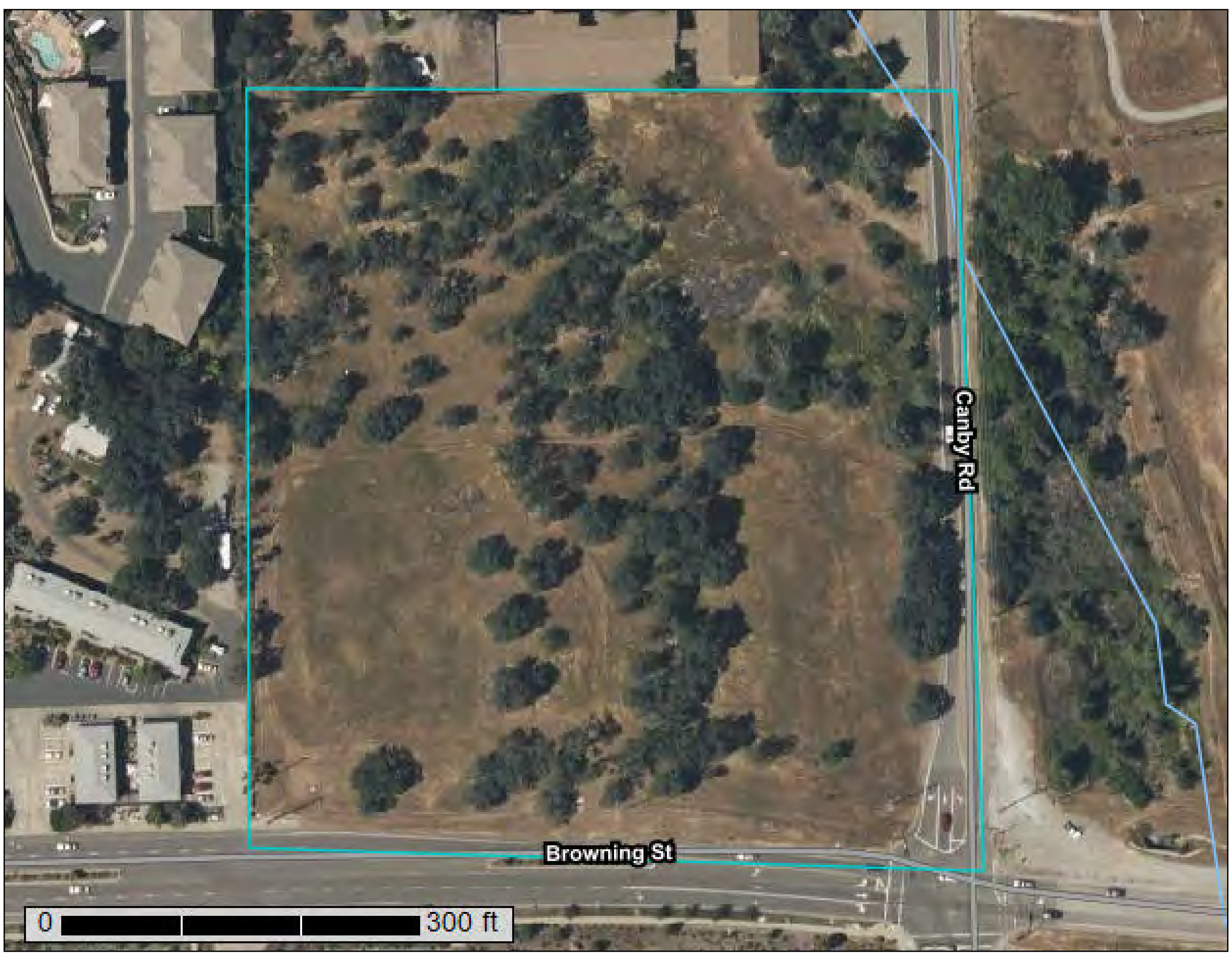
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Shasta County Area, California



April 11, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

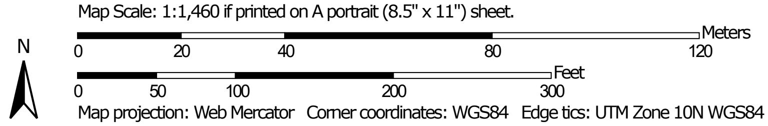
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (Redding Canby Apartments)

Map Scale: 1:1,460 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Shasta County Area, California
Survey Area Data: Version 18, Sep 2, 2022

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

Date(s) aerial images were photographed: May 8, 2019—Jun 21, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Redding Canby Apartments)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CfA	Churn gravelly loam, deep, 0 to 3 percent slopes	1.7	18.6%
NeD	Newtown gravelly loam, 15 to 30 percent slopes	4.6	50.9%
RdB	Redding gravelly loam, 0 to 15 percent slopes, moist, MLRA 17	2.7	30.5%
Totals for Area of Interest		**9.0**	**100.0%**

Map Unit Descriptions (Redding Canby Apartments)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Shasta County Area, California

CfA—Churn gravelly loam, deep, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: hfmf
Elevation: 400 to 800 feet
Mean annual precipitation: 35 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 250 to 275 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Churn and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Churn

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 13 inches: gravelly loam
H2 - 13 to 40 inches: gravelly loam
H3 - 40 to 60 inches: stratified gravelly loam to gravelly clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Ecological site: R017XY904CA - Subirrigated Deep Alluvial Fans
Hydric soil rating: No

Minor Components

Cobbly alluvial land

Percent of map unit: 5 percent
Landform: Channels
Landform position (three-dimensional): Tread

Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Honcut

Percent of map unit: 4 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Perkins

Percent of map unit: 3 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Tehama

Percent of map unit: 3 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

NeD—Newtown gravelly loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: hfr8
Elevation: 600 to 1,000 feet
Mean annual precipitation: 30 inches
Mean annual air temperature: 61 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Newtown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Newtown

Setting

Landform: Fan remnants
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Alluvium

Typical profile

H1 - 0 to 10 inches: gravelly loam
H2 - 10 to 18 inches: very gravelly clay loam
H3 - 18 to 35 inches: clay loam
H4 - 35 to 65 inches: silty clay loam
H5 - 65 to 72 inches: gravelly silty clay loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R017XD088CA - UPLAND TERRACE
Hydric soil rating: No

Minor Components

Perkins

Percent of map unit: 10 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Red bluff

Percent of map unit: 5 percent
Landform: Fan remnants
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

RdB—Redding gravelly loam, 0 to 15 percent slopes, moist, MLRA 17

Map Unit Setting

National map unit symbol: 2w8bn

Elevation: 430 to 1,100 feet
Mean annual precipitation: 28 to 48 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 310 to 335 days
Farmland classification: Not prime farmland

Map Unit Composition

Redding and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Redding

Setting

Landform: Fan remnants
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from igneous, metamorphic and sedimentary rock over clayey alluvium derived from igneous, metamorphic and sedimentary rock over cemented alluvium derived from igneous, metamorphic and sedimentary rock over tehama formation

Typical profile

A1 - 0 to 5 inches: gravelly loam
A2 - 5 to 6 inches: loam
Bt - 6 to 13 inches: clay
Btqm - 13 to 28 inches: cemented very gravelly material
2C - 28 to 60 inches: stratified sand to loam to clay

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches; 10 to 30 inches to duripan
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: About 5 to 13 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.2 to 0.5 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 0.9 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: R017XD089CA - ACID TERRACE
Hydric soil rating: No

Minor Components

Newtown

Percent of map unit: 5 percent
Landform: Fan remnants
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser

Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Red bluff

Percent of map unit: 5 percent
Landform: Fan remnants
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Clough

Percent of map unit: 5 percent
Landform: Fan remnants
Landform position (two-dimensional): Summit, toeslope
Landform position (three-dimensional): Tread
Microfeatures of landform position: Swales
Down-slope shape: Linear
Across-slope shape: Linear, concave
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix C

Potential for Special-Status Species in the Region to Occur in the Study Area

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
Plants			
Adiantum shastense Shasta maidenhair fern	--/--/4.3	A perennial herb found in lower montane coniferous forests from 330 – 1535 meters elevation. Blooms April – August (CNPS 2023).	**Will not occur.** The Study Area is located outside of the elevational range of this species.
Agrostis hendersonii Henderson's bent grass	--/--/3.2	An annual herb found in mesic sites in valley and foothill grasslands and in vernal pools from 70 – 305 meters elevation. Blooms April to May (CNPS 2023).	**Presumed absent.** The Study Area provides habitat suitable to support this species, however, 2023 focused surveys conducted for the current project were negative.
Allium sanbornii var. sanbornii Sanborn's onion	--/--/4.2	A perennial bulbiferous herb found on gravelly, serpentine soils in chaparral, cismontane woodlands, and lower montane coniferous forests from 260 – 1510 meters elevation. Blooms May – September (CNPS 2023).	**Will not occur.** There is no suitable clay, volcanic, or serpentine soil to support this species within the Study Area. Additionally, the site is located outside of the elevational range for this species.
Arctostaphylos malloryi Mallory''s manzanita	--/--/4.2	A perennial evergreen shrub found on volcanic soils in chapparal and lower cismontane coniferous forests from 765 – 1280 meters elevation. Blooms April – July (CNPS 2023).	**Will not occur.** The Study Area lacks volcanic soils suitable to support this species and is outside of the elevational range for this species.
Arnica venosa Shasta County arnica	--/--/4.3	A perennial rhizomatous herb is often found in disturbed areas and roadsides in cismontane woodlands and lower montane coniferous forests from 335 – 1,490 meters elevation. Blooms from May – July (CNPS 2023).	**Will not occur.** The Study Area is located outside of the elevational range of this species.
Astragalus pauperculus depauperate milk-vetch	--/--/4.3	An annual herb found in vernally mesic and volcanic sites in chaparral, cismontane woodland, and valley and foothill grassland from 60 – 1,215 meters elevation. Blooms from March to June. (CNPS, 2023)	**Will not occur.** The Study Area lacks volcanic soils and vernally mesic sites suitable to support this species.
Balsamorhiza macrolepis big-scale balsamroot	--/--/1B.2	A perennial herb found on slopes in chaparral, cismontane woodland, and valley and foothill grassland, sometimes in serpentine soil from 45 – 1,555 meters elevation. Blooms March – June (CNPS 2023).	**Presumed absent.** The Study Area provides habitat suitable to support this species, however, focused surveys conducted for the current project were negative.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
Brasenia schreberi Watershield	--/--/2B.3	A rhizomatous aquatic herb found in freshwater marshes and swamps from 30 to 2,200 meters elevation. Blooms June to September (CNPS 2023).	**Will not occur.** The Study Area lacks habitat suitable to support this species.
Brodiaea matsonii Sulphur Creek bordiaea	--/--/1B.1	A perennial bulbiferous herb found on streambanks with rocky soils in cismontane woodlands, meadows and seeps from 195 – 220 meters elevation., occurring in metamorphic amphibolite schist. Blooms May – June (CNPS 2023).	**Will not occur.** Metamorphic amphibolite schist soils, suitable to support this species, do not occur within the Study Area.
Bulbostylis capillaris thread-leaved beakseed	--/--/4.2	An annual herb found in lower montane coniferous forests, meadows and seeps, and upper montane coniferous forests from 395 – 2,075 meters elevation. Blooms June – August (CNPS 2023).	**Will not occur.** The Study Area is located outside of the elevational range of this species.
Castilleja rubicundula ssp. rubicundula pink creamsacs	--/--/1B.2	An annual herb found on serpentine soils in chaparral, cismontane woodland, meadows, seeps, and valley and foothill grassland from 20 – 910 meters elevation. Blooms April – June (CNPS 2023).	**Will not occur.** Serpentine soil, suitable to support this species, does not occur within the Study Area.
Clarkia borealis ssp. *borealis* northern clarkia	--/--/4.3	An annual found often on roadsides in chapparal, cismontane woodlands, and lower montane coniferous forests from 400 – 1,565 meters elevation. Blooms June – September (CNPS 2023).	**Will not occur.** The Study Area is located outside of the elevational range of this species.
Cypripedium montanum mountain lady's slipper	--/--/4.2	A perennial rhizomatous herb found in cismontane woodland and chaparral from 185 – 2,225 meters elevation. Blooms March – August (CNPS 2023).	**Presumed absent.** The Study Area provides habitat suitable to support this species, however, focused surveys conducted for the current project were negative.
Cryptantha crinita silky cryptantha	--/--/1B.2	An annual herb found on gravelly streambeds in cismontane woodlands, lower montane coniferous forests, riparian forests, riparian woodlands, and valley and foothill grasslands from 61 – 1,215 meters elevation. Blooms April – May (CNPS 2023).	**Presumed absent.** The Study Area provides habitat suitable to support this species, however, focused surveys conducted for the current project were negative.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
Eriogonum tripodum tripod buckwheat	--/--/4.2	A perennial deciduous shrub found on serpentine soils in chaparral and cismontane woodlands from 200 – 1,600 meters elevation. Blooms May – July (CNPS 2023).	**Will not occur.** Serpentine soil, suitable to support this species, does not occur within the Study Area.
Erythranthe glaucescens Shield-bracted monkeyflower	--/--/4.2	An annual herb found on serpentine soils in chaparral, cismontane woodlands, lower montane coniferous forests, and valley and foothill grasslands from 60 – 1,240 meters elevation. Blooms February – August (September) (CNPS 2023).	**Will not occur.** Serpentine soil, suitable to support this species, does not occur within the Study Area.
Gratiola heterosepala Boggs Lake hedge-hyssop	--/SE/1B.2	An annual herb found on clay soils in marshes and swamps at lake margins, and in vernal pools from 10 – 2,375 meters elevation. Blooms April – August (CNPS 2023).	**Will not occur.** There is no suitable clay soil to support this species within the Study Area.
Iris bracteata Siskiyou iris	--/--/3.3	A perennial rhizomatous herb found on serpentine soils in broadleafed upland forests and lower montane coniferous forests from 180 – 1,070 meters elevation. Blooms May – June (CNPS 2023).	**Will not occur.** Serpentine soil, suitable to support this species, does not occur within the Study Area.
Juncus leiospermus var. *leiospermus* Red Bluff dwarf rush	--/--/1B.1	An annual herb found in vernal pools and vernally mesic microsites in chaparral, cismontane woodland, meadows, seeps, and valley and foothill grassland from 35 – 1,250 meters elevation. Blooms March – June (CNPS 2023).	**Will not occur.** The Study Area lacks vernal pools and vernally mesic microsites suitable to support this species.
Lathyrus sulphureus var. *argillaceus* dubious pea	--/--/3	A perennial herb found in cismontane woodland, and lower- and upper montane coniferous forest from 150 – 930 meters elevation. Taxonomic status of the variety is uncertain. Blooms April – May (CNPS 2023).	**Presumed absent.** The Study Area provides habitat suitable to support this species, however, focused surveys conducted for the current project were negative.
Legenere limosa legenere	--/--/1B.1	An annual herb found in vernal pools from 1 – 880 meters above msl. Blooms April – June (CNPS 2023).	**Will not occur.** The Study Area does not contain habitat suitable to support this species.
Leptosiphon latisectus Broad-lobed leptosiphon	--/--/4.3	An annual herb found in broadleafed upland forest and cismontane woodland from 170 –	**Presumed absent.** The Study Area provides habitat suitable to support this species,

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
		1,500 meters elevation. Blooms April – June (CNPS 2023).	however, 2023 focused surveys conducted for the current project were negative.
Limnanthes floccosa ssp. *bellingeriana* Bellinger's meadowfoam	--/--/1B.2	An annual herb found in mesic sites in cismontane woodland, meadows, and seeps from 290 – 1,100 meters elevation. Blooms April – June (CNPS XXXX).	**Will not occur.** The Study Area is located outside of the elevational range of this species.
Limnanthes floccosa ssp. *floccosa* woolly meadowfoam	--/--/4.2	An annual herb found on vernally mesic soils in chaparral, cismontane woodlands, vernal pools, and valley and foothill grasslands from 60 – 1,335 meters elevation. Blooms March – May (June) (CNPS 2023).	**Will not occur.** The Study Area is located outside of the elevational range of this species.
Navarretia leucocephala ssp. *bakeri* Baker's navarretia	--/--/1B.1	An annual herb found in mesic meadows and vernal pools in cismontane woodland, lower montane coniferous forest, and valley and foothill grassland from 5 – 1,740 meters above msl. Blooms April – July (CNPS 2023).	**Will not occur.** The Study Area does not contain habitat suitable to support this species.
Neviusia cliftonii Shasta snow-wreath	--/ST/1B.2	A perennial deciduous shrub found on volcanic and sometimes carbonate soils along streambanks in cismontane woodlands, lower montane coniferous forests, and riparian woodlands from 300 – 590 meters elevation. Known only from near Lake Shasta. Blooms April – June (CNPS 20237).	**Will not occur.** There is no suitable volcanic or carbonate soil to support this species within the Study Area. Additionally, the site is located outside of the elevational range of this species.
Orcuttia tenuis slender Orcutt grass	FT/SE/1B.1	An annual herb found often on gravelly soils in vernal pools from 35 – 1,760 meters elevation. Blooms May to September (October) (CNPS 2023).	**Will not occur.** The Study Area does not contain vernal pool habitat suitable to support this species.
Paronychia ahartii Ahart's paronychia	--/--/1B.1	An annual herb found in cismontane woodland, valley and foothill grassland, and vernal pools from 30 – 510 meters elevation. Blooms March – June (CNPS XXXX).	**Presumed absent.** The Study Area provides habitat suitable to support this species, however, focused surveys conducted for the current project were negative.
Sagittaria sanfordii Sanford's arrowhead	--/--/1B.2	A perennial rhizomatous herb found in marshes, swamps, and assorted shallow freshwater habitats from 0 – 650 meters	**Presumed absent.** The Study Area provides habitat suitable to support this species, however, focused surveys conducted for the current project were negative.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
		elevation. Blooms May – October (November) (CNPS 2022).	
Sidalcea celata Redding checkerbloom	--/--/3	A perennial herb found in cismontane woodland from 135 – 1,525 meters elevation, sometimes on serpentine soils. Blooms April – August (CNPS 2023).	**Present.** This species was identified within the understory of the blue oak woodland habitat.
Trifolium piorkowskii Maverick clover	--/--/1B.2	An annual herb found on volcanic clay, streambanks and openings in chaparral, cismontane woodlands, lower montane coniferous forests, vernal pools, and mesic valley and foothill grasslands from 160 – 680 meters elevation. Blooms April – May (CNPS 2023).	**Will not occur.** The Study Area does not contain volcanic clay soils suitable to support this species.
Vaccinium shastense ssp. *shastense* Shasta huckleberry	--/--/1B.3	A perennial deciduous shrub found on rocky and acidic soils, in mesic sites, sometimes seeps, and often along streambanks in chaparral, cismontane woodlands, lower montane coniferous forests, riparian forests, subalpine coniferous forests, disturbed areas, and roadsides from 325 – 1,220 meters elevation. Blooms (June – September) December – May (CNPS 2023).	**Will not occur.** The Study Area is located outside of the elevational range of this species.
Viburnum ellipticum oval-leaved viburnum	--/--/2B.3	A perennial deciduous shrub found in chaparral, cismontane woodland, and lower montane coniferous forest from 215 – 1,400 meters above msl. Blooms May – June (CNPS 2023).	**Will not occur.** The Study Area is located outside of the elevational range of this species.
Animals			
Invertebrates			
Branchinecta lynchi vernal pool fairy shrimp	FT/--/--	Vernal pools ranging from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools. It is most frequently found in pools measuring less than 0.05 acre; although has been collected from vernal pools exceeding 25 acres. The known	**Will not occur.** The Study Area does not contain habitat suitable to support this species.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
		range within California includes the Central Valley and southern California (USFWS 2005).	
Branchinecta conservatio Conservancy fairy shrimp	FE/--/--	Occupies large clay bottomed vernal pools to vernal lakes with turbid water in grasslands. The historical distribution of this species is unknown and it is currently distributed throughout the Central Valley and southern coastal regions of California (USFWS 2005).	**Will not occur.** The Study Area does not contain habitat suitable to support this species.
Danaus plexippus pop. 1 monarch - California overwintering population	FCE/--/--	The federal listing on December 17, 2020 was for overwintering populations of Monarch butterflies that roost in wind protected tree groves, especially with Eucalyptus sp., and species of pine or cypress with nectar and water sources nearby. Winter roost sites extend along the coast from Mendocino County to Baja California. As caterpillars, monarchs feed exclusively on the leaves of milkweed (Asclepias sp.) (Nial et al. 2019 and USFWS 2020). Monarch butterfly migration routes pass east over the Sierra Nevada in the fall and back to the California coast in the spring (USFWS 2020). The overwintering population is located along the Coast while summer breeding areas occur in interior California and North America with spring breeding areas located further east (USFWS 2020).	**Will not occur.** The Study Area lacks habitat lacks trees suitable to support overwintering populations for this species.
Desmocerus californicus dimorphus valley elderberry longhorn beetle	FT/--/--	Endemic to elderberry shrubs (*Sambucus* spp.) occurring in riparian habitat in the Sacramento and San Joaquin Valleys, riparian habitats in the Sacramento and San Joaquin Valleys, and less common throughout riparian forests of the Central Valley from Redding to Fresno County (USFWS 2014) typically below 152 m amsl (USFWS 2017).	**Will not occur.** The Study Area does not contain any elderberry shrubs necessary to support this species.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
Lepidurus packardi vernal pool tadpole shrimp	FE/--/--	Vernal pools from 54 square feet to 89 acres, containing clear- to highly turbid water. Its known range is within the Central Valley of California and in the San Francisco Bay area (USFWS 2005).	**Will not occur**. The Study Area does not contain habitat suitable to support this species.
Amphibians			
Hydromantes shastae Shasta salamander	FT/--/--	Shasta salamander occurs within Shasta County in rock outcrops and fissures in conifer forests, oak woodlands, chaparral, or open areas, as well as cave habitats. This species occurs within the vicinity of Shasta Lake and its tributaries; however, it also occurs in other watersheds without tributaries to Shasta Lake. This species has a vast elevation range from 1,067 feet (Shasta Lake) to 5,613 feet (Tombstone Mountain). Requires moist, subterranean habitats in primarily barren or sparsely vegetated limestone or other rock outcrops, also occupies caves, rock fissures, and talus slopes for reproduction and refugia in high temperatures. Rock crevices and fissures, loose soil and crevices near roots, rodent burrows, or other earthen tunnels provide protection above ground (USFWS 2021).	**Will not occur.** The Study Area occurs outside of the elevation range for this species.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
Rana boylii pop. 1 North coast foothill yellow-legged frog DPS	--/--/SSC (Northern Sierra Nevada and Feather River Pop ST; FE along the Coast and Southern California; North coast populations are not listed)	The foothill yellow-legged frog occurs along the coast ranges from Oregon to Los Angeles and along the western side of the Sierra Nevada. This species uses perennial rocky streams in a wide variety of habitats up to 6,400 feet above msl. This species rarely ventures far from water, is usually found basking in the water, or under surface debris or underground within 165 feet of water. Eggs are laid in clusters attached to gravel or rocks along stream margins in flowing water. Tadpoles typically require up to four months to complete aquatic development. Breeding typically follows winter rainfall and snowmelt, which varies based upon location (Jennings and Hayes 1994).	**May occur.** Marginally suitable habitat is present within the onsite portion of the drainage; however, this segment of creek is highly disturbed due to high foot traffic.
Spea hammondii western spadefoot	--/--/SSC	Amphibian that breeds in vernal pools and seasonal ponds or slow portions of streams in grasslands and woodlands. Adults spend most of their time in underground burrows in grasslands surrounding breeding pools (Jennings and Hayes 1994). Breeding is typically finished by the end of March. Tadpoles mature through late-spring and disperse as pools dry (Zeiner et al. 1990).	**Will not occur.** The Study Area lacks habitat suitable to support this species. The site lacks loose soil for burrowing. Additionally, no CNDDB occurrences were made within 5 miles of the site.
Fishes			
Acipenser medirostris green sturgeon southern DPS	FT/--/--	Spawn in freshwater streams, in fast, deep water, over gravel, cobble, or boulders. Juveniles inhabit estuarine waters for 1-4 years until dispersing into coastal marine waters as adults. Adults return to spawn in fresh water every 6-10 years. Sacramento River watershed, including the Feather River, is the only known historical and present spawning areas for green sturgeon (NMFS 2018).	**Will not occur.** The Study Area lacks habitat suitable to support this species.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
Entosphenus tridentatus Pacific lamprey	--/--/SSC/BLMS	Pacific lamprey, an anadromous fish that is a micro-predator of larger fish lives at sea and spawns in cold clear water, like salmonids. Adults use gravel to build nests, which are associated with cover, such as cobble, vegetation or woody debris. Lamprey can use their suction mouth, in the presence of some flowing water, to climb waterfalls and overcome barriers. However, most dams and fish ladders are impassable to lampreys unless they are designed with a rough surface for lampreys to attach to (Moyle et al. 2015).	**Will not occur.** The Study Area lacks habitat suitable to support this species. The stretch of drainage that flows through the site lacks vegetation and woody debris for cover, and lacks gravel for nest building. Though the onsite intermittent drainage eventually flows to Churn Creek, after leaving the site, much of the drainage flows underground or within a concrete lined channel prior to converging with Churn Creek.
Oncorhynchus mykiss irideus Central Valley Steelhead DPS	FT/--/--	This distinct population segment includes all naturally spawned anadromous steelhead populations below natural and manmade impassable barriers in the Sacramento and San Joaquin Rivers and their tributaries, excluding steelhead from San Francisco and San Pablo Bays and their tributaries, as well as two artificial propagation programs: the Coleman NFH, and Feather River Hatchery steelhead hatchery programs (NMFS 2016). Steelhead spawn in rivers and streams with cool, clear, water and suitable silt free substrate (NMFS 2016).	**Will not occur.** The Study Area lacks habitat suitable to support this species. The downstream portion of the drainage, just outside of the Study Area to the east, east of Canby Road, is choked up with vegetation and debris preventing upstream movement for larger fish species. The onsite portion of drainage is small, ranging in depths from 3” to 12” inches, with a stream width ranging from 3’ to 10’ feet. Though the onsite intermittent drainage eventually flows to Churn Creek, after leaving the site, much of the drainage flows underground or within a concrete lined channel prior to converging with Churn Creek.
Oncorhynchus tshawytscha pop. 11 Central Valley chinook salmon spring-run ESU	FT/ST/--	Central Valley spring-run Chinook salmon spawn in rivers and streams with cool, clear, water and suitable cobble and gravel substrate. Historically occurred in all major rivers and tributaries of the Central Valley. Spawning is currently located in tributary streams of the Sacramento River (NMFS 2014). Immigration of adults through the	**Will not occur.** The Study Area lacks habitat suitable to support this species. The downstream portion of the drainage, just outside of the Study Area to the east, east of Canby Road, is choked up with vegetation and debris preventing upstream movement for larger fish species. The onsite portion of drainage is small, ranging

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
		Delta and lower Sacramento River occurs from March through September. Spawning occurs between late-August through October (NMFS 2014).	in depths from 3" to 12" inches, with a stream width ranging from 3' to 10' feet. Though the onsite intermittent drainage eventually flows to Churn Creek, after leaving the site, much of the drainage flows underground or within a concrete lined channel prior to converging with Churn Creek.
Oncorhynchus tshawytscha pop. 7 Sacramento River chinook salmon winter-run ESU	FE/SE/--	Chinook salmon spawn in rivers and streams with cool, clear, water and suitable cobble and gravel substrate. Immigration of adults through the Delta and lower Sacramento River occurs from December through July. Spawning is currently limited to the Sacramento River downstream of Keswick Dam and upstream of the Red Bluff Diversion and the lower reaches of Battle Creek (NMFS 2014). Spawning occurs between late-April through mid-August (NMFS 2014).	**Will not occur.** The Study Area lacks habitat suitable to support this species. The downstream portion of the drainage, just outside of the Study Area to the east, east of Canby Road, is choked up with vegetation and debris preventing upstream movement for larger fish species. The onsite portion of drainage is small, ranging in depths from 3" to 12" inches, with a stream width ranging from 3' to 10' feet. Though the onsite intermittent drainage eventually flows to Churn Creek, after leaving the site, much of the drainage flows underground or within a concrete lined channel prior to converging with Churn Creek.
Reptiles			
Actinemys (=Emys) marmorata western pond turtle	--/--/SSC	Inhabits slow-moving water with dense submerged vegetation, abundant basking sites, gently sloping banks, and dry clay or silt soils in nearby uplands. Turtles will lay eggs up to 0.25-mile from water, but typically go no more than 600 feet (Jennings and Hayes 1994).	**High**. Suitable habitat for this species occurs at the east end of the onsite drainage before entering the culvert under Canby Road with suitable nesting habitat occurring within the upland portions of the site.
Birds			
Agelaius tricolor tricolored blackbird	--/ST/SSC	Common locally throughout central California. Nests and seeks cover in emergent wetland vegetation and thorny vegetation such as	**May Occur.** The Study Area contains habitat suitable to support this species in a nesting and foraging capacity, however, this species

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
		Himalayan blackberry (*Rubus armeniacus*) as well as cattails and tules. The nesting area must be large enough to support a minimum colony of 50 pairs as they are a highly colonial species. Forages on ground in croplands, grassy fields, flooded land, and edges of ponds for insects (Shuford and Gardali 2008).	was not observed during the site visits. Additionally, there are no occurrences documented within 5 miles of the site.
Haliaeetus leucocephalus Bald eagle	FD/SE/FP	Requires large bodies of water with an abundant fish population. Feeds on fish, carrion, small mammals, and waterfowl. Nests are usually located within a 1-mile radius of water. Nests are most often situated in large trees with a commanding view of the area (Zeiner *et al.* 1990).	**Will not occur.** The Study Area lacks nesting and foraging habitat suitable to support this species.
Pandion haliaetus osprey	--/--/WL	Osprey breed in Northern California from the Cascade Ranges southward to Lake Tahoe, and along the coast south to Marin County. They prey primarily on fish but also predate small mammals, birds, reptiles, and invertebrates. Foraging areas include open, clear waters of rivers, lakes, reservoirs, bays, estuaries, and surf zones. Habitat and nesting requirements include large trees, snags, and dead-topped trees in open forest habitats for cover and nesting (Zeiner et al. 1988-1990).	**Will not occur.** The Study Area lacks nesting and foraging habitat suitable to support this species.
Progne subis purple martin	--/--/SSC	Nests in cavities in open areas with low canopy cover at the height of the nest, near large bodies of water that support high densities of large insects. Martins use a variety of cavities including bridges, large tree snags, and collapsed lava tubes. The species is very sensitive to competition from European starlings and is extirpated from most low-elevation areas by starlings (Shuford and Gardali 2008).	**Will not occur.** The Study Area lacks habitat suitable to support this species.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
Riparia riparia bank swallow	--/ST/--	Primarily inhabits riparian and other lowland habitats west of the deserts during the spring-fall period. In summer, restricted to riparian, lacustrine, and coastal areas with vertical banks, bluffs, and cliffs with fine-textured or sandy soils, into which it digs nesting holes. In California, bank swallow primarily nests from Siskiyou, Shasta and Lassen Counties south along the Sacramento River to Yolo County. Also nests locally across much of state (Zeiner et al. 1988-1990).	**Will not occur.** The Study Area lacks habitat suitable to support this species.
Strix occidentalis caurina northern spotted owl	FT/--/--	The northern spotted owl resides in dense, old-growth, multi-layered mixed conifer, redwood, and Douglas-fir habitats, from sea level up to approximately 7,600 ft. In southern California, this species is nearly always associated with oak and oak-conifer habitats. Northern spotted owl is found from British Colombia south through northwestern California south to San Francisco (Zeiner et al. 1988-1990).	**Will not occur.** The Study Area does not provide old growth coniferous forest habitat suitable to this species.
Mammals			
Antrozus pallidus pallid bat	--/--/SSC	Occurs throughout California except for the high Sierra Nevada and the northern Coast Ranges. Habitats include grasslands, shrublands, woodlands, and forests from sea level to 6,000 feet (Bolster, ed. 1998). This species is very sensitive to disturbance of roosting sites. Common roost sites are rock crevices, old buildings, bridges, caves, mines, and hollow trees (Barbour and Davis 1969).	**May occur.** The Study Area contains habitat suitable to support this species in a foraging and roosting capacity, however, there are no occurrences for this species documented within 5 miles of the site.
Corynorhinus townsendii Townsend's big-eared bat	--/--/SSC	Widely distributed throughout California except alpine and subalpine habitats. This species eats moths, beetles and other insects which it catches on the wing or by gleaning from vegetation. Typically found near water	**Will not occur.** The Study Area lacks habitat suitable to support this species.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
		since it is poor at concentrating its urine. This species uses caves, mines, tunnels, buildings, and human made structures for roosting. Maternity roosts are typically in warm sites. Hibernation sites are typically cold, but not freezing. This species is very sensitive to disturbance and may abandon its roost after one visit. Extremely sensitive to human disturbance (Zeiner et al. 1988-1990).	
Euderma maculatum spotted bat	--/--/SSC/BLMS	Occurs in deserts, grasslands and mixed coniferous forests up to 10,000 feet. Forages over water or close to the ground primarily on moths. Prefers to roost in rocky cliffs with crevices but may also use caves or buildings. This species also forages and roosts individually but may on occasion roost in groups. Spotted bat is considered to be one of the rarest mammals in North America (Zeiner et al. 1990).	**Will not occur.** The Study Area lacks habitat suitable to support this species.
Lasiurus frantzii western red bat	--/--/SSC	Roosts primarily in woodlands and forests amongst branches and avoids roosting in caves or buildings (Bolster 1998). Forages in open habitat such as croplands, grasslands and shrublands. This species is typically associated with water and has a poor urine concentrating ability. Primarily roosts solitarily in trees from 2–40 feet high in the trees, with females and young roosting higher in the trees than males. Forages along edge habitats (Zeiner et al. 1990). This species is rarely found in the winter at locations that freeze (Pierson et al. 2006).	**May occur.** The Study Area contains habitat suitable to support this species in a foraging and roosting capacity, however, there are no occurrences for this species documented within 5 miles of the site.

Scientific Name/ Common Name[1]	Status[2]	Habitat, Ecology and Life History	Potential to Occur[3]
Pekania pennanti Fisher	--/ST/SSC/FSS, BLMS	Occupy late-successional conifer and mixed conifer-hardwood forests with an abundance of downed wood, snags, large trees, and a dense canopy (Zielinski 2014). Typically found at elevations from 1,070 – 2,135 m amsl, where persistent snow does not accumulate and impede movement (Zielinski 2014). Riparian forests and habitat close to open water such as streams are important. Cavities and branches in trees, snags, stumps, rock piles, and downed timber are used as resting sites, and large diameter live, or dead trees are selected for natal and maternal dens (Zielinski 2014). There is a significant gap in the range of fisher between the southern Sierra Nevada population and the northern Sierra Nevada/southern Cascade population that stretches approximately 400 km wide (Zielinski 2014).	**Will not occur.** The Study Area is located outside of the elevational range of this species.

1 Sensitive species reported in CNDDB or CNPS on the *Enterprise, CA* USGS 9-quad search, or in USFWS lists for the Study Area.

2 Status is as follows: Federal (ESA) listing/State (CESA) listing/other CDFW status or CRPR. F = Federal; S = State of California; E = Endangered; T = Threatened; C = Candidate; FP=Fully Protected; SSC=Species of Special Concern; WL=Watch List ; FSS = Forest Service Sensitive; BLMS = Bureau of Land Management Sensitive.

3 Status in the Study Area is assessed as follows. **Will Not Occur**: Species is either sessile (i.e., plants) or so limited to a particular habitat that it cannot disperse on its own and/or habitat suitable for its establishment and survival does not occur in the Study Area; **Not Expected**: Species moves freely and might disperse through or across the Study Area, but suitable habitat for residence or breeding does not occur in the Study Area, potential for an individual of the species to disperse through or forage in the site cannot be excluded with 100% certainty; **Presumed Absent:** Habitat suitable for residence and breeding occurs in the Study Area; however, focused surveys conducted for the current project were negative; **May Occur**: Species was not observed on the site and breeding habitat is not present but the species has the potential to utilize the site for dispersal, **High**: Habitat suitable for residence and breeding occurs in the Study Area and the species has been recorded recently in or near the Study Area, but was not observed during surveys for the current project; **Present**: The species was observed during biological surveys for the current project and is assumed to occupy the Study Area or utilize the Study Area during some portion of its life cycle.

CRPR = California Rare Plant Rank: 1B – rare, threatened, or endangered in California and elsewhere; 2B – rare, threatened, or endangered in California but more common elsewhere. Extension codes: .1 – seriously endangered; .2 – moderately endangered.

This page intentionally left blank

Appendix D

Plant and Wildlife Species Observed in the Study Area

Family	Scientific Name	Common Name	Indicator Status[1]
Plants			
Native			
Alliaceae	*Allium amplectens*	Narrowleaf onion	-
Agavaceae	*Chlorogalum pomeridianum*	Wavyleaf soap plant	-
Anacardiaceae	*Toxicodendron diversilobum*	Poison oak	-
Apiaceae	*Sanicula bipinnatifida*	Purple sanicle	-
Asteraceae	*Gnaphalium palustre*	Lowland cudweed	-
Boraginaceae	*Amsinkia* sp.	Fiddle neck	-
	Plagiobothrys canescens	Valley popcornflower	-
Brassicaceae	*Lepidium nitidum*	Shining pepperweed	-
Caprifoliaceae	*Lonicera interrupta*	Chaparral honeysuckle	-
Cupressaceae	*Hesperocyparis* sp.	Cypress	
	Eleocharis acicularis	Needle spike rush	-
Cyperaceae	*Cyperus esculentus*	Nut grass	-
Ericaceae	*Arctostaphylos manzanita ssp. manzanita*	Common Manzanita	-
Fabaceae	*Lupinus* sp.	Lupine	-
Fagaceae	*Quercus douglasii*	Blue oak	-
	Quercus wislizeni	Interior live oak	-
Juncaceae	*Juncus bufonius*	Toad rush	-
	Juncus effusus	Common bog rush	-
Malvaceae	*Sidalcea celata*	Redding checkerbloom	-
Oleaceae	*Syringa vulgaris*	Common lilac	
Onagraceae	*Epilobium densiflorum*	Denseflower willowherb	-
	Clarkia sp.	Clarkia	-
Orobanchaceae	*Triphysaria eriantha*	Johnny tuck	-
	Castilleja attenuate	Narrow leaved owl's clover	-
Pinaceae	*Pinus sabiniana*	Gray pine	-
Ranunculaceae	*Ranunculus occidentalis*	Western buttercup	-
Rhamnaceae	*Ceanothus cuneatus*	Buckbrush	-
Rubiaceae	*Salix lasiolepis*	Arroyo willow	-
	Galium aparine	Common bedstraw	
Salicaceae	*Populus fremontii*	Cottonwood	-
	Salix Lasiolepis	Arroyo willow	-
Typhaceae	*Typha angustifolia*	Narrow leaf cattail	-
Non-native			
Apiaceae	*Torillis nodosa*	Hedge parsley	-
Asteraceae	*Centaurea solstitialis*	Yellow-star thistle	High
	Logfia gallica	Narrowleaf cottonrose	-
	Leontodon saxatalis	Hawkbit	-
Brassicaceae	*Barbarea vulgaris*	Yellow rocket	-
	Raphanus sativus	Wild radish	Limited
Caryophyllaceae	*Scleranthus annuus*	German knotgrass	-
Fabaceae	*Acmispon americanus*	American bird's foot trefoil	-
	Vicia sativa	Spring vetch	-
	Vicia villosa	Hairy vetch	-
Geraniaceae	*Erodium botrys*	Broadleaf filaree	-
	Erodium cicutarium	Red stemmed filaree	Limited
	Geranium dissectum	Cutleaf geranium	Limited
Hypericaceae	*Hypericum* sp.	St. John's wort	Unknown

Family	Scientific Name	Common Name	Indicator Status[1]
Lamiaceae	*Mentha pulegium*	Pennyroyal	Moderate
Lythraceae	*Lythrum hyssopifolium*	Hyssop loosestrife	Limited
Mollugo	*Mollugo verticillate*	Green carpetweed	Limited
Moraceae	*Ficus caica*	Common fig	Moderate
	Morus alba	White mulberry	-
Myrsinaceae	*Eucalyptus Camaldulensis*	Red gum	Limited
	Lysimachia arvensis	Scarlet pimpernel	-
Oenothera	*Oenothera speciosa*	Pinkladies	-
Plantaginaceae	*Veronica anagallis-aquatica*	Water speedwell	-
Poaceae	*Anthoxanthum aristatum*	Annual vernal grass	-
	Arundo donax	Giant reed grass	High
	Briza maxima	Rattlesnake grass	Limited
	Briza minor	Little rattlesnake grass	-
	Bromus diandrus	Ripgut brome	Moderate
	Bromus hordeaceus	Soft chess	Limited
	Hordeum marinum	Mediterranean barley	-
	Hordeum murinum	Foxtail barely	Moderate
	Lolium perenne	Italian ryegrass	Moderate
	Paspalum dilatatum	Dallisgrass	-
Polygonaceae	*Rumex crispus*	Curly dock	Limited
Rosaceae	*Prunus dulcis*	Sweet almond	-
	Rubus armeniacus	Himalayan blackberry	High
Viburnaceae	*Viburnum tinus*	Viburnum	-
Birds			
Aegithalidae	*Psaltriparus minimus*	Bushtit	
Anatidae	*Branta canadensis*	Canada goose	
Cathartiformes	*Cathartes aura*	Turkey vulture	
Columbidae	*Zenaida macroura*	Mourning dove	
	Streptopelia decaocto	Eurasian collared-dove	
Corvidae	*Aphelocoma californica*	California scrub-jay	
	Corvus corax	Common raven	
Fringillidae	*Haemorphous mexicanus*	House finch	
	Spinus psaltria	Lesser goldfinch	
Mimidae	*Mimus polyglottos*	Northern mockingbird	
Odontophoridae	*Callipepla californica*	California quail	
Paridae	*Baeolophus inornatus*	Oak titmouse	
Parulidae	*Setophaga coronata*	Yellow-rumped warbler	
Passerellidae	*Melospiza melodia*	Song sparrow	
	Melozone crissalis	California towhee	
	Zonotrichia leucophrys	White-crowned sparrow	
Passeridae	*Passer domesticus*	House sparrow	
Picidae	*Melanerpes formicivorus*	Acorn woodpecker	
Sittidae	*Sitta carolinensis*	White-breasted nuthatch	
Sturnidae	*Sturnus vulgaris*	European starling	
Tyrannidae	*Sayornis nigricans*	Black phoebe	

1 Cal-IPC Rating = Limited; Moderate; High

Appendix E

Rare Plant Letter Report

HELIX Environmental Planning, Inc.
1677 Eureka Road, Suite 100
Roseville, CA 95661
916.435.1202 tel
619.462.0552 fax
www.helixepi.com

June 27, 2023 Project 08391.00002.001

George Schmidbauer, Project Manager
The DANCO Group
5251 Ericson Way
Arcata, CA 95521

Subject: Focused Botanical Surveys for the Redding Canby Apartments Project Located in the City of Redding, Shasta County, California

Dear Mr. Schmidbauer:

On behalf of The DANCO Group (Client), HELIX Environmental Planning, Inc. (HELIX) conducted focused botanical surveys for Henderson's bent grass (*Agrostis hendersonii*), big-scale balsamroot (*Balsamorhiza macrolepis*), silky cryptantha (*Cryptantha crinita*), mountain lady's slipper (*Cypripedium montanum*), dubious pea (*Lathyrus sulphureus* var. *argillaceus*), broad-lobed leptosiphon (*Leptosiphon latisectus*), Ahart's paronychia (*Paronychia ahartii*), Sanford's arrowhead (*Sagittaria sanfordii*), and Redding checkerbloom (*Sidalcea celata*) for the Redding Canby Apartments Project (Project) located in the City of Redding, Shasta County, California (Figure 1**,** *Site and Vicinity Map*). This report describes the methods implemented for the surveys and summarizes the results of the surveys.

INTRODUCTION

HELIX Biologist Josh Goodwin conducted a botanical inventory within the Study Area on April 14, 2023, and an additional focused botanical survey of the Study Area on May 31, 2023. The focused botanical surveys were conducted according to CNPS botanical survey guidelines (CNPS 2001) and CDFW *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018). The entire site was surveyed, and all plant species were identified to the taxonomic level necessary to determine whether or not they were special-status species. Intensive surveys were conducted within the seasonal wetland features.

STUDY AREA AND EXISTING CONDITIONS

The ±8.65-acre Study Area is located at 930 and 990 Canby Road, Redding, in Shasta County, California (**Figure 1**). The Study Area includes two parcels (APNs: 117-200-005-000 and 117-200-006-000) and is located within portions of Sections 30 of Township 32 North, Range 4 West on the USGS *Enterprise, California* 7.5-minute quadrangle map. The approximate center of the Study Area is 40° 35' 38.50'' North, 122° 21' 16.79'' West.

As it relates to botanical resources, the Study Area is located within the Cascade Range Foothills Subregion (CaRF) of the Cascade Ranges Region (CaR) and has an elevation ranging from 184 to 194 meters (605 to 637 feet) above mean sea level (msl) (Jepson eFlora 2023). Biological communities within the Study Area include annual grassland, blue oak woodland, and developed/disturbed. An intermittent drainage and two seasonal wetland features are also present within the Study Area.

PROJECT DESCRIPTION

The Client proposes to construct an affordable housing residential infill development consisting of 120 multifamily residential units in ten separate two- and three-story structures. The project will include 32 one-bedroom units, 56 two-bedroom units, 28 three-bedroom units, and 4 four-bedroom units. The Project will also include a community building, onsite manager's unit, courtyard, and children's playground area. There will be a total of 212 parking spaces placed throughout the site. Flows exiting the detention basin will be directed through a low-flow channel and discharge into a culvert extension. Peak rate of discharge during 10-year, 25-year, and 100-year storms events will be metered to maintain pre-development rates.

VEGETATION COMMUNITIES

A total of five vegetation communities were documented as occurring within the Study Area including blue oak woodland, annual grassland, developed/disturbed, riparian, and seasonal wetland (Figure 2, *Biological Communities*). These habitat types are discussed below. A comprehensive list of all plant and wildlife species observed within the Study Area is provided in Attachment A. Representative site photographs can be found in Attachment B.

Annual Grassland

There are approximately 4.23 acres of annual grassland distributed throughout the Study Area, intermixed with primarily blue oak woodland (Attachment B, photos 1 and 2). The acreage of this vegetation community was calculated based on large open areas of this community, not including small in-between/understory grassland areas within the blue oak community. This vegetation community appears to be routinely maintained as vegetation heights ranged from 2 and 12 inches. This vegetation community was dominated by non-native and native species including purple sanicle (*Sanicula bipinnatifida*), broadleaf filaree (*Erodium botrys*), shining pepperweed (*Lepidium nitidum*), Italian ryegrass (*Festuca perennis*), annual vernal grass (*Anthoxanthum aristatum*), foxtail barley (*Hordeum murinum*), and wild oat (*Avena fatua*).

Blue Oak Woodland

Approximately 3.39 acres of the Study Area is comprised of blue oak woodland. This vegetation community occurs primarily within the center portion of the site extending to the northwest (**Attachment B**, photo 3). This community has a canopy density of approximately 30 to 40 percent with an understory dominated by annual grassland and forb species. The dominant tree species within this community includes blue oak (*Quercus douglasii*), with a single common lilac (*Syringa vulgaris*) and a cypress tree (*Hesperocyparis* sp.) observed. Dominant understory vegetation consisted of foxtail barley, cutleaf geranium (*Geranium dissectum*), common bedstraw (*Galium aparine*), annual vernal grass (*Anthoxanthum aristatum*), wild oat, and poison oak (*Toxicodendron diversilobum*).

Developed/Disturbed

There is approximately 0.61 acre of developed/disturbed land, positioned along the eastern and southern boundaries of the Study Area (Attachment B, photo 4 and 5). These areas include portions of Canby Road along the eastern boundary and portions of Browning Street along the southern boundary. The southern boundary also includes some highly disturbed ground composed of a remnant access road and a slope cut adjacent to Browning Street. These disturbed areas are characterized by heavy disturbance by past or ongoing human activities but retain a soil substrate. These disturbed areas are sparsely to densely vegetated, but do not support a recognizable community or species assemblage. Vegetative cover is herbaceous and dominated by a wide variety of weedy non-native species or a few ruderal native species.

The disturbed habitat in the Study Area consists of upland vegetation including wild oats, ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), common vetch (*Vicia sativa*) and cut-leaf geranium (*Geranium dissectum*).

Riparian

Approximately 0.20 acre of riparian habitat occurs in the northeast corner of the Study Area, surrounding the onsite intermittent drainage (Attachment B, photos 6 and 7). This habitat is relatively degraded due to being impacted by foot traffic and the establishment of invasive plants. The riparian habitat on the south side of the intermittent drainage is highly disturbed due to ground compaction from foot traffic, evident by the presence of a social trail. A multifamily development abuts this area to the north. The riparian habitat occurring on the north side the intermittent drainage is overgrown with Himalayan blackberry (*Rubus armeniacus*) and is intermixed with various tree species. Trees occurring within this riparian habitat consist of interior live oak (*Quercus wislizeni*), blue oak, eucalyptus (*Eucalyptus* sp.), grey pine (*Pinus sabiniana*), and willow (*Salix* sp.). The understory is dominated by common bog rush (*Juncus effusus*), dallisgrass (*Paspalum dilatatum*), penny royal (*Mentha pulegium*), curly dock (*Rumex crispus*), Himalayan blackberry (*Rubus armeniacus*), and St. John's wort (*Hypericum* sp.).

Seasonal Wetland

Approximately 0.20 acre of the Study Area is comprised of seasonal wetland habitat, made up of two separate and distinct wetlands (Attachment B, photos 9-11). The smaller of the two seasonal wetland features occurs along the western boundary of the Study Area, near the northwest corner. This seasonal wetland is positioned in a northeast orientation located between two gently sloped hills. The source of water appears to be from direct precipitation and possibly runoff from the adjacent development to the west. The larger wetland feature gently slopes to the east, occurring closer to the eastern boundary of the site, near the northeast corner. Water collected by this larger wetland feature drains into a culvert positioned under Canby Road, which then flows to an offsite creek channel. Dominant vegetation occurring within the smaller wetland feature includes wild oat, spring vetch (*Vicia sativa*), Italian ryegrass, Mediterranean barley (*Hordeum marinum*), curly dock, and willow. No standing water was present within this feature at the time of the survey. The larger seasonal wetland is dominated by vegetation consisting of pennyroyal, tall flatsedge (*Cyperus eragrostis*), Himalayan blackberry, Mediterranean barley, yellow rocket (*Barbarea vulgaris*) and willow. No standing water was present within this feature, but the ground was saturated in some areas at the time of the site visits.

SPECIAL-STATUS PLANT SPECIES

Several special-status plant species were determined to have potential to occur within the Study Area, which includes Henderson's bent grass, big-scale balsamroot, silky cryptantha, mountain lady's slipper, dubious pea, broad-lobed leptosiphon, Ahart's paronychia, Sanford's arrowhead, and Redding checkerbloom. These species are discussed in further detail below.

Henderson's Bent Grass

Henderson's bent grass (*Agrostis hendersonii*) is an annual herb in the grass family (Poaceae) that is classified with a California Rare Plant Rank (CRPR) of 3.2 by the CNPS, which are plants about which more information is needed to assign them to one of the other ranks. This species is native to northern California and Oregon where it is a rare member of the flora in scattered vernal pool habitats ranging from 70 to 305 meters above msl. This species occurs within mesic valley and foothill grassland and vernal pools and has a bloom period from April to June (CNPS 2023).

Big-Scale Balsamroot

Big-scale balsamroot (*Balsamorhiza macrolepis*) is a perennial herb in the sunflower family (Asteraceae) that is classified with a CRPR of 1B.2 by the CNPS which are plants considered to be rare, threatened, or endangered in California and elsewhere. This species is endemic to California and grows in dry, open habitat, mostly in mountainous areas, mostly in the western foothills of the Sierra Nevada and in the eastern Coast Ranges near San Francisco Bay from 45 to 1,555 meters above msl. It occurs in chaparral, cismontane woodland, and valley and foothill grassland habitats that are occasionally in serpentine soils and has a bloom period from March to June. This plant is a taprooted perennial herb growing erect 20 to 60 centimeters tall. The large lobed leaves are lance-shaped to oval and the largest, generally toward the base of the plant, may approach 50 centimeters in length (CNPS 2023).

Mountain Lady's Slipper

Mountain lady's slipper (*Cypripedium montanum*) is a perennial rhizomatous herb in the orchid family (Orchidaceae) that is classified with a CRPR of 4.2 by the CNPS which are plants of limited distribution whose status should be monitored regularly. This species can be found in northwestern United States and western Canada. It is usually found at high elevation (185-2225 meters) in open woods and subalpine slopes occurring in broadleafed upland forests, cismontane woodland, lower montane coniferous forest, and north coast coniferous forest. This species has a bloom period from March to August (CNPS 2023).

Silky Cryptantha

Silky cryptantha (*Cryptantha crinita*) is an annual herb in the borage family (Boraginaceae) that is classified with a CRPR of 1B.2 by the CNPS and is endemic to California. This species is found in cismontane woodlands, lower montane coniferous forests, riparian forests, riparian woodlands, and valley and foothill grasslands from 61 to 1,215 meters above msl. Other ecological preferences of this species include gravelly streambeds. The blooming period for this species is from April to May (CNPS 2023).

Dubious Pea

Dubious pea (*Lathyrus sulphureus* var. *argillaceus*) is a perennial herb in the legume family (Fabaceae) that is classified with a CRPR of 3 by the CNPS. This species is endemic to California and is found in cismontane woodlands, lower and upper montane coniferous forests from 150 to 930 meters above msl. The blooming period for this species is from April to May (CNPS 2023).

Broad-Lobed Leptosiphon

Broad-lobed leptosiphon (*Leptosiphon latisectus*) is an annual herb in the phlox family (Polemoniaceae) that is classified with a CRPR of 4.3 by the CNPS. This species is endemic to California and is found in broadleafed upland forests and cismontane woodlands from 170 to 1,500 meters above msl. The blooming period for this species is from April to June (CNPS 2023).

Ahart's Paronychia

Ahart's paronychia (*Paronychia ahartii*) is an annual herb in the pink family (Caryophyllaceae) that is classified with a CRPR of 1B.1 by the CNPS. This species is endemic to California and is found in cismontane woodlands, valley and foothill grasslands, and vernal pools from 30 to 510 meters above msl (CNPS 2023). The blooming period for this species is from February to June (CNPS 2023).

Sanford's Arrowhead

Sanford's arrowhead (*Sagittaria sanfordii*) is a perennial, rhizomatous (emergent) herb in the water-plantain family (Alismataceae) that is classified with a CRPR of 1B.2 by the CNPS. This species is endemic to California and is found in marshes, swamps, and assorted shallow freshwater habitats from 0 to 300 meters above msl. The blooming period for this species is from May to October (November) (CNPS 2023).

Redding Checkerbloom

Redding checkerbloom (*Sidalcea celata*) is a perennial herb in the mallow family (Malvaceae) that is classified with a CRPR of 3 by the CNPS. This species is endemic to California and is found in cismontane woodlands from 135 to 1,525 meters above msl (CNPS 2023). Other ecological preferences of this species include sometimes growing in serpentine soils. The blooming period for this species is from April to August (CNPS 2023).

METHODOLOGY

HELIX biologist Josh Goodwin conducted botanical surveys within the Study Area on April 14 and May 31, 2023. A review and analysis of technical materials and relevant databases was undertaken prior to conducting the botanical surveys. The entire Study Area was surveyed on foot following the procedures described in the California Department of Fish and Wildlife's *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFW 2018). The botanical surveys were floristic in nature and all plant species observed during the surveys were identified to the taxonomic level necessary to determine rarity and listing status.

In accordance with the CDFW Protocols, Josh Goodwin possesses the following botanical field surveyor qualifications: knowledge of plant taxonomy and plant community ecology; familiarity with the plants of the region, including special-status and locally significant plants; experience with the California Natural Diversity Database (CNDDB), BIOS, and Survey of California Vegetation Classification and Mapping Standards; experience conducting floristic botanical field surveys as described in the CDFW Protocols; familiarity with the state and federal statuses and regulations related to plants and plant collecting; and experience analyzing impacts of project activities on native plant species and sensitive plant communities.

CONCLUSION AND RECOMMENDATIONS

During the May 31, 2023, botanical survey, approximately 10-15 individual Redding checkerbloom plants were observed within the understory of the blue oak woodland, located within the northern portion of the Study Area (Figure 3**,** *Redding Checkerbloom Locations*). No CNDDB (CDFW 2023) occurrences have been documented for this species however, California Native Plant Society documents this plant as occurring within Plumas, Shasta, Siskiyou, and Tehama Counties. The majority of the documented CNPS occurrences occur in Shasta County, concentrated primarily within the Redding area and areas immediately to the south.

The onsite Redding checkerbloom plants should be avoided to the greatest extent feasible. However, if project-related impacts to this species are anticipated, consultation with CDFW shall be conducted to develop a mitigation strategy, which may include but is not limited to, development of a plan to collect and relocate special-status plants and/or seed to a suitable location outside of the impact area and monitoring the relocated population to demonstrate transplant success, or preservation of this species or its habitat at an on or offsite location, or other measures deemed appropriate by CDFW. A mitigation and monitoring plan (plan) shall be developed providing a complete description of the location, size, and condition of the occurrence, and the extent of project-related impacts and shall be submitted to the City of Redding prior to any vegetation removal or any ground-disturbing activity within 250 feet of the onsite Redding Checkerbloom plants. The plan shall be submitted concurrently to CDFW for review and approval. The plan shall require maintaining viable plant populations on-site and shall identify avoidance measures for any existing population(s) to be retained and compensatory measures for any populations directly affected. Possible avoidance measures include fencing populations before construction and exclusion of project activities from the fenced-off areas, and construction monitoring by a qualified botanist to keep construction crews away from the population. The plan shall also include monitoring and reporting requirements for populations to be preserved on site or protected or enhanced off site, as applicable.

All plant species observed during the survey are documented in **Attachment A** and are classified utilizing the taxonomical nomenclature from the Jepson Manual (Baldwin et al. 2012). No other special-status plant species were observed within the Study Area during the April and May 2023 botanical surveys.

Please do not hesitate to call me at (916) 435-1202 or email JoshG@helixepi.com if you have any questions.

Sincerely,

Josh Goodwin
Biologist

Attachments:

Figure 1:	Site and Vicinity Map
Figure 2:	Biological Communities
Figure 3:	Redding Checkerbloom Locations
Attachment A:	Plant Species Observed in the Study Area
Attachment B:	Representative Site Photographs

REFERENCES

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosetti, and D.H. Wilken, editors. 2012. *The Jepson Manual: Vascular Plants of California, 2nd Edition*. University of California Press, Berkeley.

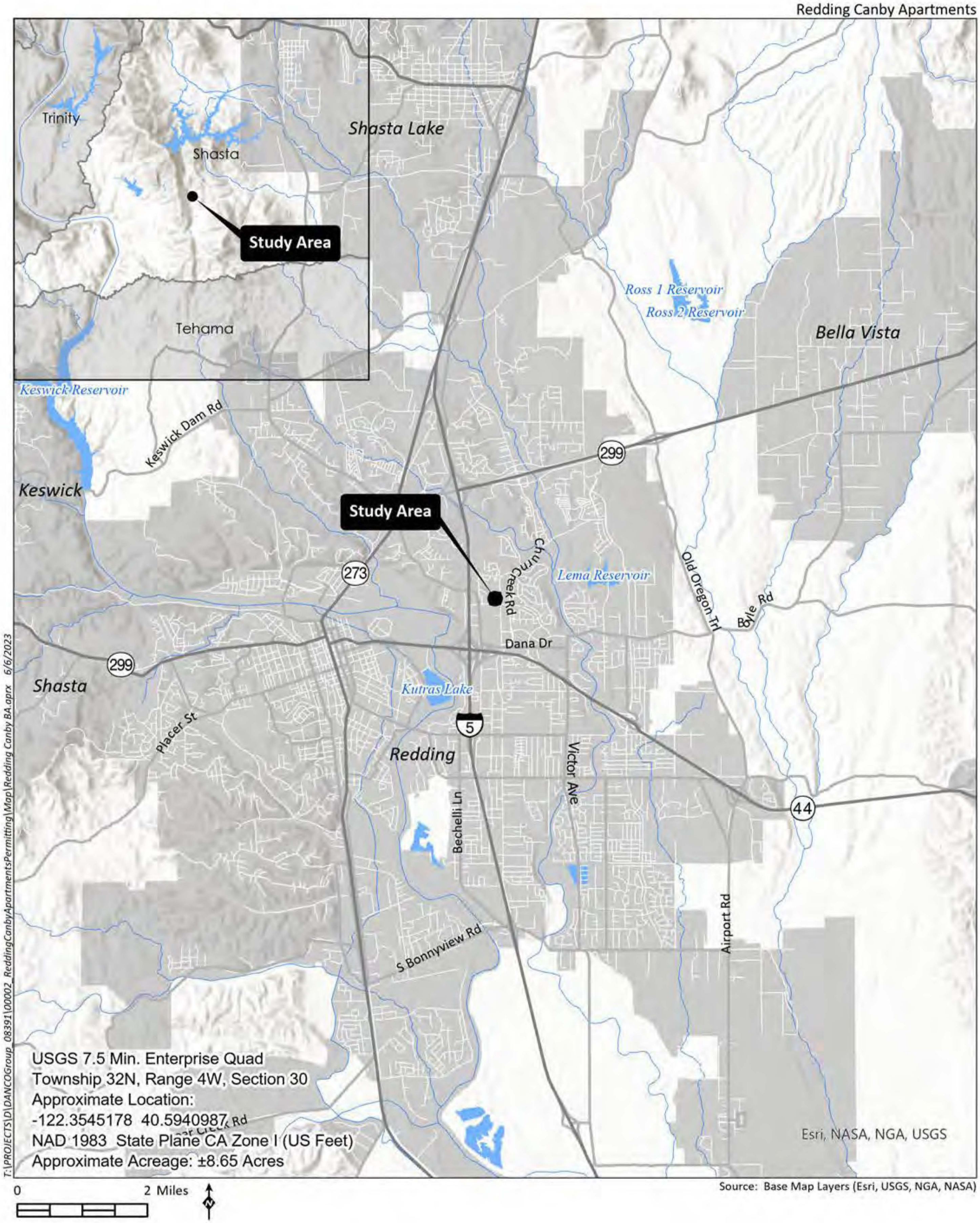
California Department of Fish and Wildlife (CDFW). 2023. California Natural Diversity Database (CNDDB). Available at: https://wildlife.ca.gov/Data/CNDDB/Maps-and-Data. Accessed June 2, 2023

2018. *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities.* Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18959&inline#:~:text=The%20purpose%20of%20these%20protocols%20is%20to%20facilitate,status%20plants%20and%20sensitive%20natural%20communities%20is%20maximized Accessed June 2, 2023.

2001. CNPS Botanical Survey Guidelines. Authored on December 9, 1983. Revised June 2, 2001. Available at https://cnps.org/wp-content/uploads/2018/03/cnps_survey_guidelines.pdf. Accessed June 2, 2023.

California Native Plant Society (CNPS). 2023. *Inventory of Rare and Endangered Plants of California* (online edition, v8-03 0.39). Available at: www.rareplants.cnps.org. Accessed June 7, 2023.

Jepson Flora Project (eds.). 2023. *Jepson eFlora*, https://ucjeps.berkeley.edu/eflora/. Accessed June 7, 2023.



Source: Base Map Layers (Esri, USGS, NGA, NASA)

HELIX
Environmental Planning

Site and Vicinity Map

Figure 1

Source: Aerial (DigitalGlobe, 3/26/2021)

HELIX
Environmental Planning

Biological Communities

Figure 2

Source: Aerial (DigitalGlobe, 3/26/2021)

HELIX Environmental Planning

Redding Checkerbloom Locations Map

Figure 3

Attachment A

Plant Species Observed in the Study Area

Family	Scientific Name	Common Name	Indicator Status[1]
Native			
Alliaceae	*Allium amplectens*	Narrowleaf onion	-
Agavaceae	*Chlorogalum pomeridianum*	Wavyleaf soap plant	-
Anacardiaceae	*Toxicodendron diversilobum*	Poison oak	-
Apiaceae	*Sanicula bipinnatifida*	Purple sanicle	-
Asteraceae	*Gnaphalium palustre*	Lowland cudweed	-
Boraginaceae	*Amsinkia* sp.	Fiddle neck	-
	Plagiobothrys canescens	Valley popcornflower	-
Brassicaceae	*Lepidium nitidum*	Shining pepperweed	-
Caprifoliaceae	*Lonicera interrupta*	Chaparral honeysuckle	-
Cupressaceae	*Hesperocyparis* sp.	Cypress	
	Eleocharis acicularis	Needle spike rush	-
Cyperaceae	*Cyperus esculentus*	Nut grass	-
Ericaceae	*Arctostaphylos manzanita ssp. manzanita*	Common Manzanita	-
Fabaceae	*Lupinus* sp.	Lupine	-
Fagaceae	*Quercus douglasii*	Blue oak	-
	Quercus wislizeni	Interior live oak	-
Juncaceae	*Juncus bufonius*	Toad rush	-
	Juncus effusus	Common bog rush	-
Malvaceae	*Sidalcea celata*	Redding checkerbloom	-
Oleaceae	*Syringa vulgaris*	Common lilac	
Onagraceae	*Epilobium densiflorum*	Denseflower willowherb	-
	Clarkia sp.	Clarkia	-
Orobanchaceae	*Triphysaria eriantha*	Johnny tuck	-
	Castilleja attenuate	Narrow leaved owl's clover	-
Pinaceae	*Pinus sabiniana*	Gray pine	-
Ranunculaceae	*Ranunculus occidentalis*	Western buttercup	-
Rhamnaceae	*Ceanothus cuneatus*	Buckbrush	-
Rubiaceae	*Salix lasiolepis*	Arroyo willow	-
	Galium aparine	Common bedstraw	
Salicaceae	*Populus fremontii*	Cottonwood	-
	Salix Lasiolepis	Arroyo willow	-
Typhaceae	*Typha angustifolia*	Narrow leaf cattail	-
Non-native			
Apiaceae	*Torillis nodosa*	Hedge parsley	-
Asteraceae	*Centaurea solstitialis*	Yellow-star thistle	High
	Logfia gallica	Narrowleaf cottonrose	-
	Leontodon saxatalis	Hawkbit	-
Brassicaceae	*Barbarea vulgaris*	Yellow rocket	-
	Raphanus sativus	Wild radish	Limited
Caryophyllaceae	*Scleranthus annuus*	German knotgrass	-
Fabaceae	*Acmispon americanus*	American bird's foot trefoil	-
	Vicia sativa	Spring vetch	-
	Vicia villosa	Hairy vetch	-
Geraniaceae	*Erodium botrys*	Broad leaf filaree	-
	Erodium cicutarium	Red stemmed filaree	Limited
	Geranium dissectum	Cutleaf geranium	Limited
Hypericaceae	*Hypericum* sp.	St. John's wort	Unknown
Lamiaceae	*Mentha pulegium*	Pennyroyal	Moderate

Family	Scientific Name	Common Name	Indicator Status[1]
Lythraceae	*Lythrum hyssopifolium*	Hyssop loosestrife	Limited
Mollugo	*Mollugo verticillate*	Green carpetweed	Limited
Moraceae	*Ficus caica*	Common fig	Moderate
	Morus alba	White mulberry	-
Myrsinaceae	*Eucalyptus Camaldulensis*	Red gum	Limited
	Lysimachia arvensis	Scarlet pimpernel	-
Oenothera	*Oenothera speciosa*	Pinkladies	-
Plantaginaceae	*Veronica anagallis-aquatica*	Water speedwell	-
Poaceae	*Anthoxanthum aristatum*	Annual vernal grass	-
	Arundo donax	Giant reed grass	High
	Briza maxima	Rattlesnake grass	Limited
	Briza minor	Little rattlesnake grass	-
	Bromus diandrus	Ripgut brome	Moderate
	Bromus hordeaceus	Soft chess	Limited
	Hordeum marinum	Mediterranean barley	-
	Hordeum murinum	Foxtail barely	Moderate
	Lolium perenne	Italian ryegrass	Moderate
	Paspalum dilatatum	Dallisgrass	-
Polygonaceae	*Rumex crispus*	Curly dock	Limited
Rosaceae	*Prunus dulcis*	Sweet Almond	-
	Rubus armeniacus	Himalayan blackberry	High
Viburnaceae	*Viburnum tinus*	Viburnum	-

[1] Cal-IPC Rating = Limited; Moderate; High

Attachment B

Representative Site Photographs

Photo 1. Annual grassland habitat. This photo was taken near the southeast corner of the Study Area, facing north.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 2. Annual grassland habitat. This photo was taken near the southwest corner of the Study Area, facing north.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 3. View of the blue oak woodland

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 4. Showing some of the developed/disturbed habitat including a portion of Browning Street.

Date. May 31, 2023 Photographer. Josh Goodwin

Photo 5. Showing some of the developed/disturbed habitat including a portion of Canby Road. This photo was taken near the northeast corner of the Study Area, facing in the southerly direction.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 6. A view of the riparian habitat and onsite intermittent drainage. This photo was taken near the northeast corner of the Study Area, facing in the westerly direction.

Date. April 14, 2022 Photographer. Josh Goodwin

Photo 7. The southern top of bank of the onsite drainage is highly disturbed due to a social trail.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 8. Showing the substrate of the onsite intermittent drainage at a narrow portion of the drainage.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 9. View of the small wetland located near the western boundary of the Study Area.

Date. April 14, 2022 Photographer. Josh Goodwin

Photo 10. Showing the larger of the two wetlands, occurring near the eastern boundary of the site, This photo was taken at the west end facing east.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 11. Another view of the larger wetland. This photo was taken at the east end, facing west.
Date. April 14, 2023 Photographer. Josh Goodwin

Photo 12. A buried culvert drains the larger wetland to the east.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 13. Showing the culvert that drains the larger wetland. Showing the culvert on the east side of Canby Road.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 14. Showing where the onsite intermittent drainage daylights on the eastside of Canby Road.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 15. Showing the Redding checkerbloom in flower.

Date. May 31, 2023 Photographer. Josh Goodwin

Photo 16. Showing the basal leaves of the Redding checkerbloom.

Date. May 31, 2023 Photographer. Josh Goodwin

Appendix F

Representative Site Photographs

Photo 1. Annual grassland habitat. This photo was taken near the southeast corner of the Study Area, facing north.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 2. Annual grassland habitat. This photo was taken near the southwest corner of the Study Area, facing north.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 3. View of the blue oak woodland

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 4. Showing some of the developed/disturbed habitat including a portion of Browning Street.

Date. May 31, 2023 Photographer. Josh Goodwin

Photo 5. Showing some of the developed/disturbed habitat including a portion of Canby Road. This photo was taken near the northeast corner of the Study Area, facing in the southerly direction.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 6. A view of the riparian habitat and onsite intermittent drainage. This photo was taken near the northeast corner of the Study Area, facing in the westerly direction.

Date. April 14, 2022 Photographer. Josh Goodwin

Photo 7. The southern top of bank of the onsite drainage is highly disturbed due to a social trail.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 8. Showing the substrate of the onsite intermittent drainage at a narrow portion of the drainage.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 9. View of the small wetland located near the western boundary of the Study Area.

Date. April 14, 2022 Photographer. Josh Goodwin

Photo 10. Showing the larger of the two wetlands, occurring near the eastern boundary of the site, This photo was taken at the west end facing east.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 11. Another view of the larger wetland. This photo was taken at the east end, facing west.
Date. April 14, 2023 Photographer. Josh Goodwin

Photo 12. A buried culvert drains the larger wetland to the east.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 13. Showing the culvert that drains the larger wetland. Showing the culvert on the east side of Canby Road.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 14. Showing where the onsite intermittent drainage daylights on the eastside of Canby Road.

Date. April 14, 2023 Photographer. Josh Goodwin

Photo 15. Showing the Redding checkerbloom in flower.

Date. May 31, 2023 Photographer. Josh Goodwin

Photo 16. Showing the basal leaves of the Redding checkerbloom.

Date. May 31, 2023 Photographer. Josh Goodwin

Attachment G

Transportation Impact Study for the Redding Canby Apartments

Draft Report

Transportation Impact Study for the Redding Canby Apartments

Prepared for the

City of Redding

February 27, 2023

490 Mendocino Avenue, Suite 201 **SANTA ROSA**, CA 95401 707.542.9500

w-trans.com

This page intentionally left blank

Table of Contents

Appendices

A. Collision Rate Calculations
B. Turn Lane Warrant Spreadsheets
C. Queuing Calculations
D. Intersection Level of Service Calculations

Executive Summary

The Redding Canby Apartments project would be located on the northwest corner of the Canby Road/ Browning Street intersection in the City of Redding and involves the development of 120 affordable apartments. The proposed project would be expected to generate an average of 577 trips per day, including 43 a.m. peak hour trips and 55 p.m. peak hour trips.

Pedestrian, bicycle, and transit facilities serving the proposed project site are adequate except for gaps in the existing sidewalk network on Browning Street and Canby Street. Installation of sidewalks to fill in the existing gaps along the project frontages and new ADA compliant curb ramps on the northwest corner of the Browning Street/Canby Road intersection are recommended for a continuous pedestrian travel path to and from surrounding sites.

Based on state guidance provided in the publication *Transportation Impacts (SB 743) CEQA Guidelines Update and Technical Advisory*, 2018, the project would be presumed to have a less-than-significant impact on vehicle miles traveled (VMT) as it would screen out as an affordable housing development.

Vehicles would access the project site via two new driveways, with one each on Browning Street and Canby Road. The driveway on Browning Street would only accommodate right-turns, while the driveway on Canby Road would provide full access. A left-turn lane would not be warranted on Canby Road at the proposed project full-access driveway. Sight distances at the proposed project driveway locations are adequate for entering and exiting drivers. It is recommended that any new signage, monuments, or other structures be positioned outside of the vision triangles of a driver waiting on the project driveways.

Proposed site access and on-site circulation are expected to function acceptably for emergency response vehicles with incorporation of applicable design standards into the site layout. Traffic from the proposed development would be expected to have a less-than-significant impact on emergency response times.

Maximum queues are expected to extend beyond the existing storage lengths for two of the study intersections under the volumes for various scenarios evaluated. However, the project does not increase queue lengths by an amount that would create an impact. Therefore, the proposed project would have a less-than-significant impact on queuing. Additionally, all study intersections are expected to operate at acceptable Levels of Service without and with the addition of project trips; therefore, the project's effect on operations would be considered acceptable.

The proposed passenger vehicle parking supply would satisfy City requirements.

Introduction

This report presents an analysis of the potential transportation impacts and operational effects that would be associated with development of the proposed Redding Canby Apartments to be located on the northwest corner of the Canby Road/Browning Street intersection in the City of Redding. The transportation study was completed in accordance with the criteria established by the City of Redding as outlined in the City's *Traffic Impact Analysis Guidelines*, January 2009, reflects a scope of work approved by City staff, and is consistent with standard traffic engineering techniques.

Prelude

The purpose of a transportation impact study (TIS) is to provide City staff and policy makers with data that they can use to make an informed decision regarding the potential transportation impacts of a proposed project, and any associated improvements that would be required to mitigate these impacts to an acceptable level under the California Environmental Quality Act (CEQA), the City's General Plan, or other policies. This report provides an analysis of those items that are identified as areas of environmental concern under CEQA and that, if significant, require an Environmental Impact Report (EIR). Impacts associated with access for pedestrians, bicyclists, and to transit; the vehicle miles traveled (VMT) generated by the project; potential safety concerns; and emergency access are addressed in the context of the CEQA criteria. While no longer a part of the CEQA review process, vehicular traffic service levels at key intersections were evaluated for consistency with General Plan policies 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 anticipated travel patterns specific to the proposed project, then analyzing the effect the new traffic would be expected to have on the study intersections and need for improvements to maintain acceptable operation. The adequacy of parking is also addressed as a policy issue.

Applied Standards and Criteria

The report is organized to provide background data that supports the various aspects of the analysis, followed by the assessment of CEQA issues and then the evaluation of policy-related issues. The CEQA criteria evaluated are as follows.

Would the project:

a. Conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?
b. Conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b)?
c. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?
d. Result in inadequate emergency access?

Project Profile

The proposed project includes 120 affordable apartment units on a site located on the northwest corner of Canby Road/Browning Street in the City of Redding. The project would be accessed via two new driveways, one each on Canby Road and Browning Street. The driveway on Canby Road would be full access, while the driveway on Browning Street would facilitate right-turn movements only both in and out of the site. The location of the project site is shown in Figure 1.

red026.ai 11/22

Transportation Impact Study for the Redding Canby Apartments

Figure 1 – Study Area and Existing Lane Configurations

W-Trans

Transportation Setting

Study Area and Periods

The study area varies depending on the topic. For pedestrian trips it consists of all streets within a half-mile of the project site that would lie along primary routes of pedestrian travel, or those leading to nearby generators or attractors. For bicycle trips it consists of all streets within one mile of the project site that would lie along primary routes of bicycle travel. For the safety and operational analyses, the study area was selected with input from City staff and consists of the following intersections:

1. Churn Creek Road/Canby Road
2. Hilltop Drive/Browning Street
3. Canby Road/Browning Street
4. Churn Creek Road/Browning Street
5. Canby Road/Old Alturas Road

Operating conditions during the weekday a.m. and 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 morning peak hour occurs between 7:00 and 9:00 a.m. and reflects conditions during the home to work or school commute, while 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. Counts were obtained for the study intersections on Tuesday, December 6, 2022, during typical traffic conditions and while local schools were in session.

Study Intersections

Churn Creek Road/Canby Road is a four-legged signalized intersection with protected left-turn phasing on all four approaches. Although the intersection is oriented on a skewed angle, for the purposes of this study, Churn Creek Road was considered to run north-south and Canby Road and Whistling Drive east-west. Crosswalks with pedestrian phasing are available on all four legs of the intersection. Class II bike lanes are striped on all but the east leg of the intersection.

Hilltop Drive/Browning Street is a signalized intersection with four legs. Protected left-turn phasing exists on the northbound and southbound approaches, while the eastbound and westbound approaches are split phased. Marked crosswalks with pedestrian phasing are provided across all four legs and Class II bike lanes are striped on the north and south Hilltop Drive legs.

Canby Road/Browning Street is a four-legged signalized intersection with protected left-turn phasing on all four approaches. Crosswalks with pedestrian phasing are available on the west and south legs of the intersection. Curb ramps are present on only the southwest corner of the intersection.

Churn Creek Road/Browning Street is a signalized intersection with protected left-turn phasing on all four approaches. Marked crosswalks with pedestrian phasing are provided on all four legs. Class II bike lanes are striped on the north, south, and east legs of the intersection.

Canby Road/Old Alturas Road is a tee intersection with all three approaches stop-controlled. Crosswalks exist on the north and east legs of the intersection.

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 (CHP) as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is June 1, 2017, through May 31, 2022.

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 *2019 Collision Data on California State Highways*, California Department of Transportation (Caltrans). These average rates statewide are for intersections in the same urban environment, with the same number of approaches (three or four), and the same controls (all-way stop or traffic signal). Two of the five study locations experienced crashes at a rate above the statewide average, so the records for these two intersections were reviewed further, as detailed below. The other three intersections had collisions rates below the statewide averages so appear to be operating acceptably with regards to safety. The collision rate calculations are provided in Appendix A.

Table 1 – Collision Rates for the Study Intersections

Study Intersection	Number of Collisions (2017-2022)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)
1. Churn Creek Rd/Canby Rd	4	0.18	0.24
2. Hilltop Dr/Browning St	15	**0.37**	0.24
3. Canby Rd/Browning St	2	0.08	0.24
4. Churn Creek Rd/Browning St	4	0.13	0.24
5. Canby Rd/Old Alturas Rd	5	**0.29**	0.07

Note: c/mve = collisions per million vehicles entering; **bold** text = rate is higher than statewide average

Of the 15 crashes reported at Hilltop Drive/Browning Street, eight were rear-end collisions, two each were broadside, hit object, or classified as “other” collisions, and one was a sideswipe. Five of the rear-end collisions were attributed to unsafe speed and three each occurred in the northbound and southbound directions. Given the wide variance in collision data, no clear trends could be identified; however, the fact that Hilltop Drive merges from two lanes to one lane approximately 350 feet north of intersection likely contributed to the rear-end collisions occurring in this direction of travel. Rear-end crashes are commonly associated with congestion and are more prevalent near lane merges. It is worth noting that only five total collisions have been reported since the onset of the COVID-19 public health pandemic despite accounting for approximately 45 percent of the study period so it is possible that COVID-19 has resulted in reduced volumes, congestion, and total collisions. It is recommended that the City continue to monitor the collision history of the intersection to determine if improvements are needed at a future date.

Although the calculated collision rate at Canby Road/Old Alturas Road is higher than the statewide average, only five total collisions occurred in a five-year period, or an average of one collision per year, which is not typically a cause for concern. Two out of five crashes were rear-end and broadside collisions and one was a vehicle/pedestrian collision that was attributed to a pedestrian right-of-way infraction. Given the limited data points available and the variance across the individual collision details, no clear safety issues were identified so no remedial actions are suggested.

Project Data

The project consists of 120 affordable apartment units to be located on the northwest corner of Canby Road/Browning Street. The proposed project site plan is shown in Figure 2.

Trip Generation

The anticipated trip generation for the proposed project was estimated using standard rates published by the Institute of Transportation Engineers (ITE) in *Trip Generation Manual*, 11th Edition, 2021 for "Affordable Housing – Income Limits" (LU #223) in a general urban/suburban location. Based on application of these rates, the proposed project would be expected to generate an average of 577 trips per day, including 43 trips during the a.m. peak hour and 55 trips during the p.m. peak hour. The results using the affordable housing rates are summarized in Table 2.

Table 2 – Trip Generation Summary

Land Use	Units	Daily		AM Peak Hour				PM Peak Hour			
		Rate	Trips	Rate	Trips	In	Out	Rate	Trips	In	Out
Affordable Housing	120 du	4.81	577	0.36	43	13	30	0.46	55	33	22

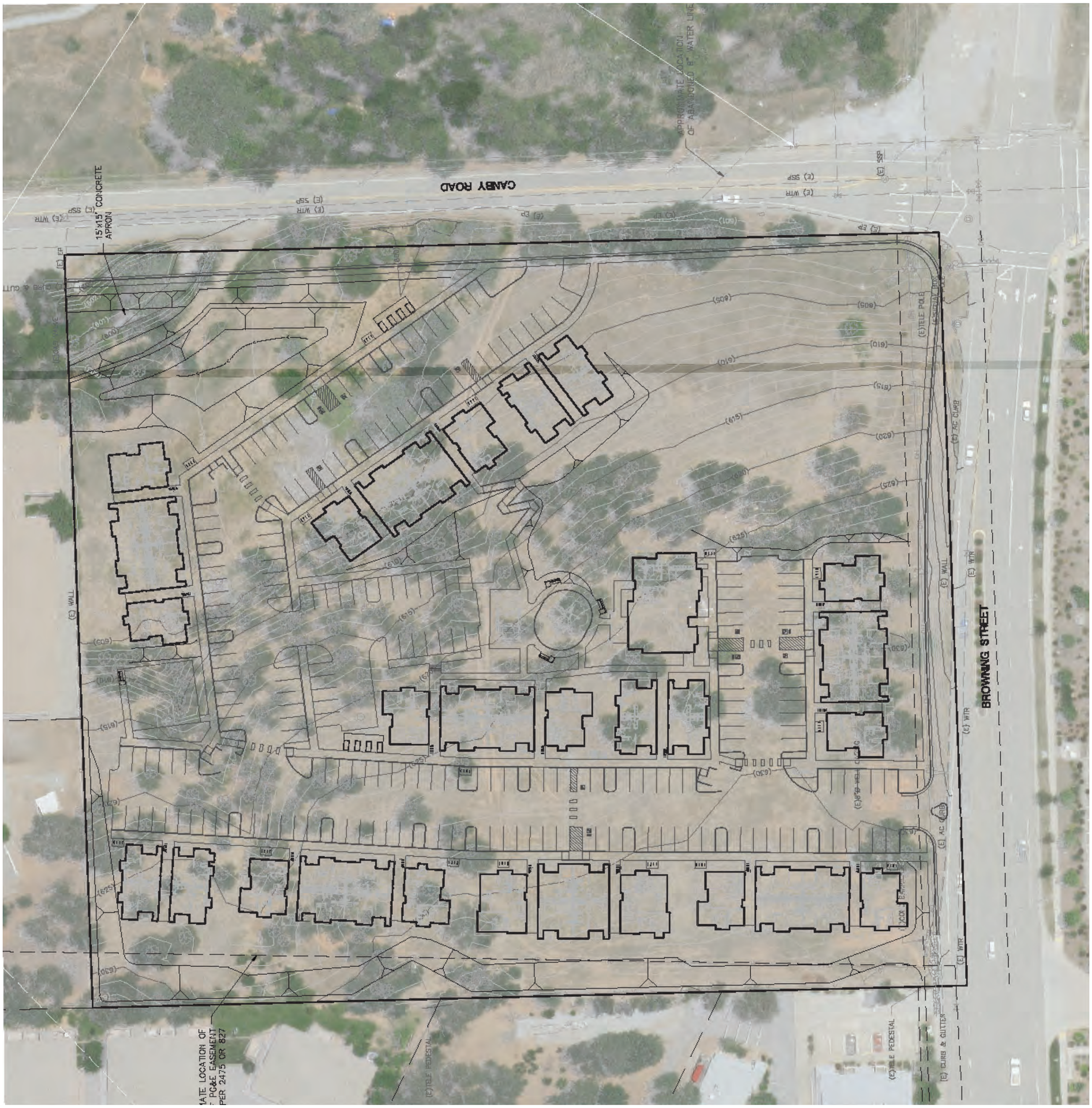
Note: du = dwelling unit

Trip Distribution

The pattern used to allocate new project trips to the surrounding roadway network was determined based on our familiarity with travel patterns in the area and likely origins and destinations for residents of the project. The applied trip distribution assumptions which were approved by City staff are shown in Table 3.

Table 3 – Trip Distribution Assumptions

Route	Percent
To/From Hilltop Dr North of Browning St	15
To/From Hilltop Dr South of Browning St	25
To/From Churn Creek Rd North of Canby Rd	15
To/From Churn Creek Rd South of Browning St	25
To/From Canby Rd South of Browning St	15
To/From Browning St East of Churn Creek Rd	5
TOTAL	**100**



Source: DG Group Architecture 2/23 red026.ai 2/23

Transportation Impact Study for the Redding Canby Apartments

Figure 2 – Site Plan

Circulation System

This section addresses the first transportation bullet point on the CEQA checklist, which relates to the potential for a project to conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities.

Pedestrian Facilities

Existing and Planned 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 exists to the south and west of the proposed project site throughout the commercial uses but is lacking along the project frontages and along Browning Street to the east. Existing sidewalk gaps along the frontages and 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.

- **Canby Road** – Intermittent sidewalk coverage is provided on Canby Road with significant gaps on both sides of the street to the north of Browning Street, including along the project frontage. Overhead streetlighting is provided.
- **Browning Street** – Continuous sidewalks are provided on both sides of Browning Street between Hilltop Drive and Old Alturas Road, except for along the project frontage and the segment between Canby Road and Churn Creek Road. Lighting is provided by overhead streetlights. Browning Street provides access to a mix of commercial and residential uses.
- **Churn Creek Road** – Sidewalks are provided along Churn Creek Road with a gap on the east side of the street to the north of Browning Street. Overhead streetlights are provided, with a large gap in lighting north of Browning Street.

According to the *Redding Active Transportation Plan* (ATP), 2018, planned pedestrian facilities include a multi-use pathway on Browning Street and sidewalk coverage on Canby Road and Churn Creek Road north of Browning Street. The provision of these facilities would fill in the existing sidewalk gaps and improve connectivity for pedestrians in the surrounding vicinity.

Pedestrian Safety

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue for pedestrians. During the five-year study period previously stated, there were three reported collisions involving pedestrians at the study intersections: two at Hilltop Drive/Browning Street and one at Canby Road/Old Alturas Road. The single collision at Canby Road/Old Alturas Road along with one of the collisions reported at Hilltop Drive/Browning Street were attributed to pedestrian right-of-way violations and the other collision at Hilltop Drive/Browning Street was attributed to unsafe speed; the latter collision involved a pedestrian walking south and an eastbound motorist, though no further details are available.

As the intersection of Hilltop Drive/Browning Street is signalized and has pedestrian phases on all four legs, the City may wish to implement an early release pedestrian interval to allow pedestrians to establish themselves in the crosswalk prior to vehicles being given the green light. This improvement could be accomplished with adjustments to the traffic signal timing.

The crossing of Canby Road at its all-way stop-controlled intersection with Old Alturas Road is about 70 feet long, putting pedestrians in conflict for a long distance. Further, as there is diagonal parking on the west side of the street pedestrians entering from that side may be hidden behind parked vehicles until they are well into the crosswalk. To enhance pedestrian visibility, the City may wish to evaluate the feasibility of installing a bulb-out on the east side of the street and converting the existing painted triangle on the north side of the crosswalk on the west side of the street into an island that extends slightly into the travel lane, creating a bulb-out to shadow the one on the east.

Project Impacts on Pedestrian Facilities

Given the proximity of commercial and residential land uses within the vicinity of the project site, it is reasonable to assume that some project residents will want to walk between these uses and the project site. As a result, sidewalks should be constructed along the project frontages on Browning Street and Canby Road and ADA compliant curb ramps should be built on the northwest corner of the Canby Road/Browning Street intersection. The new sidewalk along the Canby Road frontage should tie into the existing section of sidewalk on the parcel to the north. With the provision of these facilities, the project site would be adequately connected to the surrounding pedestrian network.

Finding – Sidewalk gaps currently exist along Browning Street and Canby Street near the proposed project site.

Recommendation – The proposed project should include construction of sidewalks along its frontages with Browning Street and Canby Road and new ADA-compliant curb ramps on the northwest corner of the Browning Street/Canby Road intersection.

Bicycle Facilities

Existing and Planned Bicycle Facilities

The *Highway Design Manual*, Caltrans, 2020, 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.

Class II bike lanes exist on numerous streets surrounding the project site. Table 4 summarizes the existing and planned bicycle facilities in the project vicinity, as contained in the City's ATP.

Table 4 – Bicycle Facility Summary				
Status **Facility**	**Class**	**Length (miles)**	**Begin Point**	**End Point**
Existing				
Churn Creek Rd	II	0.63	College View Dr	Palacio Dr
		0.52	Bodenhamer Blvd	Browning St
		3.44	Dana Dr	S Bonnyview Rd
Churn Creek Rd	IIB	0.45	Palacio Dr	Bodenhamer Blvd
		0.47	Browning St	Dana Dr
Browning St	II	0.64	Churn Creek Rd	Old Alturas Rd
Old Alturas Rd	II	0.67	Churn Creek Rd	Victor Ave
Hilltop Dr	II	2.25	Lake Blvd	Dana Dr
Planned				
Browning St	I	1.00	Hilltop Dr	Old Alturas Rd
Churn Creek Rd	IIB	3.42	Dana Dr	S Bonnyview Rd
Old Alturas Rd	IV	1.49	Browning St	Abernathy Ln
Hilltop Dr	IV	1.24	Hilltop Springs Senior Living	Palisades Ave

Notes: B = Buffered bike lane
Source: *Redding Active Transportation Plan*, City of Redding, 2018

Bicyclist Safety

Collision records for the study area were reviewed to determine if there had been any bicyclist-involved crashes. During the five-year study period previously noted, there was one reported collision involving a bicyclist at the Hilltop Drive/Browning Street intersection. The rear-end collision involved a southbound cyclist and a southbound motorist and was attributed to a "hazardous movement" by the cyclist for stopping in the road. No remedial measures appear warranted as the single crash recorded was the fault of the cyclist.

Project Impacts on Bicycle Facilities

Existing bicycle facilities on Churn Creek Road, Browning Street, Old Alturas Road, and Hilltop Drive together with shared use of minor streets provide adequate access for bicyclists. Connectivity would be further improved upon the completion of planned facilities outlined in the City's ATP. A Class I pathway is planned for Browning Street between Hilltop Drive and Old Alturas Road so it is recommended that the applicant coordinate with the City to determine what, if any, right-of-way needs to be dedicated to the City for this pathway.

Finding – Existing bicycle facilities are currently adequate and will be improved upon completion of planned facilities identified in the City's ATP.

Recommendation – The project applicant should coordinate with the City regarding the extent of the frontage improvements on Browning Street and whether or not any right-of-way needs to be dedicated to the City for the planned Class I pathway.

Bicycle Storage

The proposed project site plan includes 90 short-term bicycle parking racks and 10 long-term bicycle locker spaces. The City of Redding Municipal Code Section 10.21.050 states that bicycle parking requirements shall conform to Section 5.106.4 of the California Green Building Standards (CalGreen) Code. According to this code, the number of short-term and long-term bicycle parking stalls must be equal to or greater than five percent of the number of motorized vehicle parking spaces provided. The site plan shows that 212 vehicle parking spaces would be provided, so a minimum of 11 bicycle parking spaces would be needed. The proposed bike parking supply of 100 spaces would therefore be more than adequate.

Finding – The proposed bicycle parking supply of 90 short-term racks and 10 covered bike lockers would be more than adequate to meet applicable requirements.

Transit Facilities

Existing Transit Facilities

The Redding Area Bus Authority (RABA) provides fixed-route bus service in the City of Redding and surrounding cities including Shasta Lake and Anderson. The bus stops closest to the project site are at Browning Street/Mission De Oro Drive approximately 700 feet west of the proposed project site, Churn Creek Road/Browning Street, approximately 900 feet east of the proposed project site, and the Canby Transfer Center located about 0.3 miles south of the proposed project site. Existing transit routes and their operations are summarized in Table 5.

Table 5 – Transit Routes

Transit Agency Route	Distance to Stop (mi)[1]	Service			Connection
		Days of Operation	Time	Frequency	
Redding Area Bus Authority (RABA)					
Route #4 SB	0.25	Mon – Fri Sat	6:20 a.m. – 6:20 p.m. 9:20 a.m. – 6:20 p.m.	1 hour 1 hour	Canby Transfer Center to Bechelli/Knollcrest
Route #6 N	0.12	Mon – Sat	7:20 a.m. – 6:20 p.m.	1 hour	Canby Transfer Center to Shasta College
Route #6 S	0.25	Mon – Fri Sat	6:50 a.m. – 6:50 p.m. 9:50 a.m. – 6:50 p.m.	1 hour 1 hour	Canby Transfer Center to Southern Redding
Route #11	0.24	Mon – Fri Sat	6:20 a.m. – 6:20 p.m. 9:20 a.m. – 6:20 p.m.	1 hour 1 hour	Canby Transfer Center to Downtown Transit Center
Route #14	0.24	Mon – Fri Sat	6:20 a.m. – 6:20 p.m. 9:20 a.m. – 6:20 p.m.	1 hour 1 hour	Downtown Transit Center to Canby Transfer Center

Note: [1] Defined as the shortest walking distance between the project site and the nearest bus stop
Source: cityofredding.org

Three bicycles can be carried on all RABA buses. Bike rack space is on a first come, first served basis. All riders are responsible for loading and unloading their bicycles.

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. RABA Paratransit is designed to serve the needs of individuals with disabilities within the greater Redding area. Service hours are generally between 6:20 a.m. to 7:30 p.m. on weekdays and 9:20 a.m. to 7:30 p.m. on Saturdays.

Impact on Transit Facilities

Transit load factors would be spread out across multiple headways; therefore, the volume of transit riders expected to be generated by the project is not anticipated to exceed the carrying capacity of the existing transit services near the project site and existing transit routes are adequate to accommodate project-generated transit trips. Additionally, there are multiple existing bus stops within acceptable walking distance of the site.

Finding – Transit facilities serving the project site are adequate.

Significance Finding – The proposed project would have a less-than-significant impact on pedestrian, bicycle, and transit modes as long as sidewalks are constructed along the project frontages, ADA-complaint curb ramps at the Browning Street/Canby Road intersection, and width is provided for the planned Class I bike facility on Browning Street. With these improvements, the project would be consistent with policies and plans for these modes.

Vehicle Miles Traveled (VMT)

The potential for the project to conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b) was evaluated based the project's anticipated Vehicle Miles Traveled (VMT).

Project VMT Impact

Senate Bill (SB) 743 established VMT as the metric to be applied for determining transportation impacts associated with development projects. Like many other jurisdictions in California, the City of Redding has not yet adopted a policy or thresholds of significance regarding VMT so the project-related VMT impacts were assessed based on guidance provided by the California Governor's Office of Planning and Research (OPR) in the publication *Technical Advisory on Evaluating Transportation Impacts (SB 743) CEQA Guidelines Update and Technical Advisory*, 2018. This document identifies several criteria that may be used by jurisdictions to identify certain types of projects that are unlikely to have a VMT impact and can be "screened" from further VMT analysis. One of these screening criteria pertains to 100 percent affordable residential developments. The project can be presumed to have a less-than-significant transportation impact on VMT under this criterion as the project would provide 100 percent affordable housing.

Significance Finding – Based on guidance provided by the state of California, the proposed project would screen out from further VMT analysis with a presumed less-than-significant impact as an affordable housing development.

Safety Issues

The potential for the project to impact safety was evaluated in terms of the adequacy of sight distance and need for turn lanes at the project accesses as well as the adequacy of stacking space in dedicated turn lanes at the study intersections to accommodate additional queuing due to adding project-generated trips. This section addresses the third transportation bullet on the CEQA checklist which is whether or not the project would substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).

Site Access

The proposed project would be accessible via two new driveways, with one each on the north side of Browning Street and on the west side of Canby Road. Only right-turns both in and out of the driveway on Browning Street would be permitted and a triangular-shaped raised concrete island would be constructed to physically prohibit left-turn maneuvers. The driveway on Canby Road would provide full access so motorists entering from destinations to the west or exiting to destinations to the east would be able to use the signalized intersection of Browning Street/Canby Road to complete their left turns and enter/exit at the Canby Road driveway. To deter eastbound motorists on Browning Street from attempting to turn left into the project driveway, it is recommended that signage be installed on the south side of the street indicating that left turns are not allowed (R3-2 sign). Additionally, a right turn only sign (R3-5 (R)) should be installed in the concrete island facing motorists on the driveway approach and a "Do Not Enter" (R5-1) sign should be installed on the back side facing eastbound Browning Street motorists. Further, it is recommended that a right-turn pavement legend be marked on the driveway approach.

Finding – The right-turn only driveway on Browning Street combined with the full access driveway on Canby Road would result in acceptable site access.

Recommendation – In addition to the proposed "pork chop" style concrete island, the Browning Street driveway should include the following signing and striping enhancements.

- A "No Left Turn" sign on the south side of Browning Street facing eastbound motorists.
- A "Right Turn Only" sign in the concrete island facing the driveway approach.
- A "Do Not Enter" sign in the concrete island facing eastbound motorists.
- A right turn pavement legend on the driveway approach.

Sight Distance

At unsignalized intersections and driveways, a substantially clear line of sight should be maintained between the driver of a vehicle waiting at the crossroad and the driver of an approaching vehicle. Adequate time should be provided for the waiting vehicle to either cross, turn left, or turn right, without requiring the through traffic to radically alter their speed.

Sight distances along Canby Road and Browning Street at the proposed project driveway locations were evaluated based on sight distance criteria contained in the *Highway Design Manual* published by Caltrans. The recommended sight distances for minor street approaches that are a driveway are based on stopping sight distance, with approach travel speeds used as the basis for determining the recommended sight distance. Additionally, the stopping sight distance needed for a following driver to stop if there is a vehicle waiting to turn into a side street or driveway is evaluated based on stopping sight distance criterion and the approach speed on the major street.

Browning Street has a posted speed limit of 35 miles per hour (mph) and Canby Road has a posted speed limit of 30 mph northbound and 35 mph southbound. For speeds of 30 mph, the minimum stopping sight distance needed is 200 feet, while speeds of 35 mph require 250 feet. Field measurements were obtained to and from the position of a vehicle waiting at the locations of the proposed driveway approaches. At the Browning Street driveway location, sight lines were determined to extend more than 400 feet to the east through the intersection with Canby Road, which is more than adequate for the posted speed limit. Left turns would be physically restricted at this driveway so sight lines to the west were not measured.

At the proposed driveway location on Canby Road, sight lines were determined to extend approximately 500 feet to the north and 300 feet to the south, both of which are adequate for the respective speed limits in each direction. Additionally, adequate following sight distance is available on the major street approaches to each driveway for a motorist to observe and react to a preceding motorist slowing or stopped waiting to turn into the driveway. As a result, sight lines are adequate to accommodate right turns at the Browning Street driveway and all turns at the Canby Road driveway. To preserve existing sight lines, any new signage, monuments, or other structures should be positioned outside of the vision triangles of a driver waiting on the project driveways.

Finding – Sight lines are adequate to accommodate right turns at the Browning Street driveway and all turns at the Canby Road driveway.

Recommendation – To preserve existing sight lines, any new signage, monuments, or other structures should be positioned outside of the vision triangles of a driver waiting on the project driveways.

Left-Turn Lane Warrants

The need for a left-turn lane on Canby Road at the project driveway was evaluated based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as an update of the methodology developed by the Washington State Department of Transportation and published in the *Method for Prioritizing Intersection Improvements*, January 1997. The NCHRP report references a methodology developed by M. D. Harmelink that includes equations that can be applied to expected or actual traffic volumes to determine the need for a left-turn pocket based on safety issues.

Under Future plus Project volumes, which represent worst-case conditions, a left-turn lane would not be warranted at the project driveway during either of the peak periods evaluated. Copies of the turn lane warrant spreadsheets are provided in Appendix B.

Finding – Installation of a left-turn lane would not be warranted at the Canby Road driveway.

Queuing

Queuing in the dedicated turn pockets at the study intersections was evaluated to determine if the addition of project trips would cause any queues to extend beyond the available stacking space. Under each scenario, the projected 95th percentile queues in dedicated turn pockets at the study intersections were determined using the Synchro software package. The storage lengths for left-turn lanes which are preceded by two-way left-turn lanes (TWLTLs) were measured to the point where vehicles could queue in the TWLTL before restricting access to the nearest driveway. Summarized in Table 6 are the predicted queue lengths. Copies of the queueing reports are contained in Appendix C.

Table 6 – 95th Percentile Queues in Dedicated Turn Lanes									
Study Intersection	**Available**	**95th Percentile Queues**							
Turn Lane	**Storage**	**AM Peak Hour**				**PM Peak Hour**			
		E	**E+P**	**F**	**F+P**	**E**	**E+P**	**F**	**F+P**
1. Churn Creek Rd/Canby Rd									
Northbound Left Turn	115	25	25	28	28	21	21	24	24
Northbound Right Turn	160	40	40	44	44	0	0	0	0
Southbound Left Turn*	510	172	172	288	288	44	45	210	211
Eastbound Left Turn	210	56	59	63	68	92	94	110	112
2. Hilltop Dr/Browning St									
Northbound Left Turn	180	12	12	13	13	58	58	70	70
Northbound Right Turn	250	14	14	15	15	21	21	25	25
Southbound Left Turn*	320	108	111	162	163	224	231	262	270
Westbound Left Turn	140	129	133	**188**	**193**	**158**	**164**	**190**	**195**
3. Canby Rd/Browning St									
Northbound Left Turn*	440	37	38	37	38	106	109	117	120
Southbound Left Turn	55	24	30	27	32	21	27	21	27
Southbound Right Turn	65	43	43	43	43	12	12	13	13
Eastbound Left Turn	175	59	68	64	70	82	99	84	100
Westbound Left Turn*	320	11	11	11	11	37	37	38	38
4. Churn Creek Rd/Browning St									
Northbound Left Turn*	390	69	74	76	79	181	191	209	218
Southbound Left Turn	135	94	94	106	106	65	65	81	81
Southbound Right Turn	125	0	0	2	2	0	0	7	7
Eastbound Left Turn*	120	83	83	**150**	**150**	115	115	**140**	**140**
Westbound Left Turn*	710	32	32	33	33	20	20	23	23

Notes: Maximum Queue based on the 95th percentile queue lengths of Synchro; all distances are measured in feet; E = existing conditions; E+P = existing plus project conditions; F = future conditions; F+P = future plus project conditions; *Storage length takes into consideration adjacent TWLTL; **Bold** text = queue length exceeds available storage

Queues are anticipated to extend beyond the stacking length of 140 feet for westbound left turns at Hilltop Drive/Browning Street under all scenarios during the p.m. peak hour and under the future scenarios during the a.m. peak hour; however, the queues would already be expected to exceed available storage without project trips so the proposed project would not *cause* the condition, but rather extend the already deficient queue by less than one vehicle length. Queuing is generally considered a safety concern when a queue is extended just beyond the length of a turn lane so that part of a vehicle is protruding into the adjacent through lane, or when the back of a queue is extended to a point where adequate stopping sight distance is no longer available approaching the queue; the project would not cause either of these conditions to occur as there is adequate following sight distance on the westbound approach to the intersection. Therefore, the project-specific impact would be considered less-than-significant.

Similarly, while eastbound left turn queues are anticipated to exceed available storage length at Churn Creek Road/Browning Street under future volumes, the queue would already exceed the storage length without project trips and the project would not increase the queue so the impact would be considered less-than-significant.

Further, queues would stack in the TWLTL and while this would briefly restrict left turn movements into and out to the Chevron gas station driveway so would not be desirable operationally, there would be no safety concerns associated with this condition since vehicles would have a dedicated space to stack outside of the travel lanes.

Finding – The proposed project would have a less-than-significant impact on queueing.

Significance Finding – The proposed project would not cause any new hazards as available sight distance at the driveway locations is adequate and no queues would be impacted.

Emergency Access

The final transportation bullet on the CEQA checklist requires an evaluation as to whether the project would result in inadequate emergency access or not.

Adequacy of Site Access

The project site would be accessed via proposed driveway connections on the west side of Canby Road and north side of Browning Street. While the site plan is still preliminary, it is anticipated that all aspects of the site, including driveway widths and turning radii, would be designed in accordance with applicable standards; therefore, access would be expected to function acceptably for emergency response vehicles. It should also be noted that the project site would have two access points so should one means of access be compromised during an emergency, responders would be able to use another access point to reach the site.

Off-Site Impacts

While the project would be expected to result in slight increases in delay at the study intersections, emergency response vehicles can claim the right-of-way by using their lights and sirens; therefore, the project would be expected to have a nominal effect on emergency response times.

Finding – Emergency access and circulation are anticipated to function acceptably with incorporation of applicable design standards into the site layout and traffic from the proposed development would be expected to have a less-than-significant impact on emergency response times.

Significance Finding – The project would be expected to have a less-than-significant impact on emergency response.

Capacity Analysis

Because the proposed project would result in more than 35 new peak hour trips, an analysis of the project's potential effects on operation of the surrounding roadway network was prepared to demonstrate consistency with the City's General Plan, as required by the City's TIS Guidelines.

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, 6th Edition. 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 intersection of Canby Road/Old Alturas Road has stop signs on all approaches so was 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 other four study intersections are currently controlled by traffic signals so 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. Delays were calculated using actual signal timing parameters obtained from City of Redding staff. The ranges of delay associated with the various levels of service are indicated in Table 7.

Table 7 – 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, 2018

Traffic Operation Standards

City of Redding

Per the City of Redding's *2000-2020 General Plan*, the City strives to maintain LOS C operation for most arterials and their intersections, except within the Downtown area where LOS D is considered acceptable. Additionally, LOS D is considered acceptable for streets and intersections on the state highway network and river-crossing street corridors where capacity is affected by adjacent intersections. This applies to the overall operation of the intersection at signalized locations and to the worst-case movement on the stop-controlled approach(es) at unsignalized locations. A project would have an adverse effect on the surrounding transportation system if it would cause any study intersection to exceed the acceptable threshold for the facility. Based on the City of Redding's General Plan and TIA Guidelines, a standard of LOS C was applied to all study intersections. The following thresholds were used to determine if an effect would be considered adverse.

Signalized intersections: The project is considered to have an adverse effect if:

- The project causes an acceptable LOS to decline to an unacceptable LOS; or:
- The project increases the overall average delay by more than 5 seconds per vehicle at an intersection having an unacceptable LOS without project traffic.

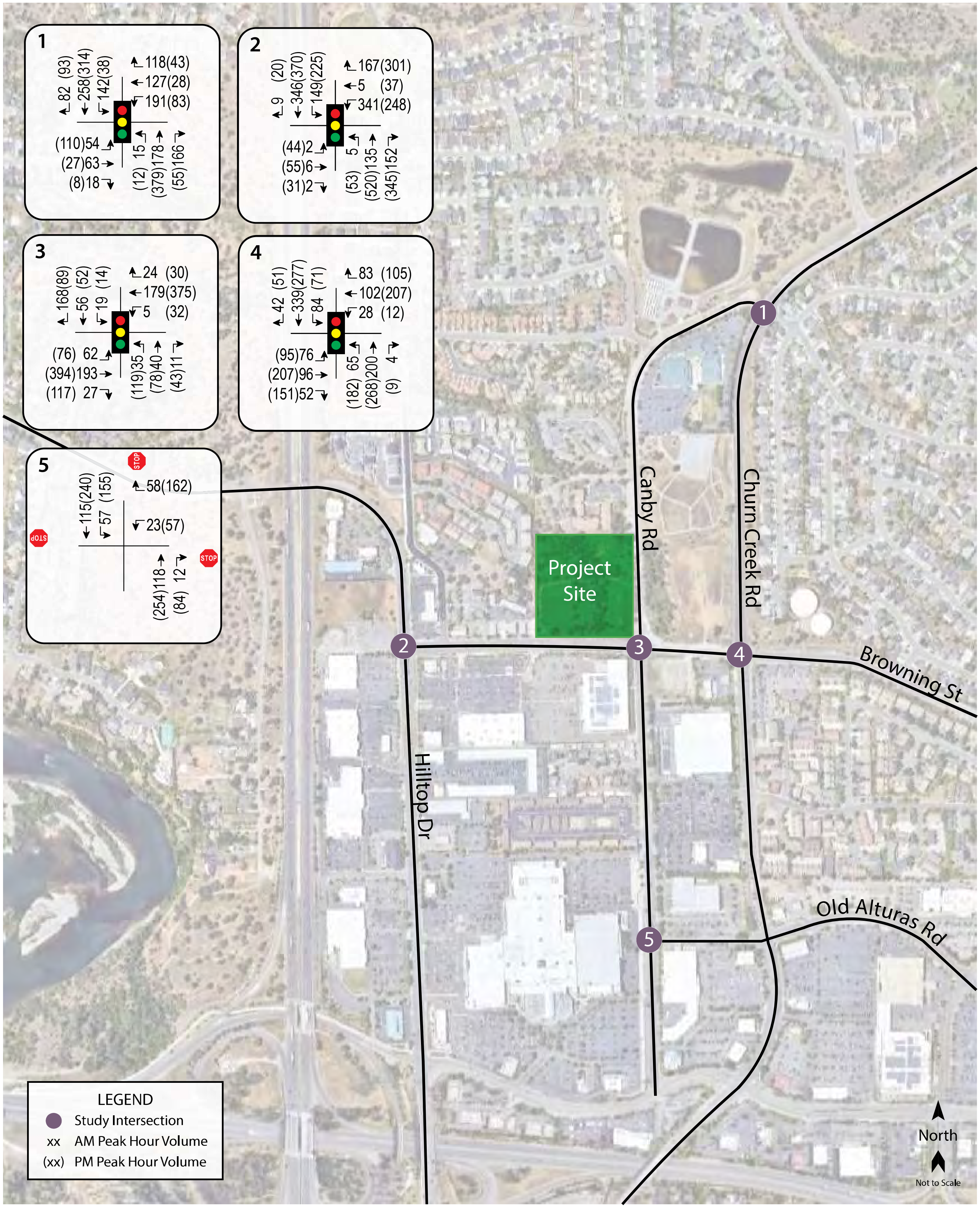
Unsignalized Intersections: The project is considered to have an adverse effect if:

- The LOS declines to an unacceptable LOS; and
- The volume to capacity ratio exceeds 0.75; and
- The 95th percentile queue exceeds 75 feet (3 vehicles); or
- The project causes the worst-case movement's acceptable LOS to decline to an unacceptable LOS and the peak hour volume signal warrant is met; or
- The project increases the average delay for the worst-case movement by more than 5 seconds per vehicle at an intersection that has an unacceptable LOS without the project and the intersection also meets the peak hour volume signal warrant.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the weekday a.m. and p.m. peak periods. This condition does not include project-generated traffic volumes. Volume data was collected on Tuesday, December 6, 2022, while local schools were in session. Peak hour factors (PHFs) were calculated based on the counts obtained and used in the analysis, unless the PHF was calculated to be less than 0.85 in which case this value was used as a "floor" to avoid overly conservative results.

Under existing conditions, all intersections operate acceptably at LOS C or better during both peak hours. The existing traffic volumes are shown in Figure 3. A summary of the intersection Level of Service calculations is contained in Table 8, and copies of the calculations are provided in Appendix D.



red026.ai 11/22

Transportation Impact Study for the Redding Canby Apartments

Figure 3 – Existing Traffic Volumes

Table 8 – Existing Peak Hour Intersection Levels of Service				
Study Intersection	**AM Peak**		**PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**
1. Churn Creek Rd/Canby Rd	26.2	C	19.8	B
2. Hilltop Dr/Browning St	13.2	B	28.2	C
3. Canby Rd/Browning St	14.6	B	17.8	B
4. Churn Creek Rd/Browning St	15.9	B	19.0	B
5. Canby Rd/Old Alturas Rd	8.5	A	13.3	B

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Baseline Conditions

A list of pending development projects throughout the City was obtained from City of Redding staff and was reviewed. It was determined that none of the pending projects would be expected to generate an appreciable amount of traffic through the study intersections; therefore, a Baseline (Existing plus Approved) conditions scenario was not analyzed. However, the cumulative effect of these pending development projects would reasonably be captured in the Future Conditions analysis.

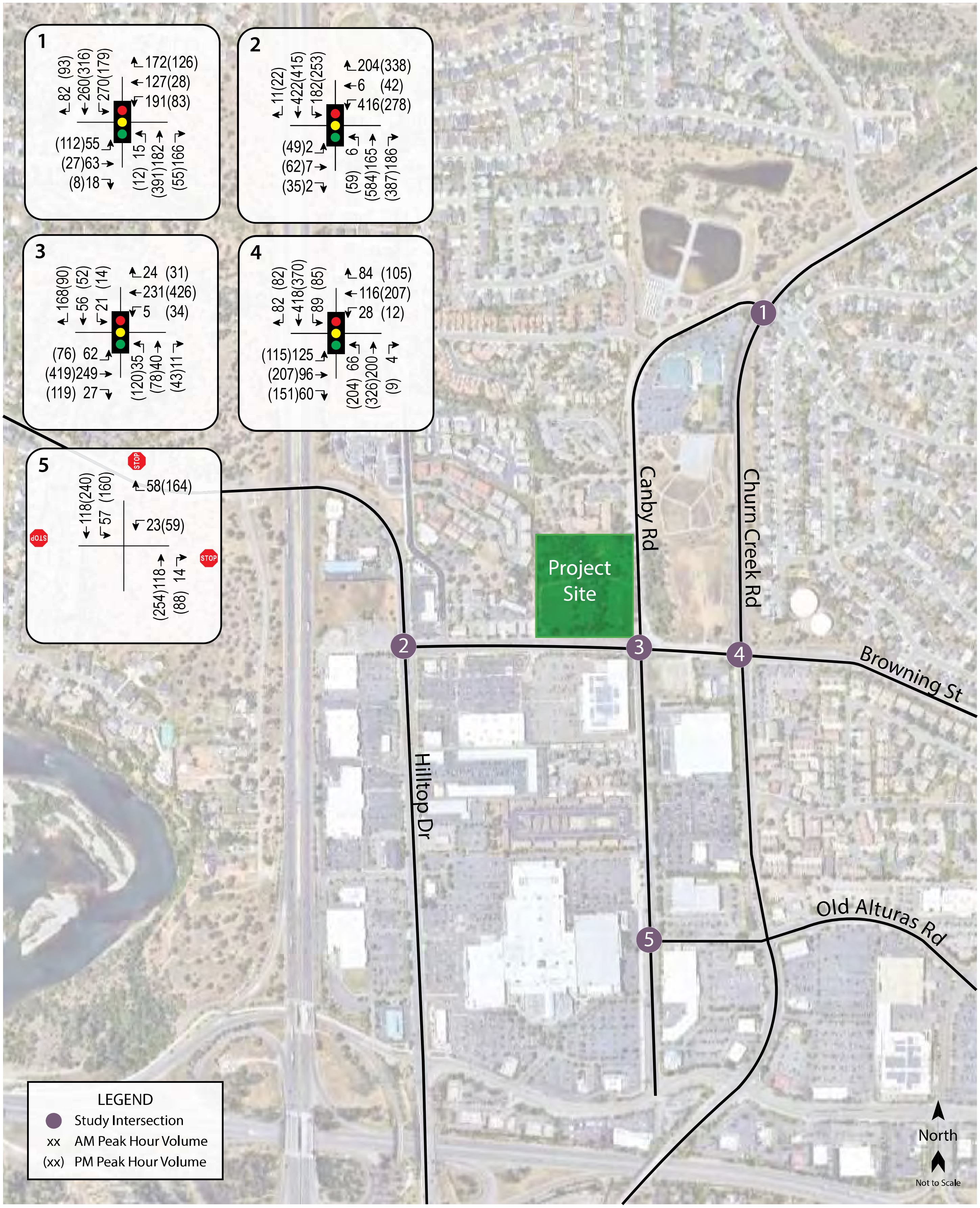
Future Conditions

Segment volumes for the horizon year of 2040 were obtained from the Shasta Regional Transportation Agency (SRTA) travel demand model and translated to turning movement volumes at each of the study intersections using a combination of the "Furness" method and factoring, depending on how the model was configured at each intersection. The Furness method is an iterative process that employs existing turn movement data, existing link volumes, and future link volumes to project likely turning future movement volumes at intersections. A computer application of the Furness procedure was used to produce the future intersection turning movement volumes.

Under the anticipated Future volumes, and with no changes to the existing configurations and controls other than routine signal timing adjustments that would be expected to occur over time, the study intersections are expected to operate acceptably at LOS C or better during both peak hours. Operating conditions are summarized in Table 9 and future volumes are shown in Figure 4.

Table 9 – Future Peak Hour Intersection Levels of Service				
Study Intersection	**AM Peak**		**PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**
1. Churn Creek Rd/Canby Rd	33.2	C	25.0	C
2. Hilltop Dr/Browning St	14.9	B	32.8	C
3. Canby Rd/Browning St	14.8	B	18.5	C
4. Churn Creek Rd/Browning St	19.2	B	20.8	C
5. Canby Rd/Old Alturas Rd	8.5	A	13.4	B

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service



red026.ai 11/22

Transportation Impact Study for the Redding Canby Apartments

Figure 4 – Future Traffic Volumes

W-Trans

Project Conditions

Existing plus Project Conditions

Upon the addition of project-related traffic to the Existing volumes, the study intersections are expected to continue operating acceptably at the same Levels of Service as without project trips. These results are summarized in Table 10 and Project traffic volumes are shown in Figure 5.

Table 10 – Existing and Existing plus Project Peak Hour Intersection Levels of Service

Study Intersection	Existing Conditions				Existing plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Churn Creek Rd/Canby Rd	26.2	C	19.8	B	26.3	C	20.0	B
2. Hilltop Dr/Browning St	13.2	B	28.2	C	13.9	B	29.0	C
3. Canby Rd/Browning St	14.6	B	17.8	B	14.8	B	18.2	B
4. Churn Creek Rd/Browning St	15.9	B	19.0	B	16.0	B	19.3	B
5. Canby Rd/Old Alturas Rd	8.5	A	13.3	B	8.6	A	13.3	B

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – The study intersections would continue operating acceptably with project traffic added to existing volumes so the project's near-term effect would be considered acceptable.

Future plus Project Conditions

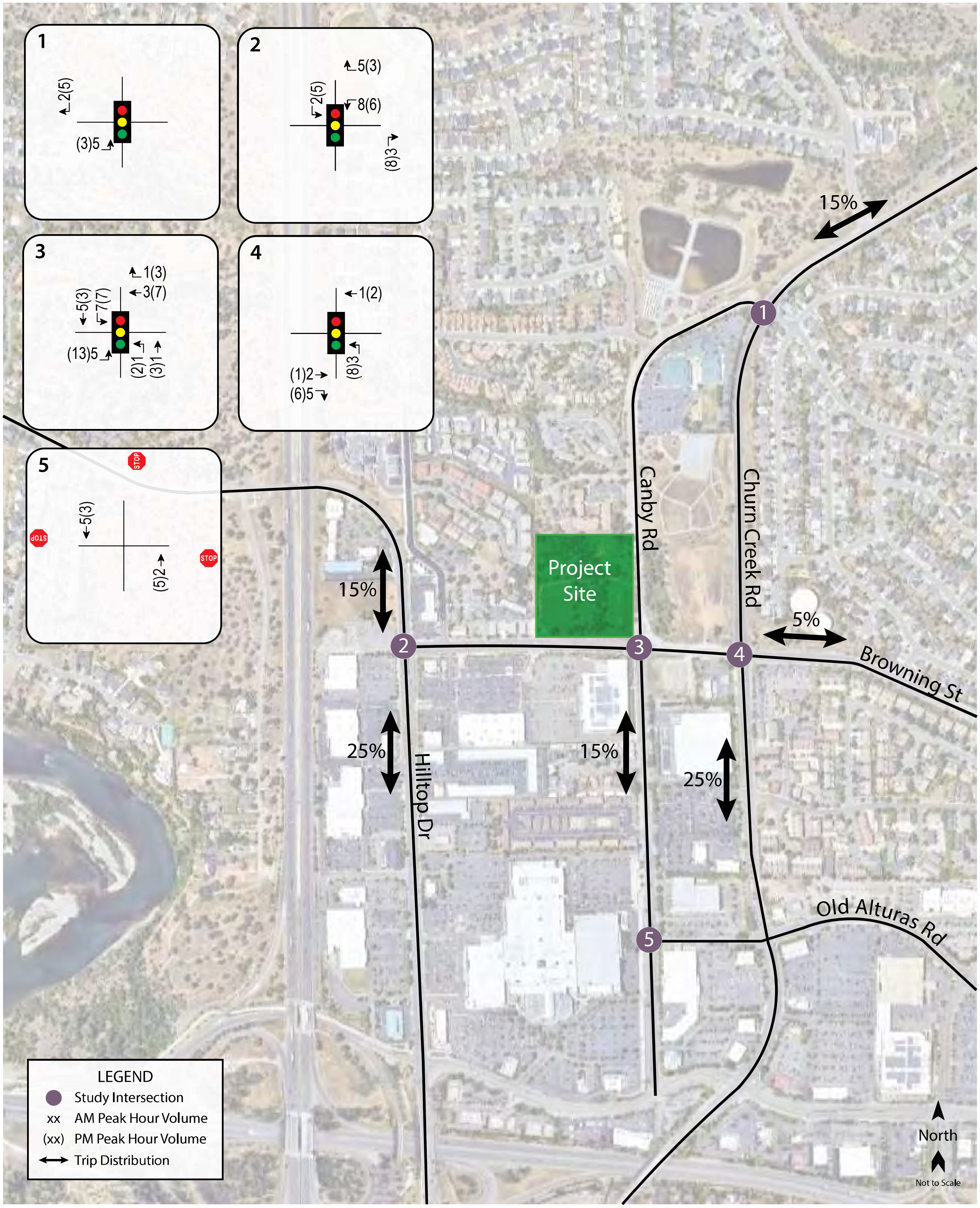
Upon the addition of project-generated traffic to the anticipated Future volumes, the study intersections are expected to operate acceptably at the same Levels of Service as without project traffic. The Future plus Project operating conditions are summarized in Table 11.

Table 11 – Future and Future plus Project Peak Hour Intersection Levels of Service

Study Intersection	Future Conditions				Future plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1. Churn Creek Rd/Canby Rd	33.2	C	25.0	C	33.3	C	25.0	C
2. Hilltop Dr/Browning St	14.9	B	32.8	C	15.0	B	33.4	C
3. Canby Rd/Browning St	14.8	B	18.5	B	15.0	B	19.2	B
4. Churn Creek Rd/Browning St	19.2	B	20.8	C	19.4	B	21.1	C
5. Canby Rd/Old Alturas Rd	8.5	A	13.4	B	8.6	A	13.6	B

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service

Finding – The study intersections would continue operating acceptably with project traffic added to the anticipated future volumes; therefore, the project's long-term effect on operations would be considered acceptable.



red026.ai 11/22

Transportation Impact Study for the Redding Canby Apartments

Figure 5 – Project Traffic Volumes and Trip Distribution

W-Trans

Parking

The project was analyzed to determine whether the proposed parking supply would be sufficient to satisfy City requirements. The project site as proposed would have a total of 212 vehicle parking spaces, including 10 ADA spaces.

Jurisdiction parking supply requirements are based on the City of Redding Municipal Code, Chapter 18.41; Off-Street Parking and Loading for “Multiple-family dwelling”. The City Code requires multi-family housing developments to provide parking at a rate of 1.5 parking spaces per one-bedroom unit, 1.75 spaces per two-bedroom unit, and two parking spaces for units with three or more bedrooms. Additionally, one guest space is required for every five units beyond the initial 30 units. Based on the proposed unit mix of 32 one-bedroom units, 56 two-bedroom units, 28 three-bedroom units, and four units with four bedrooms, a total of 228 passenger vehicle parking spaces would need to be provided on-site. The proposed parking supply of 212 spaces would therefore be short by 16 spaces.

Because the proposed supply would not satisfy City requirements, the anticipated peak parking demand was estimated using standard rates published by ITE in *Parking Generation*, 5th Edition, 2019. The 85th-percentile parking demand for the project was estimated using the published standard rates for “Affordable Housing – Income Limits” (ITE LU#223). Based on these rates, the peak parking demand is anticipated to be 160 spaces; the proposed supply would be more than adequate for the anticipated peak demand.

The proposed project has requested a California Density Bonus Parking Concession, which limits the amount of parking a jurisdiction can require for a project. If granted, this would decrease the required parking for the proposed project by at least 18 spaces to a minimum requirement of 110 spaces.

The proposed parking supply, expected demand, City of Redding requirements, and California Density Bonus Parking Concession limitations are shown in Table 12.

Table 12 – Parking Analysis			
Land Use	**Units**	**Rate**	**Parking Spaces**
City Required Parking			
Multiple-family Dwelling			
1-bedroom unit	32 du	1.5 space/du	48
2-bedroom unit	56 du	1.75 space/du	98
3+ bedroom units	32 du	2 space/du	64
Guest Parking	90 du	1 space/5 du[1]	18
City Required Parking Total			*228*
California Density Bonus Requirements			
Multiple-family Dwelling			
1-bedroom unit	32 du	1 space/du	32
2-bedroom unit	56 du	2 space/du	112
3-bedroom unit	28 du	2 space/du	56
4-bedroom unit	4 du	2.5 space/du	10
Maximum State Required Parking Total			*210*
ITE Parking Demand Estimate			
Affordable Housing – Income Limits	120 du	1.33 space/du	160
Proposed Parking Supply			**212**

Notes: du = dwelling unit
[1]For each five units that are provided beyond the initial 30 units

Finding – The proposed parking supply for the project would not satisfy the City's Code requirements but satisfies the maximum supply of parking that could be required if the California Density Bonus Parking Concession is granted. Additionally, the amount of parking provided would adequately accommodate the anticipated parking demand based on ITE rates.

Conclusions and Recommendations

Conclusions

- The proposed project would be expected to generate an average of 577 daily trips, including 43 a.m. peak hour trips and 55 p.m. peak hour trips.
- Existing pedestrian facilities serving the project site are not adequate due to sidewalk gaps along Browning Street and Canby Street near the proposed project site.
- Bicycle facilities serving the project site are adequate and will be improved upon completion of planned buffered bike lanes and multi-use pathways, as identified in the City's *Active Transportation Plan*.
- Transit facilities serving the project site are adequate since the area is served by four bus routes within less than a half-mile walk from the site.
- The proposed project would screen out as affordable housing and would therefore result in a less-than-significant impact on VMT.
- Sight lines at the proposed driveway locations are adequate for the posted speed limits and proposed turning restrictions.
- A left-turn lane would not be warranted on Canby Road at the proposed project driveway.
- The proposed project would have a less-than-significant impact on queuing since the addition of project-generated volumes would not cause any queues to exceed available turn lane storage that would not already exceed storage without the project.
- Emergency access and on-site circulation are anticipated to function acceptably and traffic from the proposed development would be expected to have a less-than-significant impact on emergency response times.
- The study intersections are expected to operate acceptably at LOS C or better under Existing and Future Conditions with or without the addition of project-generated trips; therefore, the project's effect on operating conditions would be considered acceptable.
- The proposed parking supply does not meet standard City requirements but would satisfy the reduced requirements under the California Density Bonus Law. The number of parking spaces proposed would be more than adequate for the anticipated 85th-percentile peak parking demand based on ITE rates.

Recommendations

- As part of the proposed project, sidewalks should be constructed along the project frontages with Browning Street and Canby Road and new ADA-compliant curb ramps should be constructed on the northwest corner of the Browning Street/Canby Road intersection.
- The project applicant and City should communicate about the frontage improvements on Browning Street and whether or not any right-of-way needs to be dedicated to the City for the planned Class I pathway.

- The Browning Street driveway should include the following signing and striping measures:
  - A “No Left Turn” sign (R3-2) on the south side of Browning Street facing eastbound motorists;
  - A “Right Turn Only” sign (R3-5 (R)) in the concrete island facing the driveway approach;
  - A Do Not Enter” sign (R5-1) in the concrete island facing eastbound motorists; and
  - A right turn pavement legend on the driveway approach.
- New signage, monuments, or other structures should be installed outside of the vision triangles of a driver exiting the project driveways.

Study Participants and References

Study Participants

Principal in Charge	Dalene J. Whitlock, PE, PTOE
Associate Engineer	Cameron Nye, EIT
Assistant Engineer	Valerie Haines, EIT
Graphics	Cameron Wong
Editing/Formatting	Jessica Bender
Quality Control	Dalene J. Whitlock, PE, PTOE

References

"Estimating Maximum Queue Length at Unsignalized Intersections," ITE Journal, John T. Gard, 2001
2000-2020 General Plan, City of Redding, 2000
2019 Collision Data on California State Highways, California Department of Transportation, 2021
California Green Building Standards Code, California Building Standards Commission, 2010
City of Redding Active Transportation Plan, City of Redding, 2018
Highway Capacity Manual, 6th Edition, Transportation Research Board, 2018
Highway Design Manual, 7th Edition, California Department of Transportation, 2020
Intersection Channelization Design Guide, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985
Method for Prioritizing Intersection Improvements, Washington State Transportation Center, 1997
Parking Generation, 5th Edition, Institute of Transportation Engineers, 2019
Redding Area Bus Authority, https://www.cityofredding.org/departments/redding-area-bus-authority
Redding Municipal Code, Municode, 2022
Statewide Integrated Traffic Records System (SWITRS), California Highway Patrol, 2017-2022
Technical Advisory on Evaluating Transportation Impacts in CEQA, Governor's Office of Planning and Research, 2018
Traffic Impact Analysis Guidelines, City of Redding, 2009
Technical Advisory on Evaluating Transportation Impacts in CEQA, Governor's Office of Planning and Research, 2018
Trip Generation Manual, 11th Edition, Institute of Transportation Engineers, 2021

RED026

Appendix A

Collision Rate Calculations

This page intentionally left blank

Intersection Collision Rate Worksheet

RED026 - Redding Canby Apartments

Intersection # 1: Churn Creek Rd & Canby Rd
Date of Count: Tuesday, December 6, 2022

Number of Collisions: 4
Number of Injuries: 3
Number of Fatalities: 0
Average Daily Traffic (ADT): 11900
Start Date: June 1, 2017
End Date: May 31, 2022
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{4 \times 1{,}000{,}000}{11{,}900 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.18 c/mve**	**0.0%**	**75.0%**
Statewide Average*	**0.24 c/mve**	**0.5%**	**46.9%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2019 Collision Data on California State Highways, Caltrans

Intersection # 2: Hilltop Dr & Browning St
Date of Count: Tuesday, December 6, 2022

Number of Collisions: 15
Number of Injuries: 11
Number of Fatalities: 0
Average Daily Traffic (ADT): 22500
Start Date: June 1, 2017
End Date: May 31, 2022
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{15 \times 1{,}000{,}000}{22{,}500 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.37 c/mve**	**0.0%**	**73.3%**
Statewide Average*	**0.24 c/mve**	**0.5%**	**46.9%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2019 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

RED026 - Redding Canby Apartments

Intersection # 3: Browning St & Canby Rd
Date of Count: Tuesday, December 6, 2022

Number of Collisions: 2
Number of Injuries: 1
Number of Fatalities: 0
Average Daily Traffic (ADT): 14200
Start Date: June 1, 2017
End Date: May 31, 2022
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{2 \times 1{,}000{,}000}{14{,}200 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.08 c/mve**	**0.0%**	**50.0%**
Statewide Average*	**0.24 c/mve**	**0.5%**	**46.9%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2019 Collision Data on California State Highways, Caltrans

Intersection # 4: Churn Creek Rd & Browning St
Date of Count: Tuesday, December 6, 2022

Number of Collisions: 4
Number of Injuries: 3
Number of Fatalities: 0
Average Daily Traffic (ADT): 16400
Start Date: June 1, 2017
End Date: May 31, 2022
Number of Years: 5

Intersection Type: Four-Legged
Control Type: Signals
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{4 \times 1{,}000{,}000}{16{,}400 \times 365 \times 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.13 c/mve**	**0.0%**	**75.0%**
Statewide Average*	**0.24 c/mve**	**0.5%**	**46.9%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2019 Collision Data on California State Highways, Caltrans

Intersection Collision Rate Worksheet

RED026 - Redding Canby Apartments

Intersection # 5: Canby Rd & Old Alturas Rd
Date of Count: Tuesday, December 6, 2022

Number of Collisions: 5
Number of Injuries: 3
Number of Fatalities: 0
Average Daily Traffic (ADT): 9500
Start Date: June 1, 2017
End Date: May 31, 2022
Number of Years: 5

Intersection Type: Tee
Control Type: 4 Way Stop
Area: Urban

$$\text{Collision Rate} = \frac{\text{Number of Collisions x 1 Million}}{\text{ADT x Days per Year x Number of Years}}$$

$$\text{Collision Rate} = \frac{5 \quad \text{x} \quad 1{,}000{,}000}{9{,}500 \quad \text{x} \quad 365 \quad \text{x} \quad 5}$$

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	**0.29 c/mve**	**0.0%**	**60.0%**
Statewide Average*	**0.07 c/mve**	**1.1%**	**38.6%**

Notes
ADT = average daily total vehicles entering intersection
c/mve = collisions per million vehicles entering intersection
* 2019 Collision Data on California State Highways, Caltrans

This page intentionally left blank

Appendix B

Turn Lane Warrant Spreadsheets

This page intentionally left blank

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Canby Rd/Project Driveway
Study Scenario: Future plus Project AM

Direction of Analysis Street: North/South

Cross Street Intersects: From the West

Canby Rd
Southbound Volumes (veh/hr)
Through Volume = 61
Right Turn Volume = 2

Canby Rd
Northbound Volumes (veh/hr)
41 = Through Volume
7 = Left Turn Volume

Southbound Speed Limit: 35 mph
Southbound Configuration: 2 Lanes - Undivided

Project Driveway

Northbound Speed Limit: 35 mph
Northbound Configuration: 2 Lanes - Undivided

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	1035.1
Advancing Volume	Va =	63
If AV<Va then warrant is met		No

Right Turn Lane Warranted: **NO**

Southbound Right Turn Taper Warrants
(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

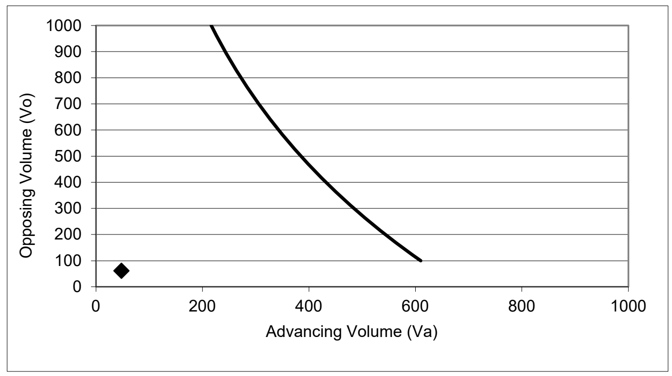
2. Check advance volume threshold criteria for taper

Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	63
If AV<Va then warrant is met		-

Right Turn Taper Warranted: **NO**

Northbound Left Turn Lane Warrants

Percentage Left Turns %lt 14.6 %
Advancing Volume Threshold AV 638 veh/hr
If AV<Va then warrant is met



◆ Study Intersection
Two lane roadway warrant threshold for: 35 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: **NO**

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

Turn Lane Warrant Analysis - Tee Intersections

Study Intersection: Canby Rd/Project Driveway
Study Scenario: Future plus Project PM

Direction of Analysis Street: North/South

Cross Street Intersects: From the West

Canby Rd
Southbound Volumes (veh/hr)
Through Volume = 55
Right Turn Volume = 5

Canby Rd
Northbound Volumes (veh/hr)
81 = Through Volume
19 = Left Turn Volume

Southbound Speed Limit: 35 mph
Southbound Configuration: 2 Lanes - Undivided

Project Driveway

Northbound Speed Limit: 35 mph
Northbound Configuration: 2 Lanes - Undivided

Southbound Right Turn Lane Warrants

1. Check for right turn volume criteria

Thresholds not met, continue to next step

2. Check advance volume threshold criteria for turn lane

Advancing Volume Threshold	AV =	1012.6
Advancing Volume	Va =	60
If AV<Va then warrant is met		No

Right Turn Lane Warranted: **NO**

Southbound Right Turn Taper Warrants
(evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

2. Check advance volume threshold criteria for taper

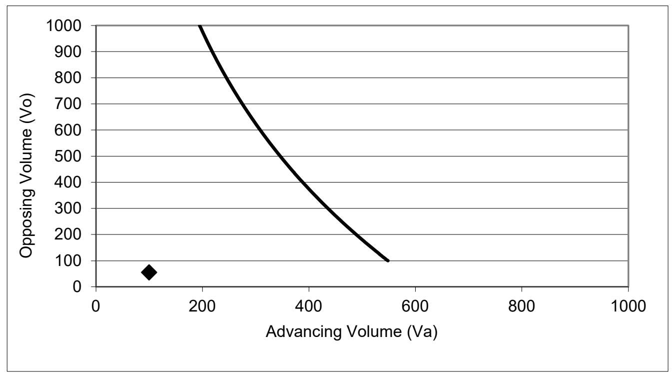
Advancing Volume Threshold	AV =	-
Advancing Volume	Va =	60
If AV<Va then warrant is met		-

Right Turn Taper Warranted: **NO**

Northbound Left Turn Lane Warrants

Percentage Left Turns %lt	19.0 %
Advancing Volume Threshold AV	578 veh/hr

If AV<Va then warrant is met



◆ Study Intersection
Two lane roadway warrant threshold for: 35 mph
Turn lane warranted if point falls to right of warrant threshold line

Left Turn Lane Warranted: **NO**

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

Appendix C

Queuing Calculations

This page intentionally left blank

Queues
1: Churn Creek Rd & Canby Rd/Whistling Dr

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	64	95	225	288	18	209	195	167	400
v/c Ratio	0.26	0.36	0.61	0.70	0.09	0.38	0.32	0.78	0.48
Control Delay	30.2	27.9	31.8	29.9	31.2	24.2	5.7	58.3	19.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.2	27.9	31.8	29.9	31.2	24.2	5.7	58.3	19.6
Queue Length 50th (ft)	25	31	84	88	7	72	0	70	106
Queue Length 95th (ft)	56	69	146	160	25	133	40	#172	#279
Internal Link Dist (ft)		411		817		699			679
Turn Bay Length (ft)	210				115		160	390	
Base Capacity (vph)	485	505	485	522	195	545	603	215	839
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.19	0.46	0.55	0.09	0.38	0.32	0.78	0.48

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
2: Hilltop Dr & Browning St

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	2	9	198	196	190	6	153	173	169	403
v/c Ratio	0.01	0.05	0.51	0.50	0.35	0.04	0.29	0.24	0.49	0.27
Control Delay	21.5	20.1	21.9	21.6	5.1	23.0	20.2	2.1	23.2	10.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.5	20.1	21.9	21.6	5.1	23.0	20.2	2.1	23.2	10.4
Queue Length 50th (ft)	1	2	44	43	0	1	18	0	38	27
Queue Length 95th (ft)	6	13	#129	126	35	12	47	14	#108	96
Internal Link Dist (ft)		459		592			755			546
Turn Bay Length (ft)			140		140	180		250	180	
Base Capacity (vph)	596	586	440	442	586	171	1305	781	394	1804
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.02	0.45	0.44	0.32	0.04	0.12	0.22	0.43	0.22

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	70	217	30	6	228	39	57	21	63	189
v/c Ratio	0.24	0.33	0.04	0.02	0.45	0.15	0.08	0.08	0.10	0.30
Control Delay	22.9	11.5	0.1	22.2	16.1	22.5	13.1	22.4	17.5	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.9	11.5	0.1	22.2	16.1	22.5	13.1	22.4	17.5	5.7
Queue Length 50th (ft)	12	17	0	1	35	7	7	4	10	0
Queue Length 95th (ft)	#59	109	0	11	112	37	38	24	45	43
Internal Link Dist (ft)		576			215		684		597	
Turn Bay Length (ft)	175							55		65
Base Capacity (vph)	287	1028	976	261	975	261	1054	261	1016	916
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.21	0.03	0.02	0.23	0.15	0.05	0.08	0.06	0.21

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	89	113	61	33	120	98	76	240	99	399	49
v/c Ratio	0.47	0.24	0.12	0.19	0.38	0.24	0.40	0.20	0.52	0.29	0.07
Control Delay	35.1	17.1	0.5	25.7	21.9	2.0	32.0	15.6	37.7	15.0	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.1	17.1	0.5	25.7	21.9	2.0	32.0	15.6	37.7	15.0	0.2
Queue Length 50th (ft)	24	20	0	9	30	0	21	28	27	51	0
Queue Length 95th (ft)	#83	65	0	32	70	4	#69	55	#94	87	0
Internal Link Dist (ft)		212			686			731		1125	
Turn Bay Length (ft)							175		135		125
Base Capacity (vph)	190	723	675	177	672	673	190	1499	190	1555	754
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.16	0.09	0.19	0.18	0.15	0.40	0.16	0.52	0.26	0.06

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Churn Creek Rd & Canby Rd/Whistling Dr

02/01/2023

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	122	39	92	79	13	421	61	42	452
v/c Ratio	0.38	0.12	0.32	0.25	0.05	0.47	0.08	0.16	0.48
Control Delay	26.2	19.1	26.7	14.8	27.3	21.7	0.2	27.0	18.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	19.1	26.7	14.8	27.3	21.7	0.2	27.0	18.7
Queue Length 50th (ft)	32	8	24	8	3	97	0	11	103
Queue Length 95th (ft)	92	34	75	46	21	#324	0	44	#346
Internal Link Dist (ft)		411		817		699			679
Turn Bay Length (ft)	210				115		160	390	
Base Capacity (vph)	592	607	592	604	238	887	813	263	935
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.06	0.16	0.13	0.05	0.47	0.08	0.16	0.48

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
2: Hilltop Dr & Browning St

02/01/2023

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	46	89	147	150	314	55	542	359	234	406
v/c Ratio	0.24	0.42	0.63	0.64	0.64	0.32	0.69	0.44	0.73	0.30
Control Delay	30.4	25.8	43.7	43.7	10.8	35.4	27.8	2.8	43.0	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.4	25.8	43.7	43.7	10.8	35.4	27.8	2.8	43.0	15.4
Queue Length 50th (ft)	18	22	61	63	0	22	106	0	93	64
Queue Length 95th (ft)	47	63	#158	#162	70	58	168	21	#224	107
Internal Link Dist (ft)		459		592			755			546
Turn Bay Length (ft)			140		140	180		250	180	
Base Capacity (vph)	434	437	249	253	505	190	1001	825	338	1397
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.20	0.59	0.59	0.62	0.29	0.54	0.44	0.69	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
3: Canby Rd & Browning St

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	78	402	119	33	414	121	124	14	53	91
v/c Ratio	0.40	0.58	0.17	0.19	0.71	0.46	0.24	0.08	0.21	0.27
Control Delay	35.5	18.2	2.4	30.4	24.8	32.7	14.6	28.6	26.6	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.5	18.2	2.4	30.4	24.8	32.7	14.6	28.6	26.6	3.5
Queue Length 50th (ft)	28	87	0	12	126	41	21	5	18	0
Queue Length 95th (ft)	#82	223	19	37	#238	#106	71	21	47	12
Internal Link Dist (ft)		576			215		684		597	
Turn Bay Length (ft)	175							55		65
Base Capacity (vph)	195	881	871	171	815	291	871	171	721	687
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.46	0.14	0.19	0.51	0.42	0.14	0.08	0.07	0.13

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
4: Churn Creek Rd & Browning St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	100	218	159	13	218	111	192	291	75	292	54
v/c Ratio	0.60	0.38	0.29	0.09	0.60	0.26	0.67	0.28	0.35	0.47	0.14
Control Delay	46.2	17.1	4.8	28.7	27.7	3.1	39.7	18.2	29.8	23.5	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.2	17.1	4.8	28.7	27.7	3.1	39.7	18.2	29.8	23.5	0.7
Queue Length 50th (ft)	33	48	0	4	66	0	62	44	23	46	0
Queue Length 95th (ft)	#115	132	37	20	136	16	#181	82	65	85	0
Internal Link Dist (ft)		212			686			731		1125	
Turn Bay Length (ft)							175		135		125
Base Capacity (vph)	166	669	620	141	536	553	288	1237	239	1152	596
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.33	0.26	0.09	0.41	0.20	0.67	0.24	0.31	0.25	0.09

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Churn Creek Rd & Canby Rd/Whistling Dr

02/01/2023

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	65	95	225	351	18	214	195	318	402
v/c Ratio	0.30	0.41	0.60	0.84	0.11	0.47	0.36	0.83	0.44
Control Delay	36.7	34.8	36.5	43.9	37.3	31.5	6.7	51.5	16.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.7	34.8	36.5	43.9	37.3	31.5	6.7	51.5	16.9
Queue Length 50th (ft)	31	39	103	138	9	95	0	156	117
Queue Length 95th (ft)	63	78	172	#268	28	159	44	#288	244
Internal Link Dist (ft)		411		817		699			679
Turn Bay Length (ft)	210				115		160	390	
Base Capacity (vph)	401	419	401	445	161	459	539	395	920
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.23	0.56	0.79	0.11	0.47	0.36	0.81	0.44

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
2: Hilltop Dr & Browning St

02/01/2023

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	2	10	241	239	232	7	188	211	207	493
v/c Ratio	0.01	0.06	0.59	0.58	0.40	0.04	0.35	0.27	0.57	0.33
Control Delay	23.0	21.4	25.6	25.3	5.7	24.5	21.1	2.0	27.6	11.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	21.4	25.6	25.3	5.7	24.5	21.1	2.0	27.6	11.0
Queue Length 50th (ft)	1	2	57	57	0	2	24	0	50	36
Queue Length 95th (ft)	6	15	#188	#186	46	13	57	15	#162	119
Internal Link Dist (ft)		459		592			755			546
Turn Bay Length (ft)			140		140	180		250	180	
Base Capacity (vph)	545	538	424	425	591	157	1131	790	370	1611
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.02	0.57	0.56	0.39	0.04	0.17	0.27	0.56	0.31

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	70	280	30	6	287	39	57	24	63	189
v/c Ratio	0.23	0.38	0.04	0.02	0.47	0.14	0.08	0.08	0.11	0.31
Control Delay	24.0	11.6	0.1	22.6	15.8	22.9	13.5	22.9	18.1	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.0	11.6	0.1	22.6	15.8	22.9	13.5	22.9	18.1	5.8
Queue Length 50th (ft)	13	23	0	1	46	7	8	4	11	0
Queue Length 95th (ft)	#64	141	0	11	142	37	38	27	45	43
Internal Link Dist (ft)		576			215		684		597	
Turn Bay Length (ft)	175							55		65
Base Capacity (vph)	303	1010	962	286	952	286	1024	286	986	895
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.28	0.03	0.02	0.30	0.14	0.06	0.08	0.06	0.21

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	147	113	71	33	136	99	78	240	105	492	96
v/c Ratio	0.92	0.26	0.15	0.23	0.46	0.25	0.51	0.25	0.68	0.44	0.16
Control Delay	87.3	18.1	0.6	28.5	24.6	2.2	39.1	15.8	51.7	17.2	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.3	18.1	0.6	28.5	24.6	2.2	39.1	15.8	51.7	17.2	1.0
Queue Length 50th (ft)	46	22	0	10	37	0	23	30	32	67	0
Queue Length 95th (ft)	#150	67	0	33	79	3	#76	55	#106	111	2
Internal Link Dist (ft)		212			686			731		1125	
Turn Bay Length (ft)							175		135		125
Base Capacity (vph)	159	594	586	144	546	581	154	1117	154	1291	657
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.19	0.12	0.23	0.25	0.17	0.51	0.21	0.68	0.38	0.15

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Churn Creek Rd & Canby Rd/Whistling Dr

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	124	39	92	171	13	434	61	199	454
v/c Ratio	0.48	0.14	0.40	0.51	0.07	0.68	0.09	0.69	0.45
Control Delay	36.3	24.7	35.8	14.8	34.9	30.2	0.3	45.3	15.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.3	24.7	35.8	14.8	34.9	30.2	0.3	45.3	15.3
Queue Length 50th (ft)	53	12	40	13	6	173	0	87	109
Queue Length 95th (ft)	110	39	87	69	24	#360	0	#210	305
Internal Link Dist (ft)		411		817		699			679
Turn Bay Length (ft)	210				115		160	390	
Base Capacity (vph)	437	451	437	508	176	642	654	303	1003
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.09	0.21	0.34	0.07	0.68	0.09	0.66	0.45

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
2: Hilltop Dr & Browning St

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	51	101	165	169	352	61	608	403	264	455
v/c Ratio	0.27	0.49	0.65	0.66	0.65	0.36	0.76	0.47	0.76	0.34
Control Delay	35.8	33.7	46.9	47.1	10.5	41.1	34.1	2.9	45.7	18.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.8	33.7	46.9	47.1	10.5	41.1	34.1	2.9	45.7	18.5
Queue Length 50th (ft)	24	35	84	86	0	30	148	0	126	83
Queue Length 95th (ft)	57	83	#190	#193	80	70	#225	25	#262	137
Internal Link Dist (ft)		459		592			755			546
Turn Bay Length (ft)			140		140	180		250	180	
Base Capacity (vph)	377	381	278	282	558	212	955	877	401	1378
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.27	0.59	0.60	0.63	0.29	0.64	0.46	0.66	0.33

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
3: Canby Rd & Browning St
02/01/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	78	428	121	35	467	122	124	14	53	92
v/c Ratio	0.50	0.61	0.17	0.25	0.77	0.58	0.22	0.10	0.24	0.29
Control Delay	40.9	18.6	2.4	32.0	27.3	40.2	15.1	28.9	27.4	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.9	18.6	2.4	32.0	27.3	40.2	15.1	28.9	27.4	4.0
Queue Length 50th (ft)	29	90	0	13	144	44	23	5	18	0
Queue Length 95th (ft)	#84	#243	19	38	#298	#117	71	21	47	13
Internal Link Dist (ft)		576			215		684		597	
Turn Bay Length (ft)	175							55		65
Base Capacity (vph)	157	786	793	142	702	214	718	142	617	609
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.54	0.15	0.25	0.67	0.57	0.17	0.10	0.09	0.15

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
4: Churn Creek Rd & Browning St
02/01/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	121	218	159	13	218	111	215	352	89	389	86
v/c Ratio	0.65	0.35	0.27	0.11	0.66	0.28	0.73	0.38	0.43	0.59	0.21
Control Delay	50.1	18.9	5.1	34.1	35.0	4.0	44.5	21.4	35.0	27.6	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.1	18.9	5.1	34.1	35.0	4.0	44.5	21.4	35.0	27.6	2.0
Queue Length 50th (ft)	47	58	0	5	80	0	81	61	33	74	0
Queue Length 95th (ft)	#140	148	42	23	158	20	#209	105	81	122	7
Internal Link Dist (ft)		212			686			731		1125	
Turn Bay Length (ft)							175		135		125
Base Capacity (vph)	187	625	587	116	440	476	311	1039	256	946	511
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.35	0.27	0.11	0.50	0.23	0.69	0.34	0.35	0.41	0.17

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Churn Creek Rd & Canby Rd/Whistling Dr
02/01/2023

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	69	95	225	288	18	209	195	167	403
v/c Ratio	0.28	0.36	0.61	0.70	0.09	0.38	0.32	0.78	0.48
Control Delay	30.5	27.9	31.8	29.9	31.2	24.2	5.7	58.3	19.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.5	27.9	31.8	29.9	31.2	24.2	5.7	58.3	19.7
Queue Length 50th (ft)	27	31	84	88	7	72	0	70	107
Queue Length 95th (ft)	59	69	146	160	25	133	40	#172	#282
Internal Link Dist (ft)		411		817		699			679
Turn Bay Length (ft)	210				115		160	390	
Base Capacity (vph)	485	505	485	522	195	545	603	215	838
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.19	0.46	0.55	0.09	0.38	0.32	0.78	0.48

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
2: Hilltop Dr & Browning St
02/01/2023

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	2	9	202	201	195	6	153	176	172	403
v/c Ratio	0.01	0.05	0.52	0.51	0.36	0.04	0.30	0.24	0.49	0.27
Control Delay	21.5	20.1	22.2	22.0	5.3	23.0	20.3	2.1	23.5	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.5	20.1	22.2	22.0	5.3	23.0	20.3	2.1	23.5	10.5
Queue Length 50th (ft)	1	2	45	45	0	2	18	0	39	27
Queue Length 95th (ft)	6	13	#133	#132	38	12	47	14	#111	96
Internal Link Dist (ft)		459		592			755			546
Turn Bay Length (ft)			140		140	180		250	180	
Base Capacity (vph)	592	582	437	438	583	170	1295	778	391	1791
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.02	0.46	0.46	0.33	0.04	0.12	0.23	0.44	0.23

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	75	217	30	6	232	40	58	29	69	189
v/c Ratio	0.27	0.33	0.04	0.02	0.44	0.16	0.08	0.11	0.11	0.30
Control Delay	24.0	11.4	0.1	22.2	15.9	22.8	13.1	22.7	17.6	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.0	11.4	0.1	22.2	15.9	22.8	13.1	22.7	17.6	5.7
Queue Length 50th (ft)	13	17	0	1	35	7	8	5	12	0
Queue Length 95th (ft)	#68	109	0	11	114	38	39	30	49	43
Internal Link Dist (ft)		576			215		684		597	
Turn Bay Length (ft)	175							55		65
Base Capacity (vph)	283	1013	965	257	963	257	1038	257	999	904
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.21	0.03	0.02	0.24	0.16	0.06	0.11	0.07	0.21

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	89	115	67	33	121	98	80	240	99	399	49
v/c Ratio	0.47	0.24	0.13	0.19	0.38	0.24	0.43	0.20	0.53	0.31	0.08
Control Delay	35.4	17.3	0.5	25.8	22.0	2.0	33.2	15.5	38.0	16.2	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.4	17.3	0.5	25.8	22.0	2.0	33.2	15.5	38.0	16.2	0.2
Queue Length 50th (ft)	24	20	0	9	30	0	22	28	27	51	0
Queue Length 95th (ft)	#83	66	0	32	70	4	#74	55	#94	88	0
Internal Link Dist (ft)		212			686			731		1125	
Turn Bay Length (ft)							175		135		125
Base Capacity (vph)	188	716	671	175	665	668	188	1487	188	1542	750
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.16	0.10	0.19	0.18	0.15	0.43	0.16	0.53	0.26	0.07

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

1: Churn Creek Rd & Canby Rd/Whistling Dr

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	126	39	92	79	13	421	61	42	458
v/c Ratio	0.39	0.12	0.33	0.25	0.05	0.48	0.08	0.16	0.49
Control Delay	26.3	19.1	26.8	14.9	27.4	21.8	0.2	27.1	18.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.3	19.1	26.8	14.9	27.4	21.8	0.2	27.1	18.9
Queue Length 50th (ft)	33	8	25	8	4	98	0	11	105
Queue Length 95th (ft)	94	34	75	46	21	#325	0	45	#353
Internal Link Dist (ft)		411		817		699			679
Turn Bay Length (ft)	210				115		160	390	
Base Capacity (vph)	590	606	590	603	237	885	812	262	932
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.06	0.16	0.13	0.05	0.48	0.08	0.16	0.49

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

2: Hilltop Dr & Browning St

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	46	89	151	153	317	55	542	368	240	406
v/c Ratio	0.24	0.42	0.65	0.65	0.64	0.33	0.69	0.45	0.74	0.29
Control Delay	30.4	25.9	44.7	44.4	10.8	35.5	27.9	2.8	43.7	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.4	25.9	44.7	44.4	10.8	35.5	27.9	2.8	43.7	15.4
Queue Length 50th (ft)	18	22	63	64	0	22	106	0	96	64
Queue Length 95th (ft)	47	63	#164	#166	71	58	168	21	#231	107
Internal Link Dist (ft)		459		592			755			546
Turn Bay Length (ft)			140		140	180		250	180	
Base Capacity (vph)	431	434	247	251	506	188	994	828	335	1400
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.21	0.61	0.61	0.63	0.29	0.55	0.44	0.72	0.29

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

3: Canby Rd & Browning St

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	91	402	119	33	424	123	127	21	56	91
v/c Ratio	0.47	0.58	0.16	0.20	0.71	0.47	0.25	0.12	0.22	0.27
Control Delay	39.1	18.0	2.4	30.7	25.1	33.4	14.9	29.4	26.9	3.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.1	18.0	2.4	30.7	25.1	33.4	14.9	29.4	26.9	3.5
Queue Length 50th (ft)	33	87	0	12	131	43	23	7	19	0
Queue Length 95th (ft)	#99	224	20	37	#267	#109	72	27	49	12
Internal Link Dist (ft)		576			215		684		597	
Turn Bay Length (ft)	175							55		65
Base Capacity (vph)	192	880	869	168	803	287	860	168	711	679
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.46	0.14	0.20	0.53	0.43	0.15	0.13	0.08	0.13

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

4: Churn Creek Rd & Browning St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	100	219	165	13	220	111	200	291	75	292	54
v/c Ratio	0.60	0.38	0.30	0.09	0.61	0.26	0.70	0.28	0.36	0.47	0.14
Control Delay	46.3	17.1	5.0	28.7	27.8	3.1	41.5	18.2	29.9	23.6	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.3	17.1	5.0	28.7	27.8	3.1	41.5	18.2	29.9	23.6	0.7
Queue Length 50th (ft)	33	48	0	4	67	0	65	44	23	46	0
Queue Length 95th (ft)	#115	133	40	20	137	16	#191	82	65	85	0
Internal Link Dist (ft)		212			686			731		1125	
Turn Bay Length (ft)							175		135		125
Base Capacity (vph)	166	669	620	141	535	552	287	1237	239	1150	595
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.33	0.27	0.09	0.41	0.20	0.70	0.24	0.31	0.25	0.09

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	71	95	225	351	18	214	195	318	405
v/c Ratio	0.33	0.41	0.60	0.84	0.11	0.47	0.36	0.83	0.44
Control Delay	37.3	34.8	36.5	43.9	37.3	31.5	6.7	51.5	17.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.3	34.8	36.5	43.9	37.3	31.5	6.7	51.5	17.0
Queue Length 50th (ft)	34	39	103	138	9	95	0	156	118
Queue Length 95th (ft)	68	78	172	#268	28	159	44	#288	246
Internal Link Dist (ft)		411		817		699			679
Turn Bay Length (ft)	210				115		160	390	
Base Capacity (vph)	401	419	401	445	161	459	539	395	919
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.23	0.56	0.79	0.11	0.47	0.36	0.81	0.44

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	2	10	246	243	238	7	188	215	209	493
v/c Ratio	0.01	0.06	0.59	0.58	0.40	0.04	0.36	0.27	0.58	0.33
Control Delay	23.0	21.4	25.9	25.4	5.6	24.5	21.2	2.0	27.9	11.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	21.4	25.9	25.4	5.6	24.5	21.2	2.0	27.9	11.0
Queue Length 50th (ft)	1	2	60	58	0	2	24	0	50	36
Queue Length 95th (ft)	6	15	#193	#190	46	13	57	15	#163	119
Internal Link Dist (ft)		459		592			755			546
Turn Bay Length (ft)			140		140	180		250	180	
Base Capacity (vph)	542	535	421	423	593	156	1124	789	368	1601
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.02	0.58	0.57	0.40	0.04	0.17	0.27	0.57	0.31

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

3: Canby Rd & Browning St

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	75	280	30	6	291	40	58	31	69	189
v/c Ratio	0.25	0.38	0.04	0.02	0.48	0.14	0.09	0.11	0.11	0.30
Control Delay	24.9	11.6	0.1	22.6	15.9	23.0	15.5	23.0	18.1	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.9	11.6	0.1	22.6	15.9	23.0	15.5	23.0	18.1	5.8
Queue Length 50th (ft)	14	24	0	1	47	8	8	6	12	0
Queue Length 95th (ft)	#70	141	0	11	145	38	39	32	49	43
Internal Link Dist (ft)		576			215		684		597	
Turn Bay Length (ft)	175							55		65
Base Capacity (vph)	303	1008	961	286	948	286	1020	286	982	892
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.28	0.03	0.02	0.31	0.14	0.06	0.11	0.07	0.21

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

4: Churn Creek Rd & Browning St

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	147	115	76	33	138	99	81	240	105	492	96
v/c Ratio	0.92	0.26	0.16	0.23	0.46	0.25	0.53	0.25	0.68	0.44	0.16
Control Delay	86.8	18.1	0.7	28.6	24.6	2.1	40.4	15.9	51.9	17.3	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	86.8	18.1	0.7	28.6	24.6	2.1	40.4	15.9	51.9	17.3	1.0
Queue Length 50th (ft)	46	23	0	10	38	0	24	30	32	67	0
Queue Length 95th (ft)	#150	68	0	33	80	3	#79	56	#106	111	2
Internal Link Dist (ft)		212			686			731		1125	
Turn Bay Length (ft)							175		135		125
Base Capacity (vph)	160	594	587	144	546	581	154	1112	154	1286	655
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.19	0.13	0.23	0.25	0.17	0.53	0.22	0.68	0.38	0.15

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Churn Creek Rd & Canby Rd/Whistling Dr

02/01/2023

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	128	39	92	171	13	434	61	199	460
v/c Ratio	0.48	0.14	0.40	0.51	0.07	0.68	0.09	0.69	0.46
Control Delay	36.4	24.5	36.0	14.9	35.1	30.4	0.3	45.6	15.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.4	24.5	36.0	14.9	35.1	30.4	0.3	45.6	15.5
Queue Length 50th (ft)	55	12	40	13	6	174	0	87	112
Queue Length 95th (ft)	112	39	87	69	24	#363	0	#211	312
Internal Link Dist (ft)		411		817		699			679
Turn Bay Length (ft)	210				115		160	390	
Base Capacity (vph)	436	449	436	507	175	640	653	302	999
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.09	0.21	0.34	0.07	0.68	0.09	0.66	0.46

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
2: Hilltop Dr & Browning St

02/01/2023

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	51	101	169	171	355	61	608	411	269	455
v/c Ratio	0.27	0.49	0.67	0.67	0.65	0.36	0.76	0.48	0.76	0.34
Control Delay	35.8	33.8	47.9	47.6	10.5	41.2	34.3	2.9	46.2	18.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.8	33.8	47.9	47.6	10.5	41.2	34.3	2.9	46.2	18.5
Queue Length 50th (ft)	24	35	86	87	0	30	148	0	129	83
Queue Length 95th (ft)	57	83	#195	#197	81	70	#225	25	#270	137
Internal Link Dist (ft)		459		592			755			546
Turn Bay Length (ft)			140		140	180		250	180	
Base Capacity (vph)	374	379	277	280	560	211	949	880	399	1370
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.27	0.61	0.61	0.63	0.29	0.64	0.47	0.67	0.33

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

3: Canby Rd & Browning St

02/01/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	91	428	121	35	477	124	127	21	56	92
v/c Ratio	0.59	0.60	0.17	0.25	0.77	0.59	0.23	0.15	0.26	0.29
Control Delay	46.7	18.5	2.4	32.2	27.7	41.2	15.3	30.0	27.7	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.7	18.5	2.4	32.2	27.7	41.2	15.3	30.0	27.7	4.0
Queue Length 50th (ft)	34	91	0	13	149	45	24	8	20	0
Queue Length 95th (ft)	#100	#244	20	38	#309	#120	73	27	49	13
Internal Link Dist (ft)		576			215		684		597	
Turn Bay Length (ft)	175							55		65
Base Capacity (vph)	155	782	790	140	692	211	709	140	608	603
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.55	0.15	0.25	0.69	0.59	0.18	0.15	0.09	0.15

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

4: Churn Creek Rd & Browning St

02/01/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	121	219	165	13	220	111	223	352	89	389	86
v/c Ratio	0.66	0.35	0.28	0.11	0.67	0.28	0.76	0.38	0.43	0.59	0.21
Control Delay	50.4	18.9	5.1	34.2	35.1	4.0	46.2	21.4	35.1	27.7	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.4	18.9	5.1	34.2	35.1	4.0	46.2	21.4	35.1	27.7	2.0
Queue Length 50th (ft)	47	58	0	5	80	0	85	61	33	75	0
Queue Length 95th (ft)	#140	149	43	23	160	20	#218	105	81	122	7
Internal Link Dist (ft)		212			686			731		1125	
Turn Bay Length (ft)							175		135		125
Base Capacity (vph)	186	624	590	115	439	475	310	1041	255	943	510
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.35	0.28	0.11	0.50	0.23	0.72	0.34	0.35	0.41	0.17

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Appendix D

Intersection Level of Service Calculations

This page intentionally left blank

HCM 6th Signalized Intersection Summary
1: Churn Creek Rd & Canby Rd/Whistling Dr

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	54	63	18	191	127	118	15	178	166	142	258	82
Future Volume (veh/h)	54	63	18	191	127	118	15	178	166	142	258	82
Initial Q (Qb), veh	0	0	0	2	0	0	0	0	0	3	3	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1945	1945	1870	1945	1945
Adj Flow Rate, veh/h	64	74	14	225	149	100	18	209	76	167	304	58
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	208	179	34	345	208	140	53	548	465	211	602	110
Arrive On Green	0.12	0.12	0.12	0.19	0.19	0.19	0.03	0.29	0.29	0.12	0.38	0.38
Sat Flow, veh/h	1781	1529	289	1781	1040	698	1781	1945	1648	1781	1587	303
Grp Volume(v), veh/h	64	0	88	225	0	249	18	209	76	167	0	362
Grp Sat Flow(s),veh/h/ln	1781	0	1818	1781	0	1738	1781	1945	1648	1781	0	1890
Q Serve(g_s), s	2.1	0.0	2.8	7.4	0.0	8.5	0.6	5.4	2.2	5.7	0.0	9.3
Cycle Q Clear(g_c), s	2.1	0.0	2.8	7.4	0.0	8.5	0.6	5.4	2.2	5.7	0.0	9.3
Prop In Lane	1.00		0.16	1.00		0.40	1.00		1.00	1.00		0.16
Lane Grp Cap(c), veh/h	208	0	212	345	0	348	53	548	465	211	0	707
V/C Ratio(X)	0.31	0.00	0.41	0.65	0.00	0.72	0.34	0.38	0.16	0.79	0.00	0.51
Avail Cap(c_a), veh/h	508	0	519	508	0	496	198	555	470	226	0	709
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	0.00	1.00
Uniform Delay (d), s/veh	25.9	0.0	26.2	23.7	0.0	23.8	30.4	18.5	17.3	28.2	0.0	15.5
Incr Delay (d2), s/veh	0.8	0.0	1.3	2.1	0.0	2.8	3.7	2.0	0.8	16.3	0.0	2.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.3
%ile BackOfQ(50%),veh/ln	0.9	0.0	1.3	3.4	0.0	3.6	0.3	2.5	0.8	3.9	0.0	4.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.7	0.0	27.5	26.5	0.0	26.6	34.1	20.5	18.1	51.5	0.0	18.4
LnGrp LOS	C	A	C	C	A	C	C	C	B	D	A	B
Approach Vol, veh/h		152			474			303			529	
Approach Delay, s/veh		27.2			26.5			20.7			28.9	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.1	22.5		11.9	6.4	28.2		16.6
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.0	18.0		18.0	7.0	19.0		18.0
Max Q Clear Time (g_c+I1), s	7.7	7.4		4.8	2.6	11.3		10.5
Green Ext Time (p_c), s	0.0	0.9		0.5	0.0	1.2		1.4

Intersection Summary		
HCM 6th Ctrl Delay		26.2
HCM 6th LOS		C

HCM 6th Signalized Intersection Summary
2: Hilltop Dr & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	6	2	341	5	167	5	135	152	149	346	9
Future Volume (veh/h)	2	6	2	341	5	167	5	135	152	149	346	9
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		1.00	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1616	1616	1683	1683	1751	1683	1683	1751	1683	1683	1683
Adj Flow Rate, veh/h	2	7	2	392	0	113	6	153	148	169	393	9
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	23	17	5	632	0	292	13	511	529	214	910	21
Arrive On Green	0.01	0.01	0.01	0.20	0.00	0.20	0.01	0.16	0.16	0.13	0.29	0.29
Sat Flow, veh/h	1603	1209	345	3206	0	1484	1603	3198	1481	1603	3194	73
Grp Volume(v), veh/h	2	0	9	392	0	113	6	153	148	169	196	206
Grp Sat Flow(s),veh/h/ln	1603	0	1554	1603	0	1484	1603	1599	1481	1603	1599	1668
Q Serve(g_s), s	0.0	0.0	0.2	4.1	0.0	2.4	0.1	1.5	2.6	3.7	3.6	3.7
Cycle Q Clear(g_c), s	0.0	0.0	0.2	4.1	0.0	2.4	0.1	1.5	2.6	3.7	3.6	3.7
Prop In Lane	1.00		0.22	1.00		1.00	1.00		1.00	1.00		0.04
Lane Grp Cap(c), veh/h	23	0	22	632	0	292	13	511	529	214	456	475
V/C Ratio(X)	0.09	0.00	0.40	0.62	0.00	0.39	0.46	0.30	0.28	0.79	0.43	0.43
Avail Cap(c_a), veh/h	794	0	770	1191	0	551	221	1672	1067	507	1122	1171
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	17.7	0.0	17.7	13.3	0.0	12.7	17.9	13.5	8.3	15.3	10.6	10.6
Incr Delay (d2), s/veh	1.6	0.0	11.1	1.0	0.0	0.8	23.6	0.3	0.3	6.5	0.6	0.6
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	0.0	0.0	0.1	1.2	0.0	0.7	0.1	0.5	0.9	1.4	1.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	19.2	0.0	28.9	14.3	0.0	13.5	41.5	13.8	8.6	21.7	11.2	11.2
LnGrp LOS	B	A	C	B	A	B	D	B	A	C	B	B
Approach Vol, veh/h		11			505			307			571	
Approach Delay, s/veh		27.1			14.2			11.8			14.3	
Approach LOS		C			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.3	10.3		5.0	4.8	14.9		11.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	11.5	19.0		18.0	5.0	25.5		13.5
Max Q Clear Time (g_c+I1), s	5.7	4.6		2.2	2.1	5.7		6.1
Green Ext Time (p_c), s	0.2	1.2		0.0	0.0	2.1		1.1

Intersection Summary		
HCM 6th Ctrl Delay		13.8
HCM 6th LOS		B

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: Canby Rd & Browning St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	62	193	27	5	179	24	35	40	11	19	56	168
Future Volume (veh/h)	62	193	27	5	179	24	35	40	11	19	56	168
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		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1751	1683	1683	1683	1683	1751	1751	1683	1683	1683
Adj Flow Rate, veh/h	70	217	27	6	201	26	39	45	3	21	63	80
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	114	460	404	13	308	40	72	275	18	42	254	213
Arrive On Green	0.07	0.27	0.27	0.01	0.21	0.21	0.05	0.17	0.17	0.03	0.15	0.15
Sat Flow, veh/h	1603	1683	1478	1603	1460	189	1603	1623	108	1603	1683	1412
Grp Volume(v), veh/h	70	217	27	6	0	227	39	0	48	21	63	80
Grp Sat Flow(s),veh/h/ln	1603	1683	1478	1603	0	1649	1603	0	1731	1603	1683	1412
Q Serve(g_s), s	1.5	3.7	0.5	0.1	0.0	4.3	0.8	0.0	0.8	0.4	1.1	1.8
Cycle Q Clear(g_c), s	1.5	3.7	0.5	0.1	0.0	4.3	0.8	0.0	0.8	0.4	1.1	1.8
Prop In Lane	1.00		1.00	1.00		0.11	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	114	460	404	13	0	348	72	0	293	42	254	213
V/C Ratio(X)	0.62	0.47	0.07	0.46	0.00	0.65	0.54	0.00	0.16	0.50	0.25	0.38
Avail Cap(c_a), veh/h	256	904	794	233	0	862	233	0	930	233	904	758
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.5	10.4	9.3	17.0	0.0	12.4	16.1	0.0	12.2	16.5	12.9	13.2
Incr Delay (d2), s/veh	5.3	0.8	0.1	23.5	0.0	2.1	6.1	0.0	0.3	8.7	0.5	1.1
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	1.1	0.1	0.1	0.0	1.4	0.4	0.0	0.3	0.2	0.4	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	20.9	11.2	9.3	40.5	0.0	14.5	22.2	0.0	12.5	25.2	13.4	14.3
LnGrp LOS	C	B	A	D	A	B	C	A	B	C	B	B
Approach Vol, veh/h		314			233			87			164	
Approach Delay, s/veh		13.2			15.2			16.8			15.3	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.4	10.3	4.8	13.9	6.1	9.7	6.9	11.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	18.5	5.0	18.5	5.0	18.5	5.5	18.0
Max Q Clear Time (g_c+I1), s	2.4	2.8	2.1	5.7	2.8	3.8	3.5	6.3
Green Ext Time (p_c), s	0.0	0.1	0.0	1.0	0.0	0.4	0.0	0.9

Intersection Summary			
HCM 6th Ctrl Delay			14.6
HCM 6th LOS			B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
4: Churn Creek Rd & Browning St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	76	96	52	28	102	83	65	200	4	84	339	42
Future Volume (veh/h)	76	96	52	28	102	83	65	200	4	84	339	42
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		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	89	113	35	33	120	45	76	235	4	99	399	31
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	130	294	249	62	223	189	118	674	11	139	712	317
Arrive On Green	0.08	0.17	0.17	0.04	0.13	0.13	0.07	0.21	0.21	0.09	0.22	0.22
Sat Flow, veh/h	1603	1683	1427	1603	1683	1427	1603	3218	55	1603	3198	1423
Grp Volume(v), veh/h	89	113	35	33	120	45	76	117	122	99	399	31
Grp Sat Flow(s),veh/h/ln	1603	1683	1427	1603	1683	1427	1603	1599	1673	1603	1599	1423
Q Serve(g_s), s	2.0	2.2	0.8	0.7	2.4	1.0	1.7	2.3	2.3	2.2	4.1	0.6
Cycle Q Clear(g_c), s	2.0	2.2	0.8	0.7	2.4	1.0	1.7	2.3	2.3	2.2	4.1	0.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.03	1.00		1.00
Lane Grp Cap(c), veh/h	130	294	249	62	223	189	118	335	351	139	712	317
V/C Ratio(X)	0.68	0.38	0.14	0.53	0.54	0.24	0.65	0.35	0.35	0.71	0.56	0.10
Avail Cap(c_a), veh/h	218	826	700	218	826	700	218	784	821	218	1569	698
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.4	13.4	12.8	17.3	14.9	14.3	16.5	12.4	12.4	16.3	12.7	11.3
Incr Delay (d2), s/veh	6.2	0.8	0.3	6.8	2.0	0.6	5.8	0.6	0.6	6.6	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	0.8	0.7	0.2	0.3	0.9	0.3	0.7	0.7	0.7	0.9	1.1	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	22.6	14.2	13.1	24.1	16.9	14.9	22.3	13.0	13.0	22.9	13.4	11.5
LnGrp LOS	C	B	B	C	B	B	C	B	B	C	B	B
Approach Vol, veh/h		237			198			315			529	
Approach Delay, s/veh		17.2			17.6			15.2			15.0	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.7	12.2	5.9	10.9	7.2	12.7	7.5	9.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	18.0	5.0	18.0	5.0	18.0	5.0	18.0
Max Q Clear Time (g_c+I1), s	4.2	4.3	2.7	4.2	3.7	6.1	4.0	4.4
Green Ext Time (p_c), s	0.0	1.0	0.0	0.5	0.0	1.9	0.0	0.6

Intersection Summary			
HCM 6th Ctrl Delay			15.9
HCM 6th LOS			B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
5: Canby Rd & Old Alturas Rd

02/01/2023

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	23	58	118	12	57	115
Future Vol, veh/h	23	58	118	12	57	115
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	27	68	139	14	67	135
Number of Lanes	1	0	2	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	2
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	8	8.1	9
HCM LOS	A	A	A

Lane	NBLn1	NBLn2	WBLn1	SBLn1
Vol Left, %	0%	0%	28%	33%
Vol Thru, %	100%	77%	0%	67%
Vol Right, %	0%	23%	72%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	79	51	81	172
LT Vol	0	0	23	57
Through Vol	79	39	0	115
RT Vol	0	12	58	0
Lane Flow Rate	93	60	95	202
Geometry Grp	7	7	2	5
Degree of Util (X)	0.127	0.08	0.116	0.252
Departure Headway (Hd)	4.921	4.757	4.375	4.486
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	733	758	820	803
Service Time	2.621	2.457	2.393	2.503
HCM Lane V/C Ratio	0.127	0.079	0.116	0.252
HCM Control Delay	8.3	7.9	8	9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	0.3	0.4	1

HCM 6th Signalized Intersection Summary
1: Churn Creek Rd & Canby Rd/Whistling Dr

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	110	27	8	83	28	43	12	379	55	38	314	93
Future Volume (veh/h)	110	27	8	83	28	43	12	379	55	38	314	93
Initial Q (Qb), veh	0	0	0	1	1	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1945	1945	1870	1945	1945
Adj Flow Rate, veh/h	122	30	3	92	31	28	13	421	35	42	349	76
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	238	224	22	230	116	101	41	649	538	123	585	127
Arrive On Green	0.13	0.13	0.13	0.13	0.13	0.13	0.02	0.33	0.33	0.07	0.38	0.38
Sat Flow, veh/h	1781	1673	167	1781	882	797	1781	1945	1612	1781	1540	335
Grp Volume(v), veh/h	122	0	33	92	0	59	13	421	35	42	0	425
Grp Sat Flow(s),veh/h/ln	1781	0	1840	1781	0	1678	1781	1945	1612	1781	0	1875
Q Serve(g_s), s	3.4	0.0	0.9	2.6	0.0	1.7	0.4	9.9	0.8	1.2	0.0	9.8
Cycle Q Clear(g_c), s	3.4	0.0	0.9	2.6	0.0	1.7	0.4	9.9	0.8	1.2	0.0	9.8
Prop In Lane	1.00		0.09	1.00		0.47	1.00		1.00	1.00		0.18
Lane Grp Cap(c), veh/h	238	0	246	230	0	217	41	649	538	123	0	713
V/C Ratio(X)	0.51	0.00	0.13	0.40	0.00	0.27	0.32	0.65	0.07	0.34	0.00	0.60
Avail Cap(c_a), veh/h	596	0	615	596	0	561	232	651	539	265	0	714
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	0.00	1.00
Uniform Delay (d), s/veh	21.7	0.0	20.6	21.6	0.0	21.2	25.9	15.3	12.2	23.9	0.0	13.4
Incr Delay (d2), s/veh	1.7	0.0	0.2	1.1	0.0	0.7	4.4	5.0	0.2	1.6	0.0	3.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.4	0.0	0.4	1.2	0.0	0.7	0.2	4.5	0.3	0.5	0.0	4.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.4	0.0	20.8	23.0	0.0	22.1	30.3	20.2	12.5	25.5	0.0	17.1
LnGrp LOS	C	A	C	C	A	C	C	C	B	C	A	B
Approach Vol, veh/h		155			151			469			467	
Approach Delay, s/veh		22.9			22.6			19.9			17.8	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.2	22.5		11.7	5.7	25.0		11.4
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.0	18.0		18.0	7.0	19.0		18.0
Max Q Clear Time (g_c+I1), s	3.2	11.9		5.4	2.4	11.8		4.6
Green Ext Time (p_c), s	0.0	1.3		0.4	0.0	1.4		0.4

Intersection Summary	
HCM 6th Ctrl Delay	19.8
HCM 6th LOS	B

HCM 6th Signalized Intersection Summary
2: Hilltop Dr & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	55	31	248	37	301	53	520	345	225	370	20
Future Volume (veh/h)	44	55	31	248	37	301	53	520	345	225	370	20
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	1	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1616	1616	1683	1683	1751	1683	1683	1751	1683	1683	1683
Adj Flow Rate, veh/h	46	57	32	286	0	243	55	542	336	234	385	20
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	148	89	50	554	0	241	80	849	647	279	1173	60
Arrive On Green	0.09	0.09	0.09	0.18	0.00	0.18	0.05	0.26	0.26	0.17	0.38	0.38
Sat Flow, veh/h	1603	968	544	3206	0	1452	1603	3198	1473	1603	3089	160
Grp Volume(v), veh/h	46	0	89	286	0	243	55	542	336	234	199	206
Grp Sat Flow(s),veh/h/ln	1603	0	1512	1603	0	1452	1603	1599	1473	1603	1599	1649
Q Serve(g_s), s	1.6	0.0	3.4	4.8	0.0	9.9	2.0	9.1	10.0	8.4	5.2	5.3
Cycle Q Clear(g_c), s	1.6	0.0	3.4	4.8	0.0	9.9	2.0	9.1	10.0	8.4	5.2	5.3
Prop In Lane	1.00		0.36	1.00		1.00	1.00		1.00	1.00		0.10
Lane Grp Cap(c), veh/h	148	0	139	554	0	241	80	849	647	279	607	626
V/C Ratio(X)	0.31	0.00	0.64	0.52	0.00	1.01	0.69	0.64	0.52	0.84	0.33	0.33
Avail Cap(c_a), veh/h	484	0	456	565	0	256	204	1073	755	363	695	716
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	25.8	0.0	26.6	22.9	0.0	26.4	28.5	19.8	12.4	24.3	13.1	13.1
Incr Delay (d2), s/veh	1.2	0.0	4.8	0.8	0.0	58.1	10.1	0.8	0.6	12.8	0.3	0.3
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	0.6	0.0	1.4	1.8	0.0	7.2	1.0	3.1	4.2	4.0	1.7	1.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	27.0	0.0	31.4	23.7	0.0	84.5	38.6	20.6	13.1	37.1	13.5	13.5
LnGrp LOS	C	A	C	C	A	F	D	C	B	D	B	B
Approach Vol, veh/h		135			529			933			639	
Approach Delay, s/veh		29.9			51.6			18.9			22.1	
Approach LOS		C			D			B			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	14.9	19.7		10.0	7.5	27.1		15.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	13.5	20.0		18.0	7.6	25.9		10.5
Max Q Clear Time (g_c+I1), s	10.4	12.0		5.4	4.0	7.3		11.9
Green Ext Time (p_c), s	0.2	3.0		0.4	0.0	2.1		0.0

Intersection Summary		
HCM 6th Ctrl Delay		28.2
HCM 6th LOS		C

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: Canby Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	76	394	117	32	375	30	119	78	43	14	52	89
Future Volume (veh/h)	76	394	117	32	375	30	119	78	43	14	52	89
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		0.98	1.00		0.99	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1751	1683	1683	1683	1683	1751	1751	1683	1683	1683
Adj Flow Rate, veh/h	78	402	80	33	383	27	121	80	26	14	53	51
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	112	579	511	60	484	34	150	241	78	29	194	164
Arrive On Green	0.07	0.34	0.34	0.04	0.31	0.31	0.09	0.19	0.19	0.02	0.12	0.12
Sat Flow, veh/h	1603	1683	1484	1603	1551	109	1603	1261	410	1603	1683	1420
Grp Volume(v), veh/h	78	402	80	33	0	410	121	0	106	14	53	51
Grp Sat Flow(s),veh/h/ln	1603	1683	1484	1603	0	1661	1603	0	1670	1603	1683	1420
Q Serve(g_s), s	2.1	9.1	1.6	0.9	0.0	9.9	3.3	0.0	2.4	0.4	1.3	1.4
Cycle Q Clear(g_c), s	2.1	9.1	1.6	0.9	0.0	9.9	3.3	0.0	2.4	0.4	1.3	1.4
Prop In Lane	1.00		1.00	1.00		0.07	1.00		0.25	1.00		1.00
Lane Grp Cap(c), veh/h	112	579	511	60	0	518	150	0	319	29	194	164
V/C Ratio(X)	0.70	0.69	0.16	0.55	0.00	0.79	0.81	0.00	0.33	0.49	0.27	0.31
Avail Cap(c_a), veh/h	208	899	792	182	0	861	310	0	892	182	765	646
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.0	12.4	10.0	20.8	0.0	13.8	19.5	0.0	15.4	21.4	17.8	17.9
Incr Delay (d2), s/veh	7.6	1.5	0.1	7.5	0.0	2.8	9.7	0.0	0.6	12.3	0.7	1.1
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	0.9	2.8	0.4	0.4	0.0	3.3	1.4	0.0	0.8	0.2	0.5	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	27.6	13.9	10.1	28.3	0.0	16.6	29.3	0.0	16.0	33.7	18.5	18.9
LnGrp LOS	C	B	B	C	A	B	C	A	B	C	B	B
Approach Vol, veh/h		560			443			227			118	
Approach Delay, s/veh		15.3			17.5			23.1			20.5	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.3	12.9	6.2	19.6	8.6	9.6	7.6	18.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	23.5	5.0	23.5	8.5	20.0	5.7	22.8
Max Q Clear Time (g_c+I1), s	2.4	4.4	2.9	11.1	5.3	3.4	4.1	11.9
Green Ext Time (p_c), s	0.0	0.4	0.0	2.1	0.1	0.3	0.0	1.8

Intersection Summary		
HCM 6th Ctrl Delay		17.8
HCM 6th LOS		B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
4: Churn Creek Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	95	207	151	12	207	105	182	268	9	71	277	51
Future Volume (veh/h)	95	207	151	12	207	105	182	268	9	71	277	51
Initial Q (Qb), veh	0	0	0	0	0	0	1	5	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	100	218	99	13	218	55	192	282	3	75	292	19
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	129	434	366	27	327	271	240	796	8	109	530	233
Arrive On Green	0.08	0.26	0.26	0.02	0.19	0.19	0.15	0.24	0.24	0.07	0.16	0.16
Sat Flow, veh/h	1603	1683	1418	1603	1683	1395	1603	3242	34	1603	3198	1407
Grp Volume(v), veh/h	100	218	99	13	218	55	192	139	146	75	292	19
Grp Sat Flow(s),veh/h/ln	1603	1683	1418	1603	1683	1395	1603	1599	1677	1603	1599	1407
Q Serve(g_s), s	2.7	4.8	2.4	0.3	5.2	1.4	5.0	3.1	3.1	2.0	3.7	0.5
Cycle Q Clear(g_c), s	2.7	4.8	2.4	0.3	5.2	1.4	5.0	3.1	3.1	2.0	3.7	0.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	129	434	366	27	327	271	240	392	411	109	530	233
V/C Ratio(X)	0.78	0.50	0.27	0.49	0.67	0.20	0.80	0.35	0.36	0.69	0.55	0.08
Avail Cap(c_a), veh/h	203	716	603	184	696	577	350	757	794	291	1397	615
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.8	13.9	13.0	21.4	16.4	14.9	18.2	13.8	13.8	20.0	16.8	15.5
Incr Delay (d2), s/veh	9.5	0.9	0.4	13.0	2.3	0.4	8.1	0.5	0.5	7.4	0.9	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.5	0.4	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	1.6	0.7	0.2	1.9	0.4	2.2	1.1	1.2	0.9	1.2	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.3	14.8	13.4	34.4	18.7	15.2	27.0	14.8	14.7	27.4	17.7	15.6
LnGrp LOS	C	B	B	C	B	B	C	B	B	C	B	B
Approach Vol, veh/h		417			286			477			386	
Approach Delay, s/veh		17.9			18.8			19.7			19.5	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.5	15.1	5.2	15.7	11.0	11.6	8.0	13.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.9	20.6	5.0	18.5	9.5	19.0	5.5	18.0
Max Q Clear Time (g_c+I1), s	4.0	5.1	2.3	6.8	7.0	5.7	4.7	7.2
Green Ext Time (p_c), s	0.0	1.2	0.0	1.1	0.1	1.4	0.0	1.0

Intersection Summary	
HCM 6th Ctrl Delay	19.0
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
5: Canby Rd & Old Alturas Rd

02/01/2023

Intersection	
Intersection Delay, s/veh	13.3
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	57	162	254	84	155	240
Future Vol, veh/h	57	162	254	84	155	240
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	61	174	273	90	167	258
Number of Lanes	1	0	2	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	2
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	11.5	10.5	16.6
HCM LOS	B	B	C

Lane	NBLn1	NBLn2	WBLn1	SBLn1
Vol Left, %	0%	0%	26%	39%
Vol Thru, %	100%	50%	0%	61%
Vol Right, %	0%	50%	74%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	169	169	219	395
LT Vol	0	0	57	155
Through Vol	169	85	0	240
RT Vol	0	84	162	0
Lane Flow Rate	182	181	235	425
Geometry Grp	7	7	2	5
Degree of Util (X)	0.289	0.27	0.356	0.621
Departure Headway (Hd)	5.707	5.354	5.44	5.266
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	630	671	662	688
Service Time	3.436	3.083	3.473	3.293
HCM Lane V/C Ratio	0.289	0.27	0.355	0.618
HCM Control Delay	10.8	10.1	11.5	16.6
HCM Lane LOS	B	B	B	C
HCM 95th-tile Q	1.2	1.1	1.6	4.3

HCM 6th Signalized Intersection Summary
1: Churn Creek Rd & Canby Rd/Whistling Dr

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	63	18	191	127	172	15	182	166	270	260	82
Future Volume (veh/h)	55	63	18	191	127	172	15	182	166	270	260	82
Initial Q (Qb), veh	0	0	0	2	0	0	0	0	0	3	3	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1945	1945	1870	1945	1945
Adj Flow Rate, veh/h	65	74	14	225	149	163	18	214	76	318	306	58
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	181	155	29	382	175	191	52	470	398	367	672	123
Arrive On Green	0.10	0.10	0.10	0.21	0.21	0.21	0.03	0.24	0.24	0.20	0.42	0.42
Sat Flow, veh/h	1781	1529	289	1781	813	890	1781	1945	1648	1781	1589	301
Grp Volume(v), veh/h	65	0	88	225	0	312	18	214	76	318	0	364
Grp Sat Flow(s),veh/h/ln	1781	0	1818	1781	0	1703	1781	1945	1648	1781	0	1890
Q Serve(g_s), s	2.6	0.0	3.4	8.6	0.0	13.3	0.7	7.1	2.8	13.1	0.0	10.5
Cycle Q Clear(g_c), s	2.6	0.0	3.4	8.6	0.0	13.3	0.7	7.1	2.8	13.1	0.0	10.5
Prop In Lane	1.00		0.16	1.00		0.52	1.00		1.00	1.00		0.16
Lane Grp Cap(c), veh/h	181	0	184	382	0	366	52	470	398	367	0	788
V/C Ratio(X)	0.36	0.00	0.48	0.59	0.00	0.85	0.35	0.46	0.19	0.87	0.00	0.46
Avail Cap(c_a), veh/h	425	0	434	425	0	406	165	472	400	418	0	787
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	0.00	1.00
Uniform Delay (d), s/veh	31.7	0.0	32.1	26.9	0.0	28.6	36.1	24.5	22.8	29.4	0.0	16.1
Incr Delay (d2), s/veh	1.2	0.0	1.9	1.8	0.0	14.8	3.9	3.2	1.1	15.8	0.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.2
%ile BackOfQ(50%),veh/ln	1.1	0.0	1.6	4.0	0.0	6.8	0.4	3.4	1.1	7.4	0.0	4.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.9	0.0	34.0	29.1	0.0	43.4	40.0	27.6	23.9	48.9	0.0	18.2
LnGrp LOS	C	A	C	C	A	D	D	C	C	D	A	B
Approach Vol, veh/h		153			537			308			682	
Approach Delay, s/veh		33.6			37.4			27.4			32.5	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	19.8	22.8	12.2	6.7	35.9	20.6
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	17.7	18.3	18.0	7.0	29.0	18.0
Max Q Clear Time (g_c+I1), s	15.1	9.1	5.4	2.7	12.5	15.3
Green Ext Time (p_c), s	0.3	0.9	0.4	0.0	1.8	0.8

Intersection Summary	
HCM 6th Ctrl Delay	33.2
HCM 6th LOS	C

HCM 6th Signalized Intersection Summary
2: Hilltop Dr & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	7	2	416	6	204	6	165	186	182	422	11
Future Volume (veh/h)	2	7	2	416	6	204	6	165	186	182	422	11
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		1.00	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1616	1616	1683	1683	1751	1683	1683	1751	1683	1683	1683
Adj Flow Rate, veh/h	2	8	2	478	0	155	7	188	186	207	480	11
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	25	19	5	699	0	323	15	547	576	259	1032	24
Arrive On Green	0.02	0.02	0.02	0.22	0.00	0.22	0.01	0.17	0.17	0.16	0.32	0.32
Sat Flow, veh/h	1603	1248	312	3206	0	1484	1603	3198	1481	1603	3194	73
Grp Volume(v), veh/h	2	0	10	478	0	155	7	188	186	207	240	251
Grp Sat Flow(s),veh/h/ln	1603	0	1560	1603	0	1484	1603	1599	1481	1603	1599	1668
Q Serve(g_s), s	0.1	0.0	0.3	5.7	0.0	3.8	0.2	2.1	3.6	5.2	5.0	5.0
Cycle Q Clear(g_c), s	0.1	0.0	0.3	5.7	0.0	3.8	0.2	2.1	3.6	5.2	5.0	5.0
Prop In Lane	1.00		0.20	1.00		1.00	1.00		1.00	1.00		0.04
Lane Grp Cap(c), veh/h	25	0	24	699	0	323	15	547	576	259	517	539
V/C Ratio(X)	0.08	0.00	0.41	0.68	0.00	0.48	0.47	0.34	0.32	0.80	0.46	0.47
Avail Cap(c_a), veh/h	696	0	677	1098	0	508	193	1388	966	456	956	997
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	20.1	0.0	20.2	14.9	0.0	14.2	20.4	15.1	8.9	16.7	11.2	11.2
Incr Delay (d2), s/veh	1.4	0.0	10.8	1.2	0.0	1.1	21.0	0.4	0.3	5.6	0.7	0.6
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	0.0	0.0	0.2	1.8	0.0	1.1	0.1	0.7	1.4	2.0	1.4	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.5	0.0	31.0	16.1	0.0	15.3	41.4	15.5	9.2	22.3	11.8	11.8
LnGrp LOS	C	A	C	B	A	B	D	B	A	C	B	B
Approach Vol, veh/h		12			633			381			698	
Approach Delay, s/veh		29.4			15.9			12.9			14.9	
Approach LOS		C			B			B			B	

Timer - Assigned Phs	1	2	4	5	6	8
Phs Duration (G+Y+Rc), s	11.2	11.6	5.1	4.9	17.9	13.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	11.8	18.0	18.0	5.0	24.8	14.2
Max Q Clear Time (g_c+I1), s	7.2	5.6	2.3	2.2	7.0	7.7
Green Ext Time (p_c), s	0.2	1.4	0.0	0.0	2.6	1.4

Intersection Summary	
HCM 6th Ctrl Delay	14.9
HCM 6th LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: Canby Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	62	249	27	5	231	24	35	40	11	21	56	168
Future Volume (veh/h)	62	249	27	5	231	24	35	40	11	21	56	168
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		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1751	1683	1683	1683	1683	1751	1751	1683	1683	1683
Adj Flow Rate, veh/h	70	280	27	6	260	26	39	45	3	24	63	80
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	112	517	454	13	369	37	72	257	17	47	241	202
Arrive On Green	0.07	0.31	0.31	0.01	0.25	0.25	0.04	0.16	0.16	0.03	0.14	0.14
Sat Flow, veh/h	1603	1683	1479	1603	1506	151	1603	1623	108	1603	1683	1412
Grp Volume(v), veh/h	70	280	27	6	0	286	39	0	48	24	63	80
Grp Sat Flow(s),veh/h/ln	1603	1683	1479	1603	0	1656	1603	0	1731	1603	1683	1412
Q Serve(g_s), s	1.5	5.0	0.5	0.1	0.0	5.7	0.9	0.0	0.9	0.5	1.2	1.9
Cycle Q Clear(g_c), s	1.5	5.0	0.5	0.1	0.0	5.7	0.9	0.0	0.9	0.5	1.2	1.9
Prop In Lane	1.00		1.00	1.00		0.09	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	112	517	454	13	0	406	72	0	275	47	241	202
V/C Ratio(X)	0.63	0.54	0.06	0.46	0.00	0.70	0.54	0.00	0.17	0.51	0.26	0.40
Avail Cap(c_a), veh/h	234	850	747	221	0	823	221	0	893	221	869	728
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.4	10.4	8.9	17.9	0.0	12.5	16.9	0.0	13.2	17.3	13.8	14.1
Incr Delay (d2), s/veh	5.6	0.9	0.1	23.6	0.0	2.2	6.2	0.0	0.3	8.1	0.6	1.2
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	0.6	1.4	0.1	0.1	0.0	1.8	0.4	0.0	0.3	0.3	0.4	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	22.0	11.3	8.9	41.4	0.0	14.7	23.2	0.0	13.5	25.4	14.4	15.3
LnGrp LOS	C	B	A	D	A	B	C	A	B	C	B	B
Approach Vol, veh/h		377			292			87			167	
Approach Delay, s/veh		13.1			15.3			17.8			16.4	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.6	10.2	4.8	15.6	6.1	9.7	7.0	13.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	18.7	5.0	18.3	5.0	18.7	5.3	18.0
Max Q Clear Time (g_c+I1), s	2.5	2.9	2.1	7.0	2.9	3.9	3.5	7.7
Green Ext Time (p_c), s	0.0	0.1	0.0	1.2	0.0	0.4	0.0	1.1

Intersection Summary	
HCM 6th Ctrl Delay	14.8
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
4: Churn Creek Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	125	96	60	28	116	84	66	200	4	89	418	82
Future Volume (veh/h)	125	96	60	28	116	84	66	200	4	89	418	82
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		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	147	113	45	33	136	46	78	235	4	105	492	78
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	180	356	301	61	230	195	114	750	13	135	787	350
Arrive On Green	0.11	0.21	0.21	0.04	0.14	0.14	0.07	0.23	0.23	0.08	0.25	0.25
Sat Flow, veh/h	1603	1683	1427	1603	1683	1427	1603	3218	55	1603	3198	1423
Grp Volume(v), veh/h	147	113	45	33	136	46	78	117	122	105	492	78
Grp Sat Flow(s),veh/h/ln	1603	1683	1427	1603	1683	1427	1603	1599	1673	1603	1599	1423
Q Serve(g_s), s	3.7	2.4	1.1	0.8	3.2	1.2	2.0	2.5	2.5	2.7	5.7	1.8
Cycle Q Clear(g_c), s	3.7	2.4	1.1	0.8	3.2	1.2	2.0	2.5	2.5	2.7	5.7	1.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.03	1.00		1.00
Lane Grp Cap(c), veh/h	180	356	301	61	230	195	114	373	390	135	787	350
V/C Ratio(X)	0.82	0.32	0.15	0.54	0.59	0.24	0.68	0.31	0.31	0.78	0.63	0.22
Avail Cap(c_a), veh/h	193	729	618	193	729	618	193	693	725	193	1385	616
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.0	13.9	13.3	19.6	16.8	16.0	18.8	13.2	13.2	18.6	14.0	12.5
Incr Delay (d2), s/veh	21.9	0.5	0.2	7.2	2.4	0.6	6.9	0.5	0.5	11.7	0.8	0.3
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	2.2	0.8	0.3	0.4	1.2	0.4	0.8	0.7	0.8	1.3	1.7	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.9	14.4	13.6	26.9	19.2	16.6	25.8	13.7	13.6	30.4	14.8	12.8
LnGrp LOS	D	B	B	C	B	B	C	B	B	C	B	B
Approach Vol, veh/h		305			215			317			675	
Approach Delay, s/veh		26.5			19.8			16.6			17.0	
Approach LOS		C			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.0	14.2	6.1	13.3	7.5	14.7	9.2	10.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	18.0	5.0	18.0	5.0	18.0	5.0	18.0
Max Q Clear Time (g_c+I1), s	4.7	4.5	2.8	4.4	4.0	7.7	5.7	5.2
Green Ext Time (p_c), s	0.0	0.9	0.0	0.5	0.0	2.4	0.0	0.6

Intersection Summary	
HCM 6th Ctrl Delay	19.2
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	25	58	118	14	57	118
Future Vol, veh/h	25	58	118	14	57	118
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	29	68	139	16	67	139
Number of Lanes	1	0	2	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	2
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	8	8.1	9.1
HCM LOS	A	A	A

Lane	NBLn1	NBLn2	WBLn1	SBLn1
Vol Left, %	0%	0%	30%	33%
Vol Thru, %	100%	74%	0%	67%
Vol Right, %	0%	26%	70%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	79	53	83	175
LT Vol	0	0	25	57
Through Vol	79	39	0	118
RT Vol	0	14	58	0
Lane Flow Rate	93	63	98	206
Geometry Grp	7	7	2	5
Degree of Util (X)	0.127	0.083	0.119	0.257
Departure Headway (Hd)	4.931	4.746	4.402	4.494
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	731	759	815	801
Service Time	2.631	2.446	2.421	2.51
HCM Lane V/C Ratio	0.127	0.083	0.12	0.257
HCM Control Delay	8.3	7.9	8	9.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	0.3	0.4	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	112	27	8	83	28	126	12	391	55	179	316	93
Future Volume (veh/h)	112	27	8	83	28	126	12	391	55	179	316	93
Initial Q (Qb), veh	0	0	0	1	1	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1945	1945	1870	1945	1945
Adj Flow Rate, veh/h	124	30	3	92	31	120	13	434	35	199	351	76
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	199	187	19	252	50	173	40	672	557	244	709	154
Arrive On Green	0.11	0.11	0.11	0.14	0.14	0.14	0.02	0.35	0.35	0.14	0.46	0.46
Sat Flow, veh/h	1781	1673	167	1781	323	1250	1781	1945	1612	1781	1542	334
Grp Volume(v), veh/h	124	0	33	92	0	151	13	434	35	199	0	427
Grp Sat Flow(s),veh/h/ln	1781	0	1840	1781	0	1573	1781	1945	1612	1781	0	1876
Q Serve(g_s), s	4.5	0.0	1.1	3.2	0.0	6.2	0.5	12.8	1.0	7.4	0.0	10.8
Cycle Q Clear(g_c), s	4.5	0.0	1.1	3.2	0.0	6.2	0.5	12.8	1.0	7.4	0.0	10.8
Prop In Lane	1.00		0.09	1.00		0.79	1.00		1.00	1.00		0.18
Lane Grp Cap(c), veh/h	199	0	205	252	0	223	40	672	557	244	0	863
V/C Ratio(X)	0.62	0.00	0.16	0.37	0.00	0.68	0.33	0.65	0.06	0.82	0.00	0.49
Avail Cap(c_a), veh/h	472	0	488	472	0	417	184	673	558	328	0	864
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	0.00	1.00
Uniform Delay (d), s/veh	28.9	0.0	27.3	26.5	0.0	27.8	32.7	18.8	14.9	28.5	0.0	12.8
Incr Delay (d2), s/veh	3.2	0.0	0.4	0.9	0.0	3.5	4.6	4.7	0.2	11.1	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.0	0.5	1.5	0.0	2.6	0.2	5.9	0.4	3.7	0.0	4.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.0	0.0	27.7	27.6	0.0	31.8	37.4	23.5	15.1	39.6	0.0	14.9
LnGrp LOS	C	A	C	C	A	C	D	C	B	D	A	B
Approach Vol, veh/h		157			243			482			626	
Approach Delay, s/veh		31.1			30.2			23.3			22.7	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.8	28.0		12.1	6.0	35.8		14.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	12.5	23.5		18.0	7.0	29.0		18.0
Max Q Clear Time (g_c+I1), s	9.4	14.8		6.5	2.5	12.8		8.2
Green Ext Time (p_c), s	0.2	1.7		0.3	0.0	2.2		0.8

Intersection Summary		
HCM 6th Ctrl Delay		25.0
HCM 6th LOS		C

HCM 6th Signalized Intersection Summary
2: Hilltop Dr & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	49	62	35	278	42	338	59	584	387	253	415	22
Future Volume (veh/h)	49	62	35	278	42	338	59	584	387	253	415	22
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	1	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1616	1616	1683	1683	1751	1683	1683	1751	1683	1683	1683
Adj Flow Rate, veh/h	51	65	36	321	0	281	61	608	380	264	432	22
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	159	96	53	608	0	269	79	853	675	307	1246	63
Arrive On Green	0.10	0.10	0.10	0.19	0.00	0.19	0.05	0.26	0.26	0.19	0.40	0.40
Sat Flow, veh/h	1603	974	539	3206	0	1453	1603	3198	1473	1603	3092	157
Grp Volume(v), veh/h	51	0	101	321	0	281	61	608	380	264	223	231
Grp Sat Flow(s),veh/h/ln	1603	0	1513	1603	0	1453	1603	1599	1473	1603	1599	1650
Q Serve(g_s), s	2.1	0.0	4.5	6.3	0.0	13.5	2.6	12.2	13.4	11.2	6.8	6.8
Cycle Q Clear(g_c), s	2.1	0.0	4.5	6.3	0.0	13.5	2.6	12.2	13.4	11.2	6.8	6.8
Prop In Lane	1.00		0.36	1.00		1.00	1.00		1.00	1.00		0.10
Lane Grp Cap(c), veh/h	159	0	150	608	0	269	79	853	675	307	644	665
V/C Ratio(X)	0.32	0.00	0.67	0.53	0.00	1.04	0.77	0.71	0.56	0.86	0.35	0.35
Avail Cap(c_a), veh/h	411	0	388	616	0	279	224	1001	746	422	699	721
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	29.8	0.0	31.0	26.0	0.0	29.7	33.4	23.6	14.2	27.8	14.6	14.6
Incr Delay (d2), s/veh	1.2	0.0	5.2	0.8	0.0	67.1	14.7	2.0	0.8	12.4	0.3	0.3
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	1.9	2.4	0.0	9.4	1.3	4.5	6.0	5.1	2.3	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	31.0	0.0	36.1	26.8	0.0	96.8	48.1	25.6	14.9	40.3	14.9	14.9
LnGrp LOS	C	A	D	C	A	F	D	C	B	D	B	B
Approach Vol, veh/h		152			602			1049			718	
Approach Delay, s/veh		34.4			59.5			23.0			24.2	
Approach LOS		C			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.0	22.8		11.5	8.0	32.8		18.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	18.5	22.0		18.0	9.8	30.7		13.5
Max Q Clear Time (g_c+I1), s	13.2	15.4		6.5	4.6	8.8		15.5
Green Ext Time (p_c), s	0.4	3.0		0.5	0.0	2.5		0.0

Intersection Summary		
HCM 6th Ctrl Delay		32.8
HCM 6th LOS		C

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: Canby Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	76	419	119	34	426	31	120	78	43	14	52	90
Future Volume (veh/h)	76	419	119	34	426	31	120	78	43	14	52	90
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		0.98	1.00		0.99	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1751	1683	1683	1683	1683	1751	1751	1683	1683	1683
Adj Flow Rate, veh/h	78	428	82	35	435	28	122	80	26	14	53	52
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	110	622	548	63	531	34	151	234	76	29	184	156
Arrive On Green	0.07	0.37	0.37	0.04	0.34	0.34	0.09	0.19	0.19	0.02	0.11	0.11
Sat Flow, veh/h	1603	1683	1484	1603	1562	101	1603	1261	410	1603	1683	1420
Grp Volume(v), veh/h	78	428	82	35	0	463	122	0	106	14	53	52
Grp Sat Flow(s),veh/h/ln	1603	1683	1484	1603	0	1663	1603	0	1670	1603	1683	1420
Q Serve(g_s), s	2.2	10.0	1.7	1.0	0.0	11.8	3.5	0.0	2.6	0.4	1.3	1.6
Cycle Q Clear(g_c), s	2.2	10.0	1.7	1.0	0.0	11.8	3.5	0.0	2.6	0.4	1.3	1.6
Prop In Lane	1.00		1.00	1.00		0.06	1.00		0.25	1.00		1.00
Lane Grp Cap(c), veh/h	110	622	548	63	0	565	151	0	311	29	184	156
V/C Ratio(X)	0.71	0.69	0.15	0.56	0.00	0.82	0.81	0.00	0.34	0.49	0.29	0.33
Avail Cap(c_a), veh/h	190	871	767	173	0	842	259	0	828	173	744	627
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.2	12.4	9.8	21.9	0.0	14.0	20.6	0.0	16.4	22.6	19.0	19.1
Incr Delay (d2), s/veh	8.3	1.4	0.1	7.5	0.0	4.0	9.8	0.0	0.6	12.5	0.8	1.2
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	1.0	3.1	0.5	0.5	0.0	4.1	1.5	0.0	0.9	0.2	0.5	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.4	13.7	9.9	29.4	0.0	18.0	30.4	0.0	17.1	35.0	19.8	20.3
LnGrp LOS	C	B	A	C	A	B	C	A	B	D	B	C
Approach Vol, veh/h		588			498			228			119	
Approach Delay, s/veh		15.3			18.8			24.2			21.9	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.3	13.1	6.3	21.6	8.9	9.6	7.7	20.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	23.0	5.0	24.0	7.5	20.5	5.5	23.5
Max Q Clear Time (g_c+I1), s	2.4	4.6	3.0	12.0	5.5	3.6	4.2	13.8
Green Ext Time (p_c), s	0.0	0.4	0.0	2.2	0.1	0.3	0.0	2.0

Intersection Summary		
HCM 6th Ctrl Delay		18.5
HCM 6th LOS		B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
4: Churn Creek Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	207	151	12	207	105	204	326	9	85	370	82
Future Volume (veh/h)	115	207	151	12	207	105	204	326	9	85	370	82
Initial Q (Qb), veh	0	0	0	0	0	0	1	5	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	121	218	99	13	218	55	215	343	3	89	389	51
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	150	443	373	26	313	260	267	932	8	114	613	270
Arrive On Green	0.09	0.26	0.26	0.02	0.19	0.19	0.17	0.28	0.28	0.07	0.19	0.19
Sat Flow, veh/h	1603	1683	1418	1603	1683	1395	1603	3249	28	1603	3198	1408
Grp Volume(v), veh/h	121	218	99	13	218	55	215	169	177	89	389	51
Grp Sat Flow(s),veh/h/ln	1603	1683	1418	1603	1683	1395	1603	1599	1678	1603	1599	1408
Q Serve(g_s), s	3.7	5.4	2.7	0.4	6.0	1.7	6.4	4.2	4.2	2.7	5.5	1.5
Cycle Q Clear(g_c), s	3.7	5.4	2.7	0.4	6.0	1.7	6.4	4.2	4.2	2.7	5.5	1.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	150	443	373	26	313	260	267	458	481	114	613	270
V/C Ratio(X)	0.81	0.49	0.27	0.49	0.70	0.21	0.81	0.37	0.37	0.78	0.63	0.19
Avail Cap(c_a), veh/h	243	698	588	162	613	508	405	685	719	334	1229	541
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.1	15.5	14.5	24.2	18.9	17.1	20.0	14.3	14.3	22.7	18.5	16.8
Incr Delay (d2), s/veh	9.8	0.8	0.4	13.4	2.8	0.4	6.8	0.5	0.5	10.8	1.1	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.3	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	1.9	0.8	0.2	2.3	0.5	2.6	1.5	1.5	1.2	1.8	0.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	31.9	16.4	14.9	37.6	21.7	17.5	27.4	15.1	15.0	33.5	19.6	17.2
LnGrp LOS	C	B	B	D	C	B	C	B	B	C	B	B
Approach Vol, veh/h		438			286			561			529	
Approach Delay, s/veh		20.3			21.6			19.8			21.7	
Approach LOS		C			C			B			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.0	18.6	5.3	17.5	12.7	14.0	9.1	13.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	10.3	21.2	5.0	20.5	12.5	19.0	7.5	18.0
Max Q Clear Time (g_c+I1), s	4.7	6.2	2.4	7.4	8.4	7.5	5.7	8.0
Green Ext Time (p_c), s	0.1	1.6	0.0	1.2	0.2	1.9	0.0	0.9

Intersection Summary	
HCM 6th Ctrl Delay	20.8
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
5: Canby Rd & Old Alturas Rd

02/01/2023

Intersection	
Intersection Delay, s/veh	13.4
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	59	164	254	88	160	240
Future Vol, veh/h	59	164	254	88	160	240
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	63	176	273	95	172	258
Number of Lanes	1	0	2	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	2
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	11.6	10.5	17
HCM LOS	B	B	C

Lane	NBLn1	NBLn2	WBLn1	SBLn1
Vol Left, %	0%	0%	26%	40%
Vol Thru, %	100%	49%	0%	60%
Vol Right, %	0%	51%	74%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	169	173	223	400
LT Vol	0	0	59	160
Through Vol	169	85	0	240
RT Vol	0	88	164	0
Lane Flow Rate	182	186	240	430
Geometry Grp	7	7	2	5
Degree of Util (X)	0.29	0.277	0.364	0.632
Departure Headway (Hd)	5.734	5.373	5.469	5.291
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	628	668	657	684
Service Time	3.464	3.103	3.503	3.317
HCM Lane V/C Ratio	0.29	0.278	0.365	0.629
HCM Control Delay	10.8	10.2	11.6	17
HCM Lane LOS	B	B	B	C
HCM 95th-tile Q	1.2	1.1	1.7	4.5

HCM 6th Signalized Intersection Summary
1: Churn Creek Rd & Canby Rd/Whistling Dr

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	59	63	18	191	127	118	15	178	166	142	258	84
Future Volume (veh/h)	59	63	18	191	127	118	15	178	166	142	258	84
Initial Q (Qb), veh	0	0	0	2	0	0	0	0	0	3	3	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1945	1945	1870	1945	1945
Adj Flow Rate, veh/h	69	74	14	225	149	100	18	209	76	167	304	61
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	209	180	34	345	208	140	53	548	464	211	596	114
Arrive On Green	0.12	0.12	0.12	0.19	0.19	0.19	0.03	0.29	0.29	0.12	0.37	0.37
Sat Flow, veh/h	1781	1529	289	1781	1040	698	1781	1945	1648	1781	1572	315
Grp Volume(v), veh/h	69	0	88	225	0	249	18	209	76	167	0	365
Grp Sat Flow(s),veh/h/ln	1781	0	1818	1781	0	1738	1781	1945	1648	1781	0	1887
Q Serve(g_s), s	2.2	0.0	2.8	7.4	0.0	8.5	0.6	5.4	2.2	5.7	0.0	9.5
Cycle Q Clear(g_c), s	2.2	0.0	2.8	7.4	0.0	8.5	0.6	5.4	2.2	5.7	0.0	9.5
Prop In Lane	1.00		0.16	1.00		0.40	1.00		1.00	1.00		0.17
Lane Grp Cap(c), veh/h	209	0	213	345	0	348	53	548	464	211	0	706
V/C Ratio(X)	0.33	0.00	0.41	0.65	0.00	0.72	0.34	0.38	0.16	0.79	0.00	0.52
Avail Cap(c_a), veh/h	508	0	518	508	0	495	197	554	470	226	0	708
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	0.00	1.00
Uniform Delay (d), s/veh	25.9	0.0	26.2	23.7	0.0	23.9	30.4	18.5	17.3	28.2	0.0	15.6
Incr Delay (d2), s/veh	0.9	0.0	1.3	2.1	0.0	2.8	3.7	2.0	0.8	16.4	0.0	2.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.3
%ile BackOfQ(50%),veh/ln	1.0	0.0	1.3	3.4	0.0	3.6	0.3	2.5	0.8	3.9	0.0	4.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.9	0.0	27.5	26.5	0.0	26.7	34.1	20.5	18.1	51.7	0.0	18.6
LnGrp LOS	C	A	C	C	A	C	C	C	B	D	A	B
Approach Vol, veh/h		157			474			303			532	
Approach Delay, s/veh		27.2			26.6			20.7			29.0	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.1	22.5		12.0	6.4	28.2		16.6
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.0	18.0		18.0	7.0	19.0		18.0
Max Q Clear Time (g_c+I1), s	7.7	7.4		4.8	2.6	11.5		10.5
Green Ext Time (p_c), s	0.0	0.9		0.5	0.0	1.2		1.4

Intersection Summary	
HCM 6th Ctrl Delay	26.3
HCM 6th LOS	C

HCM 6th Signalized Intersection Summary
2: Hilltop Dr & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	6	2	349	5	172	5	135	155	151	346	9
Future Volume (veh/h)	2	6	2	349	5	172	5	135	155	151	346	9
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		1.00	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1616	1616	1683	1683	1751	1683	1683	1751	1683	1683	1683
Adj Flow Rate, veh/h	2	7	2	401	0	118	6	153	151	172	393	9
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	23	17	5	640	0	296	13	513	534	217	920	21
Arrive On Green	0.01	0.01	0.01	0.20	0.00	0.20	0.01	0.16	0.16	0.14	0.29	0.29
Sat Flow, veh/h	1603	1209	345	3206	0	1484	1603	3198	1481	1603	3194	73
Grp Volume(v), veh/h	2	0	9	401	0	118	6	153	151	172	196	206
Grp Sat Flow(s),veh/h/ln	1603	0	1554	1603	0	1484	1603	1599	1481	1603	1599	1668
Q Serve(g_s), s	0.0	0.0	0.2	4.2	0.0	2.5	0.1	1.5	2.7	3.8	3.7	3.7
Cycle Q Clear(g_c), s	0.0	0.0	0.2	4.2	0.0	2.5	0.1	1.5	2.7	3.8	3.7	3.7
Prop In Lane	1.00		0.22	1.00		1.00	1.00		1.00	1.00		0.04
Lane Grp Cap(c), veh/h	23	0	22	640	0	296	13	513	534	217	460	480
V/C Ratio(X)	0.09	0.00	0.40	0.63	0.00	0.40	0.46	0.30	0.28	0.79	0.43	0.43
Avail Cap(c_a), veh/h	786	0	761	1178	0	545	218	1654	1062	502	1110	1158
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	17.9	0.0	17.9	13.5	0.0	12.8	18.1	13.6	8.4	15.4	10.6	10.6
Incr Delay (d2), s/veh	1.6	0.0	11.1	1.0	0.0	0.9	23.6	0.3	0.3	6.4	0.6	0.6
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	0.0	0.0	0.1	1.3	0.0	0.7	0.1	0.5	1.0	1.5	1.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	19.4	0.0	29.1	14.5	0.0	13.7	41.7	13.9	8.7	21.7	11.2	11.2
LnGrp LOS	B	A	C	B	A	B	D	B	A	C	B	B
Approach Vol, veh/h		11			519			310			574	
Approach Delay, s/veh		27.3			14.3			11.9			14.4	
Approach LOS		C			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.5	10.4		5.0	4.8	15.1		11.8
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	11.5	19.0		18.0	5.0	25.5		13.5
Max Q Clear Time (g_c+I1), s	5.8	4.7		2.2	2.1	5.7		6.2
Green Ext Time (p_c), s	0.2	1.2		0.0	0.0	2.1		1.2

Intersection Summary	
HCM 6th Ctrl Delay	13.9
HCM 6th LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: Canby Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	67	193	27	5	182	25	36	41	11	26	61	168
Future Volume (veh/h)	67	193	27	5	182	25	36	41	11	26	61	168
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		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1751	1683	1683	1683	1683	1751	1751	1683	1683	1683
Adj Flow Rate, veh/h	75	217	27	6	204	27	40	46	3	29	69	80
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	119	469	412	13	310	41	74	260	17	56	251	211
Arrive On Green	0.07	0.28	0.28	0.01	0.21	0.21	0.05	0.16	0.16	0.04	0.15	0.15
Sat Flow, veh/h	1603	1683	1478	1603	1456	193	1603	1626	106	1603	1683	1412
Grp Volume(v), veh/h	75	217	27	6	0	231	40	0	49	29	69	80
Grp Sat Flow(s),veh/h/ln	1603	1683	1478	1603	0	1649	1603	0	1732	1603	1683	1412
Q Serve(g_s), s	1.6	3.7	0.5	0.1	0.0	4.5	0.8	0.0	0.9	0.6	1.3	1.8
Cycle Q Clear(g_c), s	1.6	3.7	0.5	0.1	0.0	4.5	0.8	0.0	0.9	0.6	1.3	1.8
Prop In Lane	1.00		1.00	1.00		0.12	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	119	469	412	13	0	351	74	0	277	56	251	211
V/C Ratio(X)	0.63	0.46	0.07	0.46	0.00	0.66	0.54	0.00	0.18	0.51	0.27	0.38
Avail Cap(c_a), veh/h	254	896	787	231	0	853	231	0	921	231	896	751
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.6	10.4	9.2	17.2	0.0	12.5	16.2	0.0	12.6	16.5	13.1	13.3
Incr Delay (d2), s/veh	5.4	0.7	0.1	23.5	0.0	2.1	6.0	0.0	0.3	7.1	0.6	1.1
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	1.1	0.1	0.1	0.0	1.4	0.4	0.0	0.3	0.3	0.4	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.1	11.1	9.3	40.6	0.0	14.6	22.3	0.0	12.9	23.6	13.7	14.5
LnGrp LOS	C	B	A	D	A	B	C	A	B	C	B	B
Approach Vol, veh/h		319			237			89			178	
Approach Delay, s/veh		13.3			15.3			17.1			15.7	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.7	10.1	4.8	14.2	6.1	9.7	7.1	11.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	18.5	5.0	18.5	5.0	18.5	5.5	18.0
Max Q Clear Time (g_c+I1), s	2.6	2.9	2.1	5.7	2.8	3.8	3.6	6.5
Green Ext Time (p_c), s	0.0	0.1	0.0	1.0	0.0	0.4	0.0	0.9

Intersection Summary	
HCM 6th Ctrl Delay	14.8
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
4: Churn Creek Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	76	98	57	28	103	83	68	200	4	84	339	42
Future Volume (veh/h)	76	98	57	28	103	83	68	200	4	84	339	42
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		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	89	115	41	33	121	45	80	235	4	99	399	31
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	130	295	250	62	224	190	122	681	12	139	710	316
Arrive On Green	0.08	0.18	0.18	0.04	0.13	0.13	0.08	0.21	0.21	0.09	0.22	0.22
Sat Flow, veh/h	1603	1683	1427	1603	1683	1427	1603	3218	55	1603	3198	1423
Grp Volume(v), veh/h	89	115	41	33	121	45	80	117	122	99	399	31
Grp Sat Flow(s),veh/h/ln	1603	1683	1427	1603	1683	1427	1603	1599	1673	1603	1599	1423
Q Serve(g_s), s	2.0	2.2	0.9	0.7	2.5	1.0	1.8	2.3	2.3	2.2	4.1	0.6
Cycle Q Clear(g_c), s	2.0	2.2	0.9	0.7	2.5	1.0	1.8	2.3	2.3	2.2	4.1	0.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.03	1.00		1.00
Lane Grp Cap(c), veh/h	130	295	250	62	224	190	122	338	354	139	710	316
V/C Ratio(X)	0.68	0.39	0.16	0.53	0.54	0.24	0.66	0.34	0.35	0.71	0.56	0.10
Avail Cap(c_a), veh/h	217	822	696	217	822	696	217	781	817	217	1561	694
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.5	13.5	12.9	17.4	14.9	14.3	16.6	12.4	12.4	16.4	12.7	11.4
Incr Delay (d2), s/veh	6.2	0.8	0.3	6.8	2.0	0.6	5.9	0.6	0.6	6.7	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	0.8	0.7	0.2	0.3	0.9	0.3	0.7	0.7	0.7	0.9	1.1	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	22.7	14.3	13.2	24.2	17.0	15.0	22.5	13.0	12.9	23.1	13.4	11.5
LnGrp LOS	C	B	B	C	B	B	C	B	B	C	B	B
Approach Vol, veh/h		245			199			319			529	
Approach Delay, s/veh		17.2			17.7			15.4			15.1	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.7	12.3	5.9	11.0	7.3	12.7	7.5	9.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	18.0	5.0	18.0	5.0	18.0	5.0	18.0
Max Q Clear Time (g_c+I1), s	4.2	4.3	2.7	4.2	3.8	6.1	4.0	4.5
Green Ext Time (p_c), s	0.0	1.0	0.0	0.5	0.0	1.9	0.0	0.6

Intersection Summary	
HCM 6th Ctrl Delay	16.0
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	23	58	120	12	57	120
Future Vol, veh/h	23	58	120	12	57	120
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	27	68	141	14	67	141
Number of Lanes	1	0	2	0	0	1
Approach	**WB**		**NB**		**SB**	
Opposing Approach			SB		NB	
Opposing Lanes	0		1		2	
Conflicting Approach Left	NB				WB	
Conflicting Lanes Left	2		0		1	
Conflicting Approach Right	SB		WB			
Conflicting Lanes Right	1		1		0	
HCM Control Delay	8		8.2		9.1	
HCM LOS	A		A		A	

Lane	NBLn1	NBLn2	WBLn1	SBLn1
Vol Left, %	0%	0%	28%	32%
Vol Thru, %	100%	77%	0%	68%
Vol Right, %	0%	23%	72%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	80	52	81	177
LT Vol	0	0	23	57
Through Vol	80	40	0	120
RT Vol	0	12	58	0
Lane Flow Rate	94	61	95	208
Geometry Grp	7	7	2	5
Degree of Util (X)	0.129	0.081	0.116	0.26
Departure Headway (Hd)	4.926	4.764	4.392	4.487
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	732	757	818	802
Service Time	2.626	2.464	2.413	2.503
HCM Lane V/C Ratio	0.128	0.081	0.116	0.259
HCM Control Delay	8.4	7.9	8	9.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	0.3	0.4	1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	113	27	8	83	28	43	12	379	55	38	314	98
Future Volume (veh/h)	113	27	8	83	28	43	12	379	55	38	314	98
Initial Q (Qb), veh	0	0	0	1	1	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1945	1945	1870	1945	1945
Adj Flow Rate, veh/h	126	30	3	92	31	28	13	421	35	42	349	82
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	240	225	23	230	116	101	41	649	538	123	575	135
Arrive On Green	0.13	0.13	0.13	0.13	0.13	0.13	0.02	0.33	0.33	0.07	0.38	0.38
Sat Flow, veh/h	1781	1673	167	1781	882	797	1781	1945	1612	1781	1515	356
Grp Volume(v), veh/h	126	0	33	92	0	59	13	421	35	42	0	431
Grp Sat Flow(s),veh/h/ln	1781	0	1840	1781	0	1678	1781	1945	1612	1781	0	1871
Q Serve(g_s), s	3.5	0.0	0.9	2.6	0.0	1.7	0.4	9.9	0.8	1.2	0.0	10.0
Cycle Q Clear(g_c), s	3.5	0.0	0.9	2.6	0.0	1.7	0.4	9.9	0.8	1.2	0.0	10.0
Prop In Lane	1.00		0.09	1.00		0.47	1.00		1.00	1.00		0.19
Lane Grp Cap(c), veh/h	240	0	248	230	0	217	41	649	538	123	0	711
V/C Ratio(X)	0.53	0.00	0.13	0.40	0.00	0.27	0.32	0.65	0.07	0.34	0.00	0.61
Avail Cap(c_a), veh/h	595	0	615	595	0	561	231	650	539	265	0	712
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	0.00	1.00
Uniform Delay (d), s/veh	21.8	0.0	20.6	21.6	0.0	21.3	26.0	15.3	12.3	23.9	0.0	13.5
Incr Delay (d2), s/veh	1.8	0.0	0.2	1.1	0.0	0.7	4.4	5.0	0.2	1.6	0.0	3.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	0.4	1.2	0.0	0.7	0.2	4.5	0.3	0.5	0.0	4.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	23.5	0.0	20.8	23.0	0.0	22.1	30.3	20.3	12.5	25.6	0.0	17.3
LnGrp LOS	C	A	C	C	A	C	C	C	B	C	A	B
Approach Vol, veh/h		159			151			469			473	
Approach Delay, s/veh		23.0			22.7			20.0			18.0	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.2	22.5		11.8	5.7	25.0		11.4
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.0	18.0		18.0	7.0	19.0		18.0
Max Q Clear Time (g_c+I1), s	3.2	11.9		5.5	2.4	12.0		4.6
Green Ext Time (p_c), s	0.0	1.3		0.4	0.0	1.4		0.4

Intersection Summary		
HCM 6th Ctrl Delay		20.0
HCM 6th LOS		B

HCM 6th Signalized Intersection Summary
2: Hilltop Dr & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	55	31	254	37	304	53	520	353	230	370	20
Future Volume (veh/h)	44	55	31	254	37	304	53	520	353	230	370	20
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	1	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1616	1616	1683	1683	1751	1683	1683	1751	1683	1683	1683
Adj Flow Rate, veh/h	46	57	32	293	0	246	55	542	345	240	385	20
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	148	89	50	549	0	241	79	850	646	284	1192	61
Arrive On Green	0.09	0.09	0.09	0.17	0.00	0.17	0.05	0.26	0.26	0.18	0.39	0.39
Sat Flow, veh/h	1603	968	544	3206	0	1452	1603	3198	1473	1603	3089	160
Grp Volume(v), veh/h	46	0	89	293	0	246	55	542	345	240	199	206
Grp Sat Flow(s),veh/h/ln	1603	0	1512	1603	0	1452	1603	1599	1473	1603	1599	1649
Q Serve(g_s), s	1.6	0.0	3.4	5.0	0.0	10.2	2.0	9.1	10.5	8.7	5.3	5.3
Cycle Q Clear(g_c), s	1.6	0.0	3.4	5.0	0.0	10.2	2.0	9.1	10.5	8.7	5.3	5.3
Prop In Lane	1.00		0.36	1.00		1.00	1.00		1.00	1.00		0.10
Lane Grp Cap(c), veh/h	148	0	139	549	0	241	79	850	646	284	617	636
V/C Ratio(X)	0.31	0.00	0.64	0.53	0.00	1.02	0.69	0.64	0.53	0.84	0.32	0.32
Avail Cap(c_a), veh/h	478	0	451	558	0	253	202	1060	746	359	686	708
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	26.0	0.0	26.9	23.2	0.0	26.4	28.7	19.9	12.7	24.4	13.0	13.0
Incr Delay (d2), s/veh	1.2	0.0	4.8	1.0	0.0	62.5	10.2	0.9	0.7	13.8	0.3	0.3
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	0.7	0.0	1.4	1.8	0.0	7.5	1.0	3.2	4.3	4.2	1.7	1.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	27.2	0.0	31.7	24.1	0.0	88.9	38.9	20.8	13.4	38.2	13.3	13.3
LnGrp LOS	C	A	C	C	A	F	D	C	B	D	B	B
Approach Vol, veh/h		135			539			942			645	
Approach Delay, s/veh		30.2			53.7			19.1			22.6	
Approach LOS		C			D			B			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	15.2	20.1		10.1	7.5	27.8		15.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	13.5	20.0		18.0	7.6	25.9		10.5
Max Q Clear Time (g_c+I1), s	10.7	12.5		5.4	4.0	7.3		12.2
Green Ext Time (p_c), s	0.2	2.9		0.4	0.0	2.1		0.0

Intersection Summary	
HCM 6th Ctrl Delay	29.0
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: Canby Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	89	394	117	32	382	33	121	81	43	21	55	89
Future Volume (veh/h)	89	394	117	32	382	33	121	81	43	21	55	89
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		0.98	1.00		0.99	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1751	1683	1683	1683	1683	1751	1751	1683	1683	1683
Adj Flow Rate, veh/h	91	402	80	33	390	30	123	83	26	21	56	51
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	121	596	526	60	487	37	153	232	73	41	190	160
Arrive On Green	0.08	0.35	0.35	0.04	0.32	0.32	0.10	0.18	0.18	0.03	0.11	0.11
Sat Flow, veh/h	1603	1683	1484	1603	1540	118	1603	1274	399	1603	1683	1420
Grp Volume(v), veh/h	91	402	80	33	0	420	123	0	109	21	56	51
Grp Sat Flow(s),veh/h/ln	1603	1683	1484	1603	0	1659	1603	0	1673	1603	1683	1420
Q Serve(g_s), s	2.5	9.1	1.7	0.9	0.0	10.4	3.4	0.0	2.6	0.6	1.4	1.5
Cycle Q Clear(g_c), s	2.5	9.1	1.7	0.9	0.0	10.4	3.4	0.0	2.6	0.6	1.4	1.5
Prop In Lane	1.00		1.00	1.00		0.07	1.00		0.24	1.00		1.00
Lane Grp Cap(c), veh/h	121	596	526	60	0	525	153	0	305	41	190	160
V/C Ratio(X)	0.75	0.67	0.15	0.55	0.00	0.80	0.81	0.00	0.36	0.51	0.29	0.32
Avail Cap(c_a), veh/h	203	879	775	178	0	840	303	0	873	178	748	631
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.4	12.3	9.9	21.3	0.0	14.1	20.0	0.0	16.1	21.6	18.3	18.4
Incr Delay (d2), s/veh	9.0	1.3	0.1	7.6	0.0	2.9	9.5	0.0	0.7	9.5	0.9	1.1
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	1.1	2.8	0.4	0.4	0.0	3.5	1.5	0.0	0.9	0.3	0.5	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.4	13.7	10.0	28.8	0.0	17.0	29.5	0.0	16.8	31.1	19.2	19.5
LnGrp LOS	C	B	B	C	A	B	C	A	B	C	B	B
Approach Vol, veh/h		573			453			232			128	
Approach Delay, s/veh		15.7			17.8			23.5			21.3	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.7	12.7	6.2	20.4	8.8	9.6	7.9	18.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	23.5	5.0	23.5	8.5	20.0	5.7	22.8
Max Q Clear Time (g_c+I1), s	2.6	4.6	2.9	11.1	5.4	3.5	4.5	12.4
Green Ext Time (p_c), s	0.0	0.5	0.0	2.1	0.1	0.3	0.0	1.8

Intersection Summary	
HCM 6th Ctrl Delay	18.2
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	95	208	157	12	209	105	190	268	9	71	277	51
Future Volume (veh/h)	95	208	157	12	209	105	190	268	9	71	277	51
Initial Q (Qb), veh	0	0	0	0	0	0	1	5	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	100	219	105	13	220	55	200	282	3	75	292	19
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	128	434	366	27	328	271	248	812	8	109	528	232
Arrive On Green	0.08	0.26	0.26	0.02	0.20	0.20	0.15	0.25	0.25	0.07	0.16	0.16
Sat Flow, veh/h	1603	1683	1418	1603	1683	1395	1603	3242	34	1603	3198	1407
Grp Volume(v), veh/h	100	219	105	13	220	55	200	139	146	75	292	19
Grp Sat Flow(s),veh/h/ln	1603	1683	1418	1603	1683	1395	1603	1599	1677	1603	1599	1407
Q Serve(g_s), s	2.7	4.9	2.6	0.4	5.3	1.5	5.3	3.2	3.2	2.0	3.7	0.5
Cycle Q Clear(g_c), s	2.7	4.9	2.6	0.4	5.3	1.5	5.3	3.2	3.2	2.0	3.7	0.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	128	434	366	27	328	271	248	400	420	109	528	232
V/C Ratio(X)	0.78	0.50	0.29	0.49	0.67	0.20	0.81	0.35	0.35	0.69	0.55	0.08
Avail Cap(c_a), veh/h	200	708	596	182	688	571	346	748	785	288	1381	608
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.1	14.1	13.2	21.7	16.6	15.0	18.3	13.7	13.7	20.3	17.0	15.7
Incr Delay (d2), s/veh	9.8	0.9	0.4	13.0	2.4	0.4	9.2	0.5	0.5	7.5	0.9	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.4	0.4	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	1.6	0.7	0.2	1.9	0.4	2.4	1.1	1.2	0.9	1.2	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.8	15.0	13.6	34.7	19.0	15.4	28.1	14.7	14.6	27.7	17.9	15.8
LnGrp LOS	C	B	B	C	B	B	C	B	B	C	B	B
Approach Vol, veh/h		424			288			485			386	
Approach Delay, s/veh		18.1			19.0			20.2			19.7	
Approach LOS		B			B			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.5	15.4	5.2	15.9	11.3	11.6	8.0	13.1
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	7.9	20.6	5.0	18.5	9.5	19.0	5.5	18.0
Max Q Clear Time (g_c+I1), s	4.0	5.2	2.4	6.9	7.3	5.7	4.7	7.3
Green Ext Time (p_c), s	0.0	1.2	0.0	1.2	0.1	1.4	0.0	1.0

Intersection Summary	
HCM 6th Ctrl Delay	19.3
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

Intersection	
Intersection Delay, s/veh	13.3
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	57	162	259	84	155	243
Future Vol, veh/h	57	162	259	84	155	243
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	61	174	278	90	167	261
Number of Lanes	1	0	2	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	2
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	11.5	10.5	16.8
HCM LOS	B	B	C

Lane	NBLn1	NBLn2	WBLn1	SBLn1
Vol Left, %	0%	0%	26%	39%
Vol Thru, %	100%	51%	0%	61%
Vol Right, %	0%	49%	74%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	173	170	219	398
LT Vol	0	0	57	155
Through Vol	173	86	0	243
RT Vol	0	84	162	0
Lane Flow Rate	186	183	235	428
Geometry Grp	7	7	2	5
Degree of Util (X)	0.295	0.273	0.357	0.627
Departure Headway (Hd)	5.713	5.363	5.457	5.274
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	629	670	659	685
Service Time	3.443	3.093	3.493	3.301
HCM Lane V/C Ratio	0.296	0.273	0.357	0.625
HCM Control Delay	10.8	10.1	11.5	16.8
HCM Lane LOS	B	B	B	C
HCM 95th-tile Q	1.2	1.1	1.6	4.4

HCM 6th Signalized Intersection Summary
1: Churn Creek Rd & Canby Rd/Whistling Dr

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	63	18	191	127	172	15	182	166	270	260	84
Future Volume (veh/h)	60	63	18	191	127	172	15	182	166	270	260	84
Initial Q (Qb), veh	0	0	0	2	0	0	0	0	0	3	3	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1945	1945	1870	1945	1945
Adj Flow Rate, veh/h	71	74	14	225	149	163	18	214	76	318	306	61
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	181	156	29	382	175	191	52	470	398	367	665	128
Arrive On Green	0.10	0.10	0.10	0.21	0.21	0.21	0.03	0.24	0.24	0.20	0.42	0.42
Sat Flow, veh/h	1781	1529	289	1781	813	890	1781	1945	1648	1781	1574	314
Grp Volume(v), veh/h	71	0	88	225	0	312	18	214	76	318	0	367
Grp Sat Flow(s),veh/h/ln	1781	0	1818	1781	0	1703	1781	1945	1648	1781	0	1888
Q Serve(g_s), s	2.8	0.0	3.4	8.6	0.0	13.3	0.7	7.1	2.8	13.1	0.0	10.6
Cycle Q Clear(g_c), s	2.8	0.0	3.4	8.6	0.0	13.3	0.7	7.1	2.8	13.1	0.0	10.6
Prop In Lane	1.00		0.16	1.00		0.52	1.00		1.00	1.00		0.17
Lane Grp Cap(c), veh/h	181	0	185	382	0	366	52	470	398	367	0	787
V/C Ratio(X)	0.39	0.00	0.48	0.59	0.00	0.85	0.35	0.46	0.19	0.87	0.00	0.47
Avail Cap(c_a), veh/h	425	0	434	425	0	406	165	472	400	418	0	786
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	0.00	1.00
Uniform Delay (d), s/veh	31.8	0.0	32.1	26.9	0.0	28.6	36.1	24.5	22.9	29.5	0.0	16.1
Incr Delay (d2), s/veh	1.4	0.0	1.9	1.8	0.0	14.9	3.9	3.2	1.1	15.8	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.2
%ile BackOfQ(50%),veh/ln	1.3	0.0	1.6	4.0	0.0	6.8	0.4	3.4	1.1	7.4	0.0	4.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	33.2	0.0	34.0	29.1	0.0	43.5	40.0	27.7	23.9	48.9	0.0	18.3
LnGrp LOS	C	A	C	C	A	D	D	C	C	D	A	B
Approach Vol, veh/h		159			537			308			685	
Approach Delay, s/veh		33.7			37.5			27.5			32.5	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	19.8	22.8		12.2	6.7	35.9		20.6
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	17.7	18.3		18.0	7.0	29.0		18.0
Max Q Clear Time (g_c+I1), s	15.1	9.1		5.4	2.7	12.6		15.3
Green Ext Time (p_c), s	0.3	0.9		0.5	0.0	1.9		0.8

Intersection Summary	
HCM 6th Ctrl Delay	33.3
HCM 6th LOS	C

HCM 6th Signalized Intersection Summary
2: Hilltop Dr & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	7	2	424	6	209	6	165	189	184	422	11
Future Volume (veh/h)	2	7	2	424	6	209	6	165	189	184	422	11
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		1.00	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1616	1616	1683	1683	1751	1683	1683	1751	1683	1683	1683
Adj Flow Rate, veh/h	2	8	2	487	0	161	7	188	190	209	480	11
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	25	19	5	706	0	327	15	550	581	261	1040	24
Arrive On Green	0.02	0.02	0.02	0.22	0.00	0.22	0.01	0.17	0.17	0.16	0.33	0.33
Sat Flow, veh/h	1603	1248	312	3206	0	1484	1603	3198	1481	1603	3194	73
Grp Volume(v), veh/h	2	0	10	487	0	161	7	188	190	209	240	251
Grp Sat Flow(s),veh/h/ln	1603	0	1560	1603	0	1484	1603	1599	1481	1603	1599	1668
Q Serve(g_s), s	0.1	0.0	0.3	5.9	0.0	4.0	0.2	2.2	3.8	5.3	5.0	5.0
Cycle Q Clear(g_c), s	0.1	0.0	0.3	5.9	0.0	4.0	0.2	2.2	3.8	5.3	5.0	5.0
Prop In Lane	1.00		0.20	1.00		1.00	1.00		1.00	1.00		0.04
Lane Grp Cap(c), veh/h	25	0	24	706	0	327	15	550	581	261	521	543
V/C Ratio(X)	0.08	0.00	0.41	0.69	0.00	0.49	0.47	0.34	0.33	0.80	0.46	0.46
Avail Cap(c_a), veh/h	688	0	670	1086	0	503	191	1373	963	451	946	987
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	20.3	0.0	20.4	15.0	0.0	14.3	20.7	15.3	8.9	16.9	11.2	11.2
Incr Delay (d2), s/veh	1.4	0.0	10.8	1.2	0.0	1.2	21.0	0.4	0.3	5.6	0.6	0.6
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	0.0	0.0	0.2	1.8	0.0	1.2	0.1	0.7	1.5	2.0	1.4	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	21.7	0.0	31.2	16.2	0.0	15.4	41.6	15.6	9.2	22.5	11.9	11.8
LnGrp LOS	C	A	C	B	A	B	D	B	A	C	B	B
Approach Vol, veh/h		12			648			385			700	
Approach Delay, s/veh		29.6			16.0			12.9			15.0	
Approach LOS		C			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.3	11.7		5.2	4.9	18.1		13.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	11.8	18.0		18.0	5.0	24.8		14.2
Max Q Clear Time (g_c+I1), s	7.3	5.8		2.3	2.2	7.0		7.9
Green Ext Time (p_c), s	0.2	1.4		0.0	0.0	2.6		1.4

Intersection Summary	
HCM 6th Ctrl Delay	15.0
HCM 6th LOS	B

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: Canby Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	67	249	27	5	234	25	36	41	11	28	61	168
Future Volume (veh/h)	67	249	27	5	234	25	36	41	11	28	61	168
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		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1751	1683	1683	1683	1683	1751	1751	1683	1683	1683
Adj Flow Rate, veh/h	75	280	27	6	263	27	40	46	3	31	69	80
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	117	525	461	13	371	38	73	245	16	59	239	201
Arrive On Green	0.07	0.31	0.31	0.01	0.25	0.25	0.05	0.15	0.15	0.04	0.14	0.14
Sat Flow, veh/h	1603	1683	1479	1603	1501	154	1603	1626	106	1603	1683	1411
Grp Volume(v), veh/h	75	280	27	6	0	290	40	0	49	31	69	80
Grp Sat Flow(s),veh/h/ln	1603	1683	1479	1603	0	1656	1603	0	1732	1603	1683	1411
Q Serve(g_s), s	1.7	5.0	0.5	0.1	0.0	5.8	0.9	0.0	0.9	0.7	1.3	1.9
Cycle Q Clear(g_c), s	1.7	5.0	0.5	0.1	0.0	5.8	0.9	0.0	0.9	0.7	1.3	1.9
Prop In Lane	1.00		1.00	1.00		0.09	1.00		0.06	1.00		1.00
Lane Grp Cap(c), veh/h	117	525	461	13	0	409	73	0	261	59	239	201
V/C Ratio(X)	0.64	0.53	0.06	0.46	0.00	0.71	0.55	0.00	0.19	0.52	0.29	0.40
Avail Cap(c_a), veh/h	232	842	740	219	0	815	219	0	885	219	861	722
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.5	10.4	8.8	18.1	0.0	12.6	17.1	0.0	13.6	17.3	14.0	14.3
Incr Delay (d2), s/veh	5.8	0.8	0.1	23.6	0.0	2.3	6.2	0.0	0.3	7.0	0.7	1.3
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	0.7	1.4	0.1	0.1	0.0	1.9	0.4	0.0	0.3	0.3	0.4	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	22.2	11.2	8.9	41.6	0.0	14.8	23.3	0.0	13.9	24.3	14.7	15.5
LnGrp LOS	C	B	A	D	A	B	C	A	B	C	B	B
Approach Vol, veh/h		382			296			89			180	
Approach Delay, s/veh		13.2			15.4			18.1			16.7	
Approach LOS		B			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.9	10.0	4.8	15.9	6.2	9.7	7.2	13.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	18.7	5.0	18.3	5.0	18.7	5.3	18.0
Max Q Clear Time (g_c+I1), s	2.7	2.9	2.1	7.0	2.9	3.9	3.7	7.8
Green Ext Time (p_c), s	0.0	0.1	0.0	1.2	0.0	0.4	0.0	1.1

Intersection Summary	
HCM 6th Ctrl Delay	15.0
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
4: Churn Creek Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	125	98	65	28	117	84	69	200	4	89	418	82
Future Volume (veh/h)	125	98	65	28	117	84	69	200	4	89	418	82
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		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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	147	115	50	33	138	46	81	235	4	105	492	78
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	180	358	303	61	232	197	117	754	13	135	785	349
Arrive On Green	0.11	0.21	0.21	0.04	0.14	0.14	0.07	0.23	0.23	0.08	0.25	0.25
Sat Flow, veh/h	1603	1683	1427	1603	1683	1427	1603	3218	55	1603	3198	1423
Grp Volume(v), veh/h	147	115	50	33	138	46	81	117	122	105	492	78
Grp Sat Flow(s),veh/h/ln	1603	1683	1427	1603	1683	1427	1603	1599	1673	1603	1599	1423
Q Serve(g_s), s	3.7	2.4	1.2	0.8	3.2	1.2	2.1	2.5	2.5	2.7	5.7	1.8
Cycle Q Clear(g_c), s	3.7	2.4	1.2	0.8	3.2	1.2	2.1	2.5	2.5	2.7	5.7	1.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.03	1.00		1.00
Lane Grp Cap(c), veh/h	180	358	303	61	232	197	117	375	392	135	785	349
V/C Ratio(X)	0.82	0.32	0.16	0.54	0.59	0.23	0.69	0.31	0.31	0.78	0.63	0.22
Avail Cap(c_a), veh/h	192	725	615	192	725	615	192	689	721	192	1378	613
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.1	13.9	13.4	19.7	16.9	16.0	18.9	13.2	13.2	18.7	14.0	12.6
Incr Delay (d2), s/veh	22.0	0.5	0.3	7.2	2.4	0.6	7.1	0.5	0.5	12.0	0.8	0.3
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	2.3	0.8	0.3	0.4	1.2	0.4	0.9	0.7	0.8	1.3	1.7	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.1	14.4	13.7	27.0	19.3	16.6	26.0	13.7	13.7	30.8	14.9	12.9
LnGrp LOS	D	B	B	C	B	B	C	B	B	C	B	B
Approach Vol, veh/h		312			217			320			675	
Approach Delay, s/veh		26.4			19.9			16.8			17.1	
Approach LOS		C			B			B			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.0	14.3	6.1	13.4	7.5	14.8	9.2	10.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	18.0	5.0	18.0	5.0	18.0	5.0	18.0
Max Q Clear Time (g_c+I1), s	4.7	4.5	2.8	4.4	4.1	7.7	5.7	5.2
Green Ext Time (p_c), s	0.0	0.9	0.0	0.5	0.0	2.4	0.0	0.6

Intersection Summary	
HCM 6th Ctrl Delay	19.4
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
5: Canby Rd & Old Alturas Rd

02/01/2023

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	25	58	120	14	57	123
Future Vol, veh/h	25	58	120	14	57	123
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	29	68	141	16	67	145
Number of Lanes	1	0	2	0	0	1

Approach	WB		NB		SB	
Opposing Approach			SB		NB	
Opposing Lanes	0		1		2	
Conflicting Approach Left	NB				WB	
Conflicting Lanes Left	2		0		1	
Conflicting Approach Right	SB		WB			
Conflicting Lanes Right	1		1		0	
HCM Control Delay	8		8.2		9.1	
HCM LOS	A		A		A	

Lane	NBLn1	NBLn2	WBLn1	SBLn1
Vol Left, %	0%	0%	30%	32%
Vol Thru, %	100%	74%	0%	68%
Vol Right, %	0%	26%	70%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	80	54	83	180
LT Vol	0	0	25	57
Through Vol	80	40	0	123
RT Vol	0	14	58	0
Lane Flow Rate	94	64	98	212
Geometry Grp	7	7	2	5
Degree of Util (X)	0.129	0.084	0.12	0.264
Departure Headway (Hd)	4.937	4.755	4.42	4.494
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	730	758	812	800
Service Time	2.637	2.455	2.438	2.513
HCM Lane V/C Ratio	0.129	0.084	0.121	0.265
HCM Control Delay	8.4	7.9	8	9.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	0.3	0.4	1.1

HCM 6th Signalized Intersection Summary
1: Churn Creek Rd & Canby Rd/Whistling Dr

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	115	27	8	83	28	126	12	391	55	179	316	98
Future Volume (veh/h)	115	27	8	83	28	126	12	391	55	179	316	98
Initial Q (Qb), veh	0	0	0	1	1	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.95	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1945	1945	1870	1945	1945
Adj Flow Rate, veh/h	128	30	3	92	31	120	13	434	35	199	351	82
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	199	187	19	252	50	173	40	672	557	244	698	163
Arrive On Green	0.11	0.11	0.11	0.14	0.14	0.14	0.02	0.35	0.35	0.14	0.46	0.46
Sat Flow, veh/h	1781	1673	167	1781	323	1250	1781	1945	1612	1781	1517	354
Grp Volume(v), veh/h	128	0	33	92	0	151	13	434	35	199	0	433
Grp Sat Flow(s),veh/h/ln	1781	0	1840	1781	0	1573	1781	1945	1612	1781	0	1872
Q Serve(g_s), s	4.7	0.0	1.1	3.2	0.0	6.2	0.5	12.8	1.0	7.4	0.0	11.0
Cycle Q Clear(g_c), s	4.7	0.0	1.1	3.2	0.0	6.2	0.5	12.8	1.0	7.4	0.0	11.0
Prop In Lane	1.00		0.09	1.00		0.79	1.00		1.00	1.00		0.19
Lane Grp Cap(c), veh/h	199	0	206	252	0	223	40	672	557	244	0	861
V/C Ratio(X)	0.64	0.00	0.16	0.37	0.00	0.68	0.33	0.65	0.06	0.82	0.00	0.50
Avail Cap(c_a), veh/h	472	0	488	472	0	417	184	673	558	328	0	862
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	0.00	1.00
Uniform Delay (d), s/veh	28.9	0.0	27.3	26.5	0.0	27.8	32.8	18.8	14.9	28.5	0.0	12.9
Incr Delay (d2), s/veh	3.4	0.0	0.4	0.9	0.0	3.6	4.6	4.8	0.2	11.1	0.0	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	0.0	0.5	1.5	0.0	2.6	0.2	5.9	0.4	3.7	0.0	4.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.3	0.0	27.7	27.6	0.0	31.8	37.4	23.5	15.1	39.6	0.0	15.0
LnGrp LOS	C	A	C	C	A	C	D	C	B	D	A	B
Approach Vol, veh/h		161			243			482			632	
Approach Delay, s/veh		31.4			30.2			23.3			22.8	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	13.8	28.0		12.1	6.0	35.8		14.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	12.5	23.5		18.0	7.0	29.0		18.0
Max Q Clear Time (g_c+I1), s	9.4	14.8		6.7	2.5	13.0		8.2
Green Ext Time (p_c), s	0.2	1.7		0.4	0.0	2.3		0.8

Intersection Summary			
HCM 6th Ctrl Delay			25.0
HCM 6th LOS			C

HCM 6th Signalized Intersection Summary
2: Hilltop Dr & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	49	62	35	284	42	341	59	584	395	258	415	22
Future Volume (veh/h)	49	62	35	284	42	341	59	584	395	258	415	22
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	1	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1616	1616	1683	1683	1751	1683	1683	1751	1683	1683	1683
Adj Flow Rate, veh/h	51	65	36	327	0	284	61	608	388	269	432	22
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	158	96	53	604	0	269	79	855	673	311	1263	64
Arrive On Green	0.10	0.10	0.10	0.19	0.00	0.19	0.05	0.26	0.26	0.19	0.41	0.41
Sat Flow, veh/h	1603	974	539	3206	0	1453	1603	3198	1473	1603	3092	157
Grp Volume(v), veh/h	51	0	101	327	0	284	61	608	388	269	223	231
Grp Sat Flow(s),veh/h/ln	1603	0	1513	1603	0	1453	1603	1599	1473	1603	1599	1650
Q Serve(g_s), s	2.1	0.0	4.6	6.5	0.0	13.5	2.7	12.3	13.9	11.5	6.8	6.8
Cycle Q Clear(g_c), s	2.1	0.0	4.6	6.5	0.0	13.5	2.7	12.3	13.9	11.5	6.8	6.8
Prop In Lane	1.00		0.36	1.00		1.00	1.00		1.00	1.00		0.10
Lane Grp Cap(c), veh/h	158	0	150	604	0	269	79	855	673	311	653	674
V/C Ratio(X)	0.32	0.00	0.68	0.54	0.00	1.06	0.78	0.71	0.58	0.86	0.34	0.34
Avail Cap(c_a), veh/h	406	0	383	609	0	276	221	991	738	418	691	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	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	30.1	0.0	31.2	26.3	0.0	29.7	33.7	23.7	14.4	28.0	14.5	14.5
Incr Delay (d2), s/veh	1.2	0.0	5.2	1.0	0.0	70.4	14.9	2.0	0.9	13.3	0.3	0.3
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	0.9	0.0	1.9	2.5	0.0	9.7	1.3	4.5	6.2	5.3	2.3	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	31.2	0.0	36.4	27.2	0.0	100.1	48.6	25.8	15.3	41.3	14.8	14.8
LnGrp LOS	C	A	D	C	A	F	D	C	B	D	B	B
Approach Vol, veh/h		152			611			1057			723	
Approach Delay, s/veh		34.7			61.1			23.3			24.6	
Approach LOS		C			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	18.3	23.2		11.5	8.0	33.5		18.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	18.5	22.0		18.0	9.8	30.7		13.5
Max Q Clear Time (g_c+I1), s	13.5	15.9		6.6	4.7	8.8		15.5
Green Ext Time (p_c), s	0.4	2.8		0.5	0.0	2.5		0.0

Intersection Summary	
HCM 6th Ctrl Delay	33.4
HCM 6th LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

HCM 6th Signalized Intersection Summary
3: Canby Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	89	419	119	34	433	34	122	81	43	21	55	90
Future Volume (veh/h)	89	419	119	34	433	34	122	81	43	21	55	90
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		0.98	1.00		0.99	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1751	1683	1683	1683	1683	1751	1751	1683	1683	1683
Adj Flow Rate, veh/h	91	428	82	35	442	31	124	83	26	21	56	52
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	118	638	562	62	534	37	154	226	71	41	180	152
Arrive On Green	0.07	0.38	0.38	0.04	0.34	0.34	0.10	0.18	0.18	0.03	0.11	0.11
Sat Flow, veh/h	1603	1683	1484	1603	1552	109	1603	1274	399	1603	1683	1420
Grp Volume(v), veh/h	91	428	82	35	0	473	124	0	109	21	56	52
Grp Sat Flow(s),veh/h/ln	1603	1683	1484	1603	0	1661	1603	0	1673	1603	1683	1420
Q Serve(g_s), s	2.6	10.1	1.7	1.0	0.0	12.4	3.6	0.0	2.7	0.6	1.5	1.6
Cycle Q Clear(g_c), s	2.6	10.1	1.7	1.0	0.0	12.4	3.6	0.0	2.7	0.6	1.5	1.6
Prop In Lane	1.00		1.00	1.00		0.07	1.00		0.24	1.00		1.00
Lane Grp Cap(c), veh/h	118	638	562	62	0	572	154	0	297	41	180	152
V/C Ratio(X)	0.77	0.67	0.15	0.56	0.00	0.83	0.81	0.00	0.37	0.51	0.31	0.34
Avail Cap(c_a), veh/h	186	851	750	169	0	822	253	0	810	169	727	613
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.6	12.3	9.7	22.4	0.0	14.3	21.0	0.0	17.2	22.8	19.6	19.6
Incr Delay (d2), s/veh	10.1	1.3	0.1	7.7	0.0	4.7	9.6	0.0	0.8	9.7	1.0	1.3
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	1.2	3.1	0.5	0.5	0.0	4.4	1.6	0.0	1.0	0.3	0.5	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	31.7	13.5	9.8	30.1	0.0	19.0	30.6	0.0	17.9	32.5	20.5	21.0
LnGrp LOS	C	B	A	C	A	B	C	A	B	C	C	C
Approach Vol, veh/h		601			508			233			129	
Approach Delay, s/veh		15.8			19.8			24.7			22.7	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	5.7	12.9	6.3	22.5	9.0	9.6	8.0	20.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	5.0	23.0	5.0	24.0	7.5	20.5	5.5	23.5
Max Q Clear Time (g_c+I1), s	2.6	4.7	3.0	12.1	5.6	3.6	4.6	14.4
Green Ext Time (p_c), s	0.0	0.4	0.0	2.2	0.0	0.3	0.0	1.9

Intersection Summary	
HCM 6th Ctrl Delay	19.2
HCM 6th LOS	B

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th Signalized Intersection Summary
4: Churn Creek Rd & Browning St

02/01/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑↱		↰	↑↑	↱
Traffic Volume (veh/h)	115	208	157	12	209	105	212	326	9	85	370	82
Future Volume (veh/h)	115	208	157	12	209	105	212	326	9	85	370	82
Initial Q (Qb), veh	0	0	0	0	0	0	1	5	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	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
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Adj Flow Rate, veh/h	121	219	105	13	220	55	223	343	3	89	389	51
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	150	444	374	26	314	260	275	946	8	114	610	269
Arrive On Green	0.09	0.26	0.26	0.02	0.19	0.19	0.17	0.29	0.29	0.07	0.19	0.19
Sat Flow, veh/h	1603	1683	1418	1603	1683	1395	1603	3249	28	1603	3198	1408
Grp Volume(v), veh/h	121	219	105	13	220	55	223	169	177	89	389	51
Grp Sat Flow(s),veh/h/ln	1603	1683	1418	1603	1683	1395	1603	1599	1678	1603	1599	1408
Q Serve(g_s), s	3.7	5.5	2.9	0.4	6.1	1.7	6.7	4.2	4.2	2.7	5.6	1.5
Cycle Q Clear(g_c), s	3.7	5.5	2.9	0.4	6.1	1.7	6.7	4.2	4.2	2.7	5.6	1.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	150	444	374	26	314	260	275	466	489	114	610	269
V/C Ratio(X)	0.81	0.49	0.28	0.49	0.70	0.21	0.81	0.36	0.36	0.78	0.64	0.19
Avail Cap(c_a), veh/h	240	689	580	160	605	501	400	677	710	330	1213	534
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.4	15.7	14.7	24.6	19.2	17.3	20.2	14.3	14.3	23.0	18.8	17.1
Incr Delay (d2), s/veh	10.0	0.9	0.4	13.4	2.8	0.4	7.8	0.5	0.5	11.1	1.1	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.3	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	1.9	0.9	0.2	2.3	0.5	2.8	1.5	1.5	1.3	1.9	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.4	16.6	15.2	38.0	22.0	17.7	28.5	15.1	15.0	34.2	19.9	17.4
LnGrp LOS	C	B	B	D	C	B	C	B	B	C	B	B
Approach Vol, veh/h		445			288			569			529	
Approach Delay, s/veh		20.5			21.9			20.3			22.0	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.1	19.0	5.3	17.7	13.0	14.0	9.2	13.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	10.3	21.2	5.0	20.5	12.5	19.0	7.5	18.0
Max Q Clear Time (g_c+I1), s	4.7	6.2	2.4	7.5	8.7	7.6	5.7	8.1
Green Ext Time (p_c), s	0.1	1.6	0.0	1.2	0.2	1.9	0.0	0.9

Intersection Summary	
HCM 6th Ctrl Delay	21.1
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

HCM 6th AWSC
5: Canby Rd & Old Alturas Rd

02/01/2023

Intersection	
Intersection Delay, s/veh	13.6
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↱			↰↑
Traffic Vol, veh/h	59	164	259	88	160	243
Future Vol, veh/h	59	164	259	88	160	243
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	63	176	278	95	172	261
Number of Lanes	1	0	2	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	2
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	2	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	11.7	10.5	17.2
HCM LOS	B	B	C

Lane	NBLn1	NBLn2	WBLn1	SBLn1
Vol Left, %	0%	0%	26%	40%
Vol Thru, %	100%	50%	0%	60%
Vol Right, %	0%	50%	74%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	173	174	223	403
LT Vol	0	0	59	160
Through Vol	173	86	0	243
RT Vol	0	88	164	0
Lane Flow Rate	186	187	240	433
Geometry Grp	7	7	2	5
Degree of Util (X)	0.296	0.28	0.365	0.638
Departure Headway (Hd)	5.743	5.385	5.487	5.301
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	626	667	655	685
Service Time	3.471	3.113	3.523	3.325
HCM Lane V/C Ratio	0.297	0.28	0.366	0.632
HCM Control Delay	10.9	10.2	11.7	17.2
HCM Lane LOS	B	B	B	C
HCM 95th-tile Q	1.2	1.1	1.7	4.6

Attachment H

Tree Identification and Evaluation for 900 and 930 Canby Road

AEI Consultants

June 16, 2022

Mr. George Schmidbauer
Danco Group
5251 Ericson Way
Arcata, CA 95521

RE: Tree Identification and Evaluation
930-990 Canby Road, Redding, Shasta County, California
AEI Project No. 455830

Dear Mr. Schmidbauer,

AEI Consultants (AEI) is pleased to provide the Tree Identification and Evaluation for the proposed multi-family residential development located at 930-990 Canby Road, Redding, California. The Tree Identification and Evaluation survey assessed the 8-acre Project Area, in compliance with the Redding Municipal Code Title 13, Chapter 13.40 and Chapter 18.45.

The report includes the regulatory setting of the Project Area, methods for conducting the Tree Identification, results of the Tree Identification and Evaluation with an inventory table and maps, and recommendations on how to proceed with development efforts. Please note, once site plans have been received, conclusions and recommendations can be revised based on impacts to tree within the Project Area. If you have any additional questions or would like clarifications, please contact me at johni.etheridge@aeiconsultants.com or 831.524.1153.

Sincerely,

Johni Etheridge
Senior Project Manager
AEI Consultants
Phone: 831.524.1153
Email: johni.etheridge@aeiconsultants.com

June 16, 2022

SUBJECT:

Technical Memo: Tree Identification and Evaluation for 900 & 930 Canby Road, Redding, California.

INTRODUCTION

Natural Investigations Co. conducted an arborist survey on an 8-acre property that consists of 2 parcels (APNs: 117-200-005-000 and 117-200-006-000), located at 900 and 930 Canby Road, Redding, in Shasta County, California (the Study Area). The arborist survey followed the Redding Tree Ordinance's requirement for tree initial mapping and evaluation as part of the environmental review of a housing development proposal. These survey results should not be construed as a technical analysis, such as for tree hazard assessment, plant appraisal, tree health diagnosis, or tree care prescription.

REGULATORY SETTING

The City of Redding regulates trees within their jurisdiction via the Redding Municipal Code Title 13 – Streets and Sidewalks, Chapter 13.40 – Trees and Shrubs and also Chapter 18.45 Tree Management (the Tree Preservation Ordinance) and the Comprehensive Tree Plan.

Redding Municipal Code Title 13 – Streets and Sidewalks, Chapter 13.40 – Trees and Shrubs (management of City-owned trees)

- "Tree" includes any tree, palm, shrub or plant growing in excess of two feet in height.
- Street trees shall be defined as trees, shrubs, bushes, and all other woody vegetation on land lying between property lines on either side of all streets, avenues, or ways within the City.
- Park trees shall be defined as trees, shrubs, bushes, and all other woody vegetation in public parks and all are-as owned by the City or to which the public has free access, such as a park.
- "Landmark and heritage tree plan" shall mean that plan developed by the commission designed to identify and preserve those trees which are unique because they are an outstanding specimen of a desirable species, are one of the largest or oldest trees in Redding, are of historical interest or are of distinctive form.

Chapter 18.45 Tree Management

Tree Removal Permit. No tree, regardless of species, that exceeds 6 inches diameter breast height (DBH) on any developed or undeveloped/vacant property in the city shall be destroyed, killed, or removed unless a tree removal permit is first obtained under the provisions of this chapter, except as may be permitted pursuant to the terms of Section 18.45.070, Discretionary Permits, or as may be expressly exempted under Section 18.45.040, Exemptions. (Note: Clearing activities that exceed one acre in area require a clearing permit in accordance with Chapter 16.12 of the Redding Municipal Code.)

Mitigation consists of the designation of preserved trees and/or the planting of new trees. Excerpts are provided here:

> "The following tree planting provisions shall apply to all new construction and to those parcels which have been granted a tree removal permit. The trees shall be planted prior to the issuance of an occupancy permit in those instances where planting is in conjunction with construction under a valid building permit.
>
> A. Residential Development. One 15-gallon tree shall be planted for every 500 square feet of enclosed gross living area, 2 of which shall be planted in the front yard. At least one of the trees

must be planted within 7 feet of the sidewalk, or otherwise required by a tree planting plan established with approval of the development.
B. Commercial Development (Retail, Office, Heavy Commercial Uses). One 15-gallon tree shall be planted for every 1,000 square feet of gross floor area or covered space.
C. Industrial Development. One 15-gallon tree shall be planted for every 2,000 square feet of gross floor area or covered space."

Methods

Methods followed standards of the International Society of Arboriculture (ISA) and American National Standards Institute, Inc., and were performed by a currently certified arborist—Dr. G.O. Graening, ISA Certification Number WE-6725A. The following texts were consulted for tree identification, as needed: Pavlik (1991); Lanner (2002); Stuart and Sawyer (2001); Baldwin et al. (2012); and University of California at Berkeley (2013a,b).

The survey assessed trees that met the jurisdictional criteria of the Redding Municipal Code Title 13 – Streets and Sidewalks, Chapter 13.40 – Trees and Shrubs and also Chapter 18.45 Tree Management (the Tree Preservation Ordinance). The arborist survey followed the Redding Tree Ordinance's requirement for tree initial mapping and evaluation. All trees greater than 6 inched DBH were inventoried.

Results / Tree Inventory

No Street Trees or Park Trees were detected within the Study Area. No Landmark Trees or Heritage Trees are known within the Study Area.

Conclusions and Recommendations

A specific development plan was not available, so specific tree impacts could not be enumerated at this time. A tree removal permit should be obtained before trees are removed. Mitigation typically consists of the designation of preserved trees and/or the planting of new trees.

FROM:

G. O. Graening

G. O. Graening, PhD, MSE

Tag #	Scientific Name	Common Name	Condition	DBH (inches)
1	*Pinus sabiniana*	Gray pine	Good	19
2	*Quercus wislizeni*	Interior live oak	Good	6
3	*Triadica sabiferum*	Chinese tallow	Good	7
4	*Eucalyptus*	Eucalyptus	Good	6+10+2
5	*Quercus douglasii*	Blue oak	Good	7
6	*Salix laevigata*	Red willow	Good	1+1+1+1+1+1+2+2+2+2+2+2+2+2+2+2+2+2+2+2+3+3+3+4+4
7	*Pinus sabiniana*	Gray pine	Good	9
8	*Morus alba*	white mulberry	Good	1+1+1+3+4
9	*Quercus wislizeni*	Interior live oak	Good	3+4
10	*Quercus douglasii*	Blue oak	Good	6
11	*Quercus douglasii*	Blue oak	Good	9+9
12	*Pinus sabiniana*	Gray pine	Good	6
13	*Pinus sabiniana*	Gray pine	Good	34
14	*Quercus wislizeni*	Interior live oak	Good	7+5
15	*Quercus wislizeni*	Interior live oak	Good	6+4+1
16	*Pinus sabiniana*	Gray pine	Good	19
17	*Quercus wislizeni*	Interior live oak	Good	8+5
18	*Quercus wislizeni*	Interior live oak	Good	4+2
19	*Quercus wislizeni*	Interior live oak	Good	5+4
20	*Quercus wislizeni*	Interior live oak	Good	4+4+4+4+3+2+5+5
21	*Quercus douglasii*	Blue oak	Good	7
22	*Quercus wislizeni*	Interior live oak	Poor	3+3
23	*Quercus wislizeni*	Interior live oak	Good	20
24	*Quercus wislizeni*	Interior live oak	Good	6
25	*Quercus douglasii*	Blue oak	Good	38
26	*Quercus douglasii*	Blue oak	Good	9
27	*Quercus douglasii*	Blue oak	Good	8
28	*Prunus dulcis*	Almond	Poor	1+1+1+3+3+4+8
29	*Ficus carica*	Fig	Good	1+1+1+1+1+1+1+1+1+1+2+2+2+2
30	*Pinus sabiniana*	Gray pine	Good	2+3+4+8+9
31	*Pinus sabiniana*	Gray pine	Good	15
32	*Quercus douglasii*	Blue oak	Good	8
33	*Quercus douglasii*	Blue oak	Good	7
34	*Quercus douglasii*	Blue oak	Good	8
35	*Quercus douglasii*	Blue oak	Good	9
36	*Quercus douglasii*	Blue oak	Good	7
37	*Quercus douglasii*	Blue oak	Good	6

Tag #	Scientific Name	Common Name	Condition	DBH (inches)
38	*Triadica sabiferum*	Chinese tallow	Good	6
39	*Salix goodingii*	Black willow	Good	16+16
40	*Triadica sabiferum*	Chinese tallow	Good	9+7
41	*Pinus sabiniana*	Gray pine	Good	12
42	*Pinus sabiniana*	Gray pine	Good	22
43	*Quercus douglasii*	Blue oak	Good	17
44	*Pinus sabiniana*	Gray pine	Good	6
45	*Pinus sabiniana*	Gray pine	Good	24
46	*Quercus douglasii*	Blue oak	Good	13
47	*Quercus douglasii*	Blue oak	Good	16
48	*Quercus douglasii*	Blue oak	Good	7
49	*Quercus douglasii*	Blue oak	Good	5+13
50	*Pinus sabiniana*	Gray pine	Good	11
51	*Pinus sabiniana*	Gray pine	Good	18
52	*Pinus sabiniana*	Gray pine	Good	33
53	*Pinus sabiniana*	Gray pine	Good	13
54	*Quercus douglasii*	Blue oak	Good	18+20
55	*Quercus douglasii*	Blue oak	Good	18
56	*Quercus douglasii*	Blue oak	Good	16
57	*Quercus douglasii*	Blue oak	Good	15
58	*Quercus douglasii*	Blue oak	Good	16+17
59	*Quercus douglasii*	Blue oak	Good	19+14
60	*Quercus douglasii*	Blue oak	Good	13
61	*Quercus douglasii*	Blue oak	Good	9+11+14
62	*Juglans hindsii*	Black walnut	Good	4+1+5
63	*Quercus douglasii*	Blue oak	Good	4+3+9
64	*Quercus douglasii*	Blue oak	Good	9
65	*Quercus douglasii*	Blue oak	Good	8+12+16
66	*Quercus douglasii*	Blue oak	Good	13+11
67	*Quercus douglasii*	Blue oak	Fair	7
68	*Quercus douglasii*	Blue oak	Good	6
69	*Quercus douglasii*	Blue oak	Good	10+11
70	*Quercus douglasii*	Blue oak	Good	7+8
71	*Quercus douglasii*	Blue oak	Good	8
72	*Quercus douglasii*	Blue oak	Good	6
73	*Quercus douglasii*	Blue oak	Good	10+10
74	*Quercus douglasii*	Blue oak	Good	14
75	*Quercus douglasii*	Blue oak	Good	7+8
76	*Quercus douglasii*	Blue oak	Good	11+14
77	*Quercus douglasii*	Blue oak	Good	12

Tag #	Scientific Name	Common Name	Condition	DBH (inches)
78	*Quercus douglasii*	Blue oak	Good	6
79	*Quercus douglasii*	Blue oak	Good	6
80	*Quercus douglasii*	Blue oak	Good	6
81	*Quercus douglasii*	Blue oak	Good	6
82	*Quercus douglasii*	Blue oak	Good	7
83	*Quercus douglasii*	Blue oak	Good	8
84	*Quercus douglasii*	Blue oak	Good	6
85	*Quercus douglasii*	Blue oak	Good	11+13
86	*Quercus douglasii*	Blue oak	Good	13
87	*Quercus douglasii*	Blue oak	Good	15
88	*Quercus douglasii*	Blue oak	Good	12
89	*Quercus douglasii*	Blue oak	Good	11
90	*Quercus douglasii*	Blue oak	Good	7
91	*Quercus douglasii*	Blue oak	Good	12
92	*Quercus douglasii*	Blue oak	Good	7
93	*Quercus douglasii*	Blue oak	Good	6+7
94	*Quercus douglasii*	Blue oak	Good	6
95	*Quercus douglasii*	Blue oak	Good	8
96	*Quercus douglasii*	Blue oak	Good	9
97	*Quercus douglasii*	Blue oak	Good	16
98	*Quercus douglasii*	Blue oak	Good	14
99	*Quercus douglasii*	Blue oak	Good	13
100	*Quercus douglasii*	Blue oak	Good	9+9
101	*Quercus douglasii*	Blue oak	Good	8
102	*Quercus douglasii*	Blue oak	Good	13
103	*Quercus douglasii*	Blue oak	Good	7
104	*Quercus douglasii*	Blue oak	Good	10
105	*Quercus douglasii*	Blue oak	Good	8
106	*Quercus douglasii*	Blue oak	Good	8
107	*Quercus douglasii*	Blue oak	Good	9
108	*Quercus douglasii*	Blue oak	Good	12
109	*Quercus douglasii*	Blue oak	Good	6
110	*Quercus douglasii*	Blue oak	Good	6
111	*Quercus douglasii*	Blue oak	Good	6
112	*Quercus douglasii*	Blue oak	Good	5+4
113	*Quercus douglasii*	Blue oak	Good	6
114	*Quercus douglasii*	Blue oak	Good	8
115	*Quercus douglasii*	Blue oak	Good	6
116	*Quercus douglasii*	Blue oak	Good	12
117	*Quercus douglasii*	Blue oak	Good	9

Tag #	Scientific Name	Common Name	Condition	DBH (inches)
118	*Quercus douglasii*	Blue oak	Fair	10
119	*Quercus douglasii*	Blue oak	Good	8+7
120	*Quercus douglasii*	Blue oak	Good	13
121	*Quercus douglasii*	Blue oak	Good	12
122	*Quercus douglasii*	Blue oak	Good	10
123	*Quercus douglasii*	Blue oak	Good	9
124	*Quercus douglasii*	Blue oak	Good	11
125	*Quercus douglasii*	Blue oak	Good	9
126	*Quercus douglasii*	Blue oak	Good	11
127	*tag lost*	n/a	n/a	
128	*Quercus douglasii*	Blue oak	Good	5+4
129	*Quercus douglasii*	Blue oak	Good	12
130	*Quercus douglasii*	Blue oak	Good	7
131	*Quercus douglasii*	Blue oak	Good	12+10
132	*Quercus douglasii*	Blue oak	Good	6+6
133	*Quercus douglasii*	Blue oak	Good	8
134	*Quercus douglasii*	Blue oak	Good	13
135	*Quercus douglasii*	Blue oak	Good	10
136	*Quercus douglasii*	Blue oak	Good	11
137	*Quercus douglasii*	Blue oak	Good	5+5
138	*Quercus douglasii*	Blue oak	Good	14
139	*Quercus douglasii*	Blue oak	Good	10
140	*Quercus douglasii*	Blue oak	Good	9
141	*Quercus douglasii*	Blue oak	Good	6
142	*Quercus douglasii*	Blue oak	Good	6
143	*Quercus douglasii*	Blue oak	Good	8+8
144	*Quercus douglasii*	Blue oak	Poor	14
145	*Quercus douglasii*	Blue oak	Good	13
146	*Quercus douglasii*	Blue oak	Good	7+8
147	*Quercus douglasii*	Blue oak	Good	8
148	*Quercus douglasii*	Blue oak	Good	7
149	*Quercus douglasii*	Blue oak	Good	13
150	*Quercus douglasii*	Blue oak	Good	12
151	*Quercus douglasii*	Blue oak	Good	8
152	*Quercus douglasii*	Blue oak	Good	14
153	*Quercus douglasii*	Blue oak	Good	8+8
154	*Quercus douglasii*	Blue oak	Good	9+9
155	*Quercus douglasii*	Blue oak	Good	7+6
156	*Quercus douglasii*	Blue oak	Good	9
157	*Quercus douglasii*	Blue oak	Good	12

Tag #	Scientific Name	Common Name	Condition	DBH (inches)
158	*Quercus douglasii*	Blue oak	Good	13
159	*Quercus douglasii*	Blue oak	Good	11
160	*Quercus douglasii*	Blue oak	Good	10
161	*Quercus douglasii*	Blue oak	Good	7
162	*Pinus sabiniana*	Gray pine	Good	14
163	*Quercus douglasii*	Blue oak	Good	6
164	*Quercus douglasii*	Blue oak	Good	12
165	*Quercus douglasii*	Blue oak	Good	9
166	*Quercus douglasii*	Blue oak	Good	10
167	*Quercus douglasii*	Blue oak	Good	13
168	*Quercus douglasii*	Blue oak	Good	11
169	*Quercus douglasii*	Blue oak	Good	14+9+13
170	*Quercus douglasii*	Blue oak	Good	6+8+8
171	*Quercus douglasii*	Blue oak	Good	9
172	*Quercus douglasii*	Blue oak	Good	10+11+14+7
173	*Quercus douglasii*	Blue oak	Good	7+9+11+11
174	*Quercus douglasii*	Blue oak	Good	7+8
175	*Quercus douglasii*	Blue oak	Good	7
176	*Quercus douglasii*	Blue oak	Good	8
177	*Quercus douglasii*	Blue oak	Good	6
178	*Quercus douglasii*	Blue oak	Good	7
179	*Quercus douglasii*	Blue oak	Good	8
180	*Quercus douglasii*	Blue oak	Good	8+9
181	*Quercus douglasii*	Blue oak	Fair	16+12+16
182	*Quercus douglasii*	Blue oak	Good	6
183	*Quercus douglasii*	Blue oak	Good	15
184	*Quercus douglasii*	Blue oak	Good	10+8+12
185	*Quercus douglasii*	Blue oak	Fair	13
186	*Quercus douglasii*	Blue oak	Good	16
187	*tag lost*	n/a	n/a	
188	*Quercus douglasii*	Blue oak	Good	13
189	*Quercus douglasii*	Blue oak	Good	23
190	*Quercus douglasii*	Blue oak	Good	18
191	*Quercus douglasii*	Blue oak	Good	12
192	*Quercus douglasii*	Blue oak	Good	16
193	*Quercus douglasii*	Blue oak	Good	16
194	*Quercus douglasii*	Blue oak	Good	14
195	*Quercus douglasii*	Blue oak	Good	15
196	*Quercus douglasii*	Blue oak	Good	13
197	*Quercus douglasii*	Blue oak	Good	13

Tag #	Scientific Name	Common Name	Condition	DBH (inches)
198	*Quercus douglasii*	Blue oak	Good	20
199	*Quercus douglasii*	Blue oak	Good	10
200	*Quercus douglasii*	Blue oak	Good	13
201	*Quercus douglasii*	Blue oak	Good	13
202	*Quercus douglasii*	Blue oak	Good	5+5+6
203	*Quercus douglasii*	Blue oak	Good	9
204	*Quercus douglasii*	Blue oak	Good	6
205	*Quercus douglasii*	Blue oak	Good	2+12
206	*Quercus douglasii*	Blue oak	Good	7+9
207	*Quercus douglasii*	Blue oak	Good	8+14
208	*Quercus douglasii*	Blue oak	Good	11
209	*Quercus douglasii*	Blue oak	Good	10
210	*Quercus douglasii*	Blue oak	Good	12
211	*Quercus douglasii*	Blue oak	Good	12
212	*Quercus douglasii*	Blue oak	Good	17
213	*Quercus douglasii*	Blue oak	Good	9
214	*Quercus douglasii*	Blue oak	Good	6
215	*Quercus douglasii*	Blue oak	Good	18
216	*Quercus douglasii*	Blue oak	Good	10+12+11
217	*Quercus douglasii*	Blue oak	Good	11
218	*Quercus douglasii*	Blue oak	Good	14
219	*Quercus douglasii*	Blue oak	Good	14
220	*Quercus douglasii*	Blue oak	Good	15
221	*Quercus douglasii*	Blue oak	Good	6
222	*Quercus douglasii*	Blue oak	Good	9
223	*Quercus douglasii*	Blue oak	Good	14
224	*Quercus douglasii*	Blue oak	Good	14
225	*Quercus douglasii*	Blue oak	Good	7
226	*Quercus douglasii*	Blue oak	Good	6
227	*Quercus douglasii*	Blue oak	Good	7
228	*Quercus douglasii*	Blue oak	Good	12
229	*Quercus douglasii*	Blue oak	Good	11
230	*Quercus douglasii*	Blue oak	Good	9+7
231	*Quercus douglasii*	Blue oak	Good	6+8
232	*Quercus douglasii*	Blue oak	Good	12
233	*Quercus douglasii*	Blue oak	Good	5+5+5
234	*Quercus douglasii*	Blue oak	Good	7+10
235	*Quercus douglasii*	Blue oak	Good	6+8
236	*Quercus douglasii*	Blue oak	Good	13
237	*Quercus douglasii*	Blue oak	Good	12+6+9

Tag #	Scientific Name	Common Name	Condition	DBH (inches)
238	*Quercus douglasii*	Blue oak	Good	6
239	*Quercus douglasii*	Blue oak	Good	8+7
240	*Quercus douglasii*	Blue oak	Good	6
241	*Quercus douglasii*	Blue oak	Good	6
242	*Quercus douglasii*	Blue oak	Good	6
243	*Quercus douglasii*	Blue oak	Good	36
244	*Quercus douglasii*	Blue oak	Good	8+6+8
245	*Quercus douglasii*	Blue oak	Good	8+10+14
246	*Quercus douglasii*	Blue oak	Good	10+8+6
247	*Quercus douglasii*	Blue oak	Good	16
248	*Quercus douglasii*	Blue oak	Good	10
249	*Quercus douglasii*	Blue oak	Good	9+8
250	*Quercus douglasii*	Blue oak	Good	6+13+9
251	*Quercus douglasii*	Blue oak	Good	8
252	*Quercus douglasii*	Blue oak	Good	10
253	*Quercus douglasii*	Blue oak	Good	9
254	*Quercus douglasii*	Blue oak	Good	12+12
255	*Quercus douglasii*	Blue oak	Good	16
256	*Quercus douglasii*	Blue oak	Good	18
257	*Quercus douglasii*	Blue oak	Good	12
258	*Quercus douglasii*	Blue oak	Good	9+10
259	*Quercus douglasii*	Blue oak	Good	13
260	*Quercus douglasii*	Blue oak	Good	21+12
261	*Quercus douglasii*	Blue oak	Good	16
262	*Quercus douglasii*	Blue oak	Good	4+4
263	*Quercus douglasii*	Blue oak	Good	6
264	*Quercus douglasii*	Blue oak	Good	35
265	*Quercus douglasii*	Blue oak	Good	18
266	*Quercus douglasii*	Blue oak	Good	17
267	*Quercus douglasii*	Blue oak	Good	9
268	*Quercus douglasii*	Blue oak	Good	5+8
269	*Quercus douglasii*	Blue oak	Good	20
270	*Quercus douglasii*	Blue oak	Good	9+12+12
271	*Quercus douglasii*	Blue oak	Fair	18+15
272	*Quercus douglasii*	Blue oak	Fair	10
273	*Quercus douglasii*	Blue oak	Good	18
274	*Quercus douglasii*	Blue oak	Poor	8
275	*Quercus douglasii*	Blue oak	Fair	20
276	*Quercus douglasii*	Blue oak	Good	8
277	*Quercus douglasii*	Blue oak	Good	3+4

Tag #	Scientific Name	Common Name	Condition	DBH (inches)
278	*Quercus douglasii*	Blue oak	Good	6
279	*Quercus douglasii*	Blue oak	Good	9
280	*Quercus douglasii*	Blue oak	Good	20
281	*Quercus douglasii*	Blue oak	Good	23
282	*Pinus sp.*	Ornamental pine	Poor	9
283	*Quercus douglasii*	Blue oak	Good	23
284	*Quercus douglasii*	Blue oak	Poor	10+13
285	*Quercus douglasii*	Blue oak	Poor	8
286	*Quercus douglasii*	Blue oak	Good	7
287	*Quercus douglasii*	Blue oak	Good	12
288	*Quercus douglasii*	Blue oak	Good	20
289	*Quercus douglasii*	Blue oak	Good	15
290	*Quercus douglasii*	Blue oak	Good	35
291	*Quercus douglasii*	Blue oak	Good	10+11+13
292	*Eucalyptus sp.*	Eucalyptus	Good	2+5+6+7+7+11
293	*Quercus douglasii*	Blue oak	Good	17
294	*Quercus douglasii*	Blue oak	Good	7
295	*Quercus douglasii*	Blue oak	Good	5+5
296	*Quercus douglasii*	Blue oak	Good	12+15
297	*Quercus douglasii*	Blue oak	Good	15+22
298	*Quercus douglasii*	Blue oak	Good	8+8+9
299	*Quercus douglasii*	Blue oak	Good	14
300	*Quercus douglasii*	Blue oak	Good	21
301	*Quercus douglasii*	Blue oak	Good	16
302	*Quercus douglasii*	Blue oak	Poor	11
303	*Quercus douglasii*	Blue oak	Good	11
304	*Quercus douglasii*	Blue oak	Good	27
305	*Quercus douglasii*	Blue oak	Good	17+13
306	*Quercus douglasii*	Blue oak	Good	9
307	*Quercus douglasii*	Blue oak	Good	16
308	*Hesperocyparis macnabiana*	MacNab cypress	Good	18
309	*Quercus douglasii*	Blue oak	Good	11+15
310	*Quercus douglasii*	Blue oak	Good	19
311	*Quercus douglasii*	Blue oak	Good	11
312	*Quercus douglasii*	Blue oak	Good	13+14
313	*Quercus douglasii*	Blue oak	Good	27
314	*Quercus douglasii*	Blue oak	Good	12

Literature Cited and Further Reading

County of Sacramento. 1981. Tree Preservation Ordinance. Sacramento County Code 480, Chapter 19.12, Sections 19.12.010 through 19.12.240. Effective September 29, 1981.

County of Sacramento. 1993. Sacramento County General Plan. Conservation Element, Section 5, Policy CO-130. Effective December 1983.

American National Standards Institute, Inc. 2006. American National Standard for Tree Care Operations: Tree, Shrub and Other Woody Plant Maintenance - Standard Practices. Washington, D.C. (Available electronically at http://webstore.ansi.org/ansidocstore/default.asp).

- ANSI A300 (Part 1)-2001: Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices (revision and redesignation of ANSI A300-1995).
- ANSI A300 (Part 2)-1998: Fertilization.
- ANSI A300 (Part 3)-2000: Tree Support Systems (a. Cabling, Bracing, and Guying).
- ANSI A300 (Part 4)-2002: Lightning Protection Systems.
- ANSI A300 (Part 5)-2005: Management of Trees and Shrubs During Site Planning, Site Development, and Construction.
- ANSI A300 (Part 6)-2005: Transplanting.
- ANSI A300 (Part 7)-2006: Integrated Vegetation Management and Electric Utility Rights-of-Way.

Baldwin, B.G., D.H. Golman, D.J. Keil, R. Patterson, and T.J. Rosatti, editors. 2012. The Jepson Manual: Vascular Plants of California, second edition, thoroughly revised and expanded. University of California Press, Berkeley, California. 1,600 pp.

Lanner, R. M. 2002. Conifers of California. Cachuma Press, Los Olivos, California. 274 pp.

Matheny, N.P., and J. R. Clark. 1998. Trees and development: a technical guide to preservation of trees during land development. International Society of Arboriculture, Champaign, Illinois. 183 pp.

McCreary, D.D. 1989. How to grow California Oaks. University of California Agriculture and Natural Resources Communication Services Publication Number __.

McCreary, D.D. 2001. Regenerating Rangeland Oaks in California. University of California Agriculture and Natural Resources Communication Services Publication Number 21601. 62 pp.

Pavlik, B. M., P. C. Muick, S. G. Johnson, and M. Popper.1991. Oaks of California. Cachuma Press and the California Oak Foundation. Los Olivos, California. 184 pp.

Standiford, R.B., D. McCreary, W. Frost. 2002. Modeling the effectiveness of tree planting to mitigate habitat loss in blue oak woodlands. in: Proceedings of the Fifth Symposium on Oak Woodland: Oaks in California's Changing Landscape, October 22-25, 2001, San Diego, CA. USDA Forest Service General Technical Report PSW-GTR-184. pp. 591-600.

Stuart, J. D., and J. O. Sawyer. 2001. Trees and Shrubs of California. California Natural History Guides. University of California Press, Berkeley, California. 467 pp.

University of California at Berkeley. 2013a. Jepson Online Interchange for California Floristics. Jepson Flora Project, University Herbarium and Jepson Herbarium, University of California at Berkeley. Internet database available http://ucjeps.berkeley.edu/interchange.html.

University of California at Berkeley. 2013b. CalPhotos. Biodiversity Sciences Technology Group, University of California at Berkeley. Internet database available at http://calphotos.berkeley.edu/.

Qualifications of Consulting Arborists

G.O. Graening, PhD, MSE

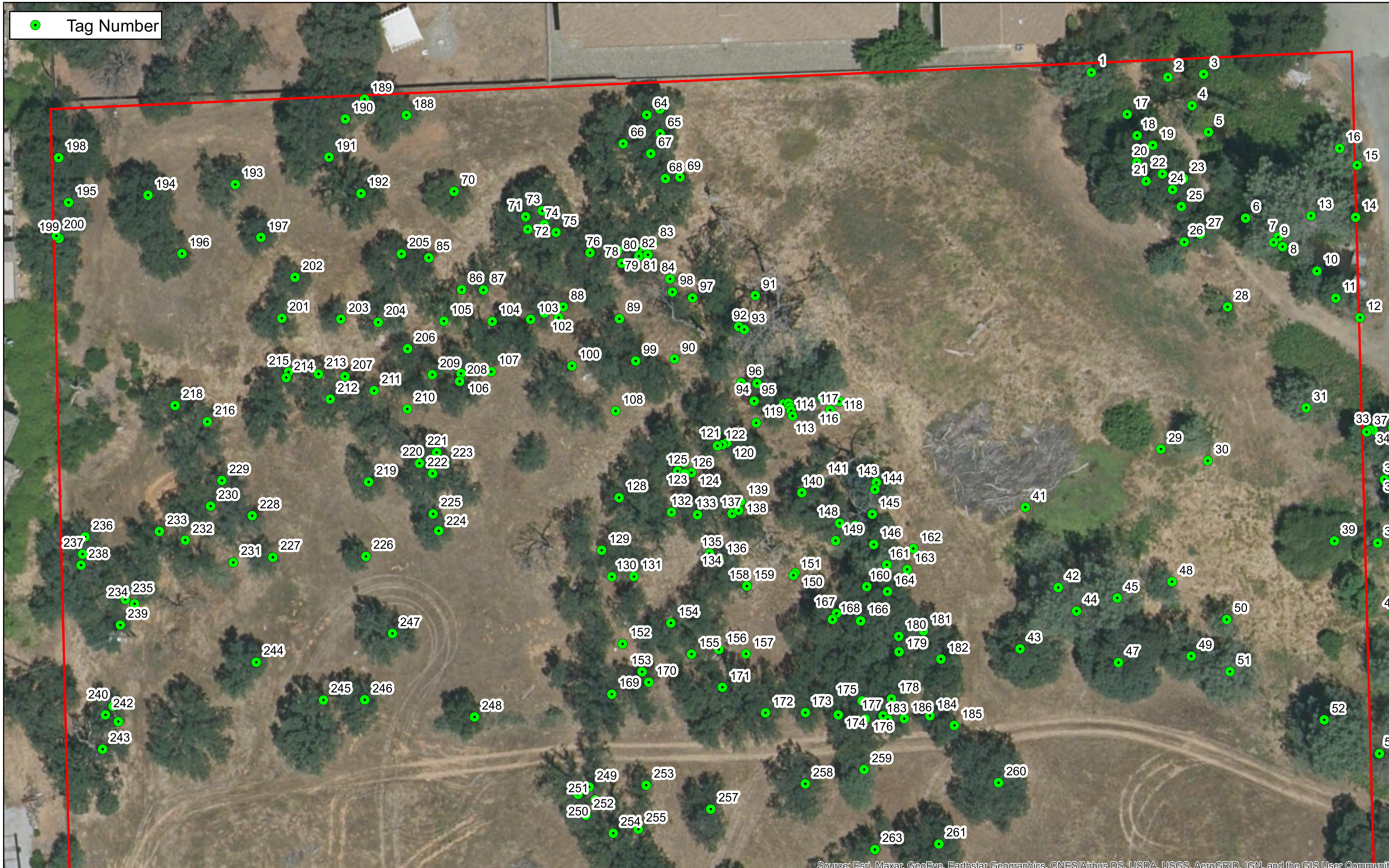
Dr. G. O. Graening is a consulting arborist continuously certified by the International Society of Arboriculture (Certification # WE-6725A) since 2003. Certification may be verified on the Internet at the ISA website (http://www.isa-arbor.com/certification/verifyCredential/index.aspx). Dr. Graening also holds a Ph.D. in Biology and a Master of Science degree in Biological and Agricultural Engineering. Dr. Graening has 30 years of experience in environmental assessment and research, including the performance of numerous arborist surveys, appraisals, and design of tree mitigation plans.

Timothy R. Nosal, M.S.

Timothy R. Nosal holds a B.S. and M.S. in Biological Sciences, and is a botanist and consulting arborist certified by the International Society of Arboriculture (Certification # WE-12038A). Mr. Nosal has statewide experience performing sensitive plant and animal surveys in addition to terrestrial vegetation investigations. Mr. Nosal has over 25 years of experience in environmental assessment and teaching with employers that include California Department of Fish and Wildlife, State Water Resources Control Board, American River College, MTI College and Pacific Municipal Consultants.

EXHIBIT 1 - Tree Inventory Diagrams


Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Tag Number
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Tag Number
53
54
55
56
57
58
59
60
61
62
249
250
251
252
253
254
255
256
257
258
259
260
261
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Site Photos















Attachment I

Crotch's Bumblebee Technical Assistance Memo for the Canby Apartments Project

gallaway
ENTERPRISES

117 Meyers Street • Suite 120 • Chico CA 95928 • 530-332-9909

February 4, 2025

The Danco Group
Attn: McKenzie Dibble
5251 Ericson Way Ste A.
Arcata, CA 95521

RE: Crotch's Bumble Bee Technical Assistance Memo for the Canby Apartments Project, Redding, Shasta County, California

Ms. Dibble,

Per your request, Gallaway Enterprises conducted a site evaluation for Crotch's bumble bee (Bombus crotchii) within the 8.65-acre biological survey area (BSA) of the Canby Apartment Project (Project) located in Redding, California. A habitat assessment and general biological survey of the BSA was completed by Gallaway Enterprises Senior Biologist Jessica Sellers on January 24, 2025. The purpose of this assessment was to evaluate current site conditions and evaluate the potential for occurrence of the bee in comparison to the conditions portrayed in the October 2024 Revised Biological Resources Assessment (BRA) developed by Helix Environmental Planning.

The BSA is the area where biological surveys are conducted and is limited to the extent where Project development activities will take place. Ms. Sellers assessed habitat elements within the BSA to evaluate site conditions and the potential for Crotches bumble bee to occur within the BSA. Other primary references consulted include species lists provided in the BRA and information gathered using the California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB). The results of this document are the findings of habitat assessments and surveys, and recommendations for avoidance and minimization measures.

PROJECT LOCATION AND ENVIRONMENTAL SETTING

The Project is located within the city limits of Redding, Shasta County, California at 930 and 990 Canby Road in the U.S. Geological Survey (USGS) *Enterprise* 7.5-minute quadrangle (latitude 40.5940967, longitude -122.3545178). The site is between 605 and 640 feet elevation, has an average annual temperature range of 51 to 80 degrees Fahrenheit and an average precipitation of 39.23 inches per year (WRCC 2024). The site is dominated by annual grasslands and blue oak woodland, and there is a small patch of riparian vegetation in the northeast corner. There is an intermittent drainage, tributary to Churn Creek, in the northeast corner of the site and two seasonal wetlands that are mainly sourced from precipitation.

The surrounding land uses consist of highly developed commercial infrastructure to the south, residential development to the west, north, and east. The site is bound on two sides by roadway, Canby Road to the east and Browning Street to the south, with a small patch of undeveloped land consisting of annual grassland and riparian habitat to the east between the residential housing and Canby Road.

PROJECT DESCRIPTION

The Project proposes the development of residential housing within the 8.65-acre site to include multibedroom units, a community building, onsite manager's unit, courtyard, a children's playground area, and associated parking spaces.

METHODS

Gallaway Enterprises reviewed the October 2024 BRA results for special-status species that potentially occur in the vicinity of the BSA. Other primary sources of information regarding the occurrence of the Crotch's bumble bee and its habitats within the BSA used in the preparation of this document are:

- The results of a nine quad species record search of the CNDDB, RareFind 5 2025, for the "*Shasta Dam, Project City, Bella Vista, Redding, Enterprise, Palo Cedro, Olinda, Cottonwood, Balls Ferry*" USGS 7.5' quadrangles (**Appendix A: CNDDB Results**);
- Review of official species lists provided in the October 2024 BRA by Helix;
- Review of described habitats provided in the October 2024 BRA by Helix;
- Review of the *Rare Plant Letter Report* provided in the October 2024 BRA by Helix;
- Review of the Observed Plant Species List provided in the October 2024 BRA by Helix (**Appendix C**); and
- Gallaway Enterprises results from a habitat assessment conducted on January 24, 2025.

Biological Surveys and Habitat Assessment

Gallaway Enterprises' Senior Biologist Jessica Sellers conducted a focused habitat assessment and biological survey within the BSA for Crotch's bumble bee on January 24, 2025. Survey methods included walking the entire BSA and scanning areas outside of the BSA with binoculars. Potential habitat when identified for special-status species was evaluated based on vegetation composition and structure, physical features (e.g. soils, elevation), micro-climate, surrounding area, and available resources (e.g. hibernacula, nesting substrates). Project site photos can be found in **Appendix B**.

DISCUSSION OF CROTCH'S BUMBLE BEE

On June 12, 2019, the California Fish and Game Commission (Commission) voted to accept a petition from the Xerces Society (2018) to consider listing four (4) subspecies of bumble bee, including the Crotch bumble bee, under the California Endangered species Act (CESA). As a result of this decision, the Crotch bumble bee is a state candidate endangered species; as such, it is temporarily afforded the same protection as state-listed threatened or endangered species. California is home to more than half (27) of the 50 bumble bee species in North America. The Crotch's bumble bee is largely endemic to California, historically known from throughout California's Central Valley, which once contained vast prairies rich with wildflowers. The range of Crotch bumble bee historically extended throughout the southern two-thirds of California, from coastal California east to the Sierra-Cascade crest and south into Mexico, but recent data indicates that this species is absent from the center of its historical range due to extensive agricultural intensification and urbanization (Xerces Society 2018). This species occurs primarily in California, including the Mediterranean region, Pacific Coast, Western Desert, Great Valley, and adjacent foothills through most of southwestern California. It has also been documented in southwest Nevada, near the California border. This species was historically common in the Central Valley of California but now appears to be absent from most of it.

Suitable bee habitat is based on three basic habitat requirements: suitable nesting sites for the colonies, availability of nectar and pollen from floral resources throughout the duration of the colony period (spring, summer, and fall), and suitable overwintering sites for the queens (Xerces Society 2018). This species is found in open grassland and scrub and is able to persist in semi-natural habitats surrounded by intensely modified landscapes. The dispersal distance of new queens as well as the colony's foraging range are difficult to determine and can vary greatly. It is estimated that the queen dispersal distance may average 6.2 miles. Some bumble bee species have been recorded foraging in patchy agricultural landscapes up to 11.5 km from their nest, though it is more likely that the foraging range occurs much closer to the nest, from 1-2 km in a single trip (CDFW 2023).

Bumble bees are generalist foragers (i.e., they do not depend on any one flower type). The Crotch bumble bee has a short tongue, and thus is best suited to forage at open flowers with short corollas. The plant families most commonly visited in California include Fabaceae, Apocynacea, Asteraceae, Lamiacea, Hydrophyllacae, Asclepiadaceae, and Boraginaceae (Thorp et al. 1983; Richardson 2017). The Crotch's bumble bee is also associated with flowering plants in the Antirrhinum (dragon flowers), Phacelia (borage), Clarkia (godetia), Dendromecon (tree poppy), Eschscholzia (poppy), and Eriogonum (wild buckwheat) genera (CNDDB 2024). Documented food plants for Crotch bumble bees include Asclepias sp.(milkweed), Chaenactis sp. (dustymaidens), Lupinus sp. (lupin), Medicago sp. (medick/burclover), Phacelia sp. (phacelia/heliotrope/borage), and Salvia sp. (sage) (Xerces 2018). Note that these floral associations do not necessarily represent preference for these plants over other flowering plants but rather may represent the prevalence of these flowers in the landscape where this species occurs (Xerces 2018).

Crotch bumble bees, like most bumble bee species, nest underground (e.g., in abandoned rodent holes) (Williams et al. 2014 cited in Xerxes Society 2018). Very little is known about the hibernacula utilized by Crotch bumble bee queens in the winter; however, bumble bees generally overwinter in soft, disturbed soil, leaf litter, or abandoned small mammal burrows (Williams et al. 2014; Xerces Society 2018). The flight period for Crotch bumble bee queens is from late February to late October, peaking in early April and again in July. The flight period for workers and males extends between late March and September (Xerces Society 2018). It is a nonmigratory species of bumblebee.

RESULTS

Survey Results

No Crotch's bumble bee was observed during any on-site field surveys or habitat assessments conducted by Helix or Gallaway Enterprises. Habitat characteristics such as documented floristic resources and suitable nesting and winter hibernacula habitats are present within the BSA.

CNDDB Occurrences

There are no CNDDB occurrences of Crotch's bumble bee within a 5-mile radius of the BSA or within the nine USGS 7.5' quads surrounding the BSA. The nearest CNDDB occurrence (#4) was documented approximately 28 miles to the south of the BSA and reported in 1956 near Red Bluff, California. There are only a total of eight (8) CNDDB occurrences (#1-5, #7, #292, #313) north of Chico, California, all recorded between 1956 and 1978 except for CNDDB #292 which was reported near Chico in 2020.

Status Occurrence in the BSA

Crotch's bumble bee is known to occur in annual grassland habitats flourishing with wildflowers and associated scrub habitats. The 8.65-acre BSA only offers 4.23-acres of annual grassland and the rest of the BSA is dominated by blue oak woodland canopy cover. Within the BSA, several flowering plant species with short corollas were observed that are suitable foraging resources, among these plants include resources that have been documented to be utilized by Crotch's bumble bee, such as flowering species in the Asteraceae, Boraginaceae, Fabaceae, and Lamiaceae families. Among the observed plant species, those within the Lupinus and Clarkia genera are also documented to be utilized by Crotch's bumble bee. Lupins tend to have an early summer blooming period that lasts about one month while Clarkia generally bloom late spring to early fall. Given that the annual grassland habitat within the BSA is routinely maintained and is dominated by non-native and native species including broadleaf filaree (*Erodium botrys*), Italian ryegrass (*Festuca perennis)*, annual vernal grass (*Anthoxanthus aristatum*), foxtail barley (*Hordeum murinum*), and wild oat (*Avena fatua*), the 4.23 acres of annual grassland does not support bountiful floristic resources that would sustain Crotch's bumble bee foraging within range of a nesting colony. Small mammal burrows are present within the BSA that are recognized as a suitable nesting habitat and soft soils and leaf litter are suitable habitat elements to support winter hibernacula for queen bees. Suitable habitat elements that support foraging, nesting, and winter refugia are present within the BSA, however, given that there are no CNDDB occurrences within a 25-mile radius of the BSA and no current CNDDB occurrences within a 60-mile radius of the BSA and the suitable habitat elements within and adjacent to the BSA are very limited (the lack of availability of nectar and pollen from floral resources throughout the duration of the colony period (spring, summer, and fall) it is not likely that Crotch's bumble bee would occur within the BSA.

CONCLUSIONS AND RECOMMENDATIONS

Suitable habitat elements that support foraging, nesting, and winter refugia are present within the BSA, however, these resources are marginal and given that there are no CNDDB occurrences within a 25-mile radius of the BSA and no current CNDDB occurrences within a 60-mile radius of the BSA and the suitable habitat elements within and adjacent to the BSA are very limited, specifically the lack of availability of nectar and pollen from floral resources throughout the duration of the colony period, it is not likely that Crotch's bumble bee would occur within the BSA. Additionally, the Crotch's bumble bee does not occur on any official species lists provided by the Agencies, thus the analysis of the species within the October 2024 BRA is not warranted without any significant data to support this species within the BSA. Because habitat elements present within the BSA are marginal, and there are no recent occurrences within a 60-mile radius, the avoidance minimization and mitigation measures proposed in the October 2024 BRA are not warranted.

If you have any questions or need further assistance, please do not hesitate to contact us at Gallaway Enterprises at (530) 332-9909.

Sincerely,

Jessica Sellers
Senior Biologist | Gallaway Enterprises
jessica@gallawayenterprises.com

Appendix A – CNDDB Results
Appendix B - Project Site Photos
Appendix C – Observed Plant Species List

Appendix A – Species List

CDFW, CNDDB Species List, updated February 2025

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Shasta Dam (4012264) OR Project City (4012263) OR Bella Vista (4012262) OR Redding (4012254) OR Enterprise (4012253) OR Palo Cedro (4012252) OR Cottonwood (4012243) OR Balls Ferry (4012242) OR Olinda (4012244))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Acipenser medirostris pop. 1 green sturgeon - southern DPS	AFCAA01031	Threatened	None	G2T1	S1	SSC
Actinemys marmorata northwestern pond turtle	ARAAD02031	Proposed Threatened	None	G2	SNR	SSC
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G1G2	S2	SSC
Agrostis hendersonii Henderson's bent grass	PMPOA040K0	None	None	G2Q	S2	3.2
Anthicus antiochensis Antioch Dunes anthicid beetle	IICOL49020	None	None	G3	S3	
Anthicus sacramento Sacramento anthicid beetle	IICOL49010	None	None	G4	S4	
Antrozous pallidus pallid bat	AMACC10010	None	None	G4	S3	SSC
Ardea alba great egret	ABNGA04040	None	None	G5	S4	
Balsamorhiza macrolepis big-scale balsamroot	PDAST11061	None	None	G2	S2	1B.2
Bombus pensylvanicus American bumble bee	IIHYM24260	None	None	G3G4	S2	
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Brasenia schreberi watershield	PDCAB01010	None	None	G5	S3	2B.3
Brodiaea matsonii Sulphur Creek brodiaea	PMLIL0C0H0	None	None	G1	S1	1B.1
Castilleja rubicundula var. rubicundula pink creamsacs	PDSCR0D482	None	None	G5T2	S2	1B.2
Clarkia borealis ssp. borealis northern clarkia	PDONA05062	None	None	G3T4	S4	4.3
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G4	S2	SSC
Cryptantha crinita silky cryptantha	PDBOR0A0Q0	None	None	G2	S2	1B.2
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T3	S3	
Entosphenus tridentatus Pacific lamprey	AFBAA02100	None	None	G4	S3	SSC

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Erethizon dorsatum North American porcupine	AMAFJ01010	None	None	G5	S3	
Euderma maculatum spotted bat	AMACC07010	None	None	G4	S3	SSC
Fluminicola seminalis nugget pebblesnail	IMGASG3110	None	None	G2	S3	
Gratiola heterosepala Boggs Lake hedge-hyssop	PDSCR0R060	None	Endangered	G2	S2	1B.2
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Great Valley Mixed Riparian Forest Great Valley Mixed Riparian Forest	CTT61420CA	None	None	G2	S2.2	
Great Valley Valley Oak Riparian Forest Great Valley Valley Oak Riparian Forest	CTT61430CA	None	None	G1	S1.1	
Great Valley Willow Scrub Great Valley Willow Scrub	CTT63410CA	None	None	G3	S3.2	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP
Helminthoglypta hertleini Oregon shoulderband	IMGASC2280	None	None	G3Q	S1S2	
Hydromantes shastae Shasta salamander	AAAAD09030	None	Threatened	G3	S3	
Juncus leiospermus var. leiospermus Red Bluff dwarf rush	PMJUN011L2	None	None	G2T2	S2	1B.1
Lanx patelloides kneecap lanx	IMGASL7030	None	None	G2?	S2	
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G3G4	S3S4	
Lasiurus cinereus hoary bat	AMACC05032	None	None	G3G4	S4	
Lasiurus frantzii western red bat	AMACC05080	None	None	G4	S3	SSC
Lathyrus sulphureus var. argillaceus dubious pea	PDFAB25101	None	None	G5T1T2Q	S1S2	3
Legenere limosa legenere	PDCAM0C010	None	None	G2	S2	1B.1
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G3	S3	
Limnanthes floccosa ssp. bellingeriana Bellinger's meadowfoam	PDLIM02041	None	None	G4T3	S1	1B.2
Limnanthes floccosa ssp. floccosa woolly meadowfoam	PDLIM02043	None	None	G4T4	S3	4.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Margaritifera falcata western pearlshell	IMBIV27020	None	None	G3G4	S1S2	
Monadenia troglodytes wintu Wintu sideband	IMGASC7092	None	None	G2T2	S2	
Myotis yumanensis Yuma myotis	AMACC01020	None	None	G5	S4	
Navarretia leucocephala ssp. bakeri Baker's navarretia	PDPLM0C0E1	None	None	G4T2	S2	1B.1
Neviusia cliftonii Shasta snow-wreath	PDROS14020	None	Threatened	G2	S2	1B.2
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	SSC
Oncorhynchus tshawytscha pop. 11 chinook salmon - Central Valley spring-run ESU	AFCHA0205L	Threatened	Threatened	G5T2Q	S2	
Oncorhynchus tshawytscha pop. 7 chinook salmon - Sacramento River winter-run ESU	AFCHA0205B	Endangered	Endangered	G5T1Q	S2	
Orcuttia tenuis slender Orcutt grass	PMPOA4G050	Threatened	Endangered	G2	S2	1B.1
Pandion haliaetus osprey	ABNKC01010	None	None	G5	S4	WL
Paronychia ahartii Ahart's paronychia	PDCAR0L0V0	None	None	G3	S3	1B.1
Pekania pennanti Fisher	AMAJF01020	None	None	G5	S2S3	SSC
Progne subis purple martin	ABPAU01010	None	None	G5	S3	SSC
Rana boylii pop. 1 foothill yellow-legged frog - north coast DPS	AAABH01051	None	None	G3T4	S4	SSC
Riparia riparia bank swallow	ABPAU08010	None	Threatened	G5	S3	
Sagittaria sanfordii Sanford's arrowhead	PMALI040Q0	None	None	G3	S3	1B.2
Spea hammondii western spadefoot	AAABF02020	Proposed Threatened	None	G2G3	S3S4	SSC
Trifolium piorkowskii maverick clover	PDFAB40410	None	None	G2	S2	1B.2
Trilobopsis roperi Shasta chaparral	IMGASA2030	None	None	G2	S1	
Trilobopsis tehamana Tehama chaparral	IMGASA2040	None	None	G2	S1	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Vaccinium shastense ssp. shastense Shasta huckleberry	PDERI181Z1	None	None	G4T3	S3	1B.3
Vespericola shasta Shasta hesperian	IMGASA4070	None	None	G3	S3	
Viburnum ellipticum oval-leaved viburnum	PDCPR07080	None	None	G4G5	S3	2B.3

Record Count: 64

Appendix B – Project Site Photos

Photos Taken January 24, 2025

Project Site Photos

Taken January 24, 2025

Blue oak woodland in northeast corner of BSA.

Aquatic resource in northeast corner of BSA.

Blue oak woodland and annual grassland along eastern boundary.

Disturbed seasonal wetland along east boundary.

Annual grassland habitat in southeast corner of BSA.

Blue oak woodland and annual grassland towards center of BSA.

Suitable winter hibernaucal habitat.

Suitable winter hibernaucal habitat.

Annual grassland habitat in southwest corner of BSA.

Annual grassland habitat in southwest corner of BSA.

Annual grassland habitat in northwest corner of BSA, suibalbe winter hibernacula habitat along western boundary.

Potenially suitable nesting habitat.

Appendix C – Observed Plant Species List

Family	Scientific Name	Common Name	Indicator Status[1]
Native			
Alliaceae	*Allium amplectens*	Narrowleaf onion	-
Agavaceae	*Chlorogalum pomeridianum*	Wavyleaf soap plant	-
Anacardiaceae	*Toxicodendron diversilobum*	Poison oak	-
Apiaceae	*Sanicula bipinnatifida*	Purple sanicle	-
Asteraceae	*Gnaphalium palustre*	Lowland cudweed	-
Boraginaceae	*Amsinkia* sp.	Fiddle neck	-
	Plagiobothrys canescens	Valley popcornflower	-
Brassicaceae	*Lepidium nitidum*	Shining pepperweed	-
Caprifoliaceae	*Lonicera interrupta*	Chaparral honeysuckle	-
Cupressaceae	*Hesperocyparis* sp.	Cypress	
	Eleocharis acicularis	Needle spike rush	-
Cyperaceae	*Cyperus esculentus*	Nut grass	-
Ericaceae	*Arctostaphylos manzanita ssp. manzanita*	Common Manzanita	-
Fabaceae	*Lupinus* sp.	Lupine	-
Fagaceae	*Quercus douglasii*	Blue oak	-
	Quercus wislizeni	Interior live oak	-
Juncaceae	*Juncus bufonius*	Toad rush	-
	Juncus effusus	Common bog rush	-
Malvaceae	*Sidalcea celata*	Redding checkerbloom	-
Oleaceae	*Syringa vulgaris*	Common lilac	
Onagraceae	*Epilobium densiflorum*	Denseflower willowherb	-
	Clarkia sp.	Clarkia	-
Orobanchaceae	*Triphysaria eriantha*	Johnny tuck	-
	Castilleja attenuate	Narrow leaved owl's clover	-
Pinaceae	*Pinus sabiniana*	Gray pine	-
Ranunculaceae	*Ranunculus occidentalis*	Western buttercup	-
Rhamnaceae	*Ceanothus cuneatus*	Buckbrush	-
Rubiaceae	*Salix lasiolepis*	Arroyo willow	-
	Galium aparine	Common bedstraw	
Salicaceae	*Populus fremontii*	Cottonwood	-
	Salix Lasiolepis	Arroyo willow	-
Typhaceae	*Typha angustifolia*	Narrow leaf cattail	-
Non-native			
Apiaceae	*Torillis nodosa*	Hedge parsley	-
Asteraceae	*Centaurea solstitialis*	Yellow-star thistle	High
	Logfia gallica	Narrowleaf cottonrose	-
	Leontodon saxatalis	Hawkbit	-
Brassicaceae	*Barbarea vulgaris*	Yellow rocket	-
	Raphanus sativus	Wild radish	Limited
Caryophyllaceae	*Scleranthus annuus*	German knotgrass	-
Fabaceae	*Acmispon americanus*	American bird's foot trefoil	-
	Vicia sativa	Spring vetch	-
	Vicia villosa	Hairy vetch	-
Geraniaceae	*Erodium botrys*	Broad leaf filaree	-
	Erodium cicutarium	Red stemmed filaree	Limited
	Geranium dissectum	Cutleaf geranium	Limited
Hypericaceae	*Hypericum* sp.	St. John's wort	Unknown
Lamiaceae	*Mentha pulegium*	Pennyroyal	Moderate

Family	Scientific Name	Common Name	Indicator Status[1]
Lythraceae	*Lythrum hyssopifolium*	Hyssop loosestrife	Limited
Mollugo	*Mollugo verticillate*	Green carpetweed	Limited
Moraceae	*Ficus caica*	Common fig	Moderate
	Morus alba	White mulberry	-
Myrsinaceae	*Eucalyptus Camaldulensis*	Red gum	Limited
	Lysimachia arvensis	Scarlet pimpernel	-
Oenothera	*Oenothera speciosa*	Pinkladies	-
Plantaginaceae	*Veronica anagallis-aquatica*	Water speedwell	-
Poaceae	*Anthoxanthum aristatum*	Annual vernal grass	-
	Arundo donax	Giant reed grass	High
	Briza maxima	Rattlesnake grass	Limited
	Briza minor	Little rattlesnake grass	-
	Bromus diandrus	Ripgut brome	Moderate
	Bromus hordeaceus	Soft chess	Limited
	Hordeum marinum	Mediterranean barley	-
	Hordeum murinum	Foxtail barely	Moderate
	Lolium perenne	Italian ryegrass	Moderate
	Paspalum dilatatum	Dallisgrass	-
Polygonaceae	*Rumex crispus*	Curly dock	Limited
Rosaceae	*Prunus dulcis*	Sweet Almond	-
	Rubus armeniacus	Himalayan blackberry	High
Viburnaceae	*Viburnum tinus*	Viburnum	-

[1] Cal-IPC Rating = Limited; Moderate; High

CANBY APARTMENTS
SITE DEVELOPMENT PERMIT SDP-2023-00085

MITIGATION MONITORING PROGRAM CONTENTS

This document is the Mitigation Monitoring Program (MMP) for Canby Apartments. The MMP includes a brief discussion of the legal basis for and purpose of the program, discussion and direction regarding complaints about noncompliance, a key to understanding the monitoring matrix, and the monitoring matrix itself.

LEGAL BASIS OF AND PURPOSE FOR THE MITIGATION MONITORING PROGRAM

California Public Resources Code Section 21081.6 requires public agencies to adopt mitigation monitoring or reporting programs whenever certifying an Environmental Impact Report (EIR) or a Mitigated Negative Declaration. This requirement facilitates implementation of all mitigation measures adopted through the California Environmental Quality Act (CEQA) process.

The MMP contained herein is intended to satisfy the requirements of CEQA as they relate to the Initial Study/Mitigated Negative Declaration prepared for Canby Apartments. It is intended to be used by City of Redding (City) staff, participating agencies, project contractors, and mitigation monitoring personnel during implementation of the project.

Mitigation is defined by CEQA Guidelines Section 15370 as a measure that does any of the following:

- Avoids impacts altogether by not taking a certain action or parts of an action.
- Minimizes impacts by limiting the degree or magnitude of the action and its implementation.
- Rectifies impacts by repairing, rehabilitating or restoring the impacted environment.
- Reduces or eliminates impacts over time by preservation and maintenance operations during the life of the project.
- Compensates for impacts by replacing or providing substitute resources or environments.

The intent of the MMP is to ensure the effective implementation and enforcement of adopted mitigation measures and permit conditions. The MMP will provide for monitoring of construction activities as necessary, on-site identification and resolution of environmental problems, and proper reporting to City staff

MITIGATION MONITORING TABLE

The Mitigation Monitoring Table identifies the mitigation measures proposed for Canby Apartments. These mitigation measures are reproduced from the Initial Study and conditions of approval for the project. The tables have the following columns:

Mitigation Measure: Lists the mitigation measures identified within the Initial Study for a specific impact, along with the number for each measure as enumerated in the Initial Study.

Timing: Identifies at what point in time, review process, or phase the mitigation measure will be completed.

Agency/Department Consultation: References the City department or any other public agency with which coordination is required to satisfy the identified mitigation measure.

Verification: Spaces to be initialed and dated by the individual designated to verify adherence to a specific mitigation measure.

NONCOMPLIANCE COMPLAINTS

Any person or agency may file a complaint asserting noncompliance with the mitigation measures associated with the project. The complaint shall be directed to the City in written form, providing specific information on the asserted violation. The City shall conduct an investigation and determine the validity of the complaint. If noncompliance with a mitigation measure has occurred, the City shall take appropriate action to remedy any violation. The complainant shall receive written confirmation indicating the results of the investigation or the final action corresponding to the particular noncompliance issue.

Mitigation Monitoring Table
For the Canby Apartments Mitigation Monitoring Program

Mitigation Measure	Timing/Implementation	Enforcement/ Monitoring	Verification (Date and Initials)
Biological Resources			
Bio-1: Prior to grading or construction, consultation with CDFW shall be conducted to develop a mitigation and/or avoidance strategy for Redding checkerbloom. This may include transplanting the plant population, compensation, or other measures established by that agency. Possible avoidance measures may include fencing populations before construction, exclusion of project activities from the fenced-off areas, construction monitoring by a qualified botanist to keep construction crews away from the population, and monitoring and reporting requirements for populations to be preserved on site.	At time of development	Public Works, Planning	
Bio-2: Prior to the commencement of construction within the onsite drainage or within 100 feet of the onsite drainage, a pre-construction survey for foothill yellow-legged frog (FYLF) shall be conducted within the onsite intermittent drainage and immediate surrounding areas, initially seven days prior to the commencement of any ground-disturbing activities and again no more than 24 hours prior to ground-disturbing activities. If there are negative findings for this species during the survey, no further action is required. If this species is observed during the survey, CDFW should be consulted prior to ground disturbance regarding the potential for the project to result in take of FYLF, and any avoidance measures or mitigation measures required by CDFW shall be implemented.	At time of development	Public Works, Planning	
Bio-3: A qualified biologist shall conduct a pre-construction survey within 14 days prior to the start of ground disturbance within 500 feet of riparian habitat or the intermittent drainage. If no western pond turtles are observed, then a letter report documenting the results of the survey shall be provided to the City, and no additional measures are required. If construction does not commence within 14 days of the pre-construction survey, or halts for more than 14 days, a new survey shall be completed. If western pond turtles are found, a qualified biologist shall conduct a pre-construction survey within 24 hours prior to commencement of construction activities and be present on the site during	At time of development	Public Works, Planning	

Mitigation Measure	Timing/Implementation	Enforcement/ Monitoring	Verification (Date and Initials)
grading activities within 500 feet of the intermittent drainage and its surrounding riparian habitat. The biologist shall establish a no disturbance buffer around any individual western pond turtle, allowing the turtle to continue downstream, offsite, on its own accord. If the turtle does not self-relocate within a reasonable amount of time established by the biologist, CDFW shall be consulted on next steps.			
Bio-4: If feasible, vegetation removal and/or construction shall be conducted between September 1 and January 31. If vegetation removal and/or construction activities is to occur during the nesting season (February 1 through August 31), a qualified biologist shall conduct a preconstruction survey no more than seven days before vegetation removal or construction activities begin. If an active nest is found, a no disturbance buffer shall be established by a qualified biologist in coordination with CDFW. Construction may resume once the young have left the nest or as approved by the qualified biologist. The survey shall be provided to the CDFW. If construction activities cease for a period greater than seven days, additional preconstruction surveys will be required.	At time of development	Public Works, Planning	
Bio-5: If vegetation removal and/or construction activities are to occur during the bat roosting season (March 1 through August 31), a qualified biologist shall conduct a preconstruction survey no more than seven days before vegetation removal or construction activities begin. If an active roost is found, a no disturbance buffer shall be established for a distance of 500 feet around the nest unless a smaller buffer zone is approved by CDFW. Construction may resume once the young have left the nest or as approved by the qualified biologist. The survey shall be provided to the CDFW. If a lapse in construction activities of 14 days or more occurs during the roosting season, an additional roost survey is required to ensure no roosts were established in the area while construction was on hold. Minimum qualifications for a Qualified Biologist include a bachelor’s degree in biological or environmental science, natural resources management, or related discipline; field experience in the habitat types that may occur at the project site; familiarity with the Covered Species (or closely related species) that may occur at the project site; and prior preconstruction survey, construction monitoring, or construction oversight experience (if and as relevant to the activity to be conducted).	At time of development	Public Works, Planning	

Mitigation Measure	Timing/Implementation	Enforcement/ Monitoring	Verification (Date and Initials)
Noise			
Noi-1: Prior to issuance of a grading permit, the applicant or designated contractor shall provide evidence to the City (via testing data or calculations from a qualified expert), demonstrating that the vibratory rollers to be used on the Project site would produce less than 75 VdB at nearby occupied residences, or all vibratory rollers shall be used in static mode only (no vibrations) when operating within 110 feet of an occupied residence.	At time of development	Public Works, Planning	