# INFORMATION HANDOUT

**For Contract No. 04-2G9404**
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**Project ID 0400021254**

## ENVIRONMENTAL DOCUMENT

Biological Opinion

## GEOTECHNICAL DESIGN

Foundation Report (FR) for Soldier Pile Wall-Slipout Repair

Foundation Review

Seepage Rate (Flow Rate) Estimate at Knoxville Soldier Pile Retaining Wall

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
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In Reply Refer to:
FF08ESMF00-
2013-F- 0576-3

Mr. Javier Almaguer
California Department of Transportation
Central Region Biology South Branch
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MAY 2 2 2014

Subject: Biological Opinion for the State Route 128 West of Knoxville Road, Soldier Pile Wall Project, Napa County, California (Caltrans EA 04-2G940)

Dear Mr. Almaguer:

This is in response to your October 4, 2013, request for formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed State Route (SR) 128 West of Knoxville Road Soldier Pile Wall Project, in Napa County, California. Your request was received in our office on October 18, 2013, and included the request for formal consultation on the threatened California red-legged frog (*Rana draytonii*). Critical habitat has been designated for the California red-legged frog but none occurs within the action area. Your consultation package was considered complete on January 2, 2014. This document represents the Service's biological opinion on the effects of the action on the California red-legged frog. This document has been prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*)(Act).

Moving Ahead for Progress in the 21st Century Act (MAP-21) was signed into law on July 6, 2012. Effective, October 1, 2012, MAP-21 includes provisions to promote streamlined and accelerated project delivery. The California Department of Transportation (Caltrans) was approved to participate in the MAP-21 Surface Transportation Project Delivery Program through the National Environmental Policy Act (NEPA) Assignment Memorandum of Understanding (MOU). The MOU allows Caltrans to assume the Federal Highway Administration's (FHWA) responsibilities under NEPA as well as FHWA's consultation and coordination responsibilities under Federal environmental laws for most highway projects in California. Caltrans is exercising this authority as the Federal nexus for section 7 consultation on this project.

This Biological Opinion (BO) is based on: (1) Caltrans' October 2013, Biological Assessment (BA); (2) a December 20, 2012, field visit; (3) Caltrans' January 2, 2014, response to the Service's November 12, 2013, 30-day letter; (4) Caltrans' March 3, 2014 electronic mail (e-mail) message; and (4) other information available to the Service.

**Consultation History**

December 20, 2012 The Service visited the proposed project site with Caltrans.

July 10, 2013 The Service received a project description summary from Caltrans with a request for technical assistance.

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| August 12, 2013 | The Service provided Caltrans with technical assistance via an e-mail message. The technical assistance included conservation measures for the California red-legged frog that would be appropriate to implement during project construction. |
| October 18, 2013 | The Service received Caltrans' October 4, 2013, request to initiate formal consultation on the California red-legged frog. The request was accompanied by an October 2013 BA. |
| November 12, 2013 | The Service issued a 30-day letter to Caltrans with recommendations and a request for additional information needed to complete the consultation (Service File #08ESMF00-2013-F- 0576-1). |
| January 2, 2014 | The Service received Caltrans' January 2, 2014, response to the 30-day letter. The Service considered the consultation package complete after reviewing the response. |
| February 3, 2014 | The Service received Caltrans feedback on inclusion of a bullfrog control measure to offset the adverse effects of the project on the California red-legged frog. |
| March 27, 2014 | The Service issued a draft BO for Caltrans' review (Service File #08ESMF00-2013-F- 0576-2). |
| May 20, 2014 | The Service received an e-mail message from Caltrans requesting issuance of a final BO. |

## BIOLOGICAL OPINION

### Description of the Action

Caltrans proposes to construct a retaining wall to secure an unstable descending slope off the northbound lane of SR 128. The design includes installation of an approximately 90 foot long segmented cast-in-drilled-hole soldier pile wall.

Site preparation will include preconstruction biological surveys, installation of the construction boundary and California red-legged frog fences, and light vegetation clearing.

Wall construction will include the excavation of loose material, drilling of vertical holes to support the wall foundation, installation of the wall, and backfilling behind the completed wall.

Caltrans will also address factors contributing to the unstable slope by replacing the local drainage system. An existing 24-inch corrugated metal pipe culvert crossing under SR 128 will be replaced with a 24-inch plastic pipe. This 24-inch culvert emerges from the steep road embankment on the north side of SR 128 where it then empties into an existing 18-inch culvert that follows the contour of the slope to a headwall near the base of the hill. This down-drain will be replaced in-kind. The existing headwall will remain.

The project will be confined to a 0.22-acre construction footprint. The footprint includes 0.13 acre of ground disturbance and 0.09 acre of staging in previously disturbed areas.

*Construction Schedule*
Construction is expected to take 2-3 months to complete and is projected to occur between June 1 and October 15, 2016.

*Equipment*
Equipment expected to be used for construction includes drill augers, cranes, concrete mixer trucks and pump trucks, excavators, compactors, rollers and pavers, jackhammers, graders, loaders, and dump trucks.

*Staging and Access*
The project footprint is contained within the existing Caltrans' Right of Way. Construction will take place from the SR 128 northbound lane, which will be cordoned off from the active southbound lane with a K-rail barrier. Additional equipment staging and access will be located in a road pullout off the SR 128 southbound lane and on an existing pullout immediately south of the proposed retaining wall. These additional non-paved staging areas consist of compacted soil and will account for the project's 0.09 acre of temporary effects.

*Conservation Measures*
Caltrans proposes to reduce their effects to listed species by implementing the following measures:

1. The Resident Engineer or their designee will be responsible for implementing the conservation measures and *Terms and Conditions* of the BO and will be the point of contact for the project. The Resident Engineer or their designee will maintain a copy of this BO and any amendments onsite. Their name and telephone number will be provided to the Service at least thirty (30) calendar days prior to groundbreaking.

2. Caltrans will enter into an agreement with California State Parks to contribute funds to be used specifically for 3 years of bullfrog control at Anadell State Park. Under the agreement, the Caltrans' funded bullfrog control task will begin within 1 year of the transfer and will continue each year for 3 consecutive years. Verification of the agreement will be provided to the Service within 60 days prior to the initiation of onsite activities. California State Parks will provide an annual report to Caltrans and the Service summarizing the success of each year's control efforts. Caltrans will coordinate with the Service to provide an alternative California red-legged frog recovery action if they are unable to reach an agreement with California State Parks within 60 days prior to the initiation of onsite activities.

3. A Service-approved biologist(s) will be on-site during all activities that may result in the take of the California red-legged frog. The biologist(s) qualifications will be presented to Service for review and written approval prior to ground-breaking at the project site.

4. A Service-approved biologist will conduct environmental education training for all construction employees prior to working onsite. The program will include the following: a description of the California red-legged frog and its habitat needs; photographs of the species; an explanation of its legal status and protection under the Act; and a list of the measures that would be implemented to reduce effects to the listed frog. Upon completion of the training program, personnel will sign a form stating that they attended the program and understand the conservation measures relevant to their activities on the project. These sign-in sheets will be kept on file and will be made available to the Service upon request.

5. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

6. All project-related vehicle traffic will be restricted to the project footprint described in the project description of this BO.

7. The active construction area will be delineated with high visibility temporary fencing at least 4 feet in height, flagging, or other barrier to prevent encroachment of construction personnel and equipment outside the described project footprint. Fencing will be inspected and maintained daily by the on-site biologist until completion of the project. Fencing will be removed after all construction equipment is removed.

8. California red-legged frog exclusionary fencing will be placed at the edge of active construction areas to restrict frog access into the work area. The fencing will consist of taut silt fabric; 24 inches in height, staked at 10-foot intervals, with the bottom buried 6 inches below grade. Exclusion fencing will be maintained on a daily basis.

9. Construction activities will be limited to between June 1 and October 15.

10. There will be no night-time construction.

11. Vegetation clearing will be limited to small shrubs. No trees will be removed. Vegetation will be cleared only where necessary and will be cut above soil level in areas that will be restored following construction. Clearing and grubbing will be completed with hand tools when possible.

12. No more than twenty (20) working days prior to any ground disturbance, pre-construction California red-legged frog surveys will be conducted by a Service-approved biologist. The Service-approved biologist(s) will investigate all potential California red-legged frog cover sites within the action area. This includes full investigation of mammal burrows. Burrow entrances will be collapsed in areas that will be subject to ground disturbance following investigation.

13. A Service-approved biologist(s) will be onsite to monitor the initial ground disturbance activities. The biologist(s) will perform a California red-legged frog clearance survey immediately prior to the initial ground disturbance. The biological monitor will also investigate areas of disturbed soil for signs of California red-legged frogs within 30 minutes following the initial disturbance of that given area.

14. The Service-approved biologist will inspect staged equipment and debris left overnight for California red-legged frogs prior to the beginning of each day's activities and prior to being moved.

15. California red-legged frogs found within the construction zone will be relocated by a Service-approved biologist. Caltrans will request access to the neighboring property and permission to release captured frogs in the nearby stockpond if inundated and biologically appropriate at the time. If permission to release frogs on the adjacent property is denied or if the pond is not sufficiently innundated, frogs will be released into a mammal burrow or other appropriate cover site no more than 300 feet from where they were captured and away from SR 128. The biological monitor will inform the Service of the capture and relocation within one (1) working day.

16. The Resident Engineer will stop work at the request of the Service-approved biologist(s) if activities are identified that may result in the take of a California red-legged frog. Should the

biologist(s) or the Resident Engineer exercise this authority, the Service will be notified by telephone and e-mail within one (1) working day. The Service's contact will be the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600.

17. Project-related vehicles will observe a 20-mile per hour speed limit within the action area, except on County roads, and State and Federal highways.

18. All food-related trash items such as wrappers, cans, bottles, and food scraps will be disposed of in closed containers and removed at least once a day from the project site.

19. Firearms will be prohibited at the project site, except for those carried by authorized security personnel, or local, State or Federal law enforcement officials.

20. Pets will be prohibited from the project area.

21. If requested, before, during, or upon completion of ground breaking and construction activities, Caltrans will allow access by Service personnel to the action area to inspect project effects. Caltrans requests that all agency representatives contact the Resident Engineer prior to accessing the work site and review and sign the *Safe Work Code of Practices*, prior to accessing the work site for the first time.

22. To prevent inadvertent entrapment of California red-legged frogs during construction, all excavated, steep-walled holes or trenches more than 1-foot deep will be covered at the close of each working day with plywood or similar materials, or provided with one or more escape ramps constructed of earthen fill or wooden planks. Holes and trenches will be thoroughly inspected for trapped animals before being filled. If at any time a trapped listed animal is discovered, the Service-approved biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and electronic mail within one (1) working day.

23. Plastic mono-filament netting (erosion control matting) or similar material will not be used at the project site because California red-legged frog may become entangled or trapped in it. Acceptable substitutes include coconut coir matting or tackified hydroseeding compounds.

24. If pumping is used for dewatering, intakes will be completely screened with wire mesh no larger than 0.2 inch to prevent frogs from entering the pump.

25. All grindings and asphaltic-concrete waste will be temporarily stored within previously disturbed areas absent of habitat and at a minimum of 50 feet from any culvert, drainage, or aquatic feature and removed from the project footprint by the time construction is complete.

26. Hazardous materials such as fuels, oils, solvents, etc. will be stored in sealable containers in a designated location that is at least 50 feet from wetlands and aquatic habitats.

27. Equipment will be maintained to prevent the leakage of vehicle fluids such as gasoline, oils or solvents and a Spill Response Plan will be prepared and implemented.

28. A Water Pollution Control Program (WPCP), and erosion control best management practices (BMPs) will be developed and implemented to minimize any wind- or water-related

erosion. These plans will also be in compliance with the Regional Water Quality Control Board requirements. Caltrans' *Construction Site BMP Manual* (Caltrans 2003) will provide guidance for design staff to include provisions in construction contracts for measures to protect sensitive areas and prevent and minimize stormwater and non-stormwater discharges. At a minimum, protective measures will include:

a. No discharge of pollutants from vehicle and equipment cleaning into any storm drains or watercourses;

b. Keeping vehicle and equipment fueling and maintenance operations at least 50 feet away from watercourses, except at established commercial gas stations or established vehicle maintenance facility;

c. Collecting and disposing of concrete wastes in washouts and water from curing operations;

d. Maintaining spill containment kits onsite at all times during construction operations and/or staging or fueling of equipment;

e. Using water trucks and dust palliatives to control dust in excavation and fill areas, covering temporary access road entrances and exits with rock (rocking), and covering temporary stockpiles during rain events;

f. Installing coir rolls or straw wattles along or at the base of slopes during construction to capture sediment;

g. Protecting graded areas from erosion with a combination of silt fences and fiber rolls along toes of slopes or along edges of staging areas, and erosion control netting (such as jute or coir) as appropriate on sloped areas; and

h. Establishing permanent erosion control measures such as bio-filtration strips and swales to receive storm water discharges from the highway, or other impervious surfaces would be incorporated to the maximum extent practicable.

29. Other than those areas replaced by hardscape structures, Caltrans will restore disturbed areas to baseline conditions or better to the maximum extent practicable. Exposed slopes and bare ground will be reseeded with native grasses and shrubs to stabilize and prevent erosion. Where disturbance includes the removal of trees and woody shrubs, native species will be replanted, based on the local species composition.

30. A revegetation plan will be submitted to the Service for review prior to the start of construction. Construction will not commence until the Service has approved the plan. In addition, annual monitoring reports on the success of the revegetation will be provided to Service for review.

31. Caltrans will comply with Presidential Executive Order 13112 (available at http://www.gpo.gov/fdsys/pkg/FR-1999-02-08/pdf/99-3184.pdf) to reduce the spread of invasive, non-native plant species and minimize the potential decrease of palatable vegetation for wildlife. This order prevents the introduction of invasive species and provides for their control in order to minimize the economic, ecological, and human health effects. In the event that noxious weeds are disturbed or removed during construction-

related activities, the contractor will be required to contain the plant material associated with these noxious weeds and dispose of them in a manner that will not promote their spread. The contractor will be responsible for obtaining all permits, licenses and environmental clearances for properly disposing of materials. Areas subject to noxious weed removal or disturbance will be replanted with fast-growing native grasses or a native erosion control seed mixture. If seeding is not possible, the areas will be covered to the extent practicable with heavy black plastic solarization material until the end of the project.

**Action Area**

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the purposes of the effects assessment, the action area encompasses the ground disturbance and other effects associated with the 0.22-acre construction footprint and to the area within at least 300 feet from the boundaries of the footprint due to noise and vibration, and the drainage and basin downstream of the headwall due to discharge.

**Analytical Framework for the Jeopardy Determination**

In accordance with policy and regulation, the jeopardy analysis in this BO relies on four components: (1) the *Status of the Species*, which evaluates the California red-legged frog range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the California red-legged frog in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the California red-legged frog; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the California red-legged frog; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the California red-legged frog.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the California red-legged frog current status, taking into account any cumulative effects, to determine if implementation of the action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild.

The jeopardy analysis in this BO places an emphasis on consideration of the range-wide survival and recovery needs of the California red-legged frog and the role of the action area in the survival and recovery of the California red-legged frog as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

**Status of the California Red-Legged Frog**

*Listing Status*
The California red-legged frog was listed as a threatened species on May 23, 1996 (Service 1996). Critical habitat was re-designated for this species on March 17, 2010 (Service 2010). A recovery plan was published for the California red-legged frog on September 12, 2002 (Service 2002).

*Description*
The California red-legged frog is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches in length (Stebbins 2003). The abdomen and hind legs

of adults are largely red, while the back is characterized by small black flecks and larger irregular dark blotches with indistinct outlines on a brown, gray, olive, or reddish background. Dorsal spots usually have light centers (Stebbins 2003), and dorsolateral folds are prominent on the back. California red-legged frogs have paired vocal sacs and vocalize in air (Hayes and Krempels 1986). Larvae (tadpoles) range from 0.6 to 3.1 inches in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

*Distribution*

The historic range of the red-legged frog extended coastally from the vicinity of Elk Creek in Mendocino County, California, and inland from the vicinity of Redding, Shasta County, California, southward to northwestern Baja California, Mexico (Jennings and Hayes 1985; Hayes and Krempels 1986; Fellers 2005). The red-legged frog was historically documented in 46 California counties but the taxon now remains in 238 streams or drainages within 23 counties, representing a loss of 70 percent of its former range (Service 2002). California red-legged frogs are still locally abundant within portions of the San Francisco Bay area and the Central Coast. Within the remaining distribution of the species, only isolated populations have been documented in the Sierra Nevada, northern Coast Range, northern Transverse Ranges, southern Transverse Ranges, and Peninsular Ranges.

*Status and Natural History*

California red-legged frogs predominately inhabit permanent water sources such as streams, lakes, marshes, natural and man-made ponds, and ephemeral drainages in valley bottoms and foothills up to 4,921 feet in elevation (Jennings and Hayes 1994, Bulger *et al.* 2003, Stebbins 2003). However, California red-legged frogs also have been found in ephemeral creeks and drainages and in ponds that may or may not have riparian vegetation. California red-legged frogs also can be found in disturbed areas such as channelized creeks and drainage ditches in urban and agricultural areas. For example, an adult California red-legged frog was observed in a shallow isolated pool on North Slough Creek in the American Canyon area of Napa County (C. Gaber, PG&E, pers. comm., 2008). This frog location was surrounded by vineyard development. Another adult California red-legged frog was observed under debris in an unpaved parking lot in a heavily industrial area of Burlingame (P. Kobernus, Coast Ridge Ecology, pers. comm., 2008). This frog was likely utilizing a nearby drainage ditch. Caltrans also has discovered California red-legged frog adults, tadpoles, and egg masses within a storm drainage system within a major cloverleaf intersection of Millbrae Avenue and SR 101 in a heavily developed area of San Mateo County (Caltrans 2007). California red-legged frog has the potential to persist in disturbed areas as long as those locations provide at least one or more of their life history requirements.

California red-legged frogs typically breed between November and April in still or slow-moving water at least 2.5 feet in depth with emergent vegetation, such as cattails, tules or overhanging willows (Hayes and Jennings 1988). There are earlier breeding records from the southern portion of their range (Storer 1925). Female frogs deposit egg masses on emergent vegetation so that the egg mass floats on or near the surface of the water (Hayes and Miyamoto 1984). Individuals occurring in coastal areas are active year-round (Jennings *et al.* 1992), whereas those found in interior sites are normally less active during the cold and dry seasons.

During other parts of the year, habitat includes nearly any area within 1-2 miles of a breeding site that stays moist and cool through the summer (Fellers 2005). According to Fellers (2005), this can include vegetated areas with coyote brush, California blackberry thickets, and root masses associated with willow and California bay trees. Sometimes the non-breeding habitat used by California red-legged frogs is extremely limited in size. For example, non-breeding California red-legged frogs have been found in a 6-foot wide coyote brush thicket growing along a small intermittent creek

surrounded by heavily grazed grassland (Fellers 2005). Sheltering habitat for California red-legged frogs is potentially all aquatic, riparian, and upland areas within the range of the species and includes any landscape features that provide cover, such as existing animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned structures, or hay stacks may also be used. Incised stream channels with portions narrower and depths greater than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

California red-legged frogs do not have a distinct breeding migration (Fellers 2005). Adult frogs are often associated with permanent bodies of water. Some frogs remain at breeding sites all year while others disperse. Dispersal distances are typically less than 0.5 mile, with other individuals moving up to 1-2 miles (Fellers 2005). Movements are typically along riparian corridors, but some individuals, especially on rainy nights, move directly from one site to another through normally inhospitable habitats, such as heavily grazed pastures or oak-grassland savannas (Fellers 2005).

In a study of California red-legged frog terrestrial activity in a mesic area of the Santa Cruz Mountains, Bulger *et al.* (2003) categorized terrestrial use as migratory and non-migratory. The latter occurred over 1 to several days and was associated with precipitation events. Migratory movements were characterized as the movement between aquatic sites and were most often associated with breeding activities. Bulger *et al.* (2003) reported that non-migrating frogs typically stayed within 200 feet of aquatic habitat 90 percent of the time and were most often associated with dense vegetative cover, *i.e.* California blackberry, poison oak and coyote brush. Dispersing frogs in northern Santa Cruz County traveled distances from 0.25-mile to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger *et al.* 2003).

In a study of California red-legged frog terrestrial activity in a xeric environment, Tatarian (2008) noted that 57 percent of frogs fitted with radio transmitters in the Round Valley study area in eastern Contra Costa County stayed at their breeding pools, whereas 43 percent moved into adjacent upland habitat or to other aquatic sites. This study reported a peak of seasonal terrestrial movement occurring in the fall months, with movement commencing with the first 0.2 inch of precipitation. Movements away from the source pools tapered off into spring. Upland movement activities ranged from 3 to 233 feet, averaging 80 feet, and were associated with a variety of refugia including grass thatch, crevices, cow hoof prints, ground squirrel burrows at the bases of trees or rocks, logs, and a downed barn door; others were associated with upland sites lacking refugia (Tatarian 2008). The majority of terrestrial movements lasted from 1-4 days; however, an adult female was reported to remain in upland habitat for 50 days (Tatarian 2008). Uplands closer to aquatic sites were used more often and frog refugia were more commonly associated with areas exhibiting higher object cover (*e.g.*, woody debris, rocks, and vegetative cover). Subterranean cover was not significantly different between occupied upland habitat and non-occupied upland habitat.

California red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Egg masses containing 2,000-5,000 eggs are attached to vegetation below the surface and hatch after 6-14 days (Storer 1925, Jennings and Hayes 1994). In coastal lagoons, the most significant mortality factor in the pre-hatching stage is water salinity (Jennings *et al.* 1992). Eggs exposed to salinity levels greater than 4.5 parts per thousand results in 100 percent mortality (Jennings and Hayes 1990). Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3.5-7 months following hatching and reach sexual maturity at 2-3 years of age (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1985, 1990, 1994). Of the various life

stages, larvae probably experience the highest mortality rates, with less than 1 percent of eggs laid reaching metamorphosis (Jennings *et al.* 1992). Sexual maturity normally is reached at 3-4 years of age (Storer 1925; Jennings and Hayes 1985). California red-legged frogs may live 8-10 years (Jennings *et al.* 1992). Populations of California red-legged frogs fluctuate from year to year. When conditions are favorable California red-legged frogs can experience extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of occupied sites. In contrast, California red-legged frogs may temporarily disappear from an area when conditions are stressful (*e.g.*, drought).

California red-legged frogs have a diverse diet which changes as they mature. The diet of larval California red-legged frogs is not well studied, but is likely similar to that of other ranid frogs, which feed on algae, diatoms, and detritus by grazing on the surfaces of rocks and vegetation (Fellers 2005; Kupferberg 1996a, 1996b, 1997). Hayes and Tennant (1985) analyzed the diets of California red-legged frogs from Cañada de la Gaviota in Santa Barbara County during the winter of 1981 and found invertebrates (comprising 42 taxa) to be the most common prey item consumed; however, they speculated that this was opportunistic and varied based on prey availability. They ascertained that larger frogs consumed larger prey and were recorded to have preyed on Pacific tree frogs, three-spined stickleback and to a limited extent, California mice, which were abundant at the study site (Hayes and Tennant 1985, Fellers 2005). Although larger vertebrate prey was consumed less frequently, it represented over half of the prey mass eaten by larger frogs suggesting that such prey may play an energetically important role in their diets (Hayes and Tennant 1985). Juvenile and subadult/adult frogs varied in their feeding activity periods; juveniles fed for longer periods throughout the day and night, while subadult/adults fed nocturnally (Hayes and Tennant 1985). Juveniles were significantly less successful at capturing prey and all life history stages exhibited poor prey discrimination; feeding on several inanimate objects that moved through their field of view (Hayes and Tennant 1985).

*Metapopulation and Patch Dynamics*

The direction and type of habitat used by dispersing animals is especially important in fragmented environments (Forys and Humphrey 1996). Models of habitat patch geometry predict that individual animals will exit patches at more "permeable" areas (Buechner 1987; Stamps *et al.* 1987). A landscape corridor may increase the patch-edge permeability by extending patch habitat (La Polla and Barrett 1993), and allow individuals to move from one patch to another. The geometric and habitat features that constitute a "corridor" must be determined from the perspective of the animal (Forys and Humphrey 1996).

Because their habitats have been fragmented, many endangered and threatened species exist as metapopulations (Verboom and Apeldom 1990; Verboom *et al.* 1991). A metapopulation is a collection of spatially discrete subpopulations that are connected by the dispersal movements of the individuals (Levins 1970; Hanski 1991). For metapopulations of listed species, a prerequisite to recovery is determining if unoccupied habitat patches are vacant due to the attributes of the habitat patch (food, cover, and patch area) or due to patch context (distance of the patch to other patches and distance of the patch to other features). Subpopulations of patches with higher quality food and cover are more likely to persist because they can support more individuals. Large populations have less of a chance of extinction due to stochastic events (Gilpin and Soule 1986). Similarly, small patches will support fewer individuals, increasing the rate of extinction. Patches that are near occupied patches are more likely to be recolonized when local extinction occurs and may benefit from emigration of individuals via the "rescue" effect (Hanski 1982; Fahrig and Merriam 1985; Gotelli 1991; Holt 1993). For the metapopulation to persist, the rate of patches being colonized must exceed the rate of patches going extinct (Levins 1970). If some subpopulations go extinct

regardless of patch context, recovery actions should be placed on patch attributes. Patches could be managed to increase the availability of food and/or cover.

Movements and dispersal corridors likely are critical to California red-legged frog population dynamics, particularly because the animals likely currently persist as metapopulations with disjunct population centers. Movement and dispersal corridors are important for alleviating over-crowding and intraspecific competition, and also they are important for facilitating the recolonization of areas where the animal has been extirpated. Movement between population centers maintains gene flow and reduced genetic isolation. Genetically isolated populations are at greater risk of deleterious genetic effects such as inbreeding, genetic drift, and founder effects. The survival of wildlife species in fragmented habitats may ultimately depend on their ability to move among patches to access necessary resources, retain genetic diversity, and maintain reproductive capacity within populations (Petit *et al.* 1995; Buza *et al.* 2000; Hilty and Merenlender 2004).

Most metapopulation or metapopulation-like models of patchy populations do not directly include the effects of dispersal mortality on population dynamics (Hanski 1994; With and Crist 1995; Lindenmayer and Possingham 1996). Based on these models, it has become a widely held notion that more vagile species have a higher tolerance to habitat loss and fragmentation than less vagile species. But models that include dispersal mortality predict the opposite: more vagile species should be more vulnerable to habitat loss and fragmentation because they are more susceptible to dispersal mortality (Fahrig 1998; Casagrandi and Gatto 1999). This prediction is supported by Gibbs (1998), who examined the presence-absence of five amphibian species across a gradient of habitat loss. He found that species with low dispersal rates are better able than more vagile species to persist in landscapes with low habitat cover. Gibbs (1998) postulated that the land between habitats serves as a demographic "drain" for many amphibians. Furthermore, Bonnet *et al.* (1999) found that snake species that use frequent long-distance movements have higher mortality rates than do sedentary species.

*Threats*

Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the red-legged frog throughout its range. Several researchers in central California have noted the decline and eventual local disappearance of California and northern California red-legged frogs (*Rana aurora*) in systems supporting bullfrogs (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish, signal crayfish, and several species of warm water fish including sunfish, goldfish, common carp, and mosquitofish (Moyle 1976, Barry 1992, Hunt 1993, Fisher and Schaffer 1996). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern California red-legged frogs, and suggested that bullfrogs could prey on subadult northern California red-legged frogs as well. Bullfrogs may also have a competitive advantage over California red-legged frogs. For instance, bullfrogs are larger and possess more generalized food habits (Bury and Whelan 1984). In addition, bullfrogs have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977). Furthermore, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with red-legged frog reproduction. Thus bullfrogs are able to prey upon and out-compete California red-legged frogs, especially in sub-optimal habitat. Both California and northern California red-legged frogs have also been observed in amplexus (mounted on) with both male and female bullfrogs (Jennings and Hayes 1990; Jennings 1993; Twedt 1993).

The urbanization of land within and adjacent to red-legged frog habitat has also adversely affected California red-legged frogs. These declines are attributed to channelization of riparian areas,

enclosure of the channels by urban development that blocks red-legged frog dispersal, and the introduction of predatory fishes and bullfrogs.

Diseases may also pose a significant threat though the specific effects of diseases on the California red-legged frog are not known. Pathogens are suspected of causing global amphibian declines (Davidson *et al.* 2003). Chytridiomycosis and ranaviruses are a potential threat to the red-legged frog because these diseases have been found to adversely affect other amphibians, including the listed species (Davidson *et al.* 2003; Lips *et al.* 2003). Non-native species, such as bullfrogs and non-native tiger salamanders that live within the range of the California red-legged frog have been identified as potential carriers of these diseases (Garner *et al.* 2005). Human activities can facilitate the spread of disease by encouraging the further introduction of non-native carriers and by acting as carriers themselves (*i.e.*, contaminated boots or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in the listed species being more susceptible to the effects of disease. Disease will likely become a growing threat because of the relatively small and fragmented remaining California red-legged frog breeding sites, the many stresses on these sites due to habitat losses and alterations, and the many other potential disease-enhancing anthropogenic changes that have occurred both inside and outside the species' range.

Negative effects to wildlife populations from roads and pavement may extend some distance from the actual road. The phenomenon can result from any of the effects already described in this BO, such as vehicle-related mortality, habitat degradation, and invasive exotic species. Forman and Deblinger (1998, 2000) described the area affected as the "road effect" zone. Along a 4-lane road in Massachusetts, they determined that this zone extend for an average of approximately 980 feet to either side of the road for an average total zone width of approximately 1,970 feet. They describe the boundaries of this zone as asymmetric and in some areas diminished wildlife use attributed to road effects was detected greater than 0.6 mile from Massachusetts Route 2. The "road-zone" effect can also be subtle. Van der Zandt *et al.* (1980) reported that lapwings and black-tailed godwits feeding at 1,575-6,560 feet from roads were disturbed by passing vehicles. The heart rate, metabolic rate and energy expenditure of female bighorn sheep increase near roads (MacArthur *et al.* 1979). Trombulak and Frossell (2000) described another type of "road-zone' effect due to contaminants. Heavy metal concentrations from vehicle exhaust were greatest within 66 feet of roads, but elevated levels of metals in both soil and plants were detected at 660 feet of roads. The "road-zone" apparently varies with habitat type and traffic volume. Based on responses by birds, Forman (2000) estimated the effect zone along primary roads of 1,000 feet in woodlands, 1,197 feet in grasslands, and 2,657 feet in natural lands near urban areas. Along secondary roads with lower traffic volumes, the effect zone was 656 feet. The "road-zone" effect with regard to California red-legged frogs has not been adequately investigated.

The necessity of moving between multiple habitats and breeding ponds means that many amphibian species, such as the California red-legged frog, are especially vulnerable to roads and well-used large paved areas in the landscape. Van Gelder (1973) and Cooke (1995) have examined the effect of roads on amphibians and found that because of their activity patterns, population structure, and preferred habitats, aquatic breeding amphibians are more vulnerable to traffic mortality than some other species. Large, high-volume highways pose a nearly impenetrable barrier to amphibians and result in mortality to individual animals as well as significantly fragmenting habitat. Hels and Buchwald (2001) found that mortality rates for anurans on high traffic roads are higher than on low traffic roads. Vos and Chardon (1998) found a significant negative effect of road density on the occupation probability of ponds by the moor frog (*Rana arvalis*) in the Netherlands. In addition, incidents of very large numbers of road-killed frogs are well documented (*e.g.*, Ashley and Robinson 1996), and studies have shown strong population level effects of traffic density (Carr and Fahrig 2001) and high traffic roads on these amphibians (Van Gelder 1973; Vos and Chardon 1998). Most

studies regularly count road kills from slow moving vehicles (Hansen 1982; Rosen and Lowe 1994; Drews 1995; Mallick *et al.* 1998) or by foot (Munguira and Thomas 1992). These studies assume that every victim is observed, which may be true for large conspicuous mammals, but it certainly is not true for small animals, such as the California red-legged frog. Amphibians appear especially vulnerable to traffic mortality because they readily attempt to cross roads, are slow-moving and small, and thus cannot easily be avoided by drivers (Carr and Fahrig 2001).

**Environmental Baseline**

The proposed project is located in a particularly rural area of Napa County. The project is approximately 8 miles east of the City of Rutherford, 5 miles east of Lake Hennessy, and 8 miles west of Lake Berryessa. The general vicinity is primarily characterized by hills and ridgelines covered with oak woodland and scrub vegetation separated by wide valleys with riparian lined creeks running through a mix of vineyards and grazing pasture. Local development is primarily limited to scattered residence, ranchettes, grazing, and agricultural operations. The local segment of SR 128 is not a significant corridor between human population centers and therefore experiences relatively low traffic volume.

Given the lack of significant development and the consistency of agricultural land use on the surrounding private properties, there is little baseline biological survey data for the project vicinity. As a result, there are few California Natural Diversity DataBase (CNDDB) records for the area despite the high habitat values for plants and wildlife (CDFW 2014a & 2014b). As an example, the closest California red-legged frog record consists of adult frogs observed on SR 128 rather than being observed in the numerous surrounding drainages or ponds where they are more likely to be found (CNDDB Occurrence 739). California red-legged frog occurrence data will remain woefully incomplete within this area of Napa County until there is greater access for biological surveys. Occurrence 739 is located approximately 5.5 miles southeast of the project footprint and is associated with riparian, meadow, oak woodland, and constructed pond habitat similar to that found within and adjacent to the project footprint.

Red-legged frogs will take refuge in an assortment of damp to inundated locations and can breed in a variety of freshwater situations, including freshwater marshes, backwater pools, ditches, agricultural basins, and stock ponds. The drainage system included in the project description exits the described headwall and continues approximately 110 feet downstream to a stock pond. Based on our review of a series of aerial images spanning 1993 to 2013, the stock pond is ephemeral and is typically dry by mid-summer (Google Inc. 2014). When fully inundated, this oblong pond is approximately 224 feet by 46 feet. The pond's ephemeral inundation likely excludes California red-legged frog non-native predators and competitors such as fish, bullfrogs, and crayfish. Although Caltrans and Service biologists have not gained access to investigate the pond, it appears to provide characteristic aquatic habitat for California red-legged frog cover, forage, and breeding. This pond is approximately 290 feet west of Soda Creek and its associated riparian corridor. The riparian corridor and pond are separated by a grassy field providing exceptional connectivity between the two aquatic resources. Without access to the creek, it is assumed to at least provide ephemeral aquatic habitat and year-round cover and forage. Soda Creek drains into Lake Berryessa and has hydrological connectivity with Capell and Oak Moss Creek (which is associated with California red-legged frog Occurrence 739).

Adult California red-legged frogs are highly mobile and have been documented to move at least 2 miles over upland habitat, therefore it is expected that frogs could be moving between areas of aquatic habitat within a 2 mile radius. Using that as a reference, there are numerous other aquatic

resources within 2 miles of the project footprint. The Service identified at least 9 additional basins and stockponds within 1 mile of the project footprint as well as numerous tributaries to Soda Creek.

There are likely wetlands associated with the drainages and ponds and potential plunge pools in the drainages. These wetlands could provide cover, forage, and refuge from dry upland conditions. The pools could provide potential breeding habitat.

The local aquatic habitat is surrounded by long valleys dominated by grasslands, vineyards, and narrow riparian corridors. The surrounding hills are vegetated by oak woodland and scrub. This contiguous upland habitat is associated with the dispersal, refugia, and foraging life history of the California red-legged frog. There are no apparent movement barriers between the various aquatic features, upland habitat, and the construction footprint. Due to roadkill risk, SR 128 and rural roads are the only perceived impediments to the frog's movement in the general vicinity.

The recovery plan for California red-legged frogs identifies eight Recovery Units (Service 2002). The establishment of these Recovery Units is based on the Recovery Team's determination that various regional areas of the species' range are essential to its survival and recovery. The status of the California red-legged frog will be considered within the smaller scale of Recovery Units as opposed to the overall range. These Recovery Units are delineated by major watershed boundaries as defined by U. S. Geological Survey (USGS) hydrologic units and the limits of the range of the California red-legged frog. The goal of the recovery plan is to protect the long-term viability of all extant populations within each Recovery Unit. The proposed project is within Recovery Unit 3 (North Coast and North San Francisco Bay Unit) (Service 2002).

The Service believes that the California red-legged frog is reasonably certain to occur within the action area due to: (1) the project being located within the species' range and current distribution; (2) the lack of significant disturbance or history of significant threats to the species in the general vicinity; (3) the project footprint is within approximately 110 feet of potential California red-legged frog breeding habitat and has connectivity with multiple potential breeding ponds well within the known dispersal distance for the species; (4) upland habitat for dispersal, forage, and cover are located within the construction footprint; (5) the action area is located within potential dispersal corridors between surrounding upland and aquatic habitat; (6) all the elements needed to support the species' life history are located within 110 feet of the construction footprint; (7) the ability of the California red-legged frog to move a considerable distance; and (8) the biology and ecology of the animal.

**Effects of the Action**

Caltrans proposes to reduce construction related effects by implementing the *Conservation Measures* included in the *Description of the Action* section of this BO. Effective implementation of the *Conservation Measures* will likely reduce effects to the California red-legged frog during construction but incidental take is still likely to occur. Therefore, the proposed project has the potential to result in a variety of adverse effects that would result in take of the California red-legged frog.

Construction activities could result in the killing, harming and/or harassment of juvenile and adult frogs inhabiting the action area. The project, as proposed in Caltrans' October 2013 BA, is defined by a 0.22-acre construction footprint, primarily located within the existing roadway and roadway embankment and is adjacent to California red-legged frog breeding habitat. The project will include 0.13 acre of permanent habitat loss associated with the construction of the retaining wall within the embankment. The 0.13 acre area includes the addition of the wall structure and the needed work area. Although the work area will be subject to ground disturbance and clearing of sparse

understory shrubs, the area will be revegetated for erosion control. The effects are being considered permanent because the disturbed area is not expected to regain baseline ecological function within 1 year of the initial disturbance and will be subject to routine Caltrans maintenance that may interfere with the ecological function of the area. The project also includes 0.09 acre of staging located in previously disturbed areas, adjacent to the SR 128 road shoulder, and characterized by bare and compacted soil.

Adverse effects to the California red-legged frog will most likely be limited to the construction phase of the project. Permanent and temporal loss of habitat will result from the construction activities associated with the installation of the retaining wall. Construction noise, vibration, and increased human activity during construction may interfere with normal frog behaviors such as feeding, sheltering, movement between refugia, foraging grounds, and other frog essential behaviors. This can result in avoidance of areas that have suitable habitat but intolerable levels of disturbance.

Unless identified by the biological monitor or site personnel and rescued by the biological monitor, individual California red-legged frogs exposed during earthwork or moving within active work areas likely will be crushed and killed or injured by construction-related activities. Even with biological monitoring, overall awareness, and proper escape ramps, California red-legged frogs could fall into the trenches, pits, or other excavations, and then risk being directly killed or be unable to escape and be killed due to desiccation, entombment, or starvation. Proper trash disposal is often difficult to enforce and is a common non-compliance issue. Improperly disposed edible trash could attract predators, such as raccoons, crows, and ravens, to the site, which could subsequently prey on the listed amphibian. Caltrans' commitment to use erosion control devices other than mono-filament should be effective in avoiding the associated risk of entrapment that can result in death by predation, starvation, or desiccation (Stuart *et al.* 2001). Constructing the project between June 1 and October 15 primarily avoids the wettest time of year and the onset of the breeding season when adult frogs are more likely to be involved in dispersal.

Caltrans will further reduce adverse effects by: locating the construction staging, storage, and parking areas on previously disturbed areas where small mammal burrows and other California red-legged frog cover sites are unlikely to occur; clearly marking construction work boundaries with high-visibility fencing; conducting preconstruction surveys and biological monitoring; and stabilizing and revegetating disturbed areas. Adverse effects from construction activities will be partially reduced by: installing wildlife exclusion fencing to deter frogs from entering the construction area; educating workers; and requiring a Service-approved biologist to be present to monitor initial ground disturbing activities.

If unrestricted, the proposed construction activities could result in the introduction of chemical contaminants to frog habitat. Exposure pathways could include inhalation, dermal contact, direct ingestion, or secondary ingestion of contaminated soil, plants or prey species. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. However, Caltrans proposes to minimize these risks by implementing a WPCP and erosion control BMPs to capture sediment and prevent runoff or other harmful chemicals from entering downstream habitat, including the nearby stockpond.

Preconstruction surveys and the relocation of individual California red-legged frogs may avoid injury or mortality; however, capturing and handling frogs may result in stress and/or inadvertent injury during handling, containment, and transport. Caltrans proposes to minimize these effects by using Service-approved biologists, limiting the duration of handling, and relocating amphibians to suitable nearby habitat with Service guidance.

If unrestricted, biologists and construction workers traveling to the action area from other project sites may transmit diseases by introducing contaminated equipment. The chance of a disease being introduced into a new area is greater today than in the past due to the increasing occurrences of disease throughout amphibian populations in California and the United States. It is possible that chytridiomycosis, caused by chytrid fungus, may exacerbate the effects of other diseases on amphibians or increase the sensitivity of the amphibian to environmental changes (*e.g.*, water pH) that reduce normal immune response capabilities (Bosch *et al.* 2001, Weldon *et al.* 2004).

The retaining wall will locally stabilize the slope, alleviating the existing and future threat of sediment discharge downstream and into the nearby stockpond. Caltrans will reseed the disturbed embankment with native plants, likely returning to baseline California red-legged frog dispersal, cover, and forage ecological values within 3 years following construction. The completed project will not result in the increase of travel speed or capacity on SR 128 and therefore is unlikely to increase the local risk of California red-legged frog mortality due to vehicle collision.

**Cumulative Effects**

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed SR 128 West of Knoxville Road, Soldier Pile Wall Project are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service is not aware of specific projects that might affect the California red-legged frog in the action area that are currently under review by State, county, or local authorities.

**Conclusion**

After reviewing the current status of California red-legged frog, the environmental baseline for the action area, and the effects of the action, and the cumulative effects on the species, it is the Service's biological opinion that the proposed SR 128 West of Knoxville Road, Soldier Pile Wall Project, as described herein, is not likely to jeopardize the continued existence of this species. We base this conclusion on the following: (1) Caltrans will implement a standard list of conservation measures to reduce their adverse effects to the California red-legged frog; (2) ground disturbing activities will be limited to the summer season when adult frogs are less likely to be dispersing through upland areas; (3) the project footprint is relatively small; and (4) construction will be completed in a short period of time.

## INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this *Incidental Take Statement.*

The measures described below are non-discretionary, and must be implemented by Caltrans so that they become binding conditions of any grant or permit issued to Caltrans as appropriate, in order for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this *Incidental Take Statement.* If Caltrans (1) fails to assume and implement the *Terms and Conditions* or (2) fails to adhere to the *Terms and Conditions* of the *Incidental Take Statement* through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Caltrans must report the progress of the action and its impact on the species to the Service as specified in the *Incidental Take Statement* [50 CFR §402.14(i)(3)].

**Amount or Extent of Take**

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect due to their wariness, cryptic nature, and the difficulty of finding and fully investigating their cover sites. Finding an injured or dead California red-legged frog is unlikely due to their relatively small body size, rapid carcass deterioration, and likelihood that the remains will be removed by a scavenger. Losses of the California red-legged frog may also be difficult to quantify due to a lack of baseline survey data and seasonal/annual fluctuations in their numbers due to environmental or human-caused disturbances. There is a risk of harm, harassment, injury and mortality as a result of the proposed construction activities, the permanent and temporary loss/degradation of suitable habitat, and capture and relocation efforts; therefore, the Service is authorizing take incidental to the action as (1) the injury and mortality of no more than one adult or juvenile California red-legged frog and (2) the capture, harm and harassment of all California red-legged frogs within the 0.22-acre project footprint. Upon implementation of the following *Reasonable and Prudent Measure*, California red-legged frogs within the action area in proportion to the amount and type of take outlined above will become exempt from the prohibitions described under section 9 of the Act. No other forms of take are exempted under this opinion.

**Effect of the Take**

The Service has determined that this level of anticipated take for the California red-legged frog is not likely to jeopardize the continued existence of this species.

**Reasonable and Prudent Measure**

The Service has determined that the following reasonable and prudent measure is necessary and appropriate to minimize the effect of the action on the California red-legged frog. Caltrans will be responsible for the implementation and compliance with this measure:

1. Minimize the adverse effects to the California red-legged frog and its habitat in the action area by implementing their proposed project, including the conservation measures as described, with the following terms and conditions.

**Terms and Conditions**

In order to be exempt from the prohibitions of section 9 of the Act, Caltrans must comply with the following terms and conditions, which implement the reasonable and prudent measure described above. These terms and conditions are nondiscretionary.

1. The following *Terms and Conditions* implement *Reasonable and Prudent Measure* one (1):

   a. Caltrans shall include language in their contracts that expressly requires contractors and subcontractors to work within the boundaries of the project footprint identified in this BO, including vehicle parking, staging, laydown areas, and access.

   b. At least 15 days prior to the onset of any construction-related activities, Caltrans will submit to the Service, for approval, the name(s) and credentials of biologists it wishes to conduct activities specified for this project. Information included in a request for authorization will include, at a minimum: (1) relevant education; (2) relevant training on California red-legged frog identification, survey techniques, handling individuals of different age classes, and handling of different life stages by a permitted biologist or recognized California red-legged frog expert authorized for such activities by the Service; (3) a summary of field experience conducting requested activities (to include project/research information); (4) a summary of BOs under which they were authorized to work with the California red-legged frog and at what level (such as construction monitoring versus handling), this will also include the names and qualifications of persons under which the work was supervised as well as the amount of work experience on the actual project; (5) A list of Federal Recovery Permits [10(a)1(A)] held or under which are authorized to work with the California red-legged frog (to include permit number, authorized activities, and name of permit holder); and (6) any relevant professional references with contact information. Project construction will not begin until Caltrans has received written Service approval for biological monitors.

   c. Each California red-legged frog encounter shall be treated on a case-by-case basis in coordination with the Service but general guidance is as follows: (1) leave the non-injured frog if it is not in danger or (2) move the frog to a nearby location if it is in danger.

      These two options are further as follows.

      1) When a California red-legged frog is encountered in the action area the first priority is to stop all activities in the surrounding area that have the potential to result in the harm, harassment, injury, or death of the individual. Then the monitor needs to assess the situation in order to select a course of action that will minimize adverse effects to the individual. Contact the Service once the site is secure. The contacts for this situation are Ryan Olah (*ryan_olah@fws.gov*) or John Cleckler (*john_cleckler@fws.gov*). They can also be reached at (916) 414-6600. If you get voicemail messages for these contacts then contact John Cleckler on his cell phone at (916) 712-6784. Contact the Service prior to the start of construction to confirm the status of this contact information.

         The first priority is to avoid contact with the frog and allow it to move out of the action area and hazardous situation on its own to a safe location. The animal should not be picked up and moved because it is not moving fast enough or it is inconvenient for the construction schedule. This guidance only applies to situations where a California red-legged frog is encountered on the move during conditions that make their upland travel feasible. This does not apply to California red-legged frog that are uncovered or otherwise exposed or in areas where there is not sufficient adjacent habitat to support the life history of the California red-legged frog should they move outside the construction footprint.

Avoidance is the preferred option if the California red-legged frog is not moving and is using aquatic habitat or is within some sort of burrow or other refugia. The area should be well marked for avoidance by construction and a Service-approved biological monitor should be assigned to the area when work is taking place nearby.

2) The animal should be captured and moved when it is the only option to prevent its death or injury.

If appropriate habitat is located immediately adjacent to the capture location then the preferred option is short distance relocation to that habitat. This must be coordinated with the Service but the general guidance is the frog should not be moved outside of the area it would have traveled on its own. Under no circumstances should a frog be relocated to another property without the owner's written permission. It is Caltrans' responsibility to arrange for that permission.

The release must be coordinated with the Service and will depend on where the individual was found and the opportunities for nearby release. In most situations the release location is likely to be into the mouth of a small burrow or other suitable refugia and in certain circumstances pools without non-native predators may be suitable.

Only Service-approved biologists for the project can capture California red-legged frogs. Nets or bare hands may be used to capture California red-legged frogs. Soaps, oils, creams, lotions, repellents, or solvents of any sort cannot be used on hands within 2 hours before and during periods when they are capturing and relocating California red-legged frogs. To avoid transferring disease or pathogens between sites during the course of surveys or handling of the frogs, Service-approved biologists must use the following guidance for disinfecting equipment and clothing. These recommendations are adapted from the *Declining Amphibian Population Task Force's Code* (http://www.open.ac.uk/daptf/).

i. All dirt and debris, including mud, snails, plant material (including fruits and seeds), and algae, must be removed from nets, traps, boots, vehicle tires and all other surfaces that have come into contact with water and/or an amphibian. Cleaned items should be rinsed with fresh water before leaving each site.

ii. Boots, nets, traps, etc., must then be scrubbed with either a 70 percent ethanol solution, a bleach solution (0.5 to 1.0 cup of bleach to 1.0 gallon of water), QUAT 128 (quaternary ammonium, use 1:60 dilution), or a 6 percent sodium hypochlorite 3 solution and rinsed clean with water between sites. Avoid cleaning equipment in the immediate vicinity of a pond or wetland. All traces of the disinfectant must be removed before entering the next aquatic habitat.

iii. Used cleaning materials (liquids, etc.) must be disposed of safely, and if necessary, taken back to the lab for proper disposal.

iv. Service-approved biologists must limit the duration of handling and captivity. While in captivity, individual California red-legged frogs shall be kept in a

cool, dark, moist, aerated environment, such as a clean and disinfected bucket or plastic container with a damp sponge. Containers used for holding or transporting should not contain any standing water.

The Service believes that no more than one California red-legged frog will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. Caltrans must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

*Reporting Requirements*
In order to monitor whether the amount or extent of incidental take anticipated from implementation of the project is approached or exceeded, Caltrans shall adhere to the following reporting requirements. Should this anticipated amount or extent of incidental take be exceeded, Caltrans must reinitiate formal consultation as per 50 CFR 402.16.

1. The Service must be notified within one (1) working day of the finding of any injured or dead listed species or any unanticipated damage to its habitat associated with the proposed project. Notification will be made to the Coast-Bay/Forest Foothills Division Chief of the Endangered Species Program at the Sacramento Fish and Wildlife Office at (916) 414-6600, and must include the date, time, and precise location of the individual/incident clearly indicated on a USGS 7.5-minute quadrangle or other maps at a finer scale, as requested by the Service, and any other pertinent information. When an injured or dead individual of the listed species is found, Caltrans shall follow the steps outlined in the following *Disposition of Individuals Taken* section.

2. Sightings of any listed or sensitive animal species should be reported to the CNDDB (http://www.dfg.ca.gov/biogeodata/cnddb/).

3. Caltrans shall submit an annual construction compliance report prepared by the on-site biologist to the Service within forty (40) working days following project completion for the year or within sixty (60) calendar days of any break in construction activity lasting more than forty (40) working days. This report will detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on listed species, if any; (v) occurrences of incidental take of any listed species; and (vi) other pertinent information. The report(s) will be addressed to the Coast-Bay/Forest Foothills Division Chief of the Endangered Species Program at the Sacramento Fish and Wildlife Office.

*Disposition of Individuals Taken*
Injured listed species must be cared for by a licensed veterinarian or other qualified person(s), such as the Service-approved biologist. Dead individuals must be sealed in a resealable plastic bag containing a paper with the date and time when the animal was found, the location where it was found, and the name of the person who found it, and the bag containing the specimen frozen in a freezer located in a secure site, until instruction s are received from the Service regarding the disposition of the dead specimen. The Service contact persons are the Coast-Bay/Forest Foothills Division Chief of the Endangered Species Program at the Sacramento Fish and Wildlife Office at

(916) 414-6600; and the Resident Agent-in-Charge of the Service's Office of Law Enforcement, 5622 Price Way, McClellen, California 95562, at (916) 569-8444.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of an action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following actions:

1. Caltrans District 4 should work with the Service to develop a conservation strategy that would identify the current safe passage potential along Bay Area highways and the areas where safe passage for wildlife could be enhanced or established.

2. Caltrans should assist the Service in implementing recovery actions identified in the *Recovery Plan for the California Red-legged Frog* (Service 2002).

3. Caltrans should consider participating in the planning for a regional habitat conservation plan for the California red-legged frog, other listed species, and sensitive species.

4. Caltrans should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the California red-legged frog, and other appropriate species. Such banking systems also could possibly be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where appropriate. Efforts should be made to preserve habitat along roadways in association with wildlife crossings.

5. Roadways can constitute a major barrier to critical wildlife movement. Therefore, Caltans should incorporate culverts, tunnels, or bridges on highways and other roadways that allow safe passage by California red-legged frog, other listed animals, and wildlife. Photographs, plans, and other information into the BAs if "wildlife friendly" crossings are incorporated into projects. Efforts should be made to establish upland culverts designed specifically for wildlife movement rather than accommodations for hydrology. Transportation agencies should also acknowledge the value of enhancing human safety by providing safe passage for wildlife in their early project design.

6. Caltrans should map and quantify the existing undercrossings on SR 128 and other highways and assess their baseline potential to provide safe passage for wildlife. Such an assessment would aide current and future planning, permitting, and shared agency stewardship goals.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

## REINITIATION--CLOSING STATEMENT

This concludes formal consultation on the proposed SR 128 West of Knoxville Road, Soldier Pile Wall Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a

manner or to an extent not considered in this BO, including work outside of the project footprint analyzed in this BO and including vehicle parking, staging, lay down areas, and access roads; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this BO including use of rodenticides or herbicides; relocation of utilities; and use of vehicle parking, staging, lay down areas, and access roads; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any additional take will not be exempt from the prohibitions of section 9 of the Act, pending reinitiation.

If you have questions concerning this BO, please contact John Cleckler, Caltrans Liaison (*john_cleckler@fws.gov*) or Ryan Olah, Coast-Bay/Forest Foothills Division Chief (*ryan_olah@fws.gov*), at the letterhead address, (916) 414-6600, or by e-mail.

Sincerely,

Jennifer M. Norris
Field Supervisor

cc:
Melissa Escaron, California Department of Fish and Wildlife, Napa, California
Sarah Soliman, California Department of Transportation, Fresno, California

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State of California
DEPARTMENT OF TRANSPORTATION

California State Transportation Agency

# Memorandum

*Serious drought*
*Help Save Water!*

**To:** MS. KELLY HOLDEN
Supervising Bridge Engineer
Bridge Design West
Structures Design

**Date:** November 20, 2014

**Attention:** G. Danke
P. Norboe

**File:** 4-NAP-128- PM 17.94
04 – 2G9401
**Efis:** 0400021254-1
Storm Damage
Soldier Pile Wall

**From:** M. ZABOLZADEH/ A. KADDOURA
Associate M and R Engineers
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

for HOOSHMAND NIKOUI
Chief, Branch A
Office of Geotechnical Design - West
Geotechnical Services
Division of Engineering Services

**Subject: FOUNDATION REPORT (FR) FOR SOLDIER PILE WALL-SLIPOUT REPAIR**

## 1. INTRODUCTION

This memorandum supersedes our FR dated February 20, 2013. This memorandum presents our geotechnical recommendations for the above referenced project. The recommendations contained in this report are based on the results from subsurface explorations within the limits of the project.

### 1.1 History

During rain storms of 2010, a sinkhole developed along the northbound shoulder of Route 128, at PM 17.94, just south of Knoxville Rd (south of Lake Berryessa) in Napa County. Refer to Figure 1 for project location.

It appears that an existing 24 inches CMP culvert that crosses Route 128 (at PM marker 17.94) has separated at a joint under the shoulder of northbound 128 creating a sinkhole. The sinkhole is about 3 ft wide and 6 ft deep. The culvert separation has saturated the embankment slope and caused a depression in the roadway. The depressed area is about 60 ft long within the southbound lane. The existing 24 inches CMP culvert is outletted at the existing head wall about 30 ft below the roadway.

## 2. PROJECT PURPOSE AND NEED

The need for this project is to permanently repair the sinkhole and resurface the roadway at this location. Several alternatives were considered for repairing the slipout such as using Gabion Wall, segmented pile wall, soldier pile wall, and Geosynthetic reinforced embankment. After discussing these options with Design, and other support units, it was decided to repair the slide with constructing a segmented pile wall as shown on Exhibits A and B. Based on the provided typical cross section by Design, the face of the proposed wall will be constructed about 19 ft from the existing roadway centerline. This will provide an 11 ft wide northbound lane, 4 ft outside shoulder, and 5 ft clearance to install a new MBGR. Refer to the attached Exhibit A for details.

## 3. SCOPE OF WORK

The following tasks were performed for the preparation of this Foundation Report:

- Field mapping
- Field geotechnical exploration, including drilling one boring
- Review of the previously prepared memorandums by this office
- Laboratory testing on selected samples

## 4. SITE AND REGIONAL GEOLOGY

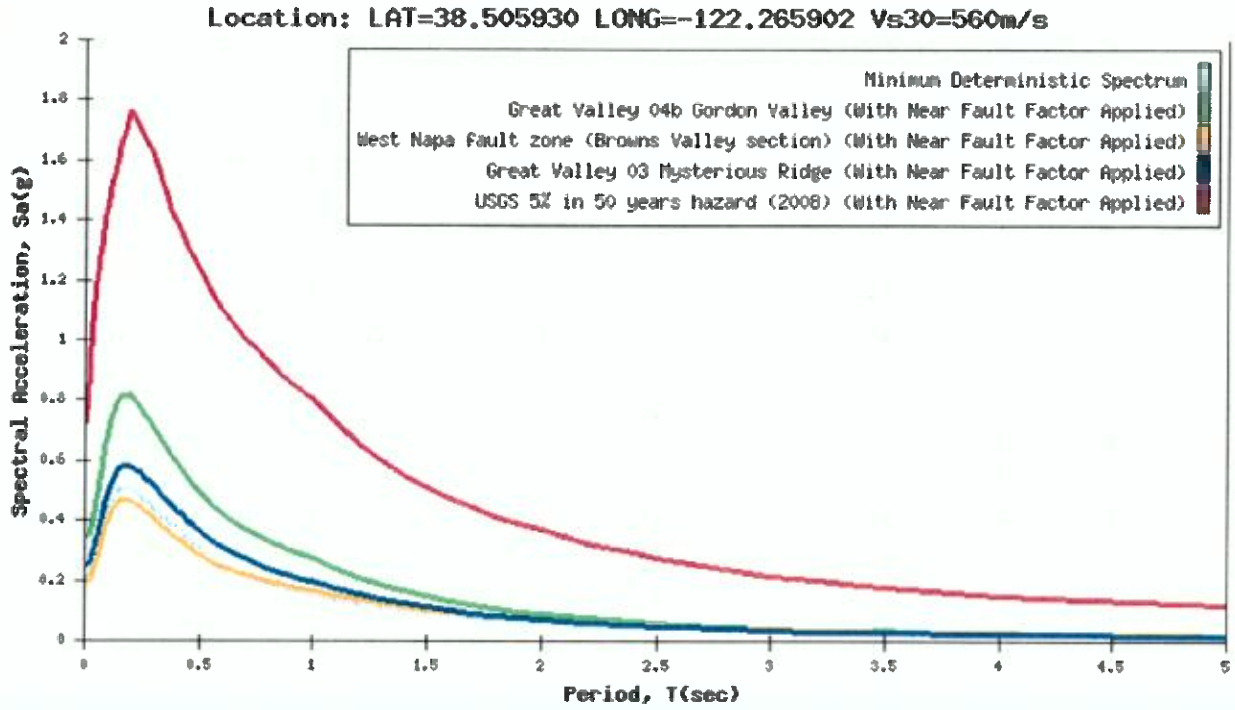
The project site is located within the California Coast Ranges geomorphic provinces. This portion of the Coast Range is composed of the accretionary wedges that formed during subduction of the Farallon Plate under the North American Plate, thrusting the Great Valley Sequence above the Franciscan Complex, creating a series of folds, thrust faults, and valleys. The project site is located in the eastern side of one of these broad folds. After the Farallon Plate was completely subducted under the North American Plate, the Pacific Plate and the North American plate were forced together and the San Andreas Fault was formed. The San Andreas is the dominant active geologic feature in California. This fault is a right lateral strike slip fault and created new stress on the plates and formed a series of northwest trending semi-parallel faults: i.e. the Hayward, West Napa faults. The force that formed these faults also compressed areas of the Coast Ranges and formed other reverse faults such as the Great Valley fault system.

As mentioned above the site is located with the Great Valley Sequence. This portion of the complex is composed of "*...Sandstone and shale (Early Cretaceous and Late Jurassic), mostly rhythmically thin-bedded fine-grained quartz-lithic wacke and greenish-gray to black mudstone*

*and shale. Locally, unit contains beds of massive sandstone or conglomerate that can be tracked for several kilometers before pinching out."*[1]
(Geology is presented on Figure 2, and boring logs are attached)

## 5. SEISMICITY

Geologists and seismologists recognize the San Francisco Bay Area as one of the most active seismic regions in the United States. There are numerous faults within 20 miles of the project site. Caltrans ARS tool gives a maximum PGA of 0.73 at a period of 0.01, using a Shear Wave Velocity (*VS*30) of 1837 ft/s (560 m/s). This data is presented in the Acceleration Response Spectrum presented in Curve 1 below. Fault data is presented in Table 2, and fault locations presented on the attached Fault Map-Figure 3.




**Curve 1: Acceleration Response Spectrum**

[1] USGS: 2007; Geologic Map and Map Database of Eastern Sonoma and Western Napa Counties, California; By Graymer, et al.

Table 2: Fault Data*

| Fault Name | Distance: Miles | Fault ID: | Fault Type: | Maximum Magnitude (MMax): | Peak Ground Acceleration* |
|---|---|---|---|---|---|
| **Great Valley 04b Gordon Valley** | 11.8 | 104 | Reverse | 6.7 | 0.35 |
| **West Napa fault zone (Browns Valley section)** | 8.5 | 106 | Strike Slip | 6.6 | 0.20 |
| **Great Valley 03 Mysterious Ridge** | 17.3 | 82 | Reverse | 7.0 | 0.25 |
| **PGA calculated with the USGS Probabilistic model, using the USGS Seismic Hazard Map (2008) and a 975 year return period** | | | | | **0.73** |

*Caltrans ARS Online (v2.0.4)

## 6. GEOLOGIC HAZARDS

The site may be affected by activity along any of the active faults discussed above. Earthquake induced hazards can be categorized as primary and secondary seismic effects.

Primary seismic effects such as ground rupture or surface deformation resulting from differential movement along a fault trace are not expected to occur. According to the Alquist-Priolo Earthquake Fault Zone Maps, there are no active faults within the project area.

Secondary seismic effects result from various soil responses to ground acceleration. These effects result from activity of any nearby active faults.

- Liquefaction of Natural Ground – Liquefaction is a process by which soil deposits below the water table temporarily lose strength and behave as a viscous liquid rather than a solid, typically during a moderate to large earthquake. In general, very loose to medium dense, clean fine- to medium-grained sand and very soft to firm; low plasticity silts that are relatively free of clay are most susceptible to liquefaction. Earthquake-induced ground shaking can cause these loose or soft materials to densify, resulting in increased pore water pressures and an upward movement of groundwater that may result in a liquefied condition. Depending on the weight of the structure, the depth to the liquefied stratum and the nature of the overlying soils, structures situated above such temporarily liquefied soils may sink or tilt, causing significant structural damage.

According to the Liquefaction Susceptibility Map, the project is located in an area of very low liquefaction susceptibility level (see Figure 4, Liquefaction Susceptibility Map). Additionally, based on the subsurface soil description in Section 5 of this report, liquefaction potential is considered to be insignificant.

- Cracking – Lurch cracks may develop in the silty and clayey soil overlying the site. The potential for lurch cracking will be higher in the rainy periods when the soil is saturated. The hazard from cracking is considered minimal.

- Differential Compaction – During moderate and large earthquakes, soft or loose, natural or fill soils can become densified and consolidate, often unevenly across a site. Since loose or soft material was not encountered in our investigation, the potential for differential compaction is minimal.

Ground Shaking - As noted in the Seismicity section above, moderate to large earthquakes are probable along several active faults in the greater Bay Area. Therefore, strong ground shaking should be expected at some time during the design life of the proposed development. The improvements should be designed in accordance with current earthquake resistant standards.

## 7. SUBSURFACE SOIL CONDITIONS

One Power boring (A-12-001) was drilled utilizing rotary wash drilling method with Standard Penetration Test (SPT) sampling in November 2012, on the westbound lane of Route 128 within the slide area to the depths of 55.5 feet. The borings describe the foundation soils/rocks as approximately 40 feet alternating layers of very stiff to sandy lean clay and loose to very dense gravel with sand. The remainders of the borings describe the foundation soils/rocks as intensely weathered, very intensely fractured shale. The unconfined compressive strength of the clayey soil (using a pocket penetrometer) was estimated to range between 2.5 and 4.0 tsf. The SPT blow counts range from 9 to more than 50 (refusal) blows per foot.

Groundwater was encountered in boring R-12-001 at the depth of 11.5 ft below roadway surface (MSL 978.50 ft) at the time during drilling (November 2012). Refer to the attached Log of Test Boring Sheets (LOTB) for details. The LOTB sheets should be included with the contract plans.

## 8. GEOTECHNICAL TESTING

### 8.1 Laboratory and In-Situ Testing

Laboratory testing was performed on selected samples of the subsurface materials obtained during our subsurface investigation for corrosion and moisture content. In-Situ tests include performing SPT and pocket penetrometer testing on clay soil samples.

## 9. FOUNDATION RECOMMENDATIONS

***Soldier Pile Wall***

We recommend repairing the slipout by placing an approximately 97 feet long (Station 34+81± to Station 35+78±) soldier pile wall. See attached Exhibits A and B.

We recommend the proposed wall be designed for the following:

- The proposed wall should be designed as a 12-feet high (max.).
- Based on Design Section, the wall will be located about 21 ft right of the existing centerline of Route 128. See attached Typical Section - Exhibit B.
- The proposed pile holes should be minimum 24 inches in diameter and at 6 ft O.C.
- Soldier piles should be minimum 32 ft long.
- Because of the location of the wall, the top 1-6 feet of the wall requires lagging to contain fill material and accommodate the proposed drainage inlet near Station 35+23±.
- We recommend excavating and replacing the top 6 ft (of the existing material was placed by field Maintenance in order to plug the sink hole) behind the wall (roadway side) to 10 ft of either side of the proposed DI (between approximate stations 35+13± to 35+33±).
- The soil excavation in front of the wall should be none to minimal (0 to 7') and as directed by the Engineer.
- The top 12 ft (wall design height) of the proposed steel piles holes should be backfilled with lean concrete that can be easily removed to install wood lagging if needed in the future.

**Earth Pressures**

The proposed wall should be designed for the following:

For *active pressure* against the wall, use the following:

*Between 0 ft and 12 ft depth (dredge line):*

- Internal friction angle $\phi = 30°$, C = 500 psf & soil moist unit weight ($\gamma$) = 120 lb/ft$^3$.
- For earth pressure distribution, use a triangular pressure distribution.
- A rectangular pressure diagram from top of the wall to a depth of 10 ft for traffic surcharge equivalent to about 2 ft of fill.
- The wall shall be capable of resisting seismic earth pressure using the following parameters:

  Horizontal seismic acceleration coefficient kh=0.18
  Vertical seismic acceleration coefficient kv=0.0

For *passive pressure* against the wall, use the following input:

*Between 12 ft and 40 ft depth:*

- Internal friction angle $\phi = 32°$, C = 2000 psf & soil moist unit weight ($\gamma$) = 125 lb/ft$^3$.

*Below 40 ft depth:*

- Internal friction angle $\phi = 34°$, C = 1000 psf & soil moist unit weight ($\gamma$) = 130 lb/ft$^3$.

The above recommendations are based on parameters established by our field exploration and engineering judgment.

## 10. CORROSION

The Department considers the site to be corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

Chloride concentration is greater than or equal to 500 ppm, sulfate concentration is greater than or equal to 2000 ppm, or the pH is 5.5 or less.

The following table provides our corrosion test summary:

| *Boring* | ***SIC Number (TL-101)*** | ***Sample Depth*** | *Resistivity (Ohm-Cm)* | ***pH*** | ***Chloride Content (ppm)*** | ***Sulfate Content (ppm)*** |
|---|---|---|---|---|---|---|
| R-12-001 | C634924 | 20'-30' | 1515 | 7.7 | N/A | N/A |

The test results indicate that the site is NOT corrosive to foundation elements.

## 11. CONSTRUCTION CONSIDERATIONS

The following construction considerations and requirements should be included in the design and construction specifications for the proposed wall.

The following construction considerations and requirements should be included in the design and construction specifications for the proposed soldier pile slope repair and mitigation measures:

The Contractor may encounter difficulties during drilling for soldier piles. This is due to the presence of groundwater and caving sandy soils. The contractor should be prepared to use casing and for dewatering and pile installation in WET Conditions.

Drilling of pile holes, installation of soldier pile beams and concrete placement shall be completed in a continuous operation.

Drilling of pile hole shall be staggered and no open holes shall be adjacent.

* * * * *

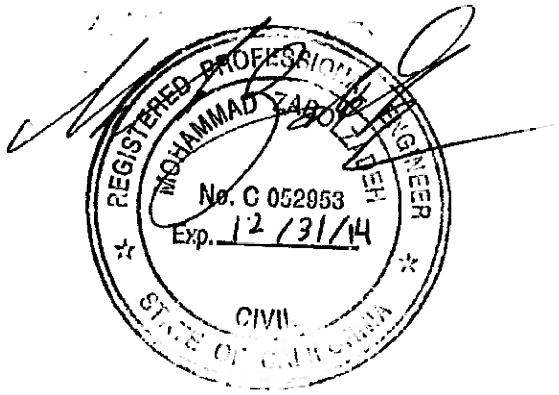
Any questions regarding the above recommendations should be directed to the attention of Ali Kaddoura/Mohammad Zabolzadeh at 510-286-4676/4831 or Hooshmand Nikoui at 510-286-4811, at the Office of Geotechnical Design-West, Branch A.

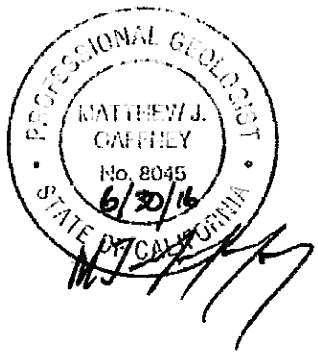
Attachments

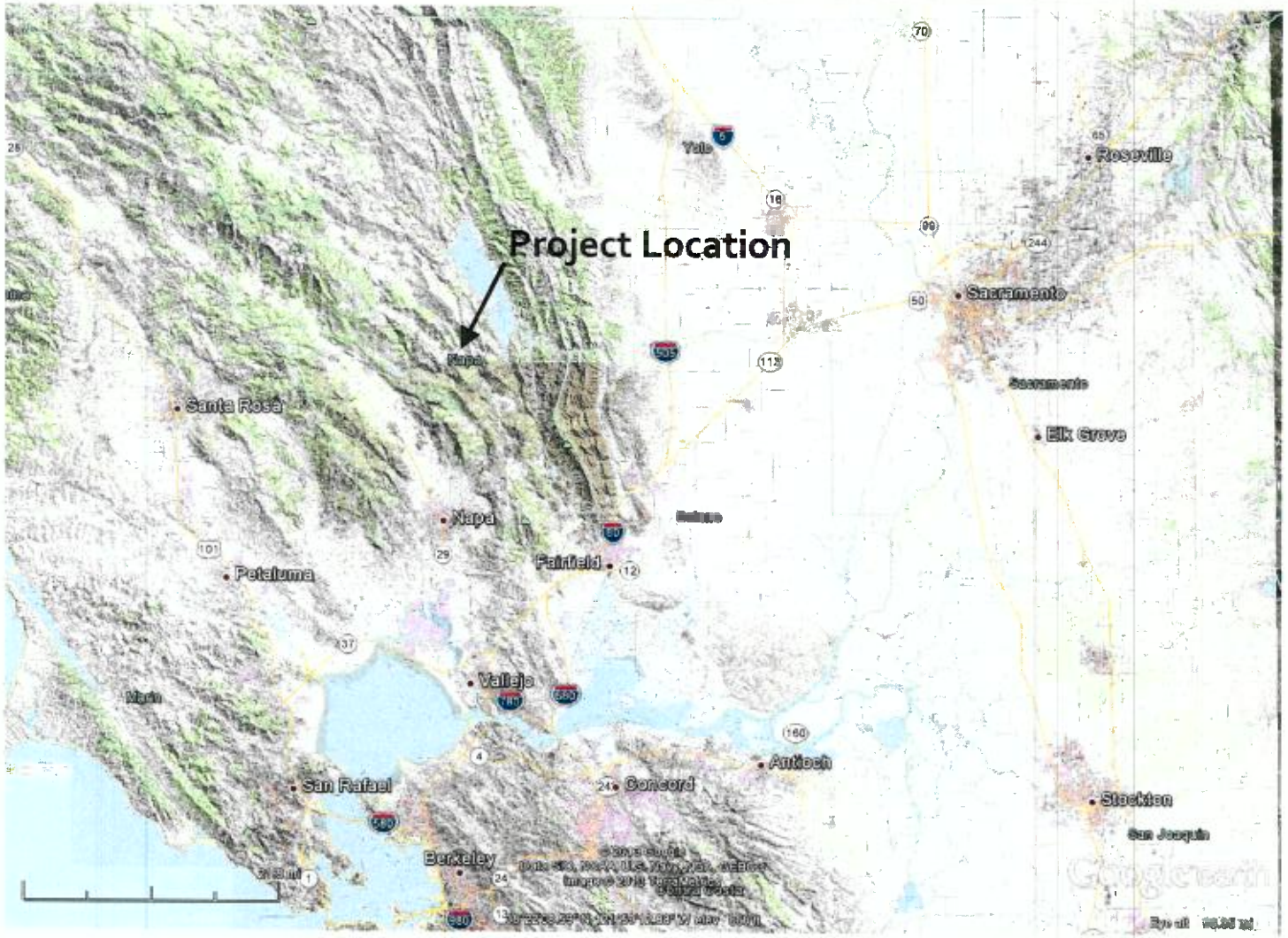
c: TPokrywka, HNikoui, MZabolzadeh, AKaddoura - (GS west)
HSeto (Project Liason Engineer)
SGalvez (District Environmental Planning)

GSetberg (Acting Manager-Structures Office Engineer)
Structure Construction (RE_pending_File)
Rubin Woo (District ME)
KReilly (Hydraulics Branch)
ARahimi (District 04 Senior Engineer)
YZhai (District 04 PE)

Kaddoura/Zabolzadeh/mm/ NAP-128-PM 17.94 FR – Soldier Pile Wall



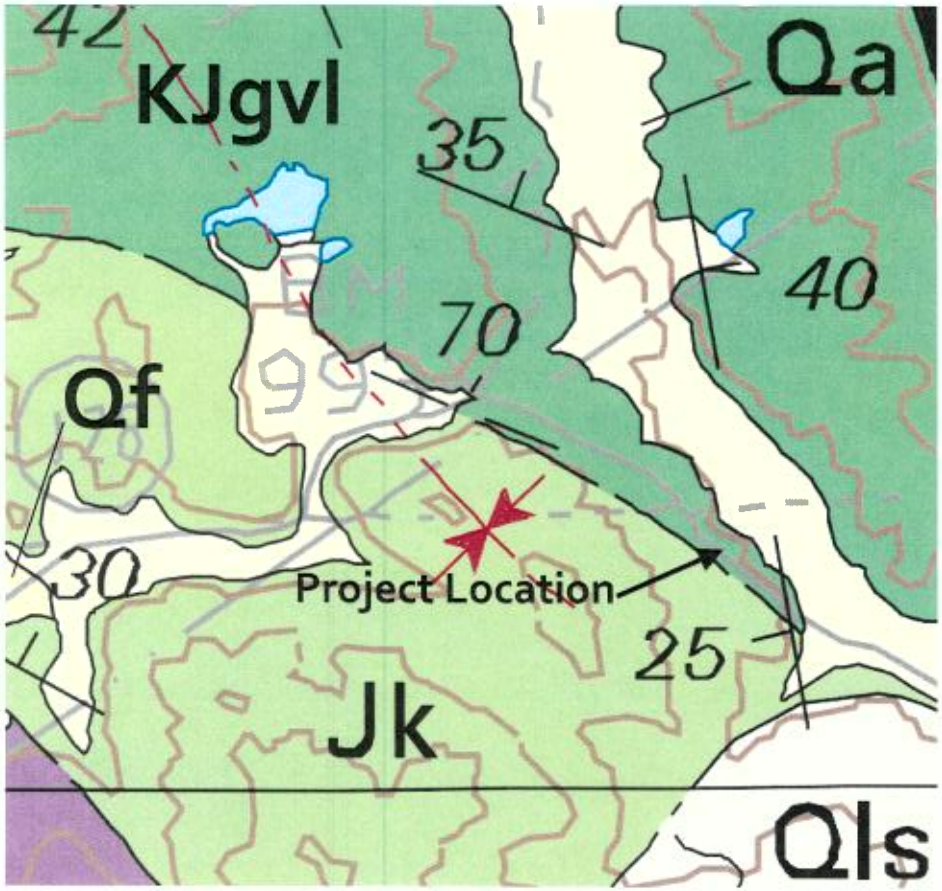



SCALE
Not to Scale

Caltrans

**DIVISION OF ENGINEERING SERVICES**
GEOTECHNICAL SERVICES
GEOTECHNICAL DESIGN - WEST – BRANCH B

| Location Map | |
|---|---|
| 04 NAP-128 | EFIS 0400021254 |
| PM 17.94 | JANUARY 2013 |
| FIGURE 1 | |




**KEY**

**SURFICIAL DEPOSITS**

| | |
|---|---|
| Qa | **Alluvium (Holocene and late Pleistocene)** |
| Qf | **Alluvial fan deposits (Holocene and late Pleistocene)** |
| Qls | **Landslide deposits (Holocene and late Pleistocene)** |

**GREAT VALLEY SEQUENCE**

| | |
|---|---|
| KJgvl | **Sandstone and shale (Early Cretaceous and Late Jurassic)** |
| Jk | **Knoxville Formation (Late Jurassic)** |

MAP TAKEN FROM: U.S. Geological Survey: Geologic Map and Map Database of Eastern Sonoma and Western Napa Counties, California By R.W. Graymer, E.E. Brabb, D.L. Jones J. Barnes and R.E. Stamski, 2007.

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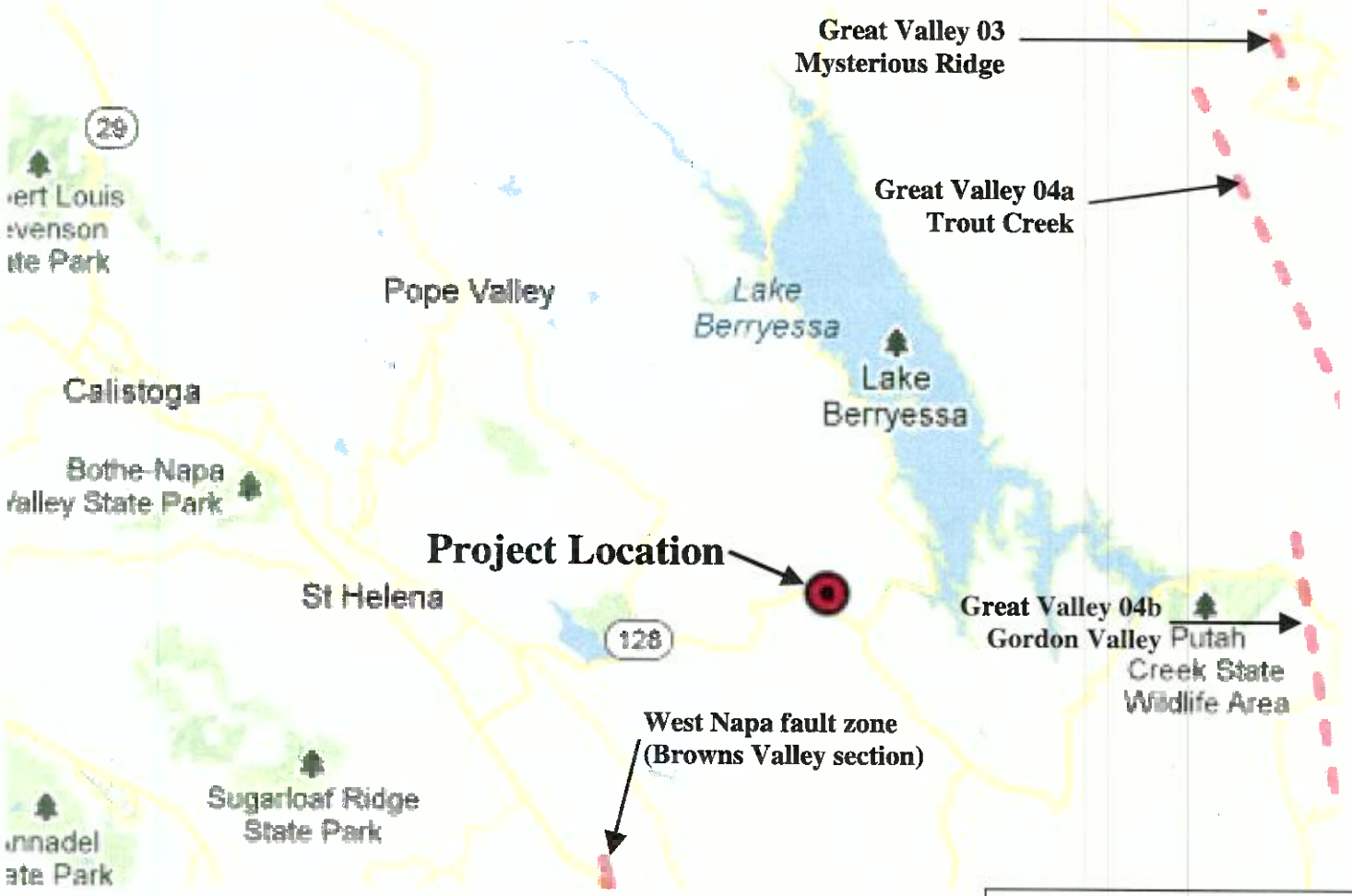
**DIVISION OF ENGINEERING SERVICES**
GEOTECHNICAL SERVICES
GEOTECHNICAL DESIGN - WEST – BRANCH B

GEOLOGIC MAP

| | |
|---|---|
| 04-NAP-128 | 0400021254 |
| PM. 17.94 | JANUARY 2013 |

FIGURE 2




MAP TAKEN FROM:
http://dap3.dot.ca.gov/shake_stable/

| | | | |
|---|---|---|---|
| SCALE<br>Not to Scale | Caltrans | **DIVISION OF ENGINEERING SERVICES**<br>GEOTECHNICAL SERVICES<br>GEOTECHNICAL DESIGN - WEST – BRANCH B | **ARS Fault Map**<br>04-NAP-128 0400021254<br>PM. 17.94 JANUARY 2013<br>FIGURE 3 |

**Liquefaction Susceptibility Map**

Susceptibility Level

- Very High
- High
- Moderate
- Low
- Very Low
- Major Roads
- Local Roads

N

Scale: 1 inch = 0.68 miles

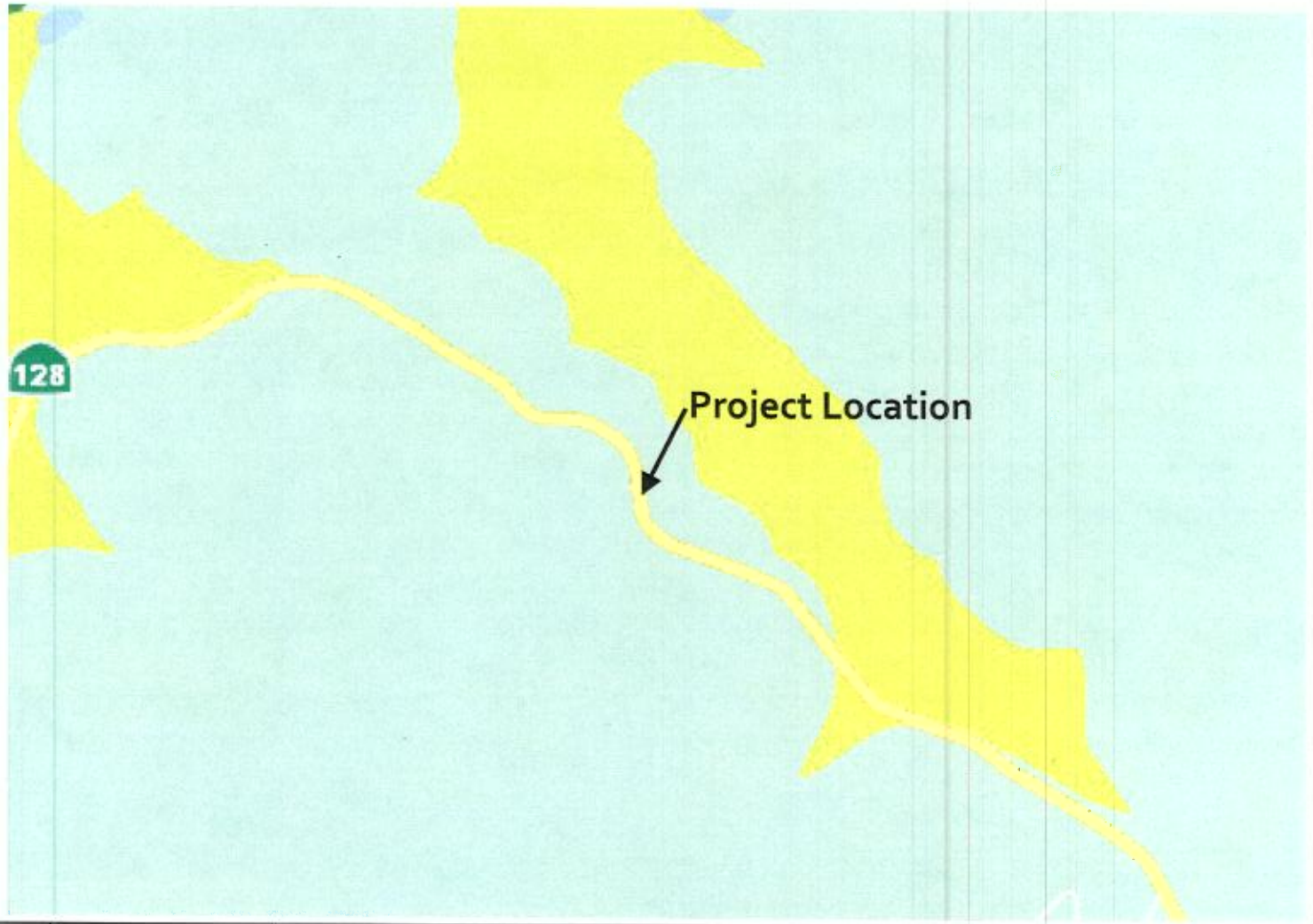
This map is intended for planning use only and is not intended to be site-specific. Rather, it depicts the general hazard level of a neighborhood and the relative hazard levels from community to community. Hazard levels are less likely to be accurate if your neighborhood is on or near the border between two zones. This information is not a substitute for a site-specific investigation by a licensed professional.

This map is available at http://quake.abag.ca.gov

Sources:
This map is based on work by William Lettis & Associates, Inc. and USGS.
USGS Open-File Report 00-444, Knudsen & others, 2000 and
USGS Open-File Report 2006-1037, Witter & others, 2006

For more information visit:
http://pubs.usgs.gov/of/2000/of00-444/
http://pubs.usgs.gov/of/2006/1037/

ABAG Geographic Information Systems

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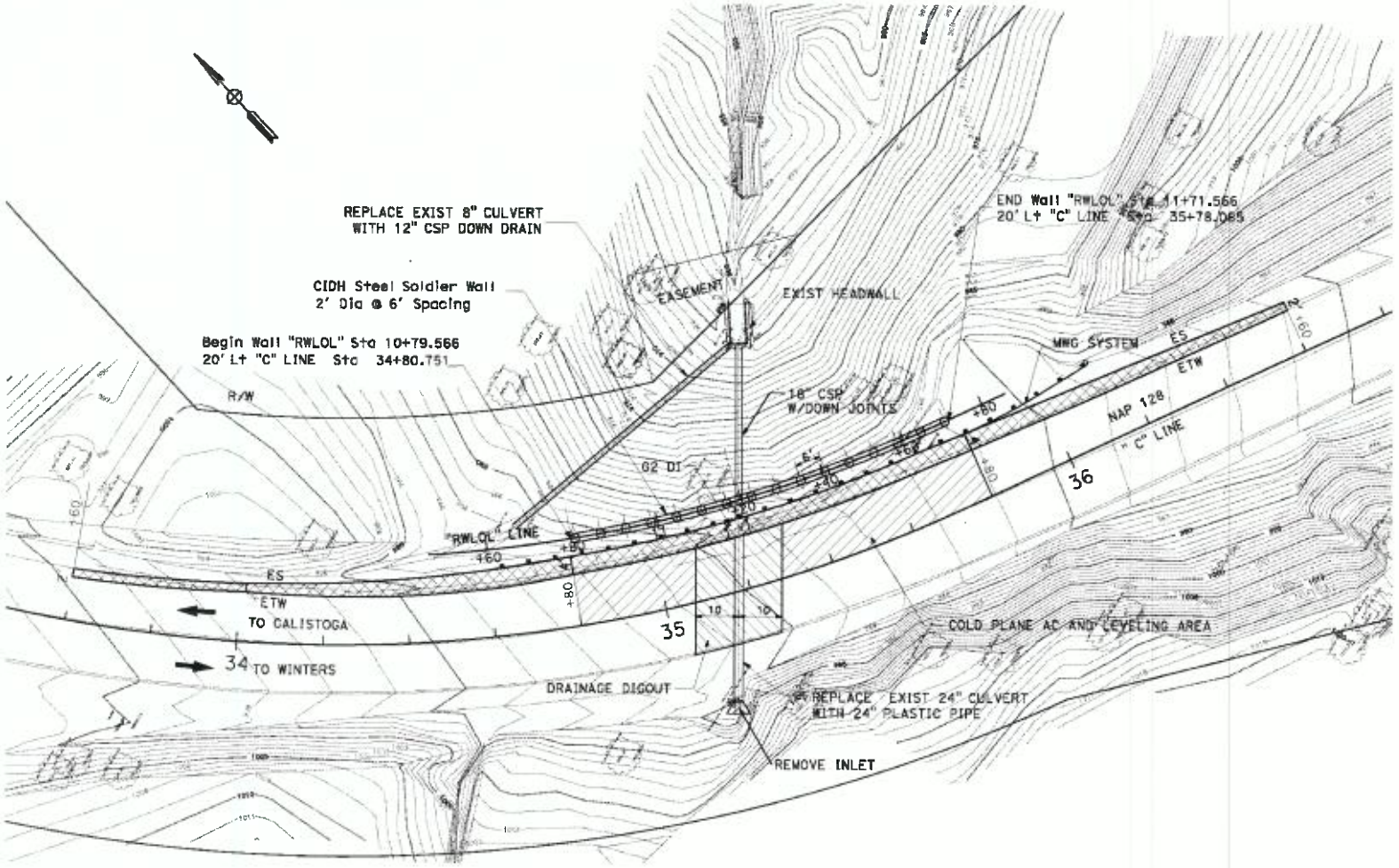
**DIVISION OF ENGINEERING SERVICES**
GEOTECHNICAL SERVICES
GEOTECHNICAL DESIGN - WEST – BRANCH B

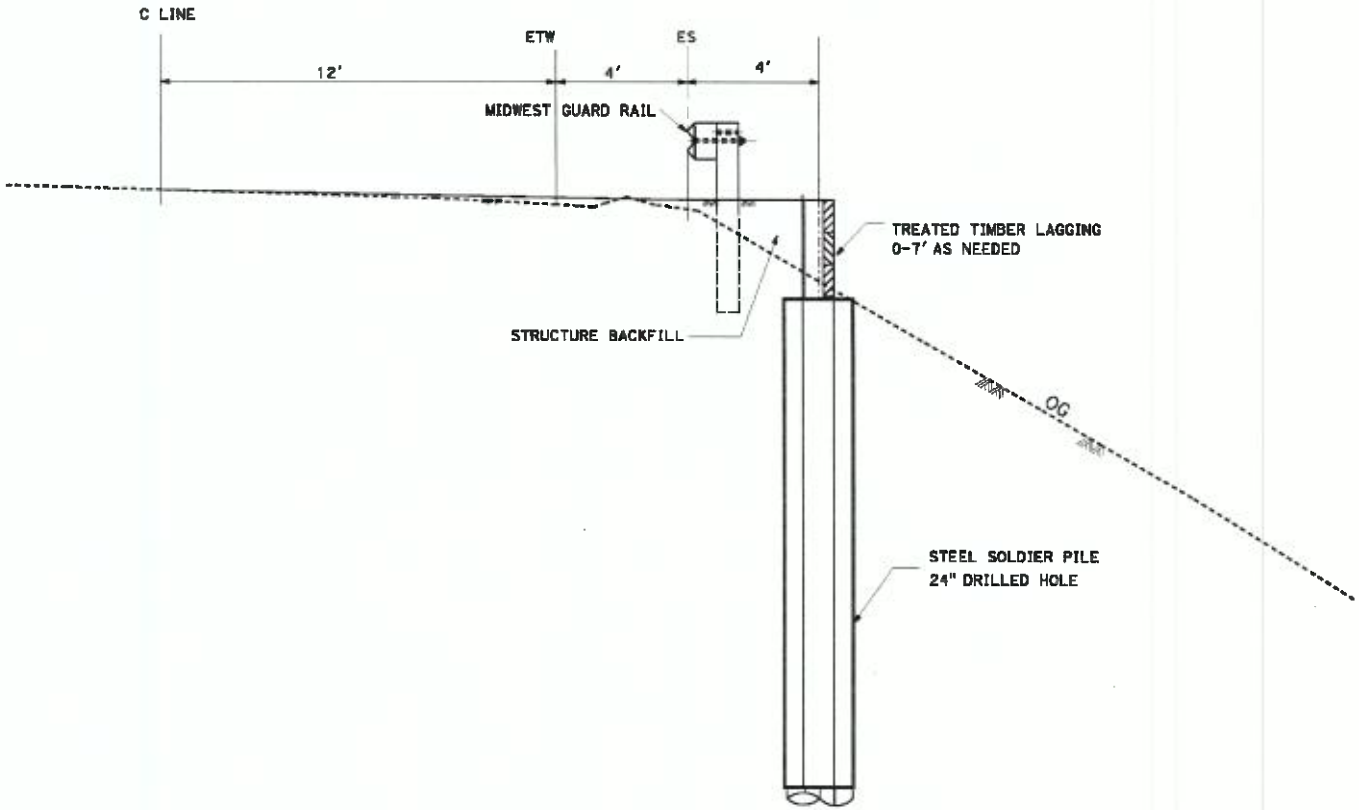
**Liquefaction Susceptibility Map**

| | |
|---|---|
| 04 NAP-128 | EFIS 0400021254 |
| PM 17.94 | JANUARY 2013 |

FIGURE 4




| | | | |
|---|---|---|---|
| SCALE<br>Not to Scale | Caltrans | **DIVISION OF ENGINEERING SERVICES**<br>GEOTECHNICAL SERVICES<br>GEOTECHNICAL DESIGN - WEST – BRANCH B | **LAYOUT SHEET**<br>04 NAP-128 EFIS 0400021254<br>PM 17.94 NOVEMBER 2014<br>EXHIBIT A |

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**DIVISION OF ENGINEERING SERVICES**
GEOTECHNICAL SERVICES
GEOTECHNICAL DESIGN - WEST – BRANCH B

**TYPICAL CROSS-SECTION**

| | |
|---|---|
| 04 NAP-128 | EFIS 0400021254 |
| PM 17.94 | NOVEMBER 2014 |

EXHIBIT B

| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET NO | TOTAL SHEETS |
|---|---|---|---|---|---|
| 04 | Nap | 128 | 17.94 | | |

Ali Kaddoura 02-20-13
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

Ali K. Kaddoura No. 55710 Exp. 12-31-14 CIVIL

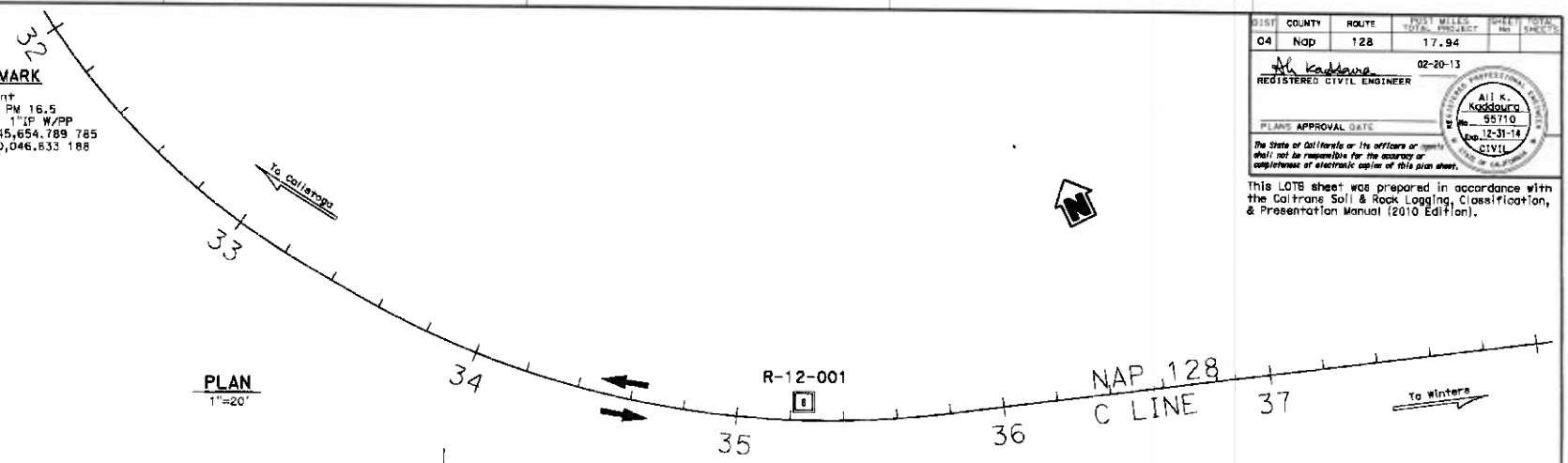
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

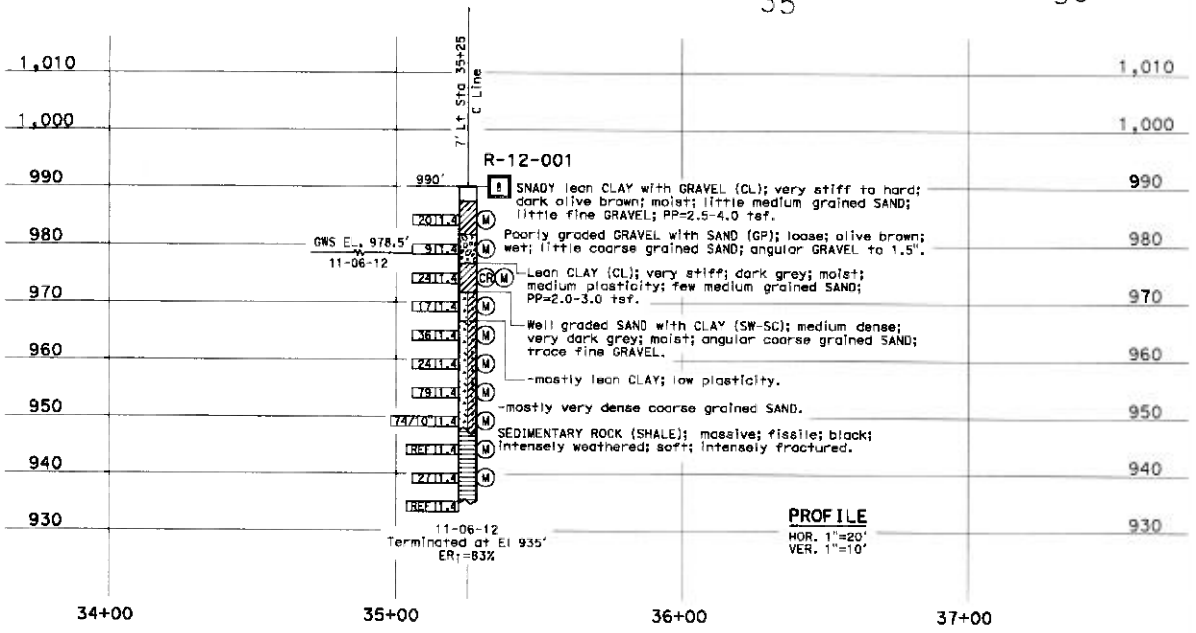
This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (2010 Edition).

## BENCH MARK

Survey Monument
North West of PM 16.5
Name: L0406 1"IP W/PP
Northing: 1,945,654.789 785
Easting: 6,480,046.833 188
Elev. 930.221'

## PLAN
1"=20'




| ENGINEERING SERVICES | | GEOTECHNICAL SERVICES | | STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION | DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH | BRIDGE NO. | SOLDIER PILE WALL |
|---|---|---|---|---|---|---|---|
| FUNCTIONAL SUPERVISOR | | DRAWN BY: M. Reynolds 01/13 | FIELD INVESTIGATION BY: A. Kaddoura | | | POST MILES 17.94 | LOG OF TEST BORINGS 1 of 1 |
| NAME: H. Nikoui | | CHECKED BY: R. Nashed | | | | | |

GWS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3960 PROJECT NUMBER & PHASE: 04000000000 CONTRACT NO.: 04-2G940U

DISREGARD PRINTS BEARING EARLIER REVISION DATES

FILE =\ LOTB 0400000000p001.dgn

# FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**
1. Preliminary Report
2. R.E. Pending File
x 3. Specifications & Estimates
4. File

**Geotechnical Services**
1. GS (Sacramento)
x 2. GS

Date: 5/28/15

KNOXVILLE RETAINING WALL
Structure Name

04 - NAP-128 - PM 17.94
District County Route Post Mile

**District** 04- Yanzhi Zhai
District Project Engineer

04-2G9401
E.A. Number

21E0018
Structure Number

Foundation Report By: M. ZABOLZADEH/A. KADDOURA Dated: November 21, 2014

Reviewed By: _____ (OSD) A. KADDOURA (GS)

General Plan Dated: 04/15/15 Foundation Plan Dated: 04/15/15

[ ] No changes. [X] The following changes are necessary.

**PLANS**

Sheet 7 of 7-LOTB Sheet: Please replace the LOTB sheet with the attached revised LOTB.

**FOUNDATION CHECKLIST**

| | | |
|---|---|---|
| ___ Pile Types and Design Loads | X Footing Elevations, Design Loads, and Locations | X LOTB's |
| X Pile Lengths | X Seismic Data | ___ Fill Surcharge |
| ___ Predrilling | X Location of Adjacent Structures and Utilities | ___ Approach Paving Slabs |
| ___ Pile Load Test | ___ Stability of Cuts or Fills | ___ Scour |
| ___ Substitution of H Piles For Concrete Piles [ ] Yes [X] No | ___ Fill Time Delay | X Ground Water |
| | ___ Effect of Fills on Abutments and Bents | ___ Tremie Seals/Type D Excavation |

Nasser Tachta 9
Office of Structure Design Section No.

A. Kaddoura
ALI KADDOURA
Geotechnical Services

Rev. 10/02

| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No | TOTAL SHEETS |
|---|---|---|---|---|---|
| 04 | Nap | 128 | 17.94 | | |

Ali Kaddoura 02-20-13
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Ali K. Kaddoura — No. 55710 — EXP. 12-31-16 — CIVIL — STATE OF CALIFORNIA

*The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.*

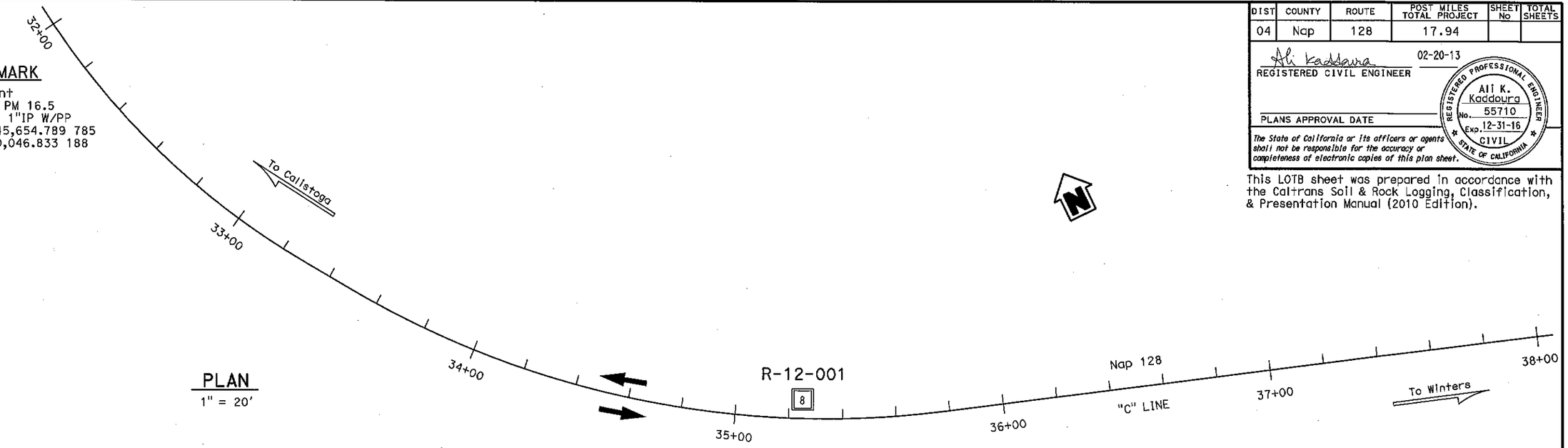
This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (2010 Edition).

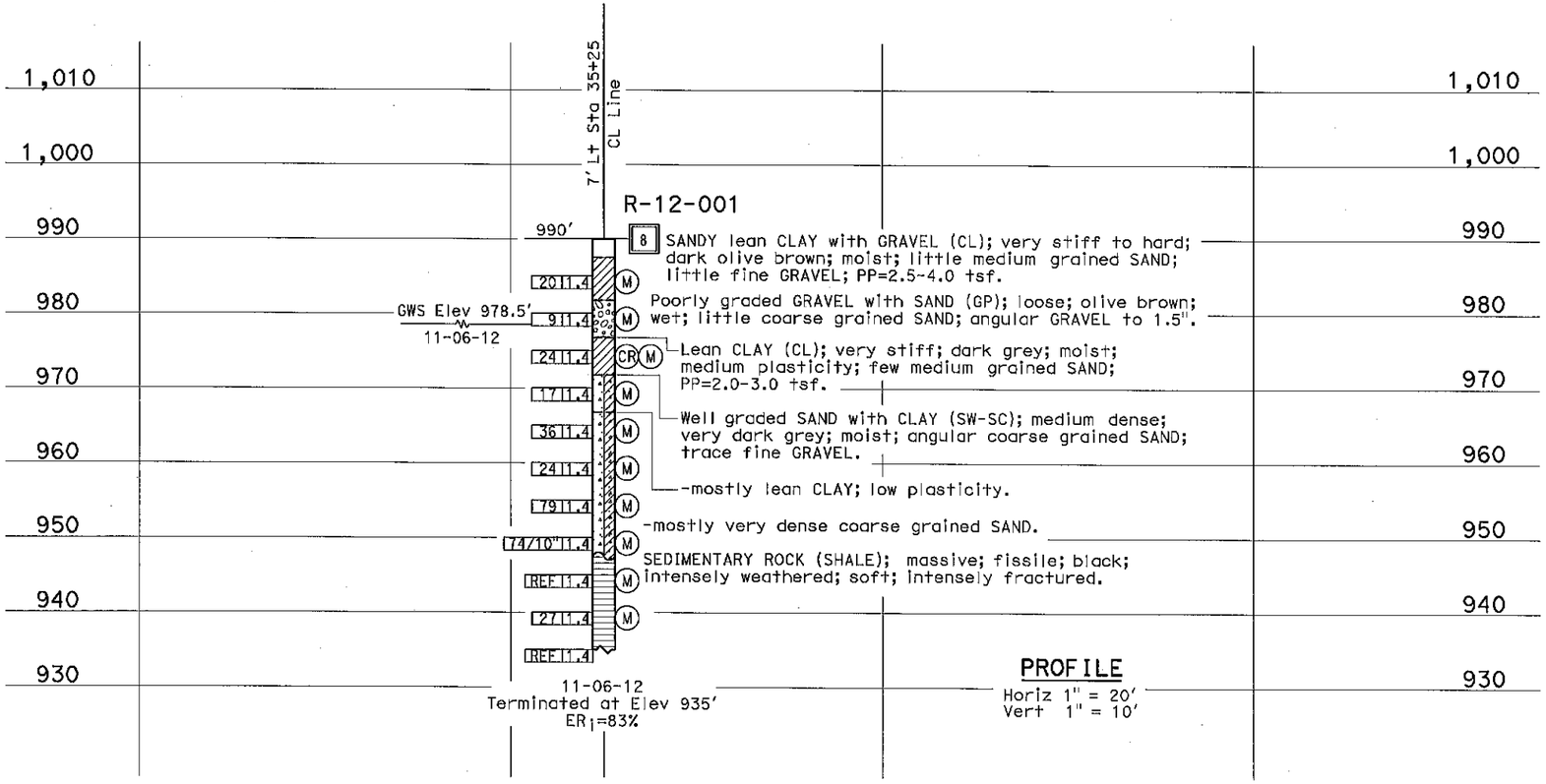
## BENCH MARK

Survey Monument
North West of PM 16.5
Name: LD406 1"IP W/PP
Northing: 1,945,654.789 785
Easting: 6,480,046.833 188
Elev. 930.221'

## PLAN

1" = 20'




## PROFILE

Horiz 1" = 20'
Vert 1" = 10'

| ENGINEERING SERVICES | | GEOTECHNICAL SERVICES | STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION | DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH | BRIDGE NO. 21E0018 POST MILES 17.94 | KNOXVILLE RETAINING WALL LOG OF TEST BORINGS 1 of 1 |
|---|---|---|---|---|---|---|
| FUNCTIONAL SUPERVISOR NAME: H. Nikoui | DRAWN BY: M. Reynolds 01/13 CHECKED BY: R. Nashed | FIELD INVESTIGATION BY: A. Kaddoura | | | | |

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3660
PROJECT NUMBER & PHASE: 0400021254 1 CONTRACT NO.: 04-2G9404

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

| REVISION DATES | | | | SHEET | OF |
|---|---|---|---|---|---|
| | | | | 7 | 7 |

FILE => 21E0018-a-lotb1.dgn

INSERNAME => s1295608 DATE PLOTTED => 28-MAY-2015 TIME PLOTTED => 08:59

State of California
**DEPARTMENT OF TRANSPORTATION**

California State Transportation Agency

# Memorandum

***Serious drought.***
***Help Save Water!***

**To:** MR. JAMES LEY
Senior Transportation Engineer
04 Deputy Project Development North

**Date:** May 14, 2015

**Attention:** Y. Zhai

**File:** 04- NAP- 128 PM 17.59
E-FIS # 0400021254
Knoxville Retaining Wall
(Seepage Rate)

**From:** RIFAAT NASHED RN
Engineering Geologist
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

CHRIS RISDEN
Chief, Branch B
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

PROFESSIONAL GEOLOGIST
CHRIS RISDEN
CERTIFIED ENGINEERING GEOLOGIST
No. 2241
Exp. 9/13/15
STATE OF CALIFORNIA

**Subject : SEEPAGE RATE (FLOW RATE) ESTIMATE AT KNOXVILLE SOLDIER PILE RETAINING WALL**

This memo is in response to your request to provide the approximate groundwater seepage rate for the soldier pile retaining wall at the above mentioned site. It is our understanding that this information will be used in estimating dewatering quantities.

It should be noted that our estimates are based on the following:

1- The geologic subsurface information from borehole No. R-12-001 was used for estimating the seepage rate for the entire soldier pile retaining wall.

2- The groundwater elevation at Boring # RW-12-001 is used for our calculation to estimate seepage rate for the entire soldier pile retaining wall. We considered the groundwater elevation to be 298.2 m (978.5 ft) above sea level, as measured on November 6, 2012.

3- The ground surface elevation for the soldier pile wall ranges between 301.4 m (988.95 ft) and 300.2 m (984.95 ft). We considered the ground surface elevation to be 300.2 m (984.95 ft) for the entire wall as the most conservative estimate.

4- The pile tip elevations range between 292.5 m (959.78 ft) and 290.7 m (953.87 ft). In our calculation, we considered the pile tip elevation to be 290.7 m (953.87 ft) for the entire wall as the most conservative estimate.

Based on the Boring R-12-001, the soils encountered below the groundwater are, poorly graded gravel (GP), well graded sand with clay (SW-SC), and lean clay (CL) with sand.

We used the Coefficient of Permeability, K value 4.83429e-$^{05}$ (13.7 ft/day) for poorly graded gravel, 9.52744e$^{-10}$ m/s (2.7x $10^{-4}$ ft/day) for lean clay, 4.941015e-$^{06}$ (1.4 ft/day) for well graded sand with clay, and , 9.52744e$^{-9}$ m/s (2.7x $10^{-3}$ ft/day) for lean clay with sand.

According to "The Federal Highway Report NO. FHWA-TS-80-224, Page 48-49" the Coefficient of Permeability K (ft/day) for the soils encountered are as follows:

| Unified Soil Classification | Coefficient of Permeability K (ft./day) | Coefficient of Permeability K (m/s) |
|---|---|---|
| Poorly graded gravel (GP) | 13.7 to 27,400 | 4.83429e-$^{05}$ to 0.096685863 |
| Lean clay (CL) | 2.7x$10^{-5}$ to 2.7x $10^{-3}$ | 9.52744e-$^{11}$ to 9.52744e-$^{09}$ |
| Well graded sand (SW) | 1.4 to 137 | 4.941015e-$^{06}$ to 4.83429e-$^{04}$ |
| Clayey sand (SC) | 2.7x$10^{-5}$ to 0.14 | 9.52744e-$^{11}$ to 4.941015e-$^{07}$ |

Our estimate of the seepage rate (flow rate) for this site is approximately 3,400 gallon /day/ hole.

These estimates of seepage rate are provided for estimates only and should not be used as a base line value for dewatering quantities.

If you have any questions or need additional information, please call Rifaat Nashed at (510) 622-1773 or Cris Risden at (510) 622-8757.

c: TPokrywka, CRisden, Daily File

RNashed/mm

## Knoxville Retaining Wall - SEEPAGE RATE

| Soil Type | Bed thickness L (m) | K m/s | √K | GW ELEV. (m) | Pile Tip elev. (m) | H | $H^2$ | $hw^2$ | $R_0$ | Tw (m) | Q $m^3/s$ | Q $ft^3/sec$ | Q $ft^3/day$ | Q Gallon/day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| Poorly gradwd sand (GP) | 0.5 | 0.000483429 | 0.021987019 | 298.2 | 290.70 | 0.5 | 0.25 | 0 | 32.98053 | 0.61 | 9.51056E-05 | 0.003358624 | 290.185094 | 2165.6 |
| Lean clay (CL) | 1.5 | 9.52744E-10 | 3.08666E-05 | 298.2 | 290.70 | 2 | 4.00 | 0 | 0.185199 | 0.61 | -1.0039E-08 | -3.5452E-07 | -0.03063013 | 0.0 |
| Well graded sand with clay (SW-SC) | 1.5 | 4.94015E-06 | 0.002222645 | 298.2 | 290.70 | 3.5 | 12.25 | 0 | 23.33777 | 0.61 | 5.21415E-05 | 0.00184136 | 159.093477 | 1187.3 |
| Lean clay with sand (CL) | 4.4 | 9.52744E-09 | 9.76086E-05 | 298.2 | 290.70 | 7.9 | 62.41 | 0 | 2.313324 | 0.61 | 1.40067E-06 | 4.94642E-05 | 4.27370697 | 31.9 |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| AVERAGE | | | | | | | | | | | | | | **3384.7** |

*$Q = \pi K (H^2 - hw^2) / Ln(R_0/T_w)$..... Dupuit Forcheimer Equation

**Notes**

Length = bed thickness

Perimeter = is the circumference of the pile (hole) = 2 PI r

A = The cylender surface area = 2 PI r x Length

k = Soil permeability (from Hwy Subdrainage Design Report No. FHWA - TS-80-224- Page 48-49)

H = ground water elevation

$h_w$ = the pile tip (bottom of the hole)

$R_0$= radius of influnce of hole or point source

= 3000(H-hw) √ K for radial flow

= 1500 (H-hw) √ K for trench / linear flow

$T_w$ = hole diameter

= √ length of excavation area X width of excavation area / π

Q = pumping rate

* Equation obtained from powers, J.P., A.B. Corwin, P.C. Schmall, and W.E. Kaeck, 2007. Construction Dewatering and Groundwater Control, New methods and applications. John Wiley & Sons, Inc., 3rd Edition.