3.2 Physical Environment

3.2.1 Introduction

This section addresses all aspects of the physical environment. These aspects include hydrology, water quality, geology, soils, seismicity, topography, hazardous materials, air quality, noise, and energy. The section describes the physical environmental attributes of the corridor, and the potential hazards that can result construction of the MSN Project, as well as concerns raised by construction of the transportation improvements in potentially hazardous areas. Many of the concerns described in this section relate to the short-term construction period and how building the mainline improvements, the HOV lanes, the interchanges, and bridge modifications can result in erosion, exposure to geotechnical hazards and/or contaminated soils or ground water, water quality and air quality impacts, and increased noise levels over the background conditions.

3.2.2 Hydrology and Floodplains

This section describes the surface water and groundwater conditions in the project corridor. The primary focus of analysis is whether the MSN Project would exacerbate existing flood hazards within the project boundaries or expose the roadway and the public to new flood risks. The information presented here is based upon the *Floodplain Evaluation Report Summary*, August 2005 (Appendix G); the *Caltrans Preliminary Drainage Report*, January 2006 and Caltrans *Draft Water Quality Report*, updated March 2007. Information in those reports is supported by several extensive on-site field reviews conducted by Caltrans Hydraulics personnel to locate and visually assess the size and condition of drainage facilities within the limits of the MSN Project study area. A total of 181 existing drainage crossings (not including bridges) have been surveyed within the project boundaries. The field reviews also included gathering information from and coordinating with maintenance personnel, representatives of the Sonoma County Water Agency (SCWA), and the public works departments of the City of Novato and the City of Petaluma.

3.2.2.1 Regulatory Setting

EO 11988 (Floodplain Management) directs all federal agencies to refrain from conducting, supporting, or allowing actions in floodplains unless it is the only

practicable alternative. The FHWA requirements for compliance are outlined in 23 CFR 650 Subpart A. In order to comply, the following must be analyzed:

- The practicality of alternatives to any longitudinal encroachments;
- Risks of the action;
- Impacts on natural and beneficial floodplain values;
- Support of incompatible floodplain development; and
- Measures to minimize floodplain impacts and to preserve/restore any beneficial floodplain values impacted by a project.

The 100-year floodplain is defined as "the area subject to flooding by the flood or tide having a 1 percent chance of being exceeded in any given year." An encroachment is defined as "an action within the limits of the 100-year floodplain."

Changes to the floodplain will require concurrence from the Federal Emergency Management Agency (FEMA). FEMA Flood Insurance Rate Maps (FIRM) can be reviewed in Appendix G.

3.2.2.2 Affected Environment

Regional Hydrology

According to the FEMA Marin County Flood Insurance Study (2006), the climate of Marin County is characterized by warm, dry summers, and mild, wet winters. The rainy season is from October to April with an annual rainfall ranging from 76 centimeters (30 inches) in the northern portions of the county to 152 centimeters (60 inches) along the higher ridges of the county.

According to the FEMA Sonoma County Flood Insurance Study (1997), the climate of Sonoma County is Mediterranean with mild winters and dry summers. The rainy season is from November to April. Precipitation in southeastern Sonoma County, the MSN Project area, ranges from less than 51 centimeters (20 inches) to 102 centimeters (40 inches).

Ground Water Resources

The MSN Project area overlies three major ground water basins: the Wilson Grove Formation Highlands, the Petaluma Valley Basin, and the Novato Valley Basin. According to the United States Department of Agriculture, Natural

Resources Conservation Service website, there are several locations in the MSN Project area where the ground water is relatively shallow (less than 6 ft or 1.8 m, below the surface), resulting in water-saturated zones. These locations are directly related to water bodies that cross the MSN Project:

- near the intersection of US 101 and Lakeview Road, adjacent to the Petaluma River;
- north of Oak Shade Lane near Black John Slough and Rush Creek;
- the Arroyo Creek crossing of US 101; and
- near Frosty Lane that also crosses US 101.

Furthermore, the Geotechnical Report (Caltrans 2005) for the MSN Project summarizes historic borings within the project boundaries. Ground water depths ranged from 0 to 10 m below existing grade. A majority of the sites with available ground water information were at or adjacent to creeks or water bodies. Ground water depths tend to be higher at these locations.

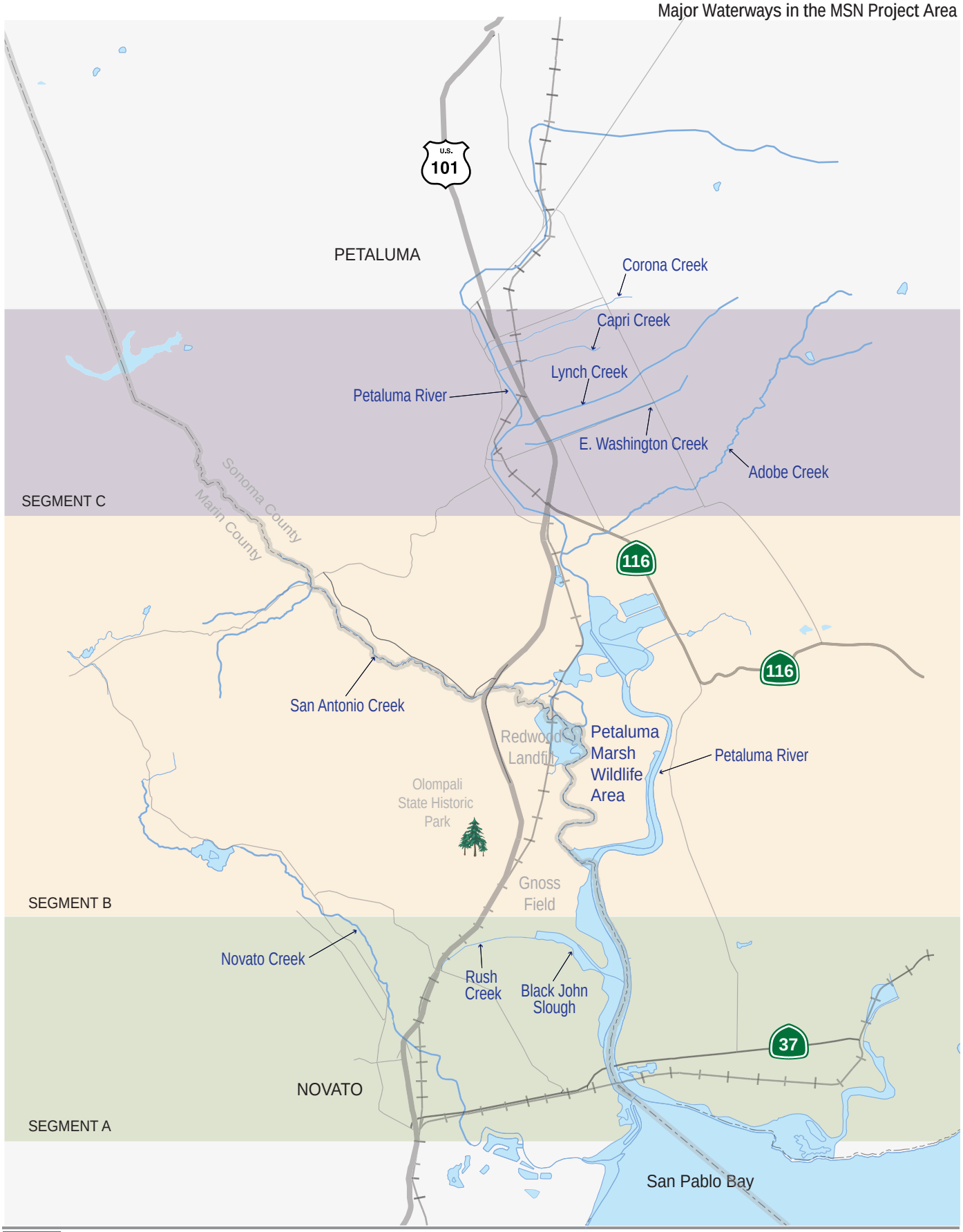
Surface Water Resources

The MSN Project is located in northern Marin County and continues through the southern section of Sonoma County. Segment A (the Southern Segment) of the MSN Project is located within Marin County, Segment C (the Northern Segment) is located within Sonoma County, and Segment B (the Central Segment) straddles both counties. The MSN Project area drains towards San Pablo Bay which is located to the southeast of the MSN Project. Figure 3.2-1 shows the surface waters in the project area and Figures 3.2-2a-d focus on those waterways within the project boundaries and the related 100-year floodplain.

The MSN Project is located in the San Pablo Unit of the San Francisco Bay Basin, and specifically within the San Pablo Bay Watershed. This watershed falls within the jurisdiction of the San Francisco Bay RWQCB.

- **Segment A (Southern Segment).** This segment is within Novato Hydrologic Sub-Area (HSA) 206.20. The primary receiving water bodies are Arroyo Avichi/Novato Creek and Arroyo San Jose. Arroyo San Jose is tributary to Novato Creek. Novato Creek drains to San Pablo Bay.

FIGURE 3.2-1
Major Waterways in the MSN Project Area



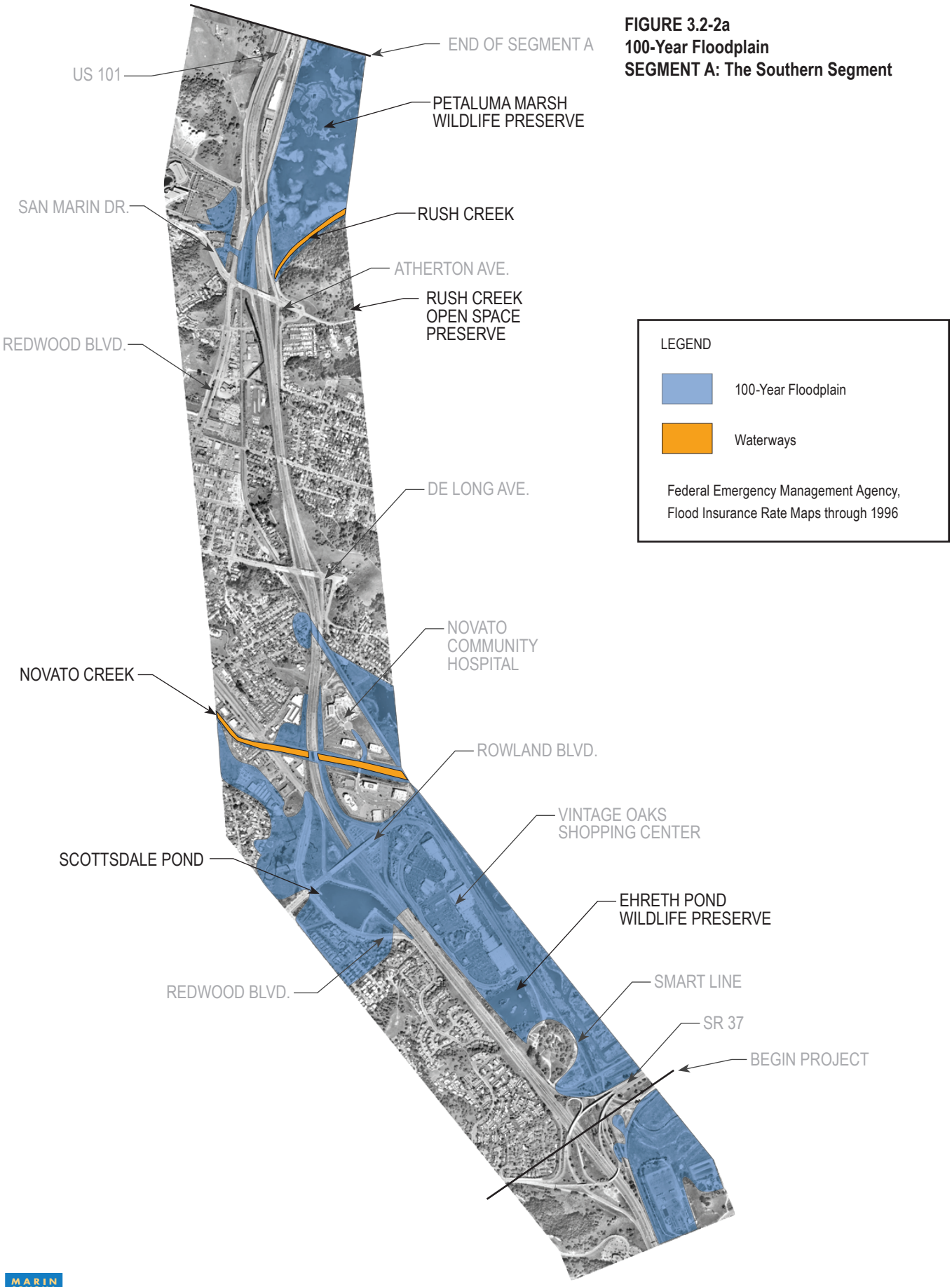
MARIN SONOMA NARROWS

NORTH

Note: Not to scale.

TB04200602BAO fig3_2_1_waterways.ai

FIGURE 3.2-2a
100-Year Floodplain
SEGMENT A: The Southern Segment



MARIN SONOMA NARROWS

NORTH

Note: Not to Scale

FIGURE 3.2-2b
100-Year Floodplain
SEGMENT B: The Central Segment
(to County line)

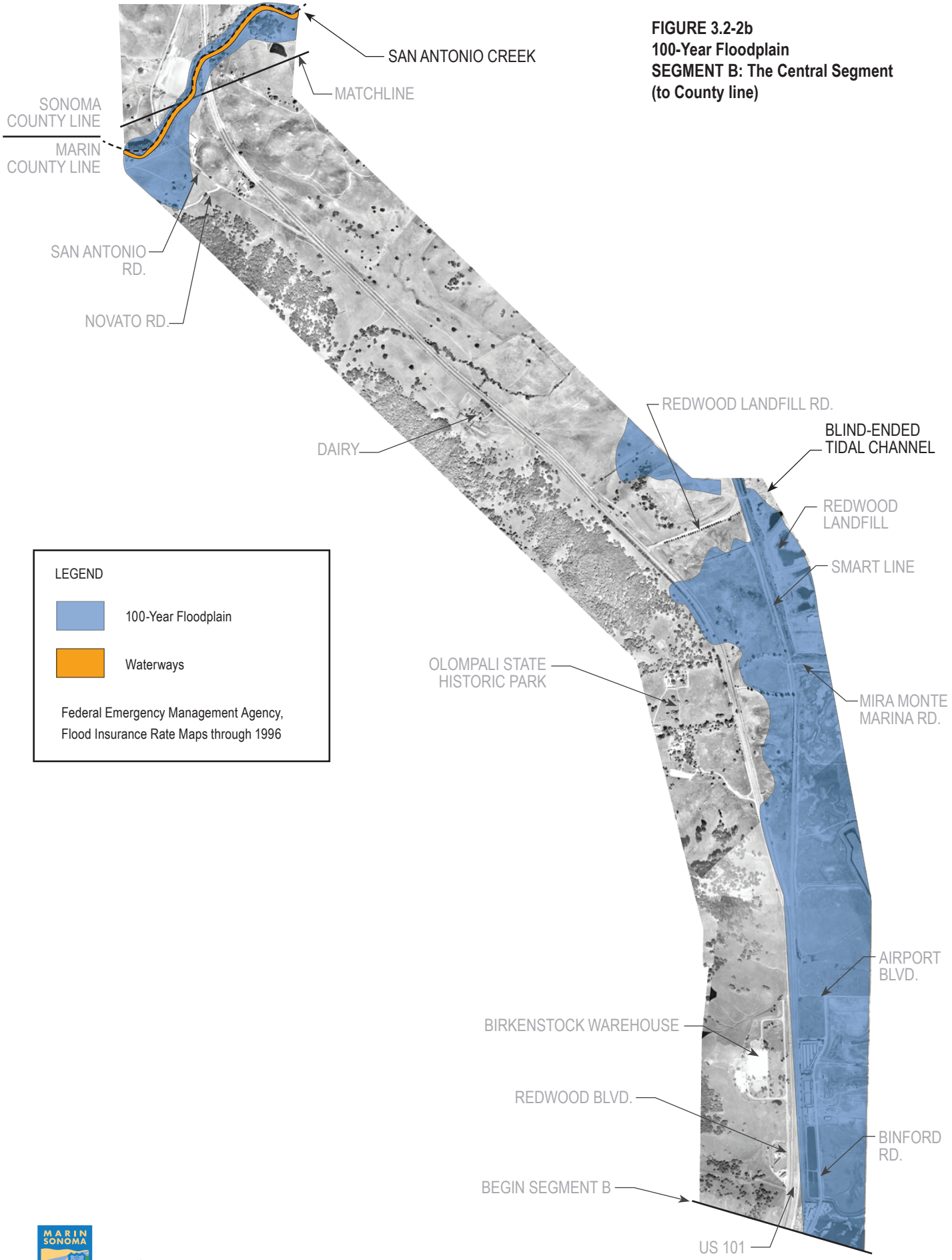


FIGURE 3.2-2c
100-Year Floodplain
SEGMENT B: The Central Segment
(from County line)

Note: Not to Scale

FIGURE 3.2-2d
100-Year Floodplain
SEGMENT C: The Northern Segment

Note: Not to Scale

- **Segment B (Central Segment).** This segment is within the Petaluma River HSA 206.30 and the Novato HSA 206.20. The primary receiving water bodies are Petaluma River, Adobe Creek, Ellis Creek, San Antonio Creek, an unnamed creek, Olompali Creek, Basalt Creek, and Rush Creek. The unnamed creek and Olompali Creek are tributary to San Antonio Creek. Adobe Creek, Ellis Creek, and San Antonio Creek are tributary to Petaluma River. Basalt Creek and Rush Creek flow east through Black John Slough before draining to Petaluma River which continues southeast and empties into San Pablo Bay. Petaluma Marsh is approximately 1.5 km east of the MSN Project.

- **Segment C (Northern Segment).** This segment is within the Petaluma River HSA 206.30. The primary receiving water bodies are Willow Brook, Corona Creek, Capri Creek, Lynch Creek, East Washington Creek, and Petaluma River. Willow Brook, Corona Creek, Capri Creek, and Lynch Creek flow southwest and are tributaries to Petaluma River. Petaluma River continues southeast and empties into San Pablo Bay.

Flooding within the Project Area

Historical records indicate that, in general, the existing culverts and drainage systems adequately transport on-site and off-site flows to receiving waters without localized flooding. Exceptions to this are in the regions of PM 23.9 (KP 38.5) in Marin County near the Birkenstock complex, PM 0.15 (KP 0.25) in Sonoma County near the San Antonio Creek and PM 3.34 (KP 5.36) of the Petaluma Urban Area, as described below.

Birkenstock Area. Near PM 23.9 in Marin County, commercial development on the western side of US 101 over the past 40 to 50 years has resulted in substantial increased runoff. Attempts to remedy this condition include redirecting some of the natural channels in the area, which has caused occasional flooding along US 101 at several locations where existing culverts are unable to accommodate the increased flows.

San Antonio Creek Area. Flooding occurs on US 101 just north of the Marin/Sonoma county line, which follows San Antonio Creek in the vicinity of the MSN Project. This condition can be caused either by infrequent, large-volume flows in San Antonio Creek or by more frequent, but less intense, storm events that cause local runoff to concentrate at the northerly intersection of Old San Antonio Road and US 101.

In general, the flooding that occurs at the northern intersection of old San Antonio Road is not the result of high flow in San Antonio Creek, but as a result of inadequate highway drainage facilities. A grated drainage inlet in the median about 500 ft north of the San Antonio intersection was found to be poorly maintained, resulting in overflow storm water being passed onto the intersection area. Additionally, there exists a system of small diameter (12") culverts that are poorly maintained and filled with roadside debris. Even with proper maintenance, it is unlikely that the drainage system at San Antonio intersection is capable of handling more than a five-year rainfall event.

Petaluma Urban Area. Localized flooding has historically been a problem in the City of Petaluma, especially in the region from US 101 westward to the Petaluma River. Much of this area lies in the Petaluma River floodplain, and in those of several smaller creeks that flow to the river. Corona Creek, Lynch Creek, and Washington Creek drain watershed areas to the east of the city and flow westward under the freeway to the Petaluma River. Most of the on-site drainage from the freeway discharges to these small creeks and finds its way to the river.

In the East Washington Interchange area, Caltrans maintenance personnel have reported backyard flooding in at least some of the residences located in the southeast quadrant of the interchange. A field review of this area indicates a depressed area to the south and east of the northbound off ramp where highway runoff may be trapped by the adjacent residential development.

3.2.2.3 Impacts

Ground Water

Fixed HOV Lane Alternative. The proposed grading required for the MSN Project may have localized impacts to the flow of ground water, particularly in the locations that are water saturated: near the intersection of US 101 and Lakeview Road; north of Oak Shade Lane near Black John Slough and Rush Creek, at the Arroyo Creek crossing of US 101, and near the Frosty Lane crossing of US 101. However, because the affected ground water basins are so large, the localized impacts of permanently installed footings, retaining walls, or bridge supports would have minimal effect on the overall direction or rate of ground water flow towards San Pablo Bay.

The additional impervious surfaces from the widened freeway, interchange, and Access Options would reduce the areas that serve to recharge the underlying

ground waters. In Segment A (the Southern Segment) and in Segment C (the Northern Segment), the reduction in ground water recharge areas would be minimal because the additional acres of impervious surface for the HOV lanes is small, especially when compared to the recharge areas of the Novato Valley Basin and the Wilson Grove Formation Highlands Basin, respectively. In addition, the affected areas of Segments A and C are in urbanized areas, where ground water recharge is already limited. In Segment B (the Central Segment), the extent of new impervious surfaces (64 ha, or 157 ac) is considerably greater than in Segments A and C (20 ha, or 49 ac, combined). While the reduction in ground water recharge area would therefore be greater in Segment B than in Segments A and C, the impact would still be minimal because the Petaluma Valley Ground Water Basin which underlies this portion of the project corridor is vast and largely undeveloped. Therefore, the risks of proposed project are not significant, do not constitute a significant floodplain encroachment, and there is no increase in the base floodplain elevation.

Reversible HOV Lane Alternative. Under this alternative, the amount of new impervious area, bridgework, and installation of support columns and footings would be the same as identified for the Fixed HOV Lane Alternative. As a result, the Reversible HOV Lane Alternative would be expected to have minimal ground water impacts.

Access Options. Table 3.2-1 indicates the amount of additional impervious surface area under each Access Option. Access Option 4b would require the least amount of additional impervious surface, 11.5 ha (28.3 ac), while Access Option 12b would require the greatest amount of additional impervious surface, 14.0 ha (34.6 ac). Impacts to ground water from loss of ground water recharge areas would be minimal under each of the four Access Options since the amount of additional impervious surface area reported in Table 3.2-1 would be negligible compared to the large recharge areas for the underlying ground water basins.

Table 3.2-1 Additional Impervious Surface by Access Option

Access Option	Hectares	Acres
4b	11.5	28.3
12b	14.0	34.6
14b	13.6	33.6
14d	13.4	33.1

No Build Alternative. The No Build Alternative would not have an impact on ground water within the project boundaries, since this alternative involves only routine maintenance and upkeep of existing facilities.

Drainage

Fixed HOV Lane Alternative. Most of the existing drainage facilities in the urban areas of the Southern and Northern Segments continue to be used with only minor modifications, while most culverts in the rural areas of the Central Segment must be replaced or upgraded to meet design standards, and address corrosion damage or inadequate capacity. The Fixed HOV Lane Alternative would increase the paved surface of the area of the freeway corridor (83 ha, or 205 ac) and thereby could permanently increase storm water runoff to the regions historically affected by flooding. Many of the existing rural culverts (Segment B) are metal and have been in place up to 70 years. These culverts typically have exceeded their service life and are severely corroded. As part of the MSN Project, many of the existing culverts would be replaced to meet the current minimum standard of 600 mm. Consequently, the MSN Project would not adversely alter drainage patterns but improve existing conditions, particularly areas currently susceptible to flooding.

Birkenstock Area. The project would upgrade the undersized culverts to handle storm water quantities calculated for the watershed as they exist today and correct the roadway overtopping problems that are periodically being experienced.

San Antonio Creek Area. The MSN Project would replace the single 24" cross culvert with two 36" cross culverts and raise the roadbed in some stretches to eliminate flooding problems.

Petaluma Urban Area. In order to maintain on-site highway drainage at or below current levels, detention facilities are planned, where necessary, throughout the Petaluma urban area. Several methods of detaining storm water runoff are being considered: (1) ponds, (2) open swales and/or ditches, and (3) underground storage. Detention ditches with metering devices could be strategically placed within the right-of-way to discharge any existing drainage channels.

Widening for the Fixed HOV Lane Alternative would take place in the existing highway median. This would likely take place after construction of the East Washington Interchange Project; therefore, the MSN Project would conform to the drainage system installed as part of that interchange project.

Reversible HOV Lane Alternative. Under this alternative, drainage impacts would be the same as for the Fixed HOV Lane Alternative. While there would be some incremental increase in storm water runoff due to the increased impervious areas (83 ha, or 205 ac), the Reversible HOV Lane Alternative would upgrade drainage facilities that are currently undersized. As a result, changes to drainage would be addressed, as described above for the Fixed HOV Lane Alternative.

Access Options. All the Access Options involve additional paving in Segment B. The additional pavement that is indicated in Table 3.2-1 would increase runoff in this segment and contribute to historic flooding hazards in the Birkenstock area and around San Antonio Creek. While the amount of impervious surface differs by Access Option, the improvements proposed in the vicinity of Birkenstock and San Antonio Creek are common to all of the Access Options. Thus, the impacts on drainage in the areas where drainage issues are greatest would be similar for all Access Options. To reduce the effect of the additional impervious surfaces and the resultant runoff and to correct existing drainage deficiencies, each of the Access Options would include new drainage facilities and improvements to the existing undersized facilities.

No Build Alternative. The No Build Alternative would involve only routine maintenance and upkeep of existing facilities. Since no additional impervious surface areas are proposed by this alternative, changes to drainage patterns would not be expected.

100-Year Flood Hazard

Fixed HOV Lane Alternative. As described below, the Fixed HOV Lane Alternative would not significantly increase flood hazards or impact the FEMA mapped 100-year floodplain.

In the Segment A, there is a 100-year flood zone (Zone "AE") around the Rowland Boulevard Interchange. The lowest elevation of US 101 in this stretch is about 11.0 ft, which is above the base flood elevation (9.0 ft on the west side and 7.0 ft on the east side). Construction of the Fixed HOV Lane Alternative in this stretch would involve widening the median to accommodate HOV lanes. This increase in impervious surface would not be enough to substantial raise the base flood water surface elevation. Therefore, although US 101 is mapped within a FEMA Special Flood Hazard Area (SFHA), the additional runoff generated by the Fixed HOV Lane Alternative would not significantly impact the floodplain.

In the Segment B, US 101 traverses another SFHA area in the vicinity of San Antonio Creek along the Marin-Sonoma County line. This area is designated Zone "A," and the 100-year flood covers an expansive area and results in flood waters flowing over US 101. To protect the road and motorists, the Fixed HOV Lane Alternative would re-align US 101 approximately 70 m to the west and raise the road 1.5 m. As a result, this build alternative would avoid the periodic overtopping that currently creates hazardous driving conditions and higher maintenance costs. In addition, to ensure that water elevations upstream would not increase as a result of the proposed improvements, Caltrans proposes to upgrade an existing 600 mm culvert to a 900 mm culvert, as well as provide an additional 900 mm culvert outlet. These improvements would enable the upstream area to drain more effectively. As a result of these modifications to the road alignment and to the drainage facilities, it is expected that the 100-year base flood elevation would not be increased and that existing hazards would be reduced or diminished. In addition, flood hazards to adjacent land uses would not be increased due to the MSN Project (preliminary Drainage Report, Caltrans 2006).

In the Segment C, extensive areas of Petaluma are subject to flooding, particularly areas along the Petaluma River and along the tributaries to the Petaluma River. At the northern end of the project corridor, where Capri and Corona Creeks feed into the Petaluma River, much of the land on either side of US 101 is designated as a FEMA 100-year floodplain. In this stretch, the Fixed HOV Lane Alternative would involve widening the median to accommodate one HOV lane in each direction. The project would not be widening the overall freeway right-of-way or further encroaching into the floodplain to an extent that would diminish the storage capacity of the 100-year floodplain. Since this build alternative would be adding new impervious surfaces that could increase storm water runoff, detention facilities would be placed strategically to not significantly impact adjacent properties and to discharge into existing natural drainage channels.

Reversible HOV Lane Alternative. Under the Reversible HOV Lane Alternative, impacts to the 100-year floodplain would be the same as the Fixed HOV Lane Alternative, because both Build Alternatives would have the same cross sections and would propose the same upgrades to existing undersized drainage facilities. In addition, the realignment of the mainline would be identical under both alternatives.

Access Options. As noted above for the discussion of the Build Alternatives, in Segment B, where the Access Options are proposed, US 101 traverses an SFHA area in the vicinity of San Antonio Creek along the Marin-Sonoma County line. The 100-year floodplain in this area covers an expansive area and results in flood waters flowing over US 101. In this vicinity, Access Options 4b, 14b, and 14d all propose the same improvements: new and modified crossings of the San Antonio Creek, an access road along the west side of US 101, an access road on the east side of US 101, and a bicycle/pedestrian path connecting the east and west sides of US 101. These Access Options would have similar impacts in terms of impervious area and contribution to flood hazards. However, both Build Alternatives would include modifications to the road alignment and to the drainage facilities, so that the 100-year base flood elevation would not be increased and that existing hazards would be reduced or diminished.

Access Option 12b would be similar to the other Access Options but would not include the frontage road along the east side of US 101. Consequently, this Access Option would result in slightly less impervious surface area than the other Access Options in this portion of Segment B, with a corresponding reduction in its contribution to flood hazards, although as explained above, the improvements associated with the Build Alternatives would result in all Access Options Being protected from the SFHA.

No Build Alternative. The No Build Alternative would not contribute to or exacerbate 100-year flood hazards. Areas that are prone to flooding currently would continue to be subject to overtapping and hazardous conditions.

Surface Water Hydrology

Fixed HOV Lane Alternative. New replacement bridges across the Petaluma River and San Antonio Creek would not further constrict the channels, and therefore would not increase flow velocity through the bridges. Caltrans does not anticipate that rock slope protection would be required around the new structures.

Reversible HOV Lane Alternative. Under this alternative, impacts to the surface water hydrology would be the same as the Fixed HOV Lane Alternative, because the design and replacement of the Petaluma River Bridge and the work around San Antonio Creek would be identical under both alternatives.

Access Options. The major waterway in Segment B, where the Access Options are proposed, is San Antonio Creek. The proposed bridgework at this creek would

be the same under each of the Access Options. Thus, the same impacts would be expected for each Access Option. As described above for the Build Alternatives, the design of the bridgework would maintain stream flow and velocity and would not be expected to adversely affect the waterway.

No Build Alternative. The No Build Alternative would not involve bridge widenings or replacement of the Petaluma River Bridge. Accordingly, this alternative would have no effect on surface water flows.

3.2.2.4 Avoidance, Minimization, and/or Mitigation Measures

The following measures would apply to both Build Alternatives.

Culvert Sizes. There are numerous locations where recommendations have been made to upgrade the existing culvert sizes to 24". Depending on the specific location, these recommendations are the result of inadequate capacity issues and/or the result of minimum design criteria for cross culverts. During the design phase of the project, it may become apparent that greater headwater elevations can be allowed at specific locations, thereby reducing the recommended culvert size.

Subsurface Drainage. Preliminary recommendations for sub-surface drainage and geotechnical considerations include:

- Install top of cut diversion ditches above all significant cut faces. Significant cuts are considered to be those greater than 3 m in height.
- Install perforated underdrain pipes at the toe of all significant cut slopes and in other locations where existing installations of perforated pipe drains suggest that seepage water may be a problem.
- Install horizontal pipe drains in cut faces where slope instability has been observed. This condition has been noted in the vicinity of PM 27.5 in the vicinity of Atherton Avenue in Marin County and PM 2.85 near Kastania Road in Sonoma County.
- Construction is proposed in channels/ditches at specific locations recommended in the Preliminary Drainage Report.

Detention Facilities. In the Petaluma urban area, detention facilities will be needed. Various options are under consideration and include ponds, open swales,

and or ditches. The detention facilities will be identified during the design phase. Regardless of the method selected to detain runoff, the facility must be designed with a capacity to detain the increased storm water runoff generated and be located strategically to discharge into natural drainage channels that ultimately flow to the Petaluma River. Metering devices (e.g., overflow weirs) could be considered to limit the rate of discharge.

Underground Storage. Caltrans will consider underground storage, which could be designed and constructed for future widening without modification of the existing storage facilities or acquisition of additional right-of-way. In evaluating this option to detention ditches, Caltrans will weigh right-of-way needs, on-going maintenance, costs, and storm water quality benefits.

3.2.3 Water Quality and Storm Water Runoff

The Water Quality section of the environmental document relies heavily on input from Environmental Engineering staff. This section describes storm water regulations affecting the project, receiving water bodies listed in Section 303(d) of the Clean Water Act and their beneficial uses, existing water quality, project-related storm water discharges and quality, and potential storm water impacts to water quality of receiving waters. The information presented in this section is based upon Caltrans Draft Water Quality Study Report, March 2007, and the Draft Storm Water Data Report, February 2007.

3.2.3.1 Regulatory Setting

The primary law regulating water quality is the federal Clean Water Act (CWA). The USEPA delegated its authority to oversee the implementation of the CWA in California to the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB). The RWQCB prepares and adopts the Water Quality Control Plan (Basin Plan), a master policy document for managing surface and groundwater quality in the region. The SWRCB and RWQCB issue permits, which implement the standards included in the Basin Plan as well as other requirements of the State Water Code and the CWA.

Section 401 of the CWA requires a water quality certification from the State Board or Regional Board when a project would require a federal license or permit and result in a discharge to waters of the United States.

Section 402 of the CWA establishes the National Pollutant Discharge Elimination System (NPDES) system to regulate storm water discharges, including discharges from highways, which are defined as point source discharges. To ensure CWA compliance and to facilitate processing of routine projects, the SWRCB has issued Caltrans a statewide NPDES Storm Water Permit to regulate discharges from Caltrans facilities (Order No. 99-06-DWQ, CAS000003).

In addition, the SWRCB has issued a statewide Construction General Permit for construction activities (Order No. 98-08-DWQ, CAS000002) that applies to all storm water discharges from land where clearing, grading, and excavation result in disturbances of at least 0.4 ha (1 ac) or more. All projects that are subject to the construction general permit require a Storm Water Pollution Prevention Plan (SWPPP).

3.2.3.2 Affected Environment

Beneficial Uses

Table 3.2-2 identifies each of the principal water bodies in the project boundaries and their beneficial uses as identified in the San Francisco Bay Region Basin Plan. For each beneficial use, there are water quality standards that have been established by the RWCQB to protect those uses.

Water bodies that do not meet water quality standards are identified on the state's List of Water Quality Limited Segments pursuant to CWA Section 303(d). Action plans must be developed for these water bodies to improve water quality.

Novato Creek, Petaluma River, San Antonio Creek, and San Pablo Bay are Section 303(d) "impaired" water bodies. Urban runoff and discharges from storm sewers are the principal contributors to water quality problems in Novato and San Antonio Creeks. The Petaluma River and San Pablo Bay are degraded by a wide variety of sources, including urban runoff and storm sewer discharges, agricultural activities, and construction and land development.

423 Table 3.2-2 Beneficial Uses for Water Bodies in the MSN Project Area

	Cold freshwater habitat	Estuarine habitat	Fish migration	Preservation of rare and endangered species	Fish spawning	Warm freshwater habitat	Wildlife habitat	Water contact recreation	Noncontact water recreation	Navigation	Shellfish harvesting	Municipal and domestic supply	Industrial service supply	Ocean, commercial, sport fishing
Novato Creek (Segment A)	☐		☐	■	☐	☐	■	☐	☐			■		
San Antonio Creek (Segment B)	■		■		☐	■	■	☐	☐					
Petaluma River (Segments B and C)	■	■	■	■	■	■	■	■	■	■				
San Pablo Bay (all segments)		■	■	■	■		■	■	■	■	■		■	■

Source: San Francisco RWQCB, San Francisco Basin Plan
Notes:
■ = Existing beneficial use
☐ = Potential beneficial use

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Areas Susceptible to Erosion

Areas that are characterized by moderate to high erosion potential, when combined with areas that are relatively steep and have rapid runoff characteristics, pose possible water quality concerns because ground disturbance in these areas can cause the soils to erode and be transported to nearby surface water bodies. Los Osos Clay Loam, Goulding Cobbly Clay Loam soils, and Los Osos-Bonnydoon Complex are classified as having a high potential of erosion hazard.

According to the Geotechnical Report (2005), Los Osos soils are in Segments A and B (Southern and Central Segments, respectively), and Goulding Cobbly Clay Loam soils are in Segment B only. There are no soils with high erosion hazards in Segment C (the Northern Segment).

3.2.3.3 Impacts

The primary potential for water quality impact from the MSN Project is soil erosion or suspended solids being introduced into the waterways due to construction activities or from additional runoff from added impervious areas. Water quality would also be affected by temporary and permanent encroachment into existing wetlands and Waters of the U.S. and the State. This section of the DEIR/S focuses on impacts due to construction and storm water runoff; Section 3.3.2 addresses impacts to wetlands and Waters of the U.S.

Temporary Impacts

Fixed HOV Lane Alternative. Construction-related activities that may affect water quality include excavation and grading activities, stockpiling of soils; loading, unloading and transport of excavated and fill materials; and working near various creek crossings in the MSN Project area. During construction, there is a potential for temporary impacts to occur due to increased erosion. In Segment A (the Southern Segment), the maximum disturbed soil area estimated by Caltrans would be approximately 13 ha (32 ac); in Segment B (the Central Segment), 190 ha (470 ac); and in Segment C (the Northern Segment), 13.4 ha (33 ac).

This potential for construction-period erosion is accentuated where the soils have moderate to high erosion potential and the ground-disturbing activities are near surface water bodies. In these locations, sediments could eventually be transported into nearby creeks and storm drains with storm runoff.

The MSN Project includes bridge widening or replacement over creeks or removal or extension of culvert creek crossings. Some of these creeks are perennial and may need dewatering operations or temporary creek diversions during construction. Perennial waterways crossed by the MSN Project include Petaluma River, San Antonio Creek, Basalt Creek, Rush Creek, and Novato Creek. Construction is anticipated within the creek channels at the bridges across Petaluma River and San Antonio Creek. Temporary creek diversions or dewatering operations may cause temporary impacts to wetlands or Waters of the U.S. and may temporarily degrade water quality. Dewatering for retaining wall footings or pilings may also be necessary for deep excavations. Over 70 sites were identified in the Caltrans' *Preliminary Site Investigation Report*, Volume 1 (January 30, 2006) as being known or potential areas of contamination. Ground disturbance or dewatering in these areas could release contaminants into near surface water bodies or into the underlying ground water basins, resulting in lower water quality.

Fueling or maintenance of construction vehicles would occur in the MSN Project area during construction, so there would be a risk of accidental spills or releases of fuels, oils, or other potentially toxic materials. An accidental release of these materials may pose a threat to water quality if contaminants enter storm drains, natural creeks, and other waterways. The magnitude of the impact from an accidental release would depend on the amount and type of material spilled.

A spill on the roadway would trigger immediate response actions to report, contain, and mitigate the incident. The California Office of Emergency Services has developed a Hazardous Materials Incident Contingency Plan, which provides a program for response to spills involving hazardous materials. The plan designates a chain of command for notification, evacuation, response, and cleanup of spills resulting from the transport of hazardous material. Caltrans also has spill contingency procedures and response crews.

Increased sediment load, construction activities in the waterways, and accidental spills would all trigger temporary water quality deterioration and, in the short term, compromise maintenance of the water quality objectives that are established to protect the beneficial water uses of the water bodies in the MSN Project area. Such impacts would be adverse, especially in Segment A (the Southern Segment) where the MSN Project crosses Novato Creek, in Segment B (the Central Segment) where the MSN Project crosses San Antonio Creek and Petaluma River,

and in Segment C (the Northern Segment) where the MSN Project crosses Lynch, Capri, and Corona Creeks, each of which drain into the Petaluma River. While short-term impacts could be experienced in many of the MSN Project area waterways, these particular locations are highlighted because the receiving water bodies are on the Section 303(d) list of waterways failing to meet water quality standards.

Reversible HOV Lane Alternative. Under this alternative, soil disturbance would be the same as the Fixed HOV Lane Alternative, because the footprints of the two alternatives would be the same. Impacts to water quality and the waterbodies within the project limits would therefore be similar to those of the Fixed HOV Lane Alternative.

Access Options. The amount of disturbed soils under the Access Options is generally included in the estimates for the Build Alternatives. The differences to water quality impacts among the four Access Options would be negligible, considering Caltrans' adherence to the various water quality regulations such as those under its NPDES permit.

No Build Alternative. The No Build Alternative would not impact water quality within the project boundaries, since this alternative involves only routine maintenance and upkeep of existing facilities. Any interference or disruption related to mainline or ramp repairs or maintenance would be limited in duration and scope. Construction activity associated with the routine maintenance and upkeep of existing facilities would adhere to the various water quality regulations such as those for the NPDES permit. These measures would require construction activity to avoid potential water quality impacts from storm water runoff.

Permanent Impacts

Fixed HOV Lane Alternative. After construction, permanent water quality impacts could result from the additional stormwater pollution that washes off new impervious surface area resulting from the Fixed HOV Lane Alternative. This alternative would create approximately 83 ha (205 ac) of new impervious areas, of which approximately 10 ha (25 ac) would occur in Segment A, 64 ha (157 ac) in Segment B, and 10 ha (25 ac) in Segment C.

Caltrans has performed studies to monitor and characterize highway storm water runoff throughout the State. Commonly found pollutants in storm water runoff are Total Suspended Solids (TSS), nitrate nitrogen, Total Kjeldahl Nitrogen (TKN),

phosphorous, Ortho-phosphate, Copper, Lead and Zinc. Some sources of these pollutants are natural erosion, phosphorus from tree leaves, combustion products from fossil fuels, and the wearing of break pads (Caltrans, November 2003). Runoff from the 83 ha (205 ac) of new impervious surface area under the Fixed HOV Lane Alternative would introduce more of these pollutants into the nearby receiving waters; however, as described in Section 3.2.2.4, Caltrans under the provisions of its NPDES permit, must monitor and regulate runoff from its facilities. Compliance with the NPDES permit is expected to avoid potential water quality impacts from storm water runoff.

Reversible HOV Lane Alternative. Under this alternative, the new impervious area would be the same as the Fixed HOV Lane Alternative since the cross-sectional width of the roadway would be identical, 34.2 m (114 ft). Impacts to water quality and the waterbodies within the project limits from increased storm water runoff from the additional impervious surface area would thus be the same as those of the Fixed HOV Lane Alternative.

Access Options. All the Access Options involve additional paving in Segment B. Of the 64 ha (157 ac) reported for Segment B under the Fixed and Reversible HOV Lane Alternatives, approximately 11.5-14.0 ha (28.3-34.6 ac) of additional impervious surface area would be added under the Access Options, which would increase runoff and contribute to storm water runoff and pollutant loading. Table 3.2-1 in Section 3.2.1.3 identifies the amount of additional impervious surface area under each Access Option. Access Option 4b would require the least amount of additional impervious surface, 11.5 ha (28.3 ac), while Access Option 12b would require the greatest amount, 14.0 ha (34.6 ac).

No Build Alternative. The No Build Alternative would not have permanent water quality impacts within the project boundaries, since this alternative involves only routine maintenance and upkeep of existing facilities. This alternative would not alter the existing amount of impervious surface area and thus would not increase storm water runoff.

3.2.3.4 Avoidance, Minimization, and/or Mitigation Measures

In developing the MSN Project, a number of alternatives have been identified and an alternative evaluation process was followed to avoid or minimize environmental impacts while maintaining the project's need and purpose. While this process has avoided or minimized many water resource and water quality

impacts that could otherwise occur, additional mitigation measures are still needed to reduce impacts.

Avoidance and/or Minimization Measures

Avoidance measures for the MSN Project were developed in consultations with locals and regulatory agencies. Roadway realignments, project footprint, and waterway crossings have been planned to avoid as much as possible wetlands, Waters of the U.S. and the State, and other Environmentally Sensitive Areas (ESA) that could have water quality impacts if disturbed, such as floodplains, areas with highly erodible soils, and steep slopes. Where such avoidance was not possible, such as waterway crossings, measures to minimize impacts were identified through consultation with regulatory partners and then subsequently incorporated as design modifications. In order to ensure that the MSN Project would maximize avoidance of ESAs that exist within or are adjacent to the MSN Project boundaries, these areas will be delineated, field verified, and included on all MSN Project contract plans.

In addition, proposed construction work in jurisdictional wetland areas will be restricted to regulatory windows defined in accordance with the USACE404 permit that will be needed for the MSN Project.

Mitigation Measures

As explained earlier in the description of the regulatory framework governing the protection of water resources, Caltrans adheres to a number of standard practices and BMPs, as identified in its Storm Water Management Plan (SWMP), NPDES permit, and Construction General Permit. The Caltrans Statewide SWMP identifies temporary and permanent BMPs that have been approved for statewide application to address the quality of discharges from Caltrans' facilities. The BMPs fall into four categories: Construction Site BMPs, Design Pollution Prevention BMPs, Treatment BMPs, and Maintenance BMPs. The BMPs that must be considered during the planning and design of all construction projects within Caltrans right-of-way include Construction Site, Design Pollution Prevention, and Treatment BMPs. Construction Site BMPs are implemented during construction activities to reduce pollutants in storm water discharges throughout construction. Design Pollution Prevention BMPs are permanent measures to improve storm water quality by reducing erosion, stabilizing disturbed soil areas, and maximizing vegetated surfaces. Treatment BMPs are permanent devices and facilities that treat storm water runoff. Because the area

disturbed by the MSN Project would be greater than 0.4 ha (1 ac), the BMPs must include the use of Best Conventional Technology (BCT) and Best Available Technology (BAT). Finally, Caltrans drainage facilities are considered a municipal separate storm sewer system under the Caltrans permit and, therefore, must reduce the discharge of pollutants to the Maximum Extent Practicable.

Temporary Water Quality Control Measures/Construction Site BMPs. The MSN Project shall be regulated under the NPDES Permit for Construction Activities (Order No. 99-08-DWQ, NPDES No. CAS000002), which is also referenced in the Caltrans NPDES Permit (Order No. 99-06-DWQ, NPDES No. CAS000003). Reducing possible construction activity pollutants to the BAT/BCT can be achieved by following the procedures in the *Statewide Storm Water Management Plan* (Caltrans 2003) and the *Storm Water Quality Handbook, Project Planning and Design Guide* (Caltrans 2002). To comply with the conditions of the Caltrans NPDES Permit, and to address the temporary water quality impacts resulting from the construction activities of the project, Standard Special Provision (SSP) 07-345 will be included in the specifications for the MSN Project. This SSP will address water pollution control work and the implementation of a SWPPP during construction.

Ultimately, the temporary erosion control and water pollution control measures will be defined in detail on the Erosion Control and Water Pollution Control design sheets prepared for the MSN Project and in the Project Specifications of the Contract Documents prepared for the MSN Project.

Construction activities near active waterways shall provide all necessary soil stabilization and sediment control practices to minimize the potential for impacts to the watershed. Preliminary temporary BMPs include linear sediment barriers, such as silt fences and fiber rolls, which serve to prevent sediment-laden sheet flow during construction of a project. Riparian areas adjacent to wetlands or environmentally sensitive areas will be designated and protected as ESAs with high visibility silt fences. To protect water quality where construction within creek channels is anticipated, temporary stream crossings and clear water diversions will be required. Other types of temporary BMPs that will be utilized during construction activities include tracking controls to prevent off-site tracking of sediments. These controls may include stabilized construction entrances, street sweeping, and vacuuming. Concrete wastes may be managed through the use of

concrete washout facilities. Dewatering discharges is anticipated and a dewatering permit will be required for the project.

There is the potential to discharge non-visible pollutants with storm water discharges from the construction site and/or the contractor's yard. A Sampling and Analysis Plan (SAP) for Non-Visible Pollutants will be prepared to describe the sampling and analysis strategy and schedule for monitoring non-visible pollutants in storm water discharges from the MSN Project site and the contractor's yard in accordance with the requirements of Section B of the General Permit and applicable requirements of the Caltrans Guidance Manual: *Storm Water Monitoring Protocols* (July 2000).

Compliance with the Caltrans statewide NPDES permit, including preparation and adherence to the SWPPP, should reduce or avoid substantial construction-related impacts. Table 3.2-3 lists temporary water quality control measures that may be required for the project.

Other temporary water quality or construction site BMPs are listed in the Caltrans SWMP and each should be considered for inclusion into the MSN Project as the design progresses.

Table 3.2-3 Temporary Water Quality Control Measures

Category	Minimum Requirement(s)
Soil Stabilization Practices	SS-1 Scheduling SS-2 Preservation of Existing Vegetation SS-6 Straw Mulch SS-7 Erosion Control Blankets SS-10 Outlet Protection/ Velocity Dissipation Devices
Sediment Control Practices	SC-1 Silt Fence SC-5 Fiber Rolls SC-7 Street Sweeping and Vacuuming SC-10 Storm Drain Inlet Protection
Wind Erosion Control	WE-1 Wind Erosion Control
Non-Storm Water Control	NS-6 Illicit Connection/Illegal Discharge Detection and Reporting NS-8 Vehicle and Equipment Cleaning NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance
Waste Management & Materials Pollution Control	WM-1 Material Delivery and Storage WM-2 Material Use WM-3 Stockpile Management WM-4 Spill Prevention and Control WM-5 Solid Waste Management WM-8 Concrete Waste Management WM-9 Sanitary/Septic Waste Management
Temporary Construction Practice	TC-1 Stabilized Construction Entrance/Exit

Design Pollution Prevention BMPs. The design of drainage and landscape elements can effectively also function as pollution prevention BMPs. Concurrence with the following BMPs shall be obtained from the Caltrans Hydraulic and Landscape Architecture units as required under Section 4.3 of the SWMP:

- **Consideration of downstream effects related to potentially increased flow:** To reduce effects of discharge to unlined channels, erosion control measures will be applied to restrict water velocity to less than 1.2 m/s during a 25 year storm. Sediment loading is considered minimal given the flattened slopes and the revegetation included as a permanent BMP.
- **Preservation of existing vegetation:** At all locations, existing vegetation will be preserved as much as possible.
- **Concentrated flow conveyance systems:** The MSN Project will have the potential to: (a) cause gullying, (b) create or modify existing slopes, and (c) require the concentration of surface runoff. To mitigate for these conditions, drainage facilities will be properly designed to handle concentrated flows. Concentrated flow conveyance systems, such as asphalt concrete (AC) dikes and oversize drains will be used to convey water from the impervious area to the vegetated ditches, swales, or trenches along the highway. AC dikes will be used for areas with side slopes steeper than 1:4. The proposed dike locations are specified in the MSN Project separate Storm Water Data Report. Though there would be an increase in impervious surface, with a relative increase in the pollutants washed off the pavement, roadside treatments will be available to treat the pollutant runoff. Rock energy dissipaters will be used at culvert inlets and outlets, channel lining and scour control will be used where appropriate.
- **Slope/surface protection systems:** The MSN Project would create or modify existing slopes, requiring that all new slopes be revegetated per the Project Erosion Control Plan (approved by the District Landscape Architect). Erosion control will be used to stabilize exposed slopes, and smooth transitions will be constructed between outlets, headwalls, wingwalls, and the natural channel.

Treatment BMPs. The MSN Project is considering treatment BMPs because this project involves soil disturbance that is greater than 1.2 ha and because the MSN Project is within Marin and Sonoma Counties, which are Municipal Separate Storm Sewer System (MS4) areas. As described in the Caltrans Project Planning and Design Guide (2002), during all phases, the Project Engineer should initiate

discussion with the Office of Environmental Engineering and all other responsible functional groups (NPDES Coordinator, Landscape Architecture, Maintenance, Hydraulics, Construction and Environmental Units) to consider Treatment BMPs for this project.

In compliance with Caltrans' NPDES requirements, water quality BMP drainage facilities will be included where practicable, and may include shallow roadside infiltration trenches, biofiltration strips or swales, and detention devices. Treatment BMPs for the Petaluma River and San Antonio Creek watersheds, which are impaired by Caltrans design constituents, nutrients, and sediment, are considered in the following order: infiltration devices, media filters, detention devices, biofiltration strips, and biofiltration swales. Novato Creek will follow General Purpose Pollutant Removal which will consider treatment BMPs in the following order: biofiltration strips, biofiltration swales, media filters, and detention devices. These BMPs are further detailed in the MSN Project Storm Water Data Report.

3.2.4 Geology/Soils/Seismic/Topography

The following discussion is based upon the Caltrans Preliminary Geotechnical Study (August 2005). In addition, Caltrans conducted a review of all the structures in the MSN Project study area. Referred to as an Advanced Planning Study, these reviews were done between January 2004 and September 2005. Preliminary design is based in part on the results of this review.

3.2.4.1 Regulatory Setting

This section discusses geology, soils, and seismic concerns as they relate to the public safety and project design. Earthquakes are prime considerations in the design and retrofit of structures. The Caltrans Office of Earthquake Engineering is responsible for assessing the seismic hazard for Caltrans projects. The current policy is to use the anticipated Maximum Credible Earthquake (MCE) from young faults in and near California. The MCE is defined as the largest earthquake that can be expected to occur on a fault over a particular period of time.

3.2.4.2 Affected Environment

The MSN Project area is in the California Coast Ranges geomorphic province, a series of long, northwest-trending mountain ranges separated by parallel river valleys. The oldest known basement rock is the Franciscan Formation, an

assemblage of sedimentary and volcanic rocks of Jurassic and Cretaceous age. Overlying the Franciscan Formation are Pliocene-age, marine sediments of Wilson Grove Formation and Pliocene-age Volcanic of the Sonoma Group.

The project area is in a region well known for seismic activity. There are three active faults located in the project area. The Rodgers Creek Fault and the Hayward Fault are located 6 km and 12 km (0.6 mi and 7.5 mi) from the project area, respectively. The San Andreas Fault is 19 km (11.6 mi) from the project area. Table 3.2-4 provides the predicted MCE based upon historical data of seismic activity near the project area.

Table 3.2-4 Predicted Maximum Credible Earthquake and Acceleration for Faults near the MSN Project Area

Fault	Distance from Project Km (mi)	Maximum Credible Earthquake	Peak Acceleration
Rodgers Creek	6.0 km	7.0	.46 g
San Andreas	19.0	8.0	.41 g
Hayward	12.0	7.5	.40 g
Source: California Department of Transportation Preliminary Geological Report, August 2005.			

The Burdell Mountain Fault zone extends from the vicinity of Santa Rosa southeastward 40-48 km (25-30 mi) to the northern margin of the San Pablo Bay. This fault intersects the expressway portion of the project, and is considered potentially active, as defined by showing evidence of surface displacement during Quaternary time (the last 1.6 million years).

Liquefaction potential in the project area varies from very low to very high. Liquefaction refers to a type of ground failure that results when cohesionless, granular materials, such as fine-grained sands, are changed into a fluid-like state as a result of seismic ground shaking events. In this "liquefied" state, soils lose their ability to support foundations and structures. The highest potential exists in the area of the SR 37 Interchange. There is also high liquefaction potential from Rowland Boulevard to Atherton Avenue and from the area around San Antonio Creek to the southern Kastania Road intersection. Moderate potential exists in the area just north of the SR 116/Lakeville Highway Separation and Overhead.

740 ### 3.2.4.3 Impacts

741 **Fixed HOV Lane Alternative.** This alternative would involve the widening of
742 several bridges, ramps and overcrossings. Table 3.2-5 lists the proposed structural
743 work under the Fixed HOV Lane Alternative. In the northern and southern
744 segments of the project, where the primary improvement involves widening the
745 median to accommodate the HOV lanes, risk of fault rupture under the Fixed
746 HOV Lane Alternative would not increase over existing conditions.

747 In addition, the Fixed HOV Lane Alternative proposes the construction of several
748 new structures, such as interchanges and a San Antonio Creek Bridge just west of
749 the existing bridge in the Central Segment. New structures would be constructed
750 following Caltrans' seismic design considerations and compliance with these
751 seismic design standards would minimize ground shaking impacts from
752 earthquakes up to the MCE.

Table 3.2-5 Proposed Structure Work

Bridge No.	Bridge Name	KP	Type of Work
27 0086K	South Novato Blvd. OC	30.5	Earthquake retrofit of columns and footings.
27 0089L/R	Novato Creek	R33.0	Widen in median, replace outside rails.
27 0090L/R	Franklin Ave. OH	R33.7	Widen in median, and outsides, soundwall both sides.
27 0092L/R	Olive Ave. UC	R34.5	Widen in median, add soundwalls on both sides. Build on raised falsework due to poor clearance.
27 0094L/R	North Novato OH	35.9	Widen in median, replace outside rails.
27 0115	Redwood Landfill OC	40.8	Widen on left (north) side with Options 4b and 12b.
TBD	San Antonio OC	42.6	New Overcrossing with Options 4b, 14b and 14d.
TBD	S. San Antonio Creek	N/A	New Bridge for frontage road
20 0019L/R	San Antonio Creek	44.5/0	Remove left Bridge, replace joint seals on right Bridge.
TBD	San Antonio Creek	44.5/0	New Bridge for US 101 on new alignment.
TBD	Petaluma Blvd. S. OC	5.1	New OC with all Access Options.
20 0156L/R	South Petaluma UC	5.6	Remove
20 0154L/R	Petaluma River	5.3	Replace on new vertical alignment.
20 0155L/R	US 101/SR 116 SOH	5.8	Widen left Bridge, replace right Bridge.
20 0163L/R	Washington Creek	7.7	Widen in median and on left and right sides.
20 0162L/R	Lynch Creek	8.3	Widen in median and on left and right sides.
20 0158L/R	North Petaluma OH	9.3	Replace OH on new vertical alignment.

Caltrans also evaluates structures for seismic retrofit. Any structure work as part of the Fixed HOV Lane Alternative would include an analysis of the seismic and scour deficiencies. Project plans would include seismic retrofit, as necessary. Table 3.2-2 indicates the South Novato Boulevard Overcrossing would undergo a seismic retrofit of columns and footings. Seismic work can be identified as part of the Advanced Planning Study, or would be identified as part of the General Plan development in final design.

Secondary seismic events could result in the MSN Project corridor, depending on the soil response to ground shaking or acceleration. Any of the active faults listed in Table 3.2-4 could cause the project corridor to undergo varying intensities of ground shaking during an earthquake. The shaking may cause lurch cracks in silty and clayey soils with a greater potential of cracking during rainy periods when the soil is saturated. Lateral spreading could also occur due to the shaking. Lateral spreading involves large masses of saturated alluvium flowing toward open slopes. Neither of these phenomena is considered to be a high risk hazard in the MSN Project corridor.

Other potential impacts related to soil and geologic conditions in the project area from construction of the Fixed HOV Lane Alternative are listed below.

- Erosion could occur in the Central and Southern Segments of the project due to the presence of erodible soils.
- Soils in portions of the Central Segment are classified as having high shrink-swell potential, meaning the soils are prone to expansion during wet conditions and to contraction during dry conditions.
- While slope stability in the Northern and Southern Segments would not cause concern, there is a history of slope instability in the Central Segment. This geologic hazard would be of particular concern where cuts are proposed.
- There is a soft clay layer of bay mud at the Rowland Avenue Overcrossing in the City of Novato, where widening is proposed. Similarly, bay mud may be encountered on the northern Petaluma River bank during bridge replacement work.

Reversible HOV Lane Alternative. Because the footprint, improvements, and scope of work for the Reversible HOV Lane Alternative would be the same as for the Fixed HOV Lane Alternative, the geoseismic and soil hazards would be the

same as under the Fixed HOV Lane Alternatives. Key seismic, geotechnical, and soil effects under the Reversible HOV Lane Alternative would be erosion, slope stability, and the presence of shrink-swell soils and bay mud.

Access Options. The number of overcrossings, ramps, and interchanges differs by Access Option; however, the potential effects from ground shaking would be similar since Caltrans would comply with seismic design standards that would minimize ground shaking impacts from earthquakes up to the MCE.

Access Option 12b involves a deeper cut to accommodate a proposed access road on the west side of US 101. This feature suggests that this option may encounter greater slope stability impacts than the other Access Options.

In the Central Segment, where the Access Options are proposed, the maximum amount of disturbed soils is estimated at 190 ha (470 ac) for both mainline improvements and the various Access Options. While the extent of areas subject to high erosion or shrink-swell soils would vary among the four Access Options, the differences in long-term impact would be negligible, because they would be addressed by Caltrans' engineering and design standards for soils, foundations, and structures and by standard practices described below in the section on mitigation measures.

No Build Alternative. Under the No Build Alternative, work in the MSN Project corridor would involve only routine maintenance and upkeep of the existing facilities. No new structures or substantial construction is proposed. Accordingly, geoseismic and soil impacts would not be expected, although grading, excavation, and other ground-disturbing activities could cause erosion, particularly in the Northern and Southern Segments.

3.2.4.4 Avoidance, Minimization and Mitigation Measures

Erosion Controls. There should be no significant increase in soil erosion as a consequence of this project. Erosion will be mitigated using various erosion controls depending on the topography. Section 3.2.3.4 identifies a number of water quality measures to control runoff and erosion. Materials used for embankment or foundation construction will conform to standard specifications to ensure proper soil settlement occurs.

Soil Settlement Control Measures. Soil settlement problems caused by the consolidation of cohesive soils are commonly mitigated by the removal of soft soils, soil mixing, wick drains, lightweight fill, grouting, or stone columns.

Expansive Soil Control Measures. Expansive soils will be mitigated by removing the soils or by mixing with other materials such as lime. Where imported fill is required for site drainage, use of non-expansive import will mitigate expansive soil effects.

Retaining Walls to Stabilize Embankments. Embankments will be stabilized and retained with retaining walls along the project. The cut/embankment slope ratios and benches will be analyzed and identified during the design phase of the project.

Dewatering Procedures to Reduce Groundwater. Groundwater will be dealt with by dewatering procedures, which may be required where large cuts are proposed.

Structures Built to Withstand Earthquakes. Structures will be built to withstand a 7.0 magnitude earthquake, the largest magnitude earthquake the active Rodgers Creek Fault is capable of producing (California Building Standards Code, 2001 and 2003). Maximum expected bedrock acceleration for Roger Creek Fault was estimated according to "Mualchine, 1996" (Caltrans – California Seismic Hazard Map, 1996).

Liquefaction Reduction. The liquefaction potential can be reduced by use of vibro or dynamic compaction methods on less cohesive soils. All liquefaction values will be confirmed by subsurface exploration and laboratory tests. In addition, specifically designed foundations for structures or ground improvement methods such as stone columns, dynamic compaction, or removing liquefiable materials are among the possible mitigation measures.

3.2.5 Hazardous Waste/Materials

3.2.5.1 Regulatory Setting

Hazardous materials and hazardous wastes are regulated by many state and federal laws. These include not only specific statutes governing hazardous waste, but also a variety of laws regulating air and water quality, human health and land use.

The primary federal laws regulating hazardous wastes/materials are the Resource Conservation and Recovery Act of 1976 (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). The purpose of CERCLA, often referred to as Superfund, is to clean up contaminated sites so that public health and welfare are not compromised. RCRA provides for "cradle to grave" regulation of hazardous wastes. Other federal laws include:

- Community Environmental Response Facilitation Act (CERFA) of 1992
- Clean Water Act
- Clean Air Act
- Safe Drinking Water Act
- Occupational Safety & Health Act (OSHA)
- Atomic Energy Act
- Toxic Substances Control Act (TSCA)
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

In addition to the acts listed above, EO 12088, Federal Compliance with Pollution Control, mandates that necessary actions be taken to prevent and control environmental pollution when federal activities or federal facilities are involved.

Hazardous waste in California is regulated primarily under the authority of the federal Resource Conservation and Recovery Act of 1976, and the California Health and Safety Code. Other California laws that affect hazardous waste are specific to handling, storage, transportation, disposal, treatment, reduction, cleanup and emergency planning.

As used in this section, the term hazardous substance includes both construction materials and wastes that may be harmful to humans or the environment.

3.2.5.2 Affected Environment

The affected environment, with regards to hazardous materials, is generally considered to be the proposed project footprint. Caltrans conducted a Preliminary Site Investigation (PSI) of the properties within and adjacent to the proposed project footprint in an attempt to identify naturally occurring hazards and

anthropogenic hazards that could adversely impact the delivery of the MSN Project. A summary of the existing conditions identified in the PSI are discussed in this section. The PSI included the following activities:

- A site reconnaissance including a visual "drive-by" inspection of the project and interviews with county environmental officials;
- A public record review using Environmental Data Resources' (EDR) DataMap Environmental Atlas;
- A file review of public information from the following sources: Caltrans District 4, RWQCB on-line Geotracker Database, Marin County Department of Environmental Management (MCDEH), Sonoma County Department of Environmental Management (SCDEH); and
- A review of geologic maps, topographic maps, and aerial photographs.

The PSI report, which was completed in January 2006, was performed in general accordance with the American Society of Testing Material Standard Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessment Process (ASTM E1527-00); however, the PSI did not include all the elements required by the standard. It is typically preferable to perform the full Phase 1 assessment during the final design due to right-of-way changes and the relatively short timeframe in which Phase 1 studies remain valid. A summary of the existing conditions identified in the PSI is presented in this section.

Sites of Potential Environmental Concern

A public record review to identify sites of potential environmental concern was performed using EDR DataMap Environmental Atlas. For this project, a 1-mile radius was used for the search corridor. The sites identified within the search corridor were screened to identify the sites located within the project footprint, or close enough to the footprint to potentially impact the project. In addition, Caltrans and regulatory file reviews were performed to obtain additional information related to potentially contaminated sites. Information from the file review was used to assess the potential that contamination from these sites could impact the proposed MSN Project.

Based on the EDR, agency file, and aerial photograph reviews, as many as 71 known or suspected areas of contamination are located within or adjacent to the

project footprint. The sites of potential concern that were identified in this evaluation include:

- UST/HIST UST/CA FID/AST: These sites are included on various databases of active or historic above ground and underground storage tanks.
- LUST: These are sites with reported incidences of leaking underground storage tanks (LUSTs).
- CORTESE: These sites are associated with identified groundwater and/or subsurface contamination identified by the California Environmental Protection Agency (Cal EPA). These sites include reported releases from underground storage tanks (USTs) and solid waste disposal facilities with reported migration of contaminants.
- CA SLIC: These sites are part of the California Spills, Leaks, Investigations and Cleanups (CA SLIC) statewide program. They are identified as having subsurface contamination by non-fuel constituents.
- VCP: These sites "low threat" properties with either confirmed or unconfirmed releases for which California Department of Toxic Substances Control (DTSC) has been asked to oversee either investigation or cleanup.
- DEED: These sites have recorded land use restrictions to protect the public from unsafe exposure to hazardous substances or wastes.
- EMI: These sites have toxics and criteria pollutant emissions data that have been collected by the California Air Resources Board or local air pollution agencies.
- CERCLIS - NFRAP: These sites have been removed from the federal list of priority sites for remedial action (the National Priorities List - NPL) and are designated "No Further Action Planned." These sites may include sites where, following an initial investigation, no contamination was found, contamination was removed quickly, or the contamination was not serious enough to require NPL consideration.
- WMUDS/SWAT: These sites are waste management sites.
- CA NFA: These sites include properties at which the DTSC has made a clear determination that the property does not pose a problem to the environment or public health.

- RCRIS (LQG/SQG): These sites are included in the Resource Conservation and Recovery system which includes selective information on sites which generate, transport, store, treat, and/or dispose of hazardous waste as defined by RCRA. Sites included are both large quantity generators and small quantity generators.
- P65: These records include facility notifications of releases that could impact drinking water.
- CUPA: These sites are included in a Certified Unified Program Agency Database (CUPA). CUPAs are responsible for implementing a unified hazardous materials and hazardous waste management regulatory program. The agency provides oversight of businesses that deal with hazardous materials, operate underground storage tanks or aboveground storage tanks.
- HAZNET: These sites have submitted hazardous waste manifests to DTSC.
- Aerial Photo: These sites were not identified in the EDR or agency file reviews, but were noted during a review of aerial photographs.
- CA WDS: These sites are identified by the California Water Resources Control Board as having waste discharge systems.
- MINES: These sites are included in the Mines Master Index File, which is based on data from the Department of Labor, Mine Safety, and Health Administration.

Historic or active underground storage tanks (UST) or above ground storage tanks (AST) were recorded in one or more databases or noted in aerial photographs for 54 of the 71 sites with known or suspected contamination; documentation of spills or leaks were noted at 28 sites. Eight sites were listed based solely on records pertaining to hazardous waste generation, transport, disposal, or management. The remaining nine sites include a quarry, two farms and/or airstrips, two possible junkyards, one Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) "No Further Action Planned" site, one Cortese site, one CA SLIC site, and one DTSC "No Further Action" site. Table 3.2-6 provides an overview of the findings of the EDR, agency file, and aerial photograph review.

Table 3.2-6 Overview of Sites of Potential Environmental Concern

Property Owner Name	Map_ID	UST/HIST UST/ CA FID/AST	LUST Report	Cortese	CA SLIC	VCP/ DEED	CNFRALP	SWF/LF	CA NFA	RCRIS (LQG/SQG)	P65	CUPA	EMI	HAZNET	Aerial Photo	CA WDS	MINES
Marin Products	1	X	X														
PG&E Ignacio Substation	2						X										
Novato Reclamation Facilities	3	X															
Costco Wholesale	4									X							
Sephora Store	5									X							
Shell/Matt & Jeff's Hand Carwash	6	X															
Chevron Station No. 92071	7	X															
Pacific Pulmonary Services	8											X					
Cloudburst Car Wash	9	X	X	X													
Ciampi Distributing Company	10	X	X														
Novato Ford	11	X	X	X						X				X			
Midas Muffler	12	X															
Novato Fire Protection District	13	X	X	X										X			
Golden Gate Business Park/Hospital?	14								X								
H. Pinl & Co Mill Site	15	X															
Golden Gate Bridge & Transit District	16	X								X	X			X			
North Marin Water District (NMWD)	17	X															
Harding Lawson Associates	18	X	X	X										X			
Fireman's Fund Insurance	19	X								X				X			
Service Station Site?	20	X													X		
Buck Institute for Research in Aging	21	X															
Novato Hotel	22	X													X		
Pacific Gas & Electric Co	23	X													X		
Suspected Service Station Site	24	X													X		
Black John Slough Rancho Del Pantano	25				X												
"Novato Storage Park"	26	X		X					X								
Aero Fuel	27	X															
Marin Air Services	28	X	X	X												X	
Redwood Landfill Inc	29													X			
Turrini's Auto Salvage	30	X						X		X			X	X		X	
Silveira A & L 2002 Trust/Dairy Ranch	31	X															
Silveira A & L 2002 Trust/Dairy Ranch Junkyard	32	X													X		
Arturus Veterinary Clinic	33													X			

Table 3.2-6 Overview of Sites of Potential Environmental Concern

Property Owner Name	Map_ID	UST/HIST UST/ CA FID/AST	LUST Report	Cortese	CA SLIC	VCP/ DEED	CNFRALP	SWF/LF	CA NFA	RCRIS (LQG/SQG)	P65	CUPA	EMI	HAZNET	Aerial Photo	CA WDS	MINES
Ray & Pamela Majauskas Property	34														X farm		
Walter or Joseph C Tognalda Former Airstrip	35														X farm/ airstrip		
Corda & Sons Ranch	36	X															
Theodoros Papageorgacopoulos	37	X	X														
G. Morrison Site	38	X															
Domenic Vachini	39	X															
Martinovich Former Junkyard	40														X junkyard		
Sonoma Gateway Properties	41														X junkyard?		
Gas N Shop	42	X	X	X										X			
Ellen D. Brians	43	X															
Novato Disposal Service	44	X	X	X				X									
Henris Investments	45	X	X	X													
Rinehart Distributing Inc	46	X															
Haynie Diesel Service	47	X															
John F. & Roase Mary Cunha	48	X								X			X				
Dutra Inc Quarry	49																X
Royal Petroleum Co	50									X			X	X			
Frank Hiebakos & Sons Trucking	51	X	X	X						X							
Caltrans Maintenance Station	52	X	X	X													
Hertz/ Big 4 Rents?	53	X															
G&C Autobody Site	54	X	X		X									X			
Don's Plumbing	55	X	X	X													
McPhail's Distribution Center	56	X	X			X											
Courtesy Auto & Truck Repair	57	X	X														
Lakeville Shell	58	X	X	X										X			
Ingerson Trucking	59	X	X	X						X				X			
Petaluma School Bus Yard	60	X															
Chevron Station No. 94081	61	X	X	X						X							
7-11 Store No. 18878	62	X	X	X													
Arco Station No. 2150	63	X	X	X													
KMART	64	X	X							X				X			
Mike Hudson Distributing	65	X	X	X													
Spurgeon Painting Inc	66									X				X			

Table 3.2-6 Overview of Sites of Potential Environmental Concern

Property Owner Name	Map_ID	UST/HIST UST/ CA FID/AST	LUST Report	Cortese	CA SLIC	VCP/ DEED	CNFRALP	SWF/LF	CA NFA	RCRIS (LQG/SQG)	P65	CUPA	EMI	HAZNET	Aerial Photo	CA WDS	MINES
Optoelectronics	67									X							
Advanced Devices Inc	68									X				X			
PG&E/Petaluma Service Station	69	X	X	X													
J&D Automotive	70	X	X	X										X			
Maltby Electrical Supply	71	X	X	X													

Notes:

UST/HIST UST/CA FID/AST	Active or historic underground storage tanks (UST) or above ground storage tanks (AST) from the following sources: Underground Storage Tank Database, Facility Inventory Database, Historic UST Registered Database, Above Ground Storage Tank Database, Aerial Photographs, or LUST sites.
LUST Report	Geotracker's Leaking Underground Fuel Tank Report
Cortese	"Cortese" Hazardous Waste & Substances Sites List
CA SLIC	Statewide Spill, Leak, Investigation, and Cleanup Cases
VCP	Voluntary Cleanup Program
DEED	Deed Restriction Program
EMI	Emissions Inventory Data
CNFRALP	Comprehensive Environmental Response, Compensation and Liability Information System - No Further Remedial Action Planned
SWF/LF	Solid Waste Facilities/Landfill Sites
CA NFA	California No Further Action
RCRIS (LQG/SQG)	Resource Conservation and Recovery Information System (Large Quantity Generators/Small Quantity Generators)
P65	RWQCB's Proposition 65 Database
CUPA	Certified Unified Program Agency Database
HAZNET	Data Extracted from Hazardous Waste Manifests
Aerial Photo	Aerial photograph review
CA WDS	California Water Resources Control Board - Waste Discharge System
MINES	Mines Master Index File

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Naturally Occurring Asbestos (NOA)

The term naturally occurring asbestos (NOA) refers to a variety of six fibrous materials. Chrysotile, the most common material of this type found in California, is part of the serpentine mineral group. Serpentine and NOA are frequently encountered in areas known as ultramafic rock units. NOA is not known to be present in the project's footprint; however, deposits do exist approximately two miles west of US 101 between Novato Creek and San Antonio Creek. Asbestos is classified as a known human carcinogen by state, federal, and international agencies and was identified as a toxic air contaminant by the California Air Resources Board (CARB) in 1986. Asbestos may cause lung disease and cancer.

If undisturbed, NOA is not hazardous. However, when asbestos-containing material is disturbed, asbestos fibers could become airborne thereby creating an inhalation hazard. There is a possibility that sediment in San Antonio Creek and Novato Creek, which flow under US 101, could contain NOA, as portions of the watersheds for these streams include some ultramafic rock formations.

Man-made Asbestos

Man-made asbestos is commonly found in many products such as the shims used under aluminum bridge barrier rails and even concrete.

Mine Tailings

The EDR report revealed the presence of an inactive, abandoned mercury mine, the Gambonini Mine, located southwest of Petaluma off Marshall-Petaluma Road, west of Wilson Hill Road in Sonoma County. It is unlikely that there would be any direct impact from mine tailings because the Gambonini Mine is in a separate watershed from the project. However, mine tailings have washed into Walker Creek and into Tomales Bay, and similar geologic formations exist within the project footprint at two locations: US 101 just north of Novato Creek, and US 101 just south of San Antonio Creek. It is also conceivable that mine tailings from other mines in the area may have been used as fill material to construct the original US 101 embankments and that these tailings contain the mineral cinnabar (mercury sulfide) which is often bright scarlet or cinnamon red in color.

Aerially Deposited Lead (ADL)

Aerially Deposited Lead (ADL) is known to exist in surface soils adjacent to the edge of pavement within the US 101 corridor due to the historic use of leaded gasoline. A 1977 study by Getz, and others, indicates that the higher the historical

traffic volume, the higher the soil lead content. This study also noted that soil concentrations were inversely proportional to the distance from the roadway. That is, lead concentrations decreased the further a sample was collected from the roadway. Soil lead concentrations are also inversely proportional to the depth of the sample below the original ground level. Typically, if the soil has not been disturbed, the highest lead concentrations are found at the ground surface and gradually decrease to naturally occurring levels at depths of approximately 2 to 3 ft below ground surface. The gradual buildup of ADL has resulted in lead concentrations in surface soils that sometimes exceed the total threshold limit concentration 5.0 milligrams per liter (mg/l), listed in Title 22 of the California Code of Regulations (22 CCR). Waste materials that exceed these levels are characterized as a California hazardous waste and must typically be disposed of at special landfills.

Yellow Traffic Striping

Yellow traffic striping and/or pavement markings containing lead and other potentially toxic substances are present on US 101 within the project boundaries. The lead concentrations in yellow painted traffic striping and in yellow thermoplastic traffic striping can occasionally exceed the aforementioned thresholds.

3.2.5.3 Impacts

This section describes potential impacts associated with hazardous materials known or suspected to exist within the project vicinity. These impacts are directly related to the location of land and other features that would be disturbed. The exact location of land to be acquired, construction staging areas, and other related details would be refined during the project design phase. As a result, the exact location and magnitude of environmental impacts are not known at this time. Only a general discussion of situations that may be encountered and prescriptive corrective actions are described.

Potentially Contaminated Sites

Fixed HOV Build Lane Alternative. Contaminated soil and/or groundwater may be encountered during construction of the Fixed HOV Lane Alternative. If these materials are removed from their present location, they may be reclassified as a hazardous material if chemical concentrations exceed state and federal limits for characterizing materials as hazardous substances. In addition, contaminated soil

and groundwater can pose a potential impact to human health if not properly managed.

The PSI rated each of the 71 sites with known or suspected contamination by both hazardous materials risk and by the probability that contamination would impact the MSN Project. The site rankings are as follows:

- Six sites were rated as low risk for both hazardous materials and probability that contamination at the site would impact the MSN Project.
- Thirty-eight sites were rated as having a medium risk for hazardous materials, but a low probability that contamination would impact the MSN Project.
- Twenty-two sites were rated as medium risk for both hazardous materials and probability that contamination at the site would impact the MSN Project.
- Three sites, including the Golden Gate Business Park/Novato Hospital, Black John Slough/Rancho Del Pantano, and Redwood Landfill were rated as high risk for hazardous materials, but low to medium risk for contamination impacting the MSN Project.
- Two sites, including Gas N Shop and Novato Disposal Service, were rated as medium risk for hazardous materials, but high risk for contamination impacting the MSN Project.

Table 3.2-7 summarizes information for each site. Sites rated as high risk for either hazardous materials or probability that contamination would impact the MSN Project, are summarized below. A dairy site that has been identified as medium risk and medium probability is also described.

Golden Gate Business Park/Novato Hospital. The Golden Gate Business Park site is located at Franklin Avenue next to the NW Pacific Railroad tracks in the City of Novato. This site is situated at or near 165 Rowland Way just north of Novato Creek. This site was on DTSC's list of sites for which no further action is required (NFA). This site is listed because the RWQCB received correspondence from the City of Novato that the area was a former dumping site; however, no documents were ever found by DTSC to confirm that this site was the site of a former landfill. No changes to the mainline alignment or right-of-way are proposed near this site as part of the Fixed HOV Lane Alternative. This site is rated potentially high risk with a low-probability of impacting construction operations. Figure 3.2-3 presents the site location.

Table 3.2-7 Sites of Known or Suspected Contamination

Line No.	County	Assessor Parcel Number[1] (APN)	ROW Type	Impact Area[2] (M^2)	Owner/Property/Site Name	Project Footprint Sheet No.	Alignment	Station (Meters)	East/West Side	Current Land Use	Hazmat Risk Rating Due to Site History	Probability that Contamination Will Impact Proposed MSN Project	Case Status	Site Address	EDR Site Number
1	Marin	157-33-19	HM		Marin Products (Geotracker Site)	A-1	101 A	290.00	East	Industrial	Medium	Low	Unknown	55 Frosty Lane Novato, CA	N/A
2	Marin	157-40-18 157-40-17	HM		PG&E Ignatio Substation	A-1	101 A	300.00	East	Industrial	Medium	Low	Unknown	NW Corner of Hamilton and Bell Marin Keys Novato, CA	145-27
3	Marin	155-220-019? 153-22-19	HM		Novato Reclamation Facilities	A-1 & A-2	101 A	309.00	East	Dump? Hist UST	Medium	Medium	Unknown	Hanna Ranch Road? Novato California	143-27
4	Marin	153-34-04	HM		Costco Wholesale at Vintage Oaks Shopping Center	A-2	101 A	316.00	East	Industrial	Medium	Low	Unknown	300 Vintage Way Novato, CA 94945	140-26
5	Marin	153-34-28?	HM		Sephora Store at Vintage Oaks Shopping Center	A-2	101 A	321.00	East	Industrial	Low	Low	Small Generator No Violations	208 Vintage Way Novato, CA 94945	139-26
6	Marin	153-34-21?	HM		Matt and Steve's Hand Car Wash Vintage Oaks Shopping Center	A-2	101 A	322.80	East	Industrial UST Site	Medium	Medium	UST Site	125 Vintage Way Novato, CA 94945	142-27 137-26
7	Marin	153-32-02?	HM		Chevron No. 92071	A-3	101 A	325.00	East	Industrial	Medium	Low	Active	22 Rowland Way Novato, CA 94945	136-26
8	Marin	152-32-04?	HM		Pacific Pulmonary Services	A-3	101 A	327.00	East	Industrial	Medium UST Site	Low	Unknown	88 Rowland Ave Novato, CA 94945	136-26
9	Marin	152-05-02?	HM		Cloudburst Car Wash (RWQCB Case No. 21-0037)	A-3	101 A	329.60	West	Industrial	Medium LUST Site	Medium	Case Closed	6981 Redwood Blvd Novato, CA 94947	131-26
10	Marin	152-05-19?	HM		Ciampi Distributing Co	A-3	101 A	330.00	West	Industrial	Medium	Low	UST Site	90 Hill Road Novato, CA 94947	132-26 133-26
11	Marin	152-05-22	HM		Novato Ford	A-3	101 A	330.35	West	Industrial	Medium	Low	LUST Site	6995 Redwood Blvd Novato, CA 94947	131-26
12	Marin	153-17-59?	HM		Midas Muffler	A-3	101 A	331.80	West	Industrial	Medium	Low	UST Site	7000 Redwood Blvd Novato, CA 94947	131-26
13	Marin	140-22-43?	HM		Novato Fire Protection District	A-3	101 A	331.80	West	Industrial	Medium	Low	LUST Site	7025 Redwood Novato, CA 94947	130-26
14	Marin	153-017-060?	TCE	2,059.1	Golden Gate Business Park/Hospital Former Dump Site	A-3	101 A	333.00	East	Hospital	High	Low	DTSC - No Further Action	Franklin Avenue next to NW Pacific Railroad - Former Dump Site Novato, CA 94945	129-26
15	Marin	153-057-001	HM		H. Pinl & Co Mill Site Robin Morton [Pinl Mill]	A-4	101 A	341.00	West	Industrial	Medium Hist UST Site	Low	Unknown	730 Scott Ct Novato, CA 94947	126-24
16	Marin	143-022-001 143-073-001	HM		Golden Gate Transit	A-4	101 A	348.40	West	Industrial	Medium	Medium	Unknown	801 Golden Gate Place Novato, CA 94945	111-24
17	Marin	143-060-009	HM		North Marin Water District (RWQCB Case No. 21-0254)	A-4	101 A	352.00	West	Industrial	Medium	Low	Case Closed HIST UST	999 Rush Creek Road Novato, CA 94945	110-24
18	Marin	125-202-002	HM		Harding Lawson Associates	A-5	101 A	357.00	West	Industrial Small Generator	Low	Low	No Violations	7655 Redwood Blvd Novato, CA 94947	103-24

Table 3.2-7 Sites of Known or Suspected Contamination

Line No.	County	Assessor Parcel Number[1] (APN)	ROW Type	Impact Area[2] (M^2)	Owner/Property/Site Name	Project Footprint Sheet No.	Alignment	Station (Meters)	East/West Side	Current Land Use	Hazmat Risk Rating Due to Site History	Probability that Contamination Will Impact Proposed MSN Project	Case Status	Site Address	EDR Site Number
19	Marin	125-202-003	HM		Fireman's Fund Insurance	A-5	101 A	357.00	West	Business Park	Medium LUST Site	Medium	Closed	777 San Marin Drive Novato, CA 94947	104-24
20	Marin	125-540-001	HM		Service Station?	B-1	101 B	1369.00	East	Industrial	Medium	Low	Unknown	## Binford Road Novato, CA 94945	N/A
21	Marin	Old 125-18-068? New 125-58-10? New 125-58-07? New 125-58-05?	HM		Buck Institute for Research in Aging (Has their own UST on site?)	B-1	101 B	1370.20	West	Industrial	Medium UST Site	Medium	Active	8001 Redwood Highway Novato, CA 94945	101-21 102-21
22	Marin	Old 125-18-34 New 125-18-80 New 125-18-81	HM		Novato Motel (Hist. UST in southern corner of site - could be Buck Institute's UST)	B-1	101 B	1370.40	West	Motel	Medium Hist UST Site	Medium	Unknown	8141 Redwood Blvd Novato, CA 94945	N/A
23	Marin	125-180-049	HM		Pacific Gas & Electric Co Former Service Station? (Shown on 1970 Aerial Photo just north of Novato Motel)	B-1	101 B	1372.80	West	Agricultural	Medium LUST Site	Medium	Unknown	8161 Redwood Blvd Novato, CA 94945	102-21?
24	Marin	125-190-061	HM		Service Station?	B-1	101 B	1373.60	East	Industrial	Medium	Low	Unknown	## Binford Road Novato, CA 94945	N/A
25	Marin	125-190-019 125-190-020 125-190-021 125-190-065 125-190-066	HM		Edward Goliti, Larissa Goliti, Rudy Tulipani and Lindberg Landing LLP Rancho Del Pantano/ Black John Slough	B-1	101 B	1375.00	East	Tire/Auto Landfill Boat Repair/Junkyard	High	Low	Unknown SLIC	8190 Binford Road Novato, CA 94945	105-24 100-21?
26	Marin	125-190-056 125-190-064	HM		Vacant Parcel Novato Storage Park	B-1	101 B	1377.00	East	Industrial	Low	Low	NFA-DTSC	Airport and Binford Roads Novato, CA 94945	100-21
27	Marin	125-190-54? or 125-190-41?	HM		Aero Fuel Northern Lights Aviation EMC Petroleum Allana Corp	B-1	101 B	1380.00	East	Industrial	Medium	Low	Unknown	351 Airport Road Novato, CA 94945	97-21 98-21
28	Marin	125-190-024?	HM		Marin Air Services Vindar Aviation Marin Co Airport/Gnoss Field	B-1	101 N	1380.10	East	Industrial	Medium	Low	Unknown	451 Airport Road Novato, CA 94945	97-21
29	Marin	125-160-013	HM		Redwood Landfill Inc a.k.a Novato Dump	B-3	101 B	1405.50	East	Landfill	High	Low		8950 Redwood Highway Novato, CA 94945	96-18
30	Marin	125-160-016	PRW	51,801.5	Turrini's Auto Salvage, Inc?	B-3	101 B	1408.00	West	Industrial	Medium	Medium	Unknown	8950 Redwood Highway Novato, CA 94948	96-19
31	Marin	125-160-015 125-160-016	PRW	2,888.0	Silveira A & L 2002 Trust	B-3 & B-4	101 B	1417.00	West	Dairy Farm	MediumHist UST Site	Medium	Unknown	9501 101 Highway Novato, CA 94947	91-17
32	Marin	125-130-024	PRW	10,250.0	Silveira A & L 2002 Trust Junkyard? (See Caltrans Aerial Photo dated 7-31-87)	B-4 & B-5	101 B	1425.10	West	Agricultural	Medium	Low	Unknown		N/A

Table 3.2-7 Sites of Known or Suspected Contamination

Line No.	County	Assessor Parcel Number[1] (APN)	ROW Type	Impact Area[2] (M^2)	Owner/Property/Site Name	Project Footprint Sheet No.	Alignment	Station (Meters)	East/West Side	Current Land Use	Hazmat Risk Rating Due to Site History	Probability that Contamination Will Impact Proposed MSN Project	Case Status	Site Address	EDR Site Number
33	Marin	125-130-013	PRW	831.4	James H / Ann Steere [Arturus Veterinary Clinic]	B-5	101 B	1434.00	West	Industrial	Low	Low	Small Generator	2 San Antonio Road Petaluma, CA 94947	89-14
34	Marin	125-130-014	PRW	13,090.8	Ray & Pamela Majauskas Farm - Possible UST Site	B-5	101 B	1437.40	West	Residential	Medium	Low			N/A
35	Sonoma	019-280-003	PRW	3,518.4	Walter or Joseph C Tognalda Former Airstrip and Farm (Shown on 1970 Aerial Photo)	B-5 & B-6	101 B	2001.00	West	Agricultural	Medium	Medium	Unknown	155 or 460 San Antonio Road Petaluma, CA 94952	N/A
36	Sonoma	019-280-005	HM		Jerome R Klima Jr. Corda & Sons Ranch US 101 at San Antonio Road	B-6	101 B	2004.00	East	Industrial	Medium	Low	Unknown	5493/5495 Redwood Highway South Petaluma, CA 94952	87-14
37	Sonoma	019-280-008	HM		Theodoros (Ted) Papageorgacopoulos US 101 just south of Gunn Road	B-6	101 B	2006.20	East	Residential	Medium	Medium	Unknown	5381 Old Redwood Highway Petaluma, CA 94952	85-14
38	Sonoma	019-290-001	PRW	25,565.4	Ann & Fred Klatte/ G. Morrison UST Site?	B-6	101 B	2007.00	West	Agricultural	Medium HIST AST	Low	Unknown	5498 Redwood Highway Petaluma, CA 94947	87-14
39	Sonoma	019-280-011	HM		Simon & Anastasia Sjoen 5303 Redwood Hwy South a.k.a. Domenic Vachini Farm?	B-6	101 B	2009.20	East	Agricultural	Medium Hist UST	Low	Unknown	5301 or 5303 Redwood Hwy - South Petaluma, CA 94952	84-14
40	Sonoma	019-330-012	PRW	140.8	Debra Martinovich Former Junkyard located east of structures in 1970 aerial photo	B-7	101 B	2024.80	East	Residential	Medium	Medium	Unknown	4747 Redwood Hwy - South Petaluma, CA 94952 North of Gambini Road and south of Kastania Road	N/A
41	Sonoma	019-330-011	PRW	385.0	Sonoma Gateway Properties LLC Salvage/Junkyard?	B-7	101 B	2029.50	East	Salvage Yard	Medium	Medium	Unknown	4555 Redwood Hwy - South Petaluma, CA 94952	N/A
42	Sonoma	019-330-006	HM		Andy & Zaida Saberi a.k.a. Gas N Shop a.k.a. Petaluma Texaco a.k.a. Sabek Inc.	B-7	101 B	2030.20	West	Gas Station	Medium	High		4550 Redwood Highway US 101 at Kastania Road Petaluma, CA	81-14 82-14
43	Sonoma	019-310-019	HM		Ellen D. Brians	B-7	101 B	2031.50	West	Residential	Medium HIST UST	Medium		4418 Redwood Highway So. Petaluma, CA 94952-9508	80-14
44	Sonoma	019-220-038	PRW	127.3	Novato Disposal Service a.k.a. Timber Cove Recycling a.k.a. Novato Recycling	B-8	101 B	2045.00	East	Industrial LUST Site	Medium LUST Site	High		2543 Petaluma Blvd. South Petaluma, CA 94952	77-11
45	Sonoma	019-220-004 019-220-036	HM		Henris Investments 2581 Petaluma Blvd S Henris Supply Warehouse (RWQCB Case No. 49-0071)	B-8	101 B	2046.60	East	Industrial	Medium	Low	Case Closed	172 Landing Road Petaluma, CA 94952	79-11
46	Sonoma	019-220-006	HM		Rinehart Distributing Inc. Rinehart Truck Stop, Petaluma Blvd at Landing	B-8	101 B	2047.00	East	Truck Stop	Medium	Low		2645 Petaluma Blvd. South Petaluma, CA 94952-5527	77-11
47	Sonoma	019-220-011	HM		Patricia & Ed Souza a.k.a. Haynie Diesel Service?	B-9	101 B	2048.60	East	Industrial	Medium	Low	Unknown	2141 Petaluma Blvd. South Petaluma, CA 94952	76-11

Table 3.2-7 Sites of Known or Suspected Contamination

Line No.	County	Assessor Parcel Number[1] (APN)	ROW Type	Impact Area[2] (M^2)	Owner/Property/Site Name	Project Footprint Sheet No.	Alignment	Station (Meters)	East/West Side	Current Land Use	Hazmat Risk Rating Due to Site History	Probability that Contamination Will Impact Proposed MSN Project	Case Status	Site Address	EDR Site Number
48	Sonoma	019-220-009	HM		John F. & Roase Mary Cunha	B-9	101 B	2050.00	East	Industrial	Medium HIST UST	Low	Unknown	2551 Petaluma Blvd. South Petaluma, CA 94952	77-11
49	Sonoma	019-220-012	HM		Dutra Inc. Quarry a.k.a. Kaiser Sand & Gravel?	B-9	101 B	2052.00	West	Industrial	Medium AST Site	Low	Unknown	1600 Petaluma Blvd. South Petaluma, CA	78-11?
50	Sonoma	019-220-026?	HM		Royal Petroleum Co.	B-9	101 B	2054.00	West	Industrial	Medium	Low	Unknown	1501 Petaluma Blvd. South Petaluma, CA 94952	75-11
51	Sonoma	019-210-010?	HM		Frank Hiebakos & Sons Trucking	B-9	101 B	2054.40	West	Industrial	Low	Low	Case Closed	1473 Petaluma Blvd. South Petaluma, CA 94952	75-11
52	Sonoma	019-210-009?	HM		Caltrans Maintenance Station	B-9	101 B	2054.50	West	Industrial	Low	Low	Unknown	1485 Petaluma Blvd. South Petaluma, CA 94952	75-11
53	Sonoma	005-060-036	HM		Rental Center Properties 1721 Lakeville Highway a.k.a. Big 4 Rents? (RWQCB Case No. 49-0014)	C-1	101 C	2059.00	East	Industrial	Medium	Low	Unknown	1731 Lakeville Hwy Petaluma, CA 94952	N/A
54	Sonoma	005-020-027?	HM		BVM Investments? C&G Autobody Site (Cyanides/Salts)	C-1	101 C	2062.75	West	Industrial	Medium LUST Site	Low	Unknown	896 Lakeville Street Petaluma, CA 94952	65-8
55	Sonoma	005-060-021?	HM		Don's Plumbing a.k.a. Milton L. Foreman	C-1	101 C	2062.75	West	Industrial	Medium HIST UST	Medium	Unknown	1004 Lakeville Street Petaluma, CA 94952	65-8
56	Sonoma	005-060-015 005-060-021 005-060-031 005-060-038	HM		McPhail's Distribution Center 1000-1010 Lakeville Street Petaluma, CA 94952	C-1	101 C	2063.00	West	Industrial	Medium HIST UST	Low	DTSC Certified O&M Plan	1000 Lakeville Street Petaluma, CA 94952	65-8 & 67-8
57	Sonoma	005-020-066	HM		Charles A Slifer Courtesy Auto & Truck Repair	C-1	101 C	2063.00	West	Industrial	Medium LUST Site	Medium	Unknown	1051 Lakeville Highway Petaluma, CA 94952	71-8
58	Sonoma	005-020-068	HM		Equilon Enterprises LLC Shell Station (RWQCB Case No. 49-0150)	C-1	101 C	2063.50	West	Industrial	Medium LUST Site	Medium	Unknown	1001 Lakeville Street Petaluma, CA 94952	65-8 & 67-8
59	Sonoma	005-010-026	HM		Jack & Mary Ingerson/ Robert Uichum - Manager? Ingerson Trucking Site (RWQCB Case No. 49-0077)	C-1	101 C	2067.00	West	Industrial	Medium LUST Site	Low	Case Closed	979 Lindberg Lane Petaluma, CA 94952	60-8
60	Sonoma	007-473-001	HM		Petaluma School Bus Yard At end of Lindberg Lane	C-1	101 C	2068.20	West	Industrial	Medium	Low	Active	993 Lindberg Lane Petaluma, CA 94952	57-8
61	Sonoma	Unknown	HM		Lutz Chevron Station	C-2	101 C	2077.50	East	Industrial	MediumLUST Site	Low	Unknown	1440 Washington St EPetaluma, CA 94952	50-8
62	Sonoma	Unknown	HM		7-11 Store No. 18878	C-2	101 C	2077.50	East	Industrial	Medium LUST Site	Low	Unknown	201 McDowell Store Petaluma, CA 94952	47-8
63	Sonoma	007-340-007	PRW	5,338.1	Arco Station No. 2150 (RWQCB Case No. 49-0021)	C-2	101 C	2078.00	East	Industrial	Medium	Low	Unknown	101 McDowell Blvd N Petaluma, CA 94952	42-8

Table 3.2-7 Sites of Known or Suspected Contamination

Line No.	County	Assessor Parcel Number[1] (APN)	ROW Type	Impact Area[2] (M^2)	Owner/Property/Site Name	Project Footprint Sheet No.	Alignment	Station (Meters)	East/West Side	Current Land Use	Hazmat Risk Rating Due to Site History	Probability that Contamination Will Impact Proposed MSN Project	Case Status	Site Address	EDR Site Number
64	Sonoma	007-350-008	PRW	3,467.7	Syers Properties Shopping Center/ KMART (RWQCB Case No. 49-0085)	C-2	101 C	2081.80	East	Industrial	Medium LUST Site	Medium	Case Closed	261 McDowell Blvd N Petaluma, CA 94952	38-8
65	Sonoma	007-630-Unknown	HM		Mike Hudson Distributing	C-3	101 C	2095.00	East	Industrial LUST Site	Medium	Low	Case Closed	1297 Dynamic Street Petaluma, CA 94952	34-5
66	Sonoma	007-630-Unknown	HM		Spurgeon Painting Inc	C-3	101 C	2095.00	East	Industrial	Medium	Medium	Small Quantity Generator No Violations	1308 Dynamic Street Petaluma, CA 94952	34-5
67	Sonoma	007-501-014? or 007-630-009?	HM		Optoelectronics Div Avco CP	C-3	101 C	2095.00	East	Industrial	Medium	Low	Small Quantity Generator No Violations	1309 Dynamic Street Petaluma, CA 94952	34-5
68	Sonoma	007-630-005	HM		Elde V. & Diane L. Toly a.k.a. Petaluma Imagesetting Inc. a.k.a. Advanced Devices Inc.	C-3	101 C	2095.00	East	Industrial	Medium	Low	Small Quantity Generator No Violations	1340 Commerce Street Petaluma, CA 94952	35-5
69	Sonoma	007-401-?	HM		PG&E Service Center/ Petaluma Service Station	C-4	101 C	2110.60	East	Industrial LUST Site	Medium	Medium	Unknown	210 Corona Road Petaluma, CA 94952	25-4
70	Sonoma	007-401-?	HM		J&D Auto	C-4	101 C	2110.80	East	Industrial LUST Site	Medium	Medium	Unknown	278 Corona Road Petaluma, CA 94952	19-4
71	Sonoma	137-110-015?	HM		Maltby Electrical Supply Holm Road at Clegg St.	C-4	101 C	2115.80	East	Industrial	Medium LUST Site	Low	Closed	1200 Holm Road Petaluma, CA 94954	20-4

Notes:

[1] An underlined parcel number indicates that the parcel is not within the project footprint but is listed here because subsurface contamination could have migrated from the site into the proposed project footprint.

[2] Right-of-way (ROW) type and impact area obtained from Yolanda Rivas spreadsheet dated REV. 07/28/2005.

Key:

ENC Right-of-way encroachment
PRW Partial right-of-way take
TEC Temporary construction easement
HM Known or potential hazardous materials release site within or adjacent to the project footprint
AST Above ground storage tank
UST Underground storage tank
LUST Leaking underground storage tank

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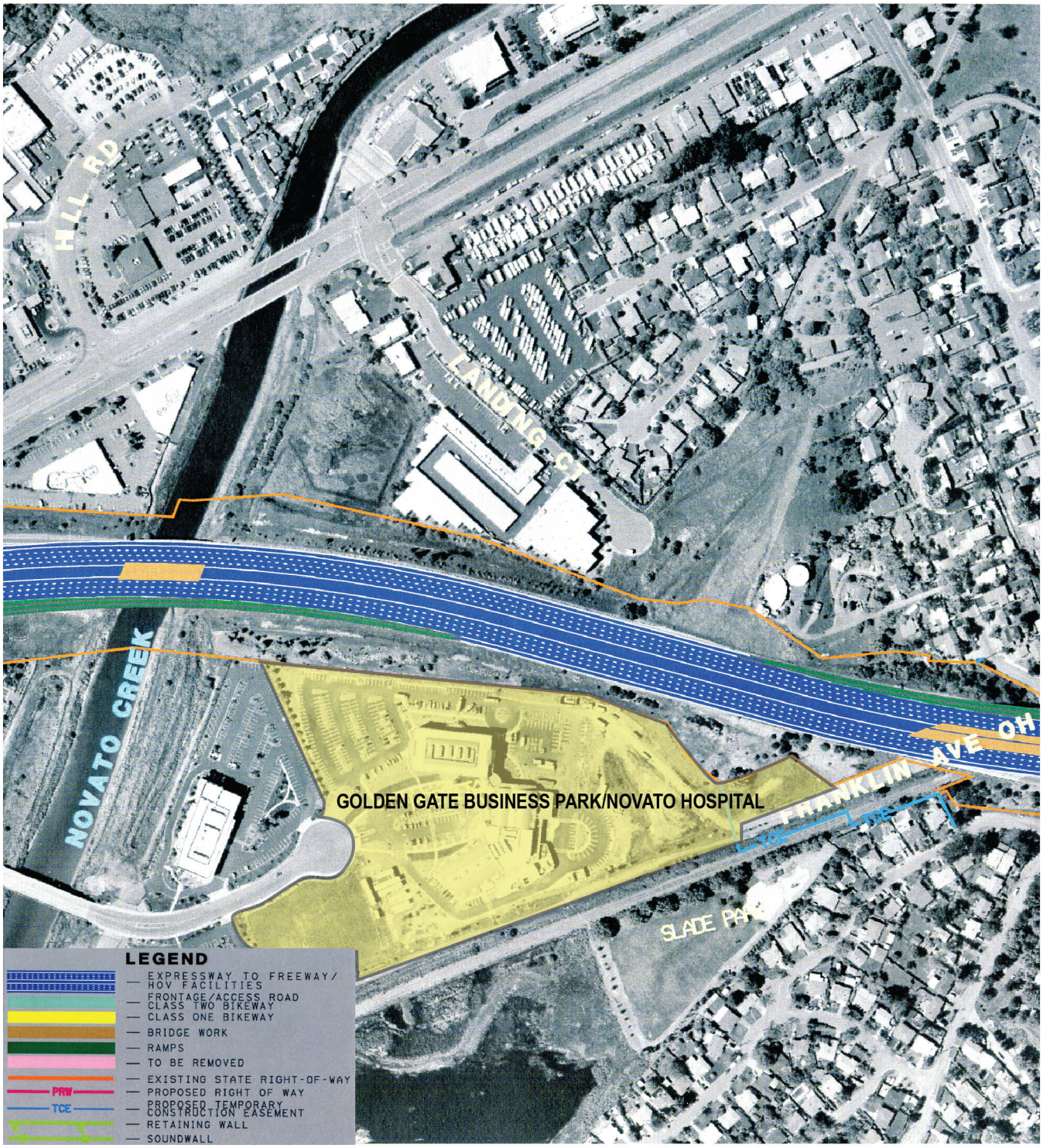
FIGURE 3.2-3
Golden Gate Business Park/Novato Hospital Sites with High Risk or High Probability to Impact Project



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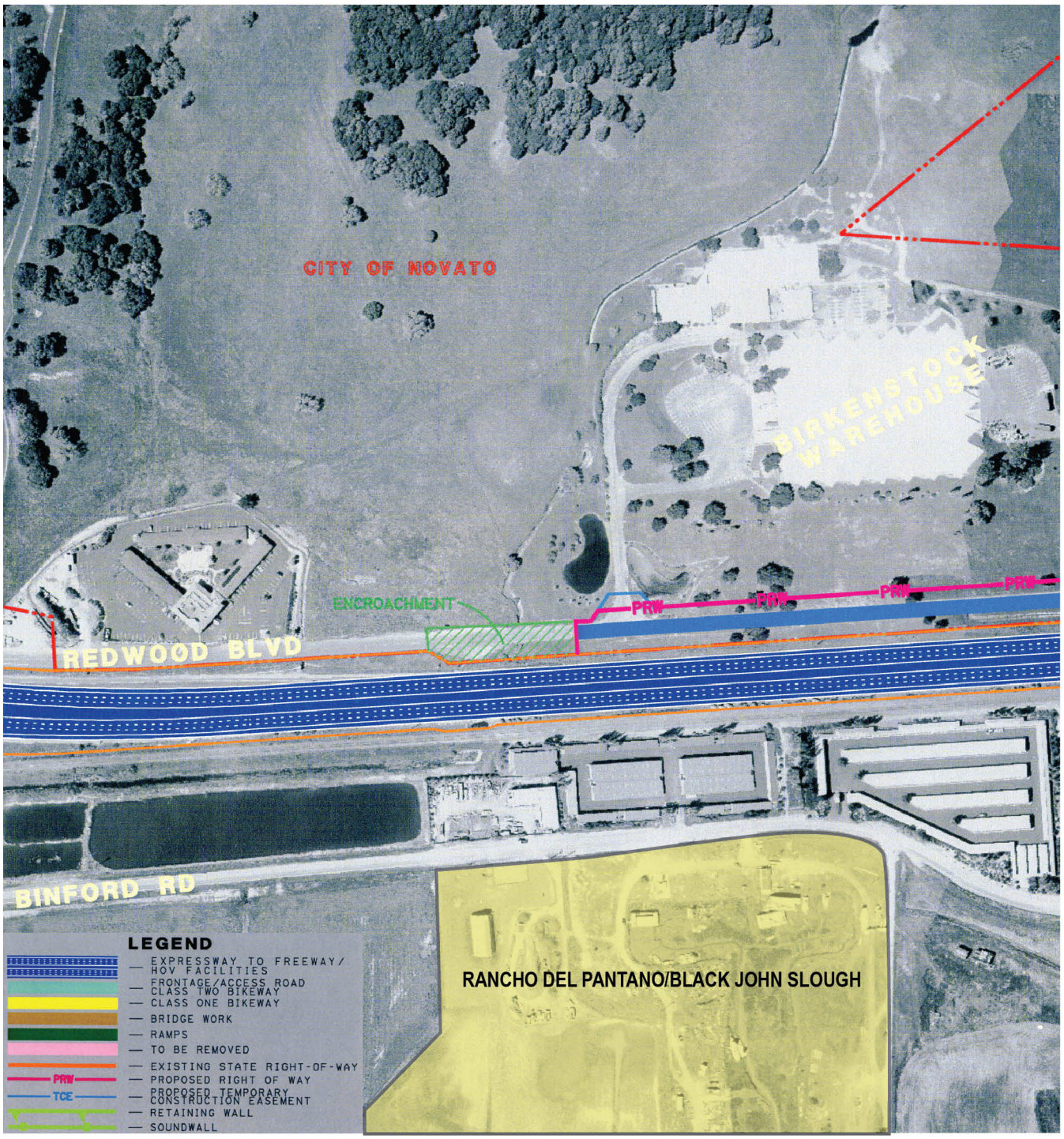
Black John Slough/Ranch Del Pantano. The Rancho Del Pantano Site is located at 8190 Binford Road at the western end of Black John Slough in the City of Novato. This site is also possibly called Edward Goliti, Larissa Goliti, Rudy Tulipani and Lindberg Landing LLP. Past uses for this site include tire/auto disposal, boat repair, and junkyard. This site was on the California RWQCB's spills, leaks, investigation and cleanup (CA SLIC) database of sites that impacts or has the potential to impact groundwater. The site is not directly adjacent to the existing US 101 right-of-way; it is separated by a parcel that has not been identified as a site with known or suspected contamination. No changes to the mainline alignment are proposed near this site as part of the Fixed HOV Lane Alternative; however right-of-way acquisition is proposed along the west side of US 101 (the site is located east of US 101). This site is rated high-risk/low-probability. Figure 3.2-4 presents the site location.

Redwood Landfill. The Redwood Landfill site is located at 8950 Redwood Highway (US 101) in the City of Novato. Redwood Landfill is an active Class 3 solid waste landfill. The HAZNET database lists the following waste categories: unspecified oil containing waste, oxygenated solvents, oil/water separation sludge. This site is listed as an active industrial facility which is considered to be a minor threat to water quality. The AST database indicates that an 11,250-gallon aboveground storage tank facility is located at this site. The RCRIS-SQG listing indicates that no violations were found with regard to their database. Leachate from this landfill has the potential to contaminate groundwater underneath the adjacent parcels of land. The site is not directly adjacent to the existing US 101 right-of-way; it is separated by a parcel that has not been identified as a site with known or suspected contamination. However, right-of-way acquisition associated with the reconfiguration or adaptation of the Redwood Landfill Road Overcrossing is proposed for the parcel adjacent to the landfill. The Redwood Landfill site is considered to be a high-risk/medium-probability site in the PSI; however, the relocation of a proposed access road away from the landfill has reduced the probability to impact the MSN Project from medium to low. Figure 3.2-5 presents the site location.

Silveira A & L Trust/Dairy Ranch. The Silveira Dairy Ranch is located at 9501 Redwood Highway – South in the City of Novato. Based on available information, USTs were used to store leaded gasoline, unleaded gasoline and diesel at the site. The status of the three recorded USTs at the site is not known; however, no leaks have been reported. In addition to the USTs, potential sources

FIGURE 3.2-4
Rancho Del Pantano/Black John Slough
Sites with High Risk or
High Probability to Impact Project



MARIN SONOMA 101 NARROWS

NORTH

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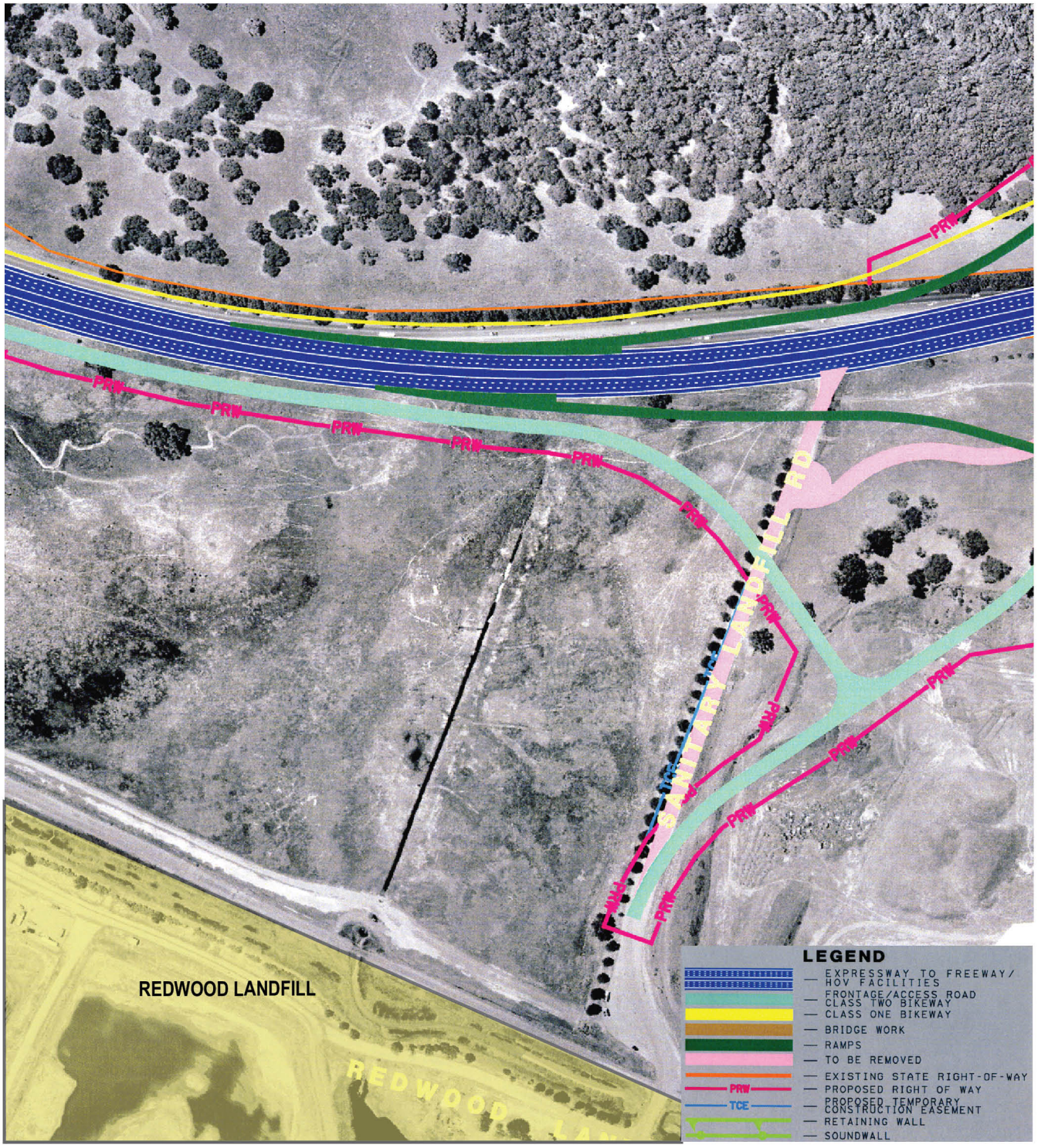
FIGURE 3.2-5
Redwood Landfill
Sites with High Risk or
High Probability to Impact Project



MARIN SONOMA NARROWS
NORTH

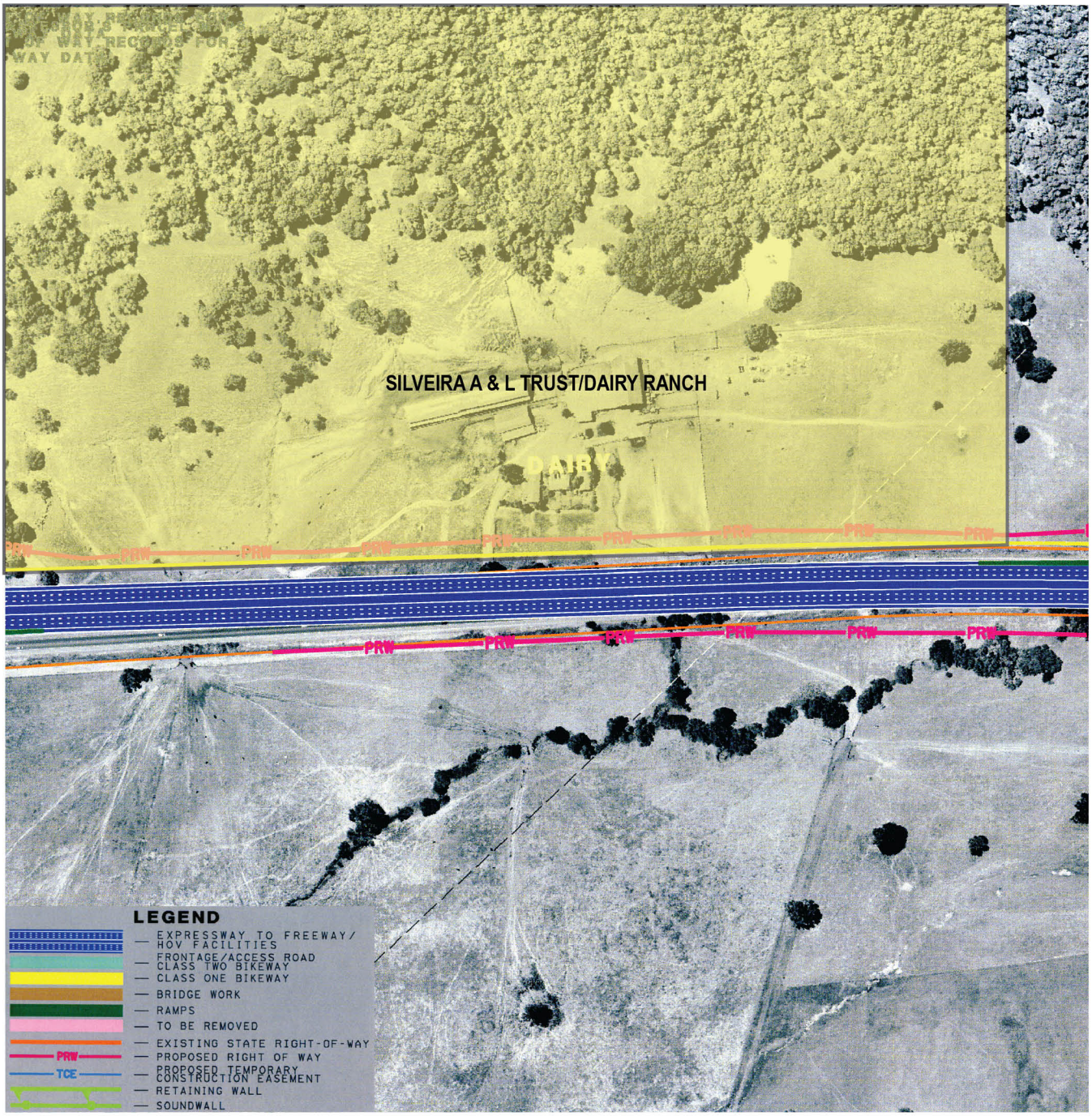
TB042006002BAO_Fig3-2_ImpactProjectSites.indd

of contamination at the site include dairy operations. Confined animal operations can be sources of contamination in groundwater, particularly nitrates and salts. Construction near the Silveira Dairy Ranch site under the Fixed HOV Lane Alternative would include realignment of US 101 requiring the purchase of new right of way at the Dairy property in a location down gradient of the dairy facility. Contaminated groundwater is unlikely to be encountered during construction of the proposed improvements; however, contamination from the site, if present, could impact the property to be acquired. This site was identified as a medium risk/medium probability site in the PSI; however, it was identified for further discussion in this document due to the emphasis that the RWQCB is currently placing on confined animal units. Figure 3.2-6 presents the site location.

Gas N Shop. The Gas N Shop site is located at 4418 Redwood Highway – South, at the intersection of US 101 and Kastania Road, in the City of Petaluma. Based on available information, four USTs are located on this site. Three of these tanks are used to store gasoline and one of them is designated for diesel fuel. Records indicate that the aquifer beneath the site has been contaminated with MTBE. A review of site investigation reports available for this site indicate that the groundwater level is approximately 8 ft below the existing ground surface. This groundwater flows eastward underneath US 101. The groundwater beneath this site, and beneath US 101, is contaminated with benzene and MTBE. Benzene and MTBE concentrations in groundwater were reported to be as high as 5,430 µg/l and 1,000 µg/l, respectively, in samples collected on May 6, 2004. Construction near the Gas N Shop site would include realignment of US 101 within the existing right of way and improvements to the frontage/access road. Under the Fixed HOV Lane Alternative, the US 101 freeway facilities adjacent to the Gas N Shop property would be placed on fill. The only planned excavation in the area is associated with a retaining wall on the northbound shoulder of US 101. The excavation is not expected to reach the groundwater table; therefore, contaminated groundwater is unlikely to be encountered during construction of the proposed improvements.

The site is located adjacent to the western US 101 right-of-way. Right-of-way acquisition is not proposed along US 101 adjacent to the site; however, right-of-way and encroachment acquisition is proposed on and adjacent to Kastania Road which runs along the southwestern property boundary of the site. The property that would be acquired is generally upgradient or cross gradient to the general groundwater flow direction; however, contamination from the site may impact the

FIGURE 3.2-6
Silveira A & L Trust/Dairy Ranch
Sites with High Risk or
High Probability to Impact Project



MARIN SONOMA NARROWS

NORTH

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property. This site is considered to be a medium-risk/high-probability site. Figure 3.2-7 presents the site location.

Novato Disposal Service. The Novato Disposal Service site is located at 2543 Petaluma Boulevard – South, in the City of Petaluma. Records indicate that this facility accepts passenger car and truck tires, and is an active LUST site. Documents indicate that the parcel is being recommended for closure by the SCDEH and the RWQCB. However, at the time the PSI was prepared, the case was officially still open.

The construction of the proposed South Petaluma Boulevard Interchange as part of the Fixed HOV Lane Alternative would require the acquisition of a small section of right-of-way at the southwest corner of the Novato Disposal Service property. The proposed project includes acquisition of encroachment along the existing South Petaluma Boulevard, which runs adjacent to the western property boundary of the site. In addition, acquisition of a small portion of the southwest corner of the site property is proposed. This site is considered to be a medium-risk/high-probability site. Figure 3.2-8 presents the site location.

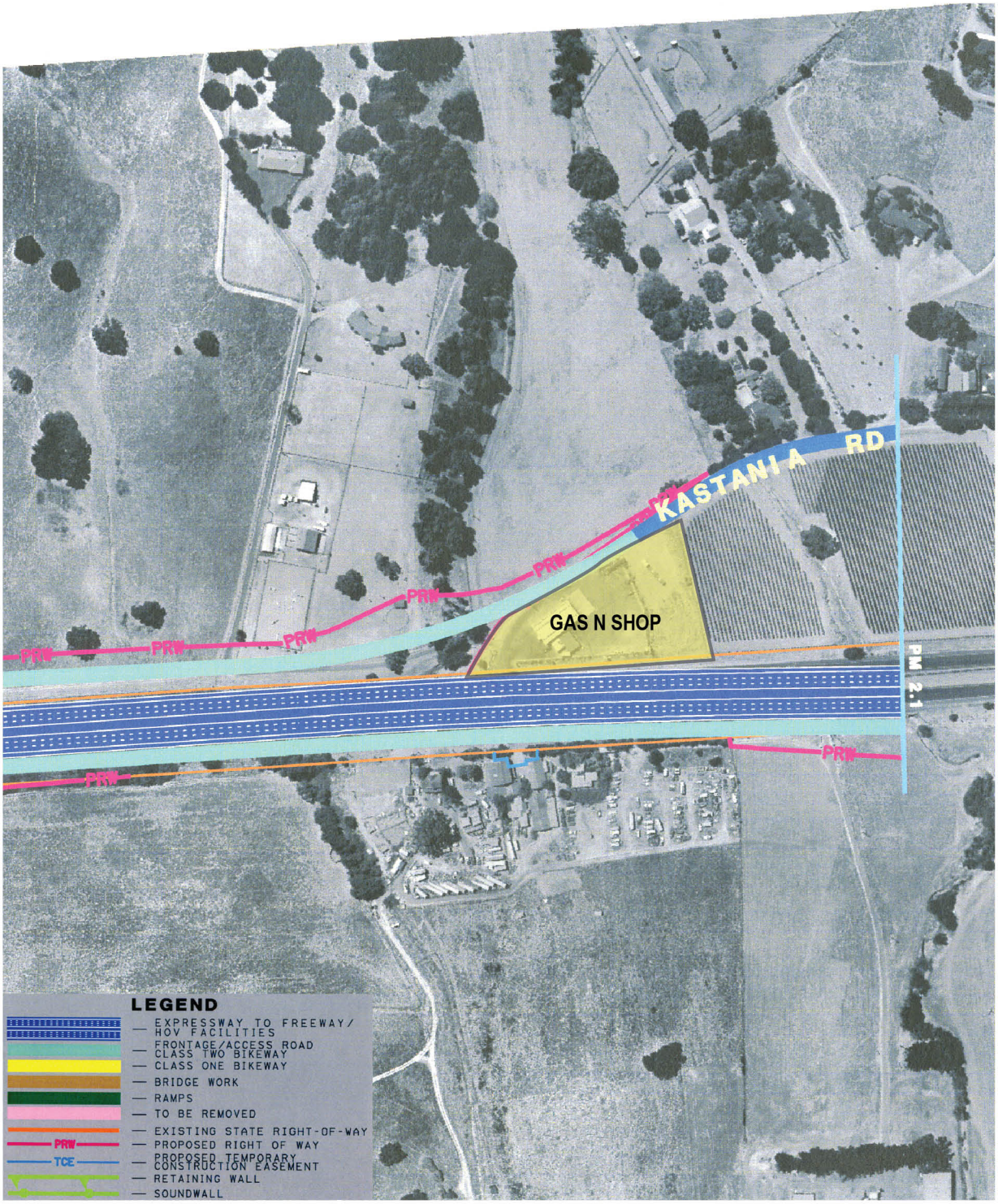
Reversible HOV Lane Alternative. The overall footprint of the Reversible HOV Lane Alternative is the same as the Fixed HOV Lane Alternative; therefore, potential impacts related to potentially contaminated sites would be the same as those identified above for the Fixed HOV Lane Alternative.

Access Options. The proposed improvements under the four Access Options would have a similar potential to disturb the high risk and/or high probability and dairy sites described above, with two notable exceptions. The potential exposure to contaminated site would be substantially different for the Redwood Landfill and the Silveira A & L Trust/Dairy Ranch.

At Redwood Landfill, the frontage/access road under Access Options 4b, 12b, and 14d would be closer to the landfill property than under Access Option 14b. Contaminated groundwater is the highest risk associated with Redwood Landfill. Because the proposed improvements would be located generally upgradient of the landfill, the probability of impact under any of the Access Options would be low.

Adjacent to the Silveira A & L Trust/Dairy Ranch property, the alignments of the frontage/access roads and bicycle/pedestrian paths are different under each Access Option and, as a result, the right-of-way to be purchased under each

FIGURE 3.2-7
Gas N Shop
Sites with High Risk or
High Probability to Impact Project



MARIN SONOMA NARROWS

NORTH

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FIGURE 3.2-8
Novato Disposal Service
Sites with High Risk or
High Probability to Impact Project

MARIN SONOMA NARROWS

NORTH

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Access Option would be different. Access Option 12 b would require the largest right of way acquisition adjacent to the dairy property; Access Option 4b would require the smallest right of way acquisition. Contaminated groundwater is unlikely to be encountered during construction of the proposed improvements. Nevertheless, because the right of way property is down gradient of the dairy facility, contamination from the site, if present, could impact the property to be acquired.

No Build Alternative. The No Build Alternative would involve only routine maintenance and upkeep of the existing US 101 facilities. Because this alternative would not involve land acquisition or extensive construction/excavation, the likelihood of encountering contaminated soil or groundwater from the high risk and/or high probability sites would be low.

NOA

Fixed HOV Build Lane Alternative. NOA may have migrated into streams and other waterways as a result of weathering and erosion of ultramafic rocks in the watershed. Impacted areas may be adjacent to or coincide with bridgework areas designated for the Petaluma River Bridge replacement, the new San Antonio Creek Bridge construction, and others. If undisturbed, NOA is generally not considered to be hazardous. However, excavation and other construction activities that cause ground disturbance may cause the asbestos fibers to become airborne, which can result in air quality and human health hazards.

Reversible HOV Lane Alternative. For the Reversible HOV Lane Alternative, the bridgework areas at the Petaluma River and San Antonio Creek would be substantially similar to the Fixed HOV Lane Alternative; therefore, potential impacts related to NOA would not be distinguishable from those identified above for the Fixed HOV Lane Alternative.

Access Options. The bridgework areas at the Petaluma River and San Antonio Creek would be common to all Access Options. Therefore, potential impacts related to NOA would the same for all Access Options.

No Build Alternative. The No Build Alternative would involve only routine maintenance and upkeep of the existing US 101 facilities. Because this alternative would not involve bridgework or major construction at the waterway crossings, potential effects from exposure to NOA would not be expected.

Man-made Asbestos

Fixed HOV Build Lane Alternative. Demolition or modification of structures including the Petaluma River Bridge, Novato Creek Bridge, Lynch Creek Bridge, and SR 116/Lakeville Highway Overhead may disturb man-made asbestos materials in concrete or other bridge parts. Disturbance of asbestos-containing materials may cause the asbestos fibers to become airborne, which can result in air quality and human health hazards.

Reversible HOV Lane Alternative. The demolition or modification of structures for the Reversible HOV Lane Alternative would be substantially the same as the Fixed HOV Lane Alternative; therefore, potential impacts related to man-made asbestos would not be distinguishable from those identified above for the Fixed HOV Lane Alternative.

Access Options. The structures to be demolished or modified are consistent for all Access Options. Therefore, potential impacts related to man-made asbestos would the substantially the same for all Access Options.

No Build Alternative. The No Build Alternative would involve only routine maintenance and upkeep of the existing US 101 facilities. Because this alternative would not involve demolition or modification of structures, impacts from exposure to man-made asbestos materials would not be expected.

Mercury Mine Tailings

Fixed HOV Build Lane Alternative. Mine tailings, which could potentially be encountered in fill materials or in rock formations in localized areas along the alignment, may contain hazardous levels of mercury. If encountered during construction of the Fixed HOV Lane Alternative, mine tailings may require special handling and disposal procedures.

Reversible HOV Lane Alternative. The overall footprint of the Reversible HOV Lane Alternative would be the same as the Fixed HOV Lane Alternative; therefore, potential impacts related to exposure to mercury mine tailings would not be distinguishable from those identified above for the Fixed HOV Lane Alternative.

Access Options. The PSI noted that geologic formations similar to those at the Gambonini Mine exist along US 101 just south of San Antonio Creek. There are some variations in the proposed bikeways/access roads in this area; however,

potential impacts related to mercury mine tailings would not likely to be substantially different for each of the Access Options, since all involve some construction/improvements in this vicinity.

No Build Alternative. The No Build Alternative would involve only routine maintenance and upkeep of the existing US 101 facilities. Because this alternative would not involve extensive construction outside the existing right-of-way, potential impacts from exposure to mine tailings would not be expected.

Yellow Traffic Striping and ADL

Fixed HOV Lane Alternative. The Fixed HOV Lane Alternative would involve the transport and disposal of lead-contaminated materials including yellow traffic striping and surface soil adjacent to the pavement that has been impacted by ADL. This lead-contaminated material, if not managed properly, could become airborne and then inhaled or disposed of in an uncontrolled area that would then present a new exposure pathway.

Reversible HOV Lane Alternative. The overall footprint of the Reversible HOV Lane Alternative is the same as the Fixed HOV Lane Alternative; therefore, potential impacts related to lead would not be distinguishable from those identified above for the Fixed HOV Lane Alternative.

No Build Alternative. The No Build Alternative would involve only routine maintenance and upkeep of the existing US 101 facilities. These relatively minor rehabilitation activities could involve the transport and disposal of lead-contaminated materials, and result in the same effects as described above for the Build Alternatives but to a less extensive degree.

3.2.5.4 Avoidance, Minimization and Mitigation Measures

It is Caltrans' policy to avoid acquisition of contaminated sites; however, if an area of contamination cannot be avoided, then engineering controls would be developed to minimize and mitigate potential impacts to human health and the environment. Because the footprints for the Fixed HOV Lane Alternative and for the Reversible HOV Lane Alternative would be identical opportunities for avoidance of potentially contaminated sites are minimal. In contrast, there may be some opportunities for avoidance with the various Access Options.

Phase 1 and Phase 2 Environmental Site Assessments (ESA). As part of the design process, site specific Phase 1 ESA will be conducted for each parcel that requires a partial or full right-of-way take. The Phase 1 ESA will be conducted in accordance with the requirements of the Final Rule for All Appropriate Inquiries promulgated as an amendment to CERCLA. Based on the findings of the Phase 1 ESA, areas potentially impacted with contaminants will be investigated and sampled, the constituents of concern identified, and any impacts delineated in a Phase 2 ESA. Caltrans will make every effort to have the property owner, or responsible party, investigate and clean-up the contamination prior to Caltrans acquisition.

Safety Plans. As appropriate, the MSN construction contract will require the development and implementations of various plans to safeguard human health and the environment during construction. These plans will include a Waste Management and Disposal Plan, a Health and Safety Plan, and a Storm Water Pollution Prevention Plan (SWPPP). The Waste Management and Disposal Plan will outline procedures for the handling, storage, and disposal of contaminated materials. The Health and Safety Plan will be prepared in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Standard 29 of the Code of Federal Regulations (CFR). The Health and Safety Plan will outline measures to protect site workers and neighbors during construction. The SWPPP will outline BMPs for construction and the handling of hazardous materials. Preparation of a SWPPP is required by the RWQCB in compliance with the NPDES under the federal CWA. The abovementioned plans will cover all potential hazardous materials, including contaminated soil and groundwater, NOA, man-made asbestos, mine tailings, and lead-containing materials. Specific requirements for material handling and disposal of hazardous materials will also be included in the special provisions.

Utility Design to Prevent Migration of Contamination. If new storm drain facilities, or other underground utilities must be installed at or near the groundwater table at petroleum-impacted sites, the design of these facilities will include minimization and mitigation measures to reduce the potential for contamination to migrate off the current area of contamination. Such measures may include the use of watertight pipe connections and the use of impermeable material for backfill around these drainage pipes.

NOA Testing and Control Measures. If sediments within the Novato Creek or the San Antonio Creek would be impacted by either Build Alternative, sediments will be sampled and tested for NOA as part of the Phase 2 ESA. If asbestos is detected, then nonstandard special provisions will be prepared to direct the safe removal and disposal of waste sediments. These special provisions will be developed in compliance with the requirements of Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations as promulgated and enforced by the California Air Resources Board (CARB). Measures that have been developed by CARB to reduce emissions during construction include dust suppression by wetting, rinsing vehicles in contact with NOA, and covering and/or wetting stockpiles and excavated materials during transport.

Asbestos-Containing Materials Testing and Control Measures. An asbestos survey will be undertaken for all structures that would be demolished as part of either Build Alternative. If asbestos-containing material is discovered, standard special provisions will be prepared to address the safe removal and disposal of this material prior to any demolition activities. These specific provisions will ensure compliance with the National Emissions Standards for Hazardous Air Pollutants, under Title 40 of the CFR Part 61, and are enforced by the Bay Area Air Quality Management District (BAAQMD) and the CARB.

Mercury Mine Tailings Testing and Control Measures. If further investigation indicates that mine tailings may be encountered during construction of either Build Alternative, suspected mine tailings will be sampled and tested for mercury as part of the Phase 2 ESA. If mercury is detected, Caltrans will implement special handling and disposal requirements in accordance with Title 22 of the California Code of Regulations (CCR) and the California Health and Safety Code.

ADL Testing and Control Measures. As part of the Phase 2 ESA, surface soil along the project corridor will be sampled and tested for lead and, possibly, for mercury if the soil is observed to be reddish in color. If concentrations exceed the soluble or total threshold limits specified in Section 66261.24 of Title 22 of the California Code of Regulations (22 CCR), lead-contaminated soil will be managed in accordance with the Variance No. 00-H-VAR-01 (Variance) issued by the California Department of Toxic Substances Control (DTSC). In these cases, the Variance specifies that lead-contaminated "waste" soils that are generated during construction can be safely encapsulated within new

embankments, thereby prevent the runoff of lead-contaminated soil into the environment. Caltrans will implement the appropriate health and safety provisions during construction to protect construction employees and the public. It is anticipated that this project would be eligible to reuse lead-contaminated soil under the provisions of the Variance. If, for some reason, Caltrans were not able to implement the Variance provisions or if mercury was detected, soil with metal concentrations in excess of the aforementioned thresholds will be disposed of as hazardous waste in accordance with 22 CCR or Section 25157.8 of the California Health and Safety Code.

Yellow Traffic Striping Testing and Control Measures. Yellow traffic striping is frequently removed during traffic staging and construction activities. Standard special provisions are available that typically specify that a high efficiency particulate air (HEPA) filter-equipment vacuum device be used concurrently when removing this material. This method of stripe removal will ensure that this waste is properly captured during the removal process. These special provisions also provide for sampling, testing and disposal of this waste.

3.2.6 Air Quality

The air quality discussion is based upon the Air Quality Impact Report (revised August 2007) for the MSN Project. Portions of the Preliminary Site Investigation (January 2006) are also discussed here as it pertains to Naturally Occurring Asbestos and asbestos-containing materials.

3.2.6.1 Regulatory Setting (Nationally Ambient Air Quality Standards and Regional Conformity)

The Clean Air Act (CAA) as amended in 1990 is the federal law that governs air quality. Its counterpart in California is the California Clean Air Act (CCAA) of 1988. These laws set standards for the quantity of pollutants that can be in the air. At the federal level, these standards are called National Ambient Air Quality Standards (NAAQS). Standards have been established for six criteria pollutants that have been linked to potential health concerns; the criteria pollutants are: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter, lead (Pb), and sulfur dioxide (SO_2). The federal and state ambient air quality standards are shown in Table 3.2-8.

Table 3.2-8 Ambient Air Quality Standards and Bay Area Attainment Status

Pollutant	Averaging Time	California Standards[1]		National Standards[2]	
		Concentration	Attainment Status	Concentration[3]	Attainment Status
Ozone	8 Hour	0.070ppm(137µg/m^3)	N[9]	0.08 ppm	N[4]
	1 Hour	0.09ppm(180 µg/m^3)	N		[5]
Carbon Monoxide	8 Hour	9.0ppm(10 mg/m^3)	A	9ppm (10 mg/m^3)	A[6]
	1 Hour	20ppm(23 mg/m^3)	A	35ppm (40 mg/m^3)	A
Nitrogen Dioxide	Annual Average			0.053ppm (100 µg/m^3)	A
	1 Hour	0.25ppm(470 µg/m^3)	A		
Sulfur Dioxide	Annual Average				
	24 Hour	0.04ppm(105 µg/m^3)	A	0.14ppm(365 µg/m^3)	A
	1 Hour	0.25ppm(655 µg/m^3)	A		
Particulate Matter	Annual Arithmetic Mean	20 µg/m^3	N[7]		
(PM_{10})	24 Hour	50 µg/m^3	N	150 µg/m^3	U
Particulate Matter	Annual Arithmetic Mean	12 µg/m^3	N[7]	15 µg/m^3	A
($PM_{2.5}$)	24 Hour			35 µg/m^3 (see Footnote 10)	U
Sulfates	24 Hour	25 µg/m^3	A		
Lead	Calendar Quarter			1.5 µg/m^3	A
	30 Day Average	1.5 µg/m^3	A		
Hydrogen Sulfide	1 Hour	0.03ppm(42 µg/m^3)	U		
Vinyl Chloride (chloroethene)	24 Hour	0.010ppm(26 µg/m^3)			
Visibility Reducing Particles	8 Hour(1000 to 1800PST)	See Footnote 8	U		

A=Attainment N=Nonattainment U=Unclassified
mg/m^3=milligrams per cubic meter
µg/m^3=micrograms per cubic meter
ppm=parts per million
Source: BAAQMD internet site, 1/4/2007

Notes:

[1] California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter - PM_{10}, and visibility reducing particles are values that are not to be exceeded. The standards for sulfates, Lake Tahoe carbon monoxide, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded. If the standard is for a 1-hour, 8-hour or 24-hour average (i.e., all standards except for lead and the PM_{10} annual standard), then some measurements may be excluded. In particular, measurements are excluded that ARB determines would occur less than once per year on the average. The Lake Tahoe CO standard is 6.0 ppm, a level one-half the national standard and two thirds the state standard.

[2]National standards other than for ozone, particulates and those based on annual averages are not to be exceeded more than once a year. The 1-hour ozone standard is attained if, during the most recent three-year period, the average number of days per year with maximum hourly concentrations above the standard is equal to or less than one. The 8-hour ozone standard is attained when the 3-year average of the 4th highest daily concentrations is 0.08 ppm or less. The 24-hour PM_{10} standard is attained when the 3-year average of the 99th percentile of monitored concentrations is less than 150 µg/m^3. The 24-hour $PM_{2.5}$ standard is attained when the 3-year average of 98th percentiles is less than 65 µg/m^3. Except for the national particulate standards, annual standards are met if the annual average falls below the standard at every site. The national annual particulate standard for PM_{10} is met if the 3-year average falls below the standard at every

Table 3.2-8 Ambient Air Quality Standards and Bay Area Attainment Status

Pollutant	Averaging Time	California Standards[1]		National Standards[2]	
		Concentration	Attainment Status	Concentration[3]	Attainment Status

site. The annual $PM_{2.5}$ standard is met if the 3-year average of annual averages spatially-averaged across officially designed clusters of sites falls below the standard.

[3] National air quality standards are set at levels determined to be protective of public health with an adequate margin of safety. Each state must attain these standards no later than three years after that state's implementation plan is approved by the Environmental Protection Agency.

[4] In June 2004, the Bay Area was designated as being in marginal attainment of the national 8-hour ozone standard.

[5] The national 1-hour ozone standard was revoked by USEPA on June 15, 2005.

[6] The Bay Area is maintenance for CO, and is subject to conformity requirements.

[7] In June 2002, CARB established new annual standards for $PM_{2.5}$ and PM_{10}.

[8] Statewide VRP Standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

[9] This standard was approved by the Air Resources Board on April 28, 2005 and became effective on May 17, 2006.

[10] USEPA lowered the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ in 2006. In March 2007, USEPA issued rules requiring 39 metropolitan areas in the country to develop plans to achieve attainment of the $PM_{2.5}$ standard by 2015. The San Francisco Bay Area is not among the designated 39 metropolitan areas.

[11] Data is based upon a long range projection. While year to year variations are to be expected and are sometimes large, they shouldn't affect long-term projections.

Under the 1990 Clean Air Act Amendments, the DOT cannot fund, authorize, or approve federal actions to support programs or projects that are not first found to conform to the State Implementation Plan (SIP) for achieving the goals of the Clean Air Act requirements. Conformity with the Clean Air Act takes place on two levels—first, at the regional level and second, at the project level. The proposed project must conform at both levels to be approved.

Regional level conformity in California is concerned with how well the region is meeting the standards set for CO, NO_2, O_3, and particulate matter. California is in attainment for the other criteria pollutants. At the regional level, a regional transportation plan (RTP) is developed that includes all of the transportation projects planned for a region over a period of years, usually at least 20. Based on the projects included in the RTP, an air quality model is run to determine whether or not the implementation of those projects would conform to emission budgets or other tests showing that attainment requirements for CO, NO_2, O_3 and particulate matter of the Clean Air Act are met. If the conformity analysis is successful, the regional planning organization, such as the Metropolitan Transportation Commission (MTC) and the FHWA, make the determination the RTP is in conformity with the State Implementation Plan for achieving the goals of the Clean Air Act. If the design and scope of the proposed transportation project are

the same as described in the RTP, then the proposed project is deemed to meet regional conformity requirements of project-level analysis. The MSN Project is listed in the MTC 2035 RTP. Specific discussion regarding the project's conformity with the SIP occurs later in this section.

Mobile Source Air Toxics

In addition to the criteria air pollutants for which there are NAAQS, USEPA also regulates a list of air toxics (64 Federal Register [FR] 38706). Air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), air sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries).

Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics identified by the USEPA. MSATs are emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as by-products. Metal air toxics result from engine wear or from impurities in oil or gasoline.

The USEPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The USEPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources 66 FR 17229 (March 29, 2001). This rule was issued under the authority in Section 202 of the Clean Air Act. FHWA has issued Interim Guidance on Air Toxic Analysis in NEPA Documents (February 3, 2006).

In its rule, USEPA also examined the impacts of existing and newly formulated mobile source control programs, including its reformulated gasoline program, its national low emission vehicle standards, its Tier 2 motor vehicle emissions standards and gasoline sulphur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulphur control requirements. FHWA projects that between 2000 and 2020, nationwide VMT will increase by 64 percent. Despite this increase, FHWA projects these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 to 65 percent, and will reduce on-highway diesel particulate matter emissions by 87 percent.

As a result, the USEPA concluded that no further motor vehicle emissions standards or fuel standards were necessary to further control MSATs. The agency

is preparing another rule under authority of Clean Air Act Section 202(l) that will address these issues and could make adjustments to the full 21 and the primary six MSATs.

This FEIR/S includes a basic analysis of the likely MSAT emission impacts of the MSN Project. However, available technical tools do not enable a prediction of the project-specific health impacts of the emission changes associated with the proposed project. Evaluating the environmental and health impacts from MSATs on a proposed highway project involves several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps requires a number of assumptions that, when compounded together, make the results imprecise and speculative for a determination of the MSAT health impacts of this project.

In 1998, California identified diesel particulate matter (diesel PM) as a toxic air contaminant based on its potential to cause cancer and other adverse health impacts. In addition, to diesel PM, emissions from diesel-fueled engines include over 40 other cancer causing substances. In September 2000, the California Air Resources Board (CARB) approved a comprehensive Diesel Risk Reduction Plan (Plan) to reduce diesel PM emissions and the associated health risk by 75 percent in 2010 and 85 percent or more by 2020.

Asbestos

Asbestos refers to a family of naturally-occurring fibrous minerals that are frequently encountered in areas known as ultramafic rock units. Chrysotile (white asbestos), the most common material of this type found in California, is part of the serpentine mineral group and the one most commonly used in structural applications. When the asbestos-containing material is disturbed, the fibers break off and become airborne, creating a health risk if inhaled. Asbestos is classified as a known human carcinogen by state, federal, and international agencies and was identified as a toxic air contaminant by CARB in 1986.

In accordance with Section 112 of the Clean Air Act, USEPA established National Emissions Standards for Hazardous Air Pollutants (NESHAP) to protect the public. On March 31, 1971, USEPA identified asbestos as a hazardous pollutant, and on April 6, 1973, USEPA first promulgated the Asbestos NESHAP

in 40 CFR Part 61. The Asbestos NESHAP was established to protect public health during activities involving the processing, handling, and disposal of asbestos-containing material by minimizing the release of asbestos when facilities that contain asbestos-containing materials are demolished or renovated. In addition, the regulations require notification to applicable State and local agencies and/or USEPA Regional Offices before all demolitions, or before renovations of buildings that contain a certain threshold amount of asbestos. The CAA allows USEPA to delegate enforcement of NESHAP to State and local agencies.

Asbestos Airborne Toxic Control Measures (ATCMs) adopted by CARB regulate (1) the use of serpentine and asbestos-bearing ultramafic rock materials used for surfacing applications, and (2) the application of best-management practices for fugitive dust from construction, grading and quarrying operations in areas that have NOA.

In 2000, CARB amended the ATCM for Surfacing Applications to apply to any person who sells, supplies, offers for sale or supply, transports, or applies "restricted material – defined as ultramafic rock and serpentine rock; any material extracted from a region defined on geologic maps a an ultramafic rock unit, and any material that has been tested and found to have an asbestos content of 0.25% or greater." The ATCM outlines notification and record-keeping requirements, prohibits the sale or use of material with an asbestos content greater than 0.25 percent for unpaved surfacing, and requires any person who transports restricted material to maintain all receipts and records with the material at all times during transit.

In addition, in 2001 CARB also approved an ATCM for Construction, Grading, Quarrying, and Surface Mining Operations in areas likely to have NOA. Road construction and maintenance operations must use dust control measures for a specified set of emission sources and prevent visible emissions from crossing the project boundaries. For construction and grading projects that will disturb one acre or less, the regulation requires several specific actions to minimize emissions of dust that are available on CARB's website. Construction projects that will disturb more than one acre must prepare and obtain district approval for an Asbestos Dust Mitigation Plan. The ATCM also outlines notification, record-keeping and off-site transport requirements,

Following the classification standard given in California Code of Regulations, section 66261.24, the California Department of Toxic Substances Control (DTSC) classifies asbestos-containing material as hazardous waste if it is friable and contains one percent (1.0 percent) or more asbestos as hazardous waste. DTSC regulates the packaging, onsite accumulation, transportation, and disposal of asbestos when it is a hazardous waste. To determine if it is hazardous, asbestos waste must be tested (California Code of Regulations, Title 22, Section (66262.11(b)(2)) by a laboratory certified by the California Department of Health Services. Asbestos removal and abatement contractors must be certified by the Contractors State License Board under Business and Professions Code Section 7058.5 and must register with California's Division of Occupational Safety and Health (Cal-OSHA) under Labor Code Section 6501.5.

Bay Area Air Quality Management District's (BAAQMD) Regulation 11-2-401.3 requires the completion of an application and notification to the BAAQMD at least ten (10) working days prior to commencement of demolition activities or renovation activities involving the removal of 100 sq. ft./lin. ft. or greater of Regulated Asbestos Containing Material (RACM). Regulation 11-2-303.8 requires a survey by a Cal-OSHA certified person that has passed a USEPA approved building course be performed prior to demolition to determine the presence of RACM. The ATCM for Construction, Grading, Quarrying, and Surface Mining Operations became effective in the BAAQMD in 2002 and requires submittal of an application and Asbestos Dust Mitigation Plan that employs the best available dust mitigation measures in order to reduce and control dust emissions. The BAAQMD must be notified in writing at least fourteen (14) days prior to the initiation of any road construction or maintenance activity.

3.2.6.2 Affected Environment

Climate

The Bay Area is characterized by cool, dry summers and mild, wet winters. Temperature in the project area and its vicinity averages approximately 58 degrees Fahrenheit annually, with an average maximum summer temperature of approximately 82 degrees Fahrenheit and an average minimum winter temperature of approximately 38 degrees Fahrenheit. The Eastern Pacific High, which is a strong persistent anticyclone, is the major influence on the climate in the area. The area experiences little precipitation during the summer months, when a high-pressure cell prevents storms from affecting the California coast.

During the winter, the high-pressure cell weakens and shifts southward. Storms occur more frequently and winds are usually moderate.

Existing Air Quality

Low wind speeds and temperature inversions contribute to the build-up of air pollution. Low wind speed contributes to the build-up or air pollution because it allows more pollutants to accumulate in the air within a period of time. The highest air pollutant concentrations in the Bay Area generally occur during inversions, when temperature increases as altitude increases, thereby preventing air close to the ground from mixing with the air above it. As a result, air pollutants are trapped near the ground. Under the California Clean Air Act, the Sonoma and Marin County portion of the Bay Area Air Basin is designated as a non-attainment area for O_3, PM_{10}, and $PM_{2.5}$. Under the Clean Air Act, the Sonoma and Marin County portion of the Bay Area Air Basin is designated as a non-attainment area for O_3 (as shown in Table 3.2-8).

Carbon Monoxide. CO is almost exclusively emitted by motor vehicles. This pollutant binds the oxygen-carrying protein in blood to hemoglobin, reducing the amount of oxygen reaching the heart and brain. Exposure to CO, even at low levels can endanger people with coronary artery disease. It can also cause headaches, fatigue, and slow reflexes, even among healthy people. Typical symptoms experienced by some people where levels of CO substantially exceed State and Federal Air quality standards are headaches and dizziness.

Violations of the CO standards usually occur in the winter, during periods of ground-based weather inversions (i.e., when warm air above traps a layer of cold air beneath, near ground level) with very low wind speed.

The BAAQMD monitoring data from the Santa Rosa station, the nearest station to the project site, shows no violations of the federal and state CO standards in the three years from 2006 to 2008, based upon available data, as shown in Table 3.2-9.

Table 3.2-9 2006-2008 Criteria Pollutant Violations: Santa Rosa - 5th Street Monitoring Station

Pollutant	Standard Exceedance	2006	2007	2008
Ozone (1 hour)	Maximum 1-hr concentration (ppm)	0.077	0.710	0.076
	Days > 0.12 ppm (Federal 1-hr standard)	0	0	0
	Days > 0.09 ppm (State 1-hr standard)	0	0	0

Table 3.2-9 2006-2008 Criteria Pollutant Violations: Santa Rosa - 5th Street Monitoring Station

Pollutant	Standard Exceedance	2006	2007	2008
Ozone (8 hour)	Maximum 8-hr concentration (ppm)	0.058	0.059	0.064
	Days > 0.08 ppm (Federal 8-hr standard)	0	0	0
Carbon Monoxide	Maximum 8-hr concentration (ppm)	1.70	1.71	1.49
	Days > 9 ppm (Federal 8-hr standard)	0	0	0
	Days > 9.0 ppm (State 8-hr standard)	0	0	0
Nitrogen Dioxide	Maximum 1-hr concentration (ppm)	0.044	0.046	0.049
	Days > 0.25 ppm (State 1-hr standard)	0	0	0
$PM_{2.5}$	Maximum 24-hr concentration (µg/m^3)	59.0	32.0	30.8
	Days >65 µg/m^3 (Federal 24-hr standard)	1	0	0
PM_{10}	Maximum 24-hr concentration (µg/m^3)	89.5	37.2	49.9
	Estimated days > 150µg/m^3 (Federal 24-hr standard)	0.0	0.0	*
	Estimated days > 50µg/m (State 24-hr standard)	11.8	0.0	*

Source: California Air Resources Board. Date: 6/8/09
* BAAQMD data not available for these pollutants from 2006-2008.

Table 3.2-10 presents the BAAQMD monitoring data from the San Rafael station, which is the Marin County station closest to the project site. Based upon available data, there were also no violations of the federal and state CO standards in the three years from 2006 to 2008.

Table 3.2-10 2006-2008 Criteria Pollutant Violations: San Rafael Monitoring Station

Pollutant	Standard Exceedance	2006	2007	2008
Ozone (1 hour)	Maximum 1-hr concentration (ppm)	0.089	0.072	0.085
	Days > 0.12 ppm (Federal 1-hr standard)	0	0	0
	Days > 0.09 ppm (State 1-hr standard)	0	0	0
Ozone (8 hour)	Maximum 8-hr concentration (ppm)	0.058	0.058	0.070
	Days > 0.08 ppm (Federal 8-hr standard)	0	0	0
Carbon Monoxide	Maximum 8-hr concentration (ppm)	1.49	1.34	1.10
	Days > 9 ppm (Federal 8-hr standard)	0	0	0
	Days > 9.0 ppm (State 8-hr standard)	0	0	0
Nitrogen Dioxide	Maximum 1-hr concentration (ppm)	0.054	0.057	0.056
	Days > 0.25 ppm (State 1-hr standard)	0	0	0
$PM_{2.5}$	Maximum 24-hr concentration (µg/m3)	*	*	*
	Days > 65 µg/m3 (Federal 24-hr standard)	*	*	*
PM_{10}	Maximum 24-hr concentration (µg/m3)	39.0	52.0	41.0
	Estimated days > 150µg/m3 (Federal 24-hr standard)	0	0	0
	Estimated days > 50µg/m3 (State 24-hr standard)	0	1	0

Source: California Air Resources Board. Date: 6/8/09
* BAAQMD data not available for these pollutants from 2006-2008.

Ozone. O_3 is the primary constituent of photochemical smog. It is not emitted directly into the atmosphere, but is produced through a complex series of chemical reactions involving hydrocarbons (HC) and oxides of nitrogen (NO_x), in the present of sunlight. Vehicle exhaust emissions contribute about half of the pollutants that form ozone. High ozone levels occur primarily in the summer and early fall. High ozone levels aggravate asthma, bronchitis, and other respiratory ailments, as well as cardiovascular disease. High concentrations of ozone may also cause dizziness, headaches, burning of eyes and throat, and nausea.

The general structure of oxidant or ozone problems is the emissions of HC and NO_x. In the morning, these pollutants react in the presence of sunlight to produce a peak oxidant concentration layer. As these reactions occur, the air mass is normally transported by the wind. Consequently, the peak oxidant concentrations in the Bay Area tend to occur downwind of the areas where the emissions were released, settling in areas like San Jose and Livermore. Photochemical oxidants cannot therefore be said to be cause by a specific source, nor do peak concentrations invariably occur in the vicinity of emission sources. Thus, photochemical oxidants are an area-wide pollution problem and require a regional analysis such as that done by MTC.

The data monitored at the BAAQMD station in Santa Rosa show no violations of the federal standards and only one violation of the state ozone standards in three years from 2003 to 2005, as shown in Table 3.2-9.

Oxides of Nitrogen (NO_x). Nitrogen oxides are produced by motor vehicles (particularly heavy duty vehicles) and high temperature industrial operations. They have not posed a separate, serious health problem in the Bay Area in the past several years but help to create the ozone problem.

Sulfur Dioxide (SO_2). Sulfur dioxide (SO_2) is produced primarily by petroleum refineries and by the combustion of sulfur-containing coal and oil in power plants. Only 20 percent is produced by burning diesel oil and other fuels in motor vehicles. While SO_2 can be a serious health hazard, no exceedance of either state or federal standards has been recorded since 1976. The Bay Area Air Quality Management District shows data up to 2007; however we have no reason to believe that there have been any new exceedances since then or that there will be any new ones in the foreseeable future.

Fine Particulate Matter (PM_{10} and $PM_{2.5}$). Fine particulate matter (PM_{10}, or particulate matter less than 10 microns in diameter) includes a wide range of solid or liquid particles, dust, smoke, aerosols and metallic oxides. $PM_{2.5}$ refers to particulate matter that is 2.5 microns or less in diameter. When inhaled, PM_{10} and $PM_{2.5}$ can penetrate the human respiratory system's natural defenses and damage the respiratory tract. There are many sources of PM_{10} emission, including, industrial processes, grading and construction, wood burning stove and fireplaces, and motor vehicles. Of the PM_{10} emissions associated with motor vehicle use, some are tailpipe and tire-wear emissions, but greater quantities are generated by re-suspended road dust. $PM_{2.5}$ results from fuel combustion (from motor vehicle, power generation, industrial facilities), residential fireplaces, and wood stoves. The data monitored at the BAAQMD station in Santa Rosa, as shown in Table 3.2-9, indicate no violations of the federal and state standards in the three years from 2003 to 2005.

Lead. Lead is a metal that was used to increase the octane rating in auto fuel, a practice that is no longer allowed. The Bay Area is in attainment of the state ambient standards of this pollutant.

Asbestos. NOA is not known to be present within the project footprint; however, deposits do exist approximately two miles west of US 101 between Novato Creek and San Antonio Creek. There is a possibility that sediment in San Antonio Creek and Novato Creek, which flow under US 101, could contain NOA, as portions of the watersheds for these streams include some ultramafic rock formations and NOA may have migrated into the streams as a result of weathering and erosion of these rocks.

Man-made asbestos is commonly found in many products such as the shims used under aluminum bridge barrier rails and even concrete.

3.2.6.3 Impacts

Carbon Monoxide

This air quality analysis utilizes the "Transportation Project-Level Carbon Monoxide Protocol," dated December 1997, prepared by the Institute of Transportation Studies, University of California at Davis. This protocol was approved by MTC in Resolution No. 3075 on June 24, 1998. Use of this protocol was recommended by the Bay Area Interagency Conformity Task Force, which is the interagency consultation group established pursuant to USEPA's conformity

regulation and the Bay Area's conformity with the State Implementation Plan (SIP).

Since the Bay Area was designated an attainment area for CO on June 1, 1998, the protocol indicates that an analysis by comparison to a similar freeway corridor is appropriate for this project. This involves a comparison of the proposed facility with existing facilities within the same air district. A list of the features to be compared is described on pages 4-6 to 4-7 of the protocol.

For mainline facilities, comparisons were made between the year 2010 Build conditions of US 101 and the existing conditions on I-880 in Alameda County from Route 92 to Route 84; for intersection comparisons, Caltrans used the Foothill/Mission Boulevard Intersection in that same area.

The Traffic Operational Analysis Report (February 2005) for future years of 2010 and 2030 indicates that traffic impacts at nearby intersections would be minimal. Most intersections would experience less than 5 percent differences in future predicted traffic volumes between the Build and No Build conditions. This difference is not significant given the accuracy of the prediction methodology.

The most critical intersection within the project area is at US 101 northbound ramps and Atherton Avenue Intersection. This intersection is considerably smaller than the intersection at Foothill and Mission Boulevard, which was used as a point of comparison. The northbound US 101 ramps are two-lane roads and Atherton Avenue is a four-lane road (two-lanes per direction). The Foothill/Mission Intersection represents the junction of two major state routes, plus a connector to downtown Hayward. This five-legged intersection consists of multiple lane approaches and experiences heavy congestion and delays. Receptor distances are comparable at both intersections 4.5 to 6 m (15 to 20 ft).[2] Traffic volumes, queues, delays and background CO are greater at Mission and Foothill. The facility and a list of the features to be compared are presented in Table 3.2-11.

[2] Receptor locations are chosen where the highest CO concentrations seem most likely to occur and where sensitive receptors are located. Sensitive receptors refer to residences, park, playgrounds, school, hospital and retirement homes, where children, the elderly, and the acutely ill are likely to reside or spend a substantial amount of time (BAAQMD 1999). The critical receptor for analysis that is the closest to the highway traffic is 15.3 m.

Table 3.2-11 Comparison of US 101 and I-880 for Air Quality Assessment

	Parameters	US 101 (Build)*	I-880 (Existing)
A	Receptor Distance	15.3 m (50')	7.62 m (25')
B	Roadway Geometry	6 lanes	8 lanes
C	Worse case Meteorology	Coastal Valley	Coastal Valley
D	Peak Hourly Volumes	12,800 vph	15,000 vph
E	Hot/Cold Starts	50/10 NB 50/10 SB	50/10 NB 50/10 SB
F	Percent HDG trucks	0.9-2.9%	7.6-8.3%
G	Background CO	2.3 ppm	3.2 ppm
Source: Air Quality Impact Report, Marin-Sonoma Narrows Project on US 101. Nov. 2005.			

Fixed HOV Lane Alternative. The Fixed HOV Lane Alternative would result in a facility that would be similar and less congested than comparable facilities within the same air district (I-880 and Foothill and Mission). Since the comparable facilities are in an area that meets air quality standards (maintenance area), this project would also be expected to meet microscale air quality requirements and would, therefore, have no significant impact on air quality or cause exceedances of state or federal carbon monoxide standards.

Reversible HOV Lane Alternative. The Reversible HOV Lane Alternative would be comparable to the Fixed HOV Lane Alternative. The annual average daily traffic, vehicle miles traveled, and the amount of vehicle hours of delay in 2030 have been predicted to be similar. As a result, like the Fixed HOV Lane Alternative, the Reversible HOV Lane Alternative would attain microscale air quality requirements and would not result in exceedances of state or federal carbon monoxide standards.

Access Options. The four Access Options would result in intersections much less congested than the comparable facilities within the same air district (Foothill and Mission). The Access Options would provide for new interchanges, overcrossings, and frontage roads that largely seek to replace at-grade connections to US 101 or access to local businesses, residences, and properties. As such, they are not serving major traffic movements like the comparable Foothill and Mission intersection, which serves two significant thoroughfares and provides access to a major East Bay community downtown. Since the comparable facility would involve much higher volumes, turning movements, and congestion, it is reasonable to expect that since that intersection operates without exceedances of state and federal carbon monoxide standards, that the interchanges and

intersections associated with the four Access Options would also not exceed state and federal carbon monoxide standards.

No Build Alternative. The No Build Alternative would involve only routine maintenance and upkeep of the existing US 101 facilities. Since this alternative would not contribute any improvements and would not reduce congestion and delays, it would not be supportive of regional efforts to attain air quality standards.

Particulates (PM_{10} and $PM_{2.5}$)

Although the USEPA Transportation Conformity Regulations require a quantified microscale analysis for PM_{10}s, no approved methodologies are available to address the microscale impacts of PM_{10} or $PM_{2.5}$. The regulations state that "the USEPA will be releasing technical guidance on how to use existing modeling tools to perform PM_{10} hotspot analysis. The requirements will not take effect until the Federal Register has announced availability of this guidance." (40 CFR Parts 51 and 93, Prologue Section V.K.: Federal Register, August 15, 1997.) These technical guidelines have not yet been released. Accordingly, the following assessment offers a qualitative review of potential fine particulate matter effects.

Fixed HOV Lane Alternative. The federal PM_{10} standards have been met in the Bay Area Air Basin. Projects are subject to hot spot analysis for PM_{10} if they are located in a PM_{10} non-attainment or maintenance area (Federal standards), for purposes of transportation conformity. The state PM_{10} standard is extremely stringent, and thus no urbanized parts of California meet the standard of 50 $\mu g/m^3$ Maximum 24-hour PM_{10}. However, the Maximum 24-hour PM_{10} published by the CARB for the Santa Rosa PM_{10} monitoring station (the monitoring station closest to the project corridor) showed no violations over the past three years. Moreover, the Fixed HOV Lane Alternative would alleviate the vehicle hours of delay and the congestion that is particularly acute in the Novato Narrows without substantially increasing vehicle miles traveled. The project would also pave the 11.6-m (38 ft) unpaved median and outside shoulders, which is notable because one of the largest sources of particulate matter is from re-suspended road dust. Given the above factors, which indicate that there is local attainment of the state PM_{10} standard and that the sources for particulates would be reduced as a result of the Fixed HOV Lane Alternative, the proposed project would not be expected to have an adverse air quality impact with respect to particulates. In fact, the provision of HOV lanes is one of the recommended transportation control

measures in the Bay Area Clean Air Plan to help achieve attainment of the ambient air quality standards.

Reversible HOV Lane Alternative. This alternative would be similar to the Fixed HOV Lane Alternative in that it would pave the median and outside shoulders in Segment B, reduce congestion and vehicle delays through the provision of an HOV lane, and accommodate the same annual average daily traffic and vehicle miles traveled. As a result, the Reversible HOV Lane Alternative would likewise not be expected to have an adverse air quality impact with respect to particulates.

Access Options. Particulate emissions associated with the Access Options would be a function of the amount of travel (e.g., average daily traffic and vehicle miles traveled), congestion (vehicle hours of delay), and disturbed soils. The amount of disturbed soils varies by Access Option and the effects on particulate emissions are described later under Construction Impacts. Traffic on the non-continuous frontage roads would either enter the US 101 mainline traffic flow or exit from that flow; therefore, traffic volumes are accounted for in the 2030 forecasts. Since the Access Options would not increase or alter annual average daily traffic, vehicle miles traveled or delays would not result in additional particulate emissions.

No Build Alternative. The No Build Alternative would involve only routine maintenance and upkeep of the existing US 101 facilities. Since this alternative would not contribute any improvements and would not reduce congestion and delays, it would not be supportive of regional efforts to attain air quality standards.

Mobile Source Air Toxics

Fixed HOV Lane Alternative. The FHWA's MSAT guidance considers projects like MSN to have low potential MSAT effects because it is intended to improve highway operations without adding substantial new capacity and without creating a facility that is likely to increase emissions [has an average annual daily traffic (AADT) less than 140,000]. From Caltrans' traffic forecast and traffic operational analysis, the maximum AADT in the section from the US 101/SR 37 Interchange to the Rowland Road Interchange, the segment within the project boundaries with the highest 24-hour volume, would be 128,300 for the No Build Alternative and 136,200 for the Fixed HOV Lane Alternative in the year 2030. The projected

truck percentage of total vehicles would be 4.42 percent in 2030. Notably, according to the traffic operational analysis, the differences of AADT and truck percentages between the Fixed HOV Lane Alternative and the No Build Alternative are negligible.

The amount of MSATs emitted would be proportional to the vehicle miles traveled, or VMT, assuming that other variables such as fleet mix are the same for each alternative. The VMT estimated in the project area for each alternative is summarized in Table 3.2-12.

Table 3.2-12 Projected Increase in Vehicle Miles Traveled in the Project Area (in thousands of miles), Year 2030*

Alternative	A.M. Peak	P.M. Peak
Build Alternatives		
Fixed HOV Lane	5,318	6,367
Reversible HOV Lane	5,318	6,367
No Build	5,312	6,358
Percent Increase	0.11%	0.14%
*Year-to-year variations can be expected, and they are sometimes large; however, they shouldn't affect long-term projections.		

The VMT estimated for the Fixed HOV Lane Alternative would be slightly higher than that for the No Build Alternative, because the additional capacity associated with the project would increase the efficiency of the roadway and attract rerouted trips from elsewhere in the transportation network. This increase in VMT would lead to higher MSAT emissions for the Fixed HOV Lane Alternative along the highway corridor, but decrease emissions along the local parallel routes.

However, there is a difference between the MSAT emissions associated with the freeway versus the MSAT emissions associated with the local roads. According to USEPA's Mobile6 emissions model, emissions of all priority MSATs except for diesel particulate matter decrease as speed increases. Consequently, the MSAT emissions from increased VMT on US 101 would be somewhat reduced by the higher speeds, compared to speeds on the local roads.

Given that AADT and VMT would not be appreciably different between the Fixed HOV Lane Alternative and the No Build Alternative, and that the percentage of truck trips of the overall fleet is not expected to change, it is

reasonable to expect that MSAT emissions would not increase under the Fixed HOV Lane Alternative.

Reversible HOV Lane Alternative. As shown above in Table 3.2-12, the predicted AADT and VMT for the Reversible HOV Lane Alternative would be identical to those reported for the Fixed HOV Lane Alternative. As a result, the Reversible HOV Lane Alternative would have the same effect in terms of MSAT emissions as the Fixed HOV Lane Alternative. In summary, given that AADT and VMT would not be appreciably different between the Reversible HOV Lane Alternative and the No Build Alternative, and that the percentage of truck trips of the overall fleet is not expected to change, it is reasonable to expect that MSAT emissions would not increase under the Reversible HOV Lane Alternative.

Access Options. The impacts to MSAT emissions would not vary by Access Option, because the Access Options do not vary in the estimated VMT or AADT.

No Build Alternative. Under the No Build Alternative, there would be no increase in VMT or AADT, and there would be no change in travel speeds or the fleet vehicle mix. Therefore, MSAT emissions would not be affected.

Asbestos

Fixed HOV Lane Alternative. NOA may be adjacent to or coincide with bridgework construction areas for the Petaluma River Bridge replacement, the new San Antonio Creek Bridge, and creek crossings. If undisturbed, NOA is generally not considered to be hazardous. However, excavation and other construction activities that cause ground disturbance may cause the asbestos fibers to become airborne, which can result in air quality and human health hazards.

In addition to NOA, there may be asbestos in man-made structures that use materials from ultramafic and serpentine rock. Demolition or modification of structures as part of the Fixed HOV Lane Alternative, including the Petaluma River Bridge, Novato Creek Bridge, Lynch Creek Bridge, and SR 116/Lakeville Highway Overhead may disturb human-made asbestos materials in concrete or other bridge parts. Disturbance of asbestos-containing materials may cause the asbestos fibers to become airborne, which can result in air quality and human health hazards.

Reversible HOV Lane Alternative. This alternative would propose improvements and construction in the same waterways and to the same existing

structures as the Fixed HOV Lane Alternative. Accordingly, the Reversible HOV Lane Alternative would have the same potentially adverse effects as the Fixed HOV Lane Alternative in terms of exposure to asbestos.

No Build Alternative. The No Build Alternative would not involve demolition of structures or major construction in waterways. Thus, the potential to disturb NOA or asbestos in man-made structures that could become airborne and pose a health hazard would be minimal. During rehabilitation, however, it may be necessary to make such modifications, so that there is still a potential for the No Build Alternative to release asbestos.

Conformity with State Implementation Plan

Build Alternatives. The MSN Project study area is located in a non-attainment area for federal and state ozone standards and in a non-attainment area for state PM_{10} standard, and includes Transportation Control Measures (TCMs) in the SIP. (Note: State and Federal attainment designations are based on region-wide data from all monitoring sites in the Bay Area air basin. Specific sites may show exceedances of some standards but these are still consistent with the attainment designations for the region when taken as a whole.) The most recent transportation plan in the project area is the Transportation 2035 Plan, adopted by MTC on April 22, 2009. The most recent Transportation Improvement Program (TIP) is the 2009 TIP. The FHWA made its conformity determination for the Transportation 2035 Plan and the 2009 TIP on May 29, 2009. The project is listed in the 2009 TIP (TIP ID nos. MRN050034 and SON070004) and the Transportation 2035 Plan (RTP reference no. 230702). The proposed MSN Project design and concept, as either the Fixed HOV Lane Alternative or the Reversible HOV Lane Alternative, are substantially the same as the design scope and concept in the 2035 RTP and Regional Transportation Improvement Program (RTIP) listings, and all applicable Transportation Control Measures are included in the project. The project therefore meets the regional tests for conformity with the SIP.

No Build Alternative. This alternative would not be consistent with the SIP, the RTP, or the RTIP.

Construction Impacts

Fixed HOV Lane Alternative. Construction activity is a source of dust and exhaust emissions that can have substantial temporary impacts on local air

quality. These emissions would result from earthmoving, use of heavy equipment, land clearing, ground excavation, embankments, and construction of roadways. Construction air emissions under the Fixed HOV Lane Alternative would be particularly substantial in the Central Segment, where US 101 would be widened to operate at freeway standards, new access roads and interchanges would be constructed, and new bicycle/pedestrian paths would be added. In addition, the erection of soundwalls in Novato and Petaluma would cause ground disturbance and the generation of dust emissions. Daily emissions can vary substantially, depending on the level of activity, specific operations, and prevailing weather. A major portion of dust emissions for the Fixed HOV Lane Alternative would likely be caused by construction traffic on temporary construction roads. The primary emissions of concern from construction activities would be PM_{10} and ozone precursors from diesel-fueled equipment.

The BAAQMD CEQA Guidelines provide some general rules of thumb by which to estimate the amount of dust and PM_{10} emissions (BAAQMD. 1999. BAAQMD CEQA Guidelines). The USEPA has estimated that construction-related emissions of total suspended particulates total 1.2 tons per acre per month of activity. Further, the CARB estimates that 64 percent of construction-related total suspended emissions are PM_{10}. Thus, an estimated 51 pounds per acre per day of PM_{10} are generated during construction. While the construction scenario for the Fixed HOV Lane Alternative has not yet been defined, there are estimates of the maximum acres of soil disturbed: 13.1 ha (32.4 ac) in the Southern Segment, 190.3 ha (470.2 ac) in the Central Segment, and 13.5 ha (33.4 ac) in the Northern Segment, for a total of 217 ha (536 ac). These numbers only serve to illustrate that the construction period would yield a considerable amount of suspended emissions and PM_{10}.

Construction-related emissions are generally short-term in duration but may still cause adverse air quality impacts. According to the BAAQMD CEQA Guidelines, emissions of carbon monoxide and ozone precursors (ROG and NO_x) from exhaust and other construction activities are included by the BAAQMD in the emission inventory that is the basis for regional air quality planning, and their generation is not expected to impede attainment or maintenance of the ozone or CO standards.[3] Consequently, construction impacts associated with these pollutants are not analyzed. For PM_{10}, the BAAQMD's approach to analyses of

[3] BAAQMD, BAAQMD CEQA Guidelines, Assessing the Air Quality Impacts of Projects and Plans, April 1996, revised December 1999, p. 13.

construction impacts is to emphasize implementation of effective and comprehensive control measures for PM_{10} rather than detailed quantification of emissions. The BAAQMD has developed feasible PM_{10} control measures for construction activities. The BAAQMD Guidelines state that a determination of significance for PM_{10} from construction activity should be based on a project's implementation of these control measures.[4] Consequently, construction emissions were not quantified in this analysis, but the Fixed HOV Lane Alternative's inclusion of PM_{10} control measures is discussed.

Reversible HOV Lane Alternative. The Reversible HOV Lane Alternative would have the same footprint, mainline improvements, and scope of work as the Fixed HOV Lane Alternative, except that the median would be constructed with a single HOV lane. Because of the similarities in the Build Alternatives, the construction-period impacts would also be similar. Thus, the Reversible HOV Lane Alternative would also result in substantial temporary impacts on local air quality from earthmoving, use of heavy equipment, as land clearing, ground excavation, cut-and-fill operations, and construction of roadways. The primary emissions of concern from construction activities would be PM_{10} and ozone precursors from diesel-fueled equipment.

Access Options. As noted above in the description of construction-related air quality impacts for the Build Alternatives, construction air emissions would be particularly substantial in the Central Segment, where US 101 would be widened to operate at freeway standards, new access roads and interchanges would be constructed, and new bicycle/pedestrian paths would be added. The various Access Options would result in different combinations of interchanges, overcrossings, frontage roads, and bicycle/pedestrian paths. Each would involve substantial ground disturbance and the generation of local dust and particulate emissions. While Access Option 12b, unlike the others, would propose fewer interchanges, it would result in the greatest amount of paving and the most significant tree removal. As such, it may result in the most substantial amount of earthmoving. More importantly, while the differences among the Access Options would not be substantial, the differences from the No Build Alternative would be substantial and cause temporary adverse air quality emissions.

[4] BAAQMD, BAAQMD CEQA Guidelines, Assessing the Air Quality Impacts of Projects and Plans, April 1996, revised December 1999, p. 12.

No Build Alternative. The No Build Alternative would involve only routine maintenance and upkeep of the existing US 101 facilities. As a result, this alternative would affect air quality during construction but it would not likely be adverse.

3.2.6.4 Avoidance, Minimization, and/or Mitigation Measures

The following mitigation measures apply to the Fixed HOV Lane and the Reversible HOV Lane Alternatives. The No Build Alternative would also be subject to asbestos measures, if structures were to be demolished, and to the construction-period measures.

Construction Air Quality Measures. As mentioned in the impact analysis, the BAAQMD requires implementation of control measures to reduce a project's construction impacts. Therefore, the following measures would be implemented as part of the Build and No Build Alternatives:

- Water exposed surfaces twice daily
- Cover all trucks hauling soil, sand, and other loose materials or maintain at least 2 ft of freeboard;
- Pave, apply water three times daily, or apply nontoxic soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites;
- Sweep daily with water sweepers all paved access roads, parking areas, and staging areas at construction sites;
- Sweep streets daily with water sweepers if visible soil material is carried onto adjacent public streets;
- Hydroseed or apply nontoxic soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more);
- Enclose, cover, water twice daily, or apply nontoxic soil binders to exposed stockpiles (dirt, sand, etc.);
- Limit traffic speeds on unpaved roads to 15 mph;
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways; and
- Replant vegetation in disturbed areas as quickly as possible.

Asbestos Testing and Control Measures. If sediments within the Novato Creek or the San Antonio Creek will be impacted by either the Fixed HOV Lane Alternative or the Reversible HOV Lane Alternative, sediments will be sampled and tested for NOA. If asbestos is detected, then nonstandard special provisions will be prepared to direct the safe removal and disposal of waste sediments.

An asbestos survey will be completed for all structures that will be demolished as part of the Build and No Build Alternatives. If asbestos-containing material is discovered, standard special provisions will be prepared to address the safe removal and disposal of this material prior to any demolition activities.

The nonstandard and standard specific provisions will be developed in compliance with CARB's, DTSC's and the Districts requirements to ensure compliance with NESHAP, under Title 40 of the Code of Federal Regulations Part 61.

In addition, special provisions will be developed in compliance with the requirements of CARB's ATCM for Construction, Grading, Quarrying, and Surface Mining Operations, including preparation and submittal of an Asbestos Dust Mitigation Plan. An example of measures that have been developed by CARB to reduce emissions during construction include dust suppression by wetting, rinsing vehicles in contact with NOA, and covering and/or wetting stockpiles and excavated materials during transport.

3.2.7 Noise and Vibration

3.2.7.1 Regulatory Setting

NEPA and CEQA provide the broad basis for analyzing and abating highway traffic noise effects. The intent of these laws is to promote the general welfare and to foster a healthy environment.

State and Federal Policies and Procedures

The noise impact evaluation criteria for the MSN Project reflect the Noise Abatement Criteria (NAC) established by the FHWA in Procedures for Abatement of Highway Traffic Noise and Construction Noise (23 CFR Part 772 2006) and criteria adopted by Caltrans in Traffic Noise Analysis Protocol (August 2006). For residential land uses, parks, schools and hospitals, the FHWA outdoor

noise criterion is 67 dBA, and the interior noise criterion is 52 dBA. Table 3.2-13, shows noise criteria for these and other land use categories.

Table 3.2-13 Activity Categories and Noise Abatement Criteria (23 CFR 772)

Activity Category	Leq (h)	L10 (h)	Description of Activity
A	57 exterior	60 exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 exterior	70 exterior	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.
C	72 exterior	75 exterior	Developed lands, properties, or activities not included in Categories A or B above.
D	---	---	Undeveloped lands.
E	52 interior	55 interior	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

According to the Protocol, traffic noise impacts at sensitive receptors occur when future predicted noise levels with the project in place either (1) results in a substantial noise increase (12 dBA or higher) from the existing levels, or (2) approach or exceed the NAC established by the FHWA shown on Table 3.2-13. The term "approach" is defined by Caltrans as one dBA below the criterion. Noise abatement measures are considered for this project when predicted future peak hour traffic levels are equal to or exceed 66 dBA.

In addition, the FHWA procedures for noise abatement allow for use of federal funds only if all of the following conditions are met:

(1) A traffic noise impact has been identified;

(2) The noise abatement measures will reduce the traffic noise impact, and;

(3) The overall noise abatement benefits are determined to outweigh the overall adverse social, economic, and environmental effects and the costs of the noise abatement measures.

The Caltrans Protocol states that if it is predicted that there would be traffic noise impacts, all reasonable and feasible noise abatement measures must be identified and implemented. Under Caltrans' policy a "feasible" soundwall is one that can achieve a readily noticeable reduction of 5dBA or more, and is buildable.

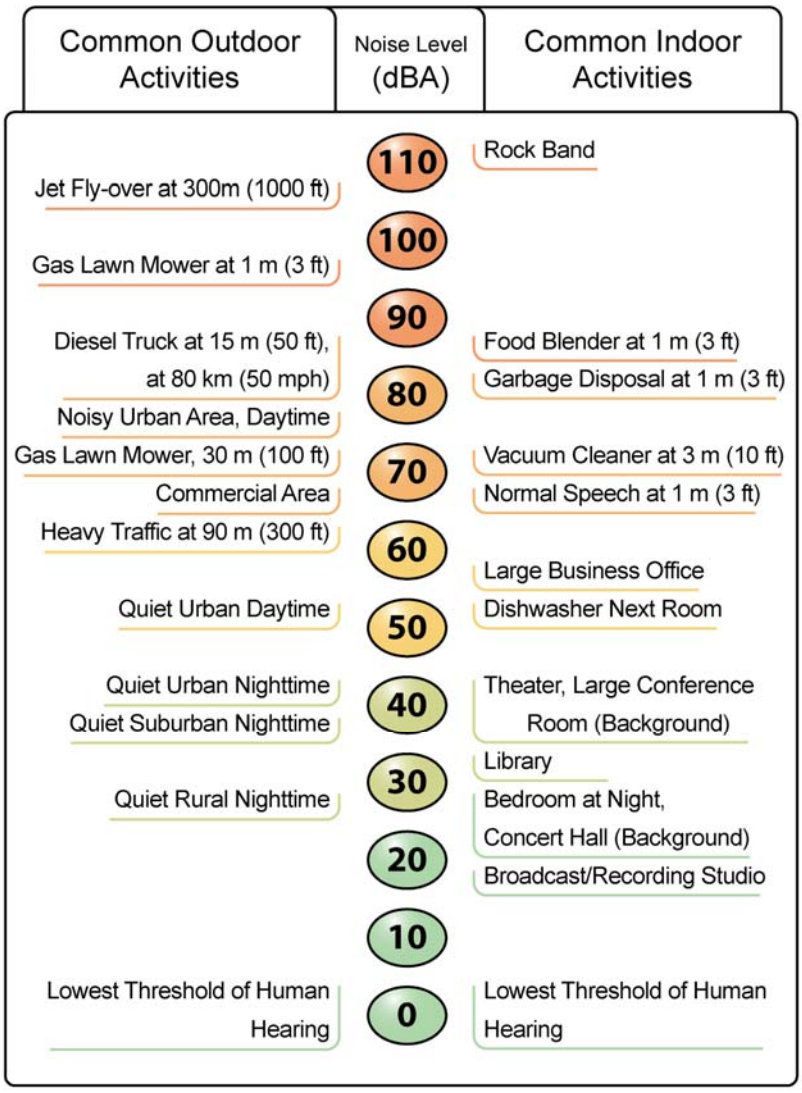
Feasibility also refers to engineering issues such as safety, topography, soil, drainage, and local access requirements. The feasibility of the abatement measures being considered is determined by noise analysis and subsequent engineering studies. "Reasonableness," as defined under the policy, consists of two parts: "preliminary reasonableness," which is based on cost; and "final reasonableness," which takes into account public input and any other pertinent factors (i.e., social, environmental, aesthetic, etc.). The determination of final reasonableness is stated at the end of this section. Only the walls that have been determined to be *feasible* and *reasonable* will be included in this project.

3.2.7.2 Affected Environment

Noise Fundamentals

Noise is defined as unwanted sound. Levels of sound are measured in terms of decibels (dB). Since the human ear cannot perceive all frequencies equally well, measured sound levels are often adjusted, or weighted to correspond to human hearing. For noise associated with traffic and similar human activity, these adjustments are referred to "A-weighted" decibels or dBA. Table 3.2-14 shows typical A-weighted noise levels.

2023 Table 3.2-14 Common Noise Levels



2024

2025 Sound in our daily environment fluctuates over time. One way of describing
2026 fluctuating sound over a specific time period is to present the changing levels of
2027 sound as if they had occurred at a steady unchanging level for a specific time
2028 period. Since highway traffic noise impacts are evaluated by using the average
2029 noise levels at sensitive receivers during the worst, or the noisiest, one hour
2030 period of the day, the sound level equivalents of the acoustical energy received in
2031 one hour is the descriptor used for this purpose, which is represented as Leq(h)[5].

[5] Leq - the equivalent steady-state sound level which in a stated period of time contains the same acoustic energy as the time-varying sound level during the same time period. Leq(h). The hourly value of Leq. (Source: 47 FR 29654 and 47 FR 33956)

Decibels are logarithmic units. A doubling of the number of noise sources, such as cars on a roadway, increases the noise levels by 3 dBA. A ten-fold increase in the number of noise sources adds 10 dBA to the noise levels. Furthermore, with normal human hearing, an increase of 10 dBA in sound levels is perceived as twice as loud, while a change of 3 dBA is barely perceivable. For every doubling of distance between the noise source and the receptor, traffic noise would decrease by 3 dBA over hard ground (e.g., paved surface) or 4.5 dBA over soft ground (e.g., vegetated plowed soil). Table 3.2-15 shows relationships between decibels, energy and loudness.

Table 3.2-15 Relationships Between Decibels (dBA), Energy, and Loudness

Sound Level Change	Human Perception	Relative Energy Change
+10 dBA	Twice as Loud	10
+5 dBA	Readily Perceptible	3.16
+3 dBA	Barely Perceptible	2
0+ dBA	Reference	0
-3 dBA	Barely Perceptible	1/2
-5 dBA	Readily Perceptible	1/3
-10 dBA	Half as Loud	1/10
-20 dBA	1/4 as Loud	1/100
-30 dBA	1/8 as Loud	1/1,000
-40 dBA	1/16 as Loud	1/10,000

Existing Noise Environment

To describe the existing noise environment, representative noise levels were measured at eight locations throughout the project boundaries. The 24-hour noise measurements were generally chosen from the first row of homes closest to the freeway, since these "receptors" are most vulnerable to changes in the noise environment along US 101.

As it pertains to the MSN Project boundaries, there are residential and commercial areas on both sides of US 101 in the City of Novato. Within this segment, the roadway alignment is basically straight. However, the roadway elevation relative to the adjoining uses varies, ranging from a few meters to nearly 10 m (32.8 ft) below the surrounding residential areas at the south end and above the surrounding residences at the north end.

The residential areas between Novato Boulevard and the south end of Redwood Boulevard on the western side of US 101 have soundwalls constructed on earth

berms. Wall heights vary from about 2.4 m (8 ft) to about 6.1 m (20 ft) above the edge of the freeway. Also in Novato, the residential areas between Cherry Street and Orange Avenue have 1.2-m (4-ft) high earth berms on both sides of US 101. The Novato Community Hospital near Rowland Way on the eastern side of US 101 has a large and wide parking area adjacent to the freeway.

In the expressway segment of the project boundaries, there is a motel and a few scattered houses along US 101 with most of the areas adjacent to the freeway being undeveloped land. In the segment through the City of Petaluma, residential and commercial uses straddle US 101, where the roadway alignment is basically straight with a roadway elevation a few meters above the surrounding residential areas.

Overall, existing peak hour noise levels ranging from 59 to 75 dBA Leq(h) were measured at locations within the project boundaries along US 101. Some residences in Petaluma are already exposed to noise levels over the Federal/State NAC of 67 dBA Leq(h) (see Table 3.2-14). These residences are located on the eastern side of US 101 from about Gumwood Lane, northward from the SR 116 Overhead to the East Washington Interchange. Likewise north of Washington Creek, where Arlington Drive parallels the western side of US 101, measurements at these residential locations were measured at 70 dBA Leq(h) to 72 dBA Leq(h).

3.2.7.3 Impacts

State policy requires that projects started after January 15, 2005 use the FHWA computer model TNM, Version 2.5. Since this traffic noise study was started in August 2001, the computer model SOUND2000 program was used. This program is a version of the FHWA Highway Traffic Noise Prediction Model and Noise Barrier Cost Reduction procedure STAMINA2/OPTIMA.

The Federal-Aid Highway Program Manual (FHPM 7-7-3) suggests that the future worst-case noise levels generated from highway traffic would occur when traffic operates under Level of Service C conditions. For Level of Service C conditions, it is assumed that 1,800 vehicles per lane per hour are traveling at 105 km (65 mi) per hour on the freeway. The traffic inputs consist of 5 percent medium trucks and 5 percent to 8 percent heavy trucks based upon field traffic counts and the SOUND2000 computer model analysis.

Fixed HOV Lane Alternative. Under this alternative, two HOV lanes, one in each direction, would be constructed in the existing median of US 101 through all three segments of the project boundary. Based on the future volumes on US 101 with two HOV lanes, predicted future peak noise levels along US 101 would range from 60 to 76 dBA Leq(h) at residential areas, an estimated increase in noise levels of approximately one to two dBA Leq(h). Table 3.2-16 presents the predicted noise levels at 42 locations along the project corridor.

Receptors along Kenwood Court in Novato experience existing traffic noise levels between 59 and 62 dBA Leq(h). Under the Fixed HOV Lane Alternative, the noise levels would be between 60 and 63 dBA Leq(h), well within NAC standards. The residential areas bordered by the soundwalls in Novato had measured and predicted noise levels at less than 66 dBA Leq(h), which is also within NAC standards.

As noted earlier, there are existing receptors within residential areas that had measured noise levels exceeding NAC standards. Although the Fixed HOV Lane Alternative is not expected to cause a significant increase over existing noise levels, Caltrans studied soundwalls to abate future worst case traffic noise as part of the MSN Project (see Figure 3.2-3). An example of this situation exists in Novato along Redwood Boulevard, where existing and future worst case traffic noise levels would be 73 dBA Leq(h) with or without the Fixed HOV Lane Alternative. Although the project would not cause an increase in traffic noise, a soundwall would provide noise abatement, to reduce future traffic noise to 66 dBA Leq(h). At the Novato Community Hospital, because only the parking lot is exposed to freeway noise, further noise abatement considerations are not needed for this facility.

In Segment B, land uses are predominantly rural, including farmlands and grazing areas. These uses, along with the Redwood Landfill, and other agricultural operations are classified as undeveloped lands for which there are no noise abatement criteria (see Table 3.2-13, Activity Category D). There are some institutional uses and the Birkenstock business in Segment B, which are not

Table 3.2-16 Existing and Future Worst-case Traffic Noise Levels with the MSN Build Alternatives

Rec #	Segment A	Existing Peak Noise	No Build	Build Alternatives Build Worst-Case Noise Level (dBA)				Barrier #	Barrier		# Homes Shielded
				8'Wall	10' Wall	12'Wall	14' Wall		Height (m)	Length (m)	
R-1	617 Manuel Dr.	63(M)	67	65	63	62	---	1	3.7	200	9
R-2	613 Davidson St.	61(E)	66	64	63	61	---		(12 ft)	(660 ft)	
R-3	101 Kenwood Ct.	61(M)	62	---	---	---	---	No Wall Recommended			
R-4	201 Kenwood Ct.	62(E)	63	---	---	---	---				
R-5	221 Kenwood Ct.	59(E)	60	---	---	---	---				
R-6	Apartment	71(E)	72	---	66	64	63	2	4.3 (14 ft)	480 (1,600 ft)	17
R-7	1508 Armstrong Ave.	71(E)	71	---	69	67	66				
R-8	Pool-Mobile Home (Armstrong)	65(E)	65	---	63	62	61				
R-9	16 Elmwood Ct.	65(E)	66	---	---	---	---	No Wall Recommended			
R-10	Playground(Olive/Elmwood)	65(E)	65	---	---	---	---				
R-11	725 W Orange Ave.	64(E)	64	---	---	---	---				
R-12	43 Reichert Ct.	65(E)	66	65	64	62	---	3	3.7 (12 ft)	500 (1,650 ft)	9
R-13	702 Lamont Ave.	67(E)	67	64	63	62	---				
R-14	701 Lamont Ave.	65(E)	66	63	62	61	---				
R-15	7 Hankle Rd.	67(E)	68	65	63	62	---				
R-16	1 Corinthian Ct., Novato	71(E)	72	---	68	67	66	4	4.3 (14 ft)	270 (890 ft)	27
R-17	1280 Redwood Blvd., Novato	73(E)	73	---	67	66	66				
R-18	82 Rosewood Dr., Novato	62(E)	63	---	---	---	---	No Wall Recommended			
R-19	706 Somoa Lane, Novato	63(M)	65	---	---	---	---				
R-20	Basketball Court	62(E)	63	---	---	---	---				
R-21	1101 Gumwood Ln.	71(E)	72	---	72	72	71	5	3.7 (12 ft)	1,760 (5,800 ft)	61
R-22	5 Ramona Ct.	73(E)	74	---	70	68	67				
R-23	1178 Lindberg Ct.	74(E)	74	---	69	67	66				
R-24	1227 Kresky Way	72(E)	73	---	68	67	65				
R-25	1247 Kresky Way	72(E)	72	---	68	66	65				
R-26	506 Stuart Dr.	69(M)	72	---	68	66	65				
R-27	434 Stuart Dr.	72(E)	73	---	67	66	64				
R-28	354 Stuart Dr.	75(E)	75	---	68	66	65				
R-29	314 Stuart Dr.	69(M)	72	---	67	66	64				

Table 3.2-16 Existing and Future Worst-case Traffic Noise Levels with the MSN Build Alternatives

Rec #	Segment A	Existing Peak Noise	No Build	Build Alternatives Build Worst-Case Noise Level (dBA)				Barrier #	Barrier		# Homes Shielded
				8'Wall	10' Wall	12'Wall	14' Wall		Height (m)	Length (m)	
R-a	333 Vintage Chateau	75(E)	75	---	72	71	69	6	4.3 (14 ft)	230 (750 ft)	18
R-b	333 Vintage Chateau	75(E)	76	---	73	71	70				
R-c	333 Vintage Chateau	75(E)	75	---	73	71	70				
R-30	63 W Napa Dr.	72(E)	73	---	70	69	68	7	4.3 (14 ft)	920 (3,040 ft)	20
R-31	1018 Napa Ct.	70(M)	72	---	70	69	68				
R-32	1002 Sonoma Dr.	72(E)	72	---	70	69	67				
R-33	89 Pamela Ct.	72(E)	72	---	70	68	67				
R-34	6 Belle Dr.	71(M)	72	---	70	69	68				
R-35	127 Pamela Ct.	71(E)	72	---	70	69	68				
R-36	13 Arlington Dr.	72(E)	73	---	68	66	65	8	3.7 (12 ft)	820 (2,700 ft)	34
R-37	53 Arlington Dr.	72(E)	72	---	67	66	65				
R-38	125 Arlington Dr.	70(M)	72	---	68	67	65				
R-39	153 Arlington Dr.	65(M)	69	---	65	64	62				

M = measured noise level in the field.
E = estimated noise level based on traffic volumes.

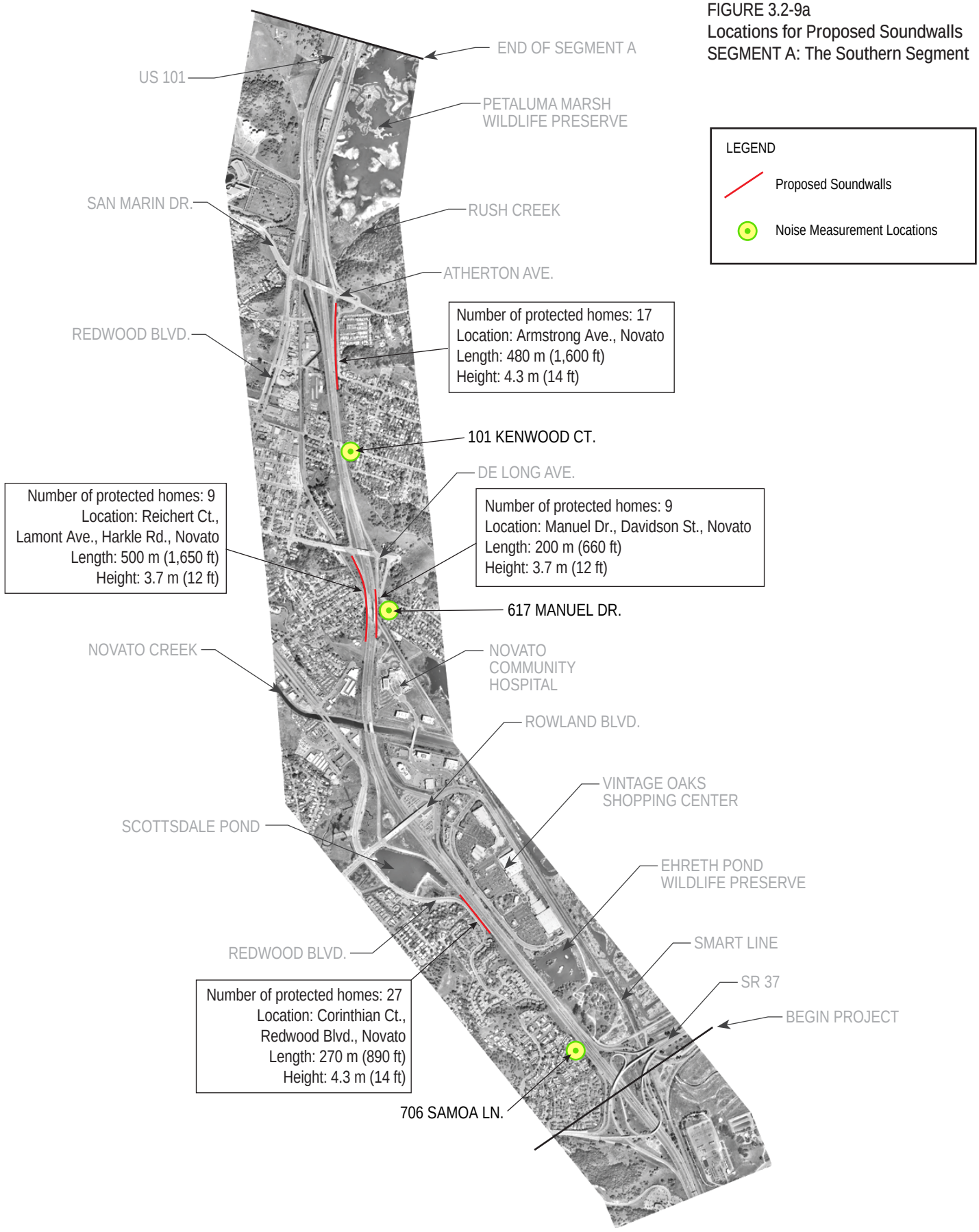
considered noise-sensitive and thus classified as Activity Category C with an exterior noise abatement criteria of 72 dBA Leq(h). A motel and rural residences in this segment might be considered the only sensitive receptors. However, these receptors are not concentrated but dispersed over the length of Segment B. Predictions of worst case traffic noise levels would be about 73 dBA Leq(h) at 30.48 m (100 ft) from the roadside, approximately 4 dB greater than estimated noise levels under the No Build Alternative in year 2030. Because of the rural nature of this area, the isolated and dispersed location of rural residences, and the change in noise environment of less that 12dB (between existing and future conditions), noise abatement would not be effective for this segment.

The highest recorded traffic noise was measured at 75 dBA Leq(h) along Vintage Chateau in Petaluma in Segment C. Under the Fixed HOV Lane Alternative, future worst case traffic noise would increase to 76 dBA Leq(h). Here, a soundwall would reduce future worst case traffic noise to 70 dBA Leq(h). This residential area occurs along one of eight soundwalls that were studied along the MSN Project boundaries, illustrated in Figures 3.2-9a and b.

Reversible HOV Lane Alternative. Within Segments A and C, the Reversible HOV Lane Alternative and the Fixed HOV Lane Alternative would be identical in terms of footprint, US 101 improvements, and proposed soundwalls. Accordingly, the impacts identified above for the Fixed HOV Lane Alternative would be identical for the Reversible HOV Lane Alternative.

With respect to Segment B, the footprint and improvements to US 101 (principally the upgrading of this segment from an expressway to a freeway), the Reversible HOV Lane Alternative would be identical to the Fixed HOV Lane Alternative. The only difference between the two Build Alternatives would be the HOV lane in the median of US 101. Under the Reversible HOV Lane Alternative, there would only be one HOV lane and it would only operate in one direction, depending on the time of day. Since the Fixed HOV Lane Alternative has one more traffic lane in Segment B than the Reversible HOV Lane Alternative, it is reasonable to expect that the Reversible HOV Lane Alternative would have a slightly smaller capacity during the peak hours and that traffic may be slightly more congested in the mixed flow lanes. These two factors, volume and speed, are directly related to the noise levels generated by vehicular traffic. The slightly reduced volume and speed under the Reversible HOV Lane Alternative (Caltrans, Traffic Operational Analysis Report, 2005) would result in lower noise levels than

FIGURE 3.2-9a
Locations for Proposed Soundwalls
SEGMENT A: The Southern Segment



Note: Not to scale.

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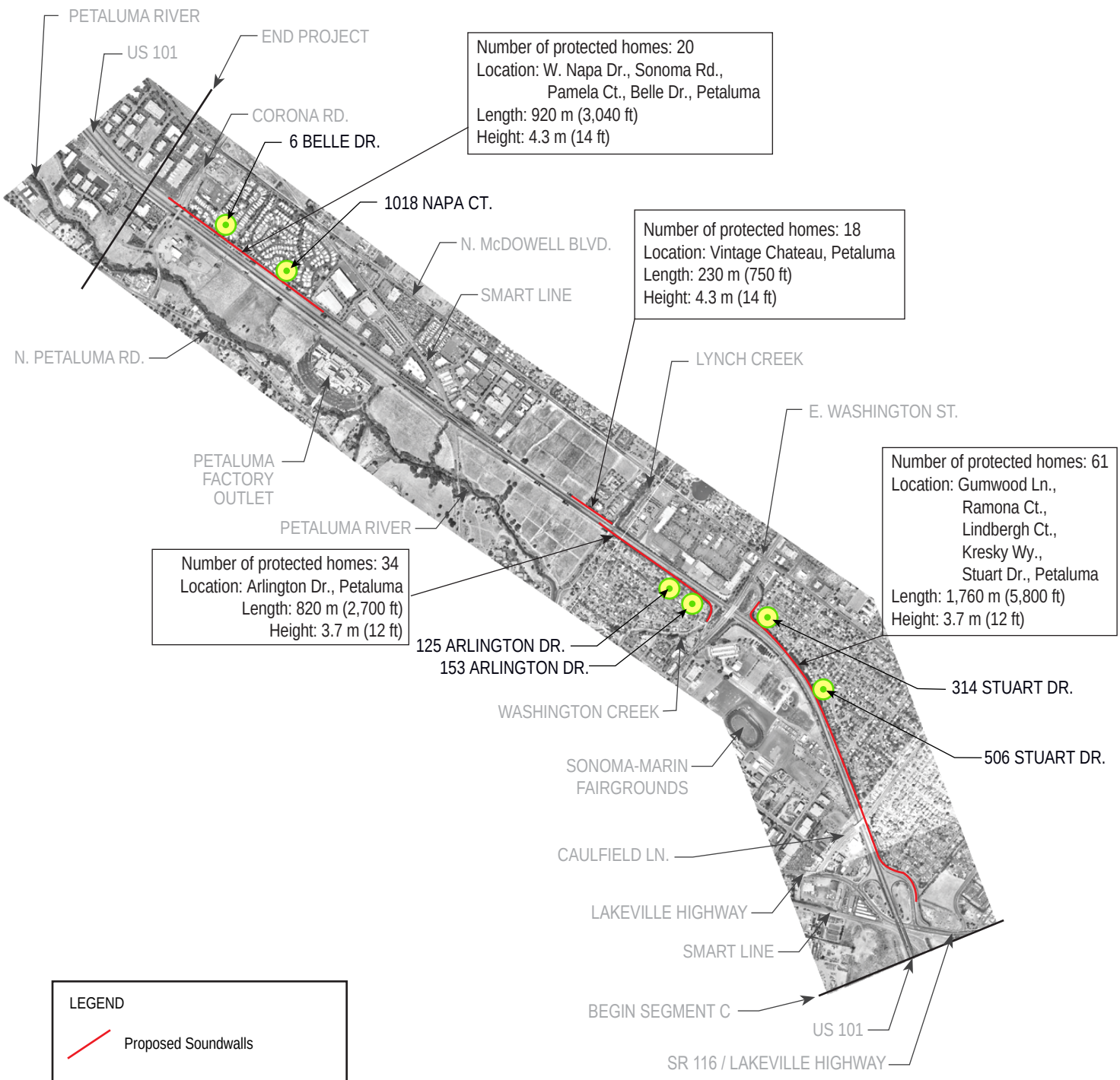
FIGURE 3.2-9b
Locations for Proposed Soundwalls under the Preferred Alternative
SEGMENT C: The Northern Segment



Note: Not to scale.

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reported for the Fixed HOV Lane Alternative. Since there were no impacts identified for the Fixed HOV Lane Alternative, no impacts would be expected for the Reversible HOV Lane Alternative.

To confirm this assumption, noise levels were predicted for a receiver hypothetically located 100 feet from the roadway, using the A.M. peak volumes in 2030 and speeds reported in the Caltrans Traffic Operational Analysis Report. For this assessment during the A.M. peak period, both HOV lanes would be operational for the Fixed HOV Lane Alternative; under the Reversible HOV Lane Alternative, the single HOV lane would be available for southbound traffic only. Table 3.2-17 compares the resultant noise levels for the No Build and Build Alternatives.

Table 3.2-17 Comparison of Predicted Noise Levels in Segment B under No Build and Build Alternatives, Year 2030

Alternative	Predicted Noise Level (Leq(h))	
	West Side of US 101	East Side of US 101
Fixed HOV Lane	73.2	73.3
Reversible HOV Lane	71.1	70.9
No Build	69.2	69.2

Source: PBS&J, 2007.

Table 3.2-17 shows that both Build Alternatives would result in higher noise levels than under the No Build conditions. The Reversible HOV Lane Alternative would result in less noise exposure than the Fixed HOV Lane Alternative, as expected, and neither of the Build Alternatives would result in adverse effects in Segment B.

Access Options. The four Access Options propose various combinations of interchanges and access roads due to the upgrading of the expressway to an access-controlled freeway in Segment B. As proposed, new access roads would be non-continuous to serve existing low-density land uses adjacent to US 101. Therefore, the number of vehicles on the interchanges and access roads would be very limited. Based on Caltrans assumptions, traffic volumes for access roads under the Access Options would be 879 vehicles. For the purposes of analysis, Caltrans used a portion of the traffic volume of South Petaluma Boulevard Interchange in Petaluma to stand-in as traffic volumes for the Access Options. The land uses and traffic volume associated with South Petaluma Boulevard are

higher than would be expected along the access roads in Segment B, but allow for a very conservative analysis of noise levels under the Access Options. For the purposes of analysis, there are no differences between the Access Options due to the relative distance of the access roads to dispersed receptors through Segment B. The analysis indicates that traffic noise on the access roads would result in a maximum of 69 dBA at Receptor R-B7, which would be less than the Noise Abatement Criteria, and would therefore not substantially contribute to the predicted noise levels under the mainline alternatives, the Fixed HOV Lane or Reversible HOV Lane Alternative (Table 3.2-16). As described above, neither of the Build Alternatives would adversely affect receivers in Segment B, where the Access Options are proposed. Consequently, neither of the Access Options is expected to result in noise exposure exceeding the Noise Abatement Criteria.

No Build Alternative. Under the No Build Alternative, future noise levels for residents along US 101 would not increase significantly since this alternative only proposes routine maintenance and upkeep which would not bring traffic closer to sensitive noise receptors.

Construction Impacts

There are no commonly accepted thresholds for acceptable levels of noise from construction activities. However, noise guidelines recommended by the USDOT (Federal Transit Administration. May 2006. Transit Noise and Vibration Impact Assessment) for construction noise are shown below for reference. These guidelines state that there may be an adverse community reaction if the one-hour Leq value (measured in dBA) from construction noise would exceed the values shown in Table 3.2-18.

Table 3.2-18 U.S. Department of Transportation Construction Noise Guidelines

Land Use	One-Hour Leq (dBA)	
	Day	Night
Residential	90	80
Commercial	100	100
Industrial	100	100
Source: Federal Transit Administration, 2006.		

Table 3.2-19 summarizes noise levels produced by construction equipment that are commonly used for roadway-construction projects. As shown in the table, most construction equipment is expected to generate noise levels ranging from

70 to 90 dB at a distance of 15.2 m (50 ft). Pile driving is expected to generate noise levels up to 101 dB at a distance of 15.2 m (50 ft). Construction equipment is considered a stationary source; therefore, noise produced by construction equipment would be reduced at a rate of about 6 dB per doubling of distance.

Table 3.2-19 Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level (dBA) 15 m (50 ft) from Source
Air compressor	81
Backhoe	80
Compactor	82
Concrete mixer	85
Concrete pump	82
Concrete vibrator	76
Crane, derrick	88
Crane, mobile	83
Dozer	85
Generator	81
Grader	85
Impact wrench	85
Jack hammer	88
Loader	85
Paver	89
Pile driver (impact)	101
Pile driver (sonic)	96
Pneumatic tool	85
Pump	76
Rock drill	98
Roller/sheep's foot	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Truck	88
Source: FTA, 1995.	

Fixed HOV Lane Alternative. Under the Fixed HOV Lane Alternative, noise from construction activities (primarily operation of heavy equipment) may intermittently dominate the noise environment in the immediate area of construction. In general, adverse noise impacts from construction are not anticipated because construction would be short-term, intermittent, and dominated by local traffic noise. This circumstance would be especially true for the

construction of the HOV lanes within the US 101 median in Novato and Petaluma. In other cases, where interchange improvements, road realignments, bridge widening/replacement, retaining walls, and soundwalls are proposed, traffic noise would still be dominant, but these types of improvements would occur closer to the sensitive receptors along the US 101 right-of-way.

A reasonable worst-case assumption for the Fixed HOV Lane Alternative is that the three loudest pieces of equipment anticipated for use on the project (paver, loader, and truck) would operate simultaneously and continuously for at least a one-hour period. At 15.2 m (50 ft) from the source, the combined sound level would be 92 dBA. Table 3.2-20 summarizes predicted noise levels at various distances from an active construction site, assuming this combined source level, distance attenuation (6 dB per doubling of distance), and attenuation from ground absorption (1 to 2 dB per doubling of distance).[6]

The results in Table 3.2-20 indicate that noise-sensitive land uses located within about 15.2 m (50 ft) of an active construction site may be exposed to construction noise that exceeds the daytime construction threshold of 90 dBA for residential uses**.** Noise-sensitive land uses located within about 41.1 m (135 ft) of an active construction site may be exposed to construction noise in excess of the nighttime construction threshold of 80 dBA. The table also indicates that commercial or industrial receptors within about 15.2 m (50 ft) may be exposed to construction noise from pile driving that exceeds the daytime construction standard of 100 dBA. Noise sensitive uses within about 45.8 m (150 ft) may be exposed to construction noise from pile driving that exceeds the daytime construction threshold of 90 dBA.

Table 3.2-20 Estimated Construction Noise from Construction Activities

Distance Between Source and Receiver	Calculated Sound Level (dBA)	
	Construction Equipment	Pile Driving
15.2 m (50 ft)	92	101
30.5 m (100 ft)	84	93
61.0 m (200 ft)	76	85
91.4 m (300 ft)	71	80
122.0 m (400 ft)	68	77
152.4 m (500 ft)	65	75

[6] Hoover, R.M., R.H. Keith. 1996. Noise control for buildings, manufacturing plants, equipment and products. Hoover & Keith, Inc. Houston, TX.

Table 3.2-20 Estimated Construction Noise from Construction Activities

Distance Between Source and Receiver	Calculated Sound Level (dBA)	
	Construction Equipment	Pile Driving
182.9 m (600 ft)	63	72
213.4 m (700 ft)	62	71
243.8 m (800 ft)	60	70
274.3 m (900 ft)	59	68
304.8 m (1,000 ft)	58	67

Source: PBS&J, 2007.

Note:
Calculations based on FTA 1995 guidance. This calculation includes geometric attenuation and ground effects; it does not include the effects, if any, of local shielding, which may reduce sound levels further.

However, there may be instances where construction activity in proximity to noise-sensitive land uses could result in noise levels that exceed the thresholds defined above. This would be considered an adverse effect.

Reversible HOV Lane Alternative. The temporary construction noise impacts under the Reversible HOV Lane Alternative would be identical to those under the Fixed HOV Lane Alternative in Segments A and C, because the footprint, improvements, and scope of work for the two Build Alternatives would be identical. In these segments, construction noise would have an adverse effect on noise-sensitive land uses.

In Segment B, both Build Alternatives involve significant construction activities as the mainline facility would be upgraded from an expressway to a freeway. In addition, new interchanges and bridges would be constructed in this stretch of the MSN Project corridor. In the median of the new, realigned US 101, the Reversible HOV Lane Alternative would have a single reversible HOV lane, shoulders and barriers; the Fixed HOV Lane Alternative would have two HOV lanes, shoulders, and barriers. Thus, the scope of work and improvements would be different between the two Build Alternatives, but the type of construction equipment and construction hours on any given day would be identical. As a result, the construction noise impacts for the Reversible HOV Lane Alternative would be similar to, but not identical to, those described above for the Fixed HOV Lane Alternative. In summary, the construction-period noise impacts for the Reversible HOV Lane Alternative would be adverse.

Access Options. Construction under the four Access Options involve combinations of interchanges, access roads, and bicycle/pedestrian facilities. The construction equipment described above for the Build Alternatives would also be needed to construct the improvements proposed under each of the Access Options. As illustrated in Figure 2-4 in Chapter 2, Project Alternatives, the Access Options include a number of common features through the length of Segment B. The differences focus on the number and location of interchanges and whether the access roads are constructed for stretches along the west or east side of US 101. Construction impacts would be most adverse where the interchanges and/or overcrossings are proposed, given the nature of the improvements and duration to complete the facilities. As a result, in the vicinity of San Antonio Road and US 101, Access Options 4b, 14b, and 14d, which include a new San Antonio Road Interchange, would result in greater construction noise impacts than Access Option 12b. In the vicinity of the Redwood Landfill Overcrossing, Access Options 4b and 12b, which would convert the overcrossing to a full interchange, would result in greater construction noise impacts than Access Options 14b and 14d, which adapt the overcrossing for public access but would not upgrade the facility to an interchange.

No Build Alternative. The No Build Alternative involves no major construction activities and only routine maintenance and upkeep of the existing US 101 facilities. As a result, there may be noise impacts during maintenance and rehabilitation activities, but the effects would be relatively short in duration and affect far fewer receivers.

3.2.7.4 Avoidance, Minimization, and/or Abatement Measures

Regulatory standards distinguish between noise abatement and noise mitigation. Mitigation is warranted where a project may cause future worst case noise levels that either show a substantial increase (12 dBA or higher) from the existing levels, or approach or exceed the NAC established by FHWA for different land uses.

Soundwalls to Abate Existing Noise Exposure. None of the receptors within the project boundaries would have a 12 dBA or more increase in future predicted noise level as a result of either Build Alternative. Consequently, mitigation is not recommended. However, abatement for existing noise levels has been identified at eight locations. Figure 3.2-9 depicts the approximate soundwall locations. Caltrans will consider a number of factors in making its determination, including whether the soundwalls would substantially reduce noise exposure (at least

5 decibels), whether they are cost effective, whether they pose visual impacts or adversely affect environment resources, and if they are acceptable/desirable in the local jurisdictions. A description of the soundwalls follows.

Soundwall Number 1. In Novato, a soundwall location was studied on the eastern side of US 101 on a bridge crossing over the SMART railway line, just south of the De Long Overcrossing parallel to Davidson Street. If constructed, the barrier would be 3.7 m (12 ft) high and approximately 200 m (660 ft) long at the outside edge of shoulder of the freeway. The future predicted noise levels in this residential area could be reduced from 67 dBA Leq(h) to 62 dBA Leq(h). An existing 1.2 m (4 ft) high earth berm would be replaced by this soundwall under the MSN Project. Approximately nine residences would be shielded from future traffic noise. The reasonable allowance, if approved, for this soundwall is estimated to be $450,000.

Soundwall Number 2. A soundwall location was studied from Cherry Street northward toward Atherton Avenue Overcrossing, parallel to Armstrong Avenue on the eastern side of US 101 in Novato. If located at the outside edge of shoulder of the freeway the soundwall would be 4.3 m (14 ft) high and approximately 480 m (1,600 ft) long. The future predicted noise levels with the soundwall could be reduced from 72 dBA Leq(h) to 63 dBA Leq(h) in the adjacent residential area. Approximately 17 homes would be shielded from future traffic noise. The reasonable allowance for this soundwall, if approved, is estimated to be $850,000.

Soundwall Number 3. Approximately nine homes could benefit from a soundwall whose location was studied on the western side of US 101 north of Novato Creek and south of De Long Overcrossing. The new soundwall would be 500 m (1,650 ft) long and 3.7 m (12 ft) high at the outside edge of shoulder of the freeway. The future predicted noise levels in this residential area could be reduced from 68 dBA Leq(h) to 62 dBA Leq(h). The existing 1.2 m (4 ft) high earth berm would be removed due to roadway realignment. The reasonable allowance for this soundwall, if approved, is estimated to be $432,000.

Soundwall Number 4. A soundwall of approximately 270 m (890 ft) and 4.3 m (14 ft) high was studied in a location south of Rowland Boulevard and parallel to Redwood Boulevard on the eastern side of US 101 in Novato, shielding approximately 27 homes from future traffic noise. If constructed along the right-of-way, future predicted noise levels in this residential area could be reduced from

73 dBA Leq(h) to 66 dBA Leq(h). The reasonable allowance for this soundwall, if approved, is estimated to be $1,404,000.

Soundwall Number 5. In Petaluma, there are two options for achieving a minimum 5 dBA predicted noise level reduction in the residential areas adjacent to the eastern side of US 101. Option 1 studied a soundwall located at the outside edge of shoulder beginning just north of the SR 116 Overhead. This soundwall could be 3.7 m (12 ft) high and approximately 1,760 m (5,800 ft) long, ending at the East Washington Street Interchange. Under Option 2 the soundwall could be broken up into three parts. From the same starting point, a 4.9 m (16 ft) high and 245 m (800 ft) long soundwall could be constructed at the right-of-way line. A second soundwall could be 3.7 m (12 ft) high and 300 m (1,000 ft) in length located at the outside edge of shoulder, ending just before Caulfield Lane. A third segment 3.7 m (12 ft) high could begin at the outside edge of the freeway shoulder just north of Caulfield Lane and extend for 1,215 m (4,000 ft), ending at the East Washington Interchange. Either option could reduce future predicted noise levels in the adjacent residential areas from 74 dBA Leq(h) to 67 dBA Leq(h) and shield 61 homes from future traffic noise. If approved, the reasonable allowance for this soundwall is estimated to be $3,294,000.

Soundwall Number 6. Also studied was a soundwall location on the eastern side of US 101 that could shield eighteen homes, including an apartment area, from future predicted noise levels. This soundwall could be 4.3 m (14 ft) high beginning just north of Lynch Creek for a distance of approximately 230 m (750 ft). If positioned at the outside edge of shoulder, future predicted noise levels could be reduced from 76 dBA Leq(h) to 70 dBA Leq(h). The reasonable allowance for this soundwall, if approved, is estimated to be $972,000.

Soundwall Number 7. The next soundwall would be on the eastern side of US 101, beginning north of the Petaluma Factory Outlet Mall and extending to just north of Corona Road. At 4.3 m (14 ft) high and approximately 920 m (3,040 ft) long, it could be constructed at the outside edge of shoulder. Another option at this location is the same length of wall with a height of 4.9 m (16 ft) placed at the right-of-way line. Under either option, the future predicted noise levels in the adjacent mobile home area could be reduced from 73 dBA Leq(h) to 68 dBA Leq(h). Approximately 20 homes could benefit from this soundwall. If approved, the reasonable allowance for this soundwall is estimated to be $1,000,000.

Soundwall Number 8. From just north of Washington Creek and extending 820 m (2,700 ft) to just north of Lynch Creek, a 3.7 m (12 ft) high soundwall was studied to be located at the outside edge of shoulder on the western side of US 101. The soundwall could reduce future predicted noise levels from 73 dBA Leq(h) to 66 dBA Leq(h), shielding approximately 34 homes. The reasonable allowance for this soundwall, if approved, is estimated to be $1,768,000.

Although the soundwalls under consideration in Novato and Petaluma have allowances that have been deemed "reasonable," two single family residences at 5381 Redwood Highway and 4747 Redwood Highway have predicted noise levels of 69 dBA and 72 dBA, respectively. Based upon a preliminary assessment, noise abatement for these two residences would not be considered further, as it is not deemed feasible to construct a soundwall to abate future noise levels for these residences.

Reflected Noise. Under certain circumstances, soundwalls have the potential of increasing noise at some locations. When this happens the increase can be no more than 3dBA (the smallest change in traffic noise that a person is capable of detecting). The conditions under which this can occur are: (1) parallel walls that are too close together; or (2) the freeway is in a deep cut surrounded by residences on hillsides. Neither of those conditions exists within the project limits. Therefore, there should be no increase in noise levels due to reflected noise from any of the proposed soundwalls.

Determination of Final Reasonableness. The aforementioned soundwalls Numbers 1 through 8 were presented in the Draft Environmental Document and the Public meetings. Preliminary reasonableness was determined based on 2007 construction costs and were compared to 2007 reasonable allowances. This comparison is provided in Table 3.2-21.

Table 3.2-21 Soundwall Construction Costs and Allowances

Soundwall Numbers	Number of Benefited Receptors	2007 Reasonable Allowances*	2007 Construction Costs	Cost-Effective?
1	9	$450,000	$416,250	yes
2	17	$850,000	$774,000	yes
3	9	$432,000	$851,000	no
4	27	$1,404,000	$763,250	yes
5	61	$3,294,000	$3,163,500	yes

Table 3.2-21 Soundwall Construction Costs and Allowances

Soundwall Numbers	Number of Benefited Receptors	2007 Reasonable Allowances*	2007 Construction Costs	Cost-Effective?
6	18	$972,000	$494,500	yes
7	20	$1,000,000	$1,870,500	no
8	34	$1,768,000	$1,406,000	yes
* Source: Traffic Noise Analysis Protocol, August 2006, and Traffic Noise Impact Report, August 2007.				

After consideration of cost effectiveness, public input, and other factors noted in the Caltrans Traffic Noise Analysis Protocol (August 2006), the following determination of *final* reasonableness was made:

Caltrans and FHWA have determined that soundwalls No. 1, 2, 4, 5 (option 1), 6 and 8 are feasible and reasonable and will be constructed as part of the MSN Project.

FHWA has determined that soundwall No. 3 is feasible and not reasonable because it is not cost effective (Table 3.2-21). As such, the construction cost of this soundwall would not be a funded by FHWA.

As indicated in Section 3.2.7.4, Caltrans has considered a number of factors in making its determination toward the proposed soundwalls, including whether they are cost effective and acceptable/ desirable in the local jurisdictions. In addition, meeting attendees were informed that public input would be considered in Caltrans' decision toward approval of the soundwalls.

Caltrans received several comments of support for soundwall No. 3 from the local residents whose homes would benefit from the noise abatement this soundwall would provide. Outside of general support for all the walls from county officials, Caltrans received no support for soundwalls No. 7 from local residents during the public comment period.

For this reason Caltrans has determined that, although both soundwalls No. 3 and 7 are not considered cost effective under the Traffic Noise Analysis Protocol (August 2006), soundwall No. 3 is reasonable and may be constructed with state funds. However, due to lack of public support in addition to lack of cost effectiveness soundwall no. 7 will not be constructed as part of the MSN Project.

This determination of final reasonableness is based on preliminary project alignments and profiles, which may be subject to change. As such, the physical characteristics of noise abatement described herein also may be subject to change. If pertinent parameters change substantially during the final project design, the proposed abatements may be changed or be eliminated from the final project design.

The following measures apply to both the Build and No Build Alternatives.

Construction Noise Mitigation Measures. The construction contractor will employ noise-reducing construction practices such that noise from construction does not exceed 90 dBA at noise-sensitive uses during daytime hours. Measures that can be used to limit noise may include the following:

- Locating equipment as far as practical from noise-sensitive uses;
- Using sound-control devices such as mufflers on equipment;
- Turning off idling equipment;
- Using equipment that is quieter than standard equipment;
- Selecting construction-access routes that affect the fewest number of people;
- Using noise-reducing enclosures around noise-generating equipment;
- Constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (terrain, structures) to block sound transmission; and
- Temporarily relocating residents during periods of high construction noise that cannot be reduced effectively by other means.

The construction contractor will prepare a detailed noise control plan based on the construction methods proposed. This plan will identify specific measures determined to be feasible by Caltrans that will be taken to ensure compliance with the noise limits specified above. The noise control plan will be reviewed and approved by Caltrans before any noise-generating construction activity begins.

The construction contractor will designate a noise disturbance coordinator who will be responsible for responding to complaints regarding construction noise. The coordinator will determine the cause of the complaint and ensure that reasonable measures are implemented to correct the problem. A contact telephone

number for the noise disturbance coordinator will be posted conspicuously on construction site fences.

3.2.8 Energy

The energy impacts of transportation projects are typically divided into two components: (1) the direct energy required for ongoing operations, in this case, the use of petroleum-based fuels and alternative fuels for motor vehicle travel within the project area, and (2) the indirect energy required to produce the materials for and to carry out construction of the project. In the long term, the direct, or operating, energy requirements are usually greater and of primary importance. This discussion, therefore, focuses on the direct energy requirements for ongoing US 101 operations with and without the proposed project. Because the proposed project has no potential for substantial energy impacts, in accordance with Caltrans' Standard Environmental Reference Guidelines, only a qualitative energy analysis was conducted.

3.2.8.1 Regulatory Setting

NEPA (42 USC Part 4332) requires the identification of all potentially significant impacts to the environment, including energy impacts.

The CEQA Guidelines, Appendix F, Energy Conservation, state that EIRs are required to include a discussion of potential energy impacts of the proposed project, with particular emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy.

3.2.8.2 Impacts

Freeway Traffic

Fixed HOV Lane Alternative. The Fixed HOV Lane Alternative would increase capacity, improve roadway operations and, by the addition of fixed HOV lanes, encourage the use of transit and carpooling along the study area. Average travel time, vehicle delay and duration of congestion on US 101 would decrease considerably with the Fixed HOV Lane Alternative compared to No Build conditions. The Fixed HOV Lane Alternative would reduce traffic delay on the US 101 mainline and at interchanges and surrounding intersections within the project area. While the Fixed HOV Lane Alternative would not eliminate all capacity problems in 2030, it would allow the highway to carry more of the total

peak-hour travel demand when compared to the No Build Alternative. Under the No Build Alternative, it would require 2.58 to 5.41 more minutes to clear one car on those congested bottlenecks than under the Fixed HOV Lane Alternative.

In the northbound direction, the average travel speeds would improve from as low as 10 mph at the worst bottleneck under the No-Build Alternative, up to the posted speed limit (65 mph) for the Build Alternative. In the southbound direction, the average vehicle speeds would improve from as low as 9 mph at the worst bottleneck under the No-Build Alternative up to the posted speed limit for the Build Alternative. The Fixed HOV Lane Alternative would improve average travel speeds in both directions, thereby reducing average travel times along the MSN Project corridor.

The Fixed HOV Lane Alternative could reduce peak-hour delay at some bottlenecks by over 89 percent. It would reduce overall delay by 2.5 to 7.2 minutes, a 49 to 76 percent reduction, depending on the peak hour (A.M. and P.M.) and direction. This reduction in delays would result in more efficient energy consumption. Due to all the above-mentioned advantages, the long-term impacts of the Fixed HOV Lane Alternative on transportation, and vehicular traffic energy use would generally be beneficial.

Reversible HOV Lane Alternative. Although the Reversible HOV Lane Alternative is predicted to have the same vehicle miles traveled as the Fixed HOV Lane Alternative, the Reversible HOV Lane Alternative would result in greater travel time for motorists in the mixed flow lanes, compared to the Fixed HOV Lane Alternative. The Reversible HOV Lane Alternative would also result in two bottlenecks that would not occur under the Fixed HOV Lane Alternative. One bottleneck would occur in Segment C in the southbound direction during the P.M. peak period because the HOV lane in Segment B would not be operational (it would only be operating in the northbound direction during this peak period). The other bottleneck would occur in the northbound direction at Atherton Avenue during the A.M. peak period because the reversible lane would only be operational in the southbound direction, which is where the greater demand would be during the A.M. peak period. These bottlenecks and queues indicate that the Reversible HOV Lane Alternative would result in a greater amount of energy consumption than the Fixed HOV Lane Alternative.

Access Options. The Access Options would not increase or alter the vehicle miles traveled or the congestion and delays experienced along the US 101 mainline under the Build Alternatives. As a result, the Access Options would not result in energy consumption that would be distinguishable from that described for the Build Alternatives. Because the Access Options are intended primarily to replace existing at-grade connections to US 101, to replace access to local properties, and to provide bicycle/pedestrian paths, they would not induce substantial increases in annual average daily traffic or vehicle miles traveled. Thus, the Access Options would not result in adverse energy consumption impacts, and the differences among the Access Options would be indistinguishable.

No Build Alternative. By 2030, without capacity improvements to US 101, congested traffic conditions would prevail in the traffic study area; the freeway would be unable to serve the projected demand. Due to insufficient mainline capacity for the forecast volumes, bottlenecks and queues would develop at certain locations along the mainline. Low travel speeds and long delays would be experienced during peak hours. Under the No Build Alternative, without highway capacity improvements, only about 72 percent of forecast peak hour demand could be accommodated through the traffic study area in 2030. This indicates that substantial delay would occur in 2030. Such congested traffic conditions contribute to inefficient energy consumption as vehicles use extra fuel while idling in stop-and-go traffic or moving at slow speeds on a congested roadway.

Local Traffic

Fixed HOV Lane Alternative. The Fixed HOV Lane Alternative would substantially reduce congestion at some of the bottleneck areas, and reduce delay through the traffic study area, providing incentive for commuter and through-traffic to remain on the freeway, freeing arterials and other local streets to serve local traffic. This reduction in congestion on local streets would contribute to more efficient fuel consumption.

Reversible HOV Lane Alternative. Like the Fixed HOV Lane Alternative, the Reversible HOV Lane Alternative would have a positive long-term impact on traffic and energy consumption. However, because the reversible HOV lane would only operate in one direction at any given time, those motorists that are traveling in the opposite direction of the reversible HOV lane would continue to travel in mixed flow and not experience congestion relief. Traffic diversion from local streets would be less under the Reversible HOV Lane Alternative, with a

corresponding reduction in the benefits identified for the Fixed HOV Lane Alternative, above.

Access Options. As previously noted, the Access Options would primarily serve local traffic and alleviate the stop-and-go conditions that currently occur with at-grade connections to US 101. Thus, compared to No Build conditions, the Access Options would improve upon existing and projected delays in Segment B. The Access Options, however, would not substantially change local traffic in Segment B and thus would not increase or reduce energy consumption related to local traffic.

No Build Alternative. Traffic diversions near bottlenecks are common and can cause considerable delay. By 2030, as congestion on the freeway increases, traffic diversion to local streets, such as Old Redwood Highway, would also increase. This increase in "cut-through" traffic would deteriorate conditions on local streets, increasing delay and energy consumption.

Transit and HOV Lane Usage

Fixed HOV Lane Alternative. The HOV lanes provided under the Fixed HOV Lane Alternative would offer dedicated peak hour capacity and a high level of traffic service to transit and carpool vehicles. This would substantially improve travel time for intercity buses and carpooling commuters as they would operate at speeds of 65 mph in the new HOV lanes. This compares to speeds as low as 9 mph in congested mixed flow lanes under the No Build Alternative. Not only would transit travel time be reduced but also transit schedule reliability would be improved. Carpools and vanpools also would have improved speeds and reduced travel times. The improved speeds and schedule reliability would work as incentives for commuters and other travelers to carpool and/or take advantage of local and express buses that would move freely along the HOV lanes. A shift by more commuters into HOVs would lead to further energy savings.

Reversible HOV Lane Alternative. Like the Fixed HOV Lane Alternative, the Reversible HOV Lane Alternative would have a positive long-term impact on traffic and energy consumption. However, because the reversible HOV lane would only operate in one direction at any given time, those motorists that are traveling in the opposite direction of the reversible HOV lane would continue to travel in mixed flow and not experience congestion relief. As a result, the energy

benefits of the Reversible HOV Lane Alternative would not be as great as those of the Fixed HOV Lane Alternative.

Access Options. The Access Options would have no-to-minimal effect on the use of transit, carpools or HOV lanes, and thus, little effect on energy savings from use of these services and facilities.

No Build Alternative. Under the No Build Alternative, this alternative would not construct HOV lanes in the stretch from Novato to Petaluma. As a result, transit would continue to operate in mixed flow traffic in this stretch and be subject to delays. Consequently, there would be no benefits associated with greater use of this more energy-efficient mode of travel.

3.2.8.3 Avoidance, Minimization, and Mitigation Measures

Since the Build Alternatives would have generally beneficial energy effects, avoidance, minimization, and mitigation measures would be unnecessary.

3.2.9 Paleontology

3.2.9.1 Regulatory Setting

Paleontology is the study of life in past geologic time based on fossil plants and animals. A number of federal statutes specifically address paleontological resources, their treatment, and funding for mitigation as a part of federally authorized or funded projects (e.g., Antiquities Act of 1906 [16 USC 431-433], Federal-Aid Highway Act of 1935 [200 USC 78]). Under California law, paleontological resources are protected by the California Environmental Quality Act, the California Code of Regulations, Title 14, Division 3, Chapter 1, Sections 4307 and 4309, and Public Resources Code Section 5097.5.

3.2.9.2 Affected Environment

According to the Preliminary Geotechnical Report prepared in August 2005 by the Caltrans Geotechnical Design Office, and the Paleontological Identification Report (PIR) prepared in June 2009 by Garcia and Associates (GANDA), the geologic units included in the project area are: Mesozoic basement rocks of the Franciscan Formation, the younger Mio-Pliocene marine sediments of the Wilson Grove Formation, and the older Quaternary sedimentary units of the Glen Ellen Formation.

The Franciscan Rock Formation has been shown to yield Late Jurassic fossils (Geomatrix, 2007). However, due to the rarity of these fossil finds, this rock unit is not considered to be an important paleontological resource.

The marine Wilson Grove Formation was identified through literature review and database search to have a high sensitivity for paleontological resources. The Wilson Grove Formation contains gastropod and mollusks shell hash (Black et al., 2002; Powell et al., 2004). Within the Wilson Grove Formation, 107 fossil localities have been mapped within Sonoma County and part of Marin County. The closest mapped fossil localities within the Wilson Grove Formation are approximately 2 miles southeast of the project area. All of the listed fossils from the Wilson Grove Locality are marine mollusks.

While a single marine invertebrate (shell or shell fragment) encountered in the Wilson Grove Formation would possess minimal scientific significance, entire assemblages of marine invertebrates from the Wilson Grove Formation have played an important role in understanding the geological and environmental history of this portion of California. This area has transitioned from coastal to interior in a geologically short span of time and well-controlled collections from the Wilson Grove Formation could help to uncover additional fossil assemblages that could assist in clarifying: the age of the upper potion of the Wilson Grove Formation, the effects of environmental change and the chronology of oceanic cooling at the Plio-Pleistocene boundary, and the taxonomy of the Wilson Grove mollusks.

Quaternary Alluvium and Quaternary artificial fill over marine and marsh deposits have a low paleontological sensitivity. Neither is known to contain fossils within the project area.

3.2.9.3 Impacts

Construction activities can impact paleontologically sensitive geologic units when vehicles or other work equipment impact previously undisturbed sediments by excavating, grading, or crushing bedrock exposed in or underlying a project. This can result in adverse impacts to fossils by destroying them or otherwise altering them in such a way that their scientific value is lost.

The MSN Project includes ground-disturbing activities. Excavations for new lanes will be to a depth or approximately 2.5 feet. There will also be drainage

modifications and improvements in isolated areas to depths of about 6 feet. In addition, an existing structure over the railroad near Petaluma will be replaced, and the roadway north and south of the railroad will be reconstructed to provide sight distance. The new railroad crossing will have two abutments and two bents with foundations greater than 20 feet.

Ground-disturbing activities within the northernmost two miles of the Project Study Area (PSA) could potentially impact paleontological resources. The paleontologically sensitive Wilson Grove Formation is exposed at the surface in this area. In addition, Quaternary alluvial deposits appear to be thin and directly deposited over the Wilson Grove Formation.

3.2.9.4 Avoidance, Minimization, and/or Mitigation Measures

Avoidance and minimization measures will be utilized whenever possible. As excavation for construction gets underway, it is possible that new and unanticipated paleontological resources might be encountered. In the event that fossils are discovered, all construction work will be stopped within a 50 ft radius of the find until a qualified paleontologist can assess the significance of the find. If the discovery is significant or potentially significant, the paleontologist will employ data recovery and analysis, prepare a data recovery report, and accession of the recovered fossil material to an accredited paleontological repository, such as the University of California's Museum of Paleontology.