TOWN OF WINDSOR

Connecting Central Windsor

July 2018



prepared by
Steven Grover & Associates

I:\80 - Public Works\Infrastructure Planning & Funding\Transportation\US 101 - ORH Ped-Bike Crossing Study\Feasibility Report\Final Report

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EXECUTIVE SUMMARY

Background

While the U.S. 101 freeway has been a major transportation asset to the Town of Windsor region since its construction in the late 1950s, it also creates a significant barrier to mobility and connectivity for town visitors and community members. For all transportation modes, travel between important destinations on each side of the freeway is restricted to just three crossing locations within Windsor. For cyclists and pedestrians these crossings are generally uninviting and have several safety issues.

The U.S. 101 at Central Windsor underpass on Old Redwood Highway is the primary link between the east and west sides of town, serving approximately half of all daily cross-town vehicular traffic. For pedestrians, the underpass experience includes loud traffic noise reverberating on hard concrete surfaces, inadequate lighting, imposing retaining walls, long crosswalks with high volume high speed freeway ramp traffic, a long distance between crosswalks across Old Redwood Highway, and long distances between pedestrian friendly resting spots. For cyclists, the crossing presents a choice between sharing a sidewalk with pedestrians that is too narrow for safe multimodal use, or using a substandard width bike lane between a vertical concrete retaining wall and heavy traffic. In addition to the challenges of crossing U.S. 101, the freeway disrupts the physical coherence of the town by bisecting and separating Windsor into an east and a west side.

Scope & Goals

To address these deficiencies and work toward the Town's broader goal of creating a more cohesive and walkable downtown area, the Town of Windsor elected to conduct a comprehensive study of bicycle and pedestrian access in Central Windsor. The scope of this Study comprised first analyzing constraints and challenges, and then developing and assessing alternative solutions to:

- **Facilitate Crossing**; improve the existing U.S. 101 Old Redwood Highway crossing and/or create a new dedicated bicycle/pedestrian crossing,
- **Improve Connectivity and Walkability**; make it easier, safer, and more inviting to walk and bike in Central Windsor in the vicinity of the U.S. 101 at Central Windsor underpass,
- **Improve Urban Coherence**; identify urban design principles and active transportation design strategies to guide ongoing development of the Central Windsor area in a way that will increase urban coherence across the division created by U.S. 101.

Process

Beginning in 2015, the Connecting Windsor project team began working on studies including traffic counts, assessments of compliance with standards, topographic surveys, drone photos, and reviews of as-built drawings, existing studies, and transportation and commercial development plans. Shortly thereafter, the team commenced public engagement, including seven stakeholder focus meetings, two public workshops, two on-line public surveys, a presentation to the Town Council, and a presentation to the Planning Commission to understand the challenges, issues, and desires for the Study as seen by the Windsor community. Together, these initial engineering studies and community engagement activities frovided a detailed understanding of the myriad specific design problems to be solved as well as concrete criteria that could be used to assess alternative solutions.

The second phase of the Connecting Windsor Study consisted of developing a broad range of alternative conceptual design solutions including:

- U.S. 101 at Central Windsor underpass beautification strategies,
- U.S. 101 at Central Windsor underpass geometric and structural modifications,
- Intersection and traffic signal improvements along Old Redwood Highway in the vicinity of the Central Windsor underpass,
- U.S. 101 at Central Windsor on-ramp improvements,
- New crosswalk opportunities,
- Public open space opportunities,
- Existing pathway improvements,
- New pathway opportunities,
- New undercrossing alternatives,
- New overcrossing alternatives, and
- Bike lane reconfiguration alternatives.

The alternative design solutions were then carefully assessed by the team based on the design criteria previously developed with the community, including:

- Aesthetics,
- Safety for all travel modes (including automobiles),
- Comfort (including shade opportunities),
- Wayfinding, and
- Access options for pedestrians and cyclists.

Engineering feasibility of the alternatives was also assessed, including:

- Cost,
- Constructability,
- Caltrans and other Agency review,
- Compatibility with future development plans,
- Flooding, and
- Traffic.

Following this assessment process the design alternatives studied were shared with the Windsor community at a series of public workshops and focus meetings. These meetings helped to refine assessments of alternatives. The meetings also provided the Connecting Windsor team with a deeper understanding of the community's goals and concerns.

Recommendations

The constraints definition, goals setting, alternatives development, and assessment processes described above have led to the following specific recommendations for action by the Town:

1. Continue to work with Caltrans on the following project components within the state right of way:
   a. Widening of the existing U.S. 101 at Central Windsor underpass along Old Redwood Highway with improvements as described in this study for pedestrian, cyclist, and vehicular user experience and safety;
   b. A new U.S. 101 Class I shared-use pedestrian and cyclist overcrossing;
   c. Bi-directional protected bike lanes on both sides of Old Redwood Highway between Conde Lane and Lakewood Drive to make it safer for cyclists to travel in both the east and west directions without crossing the roadway;
   d. A new shared-use pathway on the east of U.S. 101 connecting Los Amigos Road and Old Redwood Highway.
2. Simultaneously, take the following actions on the below stated project components outside the state right of way:
   a. Retain public ownership in perpetuity of selected Town-owned properties in Central Windsor to serve as public pedestrian-oriented open spaces and/or as mixing zones for pedestrian and cyclist transportation routes;
   b. Create a pedestrian promenade between the existing Shell and Chevron gas stations to serve as public open space and as a shortcut for cyclists and pedestrians to avoid the intersection of Conde Lane and Windsor River Road;
   c. Improve the pathways on west side of U.S. 101 adjacent to Windsor Creek connecting Old Redwood Highway and Conde Lane to make them more inviting and architecturally consistent with other Central Windsor public open spaces.
3. Pursue further study of the feasibility and costs/benefits for the following project components:
   a. A slip lane from Lakewood Drive to the U.S. 101 northbound on ramp was studied and found to reduce the number of vehicles crossing the northbound on-ramp crosswalk by 25% and reduce traffic congestion on Lakewood Drive; however, further study is recommended to assess turning movement operations, geometrics, and the overall cost/benefit of this strategy in greater detail;
   b. Signal timing or retaining Class II or III on-street bikeways along Old Redwood Highway, between Lakewood Drive and Windsor River Road, is recommended for study to assess how traveling through the corridor could me made more efficient for cyclists;
   c. A roundabout at the intersection of Conde Lane and Windsor River Road was cursorily studied. Preliminary findings indicate that the space at the intersection may be inadequate to accommodate both a vehicular roundabout and facilities for pedestrians and cyclists. Further study is recommended to determine whether a new roundabout configuration could allow pedestrian and cyclist facilities to remain adjacent to the roundabout, and if this is not possible, to assess community input on how pedestrians and cyclists could more readily cross the intersection or be detoured to avoid the intersection.

The Connecting Windsor team does not recommend further study of new undercrossing alternatives, which were studied extensively as part of this study. While the Windsor community ranked a new undercrossing concept slightly higher than an overcrossing, this study found that a new undercrossing reflecting the community's design priorities would be significantly more expensive to implement than an overcrossing, take longer to deliver, present greater personal security challenges, be subject to periodic flooding, and involve greater feasibility and review risks by agencies including Caltrans, the Army Corps of Engineers, and the Department of Fish and Wildlife.

Fiscal Impact

It is anticipated that the project would be largely funded through federal, state, and regional grants. Direct fiscal impact on Town resources would be on the order of $100-500k, depending on local grant opportunities to pay for staff time and meet local matching funds for state and federal grants. Because most state and federal grants require local matching funds, local and regional grant opportunities should be assessed early on. Initial rough order of magnitude estimate for construction costs range from $16M to $20M total (in 2017 dollars) for the following *recommended* components:

- Widened U.S. 101 at Central Windsor underpass, $2-3.9M;
- New cyclist and pedestrian overcrossing of U.S. 101, $8-10M;
- New shared-use pathway on the east of U.S. 101 connecting Los Amigos Road and Old Redwood Highway, $1.3M;
- Improved shared-use pathways on the west side of U.S. 101 connecting Old Redwood Highway and Conde Lane, $0.2M;
- New bi-directional protected bike lanes on Old Redwood Highway between Conde Lane and Lakewood Drive, $2.4M; and
- New Central Windsor promenade (involves land swap with adjacent gas stations), $2.5M.

The construction cost estimate includes 30% contingency for both roadway and structure components, but does not include costs for design, technical documents, environmental documentation and permits, agency review, construction support, or construction management. For the planning and design efforts greatest fiscal and timeline efficiency would be achieved if all recommended components are designed in parallel in a single effort. Depending on grant funding opportunities, a phased approach to construction may be most appropriate.



1. CONTEXT & GOALS

1.1. Project Study Area
1.2. Purpose & Need
1.3. Community Goals
1.4. Design Criteria

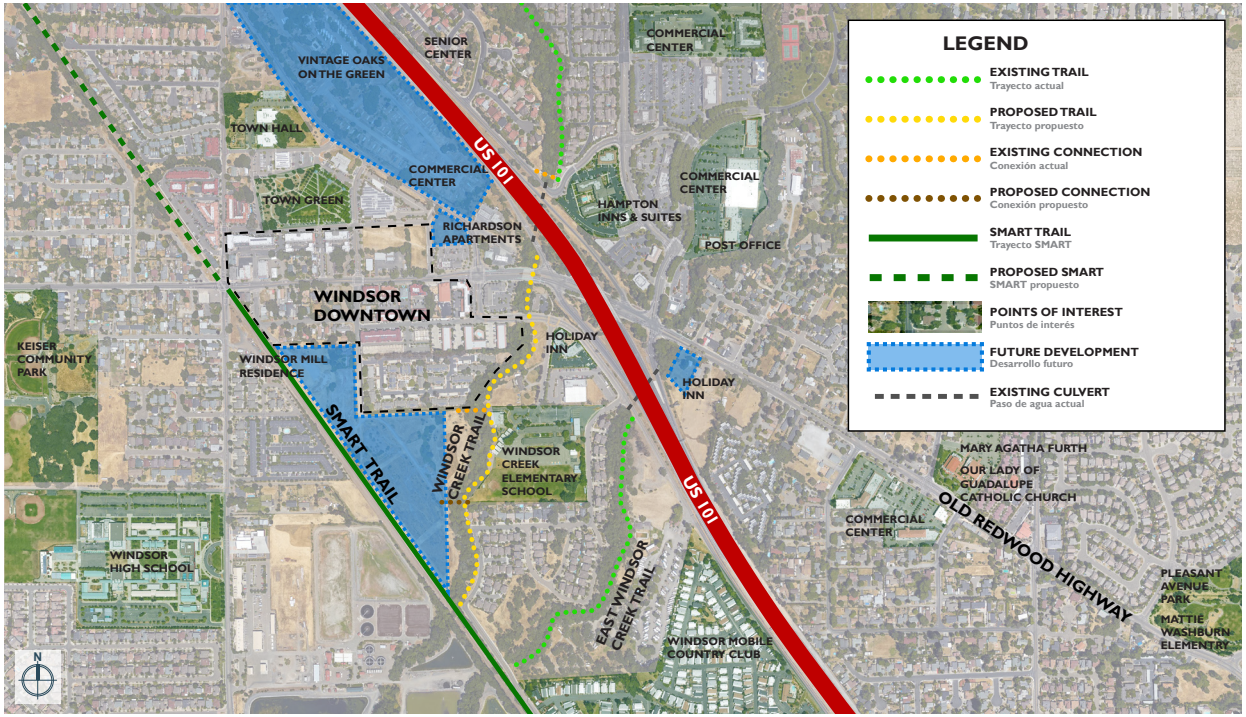
1. CONTEXT & GOALS

1.1 Project Study Area

Located along U.S. 101 in central Sonoma County, the Town of Windsor is situated approximately five miles south of the City of Healdsburg and seven miles north of the City of Santa Rosa. With a population of approximately 27,000, an incorporated land area encompassing 7.3 square miles, low crime rates, highly ranked schools, affordable housing, and a strong sense of community, Windsor is regionally known as an ideal family-oriented town.

The relatively flat topography makes Windsor an optimal community for walking and cycling. In 2012, Windsor received a Bronze Award from the League of American Bicyclists for its demonstrated commitment to improving safety and convenience for cyclists, and the Town's recently-adopted plans are promoting more pedestrian-oriented development. Windsor's riparian corridors are one of its greatest assets, providing opportunities for open space, wooded habitats for wildlife, and shade for a regional network of creek-side multi-use trails.

While U.S. 101 provides regional access as a vital transportation link for the Town of Windsor, it also creates a significant barrier to the physical coherence of the town by bisecting and separating Windsor into an east and a west side.



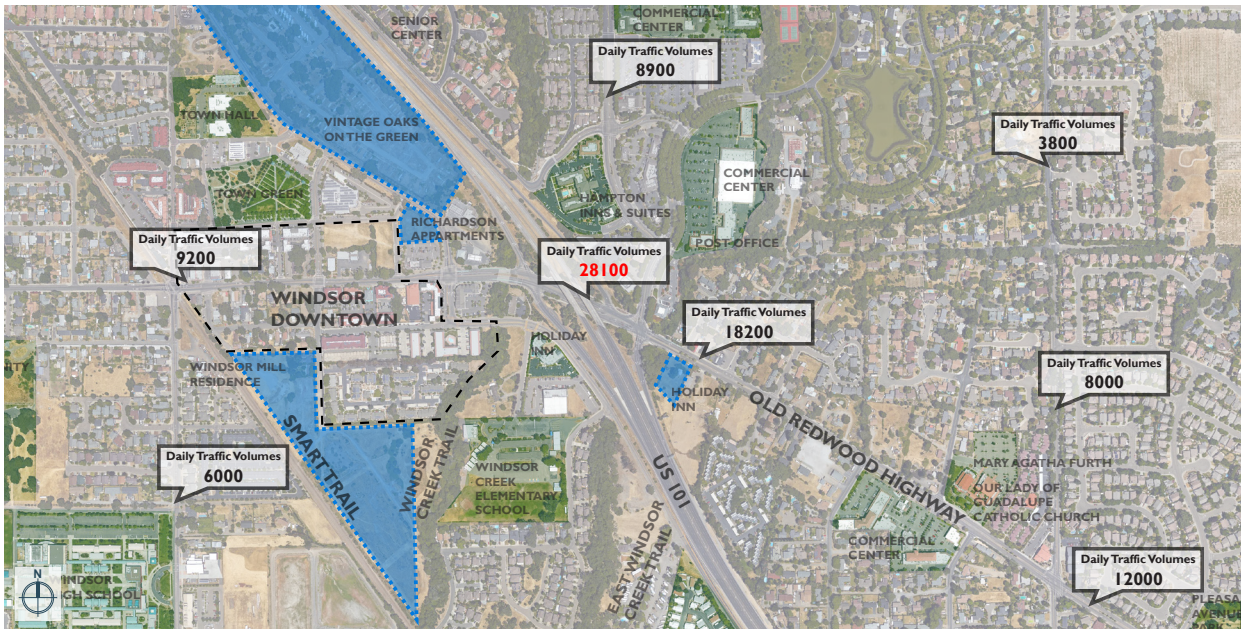
U.S. 101 Bisects the Town of Windsor



1957 Thomas Nelson Map depicts Old Redwood Highway as the main north-south thoroughfare and a dashed line represents the proposed highway

The approximate study area for the Connecting Windsor project is centered on the intersection of Old Redwood Highway and U.S. 101.

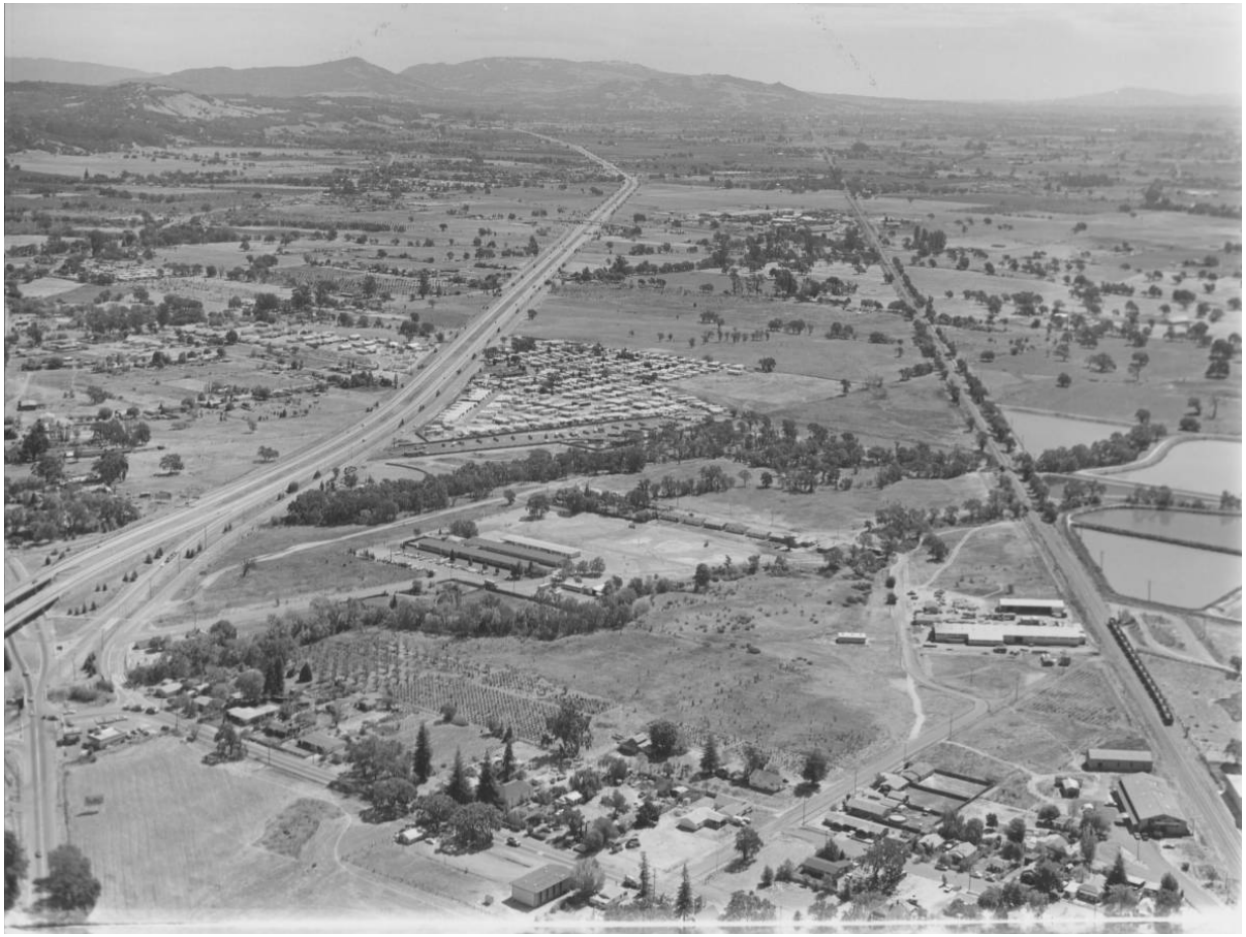
The interchange at U.S. 101 and the town's main arterial, Old Redwood Highway, serves as the primary vehicular access point to U.S. 101 in Central Windsor. The existing U.S. 101 underpass on Old Redwood Highway at the interchange is also the primary crossing point between east and west Windsor for cyclists, pedestrians, and motorists. As a result, the Old Redwood Highway corridor has the highest traffic volume of any roadway in Windsor, serving approximately 28,100 vehicles per day in 2016, half of all daily cross-town traffic. This is an increase of nearly 70% from 2012 annual daily traffic (ADT) counts.



Approximate daily traffic volumes in Central Windsor in 2016

At the U.S. 101 and Old Redwood Highway interchange, on-ramps and off-ramps are difficult to navigate for pedestrians and cyclists, and flared intersections facilitate fast turning speeds for vehicles. Pedestrian crosswalks are long, and to cross Old Redwood Highway north-south, cyclists and pedestrians must use the crosswalks at the Conde Lane intersection or the Lakewood Drive intersection, since there is no north-south crosswalk for approximately 1,000 feet between these intersections. As a result, cyclists commonly ride on the sidewalk along Old Redwood Highway and occasionally ride against traffic in the one-way Class II bike lanes. At the underpass the Class II bike lanes on Old Redwood Highway are too narrow to meet current safety standards of five feet due to the constrained width of the roadway and accommodations for 11-foot vehicular travel lanes. Within the U.S. 101 at Central Windsor underpass in particular, the adjacency of the four-foot Class II bike lanes to vehicular traffic on one side, and a solid wall on the other, compel many cyclists to ride on the sidewalk.

In 2014, the Town of Windsor, in partnership with the Sonoma County Transportation Authority (SCTA), updated the 2008 Windsor Bicycle and Pedestrian Master Plan. The plan identified that two of the largest obstacles to mobility in Windsor are U.S. 101 and the quality of the bicycle and pedestrian routes through the Central Windsor interchange. Although recent sidewalk and bike lane improvements through the existing U.S. 101 at Central Windsor underpass have been widely regarded as welcome improvements, crossing U.S. 101 remains challenging in terms of both safety and



1972 Aerial view of Central Windsor looking south from project area, with the U.S. 101 underpass on Old Redwood Highway at the left (Sonoma County Aerial Photography Collection)

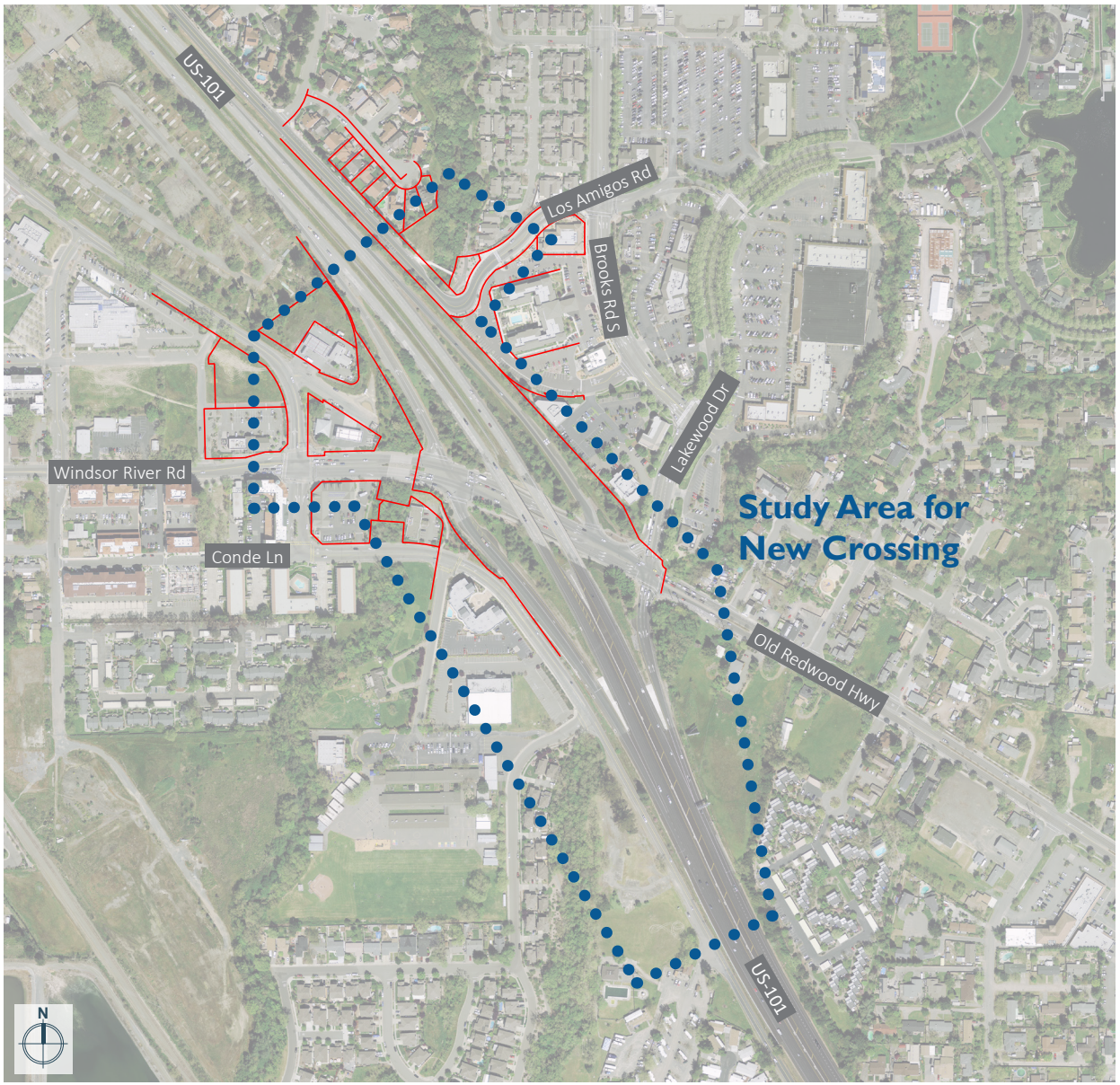


2017 Aerial view of Central Windsor looking south from project area (Google Earth)

user experience for cyclists and pedestrians, as noted by public feedback collected in 2014 for the Windsor General Plan update, and in 2016 and 2017 for the Connecting Windsor Study.

In addition to the geometric and circulation issues associated with the passage of cyclists and pedestrians between the east and west sides of Windsor, aesthetic improvements to the U.S. 101 at Central Windsor underpass, as a main entry to the Old Downtown area, would both encourage cycling and walking, and improve the urban coherence of Central Windsor. Accordingly, improving this entry into Windsor to be more welcoming and appealing for all commuters has been identified as important by the Town Council.

Supported by a 2016 Measure M grant, this Connecting Windsor Study explores ways to improve bicycle and pedestrian connectivity between the east and west sides of Windsor by developing and assessing strategies aimed at improving attractiveness, safety, comfort, wayfinding, and access options for pedestrians and cyclists to cross U.S. 101. In addition to identifying potential bicycle and pedestrian oriented improvements along the Old Redwood Highway, and ways to build a new undercrossing or bridge, this Study also examines options for expanding the existing bicycle and pedestrian network in the downtown area.



Map of the Connecting Windsor Study Area

1.2. Purpose & Need

The purpose of the Connecting Windsor Study is to close gaps in Windsor's bicycle and pedestrian transportation network and improve circulation for all travel modes by developing strategies to:

- Reduce or eliminate conflict points between vehicles, pedestrians, and bicyclists traveling through the U.S. 101 at Central Windsor underpass to increase access and safety;
- Offer a safer, more enjoyable, and inviting bicycle and pedestrian undercrossing of U.S. 101 to encourage walking and biking;
- Create modal mixing zones, resting spots, and public open spaces throughout Central Windsor with a consistent urban architectural vocabulary to encourage walking and biking;
- Provide safe and accessible connections between new and existing bicycle and pedestrian facilities east and west of U.S. 101 to improve connectivity; and
- Implement an alternative grade-separated, ADA-compliant travel route for non-motorized travelers across U.S. 101 to increase travel mode flexibility and encourage a mode shift away from motorized vehicle travel.

The Study addresses Windsor's need to:

- Reduce conflicts between pedestrians and vehicles within and around the existing U.S. 101 at Central Windsor underpass on Old Redwood Highway.
  - Pedestrians and cyclists attempting to travel east-west on Old Redwood Highway under U.S. 101 are presented with multiple vehicle conflict

points and challenging maneuvers. Potential conflicts between lower-speed pedestrians and cyclists and higher-speed vehicles exist at the crossings at the freeway on and off ramps. The intersections at Old Redwood Highway and Windsor River Road, as well as Old Redwood Highway and Lakewood Drive are also barriers for pedestrians and cyclists due to the wide roadway and turning radius, peak time traffic congestion, and number of lanes needing to be crossed, all of which decrease the safety and comfort of non-motorized travelers. Further, the existing sidewalks and bike lanes beneath U.S. 101 along Old Redwood Highway are not inviting for cyclists and pedestrians because of the footprint, visual mass, and noise of the freeway combined with the narrow width of the paths and darker ambiance of the space.

- Improve bicycle and pedestrian connectivity between the east and west sides of Windsor.
  - U.S. 101 divides the town and creates a barrier between existing cyclist and pedestrian networks on the east and west sides. The existing U.S. 101 at Central Windsor underpass at Old Redwood Highway is one of three freeway crossings in Windsor; the crossing at Arata Lane is 1.3 miles to the north and the crossing at Shiloh Road is 1.7 miles to the south. Old Redwood Highway is the only route between east and west that is near the Town Green and Old Downtown area, but it does not provide cyclists and pedestrians with a safe or comfortable user experience.
- Enhance the town's urban coherence and the primary entryway to the Central Windsor area;
  - Although bicycle and pedestrian infrastructure exists on the east and west sides, the existing pathways are disconnected and need to be stitched together into a single coherent transportation network. Windsor has a rapidly growing population, a pedestrian-oriented downtown, numerous parks, as well as an excellent topography for cycling and walking. By building new cyclist and pedestrian connections between the east and the west side of the freeway, the Town can encourage walking and biking between existing and future neighborhoods, community services, and destination points. By using a consistent architectural vocabulary throughout Central Windsor public outdoor spaces and pathways and crossing facilities, wayfinding will be improved and cyclists and pedestrians will be better assured that a coherent network of facilities serves them. By enhancing the U.S. 101 at Central Windsor underpass and corridor, Central Windsor's primary entryway, the Town can also promote a more inviting and welcoming gateway to community members and visitors alike.
- Prepare for future increases in non-motorized travel for commuting and recreating.
  - In the Central Windsor area, Old Redwood Highway is already congested at peak times. With the implementation of the Sonoma Marin Area Rail Transit (SMART) line, new pedestrian-oriented commercial and residential developments, and the 2013 adoption of the Town's Complete Streets Policy, the demand for more alternative transportation opportunities and bicycle and pedestrian infrastructure is expected to increase.

1.3. Community Goals

The Connecting Windsor team conducted extensive public engagement for the Connecting Windsor Study, including seven stakeholder focus meetings, two community workshops, and online public input surveys. The team also delivered two formal presentations about the project to the Town Council and Planning Commission. The goals, concerns, and ideas expressed by the community shaped how the team focused the Study and prioritized problems and design solutions.

On February 11, 2016, the team conducted the first community workshop, which was aimed at learning about the public's goals, priorities, and concerns for the project. The initial public survey following the workshop was completed by 288 people and found that although nearly 75% of respondents ride their bikes, only 6% ride their bikes through the U.S. 101 at Central Windsor underpass. Most found the user experience of traveling through the underpass to be "uncomfortable" and half of bikers who ride through the underpass say they ride on the sidewalk. The top priority for respondents was improving safety and connectivity, with 75% desiring mode separation between cyclist and pedestrians, and 78% of respondents reported their main safety concern to be the freeway ramp intersections at Old Redwood Highway. See Appendix A.1. for the 1st Connecting Windsor survey results.

The overwhelming conclusion drawn from initial public engagement was that the community desired a better and safer way to get from one side of town to the other. Most of the community felt that while it



Mona Ibrahim, Town of Windsor Engineer, opens the First Public Workshop, February 11, 2016, Windsor Senior Center



Steven Grover, architect and engineer, from Steven Grover and Associates, addresses attendees at the First Public Workshop

is very important to improve the existing underpass, just fixing the existing underpass along Old Redwood Highway would be insufficient, particularly because the freeway ramp intersections will always have high traffic volumes. The community felt that since it would be extremely difficult to completely move the ramps, the safety challenges would remain with any underpass improvements, and therefore, a new car-free crossing is warranted. Approximately 72% believed that a new bicycle and pedestrian bridge or tunnel to cross U.S. 101 would be a big improvement for the Town of Windsor, and public comments generally favored an overcrossing connecting the east side of Windsor to the Old Downtown area on the west side.

On May 20, 2017, the team conducted the project's second community workshop, which was aimed at hearing public feedback on the design solutions developed by the team. Following the second workshop, a second public input survey received 466 responses. Confirming initial public sentiment, 80% believed that an additional crossing of U.S. 101 was needed along with improvements to the existing underpass. Although community preference for a new undercrossing ranked slightly higher in the survey scoring than a new overcrossing, written public comments favored an overcrossing and expressed strong concerns for the personal safety and security issues of an undercrossing. Approximately 80% of respondents believed the vision developed in the Connecting Windsor project is important, and 74% stated that they would walk or bike more if the project's design solutions were implemented. A similar number of respondents (77%) believed it would be important for the Town to preserve pockets of undeveloped land in Central Windsor for future development as public spaces.



Steven Grover discusses the project at the Second Public Workshop, May 20, 2017, Town Council Chambers



Second Public Workshop attendees review a diagram of the undercrossing alternative



Second Public Workshop attendees discuss a diagram of the overcrossing alternative

Approximately two-thirds of respondents to the second public survey identified the freeway ramp intersections at Old Redwood Highway as the biggest issue with the existing U.S. 101 at Central Windsor crossing, while half of these respondents included the user experience within the underpass space as an additional significant issue. Public input revealed that an overwhelming number of respondents anticipate an increased demand for cyclist and pedestrian-oriented transportation infrastructure in the future, as only 15% of respondents believed improvements to the existing underpass would be enough to serve the Town's long-term cyclist and pedestrian needs. In addition to supporting cyclist and pedestrian infrastructure improvements in Central

Windsor, public comments identified locations in Windsor beyond the scope of this project that need improvements to bicycle and pedestrian infrastructure. These include the areas around Arata Lane and Old Redwood Highway, and around Shiloh Road and Old Redwood Highway, as well as along Conde Lane. See Appendix A.2. for results from the 2nd Connecting Windsor public survey.

1.4. Design Criteria

To address the goals and issues identified by the Windsor community, design solutions need to perform three basic functions:

1) Safe-Making Design solutions must make conditions safer for pedestrians and cyclists.

2) Path-Making Design solutions must better connect the active transportation network to improve the ways people can get from one place to another without the use of an automobile.

3) Place-Making Beyond simply creating paths or conduits for travel, design solutions must also provide outdoor public spaces which are connected by, or occur along pathways. Small and large outdoor public spaces create resting spots and increase the attractiveness of walking and biking by creating a series of places that facilitate modal mixing at intersections, as well as places that provide shade and foster community by facilitating interaction, rest, people-watching, and reflecting. These are the qualities that make the Town Green such a



Windsor's Town Green is a successful large, grassy, and relatively open park-like space



Windsor's residents often walk to the Town Green's large public community events



The Town Green's pedestrian-scaled features also support small and intimate community experiences

successful community-oriented public space. Although the Town Green is a large, grassy, and relatively open park-like space, successful pedestrian oriented places in the urban environment need not be large, park-like, or even quiet.

Placemaking is not just about creating spaces at the ends of pathways. Connections themselves, such as a bridge over a freeway, can become destinations that serve as landmarks, as well as opportunities for discovery and creative expression.



The American Tobacco Trail Bridge over Interstate 40, Durham, NC, designed by Steven Grover & Associates incorporates a thin bridge deck and transparent fencing



High visual transparency of fencing facilitates views of the freeway by bridge users, as well as views of bridge users by the drivers below



Active transportation supports the local economy


Natural corridors and waterways provide unique experiences


Public seating provides a place for rest

Placemaking along an active transportation route supports the local economy, since many people spend at local businesses for food, beverages, and equipment while walking and biking. Cafes and coffee shops along a cycling route for example, can serve as meeting points and way stations, while public seating areas can serve as a place to break for lunch. Additionally, downtown creeks and natural corridors can provide experiences in nature and opportunities for education, enhanced by signage, plaques, and artwork.


Local businesses along regional active transportation routes can serve as pit stops and meeting points



New Yorkers stop to rest in one of many Broadway Mall's mini public spaces in 1963



The Broadway Mall's benches provide a place to break for lunch in 2014

Precedents exist for small public spaces in the midst of traffic, such as in the median of a roadway, that provide an opportunity for people to stop, sit, and see other people.

In the median of busy Broadway in New York City, small paved areas with benches have long been successful as mini public spaces, meeting points, and rest stops for community interaction, repose, and the installation of artwork.



The mini public places serve as art spaces in 2017



2. SOLUTIONS

2.1. Design Components
2.2. Placemaking & Pathmaking
2.3. Old Redwood Highway Corridor Improvements
2.4. New Crossing of U.S. 101

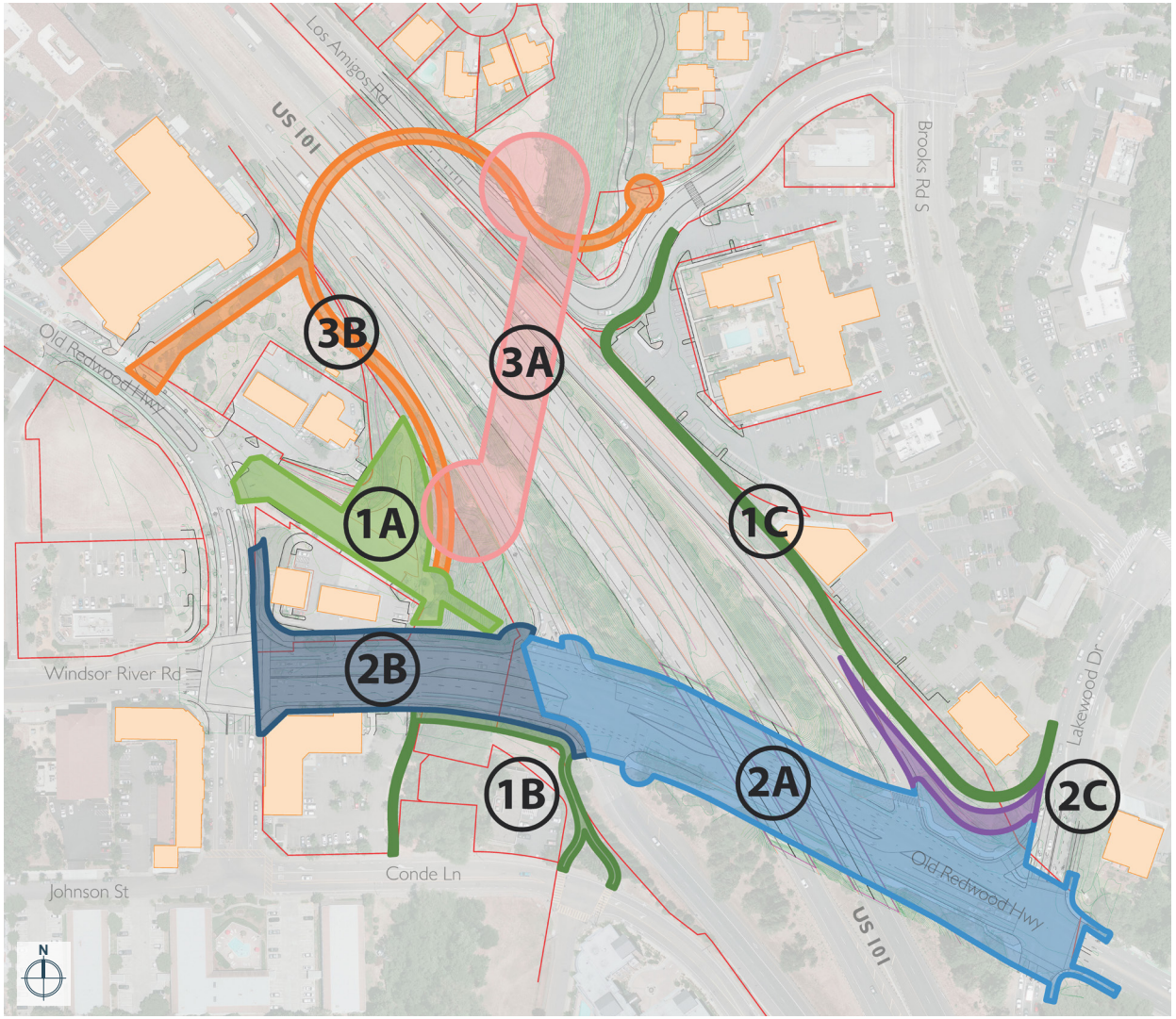
2. SOLUTIONS

2.1. Project Components

The Connecting Windsor Study incorporates a transportation planning study for Central Windsor, a beautification study for the U.S. 101 underpass on Old Redwood Highway, and five engineering feasibility studies. By integrating public input, urban planning and design, architecture, and engineering, the team has developed and evaluated the design solutions included below for achieving community goals.

Given the broad scope of the Study, the design solutions for connecting Central Windsor were organized into three groups, with sub-components to facilitate engineering, assessment, and cost estimating:

1. Placemaking and Pathmaking
   a. Redevelopment of a Historical Urban Axis
   b. Improved Shared Use Pathways
   c. New Shared Use Pathway
2. Old Redwood Highway Corridor Improvements
   a. U.S. 101 at Central Windsor Underpass
   b. Protected Bike Lanes, Roadway, and Intersection Improvements
   c. Slip Ramp to U.S. 101 North and Traffic Improvements
3. New Crossing of U.S. 101 at Central Windsor
   a. Undercrossing Alternatives
   b. Overcrossing Alternatives



Map of Connecting Windsor project components

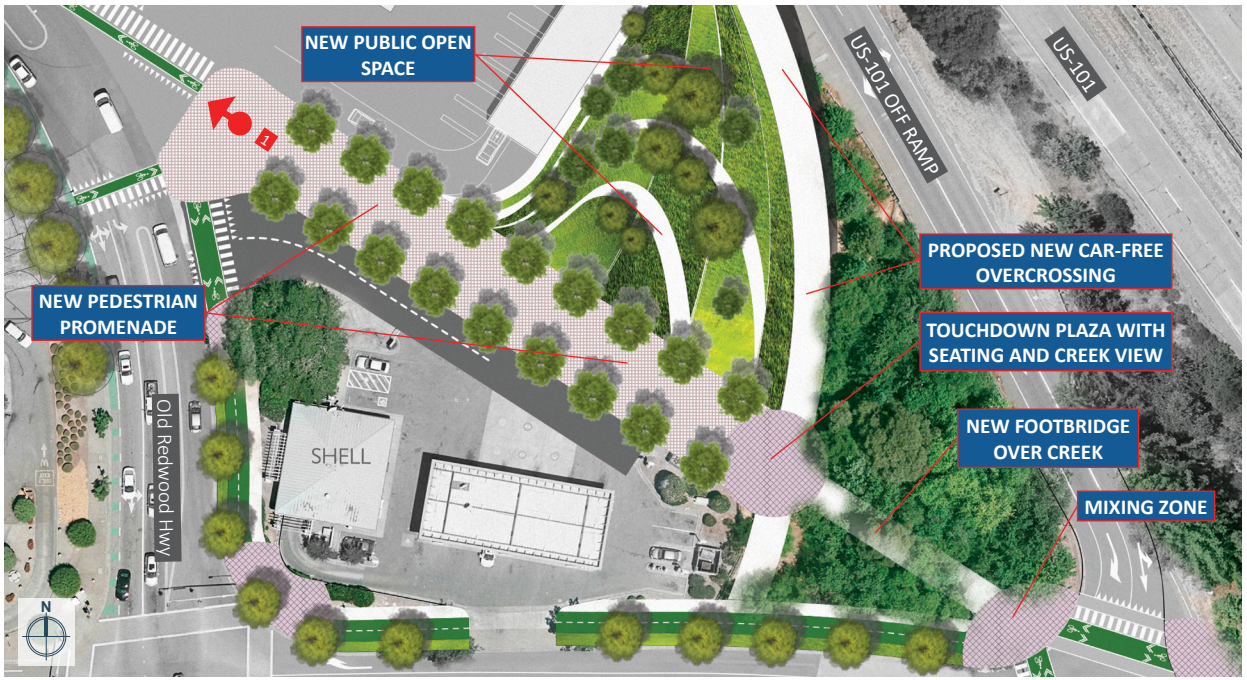
2.2. Placemaking & Pathmaking

Central Windsor Promenade and Open Space

Existing Conditions and Improvements Studied

Currently in Central Windsor, a dead-end section of roadway is located between the Chevron and Shell gas stations. This paved area is a remnant of the historical north-south alignment of Old Redwood Highway, visible in 1957 maps of Sonoma County, before the roadway was diverted to build the U.S. 101 interchange. Directly accessible only from Old Redwood Highway, the section of roadway is approximately 315 feet long and 45 feet wide, serves vehicles entering and exiting the gas stations, and terminates at Windsor Creek. The abandoned section of Old Redwood Highway presents an opportunity for improved safety and connectivity for cyclists and pedestrians by offering a car-free shortcut route that avoids a very busy intersection at Old Redwood Highway and Conde Lane. This unused area also provides a very promising opportunity for creating a new public open space consistent with the Town's goals of creating a more walkable Central Windsor.

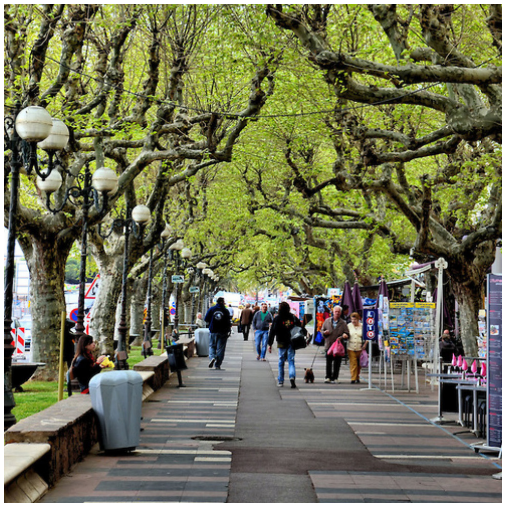
This Study therefore recommends developing a tree-lined promenade and open space in this remnant of Old Redwood Highway. The proposed promenade design consists of an approximately 40-foot wide car-free path (10-foot landscape buffer on both sides plus 20-foot multi-use pathway), with architectural pavement, new street trees for shade, and pedestrian-oriented lighting and other amenities. Even though most of this area is Town-owned, some land exchange with the adjacent gas stations, right-of-way acquisition, and redesign of station ingress and egress would be required (see 15% drawings in Chapter 4 for land swap diagram).



Proposed redevelopment of the Old Redwood Highway historical urban axis



View north along Old Redwood Highway from proposed promenade

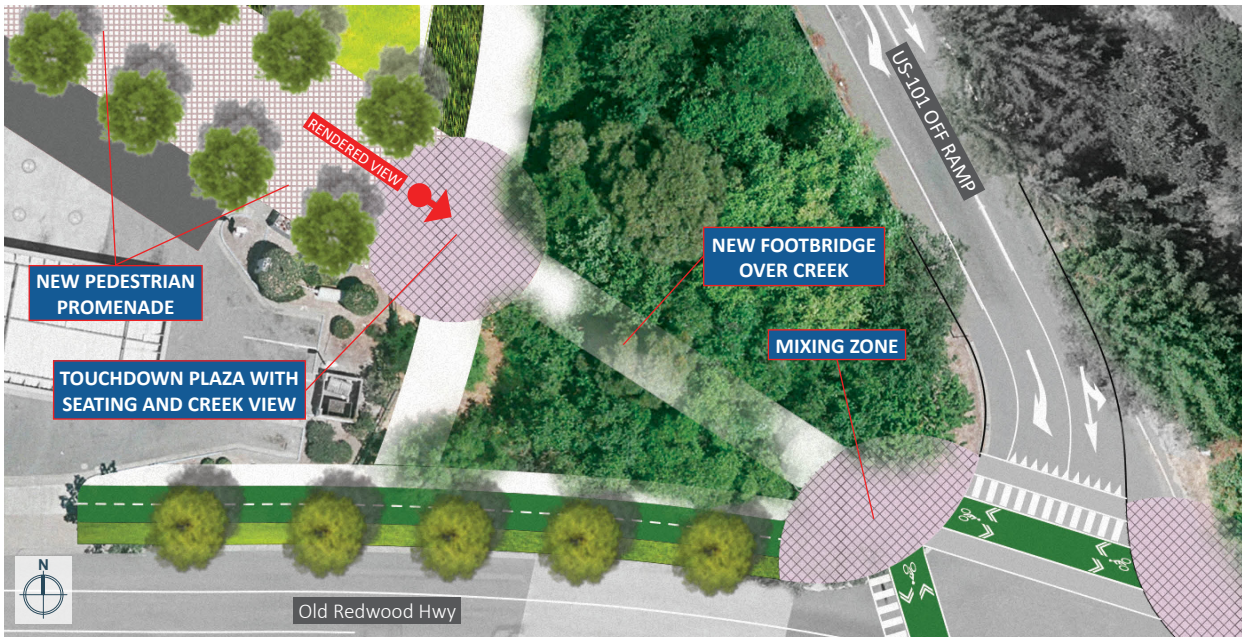


Tree-lined promenade of similar scale in France

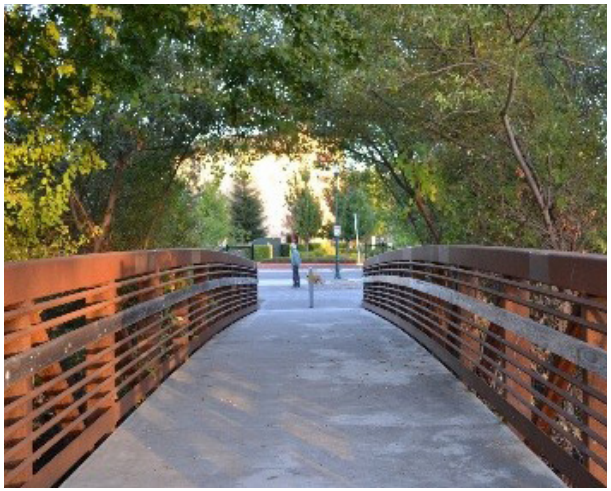
Westside Touchdown and Connection to Creek Habitat

Existing Conditions and Improvements Studied

The dead-end section of the historical Old Redwood Highway is paved but currently in poor condition. Vegetated areas are not landscaped, and fencing restricts access to the creek and freeway off-ramp. At the eastern end of the Central Windsor Promenade, we envision a mixing zone that also serves as the touchdown for a potential U.S. 101 overcrossing or undercrossing. To connect this mixing zone with the mixing zone at the northwest corner of the intersection of Old Redwood Highway and southbound U.S. 101, a new footbridge would be constructed over Windsor Creek. A precedent for the new footbridge and creek-crossing experience is located on the opposite side of U.S. 101, where a footbridge currently connects Los Amigos Road to the Windsor Creek bicycle and pedestrian path.



Rendered plan of proposed westside touchdown and new connections to Old Redwood Highway



Existing footbridge of similar scale over Windsor Creek at Los Amigos Rd.

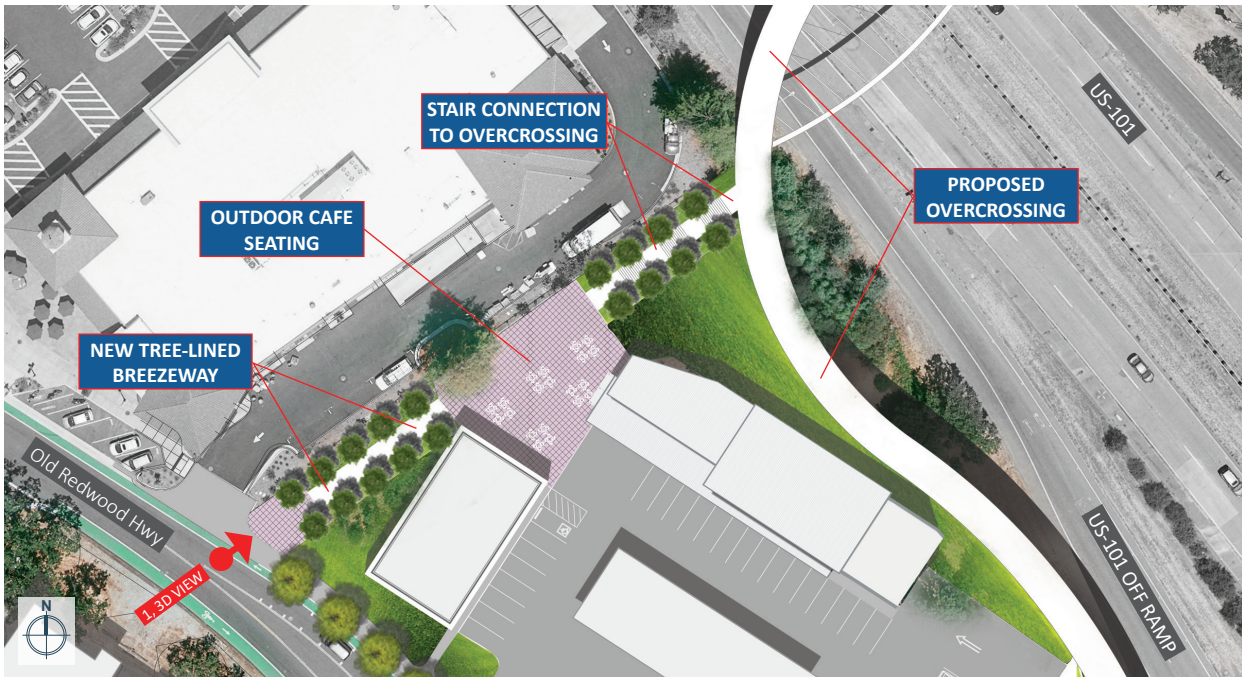


Rendered view of proposed touchdown plaza and new footbridge over Windsor Creek at Old Redwood Highway

Westside Walkway and Stairway Connection

Existing Conditions and Improvements Studied

On the west side of U.S. 101, adjacent to the rear of Oliver's Market, lies an unoccupied area of land owned by the Chevron gas station. The team proposes a tree-lined walkway leading to the stairway connecting to the proposed U.S. 101 overcrossing. Since the strip of land required for the walkway is privately owned, a land swap would be required (see Chapter 4 for land swap diagram). This path would provide pedestrians with a more direct connection between Windsor's Town Green area and the overcrossing. Small plazas along the walkway adjacent to Chevron's commercial buildings could provide community members with spots to sit and rest. A botanical survey conducted in 2015 delineated a small seasonal wetland of approximately 0.1 acre in the area (see Appendix C.2.), which future development should take into consideration.



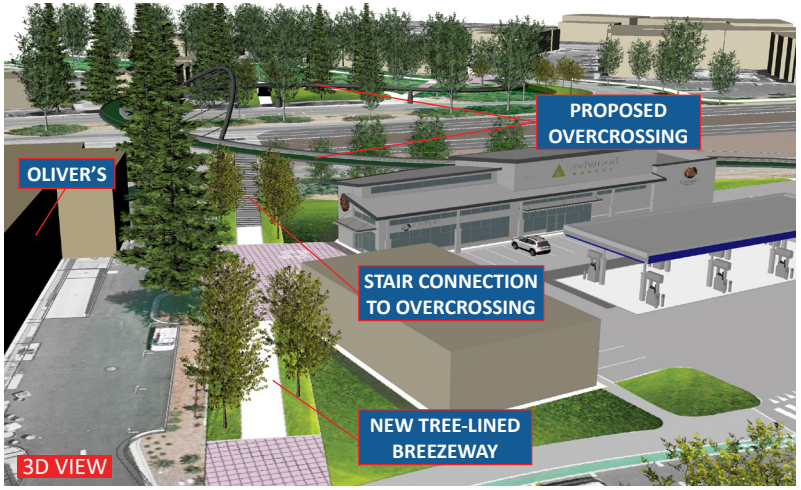
Rendered plan of westside walkway and stairway connection



Walkway of similar scale in Berkeley, CA



Existing unused space adjacent to the Chevron Station

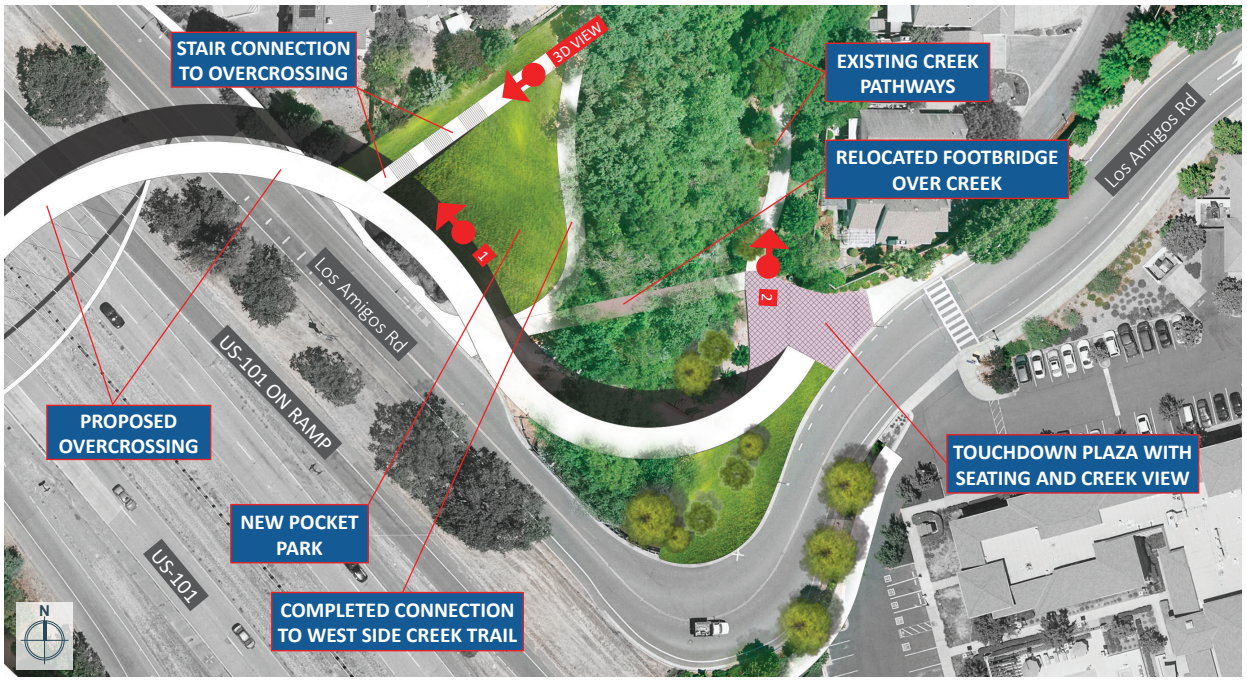


3D view of proposed walkway and new stairway connection

East Side Touchdown and Gateway to Creek Experience

Existing Conditions and Improvements Studied

On the east side of U.S. 101, a vacant Town-owned area of land adjacent to Windsor Creek could be developed into a public open space adjacent to a pedestrian stairway connecting to the proposed U.S. 101 overcrossing. This open space would be connected to the overcrossing's east side touchdown plaza and mixing zone via the footbridge over the creek. There are many opportunities in this area for educational signage about the history, biology, and flooding cycles of the creek.



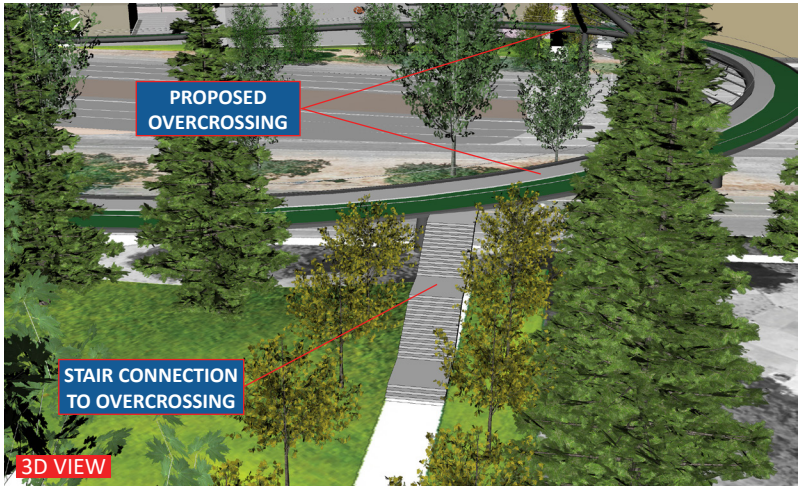
Rendered plan of eastside touchdown and new connection to Windsor Creek



Existing unused space adjacent to Los Amigos Rd. and Windsor Creek Trail



Existing Windsor Creek Trail



3D view of proposed eastside stairway connection

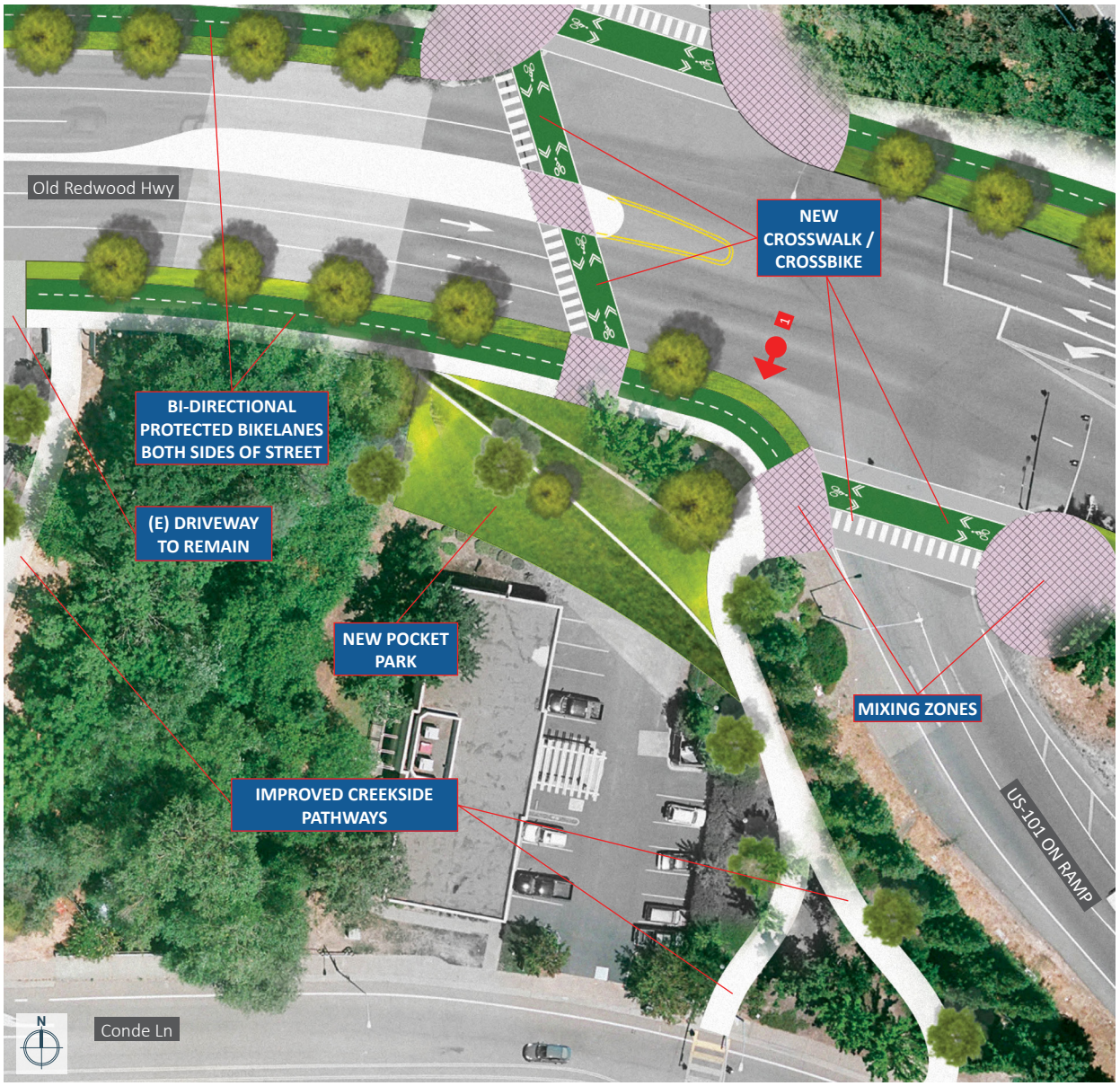
Mixing Zone and Creek Overlook

Existing Conditions and Improvements Studied

Old Redwood Highway in the vicinity of Windsor Creek is dominated by roadway pavement and currently does not provide pedestrians with opportunities to pause and view the creek. At the corner of Old Redwood Highway and the U.S. 101 Southbound on-ramp, there exists access to a pedestrian path connecting Old Redwood Highway and Conde Lane. However, the entrance to the path is unclear and unpaved. The team proposes developing a mixing zone and a mini open space at this corner for community members to find shade, rest, and view Windsor Creek.



Existing entrance on Old Redwood Highway to path to Conde Ln.



Rendered plan of mixing zone

New and Improved Shared Use Pathways

Existing Conditions

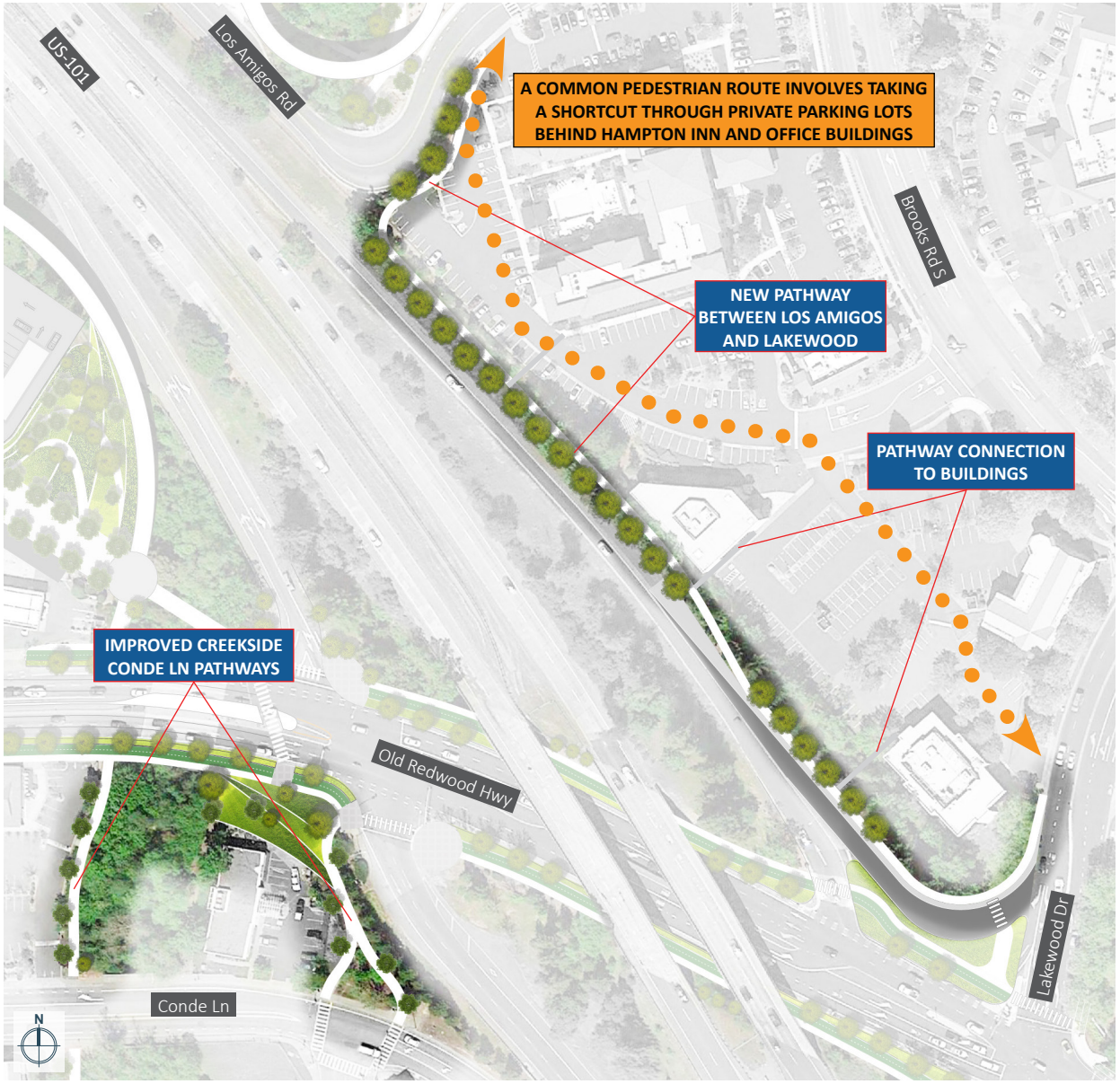
Currently, the Windsor Creek path on the east side of U.S. 101 ends abruptly at Los Amigos Road. Cyclists and pedestrians headed south towards Old Redwood Highway, or to the west side of U.S. 101, must travel approximately 0.4 mi by heading northeast along Los Amigos, south on Brooks Road, and south on Lakewood Drive to connect to Old Redwood Highway. In order to avoid the circuitous route, people often take a shortcut by walking through private properties and parking lots to travel between Los Amigos Road and Lakewood Drive.

On the west side of U.S. 101, two pedestrian paths connect Old Redwood Highway to Conde Lane. One path is 10-feet wide and parallels Windsor Creek, while the other path is 10-feet wide and parallels the U.S. 101 southbound on-ramp.

Improvements Studied

To improve the bicycle and pedestrian network on the east side of Windsor, the Study examines developing a new 12-foot wide multi-use pathway parallel to the U.S. 101 northbound on-ramp to connect Los Amigos Road directly to Old Redwood Highway.

Between Old Redwood Highway and Conde Lane, the Study examines constructing a 10-foot pathway and providing new pedestrian-oriented lighting and benches consistent with the urban architectural language established by the Town Green.



New and improved shared use pathways connecting Old Redwood Highway to Los Amigos Rd. and to Conde Ln.

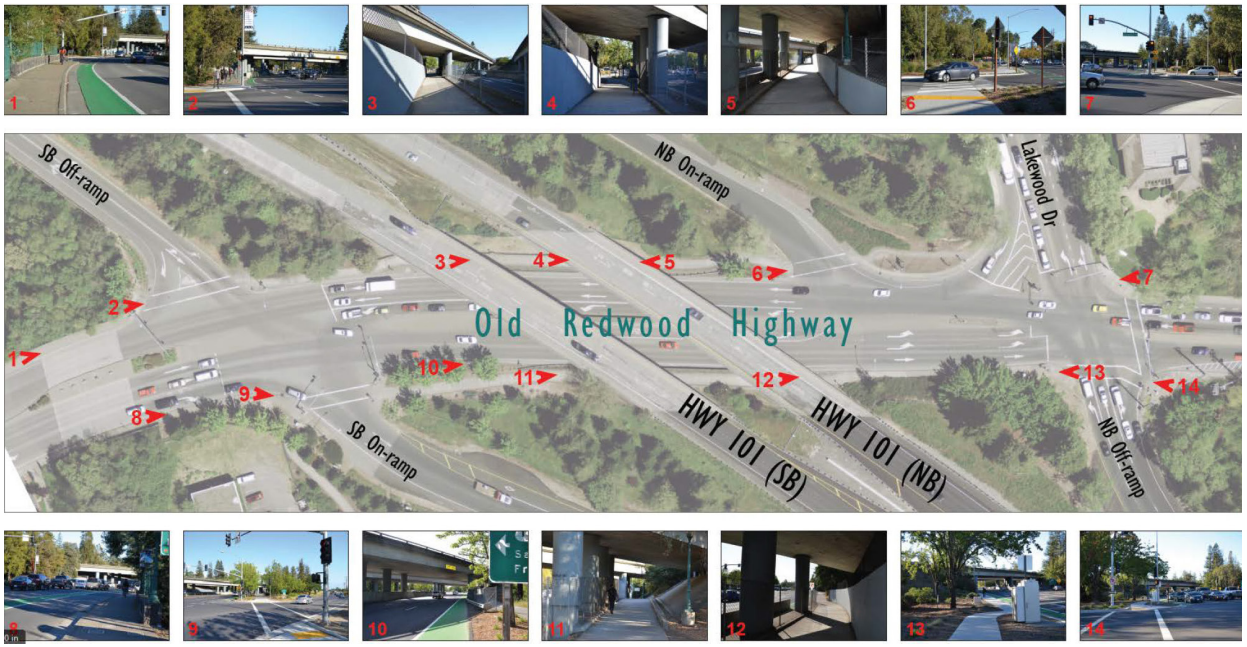
2.3. Old Redwood Highway Corridor Improvements

U.S. 101 at Central Windsor Underpass

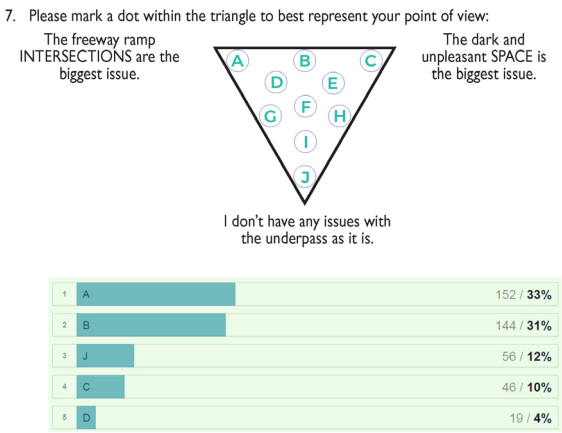
Existing Conditions

Currently, bicycle facilities through the existing U.S. 101 underpass on Old Redwood Highway consist of one-way Class II bike lanes, which vary in width from 4.5 feet to 5.5 feet, and are paved, in both directions, contiguous to a 4.5-foot high concrete retaining wall. Pedestrian facilities within the underpass consist of sidewalks approximately 9 feet wide on fill and separated from the roadway by grade, large concrete columns, and chain link fencing. On the north side, the sidewalk is paved contiguous to a retaining wall, which varies in height from approximately 3 feet to 6 feet, and on the south side, a curb separates the sidewalk from the adjacent concrete embankment. On each side of the underpass, the roadway accommodates two approximately 11-foot through lanes for vehicular traffic and one approximately 11-foot left-turn lane for vehicles entering U.S. 101. For vehicles entering the U.S. 101 northbound on-ramp, the left-turn movement is unsignalized, and drivers must yield to and cross two lanes of through traffic, a bike lane, and a crosswalk.

In public engagement meetings, and on public input surveys, the Windsor community has overwhelmingly characterized the U.S. 101 underpass as an unsafe and uncomfortable space for walking and biking. Community members consistently identify cyclist and pedestrian conflicts with vehicles at the U.S. 101 northbound on-ramp, as well as the vehicular traffic volume, as the primary reasons they neither walk nor



Existing conditions and views on Old Redwood Highway adjacent to the U.S. 101 at Central Windsor underpass





Community feedback on the existing U.S. 101 underpass on Old Redwood Highway from the Second Public Input Survey

bike through the underpass. Additionally, members of the community have described the underpass space as "scary" and "unfriendly" and suggested that the lighting within the dark space needs to be improved.

Aesthetically, the current streetscape of the Old Redwood Highway corridor is auto-oriented, with large expanses of concrete, wide intersections, and a lack of human-scale design elements and pedestrian amenities. The existing underpass of U.S. 101 at Central Windsor has been called "very industrial" and "uninviting" by Windsor community members in public meetings.



Existing northside conditions of the U.S. 101 at Central Windsor underpass



Existing southside conditions of the U.S. 101 at Central Windsor underpass

Aesthetic Improvements Studied

Aesthetic improvements to the U.S. 101 at Central Windsor underpass on Old Redwood Highway studied by the project team include new landscaping for the embankments, color for the structure, lighting under the freeway, and new signage in the vicinity of the underpass.



Existing U.S. 101 at Central Windsor underpass on Old Redwood Highway



Potential aesthetic improvements to the U.S. 101 at Central Windsor underpass

A variety of other architectural treatments and artistic additions can also be incorporated into the improvement of the underpass.



Precedents for underpass aesthetic improvements



Existing conditions within the Central Windsor underpass



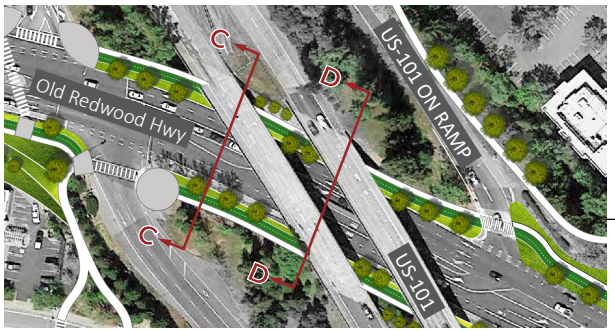
Rendered view of proposed conditions within the U.S. 101 at Central Windsor Underpass

Geometric Improvements Studied

In order to determine the amount of space available for improvements within the U.S. 101 at Central Windsor underpass for geometric improvements, the team examined the engineering as-builts of the underpass structure. The drawings revealed that there is ample room, currently taken up by embankments, to use new tie-back walls to widen the pathways by approximately 10 feet. Given this extra space, it is feasible to provide protected bicycle and pedestrian infrastructure in the form of two-way protected bike lanes, 4 feet wide in either direction, adjacent to an approximately 8-foot pedestrian sidewalk (width varies). With the removal of the chain link fence, a 4.5-foot planted or angled buffer can also be implemented within the underpass space to separate the elevated pathway from the roadway.

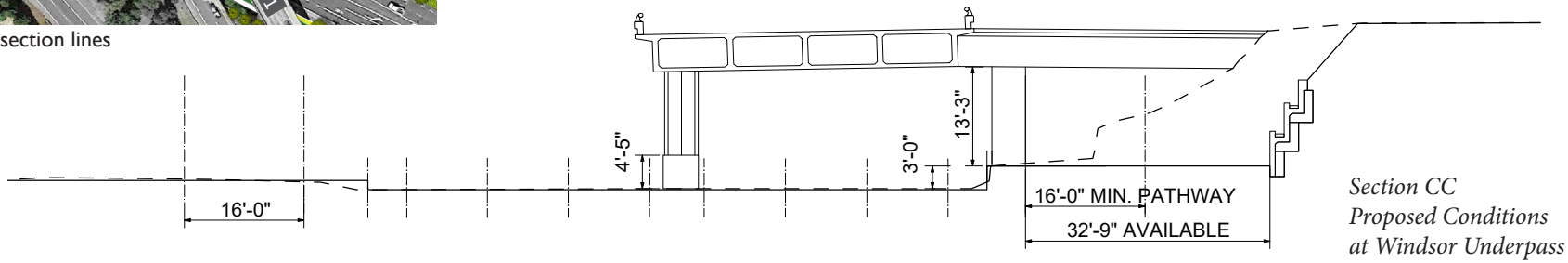


Rendered view of proposed conditions traveling towards the U.S. 101 at Central Windsor Underpass

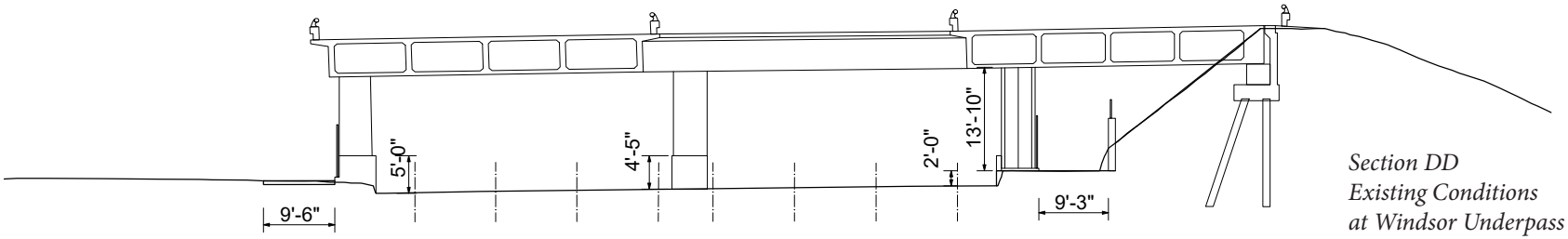


Plan showing section lines

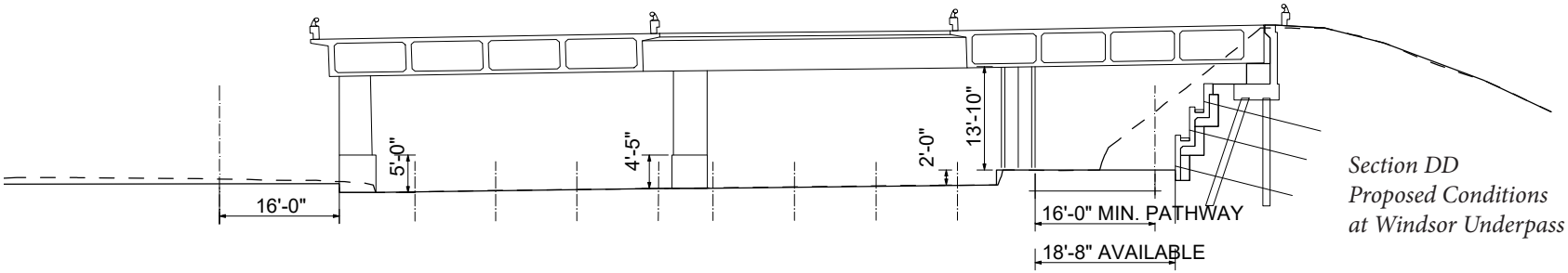
Section CC
Existing Conditions
at Windsor Underpass



Section CC
Proposed Conditions
at Windsor Underpass



Section DD
Existing Conditions
at Windsor Underpass



Section DD
Proposed Conditions
at Windsor Underpass

A recent precedent for the improvements studied for the U.S. 101 at Central Windsor underpass includes the East Campbell Avenue Portals Project in Campbell, CA. Completed in 2016, the project modified a freeway bridge structure to create wider bike lanes, as well as large, dedicated sidewalks to separate vehicle and pedestrian traffic along a busy roadway. New pedestrian lighting was added for safety and aesthetics, while beautification elements included the construction of two gateway monuments, tiered retaining walls with colored concrete and decorative finishes, new landscaping, and public art.



East Campbell Avenue at Highway 17 underpass before the Campbell Avenue Portals Project in Campbell, CA


After completion of the Campbell Avenue Portals Project

Protected Bike Lanes, Intersection and Roadway Improvements

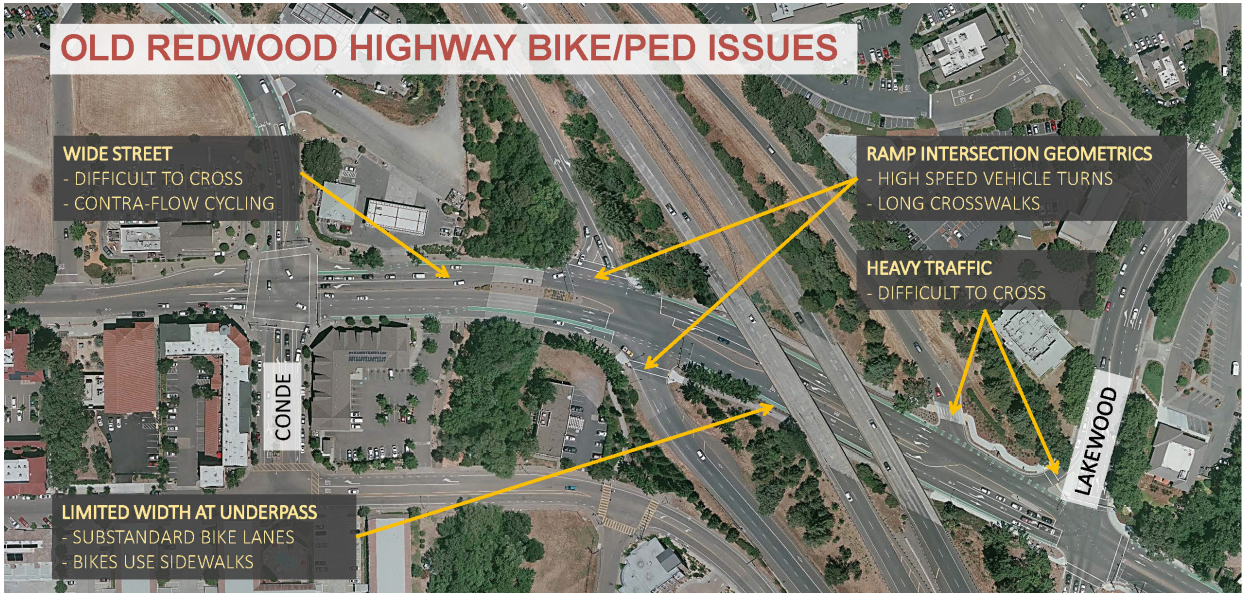
Existing Conditions

The Old Redwood Highway corridor between Lakewood Drive and Richardson Street has multiple places with potential for conflicts between vehicles and pedestrians or cyclists. This auto-oriented corridor currently consists of wide expanses of asphalt and intersections with long crosswalks that vary from 40 feet to 110 feet and large corner radii that encourage high speed turning by vehicles. No crosswalks for north-south travel across Old Redwood Highway exist for approximately 1,000 feet between the intersections with Conde Lane and Lakewood Drive.

In 2014, as part of the Old Redwood Highway Pedestrian and Bicycle Enhancement Project, the Town added green-colored Class II bike lanes to the 1500-foot long corridor in both directions, ADA-compliant curb ramps, updated pedestrian signals, and a raised crosswalk at the northbound U.S. 101 on-ramp. Despite these improvements, according to public feedback provided for the Connecting Windsor Study, many Windsor community members still choose to drive through this corridor even when taking very short trips, and many parents do not allow their children to travel through the U.S. 101 at Central Windsor underpass by foot or bike to get to school.

Improvements Studied

This Study examined extending the widened cyclist and pedestrian facilities envisioned for the U.S. 101 underpass along the Old Redwood Highway corridor.



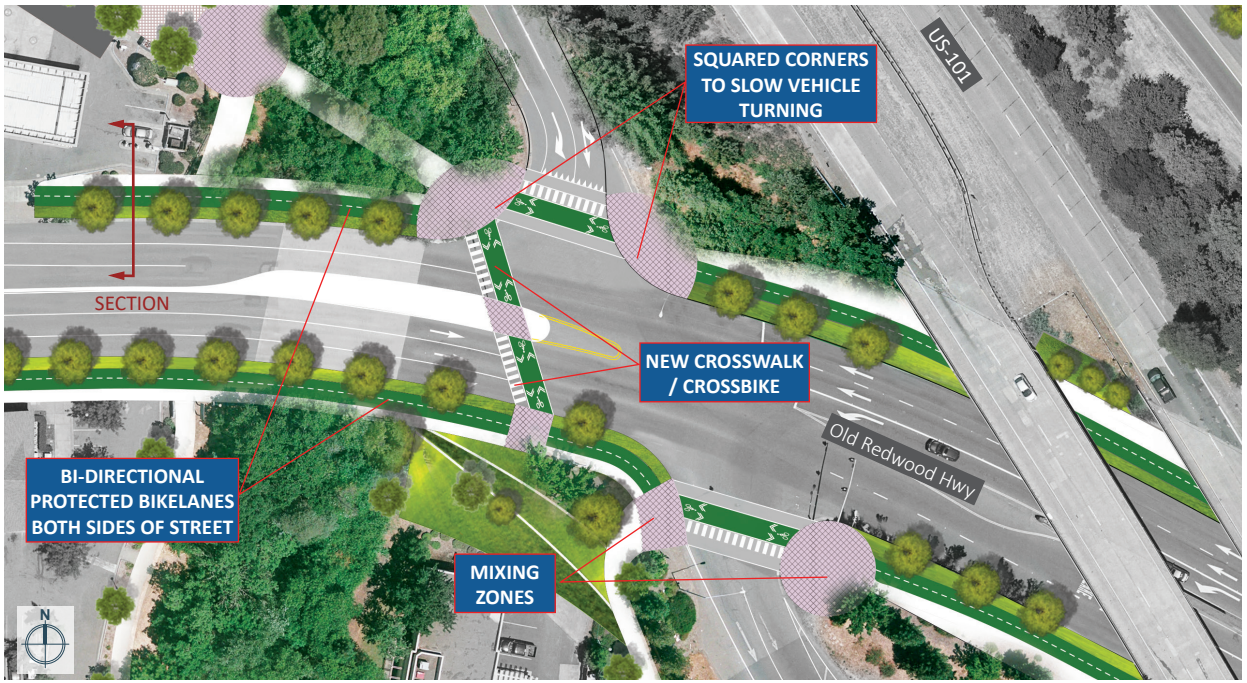
Existing bicycle and pedestrian challenges along the Old Redwood Highway corridor



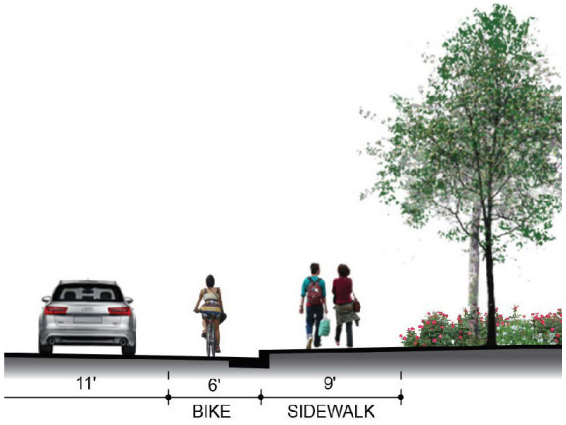
Long crosswalks and wide intersections characterize the auto-oriented streetscape of Old Redwood Highway

This includes constructing protected 8-foot wide two-way bike lanes, adjacent to an 8-foot pedestrian path, with a 5-foot planted buffer separating the cyclist and pedestrian facilities from vehicles, as well as new landscaping and pedestrian-oriented lighting. The Study also examined removing the 4.5-foot Class II bike lanes on Old Redwood Highway, widening the vehicular lanes by one foot each. New "mixing zones" at the intersections would allow cyclists to transition between the Class II bike lanes and protected bikeway.

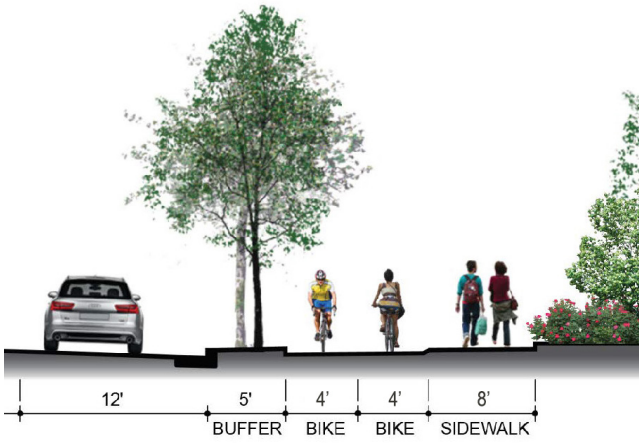
A new crosswalk was also studied to connect across Old Redwood Highway. Also recommended is "squaring off" all on and off ramp intersections to reduce vehicle turning speeds and reduce the length of crosswalks. Adjacent to all crosswalks along Old Redwood Highway, "crossbikes" may be added for dedicated bicycle travel and continuity with the envisioned two-way protected bike lanes. A traffic study of Old Redwood Highway with the proposed improvements did not find significant impacts to roadway operations (see Appendix B.1.) Signalizing the left turn movement from Old Redwood Highway to the U.S. 101 northbound on-ramp was studied but found to not be warranted (see Appendix B.2.) Additionally, a pedestrian crossing warning sign with pedestrian-activated flashing LEDs was also studied for the crossing at the U.S. 101 on-ramp. The analysis found that although no warning sign with LEDs is warranted at this time, it is reasonable to anticipate that volumes will reach a point where an active device will be warranted, given the proposed pedestrian infrastructure improvements as part of this Connecting Windsor study (see Appendix B.3.)



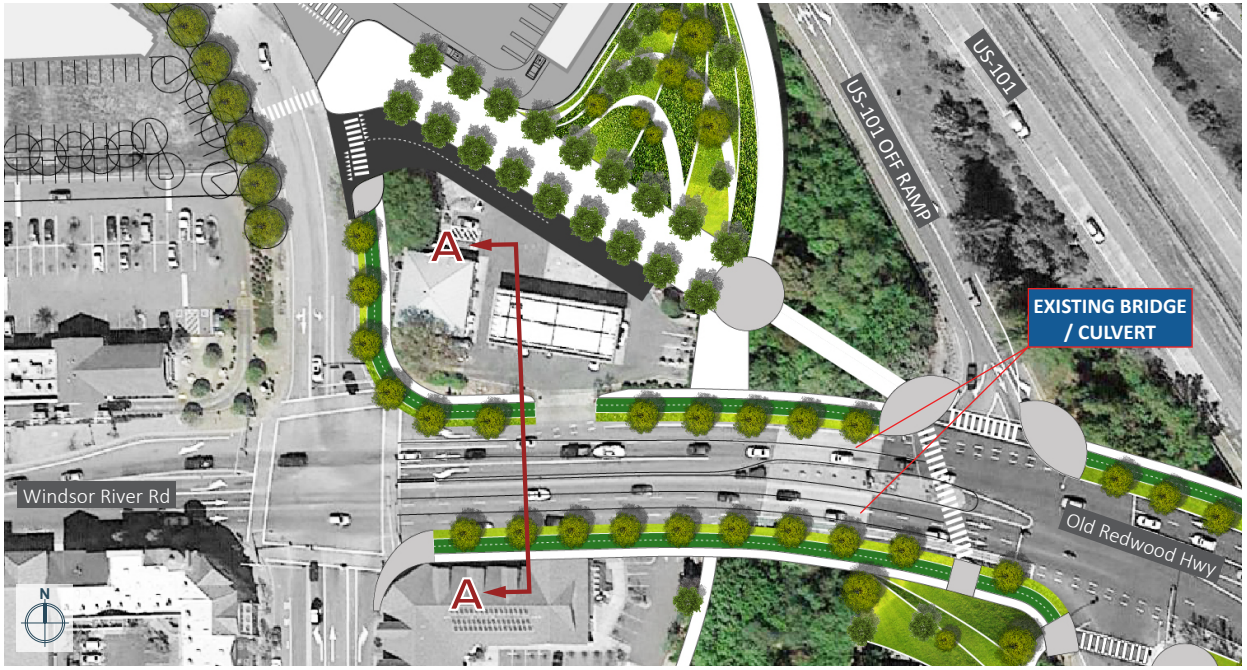
Rendered plan of proposed squared intersections, protected like lanes, crosswalks, and crossbikes on Old Redwood Highway. Shown in red is the location for the section below.



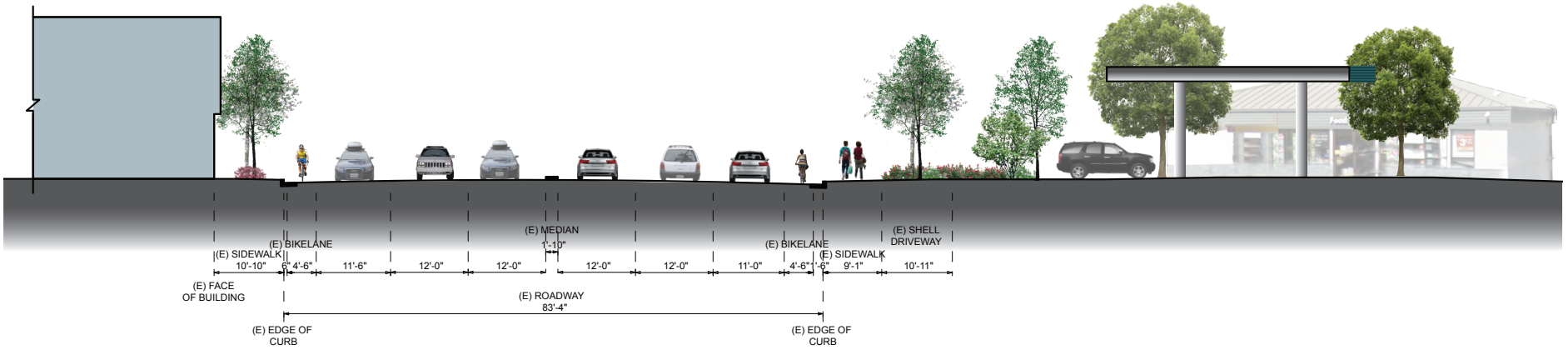
Existing conditions at Old Redwood Highway



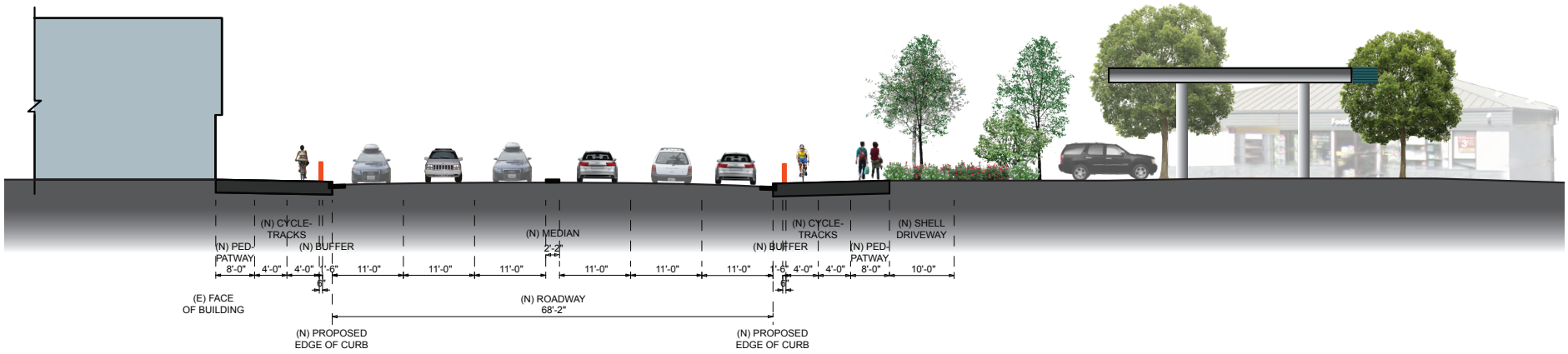
Proposed conditions at Old Redwood Highway



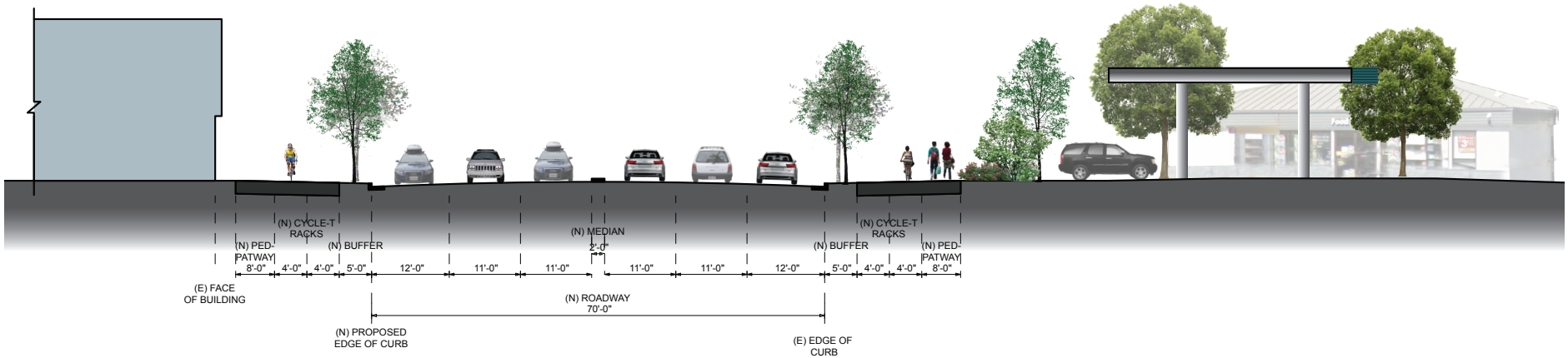
Plan with section location



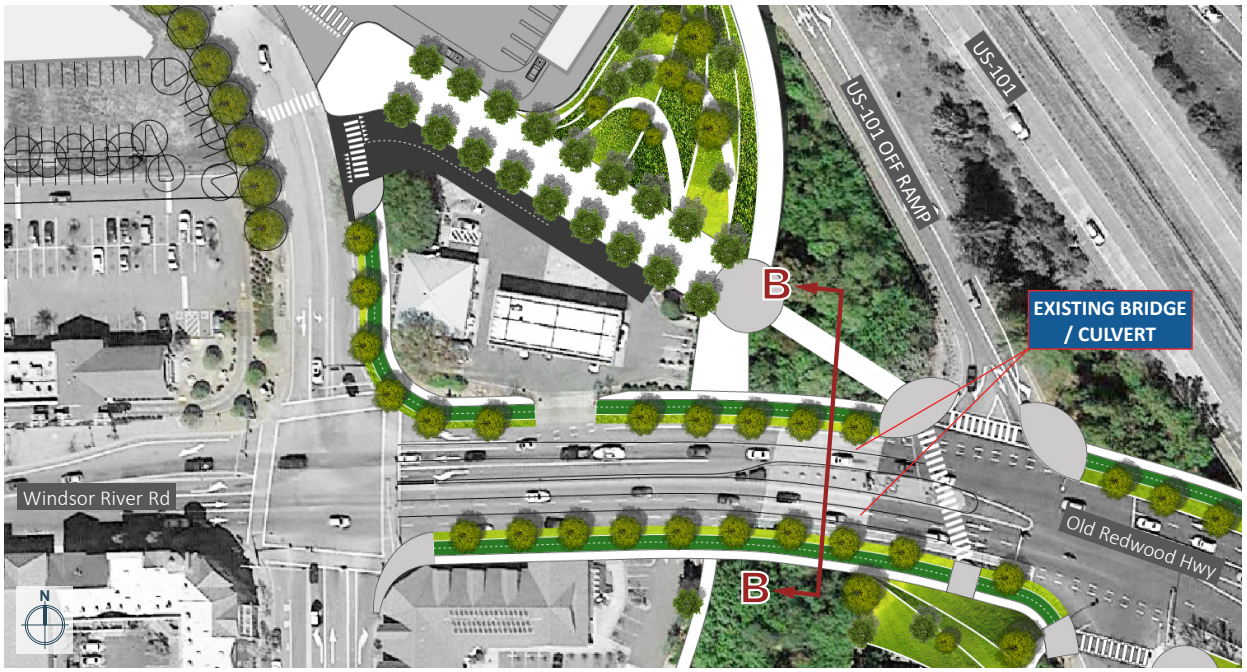
Section AA: Existing conditions at Old Redwood Highway



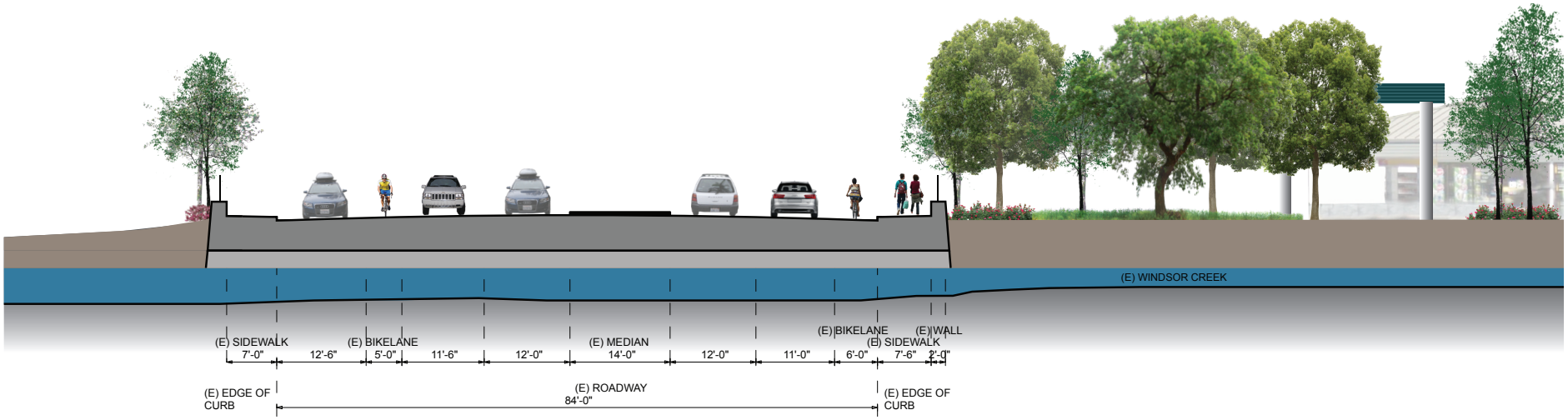
Section AA: Proposed Alternative 1 at Old Redwood Highway



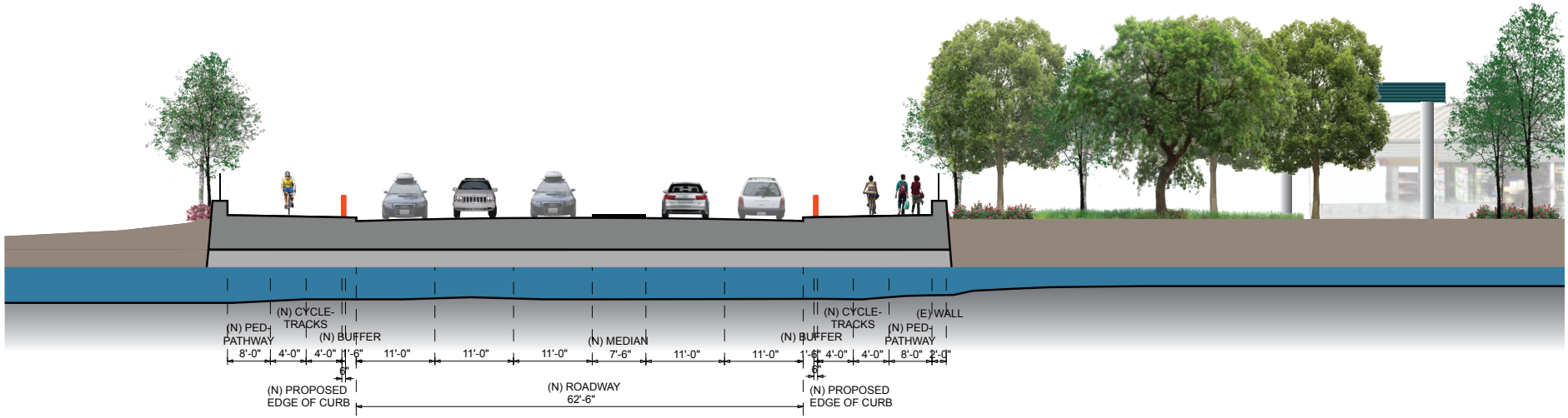
Section AA: Proposed Alternative 2 at Old Redwood Highway



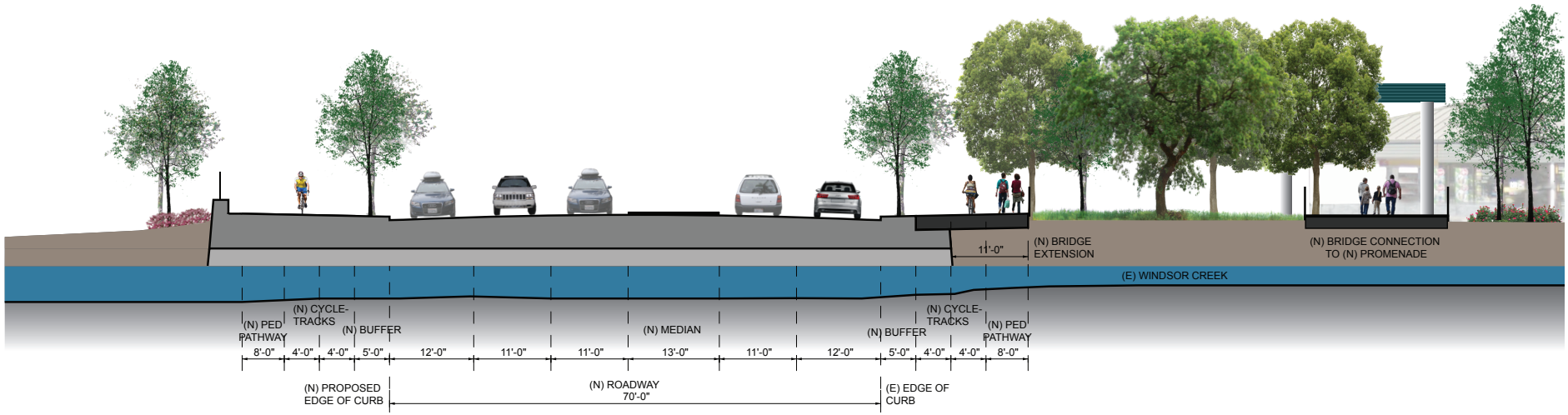
Plan with section location



Section BB: Existing conditions at Old Redwood Highway



Section BB: Proposed Alternative 1 at Old Redwood Highway



Section BB: Proposed Alternative 2 at Old Redwood Highway

Slip Ramp to U.S. 101 North and Traffic Improvements

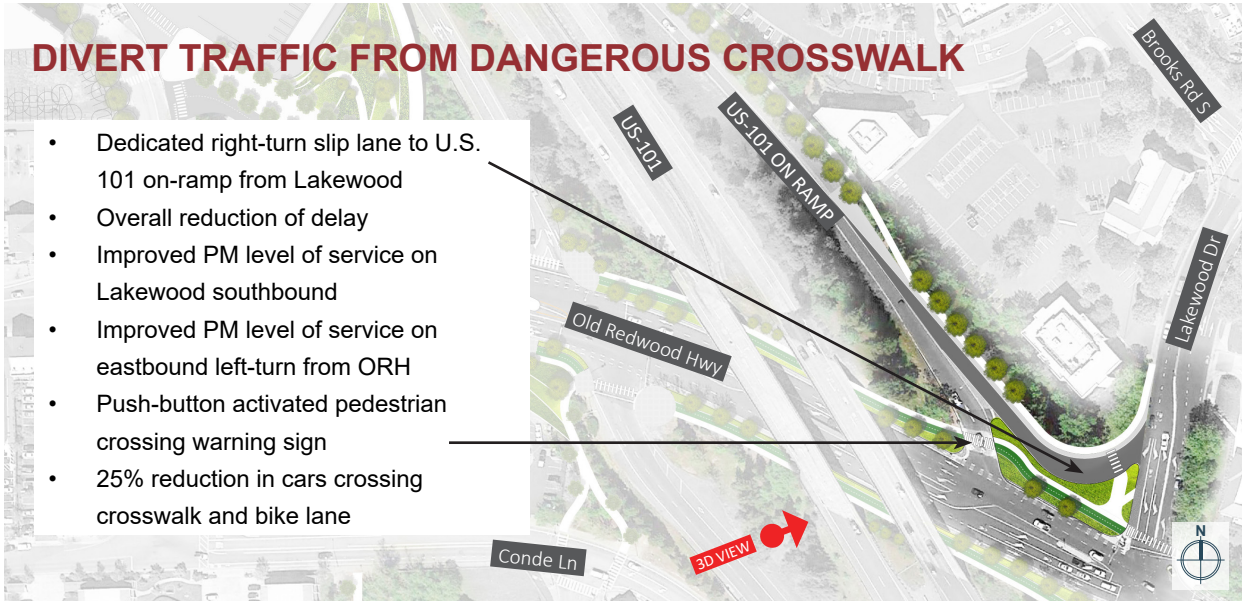
Existing Conditions

The intersection of Lakewood Drive and Old Redwood Highway presents several points for potential vehicle conflicts with cyclists and pedestrians due to its multiple travel lanes and vehicle turning movements. On the north side of the intersection in particular, cyclists and pedestrians going from east to west must travel approximately 330 feet, across signalized Lakewood Drive, across the signalized right-turn lane from Lakewood Drive to Old Redwood Highway, and across the unsignalized U.S. 101 northbound on-ramp, before they are clear of vehicular traffic.

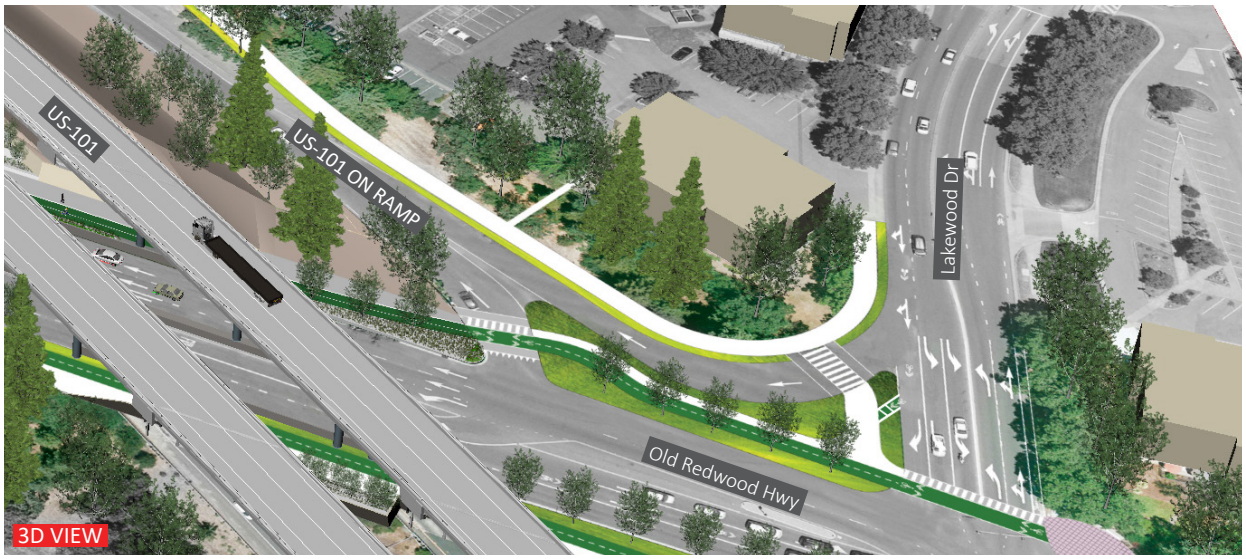
The U.S. 101 northbound on-ramp is one of two access points to northbound U.S. 101 in Windsor; the other on-ramp is located at the Shiloh Road interchange in south Windsor. Community members in northeast Windsor, who do not want to travel north on Los Amigos Road and Old Redwood Highway to Healdsburg, must therefore use the right-turn slip-lane from Lakewood Drive to Old Redwood Highway to access the U.S. 101 northbound on-ramp. This route requires drivers to cross the bike lane twice, as well as cross two crosswalks. Based on a traffic study of the Old Redwood Highway corridor conducted for this Study, approximately 105 vehicles use the right turn lane on Lakewood Drive to access the U.S. 101 northbound on-ramp at peak times.

Improvements Studied

The Study examined constructing a dedicated right-turn slip lane from Lakewood Drive to the U.S. 101



Summary improvements at the intersection of Lakewood Dr., Old Redwood Highway, and the U.S. 101 northbound on-ramp



3D view of proposed improvements

northbound on-ramp. The traffic island would be widened to include a protected bikeway, pedestrian pathway, and additional landscaping, and the radius of the corner at Lakewood Drive and Old Redwood Highway would be tightened. The provision of a small bicycle ramp would allow cyclists traveling in the southbound Class II bike lane on Lakewood Drive to transition smoothly to the east-west protected bike lanes on Old Redwood Highway.

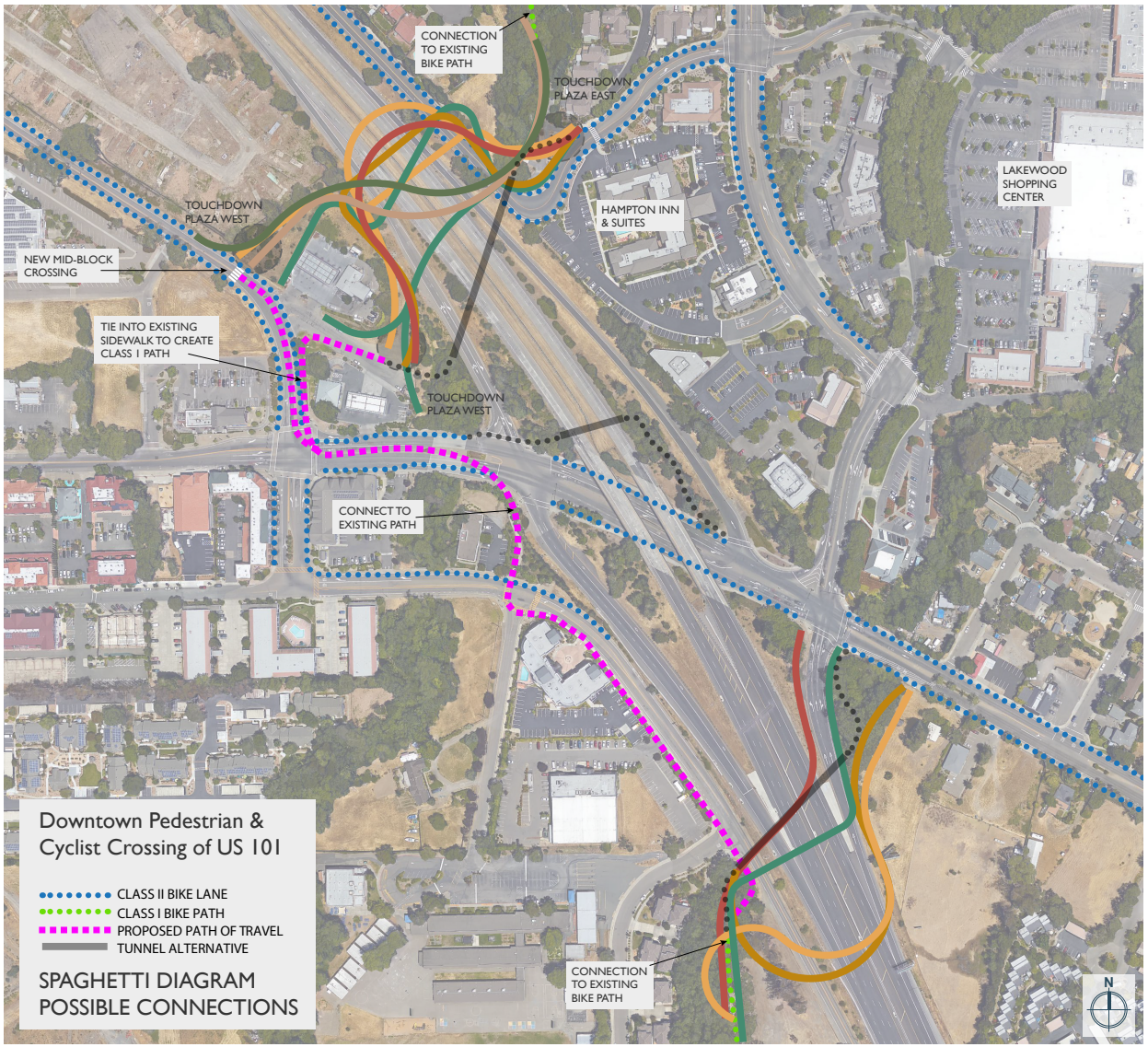
The operational analysis indicates that, as would be expected, provision of a slip lane from southbound Lakewood Drive to the US 101 North on-ramp reduces delay for that movement as well as for the intersection as a whole (see Appendix B.1.) Operation for the eastbound left-turn from Old Redwood Highway to the U.S. 101 North On-Ramp would be minimally affected by the addition of the slip lane.

2.4. New Crossing of U.S. 101

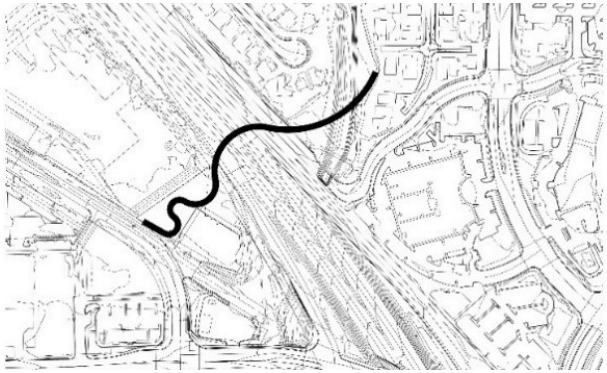
Overcrossing Alternatives

To identify new ways for cyclists and pedestrians to cross U.S. 101, the team developed 13 preliminary alignments for a new car-free overcrossing for the Connecting Windsor Study. These overcrossing alignments included nine on the north side of Old Redwood Highway and four on the south side.

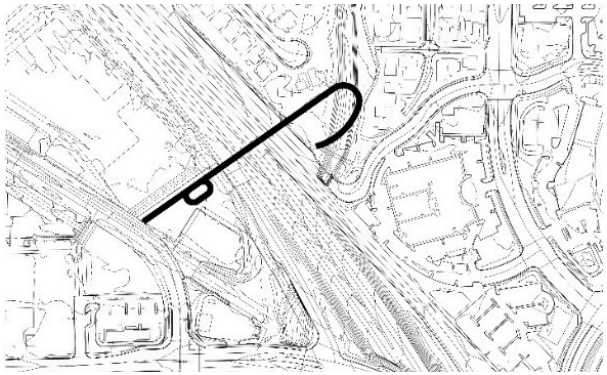
Based on community feedback provided during the initial public engagement meeting, which identified the most popular origins and destinations on the east and west sides of Windsor as the Lakewood Drive commercial areas and the Old Downtown, the team focused on further exploring nine alignments on the north side of Old Redwood Highway. It is important to note that alternatives O-3 to O-9 include the potential for a landscaped walkway and stairway that provides a shortcut between the Town Green and the overcrossing, and the grades of all approaches are less than 5%.



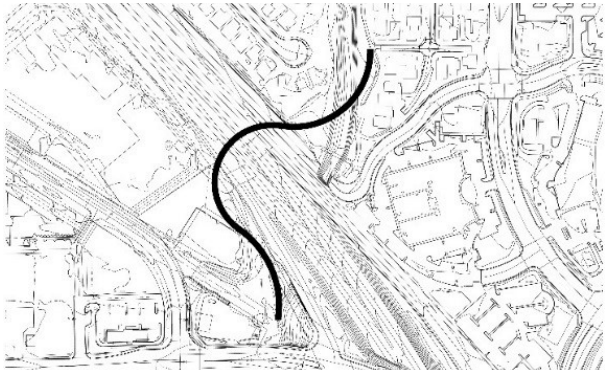
The team studied a variety of new U.S. 101 crossing alternatives



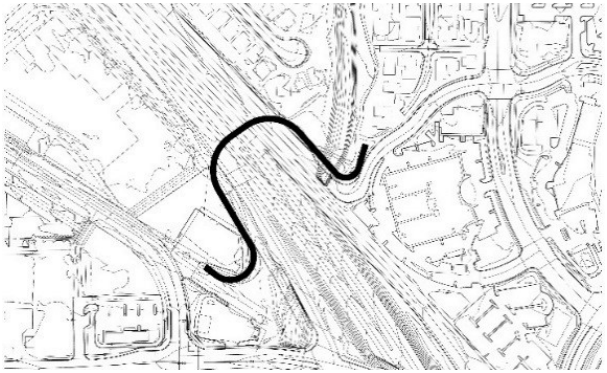
Overcrossing Alternative 1 (O-1)
Span over U.S. 101: Curved
Eastside touchdown: Windsor Creek path adjacent to the Brooks Creek neighborhood
Eastern approach: Curved over Windsor Creek
Western approach: Three tight turns between the Chevron gas station and Oliver's market
Westside touchdown: Old Redwood Highway
Approximate length from touchdown to touchdown: 1100 feet



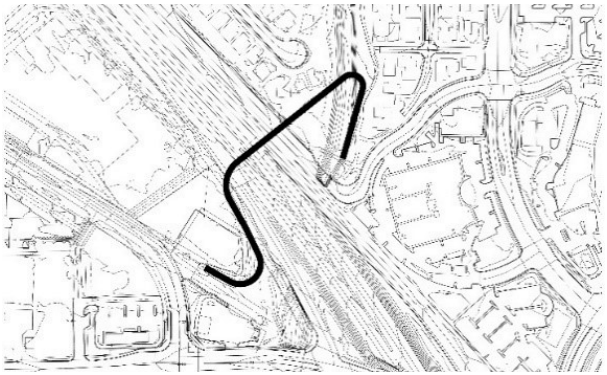
Overcrossing Alternative 2 (O-2)
Span over U.S. 101: Straight
Eastside touchdown: West end of the footbridge over Windsor Creek
Eastern approach: Curved with tight radius over Windsor Creek
Western approach: One 360-degree loop between the Chevron station and Oliver's market
Westside touchdown: Old Redwood Highway
Approximate length from touchdown to touchdown: 1270 feet



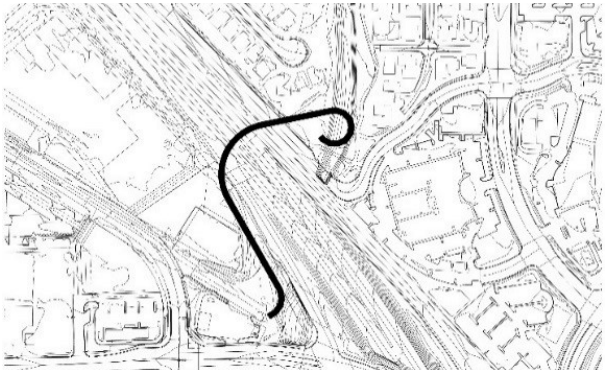
Overcrossing Alternative 3 (O-3)
Span over U.S. 101: Curved
Eastside touchdown: Windsor Creek path at Mills Brothers Court in the Brooks Creek neighborhood
Eastern approach: Curved over Windsor Creek
Western approach: Curved between the southbound U.S. 101 off-ramp and the Chevron station
Westside touchdown: East end of the dead-end section of roadway located between the Chevron and Shell gas stations
Approximate length from touchdown to touchdown: 1240 feet



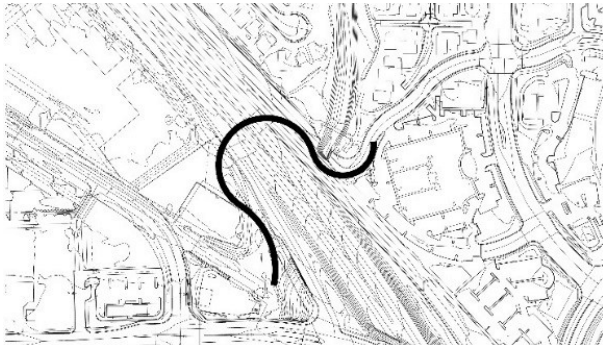
Overcrossing Alternative 4 (O-4)
Span over U.S. 101: Curved
Eastside touchdown: North side of Los Amigos Road at existing crosswalk
Eastern approach: Curved over Windsor Creek; requires relocation of existing footbridge
Western approach: Curved with tight radius around the Chevron gas station
Westside touchdown: Entrance to the Chevron station at the dead-end section of roadway located between the Chevron and Shell gas stations
Approximate length from touchdown to touchdown: 1220 feet



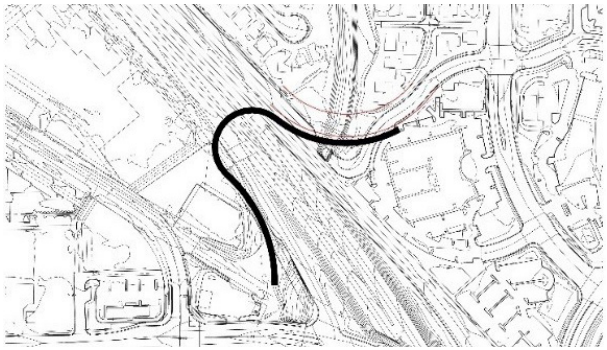
Overcrossing Alternative 5 (O-5)
Span over U.S. 101: Straight
Eastside touchdown: Windsor Creek path adjacent to the Brooks Creek neighborhood
Eastern approach: Curved over Windsor Creek
Western approach: Curved with tight radius around the Chevron gas station
Westside touchdown: Entrance to the Chevron station at the dead-end section of roadway located between the Chevron and Shell gas stations
Approximate length from touchdown to touchdown: 1330 feet



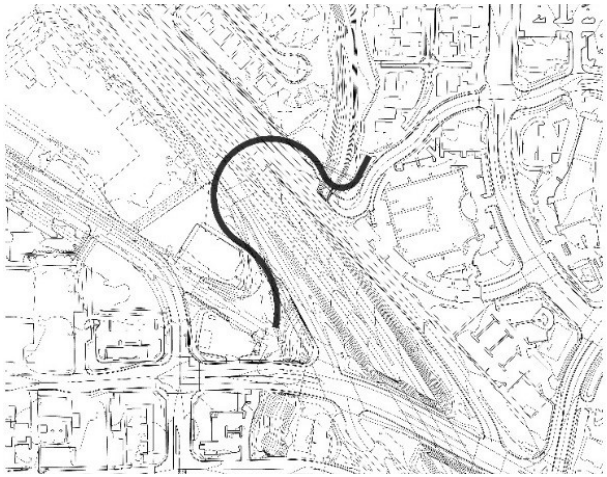
Overcrossing Alternative 6 (O-6)
Span over U.S. 101: Curved
Eastside touchdown: West end of the footbridge over Windsor Creek
Eastern approach: Curved with tight radius over Windsor Creek
Western approach: Straight between the southbound U.S. 101 off-ramp and the Chevron station
Westside touchdown: East end of the dead-end section of roadway located between the Chevron and Shell gas stations
Approximate length from touchdown to touchdown: 1190 feet



Overcrossing Alternative 7 (O-7)
Span over U.S. 101: Curved
Eastside touchdown: South side of Los Amigos Road near existing crosswalk
Eastern approach: Curved over Los Amigos Road
Western approach: Curved between the southbound U.S. 101 off-ramp and the Chevron station
Westside touchdown: East end of the dead-end section of roadway located between the Chevron and Shell gas stations
Approximate length from touchdown to touchdown: 1170 feet



Overcrossing Alternative 8 (O-8)
Span over U.S. 101: Curved
Eastside touchdown: South side of Los Amigos Road near existing crosswalk
Eastern approach: Curved over Windsor Creek; requires realignment of Los Amigos Road and relocation of existing footbridge
Western approach: Curved between the southbound U.S. 101 off-ramp and the Chevron station
Westside touchdown: East end of the dead-end section of roadway located between the Chevron and Shell gas stations
Approximate length from touchdown to touchdown: 1170 feet



Overcrossing Alternative 9 (O-9)
Span over U.S. 101: Curved
Eastside touchdown: North side of Los Amigos Road at existing crosswalk
Eastern approach: Curved over Windsor Creek; requires relocation of existing footbridge
Western approach: Curved between the southbound U.S. 101 off-ramp and the Chevron station
Westside touchdown: East end of the dead-end section of roadway located between the Chevron and Shell gas stations
Approximate length from touchdown to touchdown: 1200 feet



Rendered aerial view of overcrossing alternative O-9



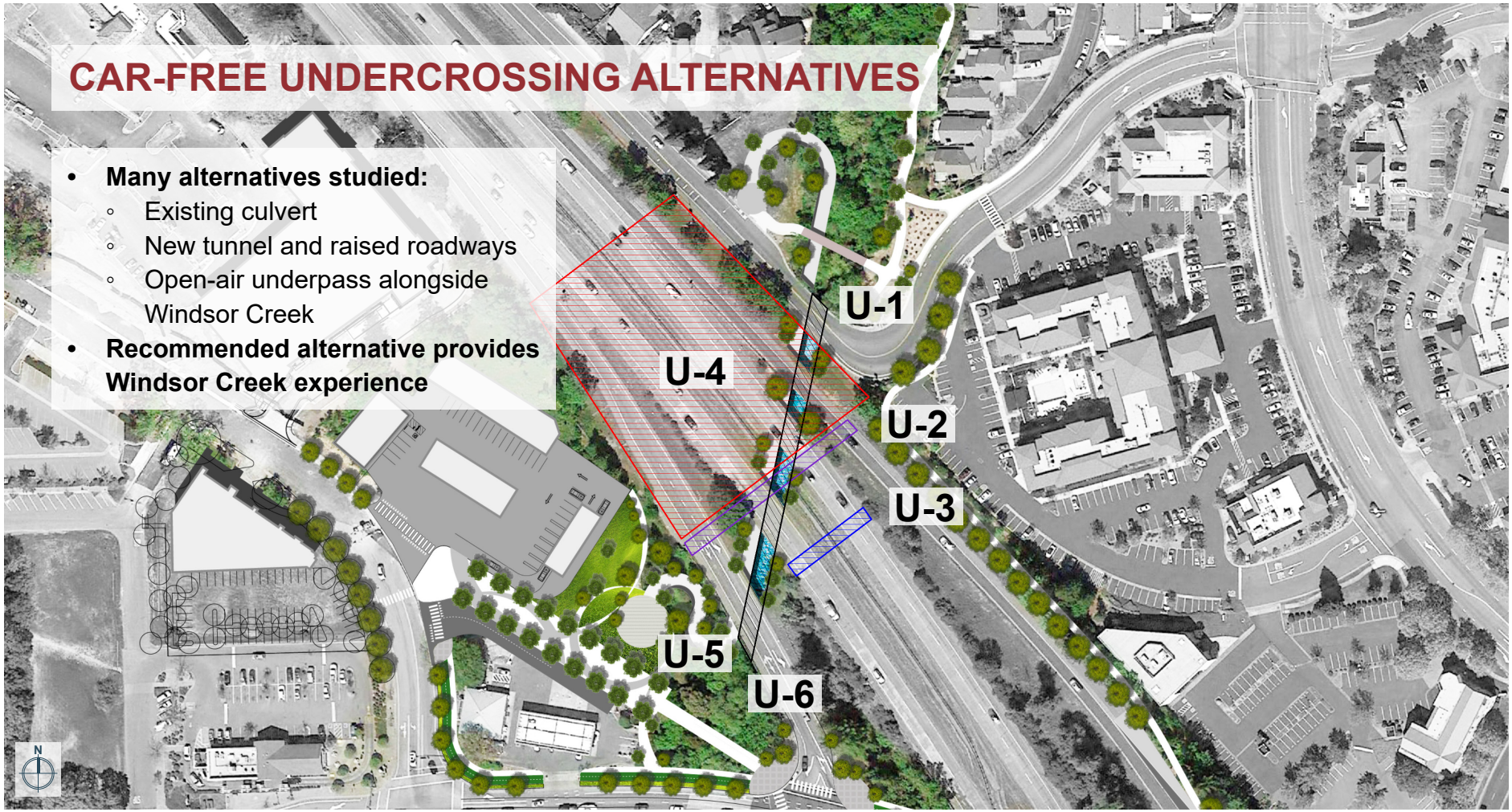
Colorado Department of Transportation concept rendering of the Central 70 Project at Swansea Elementary in Denver, CO

Overcrossing Alternative 10 (O-10)

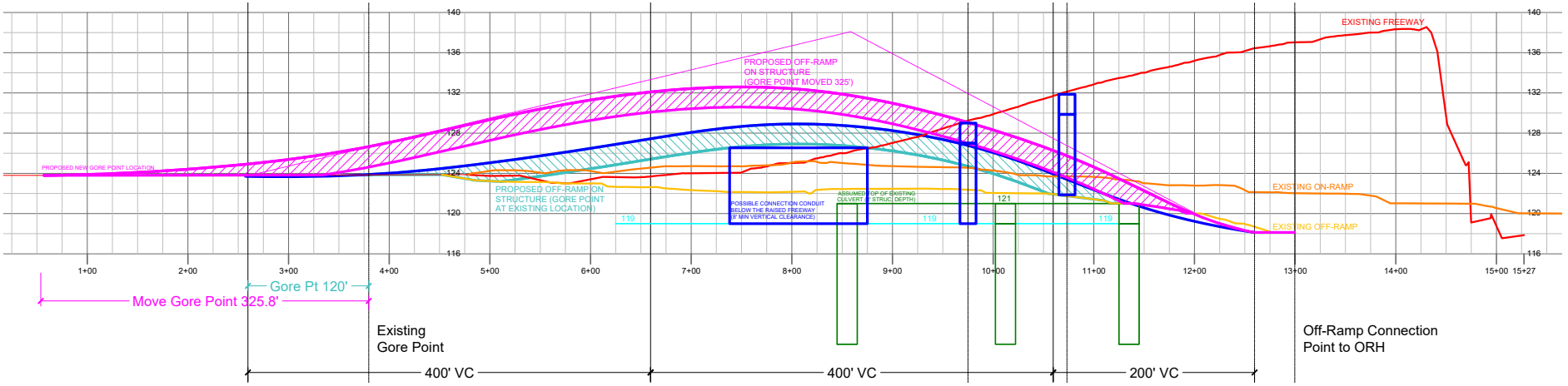
Beyond conceptualizing how pedestrians and cyclists could be routed over U.S. 101 with a new overcrossing, the team also considered how the freeway could be routed under the Town. Alternative O-10 imagines lowering a section of U.S. 101 through Central Windsor so that all modes of travel would be able to pass over the freeway at the existing grade. A precedent for this concept, planned to begin construction in 2018 at a cost of approximately $1.2 billion, is the Central 70 project in Denver, CO, which includes replacing a 1.8-mile section of Interstate 70 with a below-grade freeway and covering it with a 4-acre park.

Undercrossing Alternatives

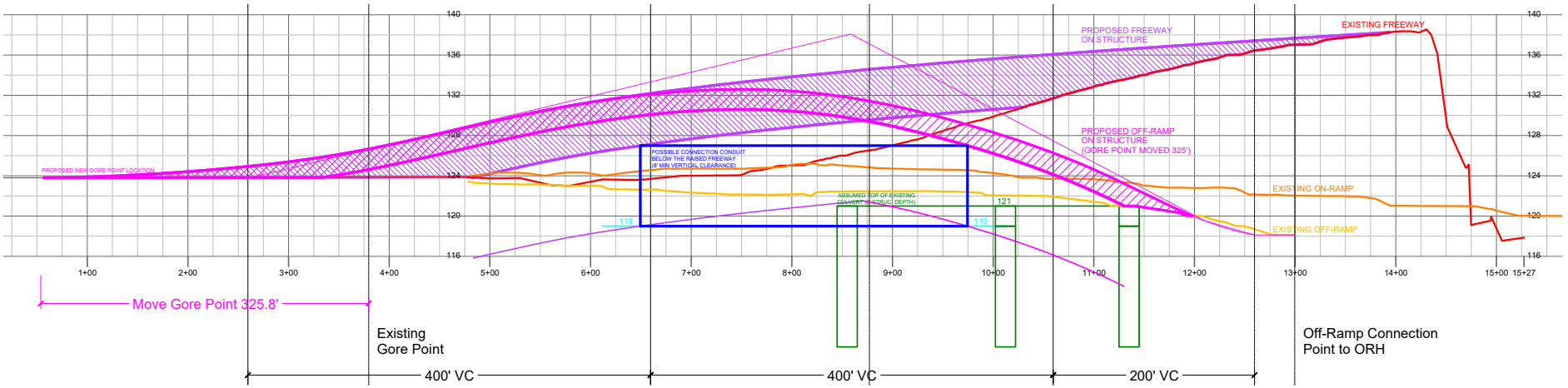
In addition to developing potential new ways to cross over U.S. 101, the team also developed six new ways for cyclists and pedestrians to cross under the freeway.



Map of undercrossing alternatives studied



Profile at centerline of U.S. 101 with three conceptual undercrossing alternatives (in blue): Retaining the existing freeway and raising the on- and off-ramps



Profile at centerline of U.S. 101 with one conceptual undercrossing alternative (in blue): Raising both the freeway and on- and off-ramps

Undercrossing Alternative 1 (U-1)
This alternative utilizes the existing culvert along Windsor Creek and considers adding an elevated pathway within the culvert's 400-foot tunnel. Since the difference in elevation from the top of the creek bank to the top of the traveled way would be approximately 12 feet, a 280-feet long approach is required on the east side, while a 320-foot approach is required on the west side for users to get from the top of the bank to the tunnel entrances.

Undercrossing Alternative 2 (U-2)
This alternative considers raising the U.S. 101 northbound on-ramp, a section of the freeway, and the southbound off-ramp to add a new 300-foot long tunnel underneath. The entrances to this tunnel would be at-grade. Raising the freeway and ramps would require reconstructing and raising approximately 1340 feet of U.S. 101 and shifting the on and off-ramp entrances and exits accordingly.

Undercrossing Alternative 3 (U-3)
Alternative U-3 considers adding a new 155-foot tunnel under U.S. 101. Although the entrances to the tunnel would be at-grade, the approaches would need to include pathways between U.S. 101 and the northbound on-ramp and the southbound off-ramp, as well as crosswalks for users to cross the ramps.

Undercrossing Alternative 4 (U-4)
This alternative considers raising an entire section U.S. 101 to create a 300-foot wide open space underneath the freeway. This creates a large underpass-like space for crossing the freeway instead of a narrower tunnel. Similar to alternative U-2, U-4 requires reconstructing and raising approximately 1340 feet of U.S. 101 and shifting the on and off-ramp entrances and exits accordingly. Unlike alternative U-2, which uses fill, U-4 requires large structures to support the freeway above the underpass space.

Undercrossing Alternative 5 (U-5)

Alternative U-5 examines adding a series of short tunnels adjacent to the existing culvert along Windsor Creek. These five tunnels would be approximately 25 feet to 50 feet in length and located directly under the roadway of the freeway and ramps. Portions of the path in the spaces between the tunnels would be open to the sky, and adjacent to embankments on one side and the wall of the existing culvert on the other. Since the difference in elevation from the top of the creek bank to the top of the traveled way would be approximately 10 feet, a 180-feet long approach is required on the east side, while a 220-foot approach is required on the west side for users to get to the tunnel entrances from the top of the bank.



Rendering of undercrossing Alternative U-5



Rendering of undercrossing Alternative U-6

Undercrossing Alternative 6 (U-6)

Similar to the previous alternative, alternative U-6 considers constructing a new undercrossing adjacent to Windsor Creek and has the same 10-foot elevation change and 180 to 220-foot approach requirements. Instead of a series of tunnels however, this alternative considers opening the culvert and constructing a series of roadway bridges. These five overpasses, which would carry freeway traffic overhead, would be approximately 25 feet to 50 feet in width, and the bridge spans would vary from 85 feet to 100 feet in length. The pathway would be adjacent to embankments on one side and Windsor Creek on the other. A precedent to the concept of this alternative is the Prince Memorial Greenway in Santa Rosa, CA.



Artwork enhances the aesthetics of the underpass



Prince Memorial Greenway in Santa Rosa, CA


US 101
Los Amigos Rd
Brooks Rd S
OLIVER'S
Old Redwood Hwy
CHEVRON
HAMPTON INN
LAKEWOOD VILLAGE
SHELL
Windsor River Rd
Lakewood Dr
Old Redwood Hwy
Johnson St
Conde Ln
US 101

3. ASSESSMENT & RECOMMENDATIONS

3.1. Alternatives Assessment

3.2. Recommended Alternatives

3. ASSESSMENT & RECOMMENDATIONS

3.1 Design Assessment

The Connecting Windsor team assessed the alternative design solutions for the Connecting Windsor Study using criteria that were previously developed through working with the community. These criteria include attractiveness; safety for all travel modes (including automobiles); comfort (including shade opportunities); wayfinding; and access options for pedestrians and cyclists. In addition to the user experience criteria, the team also assessed the design solutions based on engineering feasibility. These criteria pertain to issues such as cost; constructability; agency review processes; compatibility with future development plans; flooding potential; and traffic impacts.

Improvements to the Old Redwood Highway Corridor

The existing Old Redwood Highway corridor is generally auto-oriented with a streetscape largely characterized by plain concrete, imposing retaining walls, inadequate lighting, wide expanses of asphalt, long crosswalks with high volume freeway ramp traffic crossing at high speeds, long distance between crosswalks across Old Redwood Highway, a lack of pedestrian-oriented resting spots, traffic noise, Class II bike lanes with substandard width, and a sidewalk too narrow for a multi-use pathway.

Widening the space under U.S. 101 using new tie-back walls, and adding new lighting, landscape, color, and artwork is expected to turn the U.S. 101 at Central Windsor underpass into a friendlier and inviting gateway and improve the space. With the addition of protected two-way bike lanes, the existing Class II bike lanes can be removed and the automobile lanes can be widened using the extra width, further separating cyclists from cars, but also bringing cyclists and pedestrians closer together.

The team is aware that some cyclists may wish to travel through the corridor using on-street bicycle facilities, without needing to transition to protected bike lanes and crossbikes. The team recommends that in the next phase of the project, additional studies should A) examine signal timing so cyclists traveling in protected bike lanes can move efficiently through the corridor, and B) consider retaining Class II or III on-street bikeways.

At the intersection of Lakewood Drive and Old Redwood Highway, the addition of a slip lane to U.S. 101 north is expected to reduce overall traffic delay on Old Redwood Highway (see Appendix B.1 for a traffic analysis conducted for the Study). The slip lane would improve the PM level of service on both Lakewood Drive and on Old Redwood Highway in the eastbound left turn lane. By allowing vehicles traveling south on Lakewood Drive to directly access U.S. 101 north, the number of vehicles crossing the crosswalk at the U.S. 101 northbound on-ramp at Old Redwood Highway is reduced by 25%.

The traffic study also finds that the addition of a pedestrian crossing warning sign with pedestrian-activated flashing LEDs for the crosswalk at the existing on-ramp entrance would be warranted in the future, as it is reasonable to expect pedestrian traffic to increase as a result of the improvements to the corridor (see Appendix B.3.).

New Overcrossing

The team's assessment of new overcrossing alternatives gave lower rankings to alternatives that included tight turns that would impact safety and visibility for users. Alternatives that impacted residences or included touchdowns that were hidden behind homes were ranked lower than those that remained in open space and had visible touchdowns. Alternative O-10, which requires the removal and below-grade reconstruction of U.S. 101 would be particularly challenging due to the water table of Windsor Creek and the alternative's cost, environmental, and agency approval requirements.

Alternatives O-7 and O-9 scored the highest in terms of safety, user experience, and feasibility, with alternative O-9 ranking slightly higher, since its east side touchdown on the north side of Los Amigos Road would not impact the Hampton Inn property. Although the western approach and shortcut stairway for the alternative would require right-of-way exchange with the Chevron station, engagement with the property owners suggests that the Town would be able to swap relatively equal areas of public and private right-of-way for the project.

New Undercrossing

The team's assessment of new undercrossing alternatives determined that lifting sections of freeway or routing cyclists and pedestrians to crosswalks across the U.S. 101 northbound on-ramp and southbound off-ramp

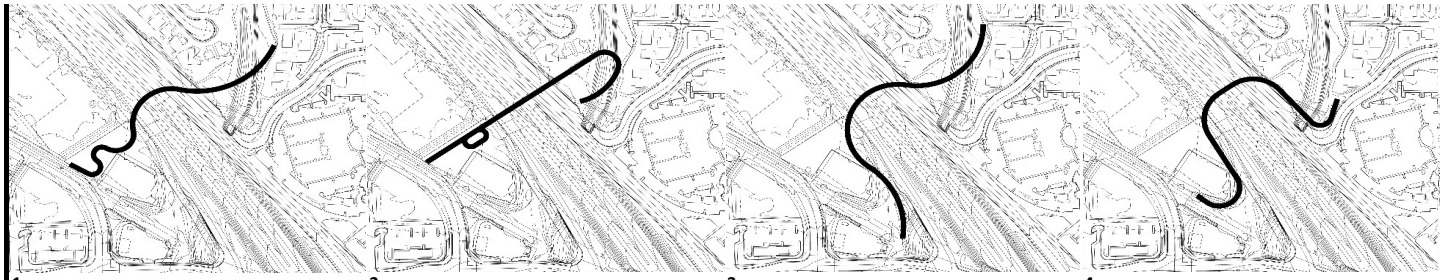


Rendered plan of overcrossing Alternative O-9

Overcrossing alternatives comparison matrix

Input rating scores of 0-5 in YELLOW cells.

Total design score will be automatically calculated and displayed in red cell.



Alignment

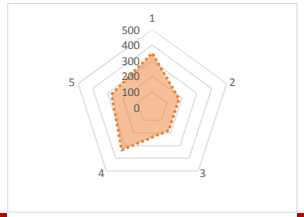
Key Feature & Issues

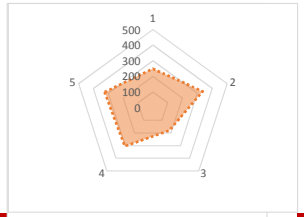
1
- Tight turns impact safety and visibility
- East TD behind homes and not on main road
- Biased wayfinding at west TD
- Provides less options to destinations
- Existing bridge remains in place

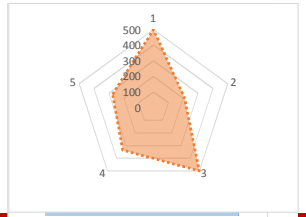
2
- Loop and tight turns impact safety and visibility
- Neutral wayfinding at TDs
- Existing bridge remains in place

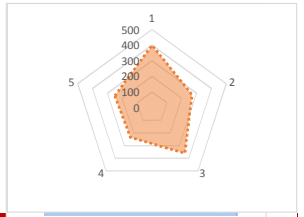
3
- Good form for safety and visibility
- East TD behind homes and not on main road
- TDs tie into ped corridor along creek & ORH
- Existing bridge remains in place

4
- TDs tie into ped corridor along creek & ORH
- Biased wayfinding at west TD
- West TD impacts driveway of Chevron
- Requires relocation of existing bridge

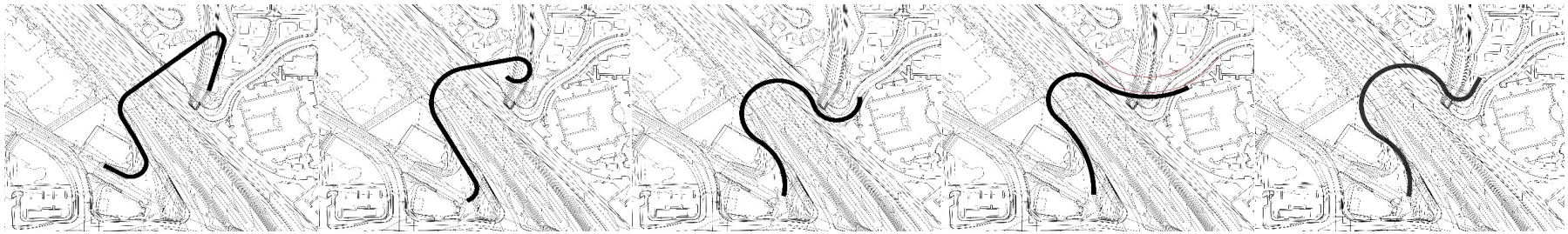








		1			2			3			4		
Design Score		**1320**			**1395**			**1820**			**1515**		
	weight	score	weighted score	comments	score	weighted score	comments	score	weighted score	comments	score	weighted score	comments
1) Elegance	**100**												
Landmark Potential	50	4	200		3	150		5	250		4	200	
Simplicity of Geometry/Strength of Concept	50	3	150		2	100		5	250		4	200	
sub-total			**350**			**250**			**500**			**400**	
2) Connection	**100**												
Wayfinding (Easy to spot / See from distance)	40	3	120	East TD behind homes	5	200		3	120	East TD behind homes	4.5	180	
Total Length (touchdown to touchdown)	30		0			0			0			0	
Multiple Routes Served (getting to touchdown is not circuitous, opportunities for stairway shortcuts)	30	2	60	East TD behind homes Biased west TD	4.5	135		3	90	East TD behind homes	3	90	Biased west TD
sub-total			**180**			**335**			**210**			**270**	
3) Safety & Experience	**100**												
Safe Geometry (Curves, Sightlines, Lengths, and Grades Ideal For Safety)	60	1	60	Tight turns	1	60	Loop and tight turn	5	300		4	240	Tight turns
Aesthetics & Convenience (views, ease of use, interactions with nature, etc.)	40	3	120	Limited view west	3	120	Limited view west	5	200	Creek view	3	120	
sub-total			**180**			**180**			**500**			**360**	
4) Adjacency	**100**												
Compatibility with existing uses (visual, functional, noise, etc.)	65	3	195	Close to homes	2	130	Very close to homes	3	195	Close to homes	2	130	Conflict with Chevron driveway
Right-of-way Acquisition	35	4	140	East TD in residential area	5	175		4	140	East TD in residential area	3	105	West TD at Cheveron
sub-total			**335**			**305**			**335**			**235**	
5) Feasibility	**100**												
Cost	50	3	150	Impacts to trees and homes	3	150	Impacts to trees	3	150	Impacts to trees and homes	2	100	Footbridge and Chevron impacts
Conflicts (utilities, trees, Caltrans, etc.)	25	3	75	East ramp around trees	4	100	East ramp around trees	3	75	East ramp around trees	2	50	West TD at Cheveron
Constructibility	25	2	50	Impacts to trees and homes	3	75	Impacts to trees	2	50	Impacts to trees and homes	4	100	Near Chevron
sub-total			**275**			**325**			**275**			**250**	



5

- Tight turn impacts safety and visibility
- West TD ties into ped corridor along ORH
- Biased wayfinding at west TD
- West TD impacts driveway of Chevron
- Requires relocation of existing bridge

6

- Tight turn impact safety and visibility
- Biased wayfinidng at east TD
- West TD ties into corridor along creek & ORH
- Existing bridge remains in place

7

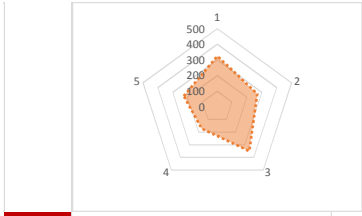
- Good form for safety and visibility
- East TD impacts driveway of Hampton Inn
- TDs tie into ped corridor along creek & ORH
- Existing bridge remains in place

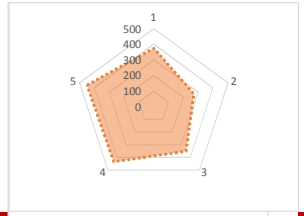
8

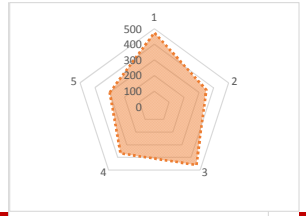
- Good form for safety and visibility
- East TD impacts driveway of Hampton Inn
- Requires realignment of Los Amigos
- Requires relocation of existing bridge

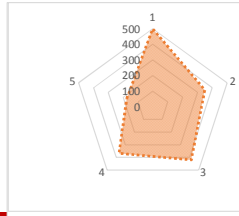
9 *Recommended Alignment*

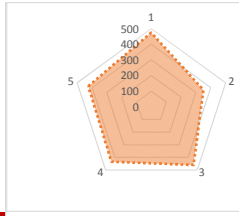
- Good form for safety and visibility
- TDs tie into ped corridor along creek & ORH
- Requires relocation of existing bridge











1340			**1880**			**1952.5**			**1812.5**			**2145**		
score	weighted score	comments	score	weighted score	comments	score	weighted score	comments	score	weighted score	comments	score	weighted score	comments
3	150		4	200		5	250		5	250		5	250	
3.5	175		3.5	175		4.5	225		5	250		4.5	225	
	325			375			475			500			475	
4.5	180		3	120	Cross bridge	5	200		5	200		5	200	
	0			0			0			0			0	
3	90	Biased west TD	5	150		5	150		5	150		5	150	
	270			270			350			350			350	
2.5	150	Tight turn	2.5	150	Tight turn	5	300		5	300		5	300	
5	200	East ramp above creek	5	200	East ramp above creek	4	160		3	120		4	160	
	350			350			460			420			460	
1	65	Very close to homes Conflict with Chevron driveway	4	260	Crosses over Chevron	3.5	227.5	Conflict with Hampton driveway	3.5	227.5	Conflict with Hampton driveway	4	260	Crosses over Chevron
3	105	West TD at Chevron	5	175		4	140	East TD at Hampton	4	140	East TD at Hampton	5	175	
	170			435			367.5			367.5			435	
2	100	Footbridge and Chevron impacts	5	250		3	150	Hampton impacts	1	50	Footbridge and Los Amigios impacts	4	200	Relocation of footbridge
2	50	West TD at Cheveron	5	125		2	50	East TD at Hampton	1	25	Los Amigos reconfigured	5	125	
3	75	Impacts to trees	3	75	Impacts to trees	4	100	Near Chevron	4	100	Near Chevron	4	100	Near Chevron
	225			450			300			175			425	

would be particularly difficult due to high costs and challenging agency approval requirements. Using the existing Windsor Creek culvert as an undercrossing is also challenging due to its length, uncomfortable user experience, and potential for frequent flooding, and this assessment was additionally informed by a 2008 study on using the culvert for a pathway (see Appendix D.4. for 2008 study). During public engagement meetings, community members identified the creek experience as a primary reason for their attraction to the idea of a new undercrossing. Although alternative U-6, which requires the removal and reconstruction of the culvert and freeway would provide users with the best creek experience, the alternative is challenged by its potential construction cost and required agency approvals. Even though alternative U-5, which also envisions constructing a new tunnel adjacent to the culvert, would be lower in cost due to its use of box structures instead of new overpasses, along the 400 foot culvert it would not provide the community with the creek-oriented user experience they seek. Additionally, many members of the community, including the Windsor Police Department, expressed strong concerns that an undercrossing would be associated with more safety and personal security issues than an overcrossing; a concern that can be very challenging to overcome psychologically.

Alternative	U-1	U-2	U-3	U-4	U-5	U-6
Description	Add Pathway within Existing Culvert	New Tunnel Under Raised SB Ramp, Freeway, and NB Ramp	New Tunnel Under Freeway Only; Crosswalks at Ramps	Raised Freeway and Ramps	Series of Short Bike/Ped Tunnels Adjacent to Existing Culvert	New Pathway and Opened Culvert under Roadway Bridges
Geometry	400' long tunnel	300' long tunnel	155' long tunnel	300' wide open space under freeway	Five 25' to 50' long tunnels	Five 25' to 50' long overpasses
User Experience	Challenging	Challenging	Challenging	Excellent	Good	Very Good
Safety	Good	Good	Poor	Good	Good	Good
Security	Poor	Poor	Poor	Good	Good	Good
Flooding Potential*	Frequent	Negligible	Negligible	Negligible	50-100 year frequency	50-100 year frequency
Top of Bike/Ped Traveled Way (elev.)	107'	119'	119'	119'	109'	109'
Environmental Approval	Very Challenging	Somewhat Challenging	No Significant Issues Anticipated	Very Challenging	Somewhat Challenging	Somewhat Challenging
Caltrans Approval	Very Challenging	Challenging	Very Unlikely	Very Challenging	Challenging	Challenging
Estimated Construction Cost	$2M Range	$20M Range	$10-15M Range	Very High	$7.5M Range	$16M Range

*100-year flood level elev. at 113'

Undercrossing alternatives comparison matrix



Rendering of undercrossing Alternative U-6

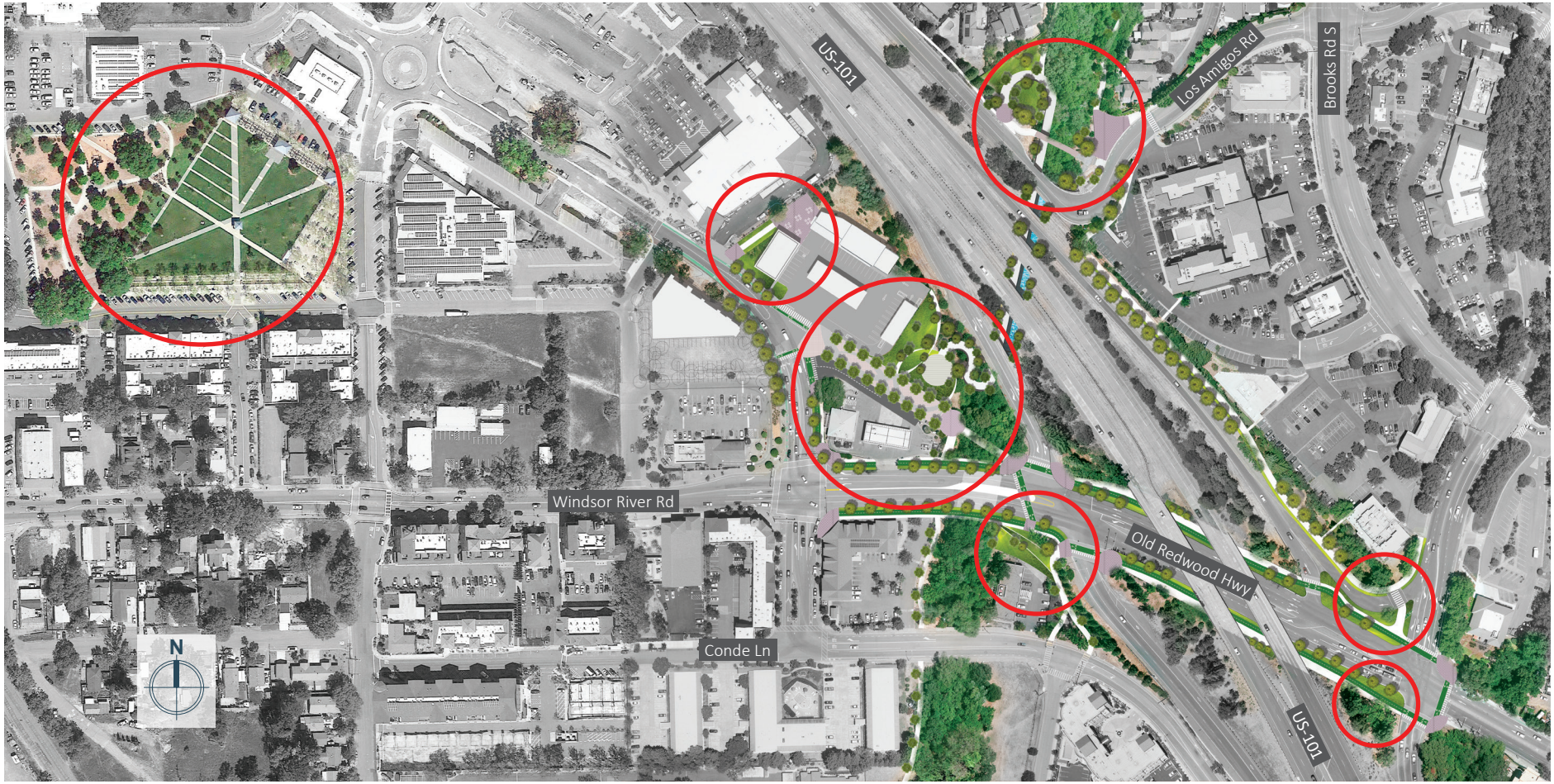
Developing Pedestrian-Oriented Places and Pathways

The development of a pedestrian promenade between the Chevron and Shell gas stations, a mixing zone, and a new footbridge over Windsor Creek would provide a safer shortcut for cyclists and pedestrians traveling north-south along Old Redwood Highway to and from the Town Green, avoiding the busy intersection of Old Redwood Highway and Conde Lane. These improvements along the historical axis of Old Redwood Highway would extend the existing tree-lined view corridor between the Town Green and Old Redwood Highway. The mixing zone and public open space would provide a unique opportunity for gathering, interactions, and rest, which relates to the architectural language of the Town Green, but is distinct in its location on a former auto-oriented thoroughfare. A preliminary biological assessment conducted in 2016 identified potential wetland areas in the roadway ditches adjacent to the remnant section of Old Redwood Highway (see Appendix C.1.); therefore, a wetland delineation report would be required prior to future development.

The development of a new multi-use pathway parallel to the U.S. 101 northbound on-ramp to connect Los Amigos Road to Old Redwood Highway would provide a direct north-south connection on the east side Windsor and allow cyclists and pedestrians to avoid narrow sidewalks on Lakewood Drive and the vehicular traffic on Lakewood Drive and Brooks Road.



Redevelopment of the historical axis of Old Redwood Highway into a pedestrian promenade and public open space



Map of potential Central Windsor open space network with existing Town Green in the upper left

Furthermore, between Old Redwood Highway and Conde Lane, the improvement of the existing paths and addition of new pedestrian-oriented lighting and benches consistent with the urban architectural language established by the Town Green would provide a continuation of the north-south Windsor Creek connection and experience. Wide paths and improved lighting would also enhance safety along this direct connection to and from Windsor Creek Elementary School, and support safer routes to school.

A roundabout at the intersection of Conde Lane and Windsor River Road was cursorily studied in the course of this project. Preliminary findings indicate that the space at the intersection may be inadequate to accommodate both a vehicular roundabout and facilities for pedestrians and cyclists, but further examination would be needed to confirm these findings.

3.2. Recommended Alternatives

Based on the assessment of the alternative design solutions discussed above, the Connecting Windsor team recommends overcrossing alternative O-9 for a new pedestrian and bicycle crossing of U.S. 101 in Central Windsor. The team does not recommend any of the undercrossing alternatives studied. The team recommends developing pedestrian-oriented places and pathways to enhance pedestrian and cyclist connectivity and cohesiveness in Central Windsor, and studying additional ways to improve safety and efficiency of active transportation.

Specifically, the team recommends the following for action by the Town:

1. Continue to work with Caltrans on the following Connecting Windsor design components in state right of way:
    a. Widening of the existing U.S. 101 underpass on Old Redwood Highway with improvements as described in this study for pedestrian, cyclist, and vehicular user experience and safety;
    b. A new U.S. 101 Class I shared-use pedestrian and cyclist overcrossing;
    c. Bi-directional protected bike lanes on both sides of Old Redwood Highway between Conde Lane and Lakewood Drive to make it safer for cyclists to travel in both the east and west directions without crossing the roadway;
    d. A new shared-use pathway on the east of U.S. 101 connecting Los Amigos Road and Old Redwood Highway.
2. Simultaneously, take the following actions on the following project components outside of state right of way:
    a. Retain public ownership in perpetuity of selected Town-owned properties in Central Windsor to serve as public pedestrian-oriented open spaces and/or as mixing zones for pedestrian and cyclist transportation routes;
    b. Create a pedestrian promenade between the existing Shell and Chevron gas stations to serve as public open space and as a shortcut for cyclists and pedestrians to avoid the intersection of Conde Lane and Windsor River Road;
    c. Improve the pathways on west side of U.S. 101 adjacent to Windsor Creek connecting Old Redwood Highway and Conde Lane to make them more inviting and architecturally consistent with other Central Windsor public open spaces.
3. Lastly, pursue further study of the feasibility and costs/benefits for the following:
    a. A slip lane from Lakewood Drive to the U.S. 101 northbound on ramp to assess turning movement operations, geometrics, and the overall cost/benefit of this strategy in greater detail;
    b. Signal timing or retaining Class II or III on-street bikeways along Old Redwood Highway, between Lakewood Drive and Windsor River Road, to assess how traveling through the corridor could me made more efficient for cyclists;
    c. A roundabout at the intersection of Conde Lane and Windsor River Road to determine whether a new roundabout configuration could allow pedestrian and cyclist facilities to remain adjacent to the roundabout. If the intersection cannot accommodate both facilities, the study should assess community input on how pedestrians and cyclists could more readily cross the roundabout or be detoured to avoid the intersection.



4. IMPLEMENTATION

4.1. Project Components & Phasing
4.2. Construction Costs
4.3. Potential Funding Sources & Strategy
4.4. Potential Fiscal Impact
4.5. Potential Project Timeline
4.6. 15% Conceptual Drawings

4. IMPLEMENTATION

4.1. Project Components & Phasing

For greatest fiscal and timeline efficiency of the planning and design efforts the team recommends a non-phased approach to the design portion of the project. This approach would reduce the potential for inconsistencies of conflicts where different project components physically interface, and would result in the greatest coherence of final results. This approach would also provide for greater efficiencies for both soft and construction costs and for project delivery, including permitting, review, and agency coordination. A phased approach to actual construction may be warranted to facilitate continuity of service for existing pathways and roadways, and to complement grant funding opportunities.

4.2. Construction Costs

The team prepared preliminary construction cost estimates in 2017 dollars for each of the Connecting Windsor design components discussed in this Study. Initial rough order of magnitude estimate for construction costs range from $16M to $20M total for the following recommended components:

1) Placemaking and Pathmaking

1A. Old Redwood Highway Promenade ($2.5M)
1B. Conde Pathways ($0.2M)
1C. Lakewood-Los Amigos Pathway ($1.3M)

2) Old Redwood Highway Corridor Improvements

2A. Old Redwood Highway Underpass ($2-3.9M)
2B. Old Redwood Highway Protected Bike Lanes, Intersection, and Roadway Improvements ($2.4M)

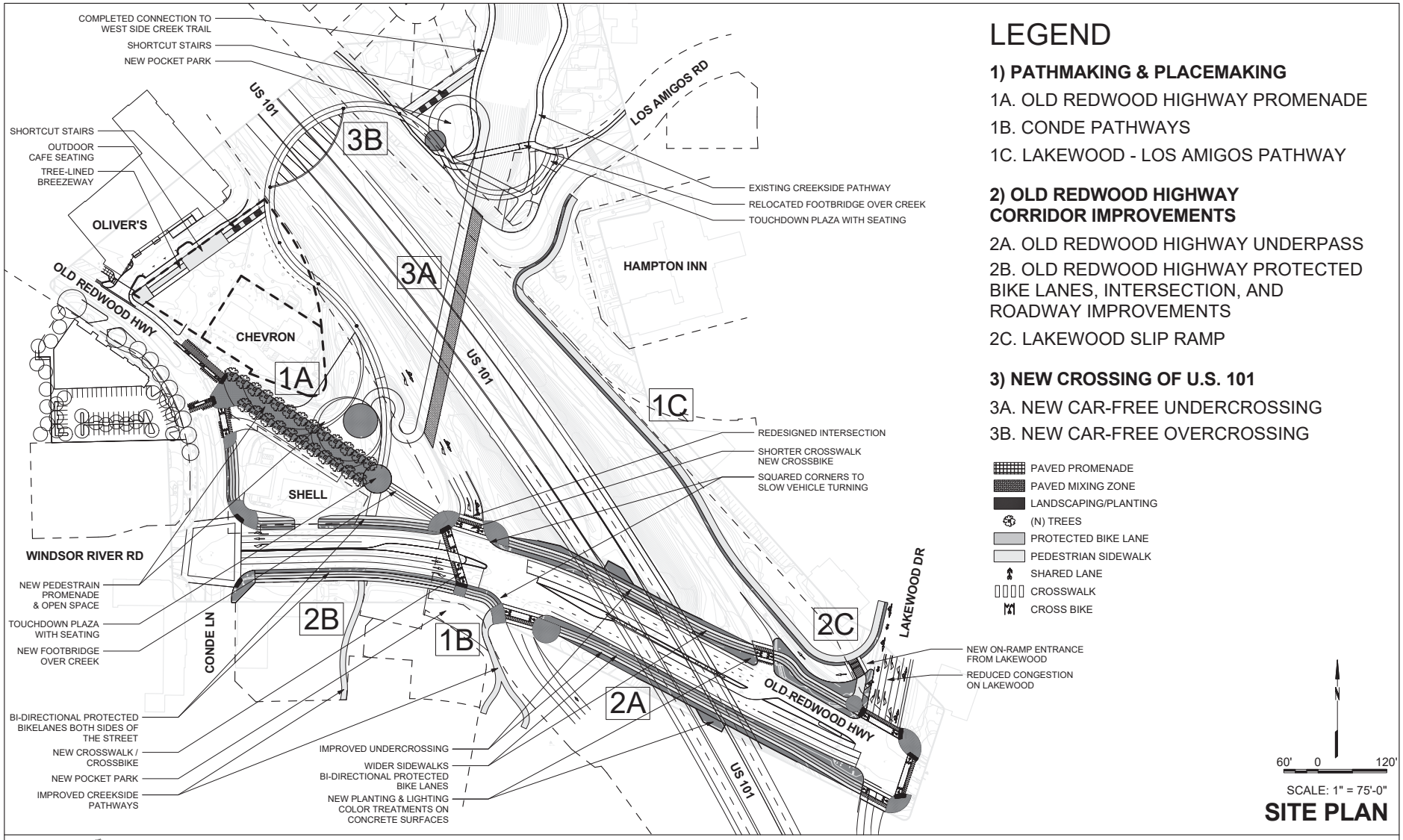
3) New Crossing of U.S. 101

3B. New Car-Free Overcrossing ($8M-10M)

The above construction cost estimate includes 30% contingency for both roadway and structure components, but does not include costs for design, technical documents, environmental documentation and permits, agency review, construction support, or construction management. Also excluded are the cost estimates for a slip ramp from Lakewood Drive to the U.S. 101 northbound on-ramp, for which the team recommends further study, and the new undercrossing, which the team does not recommended.

The cost estimates for the excluded components are:

2C. Lakewood Slip Ramp ($2.2M)
3A. New Car-Free Undercrossing ($7.5M-16M)



TOWN OF WINDSOR

CONNECTING CENTRAL WINDSOR
CONCEPT DRAWINGS (15%)

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4.3. Potential Funding Sources & Strategy

The project could be largely funded through a combination of federal, state, and regional grants. A variety of these grants are available for projects that promote active transportation and reduce congestion. Because most state and federal grants require local matching funds, local and regional grant opportunities should be assessed early on. For a project such as this with integrated components, the team recommends first seeking regional grants (e.g., administered by the Sonoma County Transportation Authority or Bay Area Air Quality Management District) to fund the preliminary design phase. Having preliminary plans would allow the Town to secure additional grants for local matching. These local matching funds would be required to receive state and federal grants. Grants requiring local match include the Caltrans Sustainable Transportation Planning Grant, California Safe Routes to School (SR2S), and other statewide Active Transportation Program grants. Notable federal grants include the Transportation Investment Generating Economic Recovery (TIGER) grant, which the Town could seek when the project is ready to build, but requires a significant co-investment.

4.4. Potential Fiscal Impact

The team anticipates that direct fiscal impact on Town resources would be on the order of $100-500k, depending on local grant opportunities to pay for staff time and meet local matching funds for state and federal grants.

Grant Program	Granting Agency	Administering Agency
Highway Bridge Program (HBP)	Caltrans	Caltrans
Highway Safety Improvement Program (HSIP)	Caltrans	Caltrans
State Transportation Improvement Program (STIP)	SCTA (through MTC)	Caltrans/CTC
Statewide Active Transportation Improvement Program (ATP)	Caltrans	Caltrans/CTC
Regional Active Transportation Improvement Program (ATP)	MTC	Caltrans/CTC
STP/CMAQ (i.e., OBAG)	SCTA (through MTC)	Caltrans
TFCA Regional Program	BAAQMD	BAAQMD
TFCA County Program Manager Fund	SCTA	SCTA
Measure M Bicycle and Pedestrian Program Funds	SCTA	SCTA
Vehicle Registration Fee Bicycle and Pedestrian Program Funds	SCTA	SCTA
Transportation Development Act Article 3	County	County
Office of Traffic Safety Funds	OTS	OTS
Transportation Investment Generating Economic Recovery (TIGER) Program	USDOT	USDOT

Potential funding sources

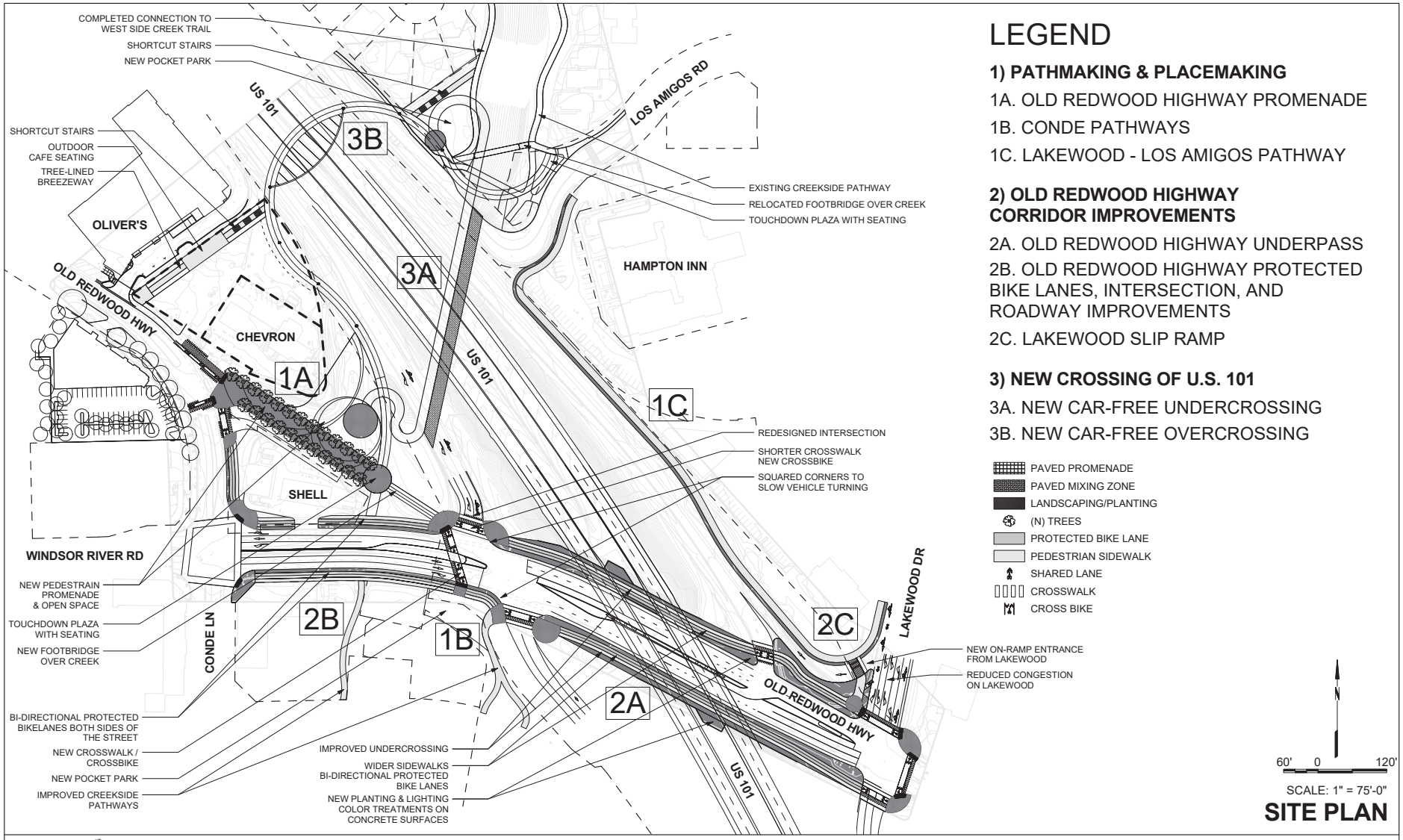
4.5. Potential Project Timeline

The potential project timeline for Connecting Windsor includes the following five overarching phases and their approximate durations:

1. Negotiate Windsor-Caltrans Cooperative Agreement (6-12 months)
2. PID/PSR-PDS (14 months)
3. PA&ED (14 months)
4. PS&E (16 months)
5. Construction (12 months)

4.6. 15% Conceptual Drawings

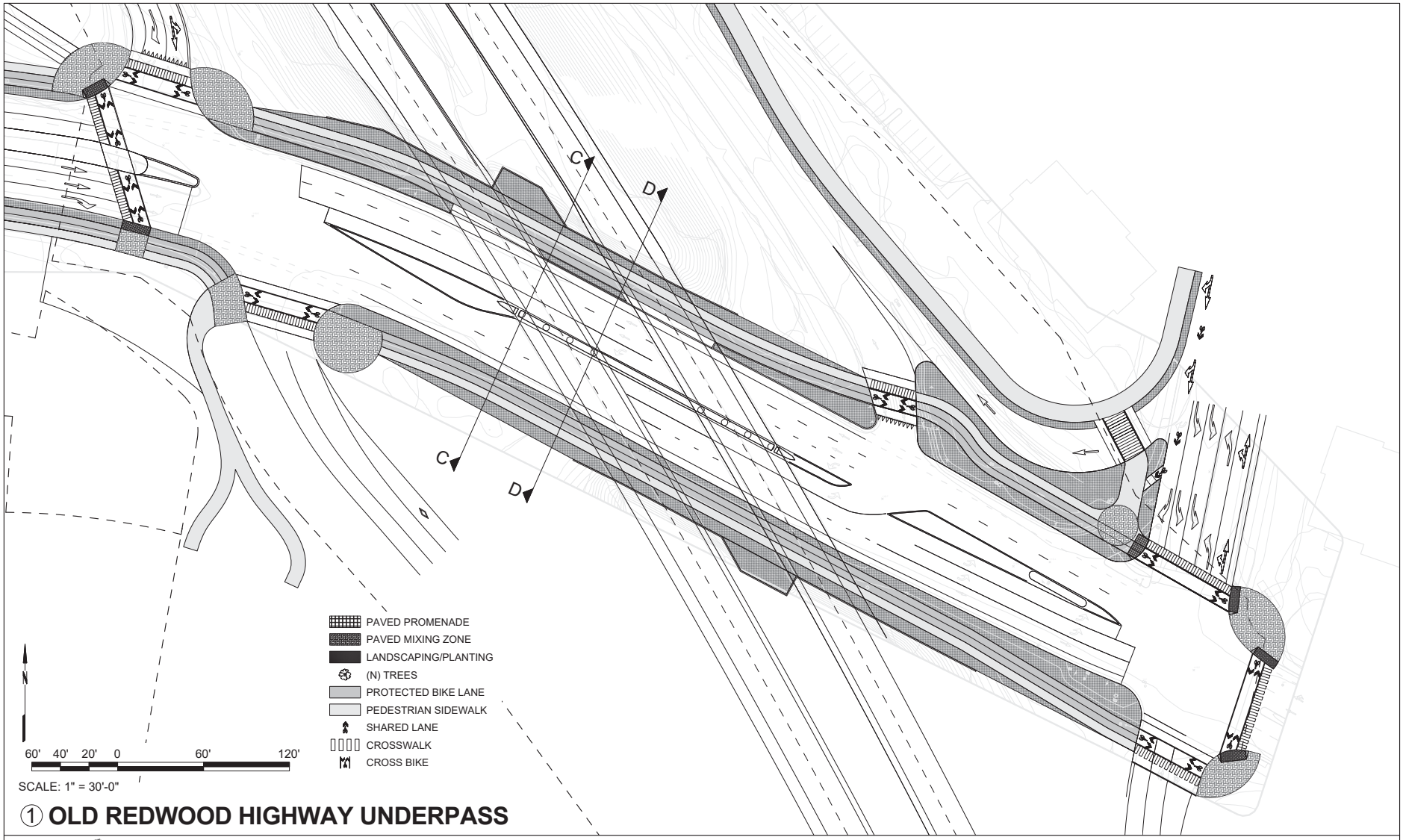
Conceptual drawings at the 15% level are included in the following pages.



TOWN OF WINDSOR

CONNECTING CENTRAL WINDSOR
CONCEPT DRAWINGS (15%)

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SCALE: 1" = 30'-0"

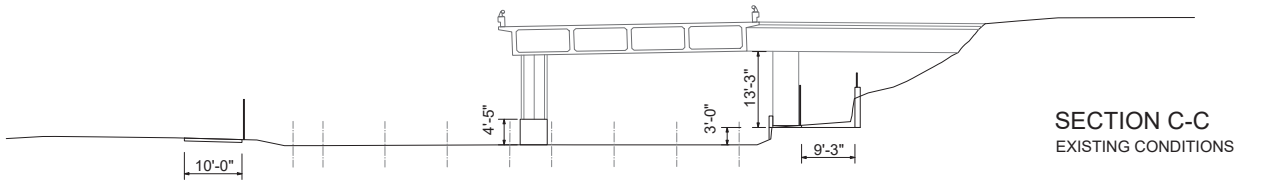
① OLD REDWOOD HIGHWAY UNDERPASS

TOWN OF WINDSOR

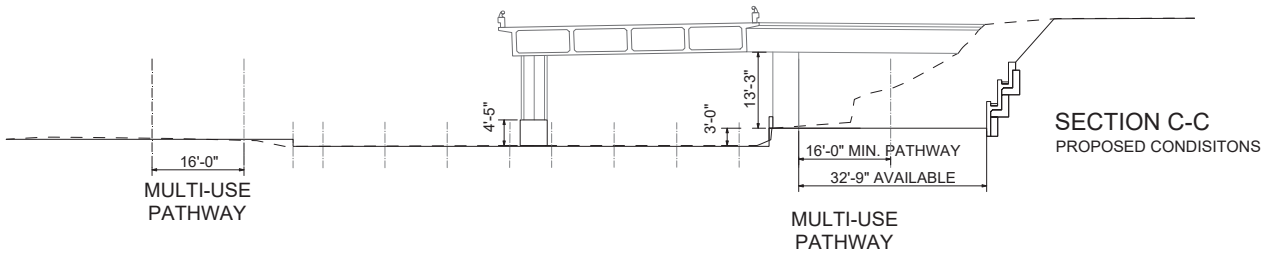
CONNECTING CENTRAL WINDSOR
CONCEPT DRAWINGS (15%)

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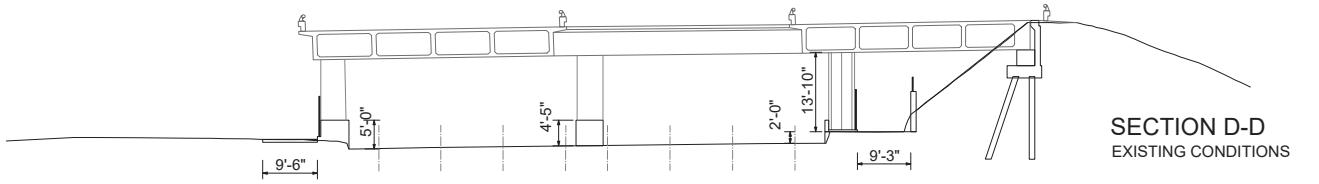
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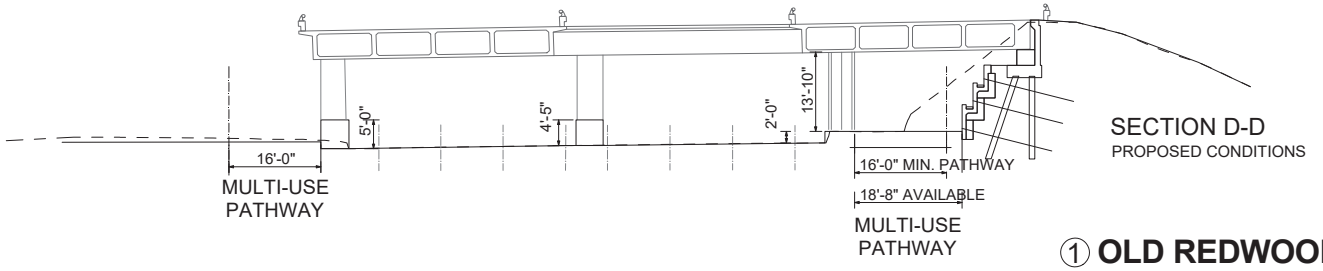
SECTION C-C
EXISTING CONDITIONS



SECTION C-C
PROPOSED CONDISITONS



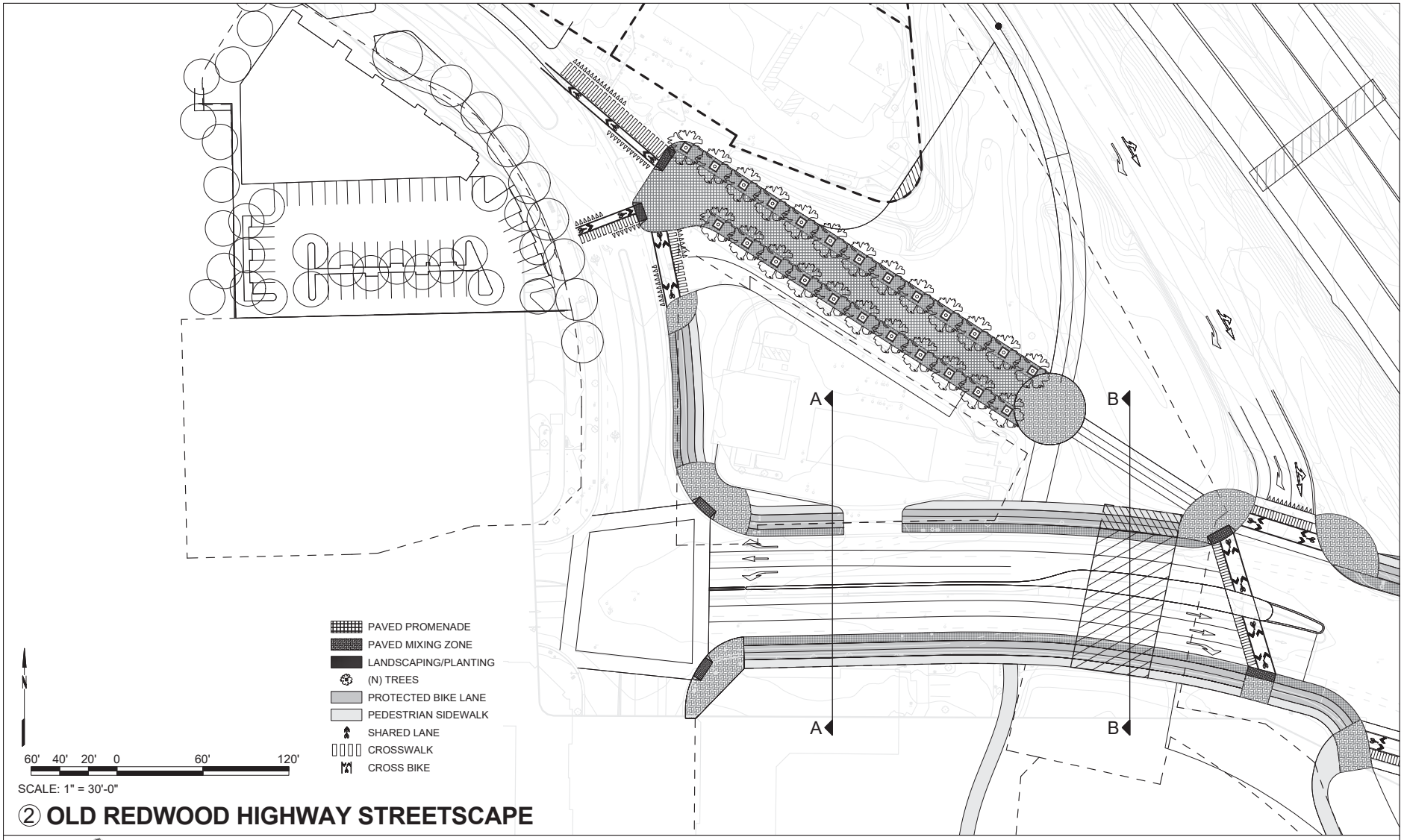
SECTION D-D
EXISTING CONDITIONS



SECTION D-D
PROPOSED CONDITIONS

① OLD REDWOOD HIGHWAY UNDERPASS

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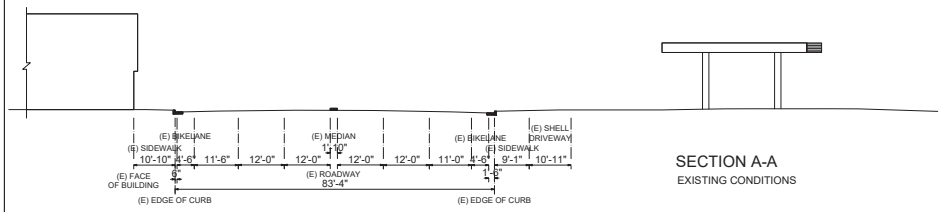
② OLD REDWOOD HIGHWAY STREETSCAPE

TOWN OF WINDSOR

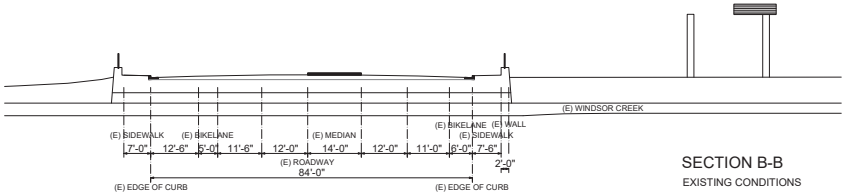
CONNECTING CENTRAL WINDSOR
CONCEPT DRAWINGS (15%)

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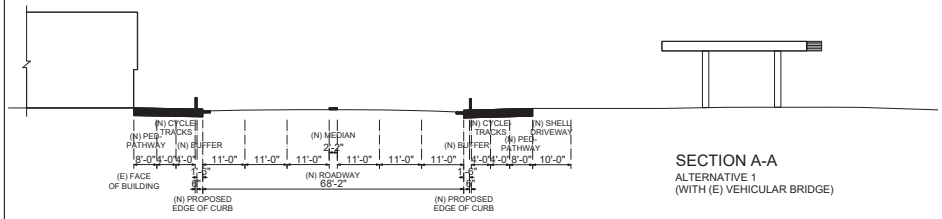
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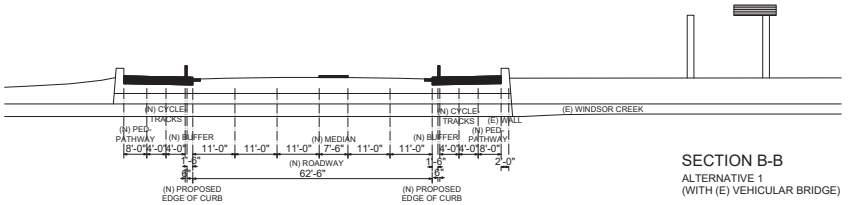
SECTION A-A
EXISTING CONDITIONS



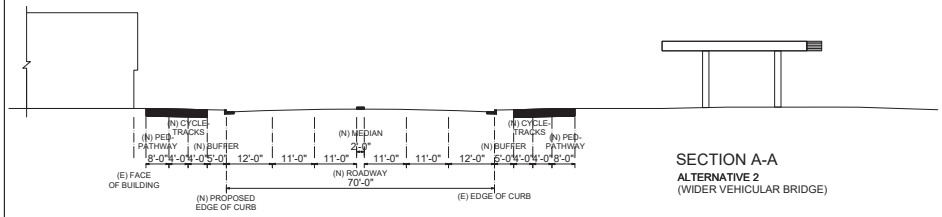
SECTION B-B
EXISTING CONDITIONS



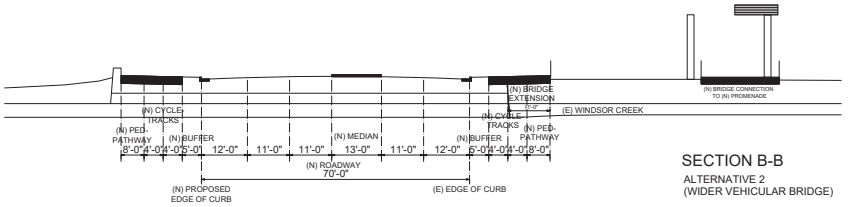
SECTION A-A
ALTERNATIVE 1
(WITH (E) VEHICULAR BRIDGE)



SECTION B-B
ALTERNATIVE 1
(WITH (E) VEHICULAR BRIDGE)



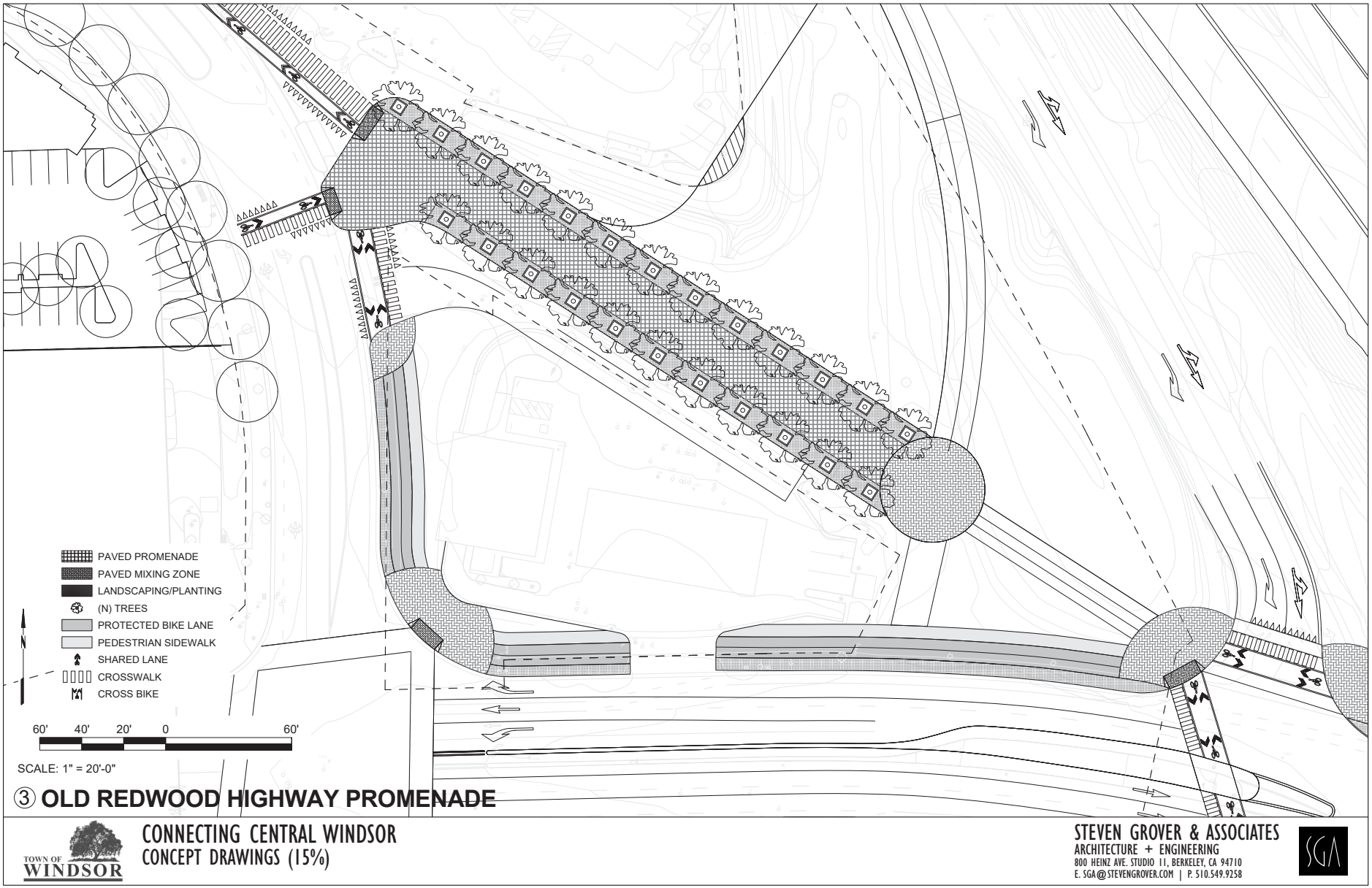
SECTION A-A
ALTERNATIVE 2
(WIDER VEHICULAR BRIDGE)



SECTION B-B
ALTERNATIVE 2
(WIDER VEHICULAR BRIDGE)

② OLD REDWOOD HIGHWAY STREETSCAPE

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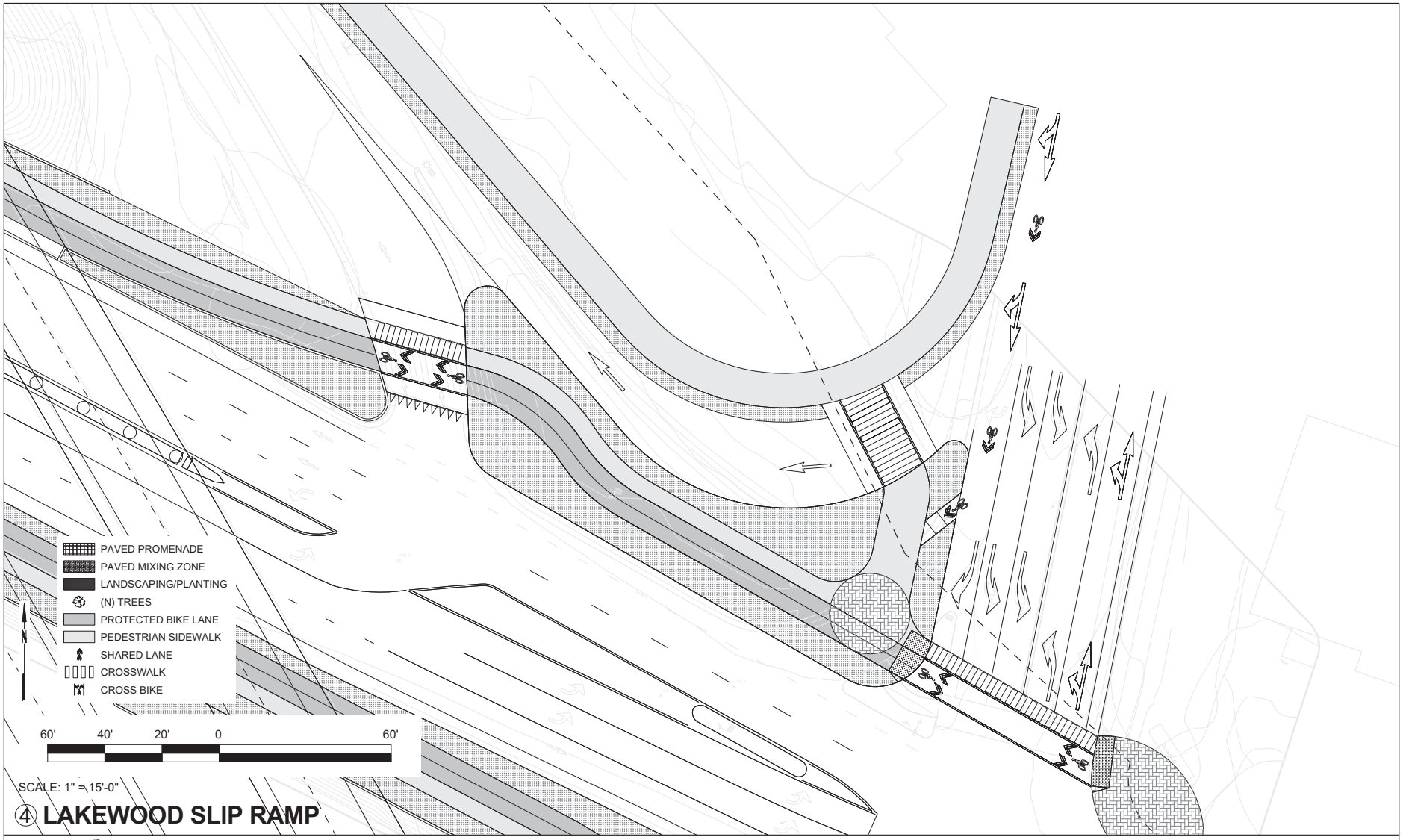
③ OLD REDWOOD HIGHWAY PROMENADE

TOWN OF WINDSOR

CONNECTING CENTRAL WINDSOR
CONCEPT DRAWINGS (15%)

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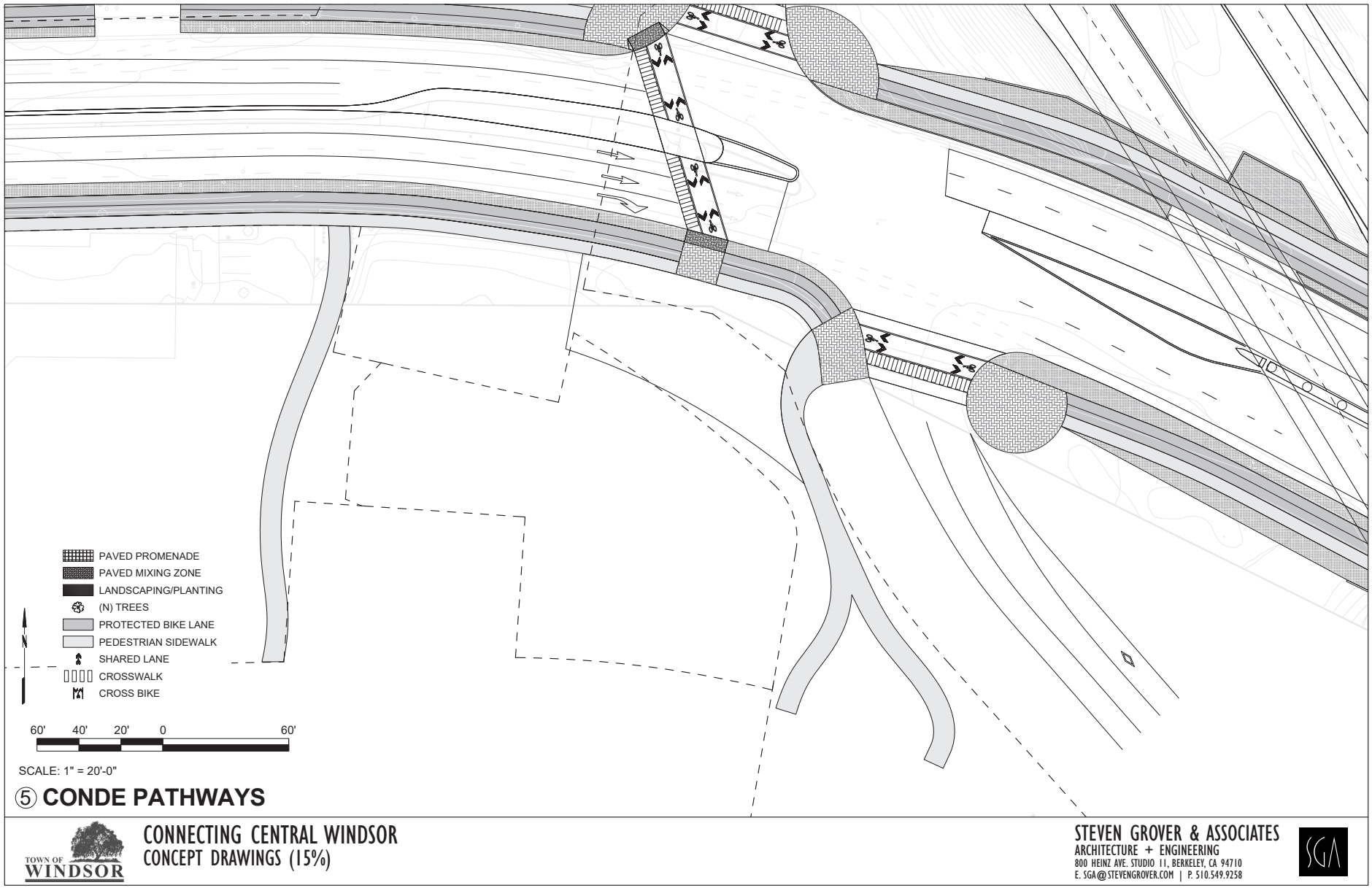
④ LAKEWOOD SLIP RAMP

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CONNECTING CENTRAL WINDSOR
CONCEPT DRAWINGS (15%)

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⑤ CONDE PATHWAYS

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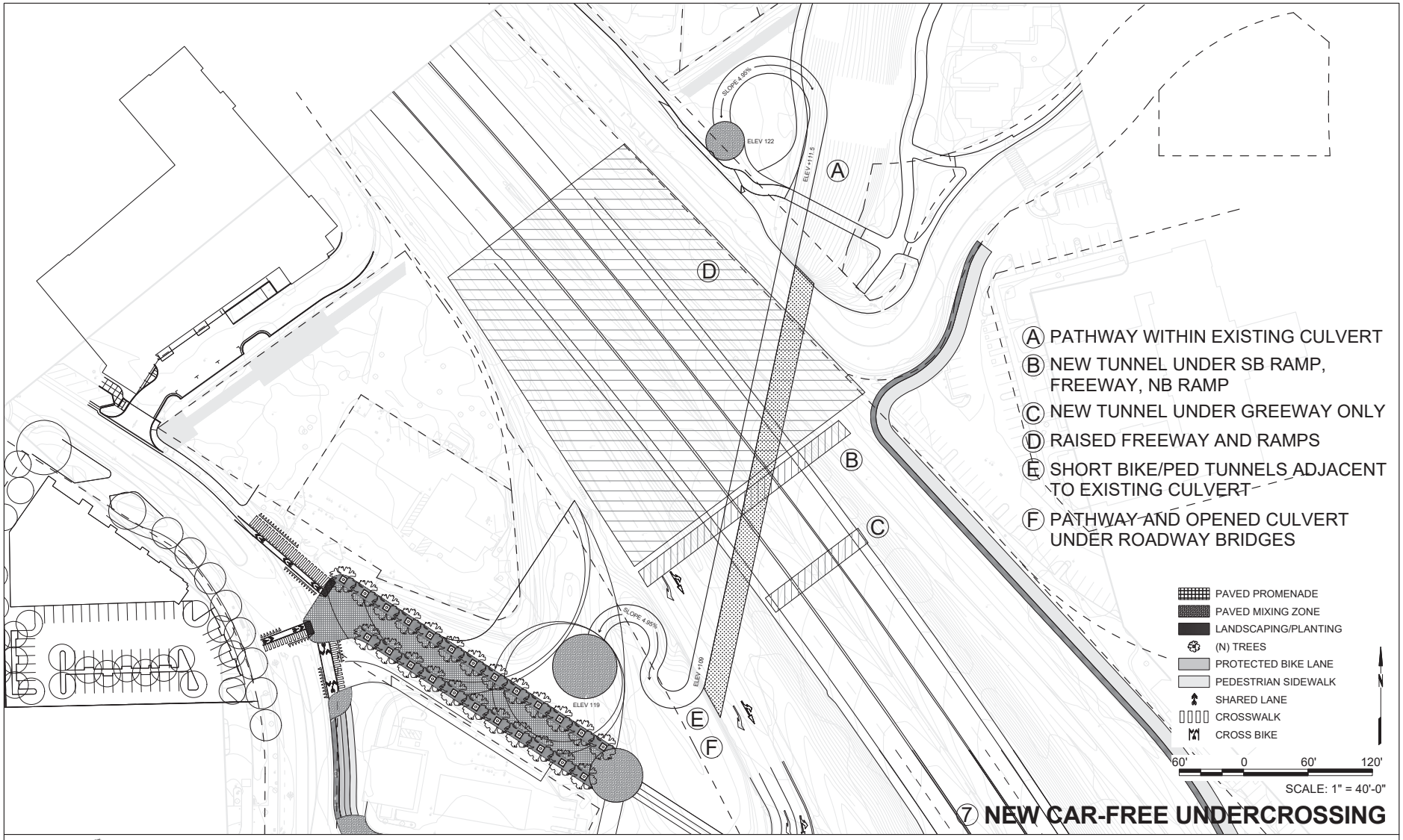
⑥ LAKEWOOD-AMIGOS PATHWAY

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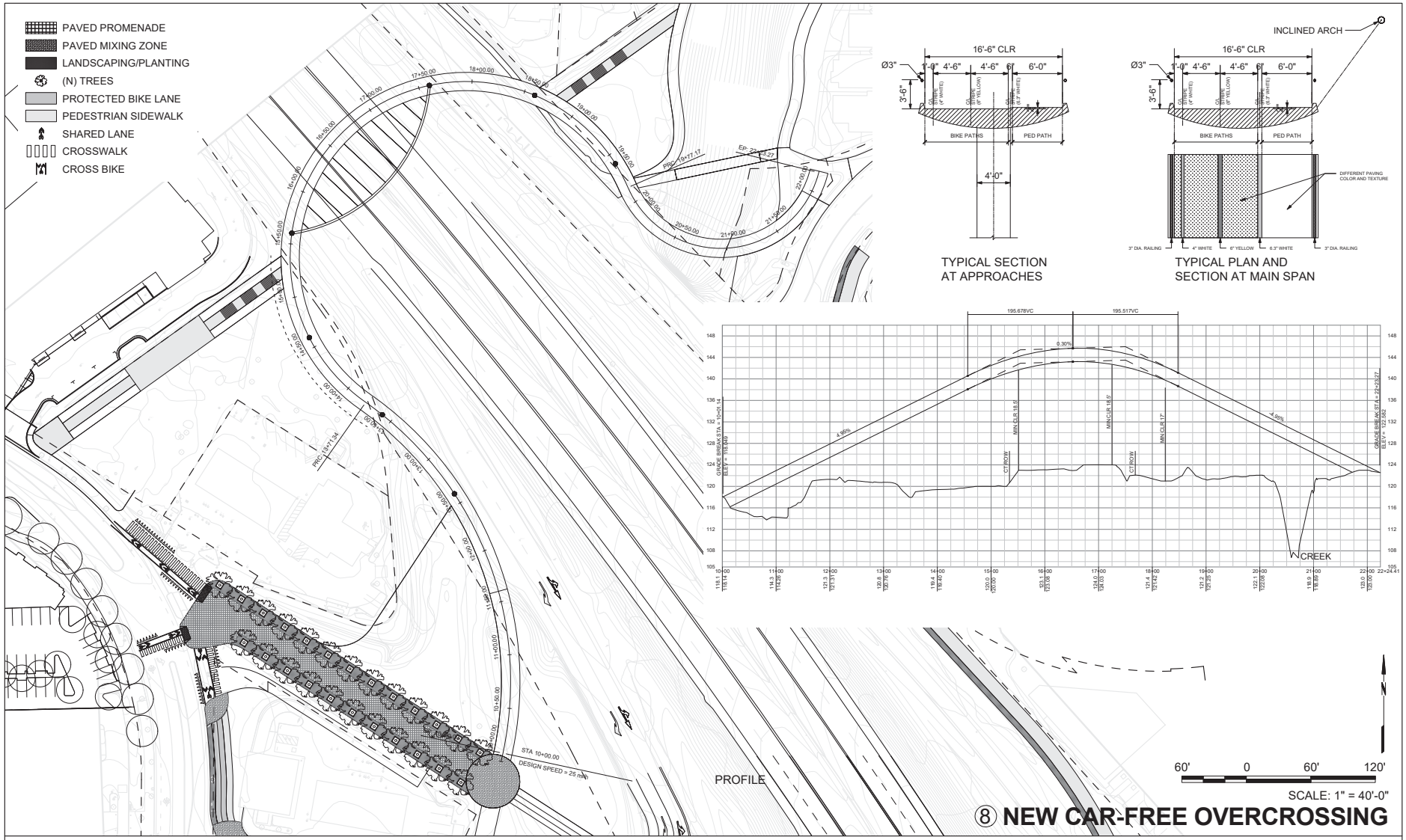


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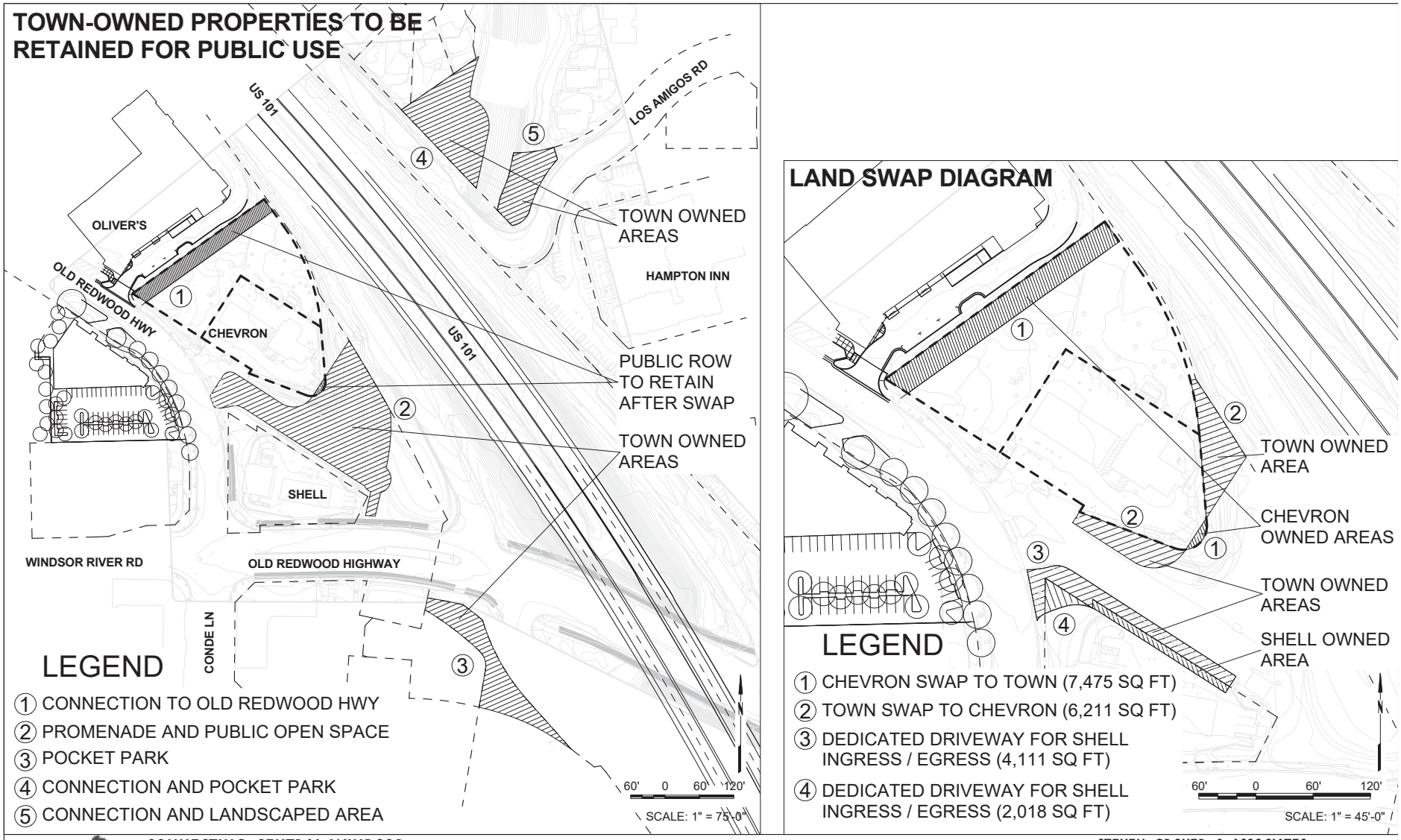
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⑧ NEW CAR-FREE OVERCROSSING

CONNECTING CENTRAL WINDSOR
CONCEPT DRAWINGS (15%)

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TOWN-OWNED PROPERTIES TO BE RETAINED FOR PUBLIC USE
US 101
LOS AMIGOS RD
OLIVER'S
OLD REDWOOD HWY
CHEVRON
HAMPTON INN
US 101
SHELL
WINDSOR RIVER RD
OLD REDWOOD HIGHWAY
CONDE LN
TOWN OWNED AREAS
PUBLIC ROW TO RETAIN AFTER SWAP
TOWN OWNED AREAS
LEGEND
① CONNECTION TO OLD REDWOOD HWY
② PROMENADE AND PUBLIC OPEN SPACE
③ POCKET PARK
④ CONNECTION AND POCKET PARK
⑤ CONNECTION AND LANDSCAPED AREA
60' 0 60' 120'
SCALE: 1" = 75'-0"
LAND SWAP DIAGRAM
TOWN OWNED AREA
CHEVRON OWNED AREAS
TOWN OWNED AREAS
SHELL OWNED AREA
LEGEND
① CHEVRON SWAP TO TOWN (7,475 SQ FT)
② TOWN SWAP TO CHEVRON (6,211 SQ FT)
③ DEDICATED DRIVEWAY FOR SHELL INGRESS / EGRESS (4,111 SQ FT)
④ DEDICATED DRIVEWAY FOR SHELL INGRESS / EGRESS (2,018 SQ FT)
60' 0 60' 120'
SCALE: 1" = 45'-0"
TOWN OF WINDSOR
CONNECTING CENTRAL WINDSOR
CONCEPT DRAWINGS (15%)
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SGA

APPENDICES

A. Public Input Questionnaires
   1. 1st Connecting Windsor Survey Results
   2. 2nd Connecting Windsor Survey Results

B. Traffic Engineering Studies
   1. 2017 Old Redwood Highway Traffic Memo
   2. 2017 Signal Warrant Memo
   3. 2017 Pedestrian-Activated Warning Sign Memo
   4. 2017 Signal Modifications Memo

C. Biological Assessments
   1. 2016 Preliminary Biological Assessment
   2. 2015 Botanical Survey

D. Windsor Creek Culvert and Bike Path Study
   1. 2008 Culvert and Bicycle Path Assessment



funded by:

TOWN OF WINDSOR

consultants:

STEVEN GROVER & ASSOCIATES ARCHITECTURE ENGINEERING

alta PLANNING + DESIGN

moffatt & nichol

TOWN OF WINDSOR

Connecting Central Windsor

July 2018



prepared by
Steven Grover & Associates

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APPENDIX A.1.

1st Connecting Windsor Survey Results

Let's Connect Windsor!

EAST-WEST PEDESTRIAN & CYCLIST CONNECTION STUDY



Survey Results

TOWN OF WINDSOR

SGA

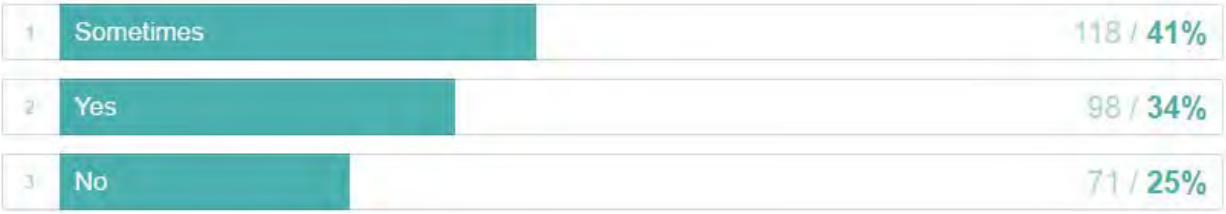
1. Do you live on the east or west side of Windsor?

283 out of 288 people answered this question



2. Are you a cyclist?

287 out of 288 people answered this question



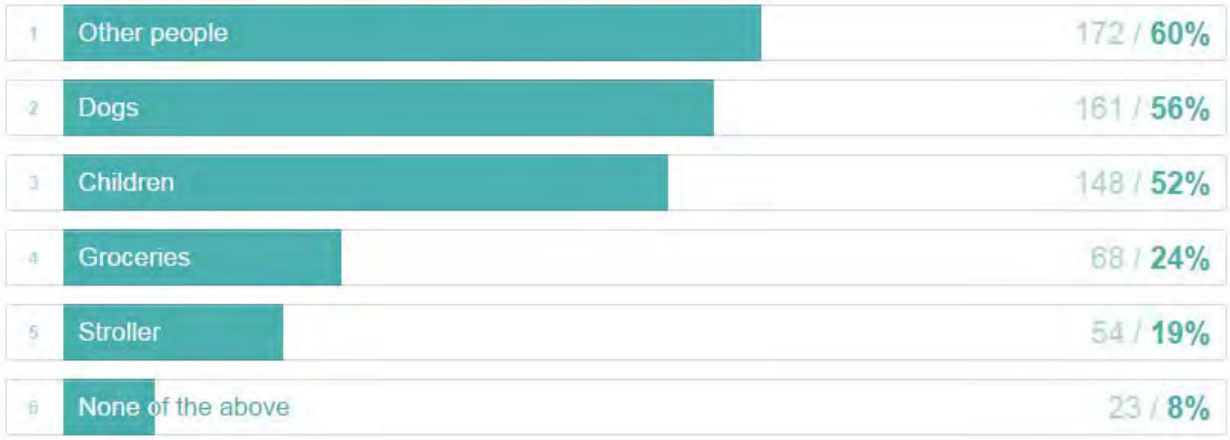
3. Are you a frequent runner?

286 out of 288 people answered this question



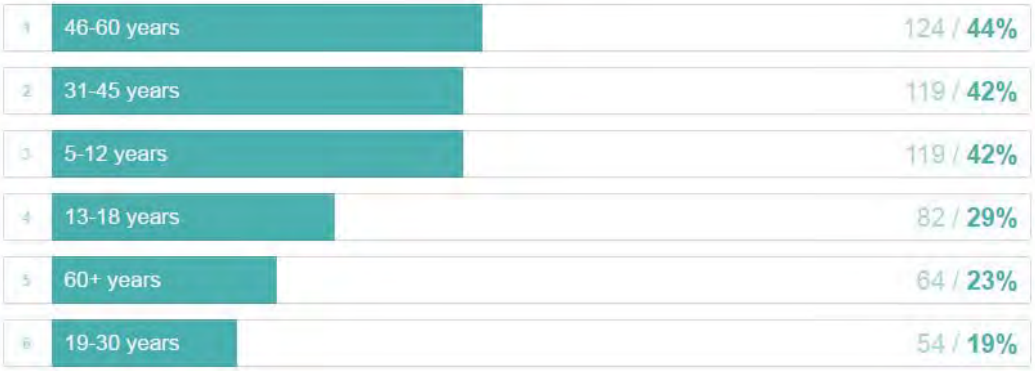
4. Do you walk or run with any of the following?

286 out of 288 people answered this question



5. What age groups in your family bike or walk in Windsor?

284 out of 288 people answered this question



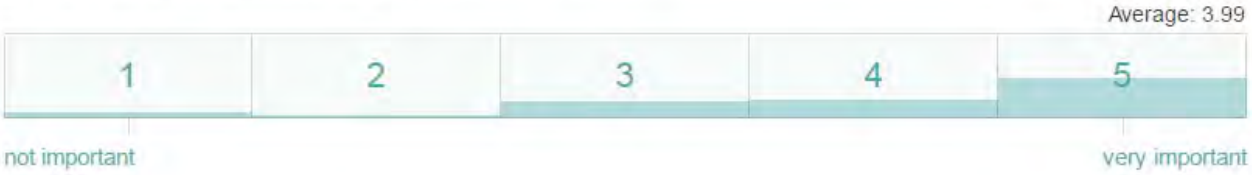
6. How important is it to improve bicycle and pedestrian connectivity between east and west Windsor?

285 out of 288 people answered this question



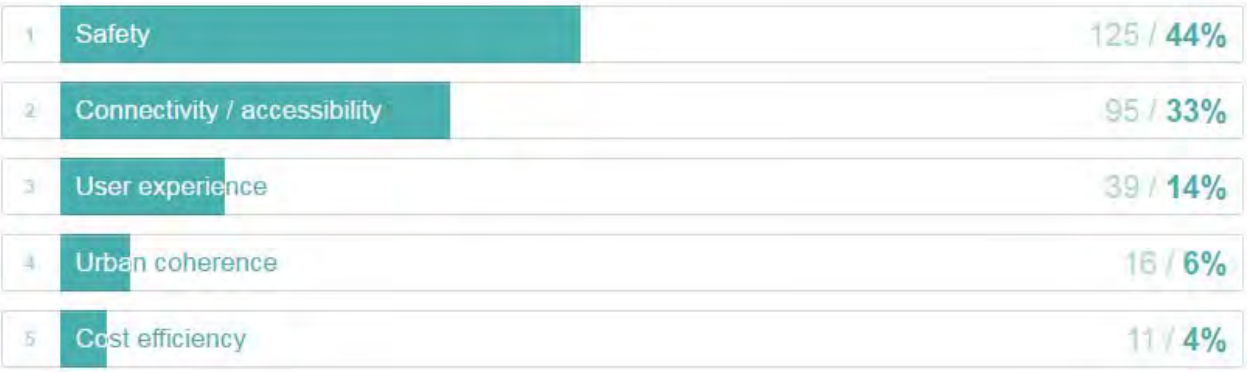
7. How important is it to create a unified town center, so that each side of the freeway still feels like it is part of the same downtown area?

284 out of 288 people answered this question



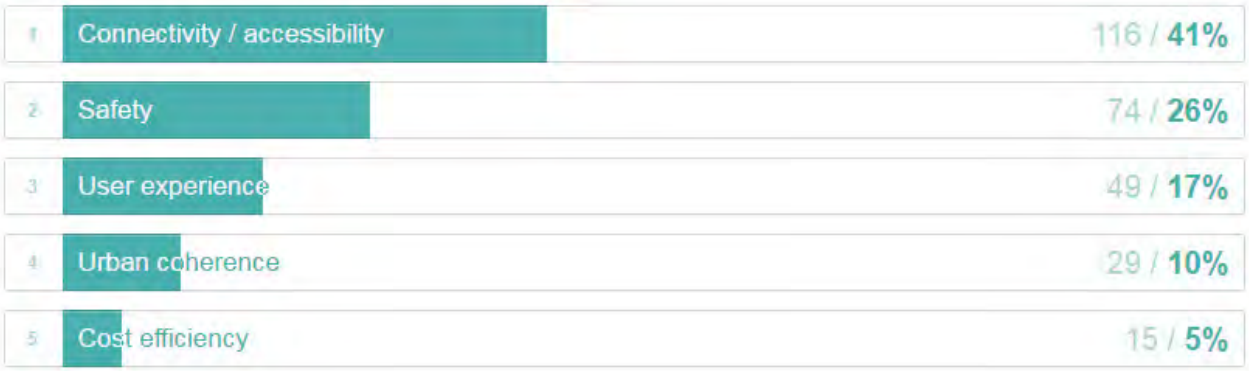
8. What is your top priority for connecting Windsor?

286 out of 288 people answered this question



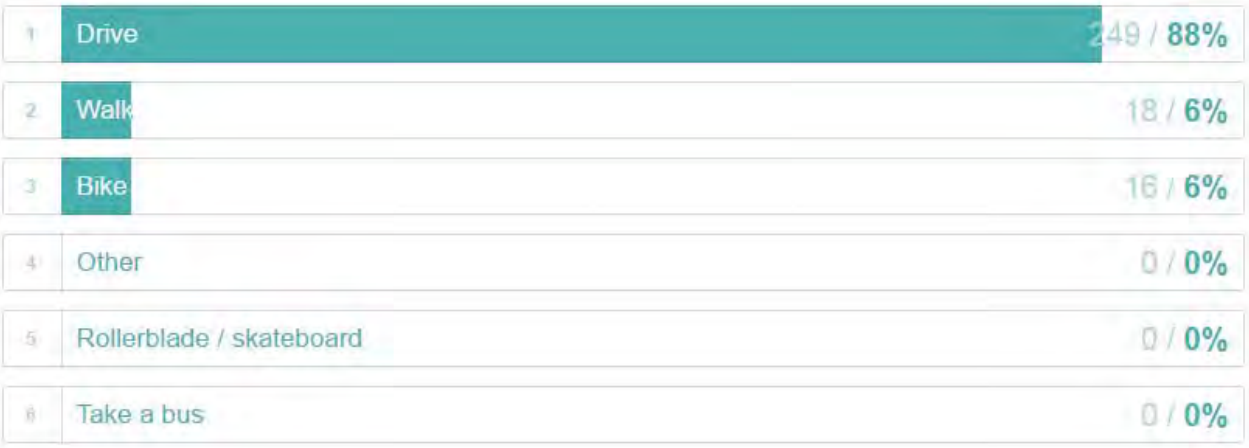
9. What is your second priority for connecting Windsor?

283 out of 288 people answered this question



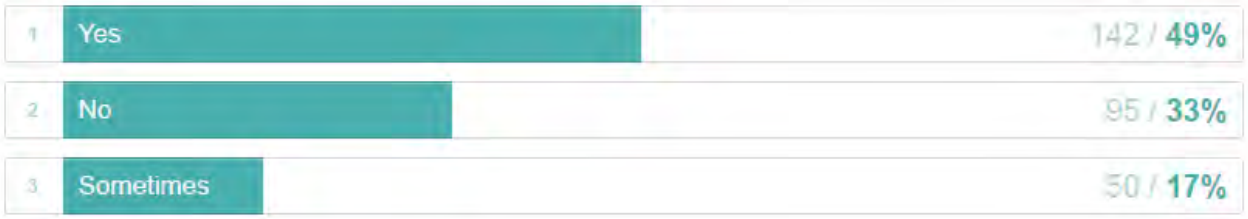
10. When traveling between east and west Windsor, what mode of transportation do you use most often?

283 out of 288 people answered this question



11. Do you ever bike or walk through the Old Redwood Highway underpass?

287 out of 288 people answered this question



12. How comfortable do you feel walking or biking through the existing Old Redwood Highway underpass?

286 out of 288 people answered this question



Average: 2.47

1	2	3	4	5

very uncomfortable — very comfortable

13. Where do you ride your bike when traveling through the existing Old Redwood Highway underpass?

280 out of 288 people answered this question





1	I choose not to ride my bike through the underpass	98 / **35%**
2	Bike lane	97 / **35%**
3	Sidewalk	85 / **30%**

14. What aspects of the existing Old Redwood Highway are safety concerns for you?

277 out of 288 people answered this question

1	Intersections and crosswalks	216 / **78%**
2	Bike lane	100 / **36%**
3	Barrier between sidewalk and roadway	82 / **30%**
4	Lighting	77 / **28%**
5	Sidewalk width	44 / **16%**

15. Which intersection(s) do you find most challenging to cross?

276 out of 288 people answered this question



1	2) US-101 NB On-ramp & ORH	171 / **62%**
2	3) SB Lakewood Dr. & ORH	112 / **41%**
3	7) US-101 SB On-ramp & ORH	89 / **32%**
4	4) NB Lakewood Dr. & ORH	80 / **29%**
5	1) US-101 SB Off-ramp & ORH	71 / **26%**

16. What enhancements would you most like to see in the Old Redwood Highway underpass?

274 out of 288 people answered this question

1	Separation between pedestrians, cyclists, and vehicles	205 / **75%**
2	Lighting	109 / **40%**
3	Wider sidewalk	64 / **23%**
4	Public art	50 / **18%**
5	Landscaping	46 / **17%**
6	Other	21 / **8%**

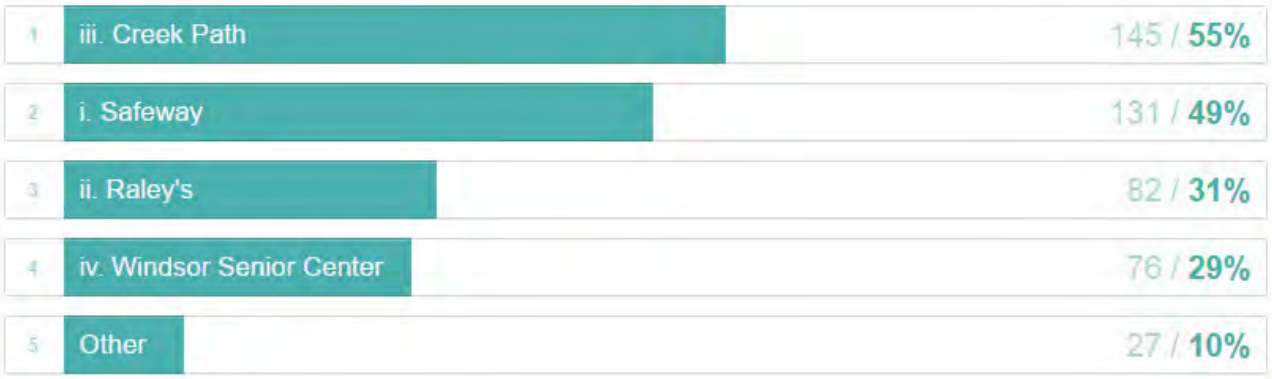
17. Which of the below statements most closely reflects your opinion?

282 out of 288 people answered this question



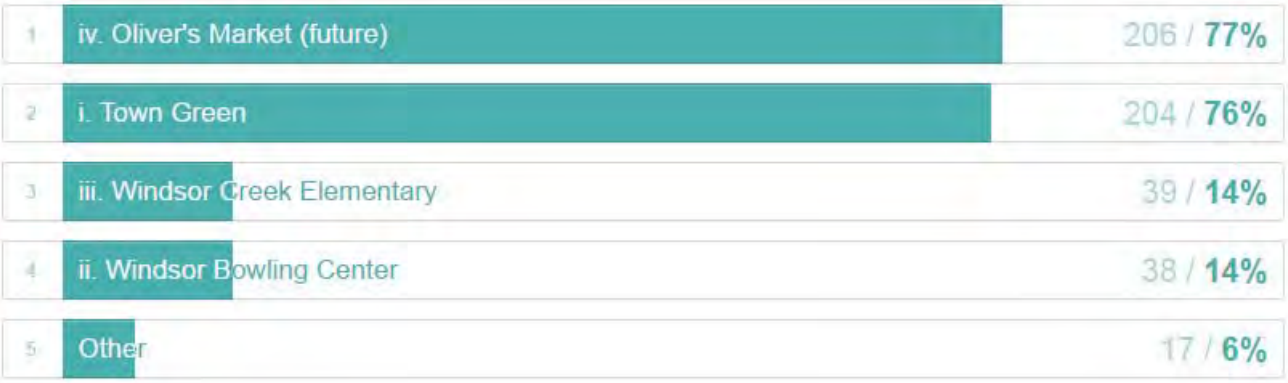
18. East side:

266 out of 288 people answered this question



19. West side:

269 out of 288 people answered this question



LET'S GO OUTSIDE
WINDSOR, CA

TOWN OF WINDSOR
DOWNTOWN PEDESTRIAN & CYCLIST CROSSING OF US 101







LET'S WALK & ROLL
WINDSOR, CA

TOWN OF WINDSOR SGA

www.ConnectingWindsor.com

APPENDIX A.2.

2nd Connecting Windsor Survey Results

Connecting Windsor

Creating a More Walkable and Bikeable Central Windsor

Survey Questionnaire Results

WELCOME

"Connecting Windsor" is a study of how to better unify the east and west sides of central Windsor. The study considers ways to improve connections and create shared urban places which contribute to a more livable, walkable, vibrant, and enjoyable Windsor Town experience.

This questionnaire is designed to elicit your ideas and feedback. Your answers to the questions below will be used by the Town Council as it formulates policy to improve opportunities for cycling, walking, and overall quality of life in Windsor. As the project moves forward, there will be many more opportunities for the Windsor community to provide feedback on specific design features.

Thank you so much for your participation!

PART I ABOUT YOU

1. How did you learn about the Connecting Windsor project?

1	Other	192 / **41%**
2	Heard about or discussed the project with family or friends	156 / **33%**
3	Visited the Connecting Windsor website	84 / **18%**
4	Windsor Times	70 / **15%**
5	Postcard or mailing	37 / **8%**
6	Poster or flyer	24 / **5%**
7	Attended the 1st Public Workshop	19 / **4%**
8	Watched the Town Council presentation	19 / **4%**
9	Listened to presentation at the 2nd Public Workshop	18 / **4%**

2. Please select the statement that best describes you:

1	I live on the EAST side of US 101, on the side with the Safeway and Raley's.	225 / **48%**
2	I live on the WEST side of US 101, on the side with the Town Green.	210 / **45%**
3	I do not live in Windsor.	31 / **7%**

3. Please select the statement that best describes you:

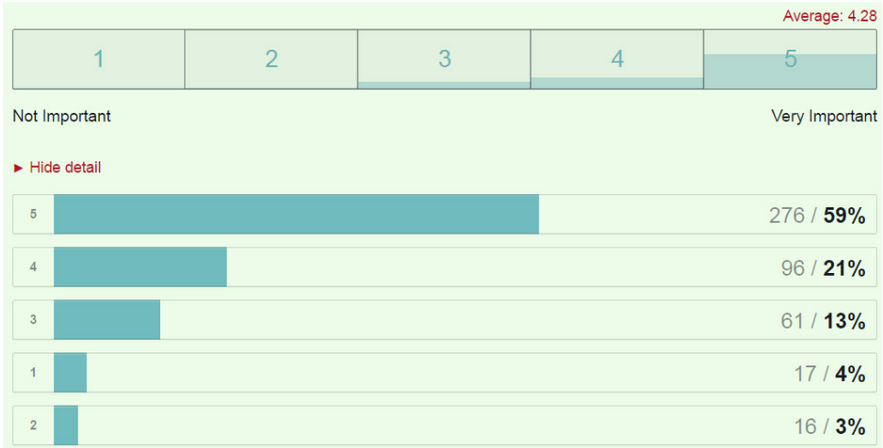
1	I mainly drive in Windsor, but occasionally walk or jog for recreation.	248 / **53%**
2	I mainly drive in Windsor, but occasionally cycle for fitness, recreation or commute.	184 / **39%**
3	Walking is the main way I get around, and I rarely drive.	13 / **3%**
4	Biking is the main way I get around, and I rarely drive.	12 / **3%**
5	I mainly use public transport or a shuttle.	6 / **1%**
6	I mostly use a wheelchair to get around central Windsor.	3 / **1%**

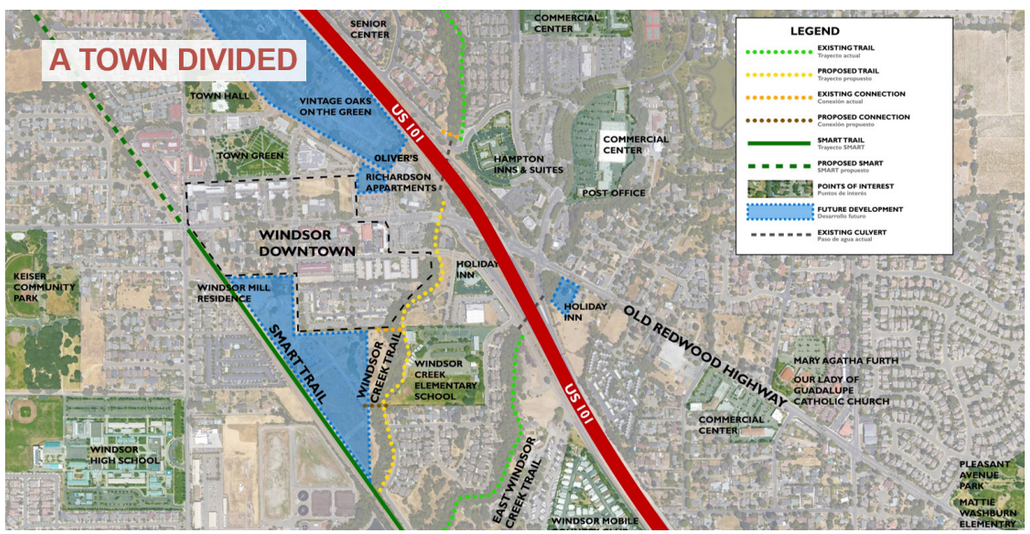
4. Please select the statement that best describes you:

1	I have lived in Windsor for 11-25 years.	164 / **35%**
2	I have lived in Windsor for 6-10 years.	98 / **21%**
3	I have lived in Windsor for 1-5 years.	90 / **19%**
4	I have lived in Windsor for more than 25 years.	84 / **18%**
5	I do not live in Windsor.	30 / **6%**

PART II NEED FOR PROJECT

5. How important is it to better unify the east and west sides of central Windsor by creating shared urban spaces and connections that are safer and more inviting for pedestrians and cyclists?

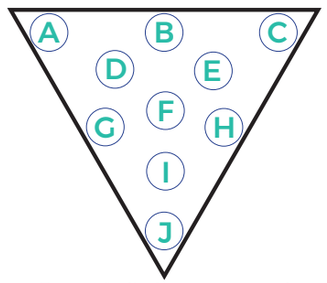




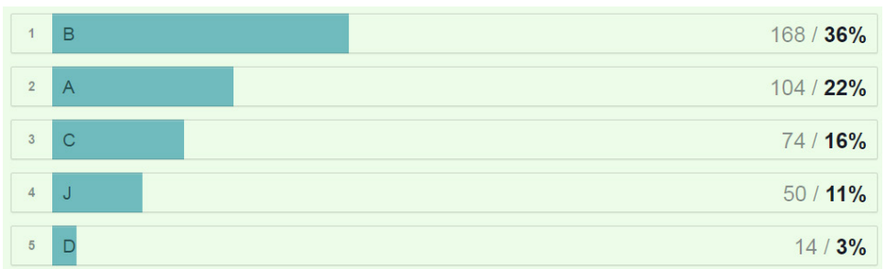
6. Please mark a dot within the triangle to best represent your point of view:

I would WALK more if many of the improvements presented in the Connecting Windsor Study were implemented.

I would BIKE more if many of the improvements presented in the Connecting Windsor Study were implemented.



Even if all the suggested improvements were made I would not walk or bike more.



OLD RED CROSSING SERVES MAJORITY OF TOWN

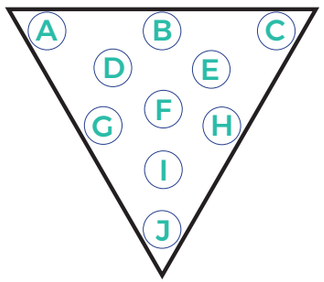


Note: top five responses displayed for triangle questions

PART III EXISTING OLD REDWOOD HIGHWAY CROSSING

7. Please mark a dot within the triangle to best represent your point of view:

The freeway ramp INTERSECTIONS are the biggest issue.



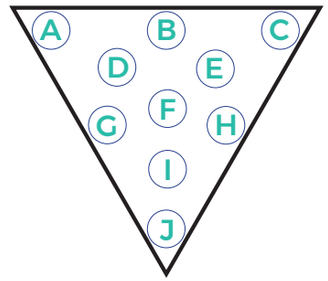
The dark and unpleasant SPACE is the biggest issue.

I don't have any issues with the underpass as it is.

1	A	152 / **33%**
2	B	144 / **31%**
3	J	56 / **12%**
4	C	46 / **10%**
5	D	19 / **4%**

8. Please mark a dot within the triangle to best represent your point of view:

The underpass needs to be improved, but since we will never be able to eliminate the safety challenges at the freeway on and off ramps, a new car-free crossing is also needed.



An additional crossing is not needed. Improvements to the existing underpass alone would be enough to improve connectivity and safety for cyclists and pedestrians in central Windsor.

The underpass is fine the way it is now. No new crossing and no improvements are needed for crossing Highway 101 by foot or by bicycle.

1	A	239 / **51%**
2	B	68 / **15%**
3	C	64 / **14%**
4	J	34 / **7%**
5	D	25 / **5%**


Northbound On-Ramp intersection

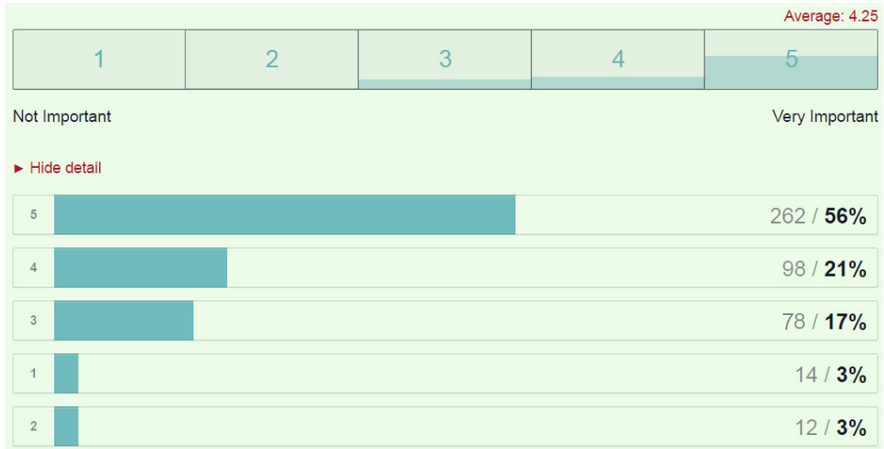

Existing Underpass Sidewalk

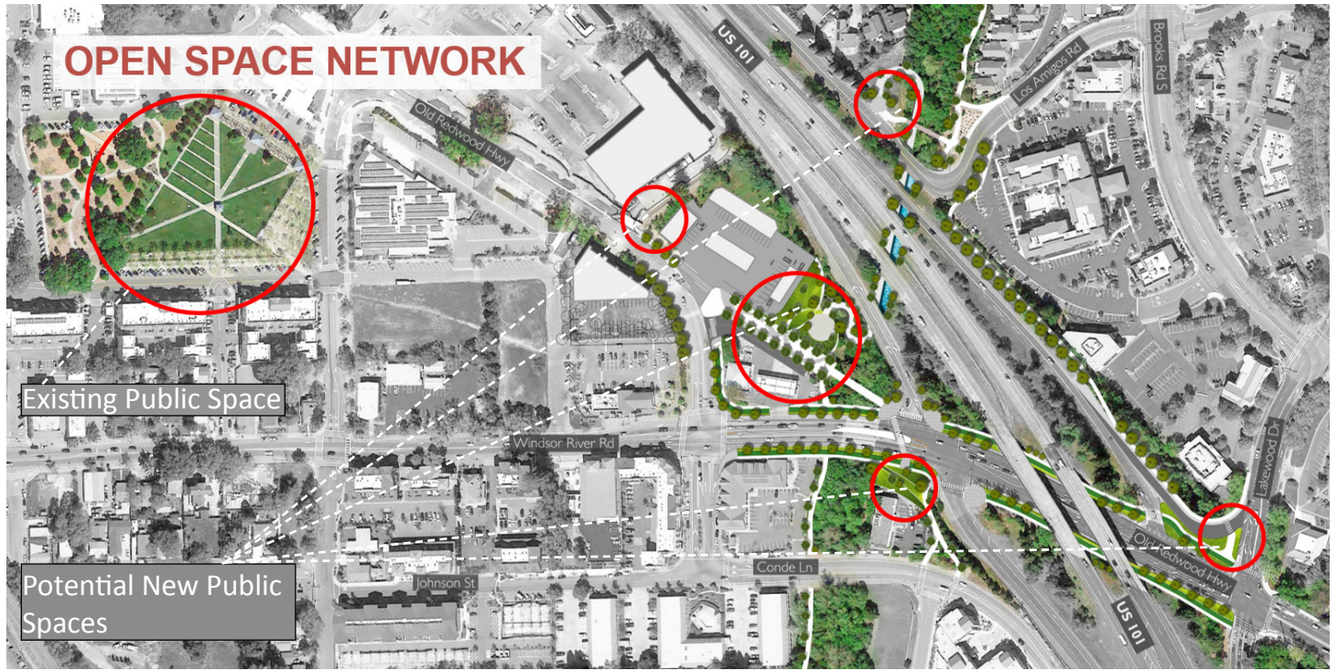

Widened Sidewalk & Protected Bike Lanes

Note: top five responses displayed for triangle questions

PART IV PUBLIC SPACES

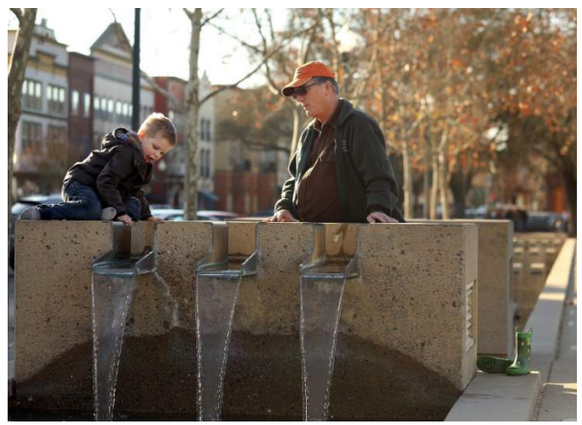
9. How important is it to set aside some of the remaining undeveloped land in central Windsor for future development as public open space?









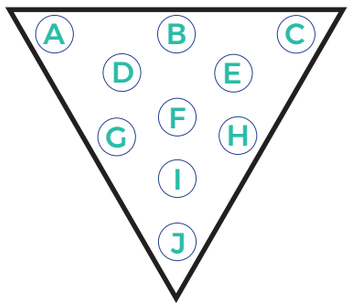




PART V NEW FREEWAY ON-RAMP

10. Please mark a dot within the triangle to best represent your point of view:

The marginal congestion and safety improvements a slip ramp would provide are not worth it.



More cost-benefit study is needed to see if a slip ramp would be worth it.

The traffic and safety issues in this area are terrible. Any improvements would be worth it.

1	J	176 / **38%**
2	C	61 / **13%**
3	H	55 / **12%**
4	A	52 / **11%**
5	B	33 / **7%**


Intersection of Lakewood Dr. + Old Redwood Highway


Existing Intersection of Lakewood Dr. +Old Redwood Hwy + NB On-Ramp

Congestion on Lakewood reduced

Vehicles crossing bike lane and crosswalk reduced by 25%



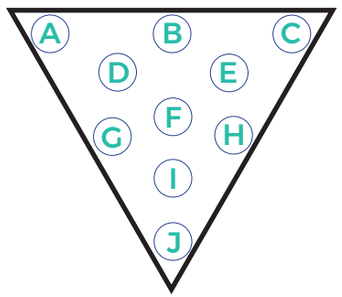
New Freeway On-Ramp from Lakewood Dr. to NB 101

Note: top five responses displayed for triangle questions

PART VI NEW OVER OR UNDER CROSSING

11. Please mark a dot within the triangle to best represent your point of view:
(See next page for undercrossing images)

An undercrossing would be shorter and allow people to experience the creek. I would prefer an undercrossing even if it costs more and takes longer to design and build.



Even a conventional overcrossing with switchbacks would be better than an undercrossing.

A new crossing of Highway 101 is not needed.





Note: top five responses displayed for triangle questions



Overcrossing total length: 1220 feet







Undercorssing total approximate length: 900 feet

APPENDIX B.1.

2017 Old Redwood Highway Traffic Memo

Memorandum

Date: January 30, 2017

Project: WIN937

To: Mr. Stuart Hayre, PE
Ms. Mona Ibrahim, PE
Town of Windsor

From: Dalene J. Whitlock
dwhitlock@w-trans.com
Briana Byrne
bbyrne@w-trans.com

Subject: Operational Analysis – Old Redwood Highway

As requested, W-Trans has prepared additional traffic engineering analysis supporting the ongoing Downtown Bicycle/Pedestrian Crossing Study.

Study Area

The study area for the operational analysis task includes Old Redwood Highway from Lakewood Drive to Conde Lane and Conde Lane from Old Redwood Highway to Armando Renzullo Way with specific emphasis on the Old Redwood Highway intersections at the US 101 North On-Ramp and the Lakewood Drive-US 101 North Off-Ramp.

Operational Analysis

The operational analysis was performed using count data from the General Plan Update as well as counts collected at the intersection of Old Redwood Highway/US 101 North On-Ramps on October 26, 2016 and November 17, 2016 which differentiated the origin of the vehicles turning right onto the on-ramp and originating from either Lakewood Drive or Old Redwood Highway. The network included conditions without and with the conceptual plans for a slip-lane for southbound vehicles form Lakewood Drive to US 101 North Ramp and removal of the eastbound right-turn lane at Old Redwood Highway/US 101 South Ramps. The slip lane is being considered in order to reduce the number of vehicles conflicting with the pedestrian crossing of the on-ramp, and consideration is being given to eliminating the eastbound right-turn lane between the intersection at Conde Lane-Windsor River Road and the US 101 South On-ramp in order to free up space for non-vehicular modes. The analysis includes the delay of specific movements and routes in addition to the associated queuing during the morning and evening peak periods. It is understood that the tee intersection of Conde Lane and Johnson Street, which is currently stop controlled on each approach, will be modified to only have stop control on the Johnson Street approach. For the purpose of this analysis, this modification was also assumed to be completed.

Delay

Within the study area, the delays incurred for specific movements and along two routes were reviewed. Generally delay at an intersection is reported with a Level of Service (LOS). The delay reported along a route is the summation of the delay through each intersection in addition to any delay between the intersections on the roadway segments.

Intersection Turning Movements

The delay of two movements, the southbound right turn from Lakewood Drive to Old Redwood Highway, without and with the conceptual slip lane to the north, and the eastbound left turn from Old Redwood Highway

to the US 101 North On-Ramp, were reviewed. These intersections were analyzed using methodologies published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 2000.

These results are summarized in Table 1.

Table 1 – Existing and "Plus Project" Peak Hour Movement Levels of Service

Study Intersection ***Approach***	**Existing Conditions**				**"Plus Project" Conditions**			
	AM Peak		**PM Peak**		**AM Peak**		**PM Peak**	
	Delay	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**
1. ORH/Lakewood Dr-US 101N Off-Ramp	40.3	D	55.0	D	39.5	D	53.0	D
SB Right turn from Lakewood Dr	*31.8*	*C*	*63.9*	*E*	*29.0*	*C*	*53.1*	*D*
2. ORH/US 101N On-Ramp								
*EB Left turn from Old Redwood Hwy**	*14.0*	*B*	*15.1*	*C*	*14.6*	*B*	*14.5*	*B*

Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service; ORH = Old Redwood Highway; The results for the movements are reported in *Italics*; * = Results for the movement at the uncontrolled intersections are reported as control delay

The Town of Windsor has adopted an acceptable service level of LOS D for all intersections except the US 101 North Off-Ramp-Lakewood Drive/Old Redwood Highway which has been grandfathered in with LOS E being accepted. Though this standard applies to the intersection's overall service level and not a single movement, the delay for the southbound right-turn movement, on its own with the existing configuration, is considered acceptable at LOS E. With the conceptual slip-lane, the service level improves to LOS D for the southbound right-turn movement. The eastbound left-turn movement, on its own, has an acceptable service level of B or high C with or without the conceptual modifications at the intersection.

Corridor Travel Times

The delay along routes of travel were evaluated using the SIMTRAFFIC application of Synchro. The first route was westbound on Old Redwood Highway from Lakewood Drive to Conde Lane and then southbound to Armando Renzullo Way, with the second route being eastbound Old Redwood Highway from Conde Lane to Lakewood Drive. The conceptual modifications at both US 101 Ramps were included in the "plus Project" travel time rounds. The results of the travel times are summarized in Table 2.

Table 2 –Travel Time and Speed

Direction	**Peak Hour**	**Existing Conditions**				**"Plus Project" Conditions**			
		Delay (sec/veh)	**Travel Time (min)**	**Avg Speed (mph)**	**LOS (Class III/ IV)***	**Delay (sec/veh)**	**Travel Time (min)**	**Avg Speed (mph)**	**LOS (Class III/ IV)***
Route 1 – Westbound	AM	132.5	3.2	9	F/D	117.2	2.9	9	F/D
	PM	140.4	3.5	9	F/D	107.5	2.8	9	F/D
Route 2 – Eastbound	AM	37.5	1.0	14	D	38.5	1.0	14	D
	PM	48.2	1.2	11	E	52.3	1.2	11	E

Note: * = Level of Service for roadways is based on classification- Old Redwood Highway is Class III and Conde Lane is Class IV. Level of service shown is for the average speed along both roads

Route 1, or westbound travel, operates with the same average travel speed during the morning and evening peak hours, with only a slightly longer travel time during the evening peak hour. With the addition of the slip

lane delay would be expected to decrease during both peaks, though the overall average travel speed and service level are not expected to change. Route 2, which is in the eastbound direction, has higher delay during the p.m. peak hour compared to the a.m. peak hour. With the conceptual project, the delay in the eastbound direction is expected to increase slightly but the travel time and average speed is excepted remain the same. Both routes report average speeds less than the posted speed limit. It is noted that Old Redwood Highway, a Class III arterial, is operating at LOS F in both directions during both peak periods, while the same speed of travel translates to LOS D operation on Conde Lane, which was considered a Class IV arterial.

Queuing

The projected queuing was determined for both the movements and the routes evaluated under both existing geometrics and with the potential changes. The maximum queue length was determined using an average of ten runs in the SIMTRAFFIC application of Synchro. Summarized in Table 3 are the predicted queue lengths for the routes and movements reviewed.

Table 3 – Maximum Queues Under Along Routes Evaluated

Study Intersection Approach	Available Storage*	Existing Maximum Queues		"Plus Project" Maximum Queues	
		AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Conde Ln/Armando Renzullo Wy					
EB on Conde Ln	*400*	268	127	257	116
Conde Ln/Johnson St					
SB on Conde Ln	*190*	31	6	72	9
ORH-Windsor River Rd/Conde Ln					
WBL from ORH	213	237	212	237	226
ORH-US 101 South Ramps					
WB Thru on ORH**	*420*	42	136	66	88
EB Thru on ORH**	*420*	213	168	253	165
ORH-US 101 North On Ramp					
WB Thru on ORH	*140*	124	75	119	21
EBL from ORH	*260*	254	230	125	116
ORH/US 101N Off Ramp-Lakewood Dr					
SBR from Lakewood Dr	*435*	420	435	210	197

Notes: Maximum Queue based on the average of the maximum value from ten SIMTRAFFIC runs; all distances are measured in feet; * = Segment distance reported where there was no storage bay and measured using available aerials ** = average of both through movements

With the Southbound slip-lane on Lakewood Drive to US 101 North Ramps and the removal of the westbound right-turn lane at the Old Redwood Highway/US 101 South Ramps intersection, the maximum queue is reported to exceed the available storage in the westbound left-turn lane on Old Redwood Highway at Conde Lane by the length of about one vehicle only during the evening peak hour.

Conclusions and Recommendations

- The operation analysis indicates that, as would be expected, provision of a slip lane from southbound Lakewood Drive to the US 101 North on-ramp reduces delay for that movement as well as for the intersection as a whole. Operation for the eastbound left-turn from Old Redwood Highway to the US 101 North On-Ramp would be minimally affected by the addition of the slip lane.

- The provision of the slip lane between Lakewood Drive and the US 101 North On-ramp as well as the elimination of the right-turn lane on Old Redwood Highway between Conde Lane-Windsor River Road and the US 101 South On-ramp would be expected to have a nominal effect on delay, travel time and travel speed for the corridors evaluated.

- The projected maximum queue exceeds the available storage length for the westbound left-turn from Old Redwood Highway to Conde Lane by one vehicle during the evening peak hour.

- It is recommended that the westbound left-turn pocket on Old Redwood Highway at Conde Lane be extended to provide adequate stacking space.

DJW/bkb/WIN937.M2

Attachments: Corridor travel times
Queuing

Arterial Level of Service
AM Peak Hour - Existing Conditions

12/13/2016

Arterial Level of Service: EB #1 Route 1

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Armondo Rezula Way	19	13.1	21.8	0.1	13
Conde Lane #1	30	3.4	16.6	0.1	19
Old Redwood Highway	16	14.7	25.0	0.1	8
US 101 SB Ramps	17	22.1	32.7	0.1	10
US 101 NB On Ramp	100	6.9	16.2	0.1	22
US 101 NB Off Ramp	18	21.5	27.9	0.0	5
Brooks Road	12	33.5	46.7	0.1	8
Total		115.2	186.9	0.6	11

Arterial Level of Service: WB #1 Route 1

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Old Redwood Highway	18	22.8	32.4	0.1	11
US 101 NB On Ramp	100	14.2	21.2	0.0	7
US 101 SB Ramps	17	2.7	12.6	0.1	29
Old Redwood Highway	16	71.2	81.4	0.1	4
Johnson Street	30	1.8	11.9	0.1	17
Armondo Rezula Way	19	19.8	31.9	0.1	10
Total		132.5	191.3	0.5	9

Arterial Level of Service
AM Peak Hour - Existing Conditions With Project

1/25/2017

Arterial Level of Service: EB #1 Route 1

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Conde Lane #1	30	4.3	17.3	0.1	19
Old Redwood Highway	16	17.8	28.3	0.1	7
US 101 SB Ramps	17	22.3	33.1	0.1	10
US 101 NB On Ramp	100	4.1	13.1	0.1	28
US 101 NB Off Ramp	18	19.7	26.4	0.0	6
Total		68.2	118.2	0.4	11

Arterial Level of Service: WB #1 Route 1

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Old Redwood Highway	18	25.6	32.0	0.0	5
US 101 NB On Ramp	100	1.1	8.5	0.0	17
US 101 SB Ramps	17	3.2	13.6	0.1	27
Old Redwood Highway	16	65.5	76.1	0.1	4
Johnson Street	30	1.8	12.1	0.1	16
Armondo Rezula Way	19	19.9	32.4	0.1	10
Total		117.2	174.8	0.4	9

Arterial Level of Service
PM Peak Hour - Existing Conditions 12/13/2016

Arterial Level of Service: EB #1 Route 1

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Armondo Rezulo Way	33	13.2	20.4	0.1	11
Conde Lane #1	30	3.4	16.7	0.1	20
Old Redwood Highway	16	13.3	24.4	0.1	9
US 101 SB Ramps	17	22.4	32.9	0.1	10
US 101 NB On Ramp	100	21.5	32.0	0.1	12
US 101 NB Off Ramp	18	34.3	41.0	0.0	4
Brooks Road	12	11.8	23.7	0.1	16
Total		120.0	191.0	0.6	10

Arterial Level of Service: WB #1 Route 1

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Old Redwood Highway	18	43.6	60.7	0.1	7
US 101 NB On Ramp	100	16.0	22.9	0.0	6
US 101 SB Ramps	17	5.8	15.5	0.1	23
Old Redwood Highway	16	62.6	72.7	0.1	4
Johnson St	30	1.7	12.3	0.1	17
Armondo Rezulo Way	33	10.8	23.7	0.1	14
Total		140.4	207.9	0.5	9

Arterial Level of Service
PM Peak Hour - Existing Conditions With Project 1/25/2017

Arterial Level of Service: EB #1 Route 1

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Conde Lane #1	30	3.6	17.2	0.1	20
Old Redwood Highway	16	14.8	25.6	0.1	8
US 101 SB Ramps	17	15.6	26.5	0.1	12
US 101 NB On Ramp	100	7.3	16.2	0.1	22
US 101 NB Off Ramp	18	29.9	36.6	0.0	4
Total		71.4	122.1	0.4	11

Arterial Level of Service: WB #1 Route 1

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Old Redwood Highway	18	28.8	35.2	0.0	5
US 101 NB On Ramp	100	0.7	8.0	0.0	18
US 101 SB Ramps	17	5.3	15.5	0.1	23
Old Redwood Highway	16	59.3	69.5	0.1	5
Johnson St	30	1.7	12.7	0.1	17
Armondo Rezulo Way	33	11.7	24.5	0.1	14
Total		107.5	165.4	0.4	9

Arterial Level of Service
AM Peak Hour - Existing Conditions 12/13/2016

Arterial Level of Service: EB #2 Route 2

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
US 101 SB Ramps	17	11.6	20.6	0.1	16
US 101 NB On Ramp	100	6.4	15.7	0.1	23
US 101 NB Off Ramp	18	19.5	24.3	0.0	6
Total		37.5	60.7	0.2	14

Arterial Level of Service: WB #2 Route 2

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
US 101 NB On Ramp	100	4.9	10.0	0.0	15
US 101 SB Ramps	17	2.7	12.6	0.1	29
Old Redwood Highway	16	27.7	36.2	0.1	9
Total		35.4	58.8	0.2	14

Arterial Level of Service
AM Peak Hour - Existing Conditions With Project 1/25/2017

Arterial Level of Service: EB #3 Route 2

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
US 101 SB Ramps	17	14.0	22.9	0.1	14
US 101 NB On Ramp	100	4.1	13.1	0.1	28
US 101 NB Off Ramp	18	20.5	25.7	0.0	6
Total		38.5	61.7	0.2	14

Arterial Level of Service: WB #3 Route 2

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
US 101 NB On Ramp	100	4.5	8.8	0.0	17
US 101 SB Ramps	17	3.2	13.6	0.1	27
Old Redwood Highway	16	28.0	36.8	0.1	9
Total		35.7	59.2	0.2	14

Arterial Level of Service
PM Peak Hour - Existing Conditions With Project 1/25/2017

Arterial Level of Service: EB #3 Route 2

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
US 101 SB Ramps	17	10.3	19.2	0.1	17
US 101 NB On Ramp	100	7.3	16.2	0.1	22
US 101 NB Off Ramp	18	34.6	39.4	0.0	4
Total		52.3	74.8	0.2	11

Arterial Level of Service: WB #3 Route 2

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
US 101 NB On Ramp	100	3.0	7.2	0.0	21
US 101 SB Ramps	17	5.3	15.5	0.1	23
Old Redwood Highway	16	26.9	35.4	0.1	9
Total		35.2	58.0	0.2	14

Arterial Level of Service
PM Peak Hour - Existing Conditions 1/26/2017

Arterial Level of Service: EB #1 Route 2

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
US 101 SB Ramps	17	5.2	14.2	0.1	23
US 101 NB On Ramp #3	100	13.9	23.5	0.1	16
US 101 NB Off Ramp	18	29.1	35.5	0.0	4
Total		48.2	73.2	0.2	11

Arterial Level of Service: WB #1 Route 2

Cross Street	Node	Delay (s/veh)	Travel time (s)	Dist (mi)	Arterial Speed
Old Redwood Highway	18	29.6	41.5	0.1	10
US 101 NB On Ramp #3	100	14.4	21.1	0.0	7
US 101 SB Ramps	17	3.8	13.6	0.1	27
Old Redwood Highway	16	25.6	34.3	0.1	9
Total		73.5	110.5	0.3	11

Intersection: 16: Conde Lane #1/Old Redwood Highway & Windsor River Road /Old Redwood Highway

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	R	L	T	R	L	TR
Maximum Queue (ft)	75	753	111	237	350	81	64	183	95	94	331
Average Queue (ft)	26	614	108	178	235	35	27	83	73	91	260
95th Queue (ft)	69	865	124	276	412	126	70	192	113	102	412
Link Distance (ft)		756			339	339		188			316
Upstream Blk Time (%)		5			4	0		3			28
Queuing Penalty (veh)		33			15	1		12			0
Storage Bay Dist (ft)	86		86	213			71		71	70	
Storage Blk Time (%)	0	18	58	9	9		1	14	10	67	9
Queuing Penalty (veh)	1	64	186	35	19		4	38	11	92	22

Intersection: 17: US 101 SB Ramps & Old Redwood Highway #2

Movement	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	R	L	T	T	L	LT	R
Maximum Queue (ft)	196	230	202	413	80	3	95	142	53
Average Queue (ft)	70	81	99	329	22	1	44	72	40
95th Queue (ft)	208	226	216	452	93	6	109	147	64
Link Distance (ft)	339	339	339	413	413	413		714	
Upstream Blk Time (%)	3	1	1	3					
Queuing Penalty (veh)	9	4	2	15					
Storage Bay Dist (ft)							330		25
Storage Blk Time (%)								57	14
Queuing Penalty (veh)								67	13

Intersection: 18: US 101 NB Off Ramp/Lakewood Drive #1 & Old Redwood Highway #2/Old Redwood Hig

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	T	T	TR	L	LT	TR	L	L	R
Maximum Queue (ft)	96	110	260	439	396	183	224	185	112	132	420
Average Queue (ft)	49	60	148	305	275	97	128	123	75	103	270
95th Queue (ft)	98	120	262	552	518	183	245	200	127	145	494
Link Distance (ft)	158	158	158	1989	1989		364			441	441
Upstream Blk Time (%)			10				0				1
Queuing Penalty (veh)			24				0				5
Storage Bay Dist (ft)						225		225	160		
Storage Blk Time (%)						0	1	0	0	0	
Queuing Penalty (veh)						1	2	1	0	0	

Intersection: 19: Armondo Rezula Way & Conde Lane #1

Movement	EB	WB	WB	NB
Directions Served	TR	L	T	LR
Maximum Queue (ft)	268	67	144	108
Average Queue (ft)	169	37	80	62
95th Queue (ft)	285	73	147	117
Link Distance (ft)	393	374	374	209
Upstream Blk Time (%)	0			
Queuing Penalty (veh)	0			
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 30: Johnson Street & Conde Lane #1

Movement	EB	WB	SB
Directions Served	LT	R	LR
Maximum Queue (ft)	74	58	31
Average Queue (ft)	43	12	6
95th Queue (ft)	79	68	38
Link Distance (ft)	373		188
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		300	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 100: Old Redwood Highway #2 & US 101 NB On Ramp

Movement	EB	EB	EB	WB	WB
Directions Served	L	T	T	T	TR
Maximum Queue (ft)	254	247	161	124	143
Average Queue (ft)	177	99	23	40	56
95th Queue (ft)	308	375	139	131	194
Link Distance (ft)		413	413	158	158
Upstream Blk Time (%)		7	0	1	7
Queuing Penalty (veh)		28	0	5	52
Storage Bay Dist (ft)	260				
Storage Blk Time (%)	21	0			
Queuing Penalty (veh)	73	0			

Zone Summary

Zone wide Queuing Penalty: 834

Intersection: 16: Conde Lane #1/Old Redwood Highway & Windsor River Road /Old Redwood Highway

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	R	L	T	R	L	TR
Maximum Queue (ft)	77	532	111	237	366	156	76	170	94	95	328
Average Queue (ft)	31	370	105	149	283	46	36	78	73	91	225
95th Queue (ft)	77	643	122	270	419	159	83	179	110	101	382
Link Distance (ft)		755			341	341		212			316
Upstream Blk Time (%)					8	0		1			17
Queuing Penalty (veh)					41	2		3			0
Storage Bay Dist (ft)	86		86	213			71		71	70	
Storage Blk Time (%)	0	16	36	2	22		6	15	6	61	10
Queuing Penalty (veh)	2	51	97	11	34		16	33	8	56	25

Intersection: 17: US 101 SB Ramps & Old Redwood Highway #2

Movement	EB	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	T	R	L	T	T	L	LT	R
Maximum Queue (ft)	170	165	102	340	213	58	182	222	50
Average Queue (ft)	85	86	35	228	79	13	85	129	44
95th Queue (ft)	240	247	105	378	225	67	195	242	63
Link Distance (ft)	341	341	341	413	413	413		714	
Upstream Blk Time (%)	1	1		1					
Queuing Penalty (veh)	3	3		3					
Storage Bay Dist (ft)							330		25
Storage Blk Time (%)								64	31
Queuing Penalty (veh)								118	57

Intersection: 18: US 101 NB Off Ramp/Lakewood Drive #1 & Old Redwood Highway #2/Old Redwood Hig

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	T	T	TR	L	LT	TR	L	L	R
Maximum Queue (ft)	171	163	280	397	423	237	389	250	181	299	435
Average Queue (ft)	86	96	257	265	319	191	356	242	138	197	357
95th Queue (ft)	171	169	297	487	566	286	458	270	214	343	573
Link Distance (ft)	158	158	158	1989	1989		364			441	441
Upstream Blk Time (%)	1	2	56				34			0	9
Queuing Penalty (veh)	3	5	144				0			0	42
Storage Bay Dist (ft)						225		225	160		
Storage Blk Time (%)						7	12	34	10	21	
Queuing Penalty (veh)						58	76	220	16	33	

Intersection: 30: Johnson St & Conde Lane #1

Movement	EB	WB	SB
Directions Served	LT	R	LR
Maximum Queue (ft)	42	18	6
Average Queue (ft)	24	3	1
95th Queue (ft)	51	21	11
Link Distance (ft)	183		212
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		300	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 33: Armondo Rezulo Way & Conde Lane #1

Movement	EB	WB	WB	NB
Directions Served	TR	L	T	LR
Maximum Queue (ft)	127	20	140	38
Average Queue (ft)	73	4	79	14
95th Queue (ft)	139	22	141	39
Link Distance (ft)	431	306	306	270
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 100: Old Redwood Highway #2 & US 101 NB On Ramp

Movement	EB	EB	EB	WB	WB
Directions Served	L	T	T	T	TR
Maximum Queue (ft)	230	334	323	75	84
Average Queue (ft)	158	111	223	22	23
95th Queue (ft)	290	383	468	81	102
Link Distance (ft)		413	413	158	158
Upstream Blk Time (%)		5	4		1
Queuing Penalty (veh)		19	17		10
Storage Bay Dist (ft)	260				
Storage Blk Time (%)	12	1			
Queuing Penalty (veh)	47	1			

Zone Summary

Zone wide Queuing Penalty: 1253

Intersection: 16: Conde Lane #1/Old Redwood Highway & Windsor River Road /Old Redwood Highway

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	R	L	T	R	L	TR
Maximum Queue (ft)	83	698	111	212	322	80	62	206	96	94	323
Average Queue (ft)	29	468	107	141	203	30	32	127	84	92	271
95th Queue (ft)	79	756	120	239	363	98	70	238	114	101	410
Link Distance (ft)		756			340	340		201			316
Upstream Blk Time (%)		1			4	0		5			27
Queuing Penalty (veh)		9			15	0		18			0
Storage Bay Dist (ft)	86		86	213			71		71	70	
Storage Blk Time (%)	1	24	44	4	10		3	15	16	66	9
Queuing Penalty (veh)	7	85	140	16	21		10	40	19	91	22

Intersection: 17: US 101 SB Ramps & Old Redwood Highway #1

Movement	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	TR	L	T	T	L	LT	R
Maximum Queue (ft)	253	346	392	123	9	105	161	53
Average Queue (ft)	105	211	303	31	2	50	86	40
95th Queue (ft)	284	378	423	122	13	114	186	67
Link Distance (ft)	340	340	394	394	394		714	
Upstream Blk Time (%)	1	3	3					
Queuing Penalty (veh)	3	14	11					
Storage Bay Dist (ft)						330		25
Storage Blk Time (%)							63	21
Queuing Penalty (veh)							74	20

Intersection: 18: US 101 NB Off Ramp/Lakewood Drive #1 & Old Redwood Highway #1/Old Redwood Hig

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	T	T	TR	L	LT	TR	L	L	R
Maximum Queue (ft)	67	81	235	398	385	161	188	183	126	120	210
Average Queue (ft)	31	43	152	249	235	84	103	110	77	70	185
95th Queue (ft)	72	94	261	410	401	168	181	200	137	133	231
Link Distance (ft)	122	122	122	1989	1989		364		137	137	137
Upstream Blk Time (%)		0	17						2	3	45
Queuing Penalty (veh)		0	39						6	8	120
Storage Bay Dist (ft)						225		225			
Storage Blk Time (%)						0	0	0			
Queuing Penalty (veh)						0	1	1			

Intersection: 19: Armondo Rezula Way & Conde Lane #1/Conde Lane

Movement	EB	WB	WB	NB
Directions Served	TR	L	T	LR
Maximum Queue (ft)	257	58	161	129
Average Queue (ft)	147	28	87	68
95th Queue (ft)	272	60	153	134
Link Distance (ft)	393	374	374	209
Upstream Blk Time (%)				0
Queuing Penalty (veh)				0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 30: Johnson Street & Conde Lane #1

Movement	EB	WB	SB
Directions Served	LT	R	LR
Maximum Queue (ft)	72	91	30
Average Queue (ft)	43	22	6
95th Queue (ft)	82	82	30
Link Distance (ft)	373		201
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		300	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 100: Old Redwood Highway #1 & US 101 NB On Ramp

Movement	EB	EB	WB	WB
Directions Served	L	T	T	TR
Maximum Queue (ft)	125	38	119	94
Average Queue (ft)	72	6	30	20
95th Queue (ft)	144	42	110	89
Link Distance (ft)		394	122	122
Upstream Blk Time (%)			2	1
Queuing Penalty (veh)			11	5
Storage Bay Dist (ft)	260			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

Zone wide Queuing Penalty: 807

Intersection: 16: Conde Lane #1/Old Redwood Highway & Windsor River Road /Old Redwood Highway

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	R	L	T	R	L	TR
Maximum Queue (ft)	60	453	111	226	344	89	67	181	95	94	292
Average Queue (ft)	26	311	105	150	248	39	36	104	77	89	211
95th Queue (ft)	68	583	124	262	408	119	82	203	112	106	368
Link Distance (ft)		755			341	341		225			316
Upstream Blk Time (%)					7	0		1			7
Queuing Penalty (veh)					35	0		3			0
Storage Bay Dist (ft)	86		86	213			71		71	70	
Storage Blk Time (%)		22	28		18		7	16	8	57	8
Queuing Penalty (veh)		71	75		27		18	36	10	52	21

Intersection: 17: US 101 SB Ramps & Old Redwood Highway #1

Movement	EB	EB	WB	WB	WB	SB	SB	SB
Directions Served	T	TR	L	T	T	L	LT	R
Maximum Queue (ft)	165	228	315	143	32	115	204	50
Average Queue (ft)	62	108	223	65	11	79	130	44
95th Queue (ft)	198	255	340	233	67	145	312	61
Link Distance (ft)	341	341	399	399	399		714	
Upstream Blk Time (%)		1	0	0				
Queuing Penalty (veh)		4	1	0				
Storage Bay Dist (ft)						330		25
Storage Blk Time (%)							66	26
Queuing Penalty (veh)							122	49

Intersection: 18: US 101 NB Off Ramp/Lakewood Drive #1 & Old Redwood Highway #1/Old Redwood Hig

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	L	T	T	TR	L	LT	TR	L	L	R
Maximum Queue (ft)	115	138	268	253	301	242	380	250	162	148	197
Average Queue (ft)	75	101	232	176	233	157	348	236	119	115	187
95th Queue (ft)	130	156	308	303	366	281	471	281	200	181	218
Link Distance (ft)	122	122	122	1989	1989		364		130	130	130
Upstream Blk Time (%)	0	6	40				30		17	14	46
Queuing Penalty (veh)	1	16	102				0		51	40	133
Storage Bay Dist (ft)						225		225			
Storage Blk Time (%)						3	8	31			
Queuing Penalty (veh)						29	48	203			

Intersection: 30: Johnson St & Conde Lane #1

Movement	EB	WB	SB
Directions Served	LT	R	LR
Maximum Queue (ft)	44	22	9
Average Queue (ft)	26	6	2
95th Queue (ft)	54	37	16
Link Distance (ft)	183		225
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		300	
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 33: Armondo Rezulo Way & Conde Lane #1/Conde Lane

Movement	EB	WB	WB	NB
Directions Served	TR	L	T	LR
Maximum Queue (ft)	116	25	110	36
Average Queue (ft)	72	6	80	12
95th Queue (ft)	130	25	127	44
Link Distance (ft)	431	306	306	270
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 100: Old Redwood Highway #1 & US 101 NB On Ramp

Movement	EB	EB	WB	WB
Directions Served	L	T	T	TR
Maximum Queue (ft)	116	190	21	31
Average Queue (ft)	70	84	4	9
95th Queue (ft)	127	231	37	50
Link Distance (ft)		399	122	122
Upstream Blk Time (%)		0	0	0
Queuing Penalty (veh)		0	0	0
Storage Bay Dist (ft)	260			
Storage Blk Time (%)				
Queuing Penalty (veh)				

Zone Summary

Zone wide Queuing Penalty: 1147

APPENDIX B.2.

2017 Signal Warrant Memo

Memorandum

Date: February 17, 2017

Project: WIN937

To: Mr. Stuart Hayre, PE
Town of Windsor
P.O. Box 100
Windsor, CA 95492

From: Dalene J. Whitlock
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Briana Byrne
bbyrne@w-trans.com

Subject: Downtown Traffic Analysis - Signal Warrant Analysis

As requested, W-Trans has prepared additional traffic engineering services supporting the ongoing Downtown Bicycle/Pedestrian Crossing Study. The focus of this task was to review volumes and other information relative to the intersection of Old Redwood Highway/US 101 North On-Ramp to determine if a traffic signal is warranted.

Signal Warrant

Chapter 4C of the *California Manual on Uniform Traffic Control Devices* (CA-MUTCD) provides guidance on when a traffic signal should be considered. There are nine different warrants, or criteria, in the manual but the three reviewed for this analysis are as follows:

- Warrant 2, Four-Hour Vehicular Volume
- Warrant 3, Peak Hour Volume
- Warrant 7, Crash Experience

Warrant 2 is met when an engineering study finds that, for each of any four hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these four hours.

Warrant 3, which is often the first warrant to be met, is satisfied if an engineering study finds that the criteria in either of the following two categories are met:

A. If all three of the following conditions exist for the same one hour (any four consecutive 15-minute periods) of an average day:

   1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: four vehicle-hours for a one-lane approach; or five vehicle-hours for a two-lane approach, and
   2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and
   3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only)

for one hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

Warrant 7 addresses the collision history of a location. The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

C. For each of any eight hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same eight hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the eight hours.

Results

The four-hour volume warrant and peak hour volume warrant were analyzed using traffic counts collected on October 26, 2016 at Old Redwood Highway/US 101 North On-ramp during the morning, midday, and evening peak hours. Based on these counts, only three of the four peak hours, when graphed, exceed the curve. As such, Warrant 2 is not met. The same counts were applied to the analysis of Warrant 3, the peak hour volume warrant. Using the same counts, Warrant 3 was not met. It is noted that volumes would need to increase by almost 50 percent, from 105 to 150, in order for this warrant to be met. With the planned future construction of the northbound on-ramp at Arata Lane, volumes at this on-ramp can reasonably be expected to remain the same or decrease, but a substantial increase is not anticipated.

The collision history for the intersection of Old Redwood Highway/US 101 Northbound On-Ramp was reviewed to determine any trends or patterns that may indicate a safety issue. Based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports, the most current one-year period available is September 1, 2015 through August 31, 2016. From these reports it was determined that two collisions occurred at the intersection that would be correctible by a traffic signal. Both were broadside crashes involving a southbound vehicle turning left and a northbound through vehicle. Based on this available information, the crash experience warrant is not satisfied.

Based on the review performed, the intersection does not have sufficient volumes or crashes to satisfy any of the three signal warrants reviewed, indicating that a signal is not warranted at this time.

Conclusions and Recommendations

- Based on signal Warrants 2, 3, and 7, a signal is not warranted at the intersection of Old Redwood Highway/US 101 North On-Ramp and therefore not recommended.

DJW/bkb/WIN937.M1A

Attachments: Signal Warrant Spreadsheets

Warrant 3: Peak-Hour Volumes and Delay

Town of Windsor WIN

Old Redwood Hwy & US 101 NB On Ramp

	Major Street	Minor Street
Street Name	Old Redwood Hwy	US 101 NB On Ramp
Direction	E-W	N-S
Number of Lanes	2	1
Approach Speed	35	25

Population less than 10,000? No
Date of Count: Wednesday, October 26, 2016
Scenario: AM Existing

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

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

Condition A1 — Not Met

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

Minor Approach 0 vehicle-hours

Condition A2 — Not Met

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

Minor Approach Volume: 86 vph

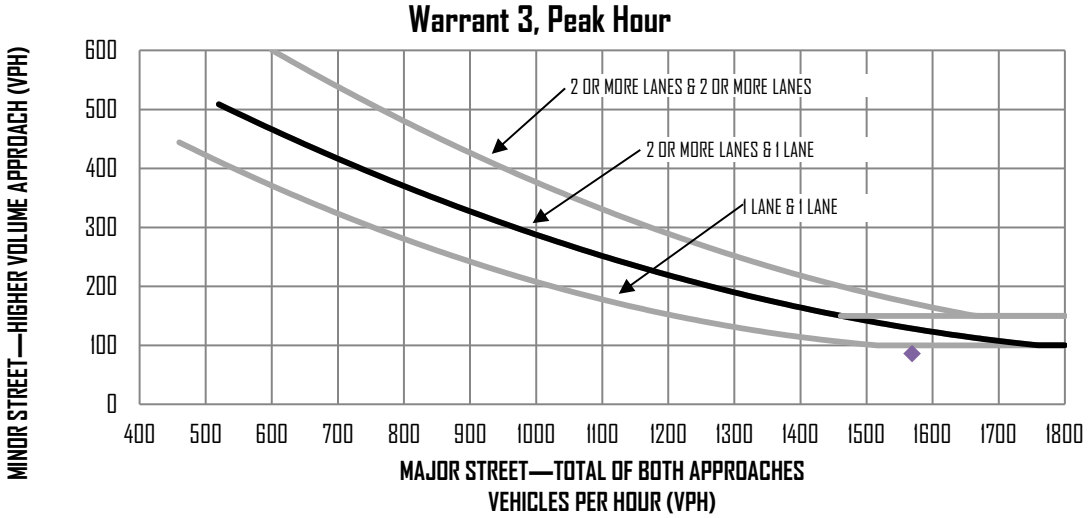
Condition A3 — Met

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

Total Entering Volume: 1655 vph

Condition B — Not Met

The plotted point falls above the curve



Warrant 3: Peak-Hour Volumes and Delay

Town of Windsor WIN937

Old Redwood Hwy & US 101 NB On Ramp

	Major Street	Minor Street
Street Name	Old Redwood Hwy	US 101 NB On Ramp
Direction	E-W	N-S
Number of Lanes	2	1
Approach Speed	35	25

Population less than 10,000? No
Date of Count: Wednesday, October 26, 2016
Scenario: Midday Existing

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

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

Condition A1 — Not Met

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

Minor Approach 0 vehicle-hours

Condition A2 — Not Met

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

Minor Approach Volume: 71 vph

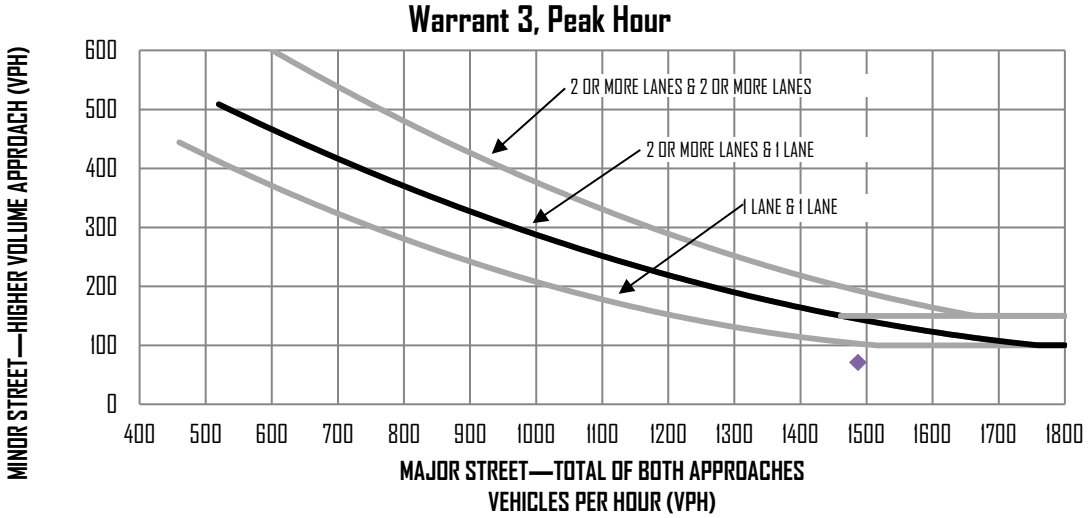
Condition A3 — Met

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

Total Entering Volume: 1558 vph

Condition B — Not Met

The plotted point falls above the curve



Warrant 3: Peak-Hour Volumes and Delay

Town of Windsor
Old Redwood Hwy & US 101 NB On Ramp

WIN

	Major Street	Minor Street
Street Name	Old Redwood Hwy	US 101 NB On Ramp
Direction	E-W	N-S
Number of Lanes	2	1
Approach Speed	35	25

Population less than 10,000? No
Date of Count: Wednesday, October 26, 2016
Scenario: PM Existing

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

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

Condition A1 — Not Met

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

Minor Approach 0 vehicle-hours

Condition A2 — Met

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

Minor Approach Volume: 105 vph

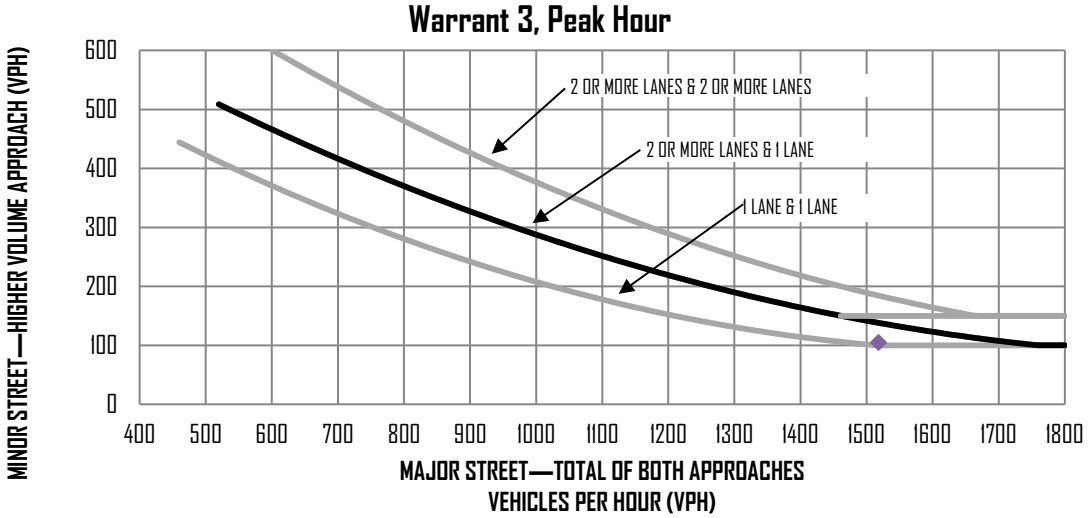
Condition A3 — Met

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

Total Entering Volume: 1623 vph

Condition B — Not Met

The plotted point falls above the curve



APPENDIX B.3.

2017 Pedestrian-Activated Warning Sign Memo

Memorandum

Date: February 17, 2017

Project: WIN937

To: Mr. Stuart Hayre, PE
Town of Windsor
P.O. Box 100
Windsor, CA 95492

From: Dalene J. Whitlock
dwhitlock@w-trans.com
Briana Byrne
bbyrne@w-trans.com

Subject: Downtown Traffic Analysis – Rectangular Rapid Flashing Beacon

---

As requested, W-Trans has prepared additional traffic engineering services supporting the ongoing Downtown Bicycle/Pedestrian Crossing Study. The focus of this task was to review volumes and other information relative to the intersection of Old Redwood Highway/US 101 North On-Ramps to determine if a rectangular flashing beacon is warranted.

Rectangular Rapid Flashing Beacon (RRFB)

Pedestrian and bicyclists volumes were reviewed at the unsignalized intersection to determine if a rectangular rapid flashing beacon (RRFB) would be warranted at Old Redwood Highway/US 101 North on-ramp at the existing raised crosswalk on the north leg. Prepared by the National Cooperative Highway Research Program and published by the Transportation Research Board, NCHRP Report 562, *Improving Pedestrian Safety at Unsignalized Crossings* (2006) was used. The study recommends select engineering treatments to improve safety for pedestrians crossing high-volume and high-speed roadways at unsignalized intersections. Quantitative procedures in the guidelines use key input variables (such as pedestrian volume, street crossing width, and traffic volume) to recommend possible crossing treatments.

The existing pedestrian crossing volume at the raised pedestrian table was counted as eleven, nine, and twelve during the morning, midday, and evening peak hours. Since this volume may increase with enhanced crossing facilities, it was assumed that the intersection could serve an average of 30 crossings per hour in the future.

One of the variables used in determining the type of enhancements at a crosswalk is the level of driver compliance with the right-of-way assignment, with levels rated as high or low. Existing conditions were assumed to result in high compliance since there is a marked crosswalk at the intersection, though conditions assuming low compliance were also assessed.

Pedestrian crossing treatment worksheets provided in the NCHRP Report were used to determine the extent of treatments appropriate for prevailing conditions. The worksheet for approach speeds less than 35 miles per hour was used, resulting in the finding that the crosswalk is adequate, and no further pedestrian treatments are warranted. It is noted that assuming either "low" or "high" compliance, an hourly volume of 35 pedestrians would warrant active or enhanced crossing treatments. Should volumes increase to 35 pedestrians hourly as a result of the improvements to be proposed upon completion of the study, an active device such as an RRFB would be warranted.

Because of the location of the crosswalk, which is back from the intersection 18 to 28 feet from west to east, consideration was given to the adequacy of sight lines for approaching drivers. Information provided by Tapco,

the manufacturer of these devices, indicates that the flashers have a viewing angle of 35 degrees in the horizontal plane. A figure indicating potential locations for the RRFBs along with their respective viewing angles is attached.

Conclusions and Recommendations

- Using the National Cooperative Highway Research Program (NCHRP) report 562 for the analysis, no further pedestrian improvements beyond the existing pedestrian table crosswalk are warranted at this time. However, because increased pedestrian volumes are the logical outcome of the improvements that are the focus of the Town's ongoing pedestrian study, it appears reasonable to anticipate that volumes will reach a point where an active device such as an RRFB will be warranted. It is recommended that such a device be included as part of the plans for the corridor.

DJW/bkb/WIN937.M1B

Attachments: NCHRP Worksheet
RRFB Location Exhibit

TCRP Report 112 - NCHRP Report 562 - Pedestrian Crossing Treatment Worksheet
Worksheet 1: Peak-Hour, 35 MPH or Less

Analyst and Site Information

Analyst: ES and BKB	Major Street: Old Redwood Hwy
Analysis Date: 23-Dec-16	Minor Street or Location:
Data Collection Date: 11/17/2016	Peak Hour: AM Existing

Step 1: Select worksheet (speed reflects posted or statutory speed limit or 85th percentile speed on the major street):
a) Worksheet 1 - 35 mph or less
b) Worksheet 2- exceeds 35 mph, communities with less than 10,000, or where major transit stop exists

Step 2: Does the crossing meet minimum pedestrian volumes to be considered for a TCD type of treatment?

2a	Peak-hour pedestrian volume (ped/h), vp ○If 2a ≥ 20 ped/h, then go to Step 3. ○If 2a < 20 ped/h, then consider median refuge islands, curb extensions, traffic calming, etc. as feasible.	**2a**	30

Step 3: Does the crossing meet the pedestrian volume warrant for a traffic signal?

3a	Major road volume, total of both approaches during peak hour (veh/h), V maj-s	**3a**	263
3b	○Minimum signal warrant volume for peak hour (use 3a for Vmaj-s), SC •SC = 0.00021 Vmaj-s² - 0.74072 Vmaj-s + 734.125)/0.75 **OR** •[(0.00021 3a² - 0.74072 3a + 734.125)/0.75]	**3b**	738.45
3c	○If 3b< 133, then enter 133. If 3b ≥ 133, then enter 3b.	**3c**	738.45484
3d	○If 15th percentile crossing speed of pedestrians is less than 3.5 ft/s (1.1 m/s), then reduce 3c by up to 50 percent; otherwise enter 3c. ○If 2a ≥ 3d, then the warrant has been met and a traffic signal should be considered if not within 300 ft of another traffic signal. Otherwise, the warrant has not been met. Go to Step 4.	**3d**	738.45484

Step 4: Estimate pedestrian delay.

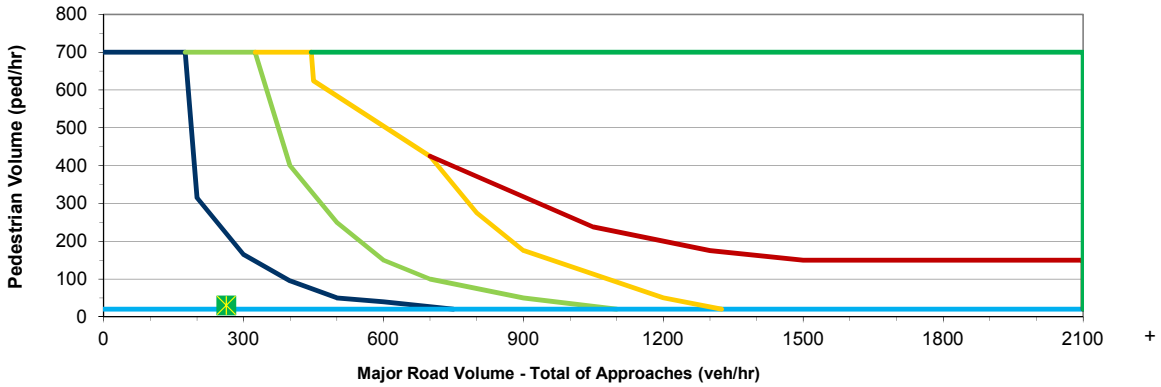
4a	Pedestrian crossing distance, curb to curb (ft), L	**4a**	55
4b	Pedestrian walking speed (ft.s), Sp	**4b**	3.5
4c	Pedestrian start-up time and end clearance time (s), ts	**4c**	20
4d	○Critical gap required for crossing pedestrian (s), tc= (L/Sp) + ts OR [(4a/4b) + 4c)]	**4d**	35.71
4e	Major road volume, total of both approaches or approach being crossed if median refuge island is present during peak hour (veh.h), Vmaj-d	**4e**	263
4f	○Major road flow rate (veh/s), v = Vmaj-d/3600 OR [4e/3600]	**4f**	0.07
4g	○Average pedestrian delay (s/person), dp = $(e^{v\,tc}$ - v tc - 1) / v OR [$(e^{4f \times 4d}$-4f x 4d - 1) / 4f]	**4g**	136.58
4h	○Total pedestrian delay (h), Dp=(dp x Vp) / 3600 OR [(4g x 2a) / 3600] (this is estimated delayfor all pedestrians crossing the major roadway without a crossing treatment - assumes 05 compliance). This calculated value can be replaced with the actual total pedestrian delay measured at the site.	**4h**	1.14

Step 5: Select treatment based upon total pedestrian delay and expected motorist compliance.

5a	Expected motorist compliance at pedestrian crossings in region, Comp = high or low	**5a**	HIGH

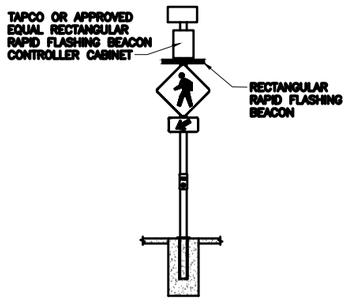
Total Pedestrian Delay Dp (**4h**) and Comp (**5a**)	**Treatment Category** (see Descriptions of Sample Treatments for examples)
Dp ≥21.3h (Comp = high or low) OR 5.3h≤Dp<21.3 h and Comp = low	DO NOT USE RED
1.3h ≤ Dp < 21.3h and Comp = high or low) OR 5.3 ≤ Dp < 21.3 h and Comp = high	DO NOT USE ACTIVE OR ENHANCED
Dp < 1.3 h (Comp = high or low)	USE CROSSWALK

Roadway Configuration: 50' Wide, <35 mph, Vped = 3.5 ft/s



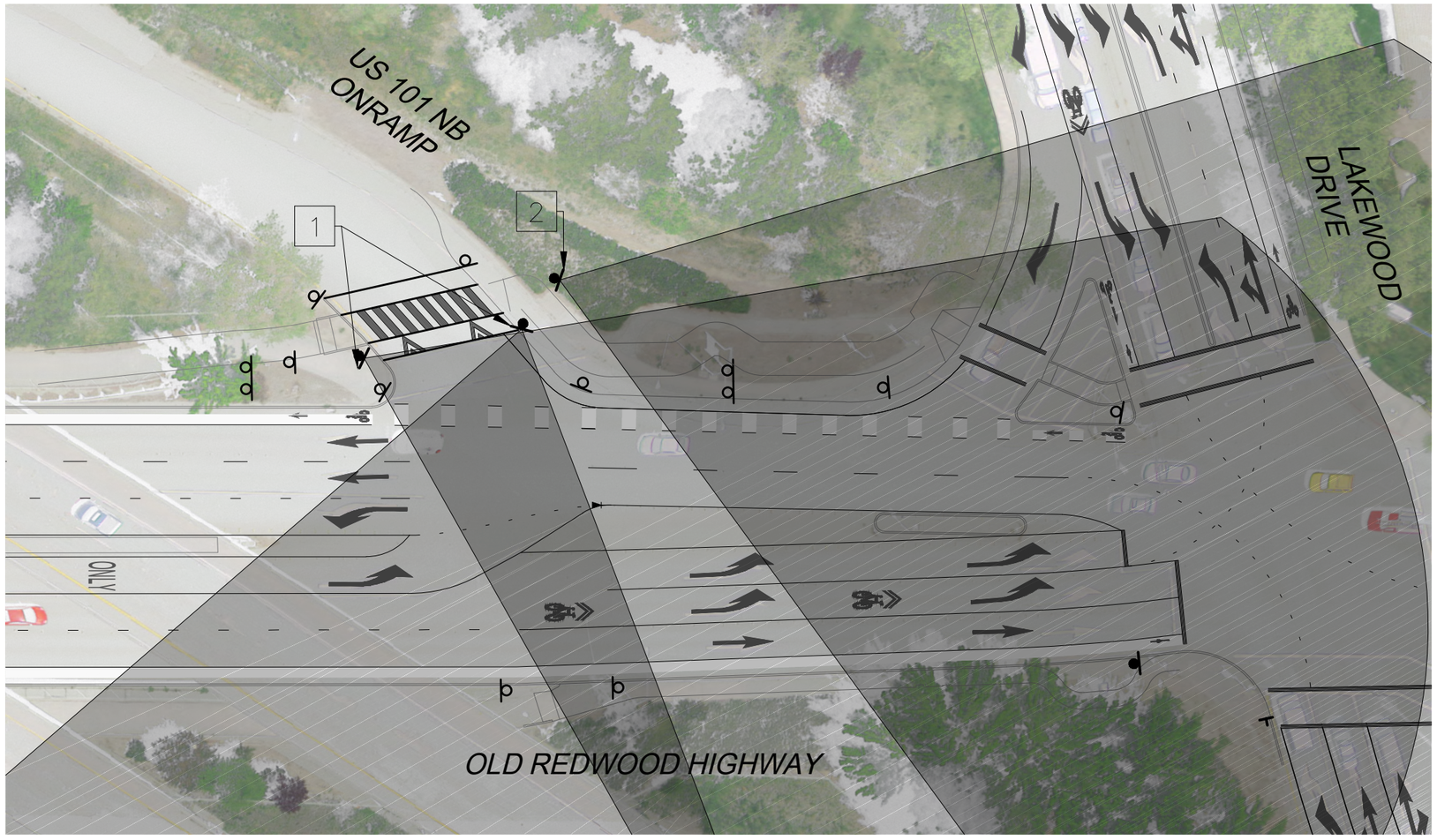
LEGEND
Study Intersection
Signal
Enhanced-High Visibility/Active when Present
Red
Enhanced-High Visibility/Active when Present (if high compliance expected) OR Red (if low compliance expected)
Striped Crosswalk
No Treatment

DESCRIPTIONS OF TREATMENT TYPE		
RED	**ENHANCED-HIGH VISIBILITY/ACTIVE WHEN PRESENT**	
	Active When Present	**Enhanced/High Visibility**
• Midblock Signal	• In Roadway Warning Lights	• In-Street Crossing Signs
	• Passive/Pushbutton Flashing Beacons	• High Visibility Signs/Markings
• Half Signal		• Pedestrian Refuge Islands
	• Pedestrian Crossing Flags	• Raised Crosswalks
		• Curb Extensions
		• Advanced Signage
• HAWK	• Rapid Rectangular Flashing Beacons	• Advanced Stop/Yield Lines
		• Constant Flashing Yellow Beacons



RECTANGULAR RAPID
FLASHING BEACON
ASSEMBLY WITH CONTROLLER

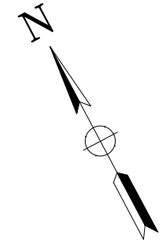
NOT TO SCALE



NOTES:

1. Replace existing post with Rectangular rapid flashing beacon (RRFB) assembly with controller and solar panel. See Detail.

2. RRFB activated by pedestrian push buttons on 1



APPENDIX B.4.

2017 Signal Modifications Memo

Memorandum

Date: March 21, 2017

Project: WIN937

To: Ms. Mona Ibrahim
Town of Windsor

From: Steve Fitzsimons
sfitzsimons@w-trans.com

CC: Stuart Hayre, Windsor
Oscar Tsai oscar@stevengrover.com
Dalene Whitlock, Mary Jo Yung,W-Trans

Subject: Cycle Track on Old Redwood Highway

As requested, W-Trans has prepared a construction cost estimate to modify traffic signals along Old Redwood Highway to allow installation of a proposed Cycle Track.

Setting

The proposed alignment of the Cycle Track is based on drawings prepared by Steven Grover & Associates (SGA) dated September 9, 2016. The drawings show the portion of Old Redwood Highway between Conde Lane and Lakewood Drive. There are three signalized intersections that may require modification:

1. Old Redwood Highway/Conde Lane/Windsor River Road
2. Old Redwood Highway/US-101 South Ramps
3. Old Redwood Highway/Lakewood Drive-US-101 North Off-ramp

There is also an unsignalized intersection at the US-101 North On-ramp intersection. The overview drawing prepared by SGA is attached for reference.

Project Description

The proposed multi-use facilities include paths on the north and south sides of Old Redwood Highway. For clarity, although Old Redwood Highway (ORH) is generally considered a north-south facility, in the project area it has a generally east-west alignment. The east-west alignment is used to describe locations herein.

On the south side, the proposed path starts about 20 feet east of the Conde Lane intersection and extends to the southwest corner of the Lakewood Drive intersection. On the north side the proposed path starts about 80 feet west of the southbound off-ramp intersection and extends to the northwest corner of the northbound on-ramp intersection. There is an existing path on the north side of Old Redwood Highway between the northbound on-ramp intersection and Lakewood Drive.

Old Redwood Highway/Conde Lane/Windsor River Road

The path along the south side appears to be designed to avoid the need for changes at the Conde Lane intersection. The proposed concrete improvements do not interfere with any traffic signal poles or equipment and the proposed striping changes between Conde Lane and the west end of the path direct path users to the pedestrian push buttons.

The path along the north side terminates well east of the intersection and directs users to the existing sidewalk and striped bike lane. There would be no anticipated costs for traffic signal modification at this location.

Old Redwood Highway/ US-101 South Ramps

Two-way paths are proposed on both sides of Old Redwood Highway (ORH) at the US-101 South (SB) Ramps intersection. Construction of the path would require addition, relocation, or reconstruction of the following traffic signal poles and equipment:

- Northeast corner: Add signals for eastbound path and detection on path. Relocate pedestrian push button post. Reconstruct loop detectors (westbound ORH and SB off-ramp)
- Northwest corner: Add bicycle signal for westbound path and pedestrian push button post.
- Southwest corner: Add signal for westbound path. Relocate street light pole. Replace traffic signal controller assembly.
- Southeast corner: Add signal for eastbound path. Relocate Type 1 pole.

The estimated construction cost for these modifications is $60,300.

Old Redwood Highway/US-101 North On-Ramp

Although this intersection is not currently signalized, SGA staff asked if it could be incorporated into the ORH/ US-101 North Off-ramp-Lakewood Drive intersection so movement along the path on the north side of ORH would be protected. The necessary signal modifications would include:

- Signals for the path on the northeast and northwest corners
- Signals for the eastbound left turn on the northeast corner
- Signals for the westbound traffic on the northwest and northeast corners

The estimated construction cost for these modifications is $83,400.

Old Redwood Highway/Lakewood Drive/US-101 North Off-Ramp

A two-way path is proposed along the south side of ORH, terminating at the southwest corner of the intersection. There does not appear to be a need for any signal modifications on the north side of ORH. Modifications on the south side would include:

- Southwest corner: Add signals for westbound path traffic. Replace eastbound and northbound detection and the traffic signal controller.
- Southeast corner: Replace northbound detection

The estimated construction cost for these modifications is $52,900.

Other Costs

Design, Town costs to administer and provide construction inspection, and Caltrans permit costs would also be incurred but are not estimated. These costs would typically be equivalent to 40 to 50 percent of the estimated construction costs.

Conclusions

- The estimated total cost (contractor price) for the traffic signal modifications described herein is $196,600.

- Total estimated costs including contractor pricing, design, administration, inspection, and Caltrans permit is $294,900

Thank you for giving W-Trans the opportunity to provide these services. Please call if you have any questions.

SMF/smf/WIN937.M3

Attachments: SGA Concept Drawing

APPENDIX C.1.

2016 Preliminary Biological Assessment

JANE VALERIUS
ENVIRONMENTAL CONSULTING
2893A Scotts Right of Way, Sebastopol, CA 95472
Office: (707) 824-1463 ♦ Mobile: (707) 529-2394
Email: jvalerius@earthlink.net
www.jvenvironmental.com

MEMORANDUM

TO: Stuart Hayre, Acting Public Works Director/Town Engineer
Mona Ibrahim, Engineer I

FROM: Jane Valerius, Botanist/Wetland Ecologist

DATE: November 22, 2016

RE: Town of Windsor Study for a Downtown Pedestrian and Bicycle Crossing of U.S. 101: Phase I –Feasibility Study

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INTRODUCTION

The Town of Windsor is preparing a Feasibility Study and Alternatives Concept Plans for a Downtown Pedestrian and Bicycle Crossing of U.S. 101 (Study). The Town is exploring crossing options above ground (U.S. 101 overcrossing), at ground level (Old Redwood Highway), below ground (Windsor Creek culvert), and other potential options that would facilitate crossing U.S. 101, provide a safer and aesthetic route, and enhance connections to existing and future trails to the Town Green. This Study includes consideration of beautification options for the existing Old Redwood Highway/U.S. 101 interchange area to improve the bicycle/pedestrian experience at this location.

The project study area, for purposes of this memorandum, included only the area on the west side of Old Redwood Highway and Highway 101 (Figure 1). The project site includes the areas adjacent to the Chevron Station, between the Chevron Station and the Shell Station, and the project Windsor Creek bridge crossing. The project area is located on the Healdsburg USGS 7.5-minute quadrangle.

The purpose of this Memorandum is to describe the biological resources at the site and provide a constraints analysis for addressing impacts to any sensitive biological resources that may occur as a result of implementation of the project. The analysis also includes what permits and agencies would be involved if any sensitive biological resources are impacted.

METHODS

Jane Valerius, botanist and wetland ecologist, met with Stuart Hayre and Mona Ibrahim on October 18, 2016 to review the proposed project area and project. Jane Valerius walked the areas within the study are boundary on the west side of Highway 101 which included the

proposed pedestrian bridge crossing for Windsor Creek to reconnect Old Redwood Highway and the proposed pedestrian/bicycle pathway on the west side. The plant communities were evaluated, which included any potential wetlands or waters of the U.S. and state, as defined by the U.S. Army Corps of Engineers (USACE), the Regional Water Quality Control Board (RWQCB), and the California Department of Fish & Wildlife (CDFW).

The California Natural Diversity Data Base (CNDDB 2016) and the California Native Plant Society (CNPS 2016) on-line electronic inventory of rare and endangered plants of California was reviewed for plants and animals know to occur in the area. Attachments A and B provide a list of special status plants and animals, respectively, that are known to occur in the project area based on a search of the Healdsburg USGS quadrangle. A previous study conducted by Charlie Patterson, Plant Ecologist, for the Chevron Station at 9120 Old Redwood Highway, was also reviewed (Patterson 2015). Mr. Patterson conducted surveys for special status plants for the Chevron site as well a wetland delineation. A list of plant species observed by Jane Valerius during her October 18, 2016 site visit is provided as Attachment C. A list of plants observed by Charlie Patterson is available in his report to Matthew E. Donohue, Trans Tech consultants for the vacant parcel at 9120 Old Redwood Highway, APN 161-070-035.

Photographs of the site are provided at the end of this memo.

RESULTS

This section includes a description of the vegetation communities and sensitive biological resources observed within the study area based on the October 18, 2016 site visit, previous studies, and the CNDDB and CNPS data base searches.

Vegetation Communities

Two main vegetation communities occur within the project area: non-native annual grassland and coast live oak woodland. Examples of these communities can be seen in Photos 1 to 6 at the end of this memo. A number of non-native ornamental plants also occur around the Chevron gas station including rosemary, a species of palm, acacias, and a species of bamboo.

Non-native annual grass is composed of non-native grasses such as oats (*Avena barbata, A. fatua*), bromes (*Bromus diandrus, B. hordaeceus*), hare barley (*Hordeum murinum* ssp. *leporinum*), large quaking grass (*Briza maxima*), Bermuda grass (*Cynodon dactylon*), Harding grass (*Phalaris aquatica*) and ryegrass (*Festuca perennis*). A number of non-native forb species also occur in the grassland area including bindweed (*Convolvulus arvensis*), fennel (*Foeniculum vulgare*), stinkwort (*Dittrichia graveolens*), English plantain (*Plantago lanceolata*), wild radish (*Raphanus sativus*), chicory (*Cichorium intybus*) and horseweed (*Erigeron bonariensis*).

The oak woodland includes valley oak (*Quercus lobata*), coast live oak (*Quercus agrifolia*) and interior live oak (*Quercus wislizeni*). One black oak (*Quercus kelloggii*) was observed along Windsor Creek. Oak woodland occurs in the area west of the Chevron gas station and is comprised mostly of young, sapling sized trees. Oak woodland also occur along the eastern side of the study area along the roadside drainage ditch north of Chevron (Photo 2) and along

Windsor Creek. The tree canopy along Windsor Creek includes willows (*Salix* sp.) and Oregon ash (*Fraxinus latifolia*) which are commonly associated with creeks. The woodland area along Windsor Creek is best characterized as a riparian oak woodland. Coyote brush (*Baccharis pilularis*) is a common shrub within the woodland and portions of the grassland areas.

Coast redwood trees (*Sequoia sempervirens*) occur mostly along the fence line along Old Redwood Highway and a few occur in the area west of the Chevron station. Most of these are also somewhat young trees and were likely planted and not necessarily native to the site, although redwood is a native tree species and typically protected by cities and counties in their tree ordinances. Some oak trees may also occur along the western edge of the off ramp.

Wetlands and Waters of the U.S. and State

A formal wetland delineation was not conducted as part of this analysis and study. Areas that meet the USACE criteria for wetlands and waters of the U.S. is based on visual observations for the presence of wetland plants and wetland hydrology. A few soil pits were also dug to examine to soils to corroborate the presence of a wetland feature but no data sheets were filled out. Areas mapped as potential wetlands include the roadside ditch that occurs along the south side of the Chevron Station between the paved roadway and the gas station (Figure 2; photos 1 and 6). This ditch continues along the east side of the Chevron gas station and also north of the gas station parallel to Old Redwood Highway (photo 2). Another small wetland area occurs on the north side of the fence between Old Redwood Highway and the fence. These are wetland ditches associated with drainage for the roadways. Wetland plants associated with the wetland ditches include Dallis grass (*Paspalum dilitatum*), penneyroyal (*Mentha pulegium*), tall flat sedge (*Cyperus eragrostis*), curly dock (*Rumex crispus*), spreading rush (*Juncus patens*), rabbitsfoot grass (*Polypogon monspeliensis*), Mediterranean barley (*Hordeum marinum* ssp*. gussoneanum*) and ryegrass. Himalayan blackberry (*Rubus armeniacus*) is also common along the ditches but is not a wetland plant species.

Windsor Creek (Photos 3 and 4) in the southeastern corner of the study area occurs as a waters of the U.S. with very little to no wetland vegetation within the ordinary high water mark of the creek. Windsor Creek does have a very dense oak woodland riparian tree community. This creates a lot of shade and that has the effect to reducing herbaceous vegetation growth, especially for wetland plants.

A small 0.1 acre seasonal wetland area occurs west of the Chevron gas station (Figure 3; photo 5). The wetland occurs within the non-native annual grassland portion of the open space area. This wetland area was mapped by Charlie Patterson (2015) and a delineation report was submitted to the USACE according to Mr. Patterson's report.

CONSTRAINTS TO PROJECT AND RECOMMENDATIONS

Wetlands

A formal wetland delineation would need to be conducted for the entire study area. Since a delineation has been conducted for the area west of the Chevron station a separate delineation would be needed for any areas not included in the Chevron delineation.
The USACE and the RWQCB have jurisdiction over wetlands and waters of the U.S. and state. CDFW has jurisdiction over lakes and streams such as Windsor Creek. To the extent that the project can avoid impacting any wetlands or waters that would be beneficial to the project and would avoid the need for obtaining permits from the USACE and RWQCB. The bridge crossing over Windsor Creek will require a Streambed Alteration Agreement from CDFW and they may require some mitigation for the loss of any trees or vegetation associated with the bridge. Because the bridge would avoid the ordinary high water mark of the creek no permit is required from the USACE. The RWQCB does take jurisdiction over riparian areas so that a 401 water quality certification or waste discharge permit may be required from the RWQCB for the bridge crossing.

If wetlands cannot be avoided permits will be required from the USACE and RWQCB. Any loss of wetlands will require compensation. Since the project site is located within the Santa Rosa Plain and within an area identified as having the potential to affect listed plants, at least 2 years of plant surveys would need to be conducted for any seasonal wetlands areas, such as the area west of the Chevron station. Charlie Patterson has conducted one year of surveys and concluded in his report that the wetland in that area was not suitable habitat for any of the three listed vernal pool plants. The USFWS and CDFW would have to concur with his findings.

Compensation for the loss of wetlands could be mitigated by purchasing credits in an approved wetland mitigation bank. Other options for wetland mitigation would be to create new wetlands on-site or at an appropriate off-site location. A wetland mitigation plan would need to be developed and the mitigation site would have to be monitored for a minimum of 5 years.

Plants and Vegetation Communities:

Surveys for special status plants, other than the three vernal pool species which are Sonoma sunshine (*Blennosperma bakeri*), Burke's goldfields (*Lasthenia burkei*), and Sebastopol meadowfoam (*Limnanthes vinculans*), would also need to be conducted for one growing season (see Attachment A). Several species have the potential to occur in the area, based on potential habitat. These are dwarf downingia (*Downingia pusilla),* hogwallow starfish *(Hesperevax caulescens),* marsh microseris *(Microseris paludosa),* Baker's navarretia *(Navarrtia leucocephala ssp. bakeri),* and Lobb's aquatic buttercup *(Ranunculus lobbii*).

Individual oak trees, especially valley oaks, are protected species and the Town of Windsor would follow its own tree ordinance for compensation for the loss of any native tree species. Loss of any oak woodland riparian along Windsor Creek would require compensation as part of the Streambed Alteration Agreement with CDFW for the bridge crossing. Compensation could

be in the form of planting additional trees along the creek or in other approved and appropriate locations, preferable adjacent to or near the project area.

Special Status Animals

Attachment B provides a list of special status animal species known to occur in the area based on a search of the Healdsburg USGS quadrangle. Steelhead and western pond turtle could occur in Windsor Creek but would not likely be affected by the bridge crossing. Pallid bat and Townsends' big-eared bat are also like to occur in the area. A bat habitat assessment would have to be conducted by a qualified biologist prior to construction. The following are standard avoidance and protection measures for birds and bats:

Birds: The following measures should be followed in order to avoid or minimize impacts to passerines that may potentially nest in the trees:

1) Removal of nesting trees should be conducted outside the nesting season, which occurs between approximately February 15 and August 15.
2) If removal between August 15 and February 15 is infeasible and removal must occur within the nesting season, a pre-construction nesting bird survey of the trees shall be performed by a qualified biologist within 7 days of ground breaking. If no nesting birds are observed no further action is required and tree removal shall occur within one week of the survey to prevent "take" of individual birds that could begin nesting after the survey.
3) If active bird nests are observed during the pre-construction survey, a disturbance-free buffer zone shall be established around the nest tree(s) until the young have fledged, as determined by a qualified biologist.
4) The radius of the required buffer zone can vary depending on the species, (i.e., 75-100 feet for passerines), with the dimensions of any required buffer zones to be determined by a qualified biologist in consultation with CDFW.
5) To delineate the buffer zone around a nesting tree, orange construction fencing shall be placed at the specified radius from the base of the tree within which no machinery or workers shall intrude.
6) After the fencing is in place there will be no restrictions on grading or construction activities outside the prescribed buffer zones.

Bats: Removal of trees may cause mortality of roosting bats. Many trees typically have numerous cavities, crevices, or large areas of exfoliating bark making humane eviction, with one-way exits, extremely difficult if not impossible. This is particularly true of snags due to their extremely poor condition, however snags provide some of the most preferred and substantial bat tree roost habitat. Conducting visual cavity surveys to determine occupancy is only rarely possible due to difficulty with access and number of trees, and emergence surveys of potential roost trees is only feasible where a few habitat trees occur, because only 1-2 trees can be surveyed each night per observer. Importantly, because bats tend to switch tree roosts more frequently than more stable roosts such as caves, mines, rock outcrops, buildings, bridges, or culverts, negative results have extremely limited temporal validity (24-48 hours), which would result in multiple mobilizations by tree cutters in order to remove trees immediately after a negative survey.

A bat habitat assessment shall be conducted before removal of any of these trees to ensure no take of individuals will occur. If the results are negative no further action is required. If trees are determined to provide potentially suitable roosting habitat, tree removal must only occur during seasonal periods of bat

activity, ***between March 1, or when evening temperatures are above 45F and rainfall less than ½" in 24 hours occurs, and April 15, prior to parturition of pups. The next acceptable period for tree removal with suitable roosting habitat is after pups become self-sufficiently volant – September 1 through about October 15, or prior to evening temperatures dropping below 45F and onset of rainfall fretter than ½" in 24 hours.***

1) Trees containing suitable potential bat roost habitat (cavities, crevices, exfoliating bark) shall not be removed until after March 1 (or after evening temperatures are above 45F and/or more than 1/2" of rainfall within 24 hours occurs), and before April 15. If tree removal is delayed, trees shall be removed after August 31and before October 15. These seasonal restrictions ensure all bats are active (no winter torpid bats, no non-volant young).

2) Tree removal shall be conducted using a *two-step process conducted over two consecutive days* (e.g. Tuesday and Wednesday, or Thursday and Friday). With this method, small branches and small limbs not containing cavity, crevice or exfoliating bark habitat on habitat trees as identified by a qualified bat biologist (who must be present on the site during the first day of tree trimming or cutting) are removed first on Day 1, using chainsaws only (no dozers, backhoes, etc.). The following day (Day 2), the remainder of the tree is removed. The disturbance caused by chainsaw noise and vibration, coupled with the physical alteration, has the effect of causing bats to abandon the roost tree after nightly emergence for foraging. Removing the tree the next day prevents re-habituation and re-occupation of the altered tree.

Trees containing suitable potential habitat must be trimmed on Day 1 under initial field supervision by a qualified bat expert to ensure that the tree cutters fully understand the process, and avoid incorrectly cutting potential habitat features or trees. After tree cutters have received sufficient instruction, the qualified bat biologist does not need to remain on the site. If different tree cutters will be conducting work on subsequent days, it may be necessary for the qualified bat biologist to return for additional instruction and supervision.

3) Non-habitat trees and all other vegetation proposed for removal further than 25 feet from identified habitat trees may be removed immediately, using any suitable means that does not cause damage to the habitat tree.

SITE PHOTOGRAPHS TAKEN ON OCTOBER 18, 2016



Photo 1: Wetland ditch looking northwest with Chevron gas station on right.



Photo 2. Wetland ditch north of Chevron station with fence along Old Redwood Highway.

SITE PHOTOGRAPHS TAKEN ON OCTOBER 18, 2016



Photo 3: Windsor Creek inside channel.



Photo 4: Windsor Creek top of bank looking south.

SITE PHOTOGRAPHS TAKEN ON OCTOBER 18, 2016



Photo 5: Grassland and trees at area west of Chevron gas station.



Photo 6: Street view of wetland ditch with Chevron station on left looking east.

Attachment A:
List of special status plants known to occur in the area based on a search of the CNDDB for the Healdsburg USGS quadrangle. 2016.

Special Status Plants *Scientific Name* Common Name	Status USFWS/ CDFW/ CNPS list	Habitat Affinities and Blooming Period/Life Form	Potential for Occurrence
Amorpha californica var. *napensis* Napa false indigo	-/-/1B	Openings in broadleafed upland forests, chaparral, cismontane woodland. Blooms April to July.	None. Potential woodland habitat in project area but not observed.
Blennosperma bakeri Sonoma sunshine	FE/CE/1B	Valley and foothill grassland (mesic), vernal pools. Blooms March to May	Low. Potential grassland and wetland habitat in project area. Not observed in 2015 by Charlie Paterson.
Brodiaea leptandra Narrow-anthered brodiaea	-/-/1B	Broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest, valley and foothill grassland/volcanic. Blooms May to July.	None. Typical habitat not present in project area.
Castilleja ambigua var. *ambigua* Johnny-nip	-/-/4	Coastal bluff scrub, coastal prairie, coastal scrub, marshes and swamps, valley and foothill grassland, vernal pools margins. Blooms March to August. Elevation: 0-435m.	Low. Potential grassland and wetland habitat in project area. Not observed in 2015 by Charlie Paterson.
Centromadia parryi ssp. *parryi* Pappose tarplant	-/-/1B	Chaparral, coastal prairie, meadows and seeps, coastal salt marshes and swamps, valley and foothill grassland (vernally mesic)/often alkaline. Blooms May to November.	None. No habitat in project area.
Cordylanthus tenuis ssp. *capillaris* Pennell's bird's-beak	FE/CR/1B	Closed-cone coniferous forest, chaparral on serpentinite. Blooms June to September. Elevation: 45-305m.	None. No habitat in project area.
Cypripedium montanum Mountain lady's-slipper	-/-/4	Broadleafed upland forest, cismontane woodland, lower montane coniferous forest, North Coast coniferous forest. Blooms March to August. Elevation: 185-2225m.	None. Typical habitat not in project area.

Special Status Plants *Scientific Name* Common Name	Status USFWS/ CDFW/ CNPS list	Habitat Affinities and Blooming Period/Life Form	Potential for Occurrence
Downingia pusilla Dwarf dowingia	-/-/2B	Valley and foothill grassland (mesic), vernal pools. Blooms March-May.	Low. Potential grassland and wetland habitat in project area. Not observed in 2015 by Charlie Paterson.
Erigeron serpentinus Serpentine daisy	-/-/1B	Chaparral on serpentine seeps. Blooms May to August. Elevation: 60-670m.	None. No habitat in project area.
Hemizonia congesta ssp. *congesta* White seaside tarplant	-/-/1B	Valley and foothill grassland/sometimes roadsides. Blooms April to November.	None. Potential habitat in project area. Not observed during 2016 survey.
Hesperevax caulescens Hogwallow starfish	-/-/4	Valley and foothill grassland (mesic, clay), vernal pools (shallow), sometimes alkaline. Blooms March to June. Elevation: 0-505m.	Low. Potential grassland and wetland habitat in project area. Not observed in 2015 by Charlie Paterson.
Lasthenia burkei Burke's goldfields	FE/CE/1B	Meadows and seeps (mesic), vernal pools. Blooms April to June.	Low. Potential wetland habitat in project area. Not observed in 2015 by Charlie Paterson.
Limnanthes vinculans Sebastopol meadowfoam	FE/CE/1B	Meadows and seeps, valley and foothill grassland, vernal pools/ vernally mesic. Blooms April-May.	Low. Potential grassland and wetland habitat in project area. Not observed in 2015 by Charlie Paterson.
Microseria paludosa Marsh microseris	-/-/1B	Closed-cone coniferous forest, cismontane woodland, coastal scrub, valley and foothill grassland. Blooms April to June (July).	Low. Potential wetland habitat in project area. Not observed in 2015 by Charlie Paterson.
Monardella viridis Green monardella	-/-/4	Broadleafed upland forest, chaparral, cismontane woodland. June-September. Elevation: 100-1010m.	None. No habitat in project area and not observed during 2016 survey.
Navarretia leucocephala ssp. *bakeri* Baker's navarretia	-/-/1B	Cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, vernal pools/mesic. Blooms April to July.	Low. Potential grassland and wetland habitat in project area. Not observed in 2015 by Charlie Paterson.

Special Status Plants *Scientific Name* Common Name	Status USFWS/ CDFW/ CNPS list	Habitat Affinities and Blooming Period/Life Form	Potential for Occurrence
Navarretia leucocephala ssp. *plientha* Many-flowered navarretia	FE/CE/1B	Volcanic ash flow vernal pools. Blooms May to June.	None. No habitat in project area.
Perideridia gairdneria ssp. *gairdneri* Gairdner's yampah	-/-/4	Broadleafed upland forest, chaparral, coastal prairie, valley and foothill grassland, vernal pools/vernally mesic. Blooms June to October. Elevation: 0-610m.	None. Potential grassland and wetland habitat in project area. Not observed in 2015 by Charlie Paterson or in 2016 by Jane Valerius.
Ranunculus lobbii Lobb's aquatic buttercup	-/-/4	Cismontane woodland, North Coast coniferous forest, valley and foothill grassland, vernal pools/mesic. Blooms February to May. Elevation: 15-470m.	Low. Potential grassland and wetland habitat in project area. Not observed in 2015 by Charlie Paterson.
Vegetation Communities			
Northern Hardpan Vernal Pool			None

NOTES:

U.S. FISH AND WILDLIFE SERVICE

FE = federally listed Endangered

CALIFORNIA DEPT. OF FISH AND WILDLIFE

CE = California listed Endangered

CALIFORNIA NATIVE PLANT SOCIETY -

List 1B: Plants rare and endangered in California and elsewhere

List 3: Plants about which additional data are needed – a review list.

List 4: Plants of limited distribution- a watch list.

Attachment B:
List of special status animals known to occur in the area based on a search of the CNDDB for the Healdsburg USGS quadrangle. 2016.

Special Status Animals Common Name *Scientific Name*	Status USFWS/ CDFW	Habitat Affinities and Reported Localities in the Project Area	Occurrence for Potential
Fish			
Rusian River tule perch *Hysterocarpus traski pomo*	-/CSC	Occurs in low elevation streams of the Russian River. Requires clear, flowing water with abundant cover and deep (>3ft) pool habitat. Recorded occurrences from Russian River in Healdsburg.	None. No habitat in project area. No recorded occurrences in Windsor Creek.
Navarro roach *Lavinia symmetircus navarroensis*	-/CSC	Habitat generalists, found in warm intermittent streams as well as cold, well-aerated streams. Recorded occurrences from Russian River in Healdsburg.	None. No habitat in project area. No recorded occurrences in Windsor Creek.
Coho salmon – central California coast ESU *Onocorhynchus kisutch*	FT/SE	Occurs from Punta Gorda, in northern California, to the San Lorenzo River, in Santa Cruz County, and includes coho salmon populations from several tributaries of San Francisco Bay. Recorded occurrences from Russian River and Dry Creek.	None. No habitat in project area. No recorded occurrences in Windsor Creek.
Steelhead – central California coast DPS *Onocorhynchus mykiss irideus*	FT	Requires beds of loose, silt-free, coarse gravel for spawning. Also needs cover, cool water and sufficient dissolved oxygen. Recorded occurrences from Russian River.	**High**. Potential habitat in project area. Known from Pool and Pruitt Creeks south of project area. Would not be impacted by bridge crossing.
Invertebrates			
California linderiella *Linderiella ocidentalis*	-/CSC	Seasonal pools in unplowed grasslands with old alluvial soils underlain by hardpan or in sandstone depressions	None. No habitat in project area.
Reptiles			
western pond turtle *Emys marmorata marmorata*	SC/SSC	Prefers permanent, slow-moving creeks, streams, ponds, rivers, marshes and irrigation ditches with basking sites and a vegetated shoreline. Requires upland sites for egg-laying.	**High.** Potential suitable habitat present in Windsor Creek. Would not be impacted by bridge development.
Birds			

Special Status Animals Common Name *Scientific Name*	Status USFWS/ CDFW	Habitat Affinities and Reported Localities in the Project Area	Occurrence for Potential
Great blue heron *Ardea herodias*	MB/CSC	Nests colonially in large trees, such as eucalyptus and cottonwood, near water.	None. No habitat in project area. Closest recorded occurrence is from Fitch Mountain in Healdsburg.
White-tailed kite *Elanus leucurus*	MB/CFP	Inhabits low rolling foothills and valley margins with scattered oaks and river bottom- lands or marshes adjacent to deciduous woodlands. Prefers open grasslands, meadows and marshes for foraging close to isolated, dense-topped trees for nesting and perching.	None. No habitat in project area. Closest recorded occurrence is from Russian River north of Healdsburg.
Osprey *Pandion haliaetus*	-/SSC	Nests in large trees within 15 miles of good fish-producing water body.	None. No habitat in project area. No recorded occurrences near project area.
Mammals			
pallid bat *Antrozous pallidus*	-/SSC	Day roosts in crevices and cavities in rock outcrops, mines, caves, buildings, bridges, as well as hollows and cavities in a wide variety of tree species. May roost alone, in small groups (2 to 20 bats), or in 100s in maternity roosts, with males and non-reproductive subadults in other, smaller roosts.	**Moderate:** Potential suitable roosting trees present.
Townsend's big-eared bat *Corynorrhinus townsendii*	-/CPT	Day roosts in cave analogs; mines, buildings, bridges, sometimes large tree hollows. Particularly sensitive to roost disturbance, this species has declined throughout its range in California; very few maternity roosts are known in California. Females form maternity colonies, males roost singly, and all disperse widely after maternity season. During winter, roosts in cold, but non-freezing roosts, which may include man-made structures.	**Moderate:** Potential suitable roosting trees present.

U.S. FISH AND WILDLIFE SERVICE

FE = federally listed Endangered
FT = federally listed Threatened
FC = federal candidate for listing
MBTA = Migratory Bird Treaty Act.

CALIFORNIA DEPT. OF FISH AND WILDLIFE

CE = California listed Endangered
CT = California listed as Threatened
CFP = California fully protected species
CPT = California proposed threatened
CSC = California species of concern
SSC = Species of Special Concern

Attachment C:
List of plants observed during the October 18, 2016 site visit.

Scientific Name	Common Name
Acacia sp.	Acacia*
Avena barbata	Wild oats*
Avena fatua	Oats*
Baccharis pilularis	Coyote brush
Berberis aquifolium	Oregon grape
Brassica nigra	Black mustard*
Briza maxima	Large quaking grass*
Bromus diandrus	Ripgut brome*
Bromus hordaeceus	Soft chess*
Cichorium intybus	Chicory*
Convolvulus arvensis	Bindweed*
Cynodon dactylon	Bermuda grass*
Cyperus eragrostis	Tall flat sedge
Daucus carota	Queen Anne's lace*
Delairea odorata	Cape ivy*
Dittrichia graveolens	Stinkwort*
Epilobium brachycarpum	Willow herb
Erigeron bonariensis	Horseweed*
Festuca perennis	Ryegrass*
Foeniculum vulgare	Fennel*
Fraxinus latifolia	Oregon ash
Galium sp.	Bedstraw
Genista monspessulana	French broom*
Geranium molle	Dove foot geranium*
Helminthotheca echioides	Bristly ox-tongue*
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley*
Hordeum murinum ssp. *leporinum*	Hare barley*
Juncus patens	Spreading rush
Lactuca serriola	Prickly lettuce*
Mentha pulegium	Penneyroyal*
Paspalum dilitatum	Dallis grass*
Phalaris aquatica	Harding grass*
Plantago lanceolate	English plantain*
Polypogon monspeliensis	Rabbitsfoot grass*
Prunus sp.	Plum?*
Pseudognaphalium luteoalbum	Jersey cudweed*
Quercus agrifolia	Coast live oak
Quercus kelloggii	Black oak
Quercus lobata	Valley oak
Quercus wislizeni	Interior live oak
Raphanus sativus	Wild radish*
Rosa sp.	Rose
Rosmarius sp.	Rosemary*
Rubus armeniacus	Himalayan blackberry

Scientific Name	Common Name
Rumex crispus	Curly dock*
Salix sp.	Willow
Sequoia sempervirens	Coast redwood
Trifolium hirtum	Rose clover*
Vitis californica	California grape

Plants with an * are non-native species.



FIGURE 1: Study Area

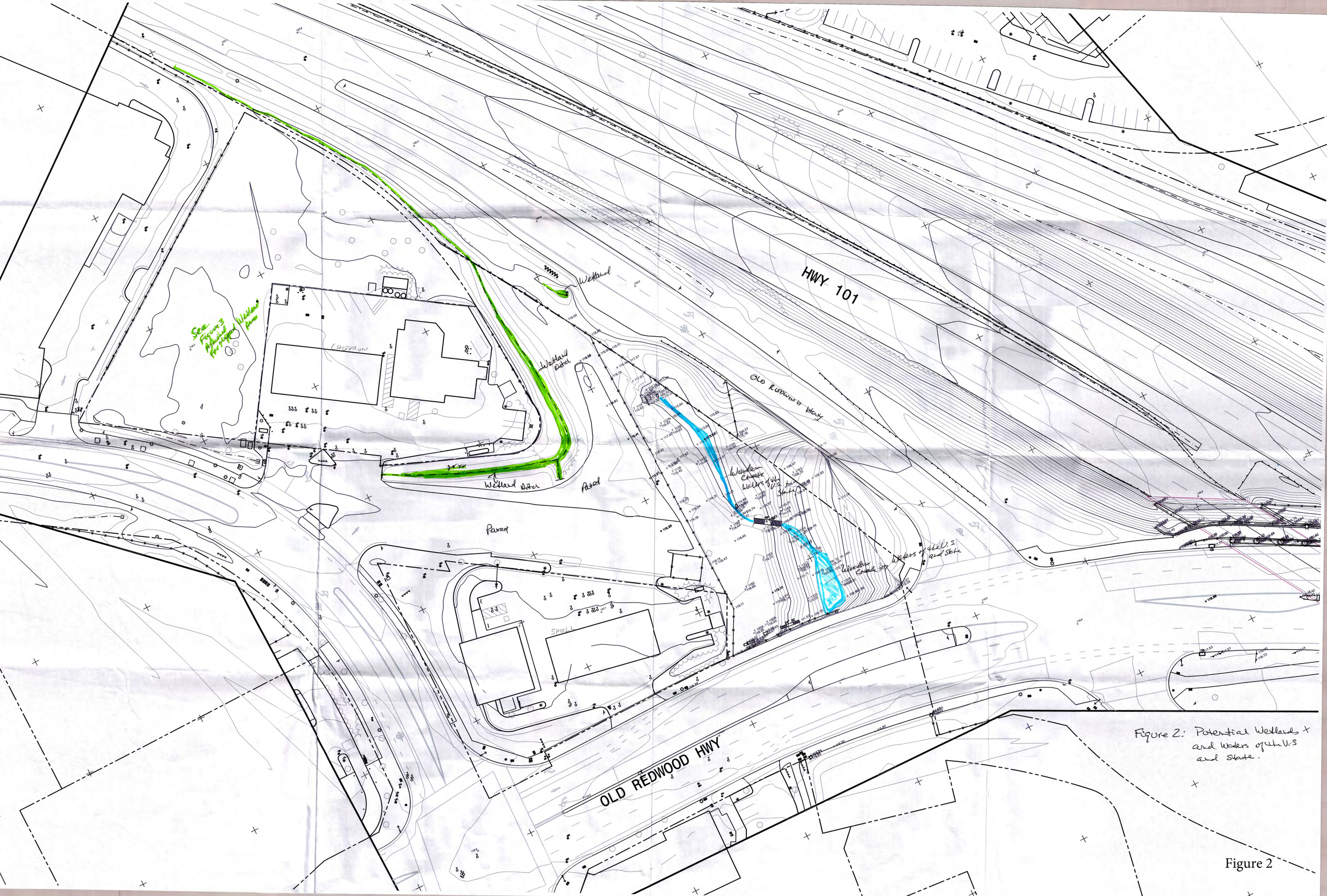


Figure 2: Potential Wetlands + and Waters of the U.S and State.

Figure 2



Q = Oaks A = Acacias R = Himalaya blackberry
• = data points

Figure 3. Onsite Biological Details			
9120 Old Redwood Highway, Windsor, Calif.			
NORTH ⇧	**Source/Prepared by:** C. Patterson; June, 2015	**Applicant:** Redwood Oil Company, 50 Professional Center Drive, Suite 100, Rohnert Park, CA 94928	**Sonoma County A. P. Numbers** 0161-070-034 0161-070-035
	Basemap: 2013 air photo by GoogleEarth **Scale:** 1 inch = approx. 70 feet		Approx. 1.0 acre
Botanical Survey Report			

APPENDIX C.2.

2015 Botanical Survey

Charles A. Patterson
Plant Ecologist
1806 Ivanhoe Avenue, Lafayette, CA 94549
ph: (925) 938 - 5263

July 7, 2015

Matthew E. Donohue
Trans Tech Consultants

San Jose, CA 95122

Re: Rare plant surveys for the vacant parcel at **9120 Old Redwood Highway**, Windsor,
Sonoma County A.P.N. 161-070-035

Dear Matthew:

I am writing to document and provide details of my botanical surveys this spring (2015) for the above-referenced site ("Site"; approximately one acre) adjoining the existing 'Chevron' gas station in downtown Windsor (see Figure 1). Literally all adjacent lands are now fully developed, with the freeway (U.S. Highway 101) immediately to the east, and urban landscape (pavement, buildings, buried drains, sidewalks, manicured landscaping) adjoining to the north, west, and south (Figure 2). Onsite conditions are highly disturbed, from both surrounding influences (major fill, drainage, and urban development) and historic onsite activities (small ruts, trenches, fill and debris piles, escaped non-native/ornamental vegetation). Still, there is a small area of essentially vacant land that sits on regionally typical soil and naturally would support a regionally typical mosaic of native grassland, oak woodland/savanna, and possibly shallow herbaceous seasonal wetlands. It is because of the potential presence of these habitats or communities that full botanical surveys have been conducted. The following sections summarize the findings and conclusions of this botanical investigation.

BACKGROUND

By way of background, I am a professional, free-lance plant ecologist, with over 35 years of botanical, wetland, and related ecological consulting experience in northern California and the west. I have prepared more than 200 wetland delineations and over 500 rare plant investigations, ranging from 1-10 acre family owned parcels to the 19,000 acre Marin (County) Municipal Water District watershed lands, the riparian habitats of the San Joaquin River Delta, and the 30,000 acre 'Flying M' Ranch in Merced County. I have conducted spring botanical surveys on the Santa Rosa Plain (SRP) for over 30 consecutive years, and was a congressional appointee to the Sonoma County Vernal Pool Task Force for six years (approximately 1988 through 1994). In addition to technical botanical and wetland work, I have spent years learning the protocols of, and cultivating relationships with the various permitting and review agencies, state, federal, and local. I was the primary consultant/biologist for a number of significant regional environmental permits, including the major Sears Point renovation some years ago, numerous County of Sonoma public works projects (landfill siting, road improvements, park development), several private hotels and golf courses, and numerous housing developments in Santa Rosa, Windsor, Petaluma, Napa, and Sonoma. I have designed and obtained approvals for seven wetland mitigation banks (and/or similar wetland preserves) on the SRP, and have worked extensively with the three primary listed plants and their preferred habitats.

This investigation was undertaken at the request of the current landowner, Redwood Oil Company, Inc. and the project's planning consultant, Trans Tech Consultants.

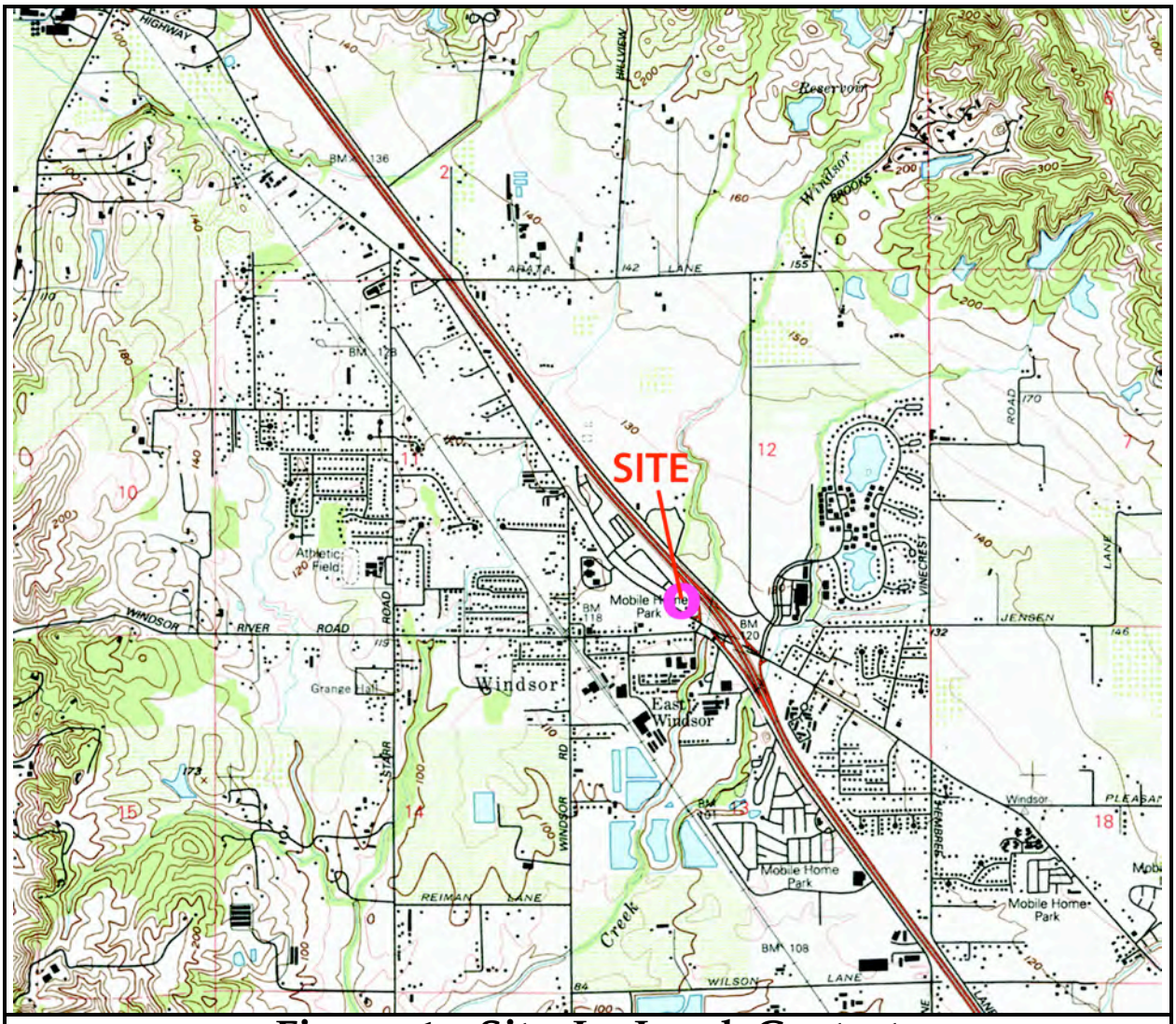


Figure 1. Site In Local Context

9120 Old Redwood Highway, Windsor, Calif.

NORTH ⇧	**Source/Prepared by:** C. Patterson; June, 2015	**Applicant:** Redwood Oil Company, 50 Professional Center Drive, Suite 100, Rohnert Park, CA 94928	**Sonoma County A. P. Numbers** **0161-070-034** **0161-070-035**
	Basemap: USGS 1:24,000 (7.5') topo map; Healdsburg quad **Scale: 1 inch = approx. 2000 feet**		Approx. 1.0 acre

Botanical Survey Report

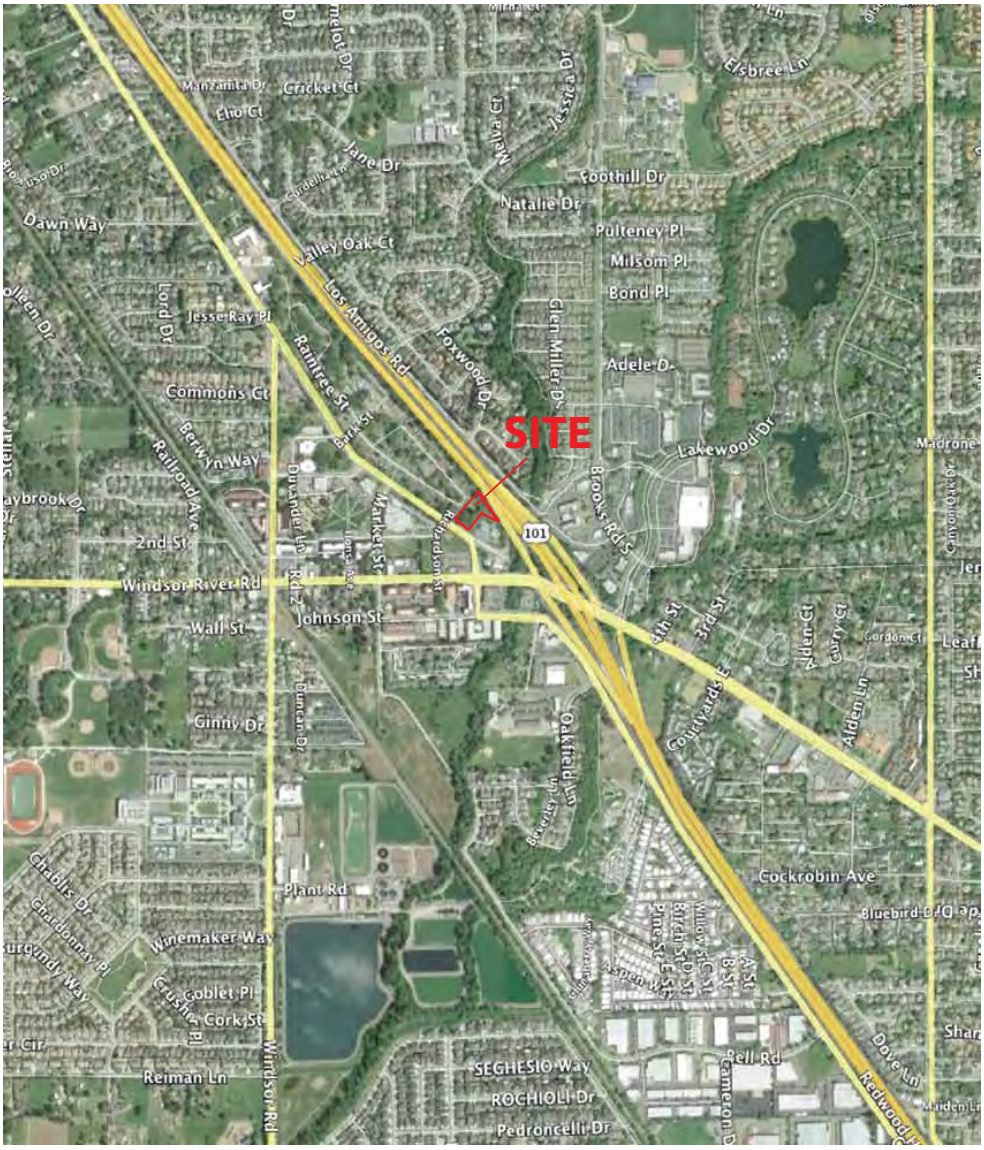


Figure 2. Site In Local Context

9120 Old Redwood Highway, Windsor, Calif.

NORTH ⇧	**Source/Prepared by:** C. Patterson; June, 2015	**Applicant:** Redwood Oil Company, 50 Professional Center Drive, Suite 100, Rohnert Park, CA 94928	**Sonoma County A. P. Numbers** **0161-070-034** **0161-070-035**
	Basemap: 2013 air photo by GoogleEarth **No Scale**		Approx. 1.0 acre

Botanical Survey Report

SURVEY METHODS AND REFERENCE SITES

There are three primary state and federally listed plant species known to occur in the Santa Rosa (and Windsor) region, these being Sebastopol meadowfoam (*Limnanthes vinculans*) or 'LIVI', Burke's goldfields (*Lasthenia burkei*) or 'LABU', and Sonoma sunshine (*Blennosperma bakeri*) or 'BLBA'. All three of these species typically occur in seasonal wetland habitats. There are roughly a dozen other plant species regarded as rare or otherwise sensitive that could also occur in the subject property vicinity (see Appendix A). However, most of these species grow in specialized habitats (e.g., serpentine, rock outcrops, marshes) or pristine grassland, chaparral, or woodland habitats, conditions that do not occur onsite or nearby. Several other wetland species could conceivably occur here and were also sought. Appendix A is a list of rare plant taxa that were considered as possibly occurring in this area.

Botanical surveys were completed for the subject property according to established state (California Department of Fish and Wildlife, or CDFW) and federal (U.S. Fish and Wildlife Service, or FWS) protocols, including at least three separate spring site visits, during each of which the entire site was walked and examined in close detail. All plant species encountered were identified, at least to the level necessary to determine whether or not they could be rare or sensitive species, as well as their 'wetland plant list' status. Appendix B is a plant species list for the site.

Field surveys were conducted for the Site on March 13, April 3 and 27, and May 22, 2015. As per the agency protocols, these were staggered during the peak blooming period (April and May) for the SRP's primary listed plant species. Each survey involved slowly walking the entire Site, completing 'back-and-forth' transects so as to have literally 100 percent visual coverage of the Site. All species encountered were identified and recorded, and any areas of potential wetland conditions were examined closely and mapped on an air photo. Potential wetland features were examined in close detail for possible wetland and/or sensitive species. Reference photographs were taken of most parts of the study area, especially potential wetlands and/or species of interest. In addition to plant surveys, wetland mapping (i.e., adding soil and hydrological data collection) was also conducted during the field visits.

Recognized 'reference' sites were also visited during this time frame to ascertain whether and/or when the three listed species of concern were actually in flower this spring. Specifically, on April 12, LIVI and BLBA were both observed in flower at the Alton Lane preserve, and all three listed species were observed in bloom there on April 27. LIVI was also observed in full flower on April 12, 16, and 27 at the Hale Mitigation Bank on Todd Road, where LABU was also documented in full bloom on April 16 and 27. Both BLBA and LABU were observed in flower at the 'Windmill' site on April 3 (early for goldfields) and April 27 (prime for goldfields, tapering off for sunshine).

While the 2015 winter and spring were relatively dry, early winter rains produced decent wetland plant germination, and the reference sites visited had varied responses, with listed species populations depressed somewhat, but some colonies thriving.

HABITAT AND GENERAL SITE CONDITIONS

The study area is approximately one acre, and is situated literally in an extensive mosaic of urban neighborhoods and infrastructure (see Figure 2). While the specific study area here is currently unoccupied, it is essentially the 'back yard' of the gas station (elevated concrete pad, etc.). The Site naturally supported some oak woodland, with open (herbaceous) meadow/grassland, but historic grazing and areawide development have resulted in the near complete displacement of native vegetation by an assemblage of common introduced grasses, weeds, volunteer ornamentals, and thickets of the aggressive (non-native) Himalaya blackberry

(*Rubus discolor*). All that remains of the historic cover are small clusters of sapling oaks (*Quercus*), and open weedy 'grassland' dominated by common introduced grasses (*Lolium, Phalaris, Avena, Hordeum, Poa, Vulpia, Bromus, Teniatherum*), aggressive weeds (*Cirsium, Carduus, Rumex, Brassica*), and common ruderal herbs (*Erodium, Geranium, Vicia, Melilotus, Convolvulus*). There is no remaining native grassland or meadow vegetation, and the few remaining native species are represented by just a few scattered individuals. Expanding thickets of non-native blackberry threaten to dominate much of the Site.

There is a broken swath of small (and a few larger) native coast live oak trees (*Quercus agrifolia*) and saplings along the northern Site edge. Aside from these and a few scattered coyote brush (*Baccharis*) and escaped (and planted along fences) ornamentals, the site supports no other woody vegetation. Planted acacia's occur occur along the Site's eastern fenceline, just offsite, as part of the highway's plantings. There is no riparian habitat or vegetation onsite or nearby.

The Site is underlain entirely by soil mapped by the USDA Soil Conservation Service as "Cole clay loam, 0 to 2 percent slopes" (Miller, et al, 1972), but locally it has been significantly disturbed from historic digging, small piles of fill, encroaching pavement and elevated pads on three sides, buried drains nearby. This soil has several layers of silty and clayey loam, with no underlying hardpan or restrictive layer. It is described as being a "somewhat poorly drained silt loam" with a significant clay component. While this soil lacks the type of buried restrictive layer (e.g., cemented alluvium, dense clay) that many regional soils have (which foster the formation of a seasonally perched water table), because of its somewhat high clay content, it has relatively slow percolation and is described in the Sonoma County Soil Surveys as "Some included areas are subject to minor inundation for short periods, generally less than two days at a time." Soil evidence (redox colors) collected directly onsite support the conclusion that this Site has some ground (the topographically lower places) where the soil behaves as described (likely inundated for a few days), and has lead to the formation of at least some potentially qualifying "jurisdictional wetland" as defined by the U. S. Army Corps of Engineers. Evidence of at least brief ponding was observed onsite in the northern part (see Figure 3) in the form of iron stained soil near the surface, and surface layers of dried algae, sediment encrusted detritus, and/or other water related surface films or stains.

Local hydrology is driven exclusively by direct rainfall and localized runoff collection, as there is no significant offsite watershed that contributes to the Site. Because there is no buried hardpan (as corroborated by recent soil borings completed throughout the Site, showing no hardpans at least to 15-20 feet in depth), there is no formation of a seasonally perched water table, and any localized expression of wetland conditions is likely to occur in clear depressional areas and possibly only when the amount and temporal distribution of rainfall is adequate (i.e., when it pours). Dry winters and periods with slow, widely separated (minor) rain events can result in no surface wetland expression at all in such situations. Over time and under average rainfall conditions, the Site (under pristine conditions) may have supported a small amount of highly ephemeral seasonal wetland in the form of a seasonally wet (but not necessarily ponded) meadow community. This situation no longer exists here because of the long history of disturbance and encroachment, but some lingering soil colors and scattered hydrological evidence indicate the continued presence of small areas of intermittent wetland conditions. The estimated extent of Corps-jurisdictional wetland is shown on Figure 3.



Q = Oaks A = Acacias R = Himalaya blackberry
● = data points

Figure 3. Onsite Biological Details

9120 Old Redwood Highway, Windsor, Calif.

NORTH ⇧	**Source/Prepared by:** C. Patterson; June, 2015	**Applicant:** Redwood Oil Company, 50 Professional Center Drive, Suite 100, Rohnert Park, CA 94928	**Sonoma County A. P. Numbers** **0161-070-034** **0161-070-035**
	Basemap: 2013 air photo by GoogleEarth **Scale:** 1 inch = approx. 70 feet		Approx. 1.0 acre

Botanical Survey Report

WETLANDS

Based on preliminary wetland mapping carried out according to the current U.S. Army Corps of Engineers' guidelines (i.e., the 1987 wetland delineation manual as modified by the recent 'Arid West' guidelines), the Site contains roughly 0.1 acre (4500 square feet) of seasonal "wetland" likely to be claimed as "jurisdictional" (and hence potentially regulated) by the Corps. This occurs in the form of a shallow, slightly depressional area just north of the existing gas station foundation, wherein the soil exhibits clear iron staining (indicating oxidation and reduction, or anaerobic/underwater conditions) and surface hydrology includes minor indicators.

Figure 3 shows the study area and its basic biotic features, including potential wetlands, native trees, and notable species occurrences, as well as man-made features.

None of the site's potential wetland remains inundated deeply or persistently enough to support aquatic invertebrates and/or truly 'aquatic' plants (e.g., *Callitriche, Lilaea,* aquatic *Ranunculus*), and there is no habitat suitable for breeding by the rare California tiger salamander (CTS). Ponding is likely only temporary (a few hours to a few days).

The inherently marginal wetness here (due to small size, shallow depression, no watershed, no hardpan), combined with the heavy historic use of the Site and the surrounding urban landscape, has almost completely eliminated native plant species here. The pristine landscape has been eliminated and displaced by one of almost complete dominance by weedy non-native vegetation. A number of native oaks remain, as do a few native grasses (*Danthonia californica*) and herbs (*Juncus tenuis,*), but the vast majority of the site's ground coverage is non-native and ruderal (weedy) in character.

In addition to the upland areas, the site's potential wetland area has been completely invaded by non-native annual grasses (*Lolium, Hordeum, Vulpia*), especially Harding grass (*Phalaris aquatica*), and weeds (*Rumex, Lythrum, Crypsis, Polygonum aviculare*) as well, with essentially no remaining native herbs or wildflowers. None of the numerous native wetland species commonly found in natural seasonal wetland features (i.e., *Downingia, Lilaea, Plagiobothrys, Eleocharis, Pleuropogon, Gratiola, Callitriche*) were not seen. It is possible that the Site's current low area is completely man-made, and it would not be surprising then to have little or no native wetland vegetation (as is the case here).

SENSITIVE SPECIES

Historically there have been scattered rare plant locations for two of the three primary targeted sensitive species (Burke's goldfields and Sonoma sunshine) in the greater Windsor vicinity, but most have been slowly eliminated or severely decimated as local urban development has expanded and filled in vacant lands in Windsor's town limits and/or sphere of influence. Historically known populations of LABU occurred on Kidd Street (1.3 miles to the NW), several places near the north end of Starr Road at Old Redwood Highway (1.2 miles from the Site), and several locations along Airport Blvd. and Shiloh Road, approximately two miles to the south. Several of these have been eliminated outright by development, and any remaining are likely to be severely compromised. The current status of any remaining populations is unknown.

The seasonally wet area present in the study area is marginally suitable for any of the three listed species, primarily because of its relatively porous, ephemeral nature, but also because of the locale's severe degree of past and ongoing disturbances. The lone onsite potential wetland feature is relatively shallow, ill-defined,

owing to its unstable character, and ultimately drained, and is almost completely dominated by weeds (*Rumex, Picris, Plantago, Geranium, Vicia*) and introduced grasses (*Phalaris, Lolium, Briza, Bromus, Poa, Vulpia*).

Only a very few native grassland, meadow, or vernal pool species were encountered during the course of four spring examinations. Scattered over the northeastern part of the Site are a few native grasses and related plants, including California oatgrass (*Danthonia californica*) and slender rush (*Juncus tenuis*) rated as "Facultative-Upland" (i.e., non-wetland) and "Facultative-Wetland" (sometimes wetland) species respectively by the National Wetland plant list issued (2012) by the Corps. The only other native plants seen are the oaks (*Quercus agrifolia* and *Q. lobata*), bicolor lupine (*Lupinus bicolor*), and one plant of blue-eyed grass (*Sisyrinchium bellum*),

There is actually a fourth rare plant species identified from the Santa Rosa Plain, the many-flowered navarretia (*Navarretia plieantha*), which was first discovered by this investigator (C. Patterson) on the 'Gossage' parcel off Sanders Road in 1985/86, (north of the Sonoma County Airport). I know of no other sites on the Santa Rosa Plain where it has been seen or reported, and I'm not sure if it has been seen at even the original site in 10 years or more. Reference sites for this species are likely non-existent. Still, this navarretia flowers in roughly the same blooming period as Burke's goldfields (mid-April through mid-June) and would have been encountered in flower at the project site had it been present. Even if not in flower, this species is relatively distinctive in form and habit, and would have been noticeable and identifiable from roughly April through June or even into July. No navarretia plants of any species were observed onsite.

With respect to the site's significance in a regional context, this small site contains a relatively small amount of only marginally wet swale habitat, in a heavily altered, extensively fragmented/isolated, and degraded setting. Onsite conditions have included heavy historic grazing and non-native species invasions, and as Figure 2 shows, the site is completely surrounded by urban infrastructure and land use.

Based on this year's detailed spring surveys and the overall condition of the Site, it is my professional conclusion that this Site does not support any listed or otherwise sensitive plants (or wildlife), and such species would not be expected to occur here in the future.

There are no significant other natural wetlands or known rare plant occurrences on any adjacent or nearby lands.

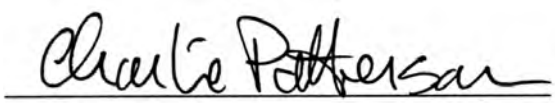
SUMMARY

Detailed protocol botanical surveys have been conducted for the Redwood oil Company Site in Windsor, and no rare, endangered, or otherwise sensitive plant species were found (or were expected). Site conditions are marginal at best for the region's three listed plant species, and the degraded wetland feature here may actually be largely man-made. Virtually none of the three listed species' most common associated cohorts (i.e., *Plagiobothrys, Downingia, Eleocharis, Eryngium, Gratiola,* etc.) are present either, and no other species of concern or interest were encountered either. Based on the results of this year's surveys, plus the visits to the identified reference sites, it is my conclusion that the site contains approximately 0.35 acre of seasonal wetland, and supports no listed or otherwise noteworthy plant species and no other species of regulatory concern or interest. The site has no suitable habitat for CTS and is well outside the known range for this amphibian. A separate 'jurisdictional determination' (i.e., formal wetland map) package has also been prepared for the study area.

The attached appendices are provided in support of these surveys.

This concludes my botanical investigation report. Please let me know if there is anything else you might need or if you have any questions.

Sincerely,



Charles A. Patterson

Appendix A. Sensitive plants potentially in the greater Windsor area.

PLANT TAXON (all on CNPS List 1B)	COMMON NAME	HABITAT	Likely In Study Area ?
Alopecurus aequalis var. sonomensis	Sonoma alopecurus	low wet places, marsh, riparian	No; no suitable habitat; none seen
Arctostaphylos (various spp.)	several manzanitas	chaparral; serpentine	No; no suitable habitat; none seen
Astragalus clarianus	Clara Hunt's milkvetch	grassy hillsides, cismontane woodland	No; poor habitat; out of range; none seen
Blennosperma bakeri	Sonoma sunshine	low wet places; valley grassland, vernal pools	Possible, but habitat conditions poor; none seen
Campanula californica	swamp harebell	freshwater marsh/bog/seep, closed	No; no suitable habitat; none seen; out of range?
Ceanothus (various spp.)	several ceanothus	foothill woodland, chaparral; serpentine	No; no suitable habitat; none seen
Chlorogalum pomeridianum var. minus	dwarf soaproot	chaparral; serpentine	No; poor habitat onsite; none seen
Clarkia imbricata	Vine Hill clarkia	chaparral near Pitkin Marsh	No; no suitable habitat; none seen; out of range?
Delphinium bakeri	Baker's larkspur	low brush and fencerows; coast'l prairie	No; no suitable habitat; out of range; none seen
Fritillaria liliacea	fragrant fritillary	heavy adobe soils, coastal grassland & scrub	No; poor habitat quality; none seen
Lasthenia burkei	Burke's goldfields	vernal pools, wet swales	YES; 140 plants in 2 small pools
Layia septentrionalis	Colusa layia	woodland, grassland; sandy, serpentine	No; poor habitat conditions; none seen
Legenere limosa	legenere	vernal pools; valley grassland	No; no suitable habitat (too ephemeral); none seen
Limnanthes vinculans	Sebastopol meadowfoam	vernal pools, wet meadows	Possible, but poor habitat (too ephemeral); none seen
Monardella villosa ssp. globosa	robust monardella	foothill woodland, clearings in chaparral	No; no good habitat; none seen
Navarretia leucocephala ssp. bakeri	Baker's navarretia	vernal pools, wet swales, mesic grassland?	Possible, but habitat conditions poor; none seen
Navarretia leucocephala ssp. pauciflora	few-flowered navarretia	vernal pools; volcanic ash-flow	Possible, but habitat conditions poor; none seen
Navarretia leucocephala ssp. plieantha	many- flowered navarretia	edges of vernal pools, meadows	Possible, but habitat conditions poor; none seen
Pleuropogon hooverianus	Hoover's semaphore grass	meadows, coastal decid. forest, wet places	No; no good habitat onsite; none seen; out of range?
Sidalcea oregana ssp. hydrophila	marsh checkerbloom	meadows, mesic riparian	No; no suitable habitat; none seen
Sidalcea oregana ssp. valida	Kenwood Marsh checkerbloom	freshwater marsh	No; no suitable habitat; none seen; out of range?
Tracyina rostrata	beaked tracyina	woodland, grassland	No; no good habitat; none seen
Trifolium amoenum	showy Indian clover	low rich fields, swales; serpentine	No; poor habitat quality; none seen

Appendix B. Plant species observed at the Oakpark Street site, Windsor.

FAMILY	NAME ('Jepson' 2012)	COMMON NAME	HABITAT
Apiaceae	Conium maculatum	poison hemlock	disturbed grassland, pastures, fencelines
Apiaceae	Daucus carota	Queen Anne's lace	disturbed grassland, pastures, fencelines
Apiaceae	Daucus pusillus	wild carrot	dry slopes, disturbed fields, burns
Apiaceae	Eryngium aristulatum	coyote thistle	vernal pools
Apiaceae	Foeniculum vulgare	fennel	disturbed fields, roadsides
Apiaceae	Scandix pecten-veneris	shepherd's needle	disturbed
Apiaceae	Torilis nodosa	hedge parsley	disturbed grassland, woodland
Asteraceae	Achillea millefolium var. borealis	yarrow	mesic grasslands, open woods, meadows
Asteraceae	Achyrachaena mollis	blow-wives	open dry grassland, meadows
Asteraceae	Anthemis cotula	mayweed	disturbed fields, pastures
Asteraceae	Baccharis pilularis ssp. consanguinea	coyote brush	dry hills, floodplains, pastures
Asteraceae	Bellis perennis	English daisy	domestic yards, pastures
Asteraceae	Carduus pycnocephalus	Italian thistle	disturbed grassland under oaks
Asteraceae	Centaurea solstitialis	yellow star thistle	grassland, disturbed
Asteraceae	Chamomilla suaveolens	pineapple weed, rayless chamomile	disturbed fields, roadsides,etc.
Asteraceae	Cichorum intybus	chicory	disturbed areas
Asteraceae	Cirsium arvense	Canada thistle	waste places, disturbed fields
Asteraceae	Cirsium vulgare	bull thistle	disturbed areas
Asteraceae	Conyza canadensis	horseweed	disturbed places
Asteraceae	Filago gallica	filago	grass, waste places, burns
Asteraceae	Gnaphalium stramineum	everlasting	moist disturbed places
Asteraceae	Hemizonia congesta ssp. congesta	tarweed	valley grassland, coastal hills
Asteraceae	Hemizonia fitchii	Fitch's tarplant	clayey grasslands, pastures
Asteraceae	Hypochaeris glabra	smooth cat's-ear	disturbed grassland, pastures
Asteraceae	Lactuca serriola	prickly lettuce	disturbed fields, meadows, roadsides
Asteraceae	Lasthenia burkei	Burke's goldfields	vernal pools & swales
Asteraceae	Picris echioides	bristly ox-tongue	disturbed grassland, meadows, moist clay
Asteraceae	Senecio vulgaris	common groundsel	disturbed grassland, pastures
Asteraceae	Silybum marianum	milk thistle	disturbed fields, pastures
Asteraceae	Sonchus asper	prickly sow thistle	disturbed grassland, pasture
Asteraceae	Tragopogon porrifolius	oyster plant	disturbed fields, grassland

Compiled by C. A. Patterson, spring, 2015.

Appendix B. Plant species observed at the Oakpark Street site, Windsor.

FAMILY	NAME ('Jepson' 2012)	COMMON NAME	HABITAT
Asteraceae	Xanthium spinosum	spiney cocklebur	wet places, dries beds of pools
Boraginaceae	Plagiobothrys bracteatus	popcorn flower	vernal pools & swales
Brassicaceae	Brassica nigra	black mustard	disturbed fields, grassland
Brassicaceae	Brassica rapa	field mustard	disturbed grassland, pastures
Brassicaceae	Capsella bursa-pastoris	shepherd's purse	disturbed grassland, pastures
Brassicaceae	Lepidium nitidum	shining peppergrass	grasslands
Brassicaceae	Raphanus sativus	wild radish	disturbed grassland, pastures
Caryophyllaceae	Cerastium arvense	mouse-ear chickweed	moist rocky places
Caryophyllaceae	Stellaria media	common chickweed	disturbed shade
Chenopodiaceae	Atriplex patula ssp. hastata	fat-hen	disturbed wet places, often saline
Chenopodiaceae	Chenopodium album	lamb's quarters	disturbed moist areas, often saline/alkaline
Convolvulaceae	Convolvulus arvensis	field morning-glory, bindweed	disturbed grassland, dry swales & pools
Crassulaceae	Crassula aquatica	water pygmy-weed	vernally moist flats
Cyperaceae	Cyperus eragrostis	umbrella or flat sedge	riparian, wet places
Euphorbiaceae	Eremocarpus setigerus	dove weed	dry open soil, disturbed, dry pools
Fabaceae	Lotus corniculatus	common bird'sfoot trefoil	moist disturbed places
Fabaceae	Lotus purshianus	Spanish clover	open disturbed places
Fabaceae	Lupinus bicolor	Lindley's annual lupine	dry loamy grassland, woodland
Fabaceae	Medicago polymorpha	bur-clover	disturbed grassland, pastures
Fabaceae	Trifolium depauperatum var. depauperatum	dwarf-sac clover	mesic grasslands, meadows, swales
Fabaceae	Trifolium fragiferum	strawberry clover	mesic disturbed grasslands, pastures
Fabaceae	Trifolium hirtum	rose clover	roadcuts, disturbed, pastures
Fabaceae	Trifolium repens	white clover	disturbed wet meadows, pastures
Fabaceae	Trifolium subterraneum	subterranean clover	disturbed wet meadows, pastures
Fabaceae	Trifolium variegatum	white-tipped clover	wet swales, pool edges, mesic grassland
Fabaceae	Trifolium wildenovii	tomcat clover	grasslands, meadows
Fabaceae	Vicia villosa ssp. varia	winter vetch	disturbed
Fagaceae	Quercus douglasii	blue oak	foothill woodland, ravines

Compiled by C. A. Patterson, spring, 2015.

Appendix B. Plant species observed at the Oakpark Street site, Windsor.

FAMILY	NAME ('Jepson' 2012)	COMMON NAME	HABITAT
Gentianaceae	Centaurium trichanthum	centaury	mesic grassland, meadows, pool edges
Geraniaceae	Erodium cicutarium	cut-leaf filaree	disturbed grassland, pastures
Geraniaceae	Geranium dissectum	cut-leaf geranium	disturbed grassland, pastures
Juncaceae	Juncus bufonius ssp. bufonius	toad rush	vernal pools, wet places
Juncaceae	Juncus patens	spreading rush	meadows, streambanks
Juncaceae	Juncus tenuis	slender rush	meadows, mesic grassland, pool edges
Lamiaceae	Marrubium vulgare	horehound	disturbed grassland & woodland
Lamiaceae	Mentha pulegium	common mint, pennyroyal	vernal pools, seasonal wetlands
Liliaceae	Brodiaea terrestris ssp. terrestris	dwarf or ground brodiaea	meadows, heavy clay; seasonal wetlands
Liliaceae	Triteleia hyacinthina	white brodiaea	meadows, mesic grassland, swales
Lythraceae	Lythrum hyssopifolia	hyssop-leaved loosestrife	vernal pools, seasonal wetlands
Malvaceae	Malva neglecta	mallow	disturbed fields, pastures
Malvaceae	Malvella leprosa	alkali mallow	disturbed moist areas
Onagraceae	Epilobium torreyi	narrow-leaved boisduvalia	moist places, vernal pools
Papaveraceae	Eschscholzia californica	California poppy	grassy, open dry places
Plantaginaceae	Plantago erecta	plantain	dry slopes, barrens, cut slopes
Plantaginaceae	Plantago lanceolata	narrow-leaved plantain	disturbed fields, pastures
Poaceae	Aira caryophyllea	annual hairgrass	grassland, woods, disturbed
Poaceae	Anthoxanthum aristatum	vernal grass	meadows, mesic grassland
Poaceae	Avena fatua	wild oat	grassland, disturbed
Poaceae	Briza minor	little quaking grass	grassland, woods, meadows
Poaceae	Bromus diandrus	ripgut	grassland, woods, disturbed
Poaceae	Bromus hordeaceus	soft chess	grassland, woods
Poaceae	Crypsis schoenoides	swamp grass	moist dist., vernal pools
Poaceae	Cynodon dactylon	Bermuda grass	moist disturbed places
Poaceae	Danthonia californica	California oatgrass	mesic grassland, meadows, swales
Poaceae	Festuca arundinacea	tall fescue	wet meadows, disturbed, pasture
Poaceae	Glyceria declinata	prostrate manna grass	disturbed wet places

Compiled by C. A. Patterson, spring, 2015.

Appendix B. Plant species observed at the Oakpark Street site, Windsor.

FAMILY	NAME ('Jepson' 2012)	COMMON NAME	HABITAT
Poaceae	Hordeum murinum ssp. gussoneanum	wild barley	grassland, disturbed
Poaceae	Hordeum murinum ssp. leporinum	mousetail barley	moist, disturbed
Poaceae	Lolium multiflorum	Italian ryegrass	disturbed grassland, pastures, swales
Poaceae	Nassella pulchra	purple needlegrass	chaparral, scrub, woods
Poaceae	Paspalum dilatatum	Dallis grass	roadsides, ditches, waste places
Poaceae	Phalaris aquatica	Harding grass	moist places, disturbed
Poaceae	Pleuropogon californicus	California semaphore grass	vernal pools, moist grassland
Poaceae	Poa annua	annual bluegrass	seasonal wetlands, pasture, clay
Poaceae	Polypogon monspeliensis	rabbit-foot grass	disturbed wet places, vernal pools
Poaceae	Vulpia dertonensis	annual fescue	mesic grassland, meadows
Polygonaceae	Polygonum arenastrum	common knotweed	moist disturbed places, pools
Polygonaceae	Rumex acetosella	sheep sorrel	disturbed fields, pastures
Polygonaceae	Rumex conglomeratus	clustered dock	disturbed wet places, wet swales, clay
Polygonaceae	Rumex crispus	curly dock	wet places, disturbed
Portulacaceae	Claytonia perfoliata	miner's lettuce	shaded woods, moist grassland
Primulaceae	Anagallis arvensis	scarlet pimpernel	moist grassland, meadows
Ranunculaceae	Ranunculus californicus	California buttercup	mesic disturbed grasslands, pastures
Ranunculaceae	Ranunculus muricatus	roughseed buttercup	disturbed wet meadows & pastures
Ranunculaceae	Ranunculus sceleratus	spiny buttercup	edges of pools, wet swales
Rosaceae	Prunus sp.	escaped ornamental	cultivated
Rosaceae	Rubus discolor	Himalayan blackberry	riparian, disturbed swales & meadows
Rubiaceae	Galium aparine	bedstraw, goose grass	shaded grassland, woodland
Scrophulariaceae	Kickxia elatine	fluellin	meadows, grassland, fields
Scrophulariaceae	Parentucellia viscosa	yellow parentucellia	mesic disturbed grasslands, pastures
Scrophulariaceae	Triphysaria lithospermoides	white owl's clover	mesic grasslands, meadows
Scrophulariaceae	Triphysaria versicolor ssp. faucibarbata	owl's clover	mesic grasslands, meadows, swales

Compiled by C. A. Patterson, spring, 2015.



Plate 1. Small colony of Burke's goldfields (yellow flowers) in shallow depression, Oakpark St., Windsor.



Plate 2. SE pasture; the two goldfields colonies occur in shallow depressions near the middle and middle-right part of photo, Oakpark St., Windsor.

APPENDIX D.1.

2008 Culvert and Bicycle Path Assessment

Brelje & Race
CONSULTING CIVIL ENGINEERS

February 28, 2008

Richard Burtt
Director of Public Works/Town Engineer
Town of Windsor
8400 Windsor Road
Windsor, CA 95492

Subject: Windsor Creek Bike Path at Hwy 101
B&R File No. 2275.04

Dear Richard:

As you requested, we have performed a concept level feasibility analysis of the issues associated with construction of a Caltrans Cl 1 Bike and Pedestrian path along Windsor Creek from just northeast of Los Amigos Road, to a terminus at grade southwest of the freeway. The purpose of this study is to:

- Determine the initial opportunities and constraints associated with this proposal.
- Prepare several sketches of alignment alternatives.
- Evaluate the impact of the addition of this facility on the 42 ft span arch culvert crossing at Los Amigos that is in the final stages of review and approval by the Town, and which is scheduled for construction this summer.
- Provide order of magnitude conceptual opinions of probable cost of the alternatives to the 42 ft arch structure.
- Discuss the horizontal and vertical challenges associated with the design.
- Discuss the regulatory environment within which this proposal would be vetted.
- Discuss the impacts of a decision to pursue this project on the proposed mid-2008 opening of the hotel project.

Due to the time constraints within which this study was prepared, the analysis is necessarily conceptual. Every effort has been made to develop meaningful data which can be used by the Town Council to make a decision on the initial feasibility of this potential project, and it's associated cost and Council goal impacts.

A Class 1 Caltrans bikeway has a required minimum width of 8 feet of pavement, with two foot shoulders on both sides, a minimum vertical clearance of 8.2 feet, and a recommended maximum sustained longitudinal slope of 1:20 (5.0%). Reaches of steeper slopes, up to a maximum of 1:12 (8.33%) are possible, so long as compliance with ADA requirements are maintained. The detailed requirements from the Caltrans manual are attached as Appendix A. The existing box culvert that runs

under Hwy 101 is a cast in place structure with a width of 20 feet, and a height of 12 feet. It has an overall length of approximately 400 feet. There is an existing asphalt bike and pedestrian path along the east side of Windsor Creek that currently terminates at Los Amigos Road. The Town Council has expressed a desire to investigate the feasibility of extending this pathway to the southwest side of the freeway, allowing for an eventual direct connection to the Town Green. Windsor Creek in the subject reach is a relatively steep sided, high flow volume creek, subject to deep flows at least annually. Outside regulatory agencies, including Caltrans, California Department of Fish & Game, Regional Water Quality Control Board, Army Corps of Engineers, and US Fish & Wildlife all have regulations in place that would discourage one or more of the components of the proposed pathway project. In addition, we anticipate that the Town police and Fire District may also have concerns over the introduction of bicycle and pedestrian traffic into a creek environment, and through a long, dark, and damp box culvert subject to seasonal flooding. There is no shortage of challenges to achieving the Council's vision for this pathway.

Starting with the basic geometric requirements, it was quickly determined that the addition of the pathway in compliance with Caltrans requirements, would not be possible within the confines of the currently proposed 42 foot span arch structure. The constraints are primarily vertical and hydraulic. It was further determined that the only arch type structure that could provide the required minimum vertical clearance for the pathway, and at the same time be located outside of the limits of "mean high water" through the crossing (a characteristic that is very important to most of the regulatory agencies listed above, and important from a practical standpoint relative to the frequency with which the pathway would have to be closed due to high water), is a 60 foot span structure, which is also the largest structure made in this configuration. This structure is inefficient from a shape standpoint, in that the additional span is needed largely to accommodate the "arch" design at the haunches of the structure, forcing the pathway to move toward the creek in order to attain sufficient minimum vertical clearance. See attached sketches. As an alternative to the widest arch, the use of a pre-cast bridge structure has also been conceptually investigated. A similar bridge was constructed several years ago to carry Windsor Road over Windsor Creek at the Vintage Greens subdivision. A bridge would require a shorter span of approximately 54 feet to contain the creek and the pathway improvements. See attached sketches. The relative costs of the currently proposed 42 foot span structure, the 60 foot span structure, and the 54 foot span bridge are presented in the table below. **These costs should be considered order of magnitude costs, as no design work has been done on the latter two alternatives.** The costs also, for simplicity, exclude costs common to each of the alternatives, including surface street improvements, traffic control, landscaping, erosion control, etc.

Structure	Base Cost	Difference
42 ft arch	$745,000	n/a
60 ft arch	$1,187,000	+$442,000
54 ft arch	$850,000	+$105,000

As you can see from the table, each of the alternatives to the currently proposed 42 foot span structure is more costly. The cost differential between the currently proposed structure and either of the

alternatives would presumably be funded by the Town, in addition to the commitment of Town Traffic Impact Fees that has been earmarked to this specific project since prior to the incorporation of the Town.

In addition to the constraints at the proposed Los Amigos Road creek crossing, there are a number of other challenges related to the vertical and horizontal alignment of the proposed pathway. The flowline of the Caltrans box culvert under Hwy 101 is approximately 20 feet below the adjoining top of creek bank elevation. Where the pathway would traverse the Caltrans box culvert, it would need to be at or near to the bottom of the culvert, so as to not significantly impact the hydraulic capacity of the structure. This structure currently always contains some amount of flow, so a method would need to be devised to keep the pathway dry, without unduly reducing the capacity of the culvert to pass storm flows. In addition, railings, lighting, and signage associated with the culvert portion of the route would have to be removable and waterproof, as the pathway would go under water a number of times in a given year.

Northeast of the crossing, the pathway must climb the twenty feet of the bank height, gradually working it's way up the east bank of the creek, requiring a significant amount of tree and vegetation removal. See photos 4, 5, and 6. In addition, in order to maintain the existing top of bank pathway connection to Los Amigos Road, a retaining wall with heights up to 13 feet will be needed between the new Cl 1 bike path and the existing bike path. This will occur northeast of the Los Amigos Road crossing. On a preliminary basis, it appears that it will require approximately 200 feet of pathway to transition from the upstream end of the Los Amigos Road structure, to the existing top of bank pathway, much of this constructed as a series of 1:12 ramps with landings every 30 feet and hand railings, to comply with ADA requirements for accessibility. The presence of hand railings will interfere with high flood flows, and so will need to be removable for larger return frequency storms, or the pathway will need to be completely closed during the winter months. For context, photo 4 illustrates the type of creek bank vegetation that would have to be removed in this area. The cleared/rip rapped area in the foreground of photo 4 is the portion of the creek that will be under the proposed Los Amigos Road crossing, and has already been cleared of vegetation. The next 200 feet of the streambank extending upstream of the currently cleared area, is what would need to be cleared and graded for the pathway transition to the top of the bank. This work would extend past the two large trees in the background.

Southwest of the Caltrans box, the creek is also steep sided, heavily vegetated, and there is only approximately 130 feet of creek available between the outlet of the box culvert, and the Old Redwood Highway bridge within which to take up the approximately 15 feet of elevation differential. If the pathway is implemented on the east side of the creek, which works best northeast of Hwy 101, the configuration south of the Highway will present a considerable constraint, as the creek is framed by the southbound off ramp and Old Redwood Highway. A series of reversing ramps separated by retaining walls would be required to accomplish the transition, and would terminate at the back of the pedestrian ramp that exists at the intersection of the southbound offramp and Old Redwood Highway. See attached sketch. It would also require the removal of all of the existing vegetation on the east bank of the creek. See photos 1, 2, and 3. If the alignment were to be shifted to the west side of the creek, there is more room for the vertical transition west of the Highway, but getting the pathway to this side of the creek east of the Highway is problematic, and crossing from one side to the other while

traversing the box culvert would present it's own set of very challenging constraints. There is also heavy vegetation on the west bank of the creek, which would be significantly disturbed by this effort.

The regulatory challenges facing this project are also significant. When the commercial project at Los Amigos and Brooks Road South was initially proposed, an extension of the existing Caltrans box culvert was proposed, which would have increased the overall length of the box culvert to nearly 500 feet. While this approach to the design was acceptable to Caltrans, it was strongly opposed by the environmental regulatory agencies from whom permits were also required. In an attempt to resolve the environmental agency concerns, Caltrans was approached with the idea of implementing some very minor design modifications inside the culvert, such as a 6" high curb near one side of the culvert, with regularly spaced partial cross curbs, the intent of which would be to create a potential area on one side of the culvert for fish passage. Another alternative that was explored with Caltrans was the creation of a notch below the floor elevation along one side of the culvert to achieve the same goal. The environmental agencies were concerned that even the existing culvert at 400 feet presents a significant barrier to the upstream migration of endangered fish species. Caltrans was adamant that no modifications of that nature could be made to their structure. Given their reaction to such relatively minor modifications, we anticipate that their reaction to a proposal to incorporate a Cl 1 bike path into the culvert, on a short pedestal, with lighting and railings, would be strongly opposed by Caltrans staff.

California Department of Fish and Game will have concerns regarding the significant loss of vegetation and trees along the creek that would result from the grading necessary to create the pathway as it transitions from the top of bank to the flowline of the box culvert, and back to the top of the bank. These impacts could potentially be mitigated by a replanting program

The US Army Corps of Engineers would require a permit for any work that would occur below the mean high water line, which is the average level to which water rises in a creek on an annual basis. All of the pathway between the Los Amigos Road structure and the Highway 101 culvert, and a good portion of it west of the Highway 101 culvert, would be below the mean high water line. Because there have been determined to be endangered fish species in this reach of Windsor Creek, the work below the mean high water line would also require a consultation from the US Fish & Wildlife Service, an agency we have found very difficult to deal with from a regulatory and processing time standpoint. It is very likely that they would require mitigations to the existing Caltrans box culvert that Caltrans would be unwilling to accept. Mitigating the loss of creek bank vegetation to their satisfaction would also be a challenge.

Finally, the Regional Water Quality Control Board would assert jurisdiction over the project as "waters of the state", and would require a full permit submittal and review, which would cover many of the same concerns that would be raised by Fish & Game, the Corps of Engineers, and US Fish & Wildlife Service.

Because of the multitude of state and federal agencies that would have jurisdiction over a project of this type, it seems inevitable that any solution that would result in a design for which permits by all of these agencies could be issued would also require political will and support for the project, on both a state and federal level, all of which would take substantial time. It should be mentioned that many of these challenges were faced by the City of Santa Rosa to implement their Prince Memorial Greenway project,

and they were ultimately successful in crafting a design and mitigation program that was acceptable to both Caltrans and the environmental regulatory agencies. This agreement was not achieved without a significant investment of time and money.

If the Council decides to pursue the feasibility of this proposed pathway beyond this initial analysis, a decision will also need to be made regarding how to finish the hotel and associated parking lots in the absence of the Los Amigos Road crossing over Windsor Creek. Completion of the hotel parking lot depends upon the vacation of the existing Los Amigos Road right of way, and rerouting all public street traffic onto new Los Amigos Road. One possible solution would be for the Council to agree to pursue the feasibility of the pathway, and authorize the redesign of the Los Amigos Road crossing to utilize one of the alternate structures discussed above that would accommodate the pathway geometry. It should be possible to redesign the crossing, and obtain approvals from all necessary agencies in a timeframe that could allow for construction of the creek crossing structure during the 2009 construction season, and the completion of the Los Amigos Road realignment in 2009. Approvals for the pathway itself would likely require several additional years to obtain, and there is no certainty that approval from all agencies having jurisdiction could be obtained. If this approach were to be taken, a temporary connection could be made between existing and new Los Amigos Roads that would utilize the existing culvert crossing, would divert public traffic out of the commercial project, and allow for the 2008 completion of the bulk of the parking lot improvements for the hotel and restaurant.

More information on the probable stance of the regulatory agencies having jurisdiction, and well as studies of how Los Amigos Road traffic could be rerouted in the interim, would be included in phase 2 of the study. We hope that you will find this information useful in your discussion of this proposed improvement.

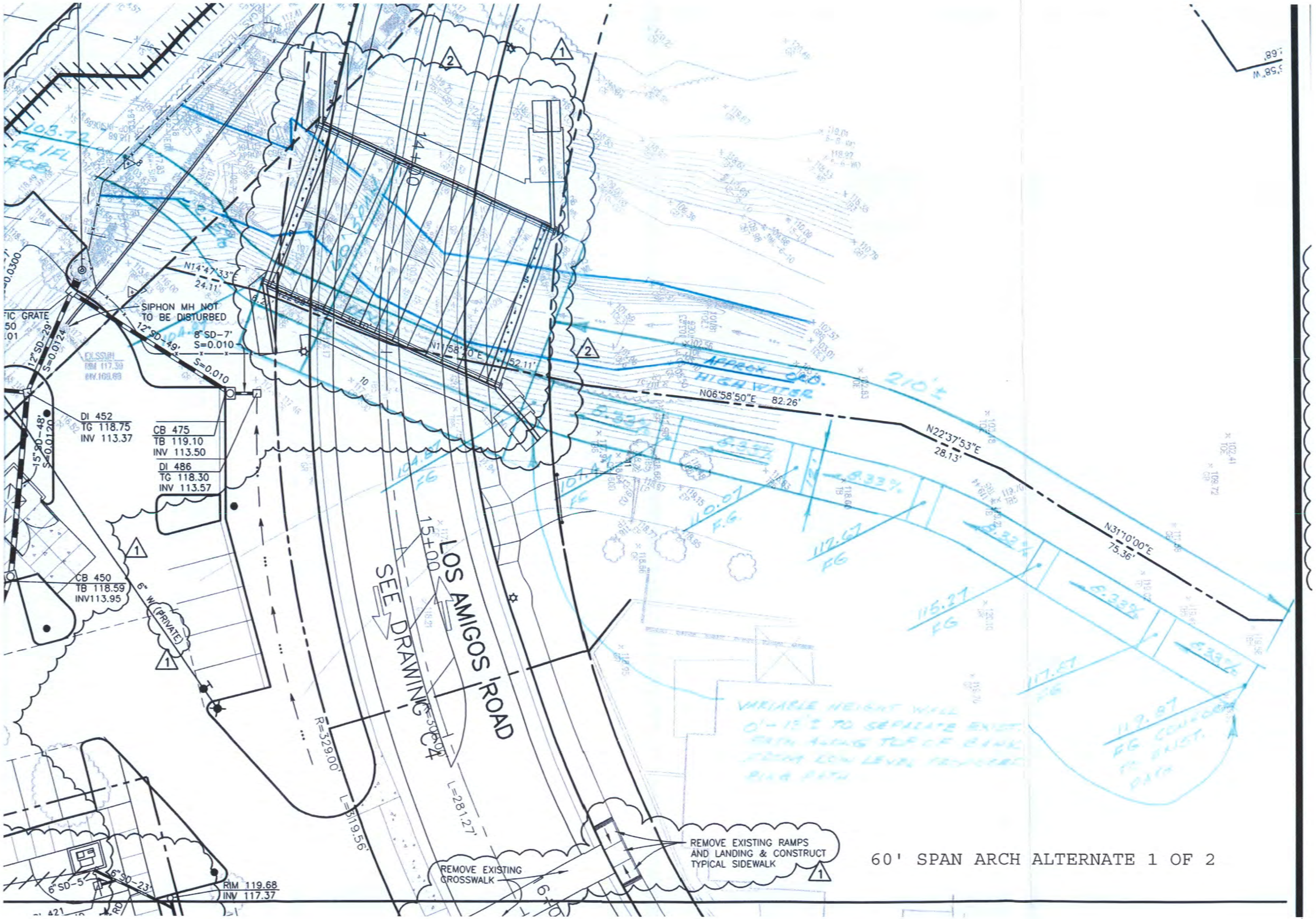
Very truly yours,

BRELJE & RACE

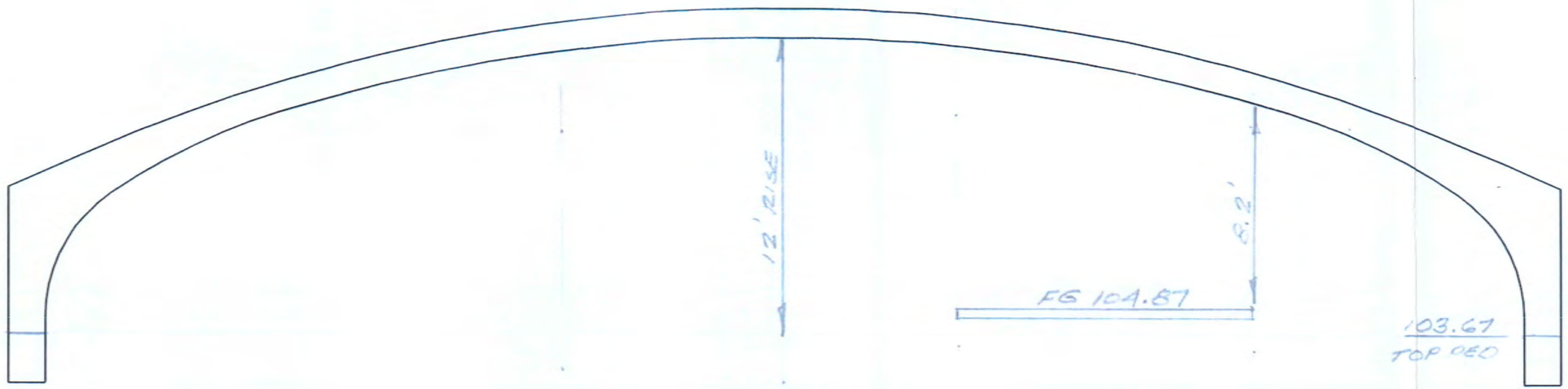
Thomas R. Jones

REGISTERED PROFESSIONAL ENGINEER
THOMAS R. JONES
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30129
EXP 12-31-09
STATE OF CALIFORNIA
2/28/08

enclosure



60' SPAN ARCH ALTERNATE 1 OF 2

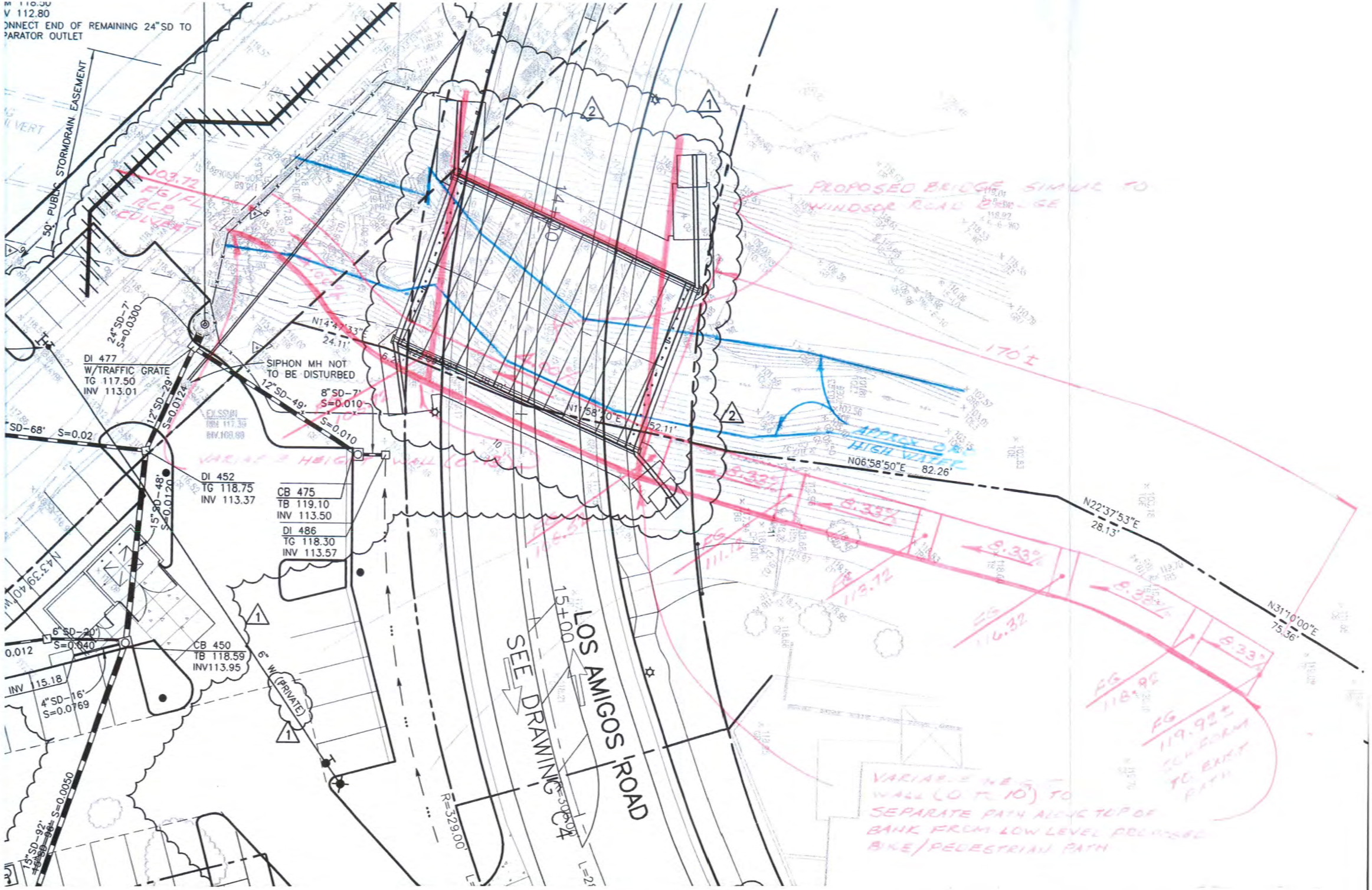


60' Span

ALTERNATE No. 3

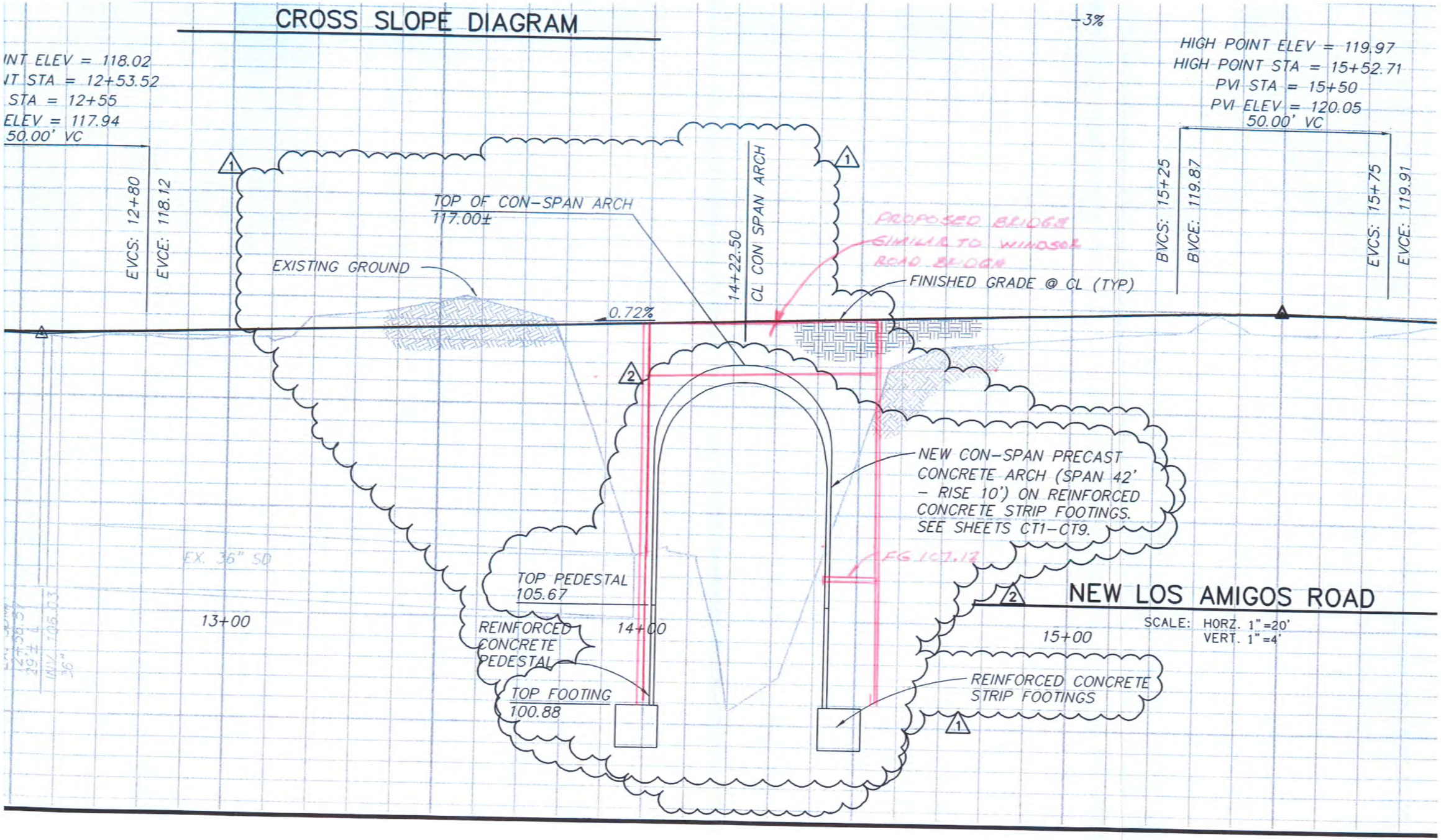
ARCH SHAPES PROVIDED BY
ERIC KENNEDY AT CONTECH BRIDGE SOLUTIONS
2/13/08 SCALE: 1" = 5'

60' SPAN ARCH ALTERNATE 2 OF 2

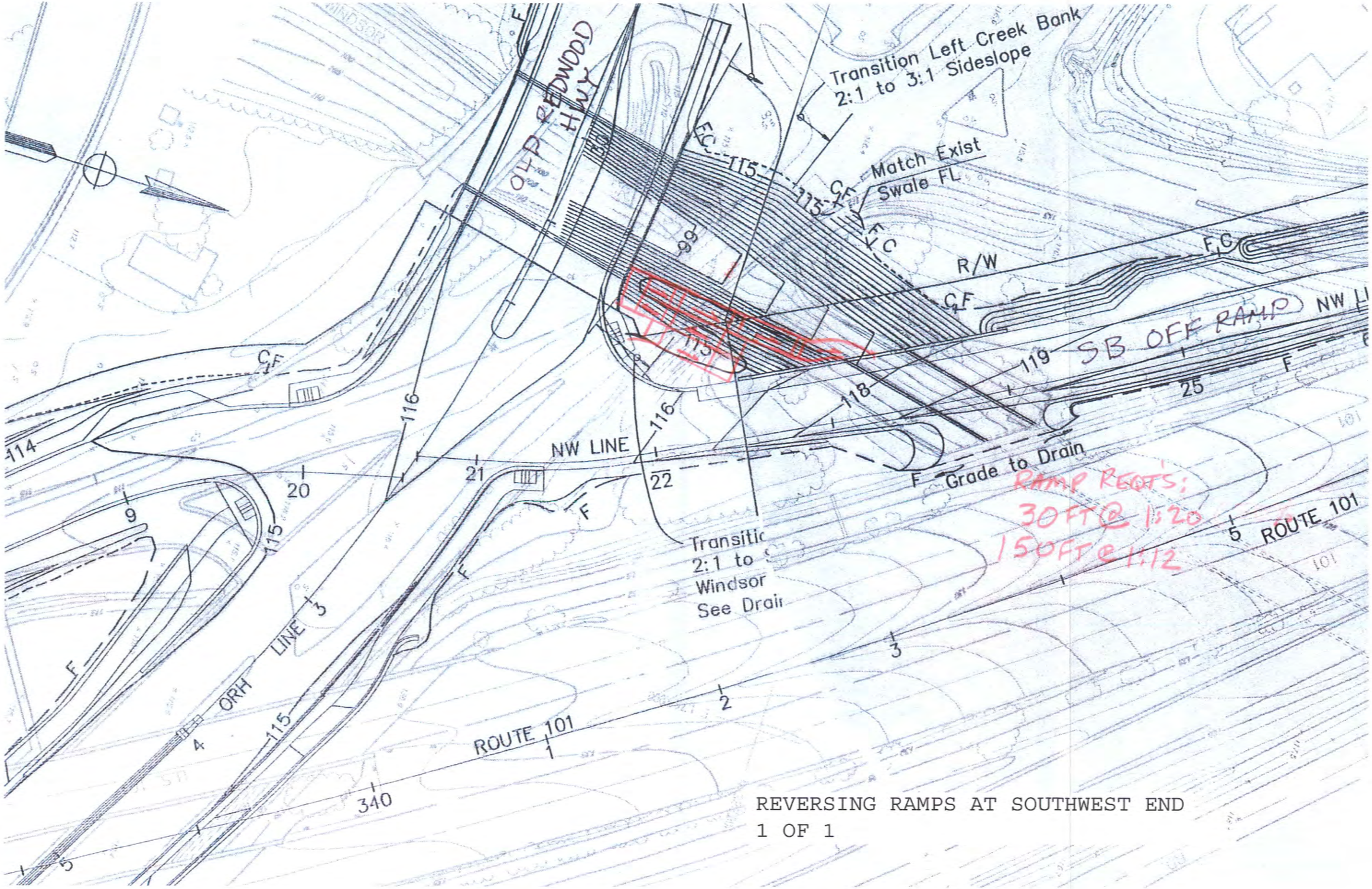


PRECAST BRIDGE ALTERNATE 1 OF 2

CROSS SLOPE DIAGRAM



PRECAST BRIDGE ALTERNATE 2 OF 2



REVERSING RAMPS AT SOUTHWEST END

1 OF 1



1. LOOKING DOWNSTREAM TOWARDS OLD REDWOOD HWY.



2. DOWNSTREAM EXIT OF EXISTING CALTRANS 12'x20' BOX.



3. LOOKING UPSTREAM FROM OLD REDWOOD HWY.



4. LOOKING UPSTREAM FROM OUTLET OF PROPOSED LOS AMIGOS ROAD CULVERT.



5. LOOKING UPSTREAM FROM PROPOSED INLET OF LOS AMIGOS ROAD. CULVERT.



6. LOOKING DOWNSTREAM AT ENTRANCE TO CALTRANS BOX.



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