VEGETATION RESTORATION PLAN

PG&E GAS TRANSMISSION LINE 109 CRYSTAL SPRINGS PIPELINE REPLACEMENT PROJECT

Prepared for

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Section 1. INTRODUCTION

1.1. PURPOSE

This Vegetation Restoration Plan details restoration and monitoring activities for areas disturbed during construction of the Pacific Gas and Electric Company (PG&E) Gas Transmission Line 109 Crystal Springs Pipeline Replacement Project (Appendix A, Figure 1). The project is on land owned by the San Francisco Public Utilities Commission (SFPUC) in San Mateo County.

This plan discusses revegetation planning and monitoring efforts including: a brief description of the work areas; a summary of vegetation communities, trees, and special-status plant species potentially impacted by project activities; recommendations for site revegetation, including seed mixes and seeding methodology; and monitoring and reporting for the project. This plan complies with all relevant requirements of the Final Mitigated Negative Declaration for the project (San Francisco Planning Department May 2, 2016), as shown in Appendix E.

1.2. PROJECT LOCATION

The Crystal Springs project site is located on the eastern edge of the Peninsula Watershed, north of Crystal Springs Road and immediately east of Interstate 280 (Appendix A, Figure 1).

The Peninsula Watershed is owned by the City and County of San Francisco and is managed by the San Francisco Public Utilities Commission (SFPUC) Natural Resources Division. The Natural Resources Division is responsible for monitoring, protecting, and restoring those lands and ecological resources under the management of the SFPUC. Land uses of the Peninsula Watershed are primarily water collection, storage, delivery and associated facilities, recreation trails, and open space. Other land uses include Crystal Springs Golf Course and PG&E utilities and transmission rights-of-way. Surrounding land uses to the north and east are primarily residential and include the communities of Pacifica, San Bruno, Millbrae, Burlingame, Hillsborough, Belmont, San Mateo, San Carlos, and Woodside.

Vegetation within the project area consists of serpentine bunchgrass grassland, non-native grassland, coyote brush scrub, coast live oak woodland (upland and riparian), and non-native shrubland/non-native woodland. Annually disked firebreaks are present in grassland communities. There is an unpaved, mowed, vegetated access road that runs the length of the project area.

Serpentine bunchgrass grassland is considered a sensitive natural community (Orion Environmental Associates 2013).

1.3. PROJECT SUMMARY

PG&E proposes to replace an approximately 1.2-mile segment of gas pipeline located approximately 0.9 mile northwest of the Bunker Hill segment (Appendix A). This segment, which parallels I-280, begins north of San Mateo Creek Canyon and terminates at a point north of the Black Mountain Road and Hayne Road intersection. The existing pipeline, with a diameter of 22 inches, would be replaced in place with a combination of 24-inch-diameter and 30-inch-diameter pipeline.

The new pipeline would follow the existing route, but would be offset from the existing alignment by approximately 5 to 7 feet. The new pipeline would be routed further from L109 and the ROW adjusted to avoid nearby Marin dwarf flax (*Hesperolinon congestum*) populations (Appendix A).

Section 2. PROJECT IMPACTS AND REVEGETATION

This section describes potential impacts on vegetation communities, trees, and special-status plant species, invasive weeds, and the revegetation actions that will be undertaken to reestablish vegetation in the work area[1].

Protocol-level special-status plant surveys were conducted for the project on select dates in 2013 by Orion Environmental Associates (Orion Environmental Associates 2013). During these surveys all plant species observed were recorded including non-native and invasive plant species. Marin western flax (*Hesperolinon congestum*, California Rare Plant Rank 1B.1, federally- and state-Threatened) and Crystal Springs lessingia (*Lessingia arachnoidea*; California Rare Plant Rank 1B.2) were documented in the project area in 2013. Marin western flax was surveyed for and mapped in the project area in 2016 (Orion Environmental Associates 2016). Crystal Springs lessingia in the work area was mapped and counted in the project area in August 2016 (Nomad Ecology 2016b in Appendix D).

The location of vegetation communities on site were mapped in 2013 (Orion Environmental Associates 2013). The location of vegetation communities in the project area were field checked and updated by Nomad Ecology in 2016. The locations of invasive weeds were mapped in August 2016 by Nomad Ecology. Figures in Appendix A show the location of the work area and the botanical resources including vegetation communities, special-status plants, and invasive weeds

Baseline vegetation cover data collected in serpentine grassland and non-native grassland is provided in Appendix D. PG&E will provide any additional vegetation sampling baseline data collected in 2017 as part of the As-Built Plan or in the Monitoring Plan Report as appropriate..

2.1. VEGETATION COMMUNITIES

2.1.1 PROJECT IMPACTS

Vegetation communities that will be impacted by the project include serpentine bunchgrass grassland, non-native grassland, coast live oak woodland, non-native woodland, and non-native shrubland (Table 1). Some of the non-native grassland to be disturbed is located in fire breaks that are annually disked by SFPUC. Some of the non-native grassland and serpentine bunchgrass to be disturbed is located in areas that are mowed annually by SFPUC, both to provide a fuel break and access road.

[1] Special-status plant species are those listed as Endangered, Threatened, or Rare by the U.S. Fish and Wildlife Service and/or the California Department of Fish and Wildlife, as well as plant species included in the California Native Plant Society's *Inventory of Rare and Endangered Plants of California,* including CNPS Ranks 1A, 1B, 2A, and 2B. Rank 4 plants also may be considered to have special-status on a case-by-case basis if they are determined to be locally significant.

Table 1. Impacts by Vegetation Community

VEGETATION COMMUNITY	APPROX. IMPACT (ACRE)
serpentine bunchgrass grassland (undisked, some is mowed)	3.38
non-native grassland (undisked, some is mowed)	3.55
coast live oak woodland	0.6
non-native woodland (undisked)	4.36
non-native shrubland	0.52
disked fuel break (non-native grassland and non-native woodland understory)	3.09
Total to be Revegetated	15.50

Notes: The amount of vegetation disturbed will be re-confirmed following construction.
The total acreage of revegetation will be adjusted, if needed, based on the as-built condition.

2.1.2 REVEGETATION

Mitigation will consist of at least a 1:1 ratio of onsite restoration of plant communities. The revegetation goal is to return vegetation to as close to pre-construction conditions as possible with the exception of non-native trees and shrubs and disked fire breaks. Non-native shrubland and non-native woodland may be converted to grassland communities as tree and shrub removal is required for project construction and trees and shrubs may not be replanted based on SFPUC input. In addition, the area near the centerline cannot be planted with trees or woody vegetation as required for pipeline safety (PG&E 2014). All disturbed areas will be revegetated with locally collected native plant species. All revegetation will be accomplished by direct seeding grasses and forbs on site, and direct seeding trees off site as appropriate.

To decrease the possibility of introducing pathogens (including *Phytophthora*) from a plant nursery to the site, container stock will not be used for revegetation. Seed mixes, plant palettes, and seeding methodology are described in Section 3, Revegetation Activities. Areas where existing land management practices are not compatible with native plant restoration on those areas, such as the SFPUC fire break, will be exempt from continued management/monitoring after initial restoration. Similarly, vegetation restoration will be implemented on pre-existing vegetated access roads, however they will be exempt from continued management/monitoring after initial restoration implementation. However, if there is a continued source of non-native invasive species which have a Cal-IPC Weed Ranking Definition of High (Cal-IPC 2016), targeted non-native invasive removal will occur annually within the project limits.

2.2. TREES

2.2.1 PROJECT IMPACTS

Please note tree removal occurred after the following section was drafted, using the measures in this plan. An As-Built plan will be prepared that will include details of final tree removal.

There are an estimated 85 native and 225 non-native or introduced trees that will be removed for project construction (Table 2). Of the 85 native trees to be removed, 76 are coast live oak (*Quercus*

agrifolia) and 9 are California bay (*Umbellularia californica*). 45 of the native trees are considered to be significant trees and 3 are considered to be heritage trees as defined in the San Mateo County Tree Ordinance[2].

Non-native tree species to be removed include Monterey pine (*Pinus radiata*), Monterey cypress (*Cupressus macrocarpa*), Canary Island pine (*Pinus canariensis*), acacia (*Acacia mearnsii* and *A. julibrissin*), cork oak (*Quercus suber*), and eucalyptus (*Eucalyptus* sp.) (Western ECI 2014). Of the 225 nonnative or introduced trees to be removed, 191 are considered to be significant trees and none are considered to be a heritage tree.

Table 2. Proposed Tree Removal

TREE SPECIES	TOTAL NO. OF TREES TO BE REMOVED	SIGNIFICANT TREES TO BE REMOVED	HERITAGE TREES TO BE REMOVED
Coast live oak (*Quercus agrifolia*) (native)	76	40	3
California bay (*Umbellularia californica*) (native)	9	5	0
non-native or introduced trees	225	191	N/A

Source: Western ECI 2014

The number of trees removed will be tracked and confirmed prior to the implementation of restoration activities.

Tree trimming will be required where the tree canopy overhangs access roads or at other locations to provide equipment access. 40 total trees are expected to be trimmed (37 Monterey cypress, 1 Eucalyptus, 1 Monterey Pine, and 1 "other"; all of which are considered Significant Trees) (Western ECI 2014). The degree of trimming is evaluated by a qualified arborist on a case by case basis; where trimming is considered likely to impact the health or stability of the tree, the tree is then included in those to be removed and it will not be left standing as a hazard tree. The information as to final counts of trimmed versus removed trees, which may vary slightly due to construction requirements, will be included in the As-Built information.

2.2.2 REVEGETATION

Significant or Heritage Trees in the work area are defined in the San Mateo County Tree Ordinance. In compliance with the Final MND, removal of any Significant or Heritage Trees as well as any other native oak trees will be replaced at a 3:1 ratio. As discussed in Section 3.7, a total of 3 acorns per tree will be used at each planting location. Removal of any other native or non-native trees will be replaced at a 1:1 ratio. With the exclusion of non-natives, replacement trees will be the same species as those removed, unless otherwise approved. Trees will be direct-seeded rather than planted with container stock. Additional trees beyond those impacted will be direct-seeded to allow for some mortality and ensure replacement ratios are met after five years. Details regarding direct-seeding are included in Section 3.7.

[2] The San Mateo Tree Ordinance defines "significant trees" as "any live woody plant rising above the ground with a single stem or trunk of circumference of 38 inches and having the inherent capacity of naturally producing one main axis". "Heritage trees" are defined as several tree species found in the county based primarily on their dbh, which is considered to be 4.5 feet above ground.

All tree planting on SFPUC land would require approval by SFPUC. Furthermore, trees may only be seeded outside of restricted areas away from the pipeline centerline as required for pipeline safety (PG&E 2014)[3]. Due to this restriction, seeding of trees in narrow portions of the work area could potentially be confined to the site periphery. However, to avoid unnatural, dense, linear plantings, it is preferable to seed trees in a pattern and density that reflects the surrounding vegetation patterns and preexisting tree densities, as feasible. Given these constraints, it may not be possible or desirable to perform these plantings within the easement or on nearby SFPUC land. If insufficient room occurs in the work area due to pipeline safety standards and SFPUC vegetation management policies, direct seeding of trees likely may need to be performed elsewhere with California Department of Fish and Wildlife (CDFW) approval.

PG&E has verbally communicated with SFPUC and since approval of the Bunker Hill VRP, has discovered that SFPUC does not consider onsite mitigation of trees to be a viable option and that all trees must be planted offsite. PG&E is currently exploring a tree mitigation plan nearby with San Mateo County Parks, and seeking CDFW approval of this plan. As necessary, other agreed-upon mitigation may need to be performed to meet revegetation goals commensurate with level of effort and expenditure associated with tree planting mitigation.

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2.3. SPECIAL-STATUS PLANTS

2.3.1 IMPACTS

One special-status plant species, Crystal Springs lessingia (*Lessingia arachnoidea*; California Rare Plant Rank 1B.2) was recorded within the planned work area and will be impacted (Orion Environmental Associates 2013; Nomad 2016b) (Table 3). The locations of Crystal Springs lessingia plants were mapped again and the numbers of plants reconfirmed in August of 2016 (Nomad 2016b in Appendix D).

No List 4 plants were found that would meet the locally rare criteria, and neither were any plant communities found that would be considered rare locally but common elsewhere.

Marin western flax (*Hesperolinon congestum*, California Rare Plant Rank 1B.1, federally- and state-Threatened) is present within the project area but will be fully avoided through protective measures as described in the Preliminary Mitigated Negative Declaration (San Francisco Planning Department 2016). The ROW has been narrowed or otherwise adjusted in several areas to avoid the Marin western flax populations. Populations of Marin western flax were fenced and will continue to be fenced and avoided during construction.

Table 3. Impacts to Special-Status Plant Species

SPECIAL-STATUS PLANT SPECIES	NO. OF PLANTS IN PROJECT AREA IN 2013	NO. OF PLANTS IN PROJECT AREA IN 2016 (80% CONFIDENCE INTERVAL)	NO. OF PLANTS IN PROJECT AREA IN 2016 (95% CONFIDENCE INTERVAL)
Crystal Springs lessingia (*Lessingia arachnoidea*)	20,412*	215,414 (± 62,663)**	215,414 (±95,834)**

[4] For example, trees, woody shrubs, or woody vegetation that may exceed 8 inches diameter at breast height at maturity cannot be planted within 10 feet of the pipeline centerline. Trees expected to grow to or exceed 36 inches diameter at breast height cannot be planted within 14 feet of the pipeline centerline.

*Reflects estimates based on surveys by Orion Environmental Associates 2013.
**Plant counts were re-confirmed in 2016 by Nomad Ecology. Details of the sampling methodology are included in Appendix D.

2.3.2 SALVAGE AND REVEGETATION

In order to restore impacted Crystal Springs lessingia habitat, seed that was collected in 2015 and 2016 prior to the start of construction will be stored during construction and distributed in the work area once construction is complete. Details of Crystal Springs lessingia restoration are included in the Technical Memorandum in Appendix B (Nomad 2016a).

Seed was collected from the gas line pipeline right-of-way (ROW) and project work area on October 2, 5, and 6, 2015 and is planned for late September and early October 2016. In 2015, seed was collected by collecting whole plants and putting them in paper bags. Inflorescences were stored indoors in paper bags for several weeks to allow seeds to further mature. Seeds were separated from other plant material (stems, inflorescence branches, and flowering parts) by hand sorting them in plastic containers. Seeds and fine chaff were stored in paper envelopes indoors in a cool, dry, dark storage room. The number of seeds collected and stored from 2015 collection efforts is estimated to be 100,000 seeds. Lessingia seed collection in 2016 will also follow these methods. Topsoil and surface material in occupied habitat will also be salvaged during construction activities as detailed in Section 3.4.

2.4. INVASIVE WEED SPECIES

2.4.1 IMPACTS

Project-related activities may potentially introduce or spread invasive weed species[4] within the work areas. Several invasive weed species known to be present on the Peninsula Watershed and tracked by SFPUC (Nomad Ecology 2009) were recorded in the project area (Orion Environmental Associates 2013). Additional field surveys were performed by Nomad in August 2016 to map the locations of invasive weeds and identify if any new species of invasive weeds occur. A weed management plan is included as Appendix C to this document.

Several invasive weed species were identified during weed surveys were recorded in the work areas during preconstruction surveys conducted in August 2016 (Table 4). These include: French broom (*Genista monspessulana*), Scotch broom (*Cytisus scoparius*), stinkwort (*Dittrichia graveolens*), Italian thistle (*Carduus pycnocephalus*), bull thistle (*Cirsium vulgare*), Harding grass (*Phalaris aquatica*), poison hemlock (*Conium maculatum*), privet (*Ligustrum sp*.), English ivy (*Hedera helix*), acacia (*Acacia* sp.), cotoneaster (*Cotoneaster* sp.), hawthorn (*Crataegus monogyna*), yellow starthistle (*Centaurea solstitialis*), teasel (*Dipsacus sativus*), bristly ox-tongue (*Helminthotheca echioides*), and sweet fennel (*Foeniculum vulgare*). Figures showing the location of noxious weeds are included in Appendix A.

These weed species will be considered target invasive weeds for monitoring and possible control as part of this plan. Portions of the right of way are currently disked for fire control (see Photographs in Appendix F). The percent cover of weeds following restoration that will be considered acceptable is

[4] For the purposes of this document, invasive weeds are plant species that are listed on the California Noxious Weed List (CDFA 2016) or have a Cal-IPC Weed Ranking Definition of High (Cal-IPC 2016). Some (but not all) species with a Cal-IPC Weed Ranking Definition of Moderate will also be considered invasive weeds particularly if they are a species of high concern for the SFPUC Watershed. Plants that are considered Moderate or High shall not be used in re-vegetation areas.

based on existing baseline cover data and comparison to reference sites and is addressed in Section 4.1, Success Criteria.

The project also has the potential to spread non-native annual grass species from non-native grassland portions of the work area into the serpentine bunchgrass grassland portion of the work area. Non-native annual grass species including ripgut brome *(Bromus diandrus),* wild oats *(Avena fatua),* and Italian ryegrass (*Festuca perennis*) are present in abundance on site in non-native annual grassland/disturbed portions of the work area. Non-native annual grasses are known to pose a threat to serpentine grasslands in the region. The project will minimize the introduction, spread, and/or proliferation of non-native grasses in serpentine grassland portions of the work area. Implementation of minimization measures will reduce the likelihood that non-native grasses that are present and have been observed under existing conditions at the site prior to the start of work, will be spread into serpentine grassland portions of the work area.

2.4.2 MINIMIZATION MEASURES

Minimization measures will be implemented before and during construction to minimize the spread of invasive weed species. Minimization measures are summarized in Appendix C, Weed Management Plan.

2.4.3 REVEGETATION

The site will be revegetated as soon as possible and within the same calendar year if possible. Construction could extend into a second calendar year, depending on the start date, and the site would be restored immediately after construction is completed or if conditions are dry, PG&E would consult with SFPUC on the timing of seeding.

The site will be revegetated with locally collected materials to reduce the likelihood of invasive weed and non-native plant establishment. All restoration activities will follow this VRP. All seed mixes will be weed free and will contain an analysis label detailing the contents of the seed mix. Revegetation activities are detailed in Section 3.

The site will be monitored annually for five years. Monitoring includes an invasive weed component. Success criteria and monitoring methodology are detailed in Section 4.

Invasive weed species will be removed and controlled in all revegetated areas during the five-year monitoring period as necessary to stay on track to meet success criteria. Non-native plant species, including annual grasses, will be controlled in serpentine grassland areas as necessary to keep the site on track to meet success criteria. For details on remedial activities including when they will be initiated, please refer to Section 4.

2.5. SOIL-BORNE PATHOGENS

2.5.1 IMPACTS

The project has the potential to spread soil borne pathogens. Implementation of minimization measures for reducing the spread of invasive weeds (as detailed in Appendix C, Weed Management Plan), as well as sanitation measures detailed below, will reduce the likelihood that soil borne pathogens are introduced or spread in the project area.

2.5.2 MINIMIZATION MEASURES

Minimization measures will be implemented before and during construction to minimize the spread of soil-borne pathogens. Minimization measures to minimize the spread of invasive weed species are summarized in Appendix C, Weed Management Plan.

Environmental Training

Information on soil borne pathogens will be included in the preconstruction environmental tailboard meeting that will be given to all construction personnel. The training will include a summary of *Phytophthora*, its issues, spread, and Best Management Practices based on SFPUC's BMPS for Pathogens (SFPUC 2016). The biological monitor will ensure that construction staff understand provisions for soil-borne pathogen spread prevention throughout the project. Soil-borne pathogen considerations will be routinely addressed during regular tailboard meetings. The monitoring biologist shall ensure that all staff have participated in the training by establishing and keeping a sign-in sheet that will record attendees.

Cleaning of Equipment and Vehicles

All equipment and material arriving on site will be clean and free of soils and plant material except for materials such as coir or fiber rolls which are made with plant material themselves; those will be kept clean of foreign plant material and soils. Wash stations will be established near the work area access points to local roadways. Contractor vehicles and equipment that have been used or driven off-road prior to arriving at the proposed project sites will be cleaned upon arriving on site at the on-site wash stations before entering further into the work site, to minimize bringing invasive weed propagules, plant pathogens, insects, and soil from elsewhere onto the project. Vehicles as described that require washing will not access the work site without using one of the wash stations. In compliance with the MND, vehicle cleaning will remove soil, seeds, and plant parts from the undercarriage, tires, sideboards, tailgates, and grills of all vehicles and equipment.

The construction workers will also brush off soil and plant material off of their boots at the wash station and decontaminate with quaternary ammonia solution or isopropyl alcohol (70-90%).. In lieu of multiple decontaminations, crew personnel can choose to have two pairs of boots (one cleaned prior to entry to SFPUC and one for use outside SFPUC) if they so choose. In this case, the boots would only be washed once prior to entry to SFPUC property, and be left on site. The monitoring biologist will verify the condition of the equipment and vehicles for proper cleaning before entering the project site.

Boots worn during restoration implementation and any hand-equipment such as shovels, spades, trowels, will also be brushed clean, washed in the vehicle wash station or immediately prior to being brought on site, and sprayed with a 0.525% sodium hypochlorite concentrations (5000 ppm available chlorine) bleach solution or preferably a 70-90% ethyl alcohol (ethanol) or isopropyl alcohol (isopropanol) solution (such as Lysol disinfectant or a prepared solution) to sanitize the equipment for invasive plant and soil borne pathogen control. The chart below will be used to prepare bleach solutions. For example, adding 100 ml of 5.25% bleach to 900 ml of water will make 1000 ml of 0.525% NaOCl solution. If using 8.3% bleach, 100 ml of bleach would be added to 1480 ml of water to make 1490 ml of 0.525% NaOCl.

Dilutions of commonly available bleach products needed to obtain approximately 0.525% sodium hypochlorite concentrations (5000 ppm available chlorine).

Percent sodium hypochlorite in bleach	Parts bleach	Parts water	Diluted bleach percent sodium hypochlorite
5.25%	1	9	0.525%
6.0%	1	10.4	0.526%
8.25%	1	14.6	0.529%

8.3%	1	14.8	0.525%

Table 4. Invasive Weeds Observed in the Vicinity of the Project Area

Common Name Scientific Name	California Invasive Plant Council Rank (Cal-IPC 2016)*	California Department of Food and Agriculture Noxious Weed List (CDFA 2016)**	Location on Crystal Springs Project Site
acacia *Acacia sp.*	Limited-Moderate (depending on species)	On List	North of Hayne Rd., one tree in between stations 56+00 and 55+00 near the transmission tower. Northeast of Skyline Blvd., multiple trees between stations 59+00 and 65+00. Additional plants may be present in the dense non-native woodland and scrub north of Skyline Blvd.
Italian thistle *Carduus pycnocephalus* subsp. *pycnocephalus*	Moderate	On List	One population in access easement in project area southeast of Caltrans rest stop; between stations 2+00 and 3+00.
bull thistle *Cirsium vulgare*	Moderate	On List	Multiple patches throughout project work area. Southeast of Caltrans rest stop near station 1+00. Two patches directly east of Caltrans rest stop, between stations 11+00 and 11+88. One patch between stations 18+00 and 19+00. One patch straddling the gas line, between stations 22+00 and 23+00. One patch at station 25+00, overlapping with a teasel weed patch. One patch near station 31+00. Two patches parallel to Black Mountain Rd.: one patch near station 37+00, one patch on the western edge of the work area between stations 51+00 and 52+00.
poison hemlock *Conium maculatum*	Moderate	---	One patch on scrub edge between stations 60+00 and 62+00, next to multiple *Acacia* sp. trees.
Cotoneaster *Cotoneaster sp.*	Moderate	---	Two individuals directly west of gas line between stations 62+00 and 63+00. Additional plants may be present in the dense non-native woodland and scrub north of Skyline Blvd.
hawthorn *Crataegus monogyna*	Limited	---	Two individuals directly west of gas line between stations 25+00 and 26+00. Additional plants may be present in the dense non-native woodland and scrub north of Skyline Blvd.
Scotch broom *Cytisis scoparius*	High	On List	One patch straddling the eastern project work area boundary between stations 21+00 and 22+00. Overlapping with French broom weed patch.

Common Name Scientific Name	California Invasive Plant Council Rank (Cal-IPC 2016)*	California Department of Food and Agriculture Noxious Weed List (CDFA 2016)**	Location on Crystal Springs Project Site
teasel *Dipsacus sativus*	Moderate	---	Multiple patches throughout project work area. One large patch in straddling the gas line at station 19+00. One patch overlapping with bull thistle weed patch at station 25+00. One patch straddling the western project work area boundary between stations 32+00 and 33+00. One patch slightly overlapping project work area western edge between stations 37+00 and 39+00. Two patches near the Hayne Rd. and Skyline Blvd. intersection: one small patch near station 54+00, one larger patch near station 55+00. One larger patch northeast of Skyline Blvd., straddling the eastern project work area boundary between stations 58+00 and 60+00.
stinkwort *Ditrichia graveolens*	Moderate	On List	In scattered locations from Station 45+00 to the northern end of the project. Plants are growing adjacent to Black Mountain Road in mowed roadside areas. These plants were hand pulled in September 2016, bagged, and removed from site.
sweet fennel *Foeniculum vulgare*	High	---	Present in one location by the Caltrans rest stop on the edge of the project area.
French broom *Genista monspessulana*	High	On List	Several patches scattered throughout the project area, primarily in the understory of non-native woodland. One patch near Station 22+00. One patch near Station 50+00. Several patches in the non-native woodland and shrubland at the north end of the project area between Stations 62+00 and 66+00/
English ivy *Hedera helix*	High	---	Present in one location at the northern end of the project area (Station 65+00). One small individual present.
bristly ox-tongue *Helminthotheca echiodes*	---	---	Present in large patches in three locations, all adjacent to Bunker Hill Road and Skyline Blvd. Stations 32+00 to 34+00, Stations 37+00 to 39+00, and Stations 54+00 to 55+00, primarily in mowed areas.
privet *Ligustrum sp.*	---	---	One dense patch present just south of Skyline Blvd under the transmission right-of-way near Station 56+00.
Harding grass *Phalaris aquatica*	Moderate	---	Several patches at the southern and northern ends of the project area. Several patches on the south end of the project from Stations 0+00 to 5+00 in the understory of trees. One patch near Station 41+00. Abundant from north of Hayne Road to the northern end of the project area. The access road from Skyline Blvd. to the northern end of the project area is characterized by dense Harding grass in the road and adjacent.
Spanish broom *Spartium junceum*	High	On List	One patch in the project area near Station 31+00.

Section 3. REVEGETATION ACTIVITIES

3.1. RESTORATION BIOLOGIST

In coordination with the PG&E biologist, a qualified botanist or restoration ecologist will oversee and monitor implementation of this plan. Qualified botanists or restoration ecologists will have a minimum of 5 years of experience working with native habitat restoration and CNPS or equivalent data collection methods or be CNPS certified in these methods; have been trained in the specific methods utilized in this project; and be familiar with the flora of the SF Bay region. For any future change to current principal restoration staff, PG&E will provide copies of proposed replacement staff resumes for CDFW review. If comments on resumes are not received by PG&E within 3 weeks following submittal, it will be assumed that staff have been approved. The PG&E biologist will be responsible for supervising site preparation, approving final seed mixes, and overseeing revegetation activities

3.2. REVEGETATION ACTIVITIES BY VEGETATION TYPE

Table 5 summarizes each vegetation type that will be impacted due to project activities, the revegetation that will occur for that vegetation type, and the seed mix to be used[5].

Table 5. Revegetation Activities by Vegetation Type

VEGETATION COMMUNITY	REVEGETATION	SEED MIX
serpentine bunchgrass grassland	seeding with seed mix (broadcast seeding only)	Serpentine Grassland Mix
non-native grassland	seeding with seed mix (broadcast or hydroseed)	Needlegrass Grassland Mix
coast live oak woodland (upland and riparian)	seeding with seed mix (broadcast or hydroseed), acorn planting, direct seeding trees and shrubs	Oak Woodland Mix
non-native shrubland and non-native woodland	seeding with seed mix (broadcast or hydroseed), direct seeding trees and shrubs	Needlegrass Grassland Mix
disced firebreaks*	seeding with seed mix (broadcast or hydroseed)	Native Annual Mix*

* A seed mix was designed for the disced firebreaks. The seed mix comprises early flowering native annual species that will mature and disperse seed in early spring prior to the discing of firebreaks. These seed of these species will be in the seed bank at the time of discing and may germinate in subsequent years. The fire breaks will be exempt from continued management/monitoring after initial restoration.

3.3. BASELINE DATA COLLECTION AND REFERENCE SITE ESTABLISHMENT

Baseline data collection methodology, potential reference site selection methodology, and baseline cover data collected in August 2016 are included in Appendix D. Additional reference site data in non-

[5] Areas where existing land management practices are not compatible with native plant restoration on those areas, such as the SFPUC fire break, will be exempt from continued management/monitoring after initial restoration. Vegetation restoration will be implemented on pre-existing access roads, however they will not be maintained after initial restoration implementation.

native grassland and serpentine grassland will be collected in spring 2017, as part of the As-Built Plan or in the Monitoring Plan Report as appropriate for the data.

Baseline data was collected in August 2016 to establish baseline conditions prior to the start of construction, document the similarity and differences of the work areas and potential reference sites pre-construction, and to select reference sites that were very similar to work area sites. Baseline data on plant species cover and composition was collected in the serpentine grassland and non-native grassland work areas and potential serpentine grassland reference sites. Categories of plant cover used to reference sites include total percent cover, native species, non-native species, native grass, and non-native grass cover. Data on vegetation cover were collected in the grasslands following the approved methodology from Bunker Hill Line 109 replacement project, so baseline data and potential reference sites could be identified in the draft VRP. Dominant late season species and native and non-native grasses were identifiable during the August sampling. Additional vegetative cover data will be obtained in spring 2017 in the work area and potential reference sites compare late-season vegetative cover to early-season cover and verify that the species composition is similar between the work are and reference sites. These data will be provided as part of the As-Built Plan or in the Monitoring Plan Report as appropriate. Annual monitoring activities following construction will occur only in the spring.

No potential reference sites for non-native grassland were established or sampled because all areas of non-native grassland outside of the work area were either disced or mowed. Potential non-native grassland reference sites will be established and sampled in spring 2017. No reference sites for non-native woodland were established because non-native woodland may be converted to grassland.

A minimum of two reference sites will be chosen for grassland vegetation communities to be impacted and restored (i.e., serpentine grassland and non-native annual grassland). Potential reference sites for serpentine grassland were established and sampled for late-season species in August 2016.

Final reference sites used in annual reports to show progress towards meeting success criteria will be established with approval from the SFPUC and CDFW based on this baseline data collection.

Plant cover data was collected by placing 1 meter x 1 meter quadrats at random locations in the work area and potential reference sites. Within each quadrat, absolute cover of plants was visually estimated and recorded for the quadrat as a whole and for each individual plant species using the California Native Plant Society's (CNPS) method for estimating cover values (CNPS 2014). The CNPS method for estimating cover values uses a "bird's eye view" looking from above and estimating cover for the living plants only (CNPS 2014). Litter/duff were not be included in these estimates and the porosity of the vegetation was taken into consideration when estimating percent cover (CNPS 2014). Percent cover diagrams were used to facilitate cover estimates.

Categories of plant cover used to compare and select work area and potential reference sites include total percent cover, native species cover, non-native species cover, native grass cover, and non-native grass cover. As described in Appendix D, serpentine grassland work area and potential serpentine grassland reference sites have very similar cover values to each other in all categories based on transect by transect comparison as well as the cover averages. Based on August 2016 sampling, the cover averages between work area sites and potential reference sites vary by a few percent for all categories b which is not a significant difference when estimating percent cover over many plots.

To avoid impacts to native plant communities in potential reference sites, soil pits or cores were not obtained; soils types are inferred from surface expression and plant communities characterization. Observations of soil type will be collected at all excavation sites where restoration will occur, at roughly 30 meter intervals in serpentine sites and approximately 50 meter intervals in non-serpentine

grasslands. In areas with homogenous soils, fewer samples will be collected (at intervals spaced more widely apart). If portions of the trench differ in soil type, more samples will be taken (narrower spacing) to capture the range of variation.

The selection of representative potential reference sites was limited due to differences in microtopography, more or less mesic, small scale variation in plant communities, and disturbance regime, among others. Collection of baseline data attempts to account for these differences. Vegetation sampling during annual monitoring will occur in both the impacted work area and associated final reference sites. Results of annual monitoring will be included in annual monitoring reports that will be submitted to CDFW and SFPUC as detailed in Section 4.

3.4. SITE PREPARATION

The following discussion describes construction methods that will be implemented to successfully prepare the work area for revegetation activities. Site preparation is also detailed in Appendix C, Weed Management Plan.

- Vegetation clearing (e.g., mowing, blading, grubbing) in natural vegetation will be limited to the minimum necessary to safely complete construction to preserve existing plants, seeds, and microorganisms. Areas that can be mowed rather than scraped will be identified during preconstruction meetings.
- Tree and shrub removal will be minimized as much as possible. Shrubs and trees that must be removed for safe construction will be cut at ground level and excavated if necessary. Mulch from woody vegetation will be removed from site. Mulched material will not be stored or spread in serpentine bunchgrass grassland. Anticipated tree removal numbers are shown in Table 2. Any change will be documented in As-Builts.
- Stockpiling of material will be allowed only in uplands within established work areas.
- Vehicles and equipment will be parked on pavement, existing roads, and within the identified work areas.
- Soil disturbance and transport will be minimized to the extent possible and topsoil will be managed. The topsoil, where scraping and excavation is necessary, shall be salvaged and stockpiled separately in upland construction work areas. Serpentine grassland topsoil will be salvaged and stockpiled separately and clearly labeled. All topsoil shall be stored in such a way that it is protected from non-native plant propagules, but does not overheat and kill native plant propagules. This shall include placing the stored topsoil where it is not in contact with non-native grassland soil and protecting it with weed-free straw mulch or other suitable cover. Following construction, the salvaged topsoil will be spread over the disturbed area from which it was removed, and the area will be graded to match as close to the pre-construction natural grade as feasible. Once the salvaged topsoil has been spread and the area returned to the pre-existing topography, the area will be revegetated.
- In areas that have a substantial population of non-native plant species (including fire breaks access roads, and non-native woodland areas where trees will be removed), the topsoil will be scraped and stockpiled separately taking care not to spread the topsoil and invasive weed propagules it contains. The topsoil will be stockpiled during construction activities and will be buried below the subsoil during backfill or off-hauled if feasible, and the soils from deeper in the trench placed on the surface. Area where topsoil will be buried due to the presence of invasive weeds will be based on the species present and absolute cover.

- During construction, the biological monitor may remove visible bulbs or roots from the stockpile where feasible and consistent with safety practices. Bulbs and roots will be stored in labeled containers and maintained under dark, dry and secure conditions.
- After construction is completed, the spoils material will be returned to the trench, compacted as required to industry standard guidelines, and the contours returned to as close to pre-project conditions as possible. After final grading is complete, stockpiled topsoil will be spread over the full width of the scraped work area. Care will be taken to not compact the topsoil.
- Grading and compaction of surface soil caused by construction does not provide the ideal conditions for germination and growth of plant species. Soil scarification can ameliorate these conditions. If determined to be necessary by the Project Restoration biologist, portions of the site may be scarified to prepare the site for seeding
- Following construction, the site will be stabilized with appropriate weed-free erosion control materials (coir, weed-free rice straw or jute netting). No plastic monofilament netting will be used.

3.5. SEEDING AND SEED MIXES

3.5.1 TIMING

Sites will be revegetated as soon as feasible after construction completion, as discussed above in Section 2.4.3. Seeding is anticipated to occur in the late fall and early winter before the onset of or during winter rains, and no later than December 15 of the year construction is completed, so that sufficient rainfall and appropriate temperatures are received to trigger germination and support growth. This will avoid the need for irrigation in most cases. If project construction is completed at a different time of year, and seeding cannot occur in late fall or early winter, the site will be temporarily stabilized with BMPs or mulch and the site will be seeded the following late fall.

Planting in fall or winter 2017 is preferable to seeding in early spring, which would likely require irrigation and may have limited success due to the requirements of the seeded species. The need for irrigation will be determined by the PG&E biologist and will be based on the timing of seeding and the amount of precipitation received after seeding.

To compensate for the additional temporal loss of serpentine habitat in the event that initial restoration is not completed by December 15, 2017, PG&E shall submit a mitigation proposal for the anticipated impact (i.e. anticipated date of restoration of serpentine habitat at the project site and resulting requirements for compensatory mitigation, in accordance with the final MND), for approval to CDFW.

3.5.2 SEED MIXES

Baseline vegetation data were collected to determine appropriate seed mixes for the site. In April 2014 data were collected along transects established in serpentine grassland and non-native grassland at the project site (Orion Environmental Associates 2014). Data were also collected in coast live oak woodland and coyote brush scrub at Canada Road (Orion Environmental Associates 2014). This information was used. Additional data were collected in August 2016 during baseline vegetation data collection (Nomad 2016b).

Custom collected and amplified seed will be used along with other seed with geographic and ecological origins as similar as possible to the project area. Grass and forb seed will be purchased from Pacific Coast Seed, S&S Seed, and Hedgerow Farms. Pacific Coast Seed custom collected seed from serpentine grassland and non-serpentine grassland habitats in 2014 and 2015 from a nearby PG&E right-of-way and they are currently amplifying this seed at the S&S Seed growing facility. This seed

will be available for seeding in 2017. Seed of local origin is scarce and the seed mixes will be limited by availability.

Seed mixes for each vegetation type are listed in Tables 6 to 9. Seed lot documentation will be provided to the SFPUC for their review. Proposed seed mixes are subject to change based on recommendations by the PG&E biologist, site conditions, and seed availability. New seed mixes shall be approved by the PG&E biologist before purchase and application. Any changes in seed mix will be provided to CDFW and SFPUC for their review and approval. If comments from CDFW and SFPUC on seed mix changes are not received by PG&E within 3 weeks following submittal, it will be assumed that CDFW and SFPUC approve of the seed mix changes.

Table 6. Serpentine Grassland Seed Mix

SPECIES	SEEDING RATE (PURE LIVE SEED POUND/ACRE)
yarrow *Achillea millefolium*	0.5
Chilean trefoil *Acmispon wrangelianus*	2
four-spot *Clarkia purpurea* var. *quadrivulnera*	0.5
California poppy *Eschscholzia californica*	0.5
small fescue *Festuca microstachys*	10
meadow barley *Hordeum brachyantherum*	3
goldfields *Lasthenia gracilis*	0.5
tidy tips *Layia platyglossa*	3
Douglas' microseris *Microseris douglasii*	5
dwarf plantain *Plantago erecta*	3
blue-eyed grass *Sisyrinchium bellum*	4
purple needlegrass *Stipa pulchra*	10
Total	**42**

Table 7. Needlegrass Grassland Seed Mix

SPECIES	SEEDING RATE (PURE LIVE SEED POUND/ACRE)
yarrow *Achillea millefolium*	0.5
Chilean trefoil *Acmispon wrangelianus*	1
four-spot *Clarkia purpurea* var. *quadrivulnera*	0.5
California poppy *Eschscholzia californica*	1.5
small fescue *Festuca microstachys*	10
tidy tips *Layia platyglossa*	1
sky lupine *Lupinus nanus*	1
Douglas' microseris *Microseris douglasii*	2
dwarf plantain *Plantago erecta*	3
blue-eyed grass *Sisyrinchium bellum*	2
foothill needlegrass *Stipa lepida*	4
purple needlegrass *Stipa pulchra*	12
Total	**38.5**

Table 8. Oak Woodland Seed Mix

SPECIES	(PURE LIVE SEED POUND/ACRE)
yarrow *Achillea millefolium*	1
California brome *Bromus carinatus*	16
blue wildrye *Elymus glaucus* subsp. *glaucus*	15
small fescue *Festuca microstachys*	5
sky lupine *Lupinus nanus*	2
California buttercup *Ranunculus californica*	1
Total	**40**

Table 9. Native Annuals Seed Mix

SPECIES	(PURE LIVE SEED POUND/ACRE)
Chilean trefoil *Acmispon wrangelianus*	1
California poppy *Eschscholzia californica*	1
small fescue *Festuca microstachys*	16
goldfields *Lasthenia gracilis*	0.5
tidy tips *Layia platyglossa*	1
sky lupine *Lupinus nanus*	1.5
Douglas' microseris *Microseris douglasii*	2
dwarf plantain *Plantago erecta*	3
California buttercup *Ranunculus californica*	1
Total	**27**

3.5.3 SEED APPLICATION

Hydroseeding

Seeds may be sowed using hydroseeding in all vegetation types except serpentine bunchgrass grassland. The hydroseeding method uses the hydraulic application of a slurry of seeds, and mulch. Hydroseeding will be done according to the specifications below or as adjusted by the PG&E biologist. A 3-step application method will increase the likelihood that the seeds are in contact with the soil and are lightly overlain with mulch, which increases seeding success. Hydroseeding materials will be applied in separate applications in the approximate sequence as follows:

1. Seed Application - Apply the hydroseeding mixture with hydroseeding equipment at the rates indicated within 60 minutes after the seed has been added to the mixture:

MATERIAL	POUNDS PER ACRE
seed	as specified in seed mix
wood fiber or equivalent	500

2. Straw Application - Apply straw at the rate of 1 to 2 tons per acre. Incorporation of straw will not be required. Distribute straw evenly without clumping or piling.

3. Fiber and Tackifier Application - Apply the following mixture with hydroseeding equipment at the corresponding rates:

MATERIAL	POUNDS PER ACRE
wood fiber or equivalent	500

MATERIAL	POUNDS PER ACRE
tackifier	125

The ratio of total water to total tackifier in the mixture will be as recommended by the manufacturer. Hydroseed materials must be applied so they are in contact with the ground surface.

Broadcast Seeding

Serpentine bunchgrass grassland sites will be broadcast seeded. Hydroseeding is not recommended for serpentine sites as the addition of tackifier and wood fiber to serpentine habitats can negatively affect serpentine plant communities and can favor non-native plant species. Other vegetation types can be broadcast seeded instead of hydroseeded if desired.

In all areas, a layer of protective mulch will be added to broadcast seeded areas, to conserve moisture, reduce soil erosion, and increase germination. In serpentine grassland areas, weed-free rice straw will be used, with test plots in flat areas comprising between 2% and 5% of total serpentine bunchgrass grassland left without straw to observe variations in success. Locations of these plots will be specified in reporting, and the project biologist may elect to modify the extent of rice straw usage in subsequent seeding on the basis of results. Such modifications shall be recorded. In other vegetation types, weed-free rice straw or hydromulch will be used. Straw will be applied at a rate of approximately 500 to 1,000 pounds per acre (depending on slope, exposure, and other permit requirements) and can be applied by hand or blown on. Hydromulch will be applied at the rate as specified by the manufacturer.

3.6. HAND SEEDING OF LESSINGIA

Crystal Springs lessingia will be seeded after the site is prepared for seeding and before or during handseeding of the native seed mix. Ideally, seeding of Crystal Springs lessingia should occur in the fall prior to the first rains, but may need to be seeded later depending on the timing of construction. The collected seed will be hand broadcast in the impact area in areas where it originally occurred and in close proximity to existing undisturbed populations. Seeds should be broadcast on the soil surface and lightly raked in to facilitate soil and seed contact. Crystal Springs lessingia restoration is detailed in Appendix B.

3.7. DIRECT SEEDING TREES AND SHRUBS

All tree planting on SFPUC land would require approval by SFPUC. Furthermore, trees may only be seeded outside of restricted areas near the pipeline centerline as required for pipeline safety (PG&E 2014)[6]. Due to this restriction, seeding of trees in narrow portions of the work area could potentially be confined to the site periphery. However, to avoid unnatural, dense, linear plantings, it is preferable to seed trees in a pattern and density that reflects the surrounding vegetation patterns and preexisting tree densities, as feasible. Given these constraints, it may not be possible or desirable to perform these plantings within the easement or on nearby SFPUC land. If insufficient room occurs in the work area due to pipeline safety standards and SFPUC vegetation management policies, direct seeding of trees likely may need to be performed elsewhere with California Department of Fish and Wildlife (CDFW) approval.

[4] For example, trees, woody shrubs, or woody vegetation that may exceed 8 inches diameter at breast height at maturity cannot be planted within 10 feet of the pipeline centerline. Trees expected to grow to or exceed 36 inches diameter at breast height cannot be planted within 14 feet of the pipeline centerline.

PG&E has verbally communicated with SFPUC and since approval of the Bunker Hill VRP, has discovered that SFPUC does not consider onsite mitigation of trees an option and that all trees must be planted offsite. PG&E is currently exploring a tree mitigation plan nearby with San Mateo County Parks, and seeking CDFW approval of this plan. As necessary, other agreed-upon mitigation may need to be performed to meet revegetation goals commensurate with level of effort and expenditure associated with tree planting mitigation.

3.8. AS BUILT PLAN

Following revegetation, an as-built report will be prepared to document the completion of revegetation activities and provided to SFPUC and CDFW within 60 days after recontouring and seeding is complete. The as-built report will include a summary of: acreages of each habitat type revegetated; the species, application method and quantity of native plant seed broadcast; and photographs documenting the restoration. A map will be prepared map showing the location of restoration activities. Any changes to activities specified in the Vegetation Restoration Plan will be noted and discussed in this as-built report. Actions to be undertaken in the following year including any additional seed collection or procurement may also be included in the as-built report.

Section 4. SUCCESS CRITERIA, MONITORING AND REPORTING

4.1. SUCCESS CRITERIA

Success criteria will be used to measure the extent of revegetation after construction completion (Table 12). At a minimum, the success criteria shall be met for the final 2 years of the monitoring period. If any of the listed criteria are not met by the end of the monitoring period, additional management and monitoring shall be required until the success criteria are met.

For the last two years of the 5 year monitoring period after revegetation, recovery success criteria will be as follows[7]:

- Species composition and cover values within the seeded areas will be comparable to the final reference sites. Total cover and native cover of work areas will be at least 75 percent of total and native cover of reference sites. Species richness will also be measured in the work areas and reference sites. The data used for comparison will be collected during the same monitoring year (e.g. Year 1). Monitoring and sampling of sites may occur over one to two weeks when conditions are appropriate for correct comparisons, that is, when species that are in common between the restoration and reference sites are displaying a similar phenology. Sites are best compared when the phenologies of dominants that are in common between the restoration sites and reference sites are similar among the sites. The slight differences in topography, soils, and aspect of references sites versus the restoration sites can affect the development and phenology of species within those sites, sometimes offsetting the phenology of the same species from one site to another. Areas that were serpentine grassland prior to construction (baseline conditions) will be compared to serpentine grassland reference sites that were selected prior to the start of construction. Areas that were mapped as non-native grassland prior to construction (baseline conditions) will be compared to non-native grassland reference sites that were selected prior to the start of construction. Areas that were non-native woodland or non-native shrubland prior to the start of construction will be compared to non-native grassland reference sites.
- Absolute cover of invasive[8] weeds in the work area will be less than or equal to the reference sites. Any infestations of invasive weeds that are not present in the adjacent reference sites or were not recorded in the work area prior to construction will be controlled. Areas that were serpentine grassland will be compared to serpentine grassland reference sites that were selected prior to the start of construction. Areas that were non-native grassland prior to construction will be compared to non-native grassland reference sites that were selected prior to the start of construction. Any new species of invasive weed that was not recorded during preconstruction surveys will be controlled. Areas that were non-native woodland or non-native shrubland prior to the start of

[7] Areas where existing land management practices are not compatible with native plant restoration on those areas, such as the SFPUC fire break, will be exempt from continued management/monitoring after initial restoration. Vegetation restoration will be implemented on pre-existing access roads, however they will be exempt from continued management/monitoring after initial restoration.

[8] For the purposes of this document, invasive weeds are plant species that are listed on the California Noxious Weed List (CDFA 2016) or have a Cal-IPC Weed Ranking Definition of High (Cal-IPC 2016). Some (but not all) species with a Cal-IPC Weed Ranking Definition of Moderate will also be considered invasive weeds particularly if they are a species of high concern for the SFPUC Watershed.

construction will be compared to non-native grassland reference sites, and will be assessed for presence of invasive weeds.

- In areas that were serpentine grassland prior to construction, the total cover of non-native plant species will be no more than 150 percent of the total cover of non-native plant species in serpentine grassland reference sites. Based on the baseline cover data collection in serpentine grassland in the work area, non-native plant species comprise an average of 24%. 150 percent of this total corresponds to a cover value of 44%.
- Restored areas will be stable (i.e., no significant indicators[9] will be noted during the monitoring period).
- 95 percent of the preconstruction number of Crystal Springs lessingia plants will be established at the end of five years with the numbers adjusted based on annual comparison to reference sites.

Table 10. Success Criteria

PERFORMANCE INDICATOR	TARGET VALUE AFTER 5 YEARS
Total Cover	75 percent of total cover of reference sites (excluding oak woodland)*.
Native Cover	75 percent of native cover of reference sites (excluding oak woodland)*.
Cover of Invasive Weeds	Absolute cover of invasive weeds will be less than or equal to reference sites. Any infestations of invasive weeds that are not present in the adjacent reference site or were not mapped during preconstruction baseline surveys will be controlled*.
Cover of Non-Native Plant Species in Serpentine Grassland Areas	In areas that were serpentine grassland prior to construction, the total cover of non-native plant species will be no more than 150 percent of the total cover of non-native plant species in serpentine grassland reference sites.
Restored Areas are Stable	No significant indicators noted**.
Crystal Springs Lessingia	95 percent of the preconstruction number of plants will be established at the end of five years (215,413 plants impacted x 95% = 204,642 plants)***.

* Areas that were non-native grassland prior to construction will be compared to non-native grassland reference sites. Areas that were serpentine grassland prior to construction will be compared to serpentine grassland reference sites. The fire breaks that are disked annually by SFPUC will be exempt from continued management/monitoring after initial restoration.

**Significant indicators include erosion, unvegetated areas, and invasive weed infestations, among other issues.

*** The numbers of Crystal Springs lessingia counted in the reference plots each year will be compared to the 2016 pre-construction reference plot numbers to adjust the yearly plant targets. For example, if only half of the plants known to occur in the reference plots are present in any given year, the target number of plants for the reestablished population in the work area will be adjusted (lowered) proportionately.

[9] Significant indicators include erosion, unvegetated areas, and large invasive weed infestations, among other issues.

4.2. MONITORING

The site will be monitored for a minimum of five years. Monitoring site visits will occur quarterly for the first two years and then annually, at a minimum, for the remainder of the monitoring period. Vegetation cover data will be collected annually all five years. Monitoring will be sufficient to allow evaluation of ongoing restoration and its trajectory to meet success criteria contained in this plan. All monitoring will be conducted by a qualified biologist (as described in Section 3.1). Annual monitoring reports shall be sent to the SFPUC and CDFW and data from the quarterly site visits will be made available to these agencies upon request.

4.2.1 PHOTOMONITORING

Permanent photo-documentation points will be established in representative locations to document recovery. Additional photo points may be taken in representative areas and in potential problem areas where restoration success appears to be lagging or uncertain to meet success criteria. At each photo point, the location will be recorded with GPS coordinates. Once per year in spring, photographs will be taken from each photo point, using a digital camera.

4.2.2 VEGETATIVE COVER

Data on plant species composition and cover will be recorded in the restored work areas and reference sites in both non-native annual grassland and serpentine grassland. The location of potential reference sites will be selected prior to the start of construction based on similarity to the work area, mapped and provided to SFPUC and CDFW, as described in Section 3.3. Final reference sites used in annual reports to show progress towards meeting success criteria will be established with approval from the SFPUC and CDFW based on baseline data collection.

Plant species composition and cover data will be collected annually using randomly selected, independent sampling units (1 meter x 1 meter quadrats) within each habitat type within the disturbance area to be restored and the reference sites that were established prior to the start of construction. Cover estimation in quadrats was chosen as the sampling method in order to provide cover data and capture species richness. Random points, stratified by habitat type, will be generated using GPS and the sampling units (quadrats) will be placed randomly according to these points. The locations of the quadrats will be randomly selected each year; the location of plots are not permanent.

Within each quadrat, absolute cover of plants will be visually estimated and recorded for the quad as a whole (total vegetation cover) and for each individual plant species using the CNPS method for estimating cover values (CNPS 2014). The CNPS method for estimating cover values uses a “bird’s eye view” looking from above and estimating cover for the living plants only (CNPS 2014). Litter/duff should not be included in these estimates and the porosity of the vegetation should be taken into consideration when estimating percent cover (CNPS 2014). Percent cover diagrams (available on the CNPS Vegetation Program website) should be used to facilitate cover estimates. To ensure consistency and accuracy in cover estimation, prior to collecting cover data, the survey team will calibrate themselves by reviewing cover estimation methodology and conducting visual estimations over several quadrats together. Total cover of vegetation, bare ground, thatch, and straw (restoration site only) will also be recorded.

Total cover contributed by natives, total cover contributed by non-natives, cover contributed by invasive weed species, species richness, and other data as determined by the PG&E biologist will be calculated from this data. A power analysis will be used to determine the sample size required to statistically test the Year 5 performance criteria (total cover, native cover, invasive weed cover, and non-native plant cover) with a 95% confidence interval level (Based on SFPUC input) [$\alpha = 5\%$, where α is the acceptable probability of incorrectly concluding the proportion is less (for total cover and

native cover) or more (for non-native and invasive species) than the threshold]. The small size and variability of the restoration area and variability of the reference sites may prevent these statistically parameters from being met, however every effort will be made to conduct the sampling and analysis in a scientifically sound method. In an effort to balance sampling effort and scientific rigor, a maximum of 120 quadrats, divided equally among monitoring units, will be sampled when collecting data in the serpentine and non-native grasslands (for example: 60 in each grassland type, 30 each in the work areas and final reference sites).

In addition, the extent of invasive weed populations will be mapped using a high precision GPS unit to map the boundary of the weed population. Percent cover will be estimated for the population. A map will be included in the annual report.

Sampling will be carried out annually in the spring and will be timed to ensure that vegetation is identifiable and has achieved its maximum growth.

4.2.3 CRYSTAL SPRINGS LESSINGIA

The number of Crystal Springs lessingia will be counted in the work area and reference sites annually to determine if the success criteria are on track to being met at the end of the monitoring period. The goal of sampling reference populations is to track annual variation in natural population abundance over several years to determine population trends, as the numbers of plants in both the restoration and reference areas are expected to vary each year.

The number of Crystal Springs lessingia individuals within the work area and reference sites will be estimated or counted depending on the size of the colony. If counting each individual plant is infeasible due to overall abundance, a portion of the population will be sampled to extrapolate the total number of individuals in that colony. The goal of sampling is to estimate the annual population size of Crystal Springs lessingia in the work area or each of the reference sites. When sampling the population size, some error is associated with the sample (the difference between the sample estimate and the real value of the population). Statistics will be used to assess that error following standard methods (Elzing et al. 1998). Confidence intervals of 80% and 95% will be used. The methodology will follow the 2016 methodology (Nomad 2016b) as detailed in Appendix D. Table 10 lists the success criterion for Crystal Springs lessingia.

4.3. REMEDIAL MEASURES

Remedial efforts may include reseeding, weeding, and/or erosion control. Remedial measures will be implemented, after consultation with SFPUC and CDFW, if the annual success criteria target values are not met or if annual success criteria are being met but there are issues that may prevent the site from meeting future success criteria. Given implementation may be time sensitive, if no response has been received from either agency within 3 weeks, PG&E will implement the measures as planned. Remedial measures will be implemented for areas that have not achieved acceptable survivorship or vegetative cover compared to reference sites. All monitoring visits will include an evaluation of the need for remedial measures if necessary.

4.3.1 SUPPLEMENTAL SEEDING

Areas will be supplementally seeded if success criteria are not met or the site is not on track to meet success criteria in the future. Supplemental seeding maybe needed only on portions of the site if other portions are meeting success criteria. Rice straw may need to be moved if it is observed that germination or growth is being impeded. Based on monitoring data and seed availability, the PG&E restoration biologist will determine what species for revegetation should be used. All supplemental

seeding will have to adhere to the guidelines presented in this plan. Should supplemental seeding and irrigation occur in the last two years of monitoring and reporting used to meet success criteria, a corresponding extension of the monitoring would occur for those areas. All planned supplemental seeding and maintenance actions will be reported to SFPUC and CDFW for review and approval. Given implementation may be time sensitive, if no response has been received from either agency within 3 weeks, PG&E will implement the measures as planned.

4.3.2 PLANT REPLACEMENT

Non-germinating seed or dead plants will be replaced as necessary to meet success criteria. Replacement shall not occur in the last two years of monitoring and reporting used to meet success criteria unless a corresponding extension of the monitoring occurs for those areas. The PG&E biologist will determine when reseeding is necessary and what species should be used. If certain species are not successful they will be replaced with other species.

4.3.3 NON-NATIVE INVASIVE SPECIES REMOVAL

Invasive weed species will be removed and controlled in all revegetated areas during the five-year monitoring period as necessary to meet success criteria. Non-native plant species, including annual grasses, will be controlled in serpentine grassland areas as necessary to keep the site on track to meet success criteria. The decision to control annual grasses will be based on the observations during early spring site visits and the results of spring data collection. If it is determined that invasive weeds or non-native grasses are preventing the lessingia restoration area from meeting the performance criteria, then non-native plant species control in these areas may be necessary. Monitoring and control will target all invasive weed species including those known to occur in the immediate project vicinity (Table 4) as well as species not currently known from the site.

4.4. MONITORING REPORTING

At the end of each monitoring year, an annual report will be prepared that includes methods used, results of monitoring, photomonitoring photographs, representative photographs, a summary of reference and restoration site data, an assessment of progress toward meeting success criteria, recommendations, and implemented actions.

Annual monitoring reports will be sent to SFPUC and CDFW by February 28 of the following year. Data from the quarterly site visits will be made available to these agencies upon request.

Section 5. REFERENCES

California Department of Food and Agriculture (CDFA). 2015. *Pest Ratings of Noxious Weed Species and Noxious Weed Seed*. Available: http://www.cdfa.ca.gov/phpps/ipc/weedinfo/winfo_list-pestrating.htm.

California Invasive Plant Council (Cal-IPC). 2012a. Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers. California Invasive Plant Council: Berkeley, CA.

____. 2012b. Preventing the Spread of Invasive Plants: Best Management Practices for Transportation and Utility Corridors. California Invasive Plant Council: Berkeley, CA.

____. 2016. *California Invasive Plant Inventory*. Cal-IPC Publication. California Invasive Plant Council: Berkeley, CA.

California Native Plant Society (CNPS). 2014. *California Native Plant Society/Department of Fish and Game Protocol for Combined Vegetation Rapid Assessment and Releve Sampling Field Form*.

Elkhorn Slough. 2001. *Native Species Planting Guide for the Elkhorn Slough National Estuarine Research Reserve.* February.

Elzing, CL, DW Salzer, and JW Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM/RS/ST-98/005+1730.

McCreary, D. 2009. *Regenerating Rangeland Oaks in California*. University of California Agriculture and Natural Resources. Sierra Foothill Research and Extension Center Publication 21601e.

Nomad Ecology LLC. 2009. *Non-indigenous Plant Species Inventory and Mapping, Peninsula Watershed, San Mateo County, California.* Prepared for SFPUC.

_____. 2016a. *DRAFT Technical Memorandum – Crystal Springs Lessingia* (*Lessingia arachnoidea*) *Restoration on the Gas Line 109 Crystal Springs Pipeline Replacement Projects, San Mateo County, California.* September.

_____. 2016b. *DRAFT Technical Memorandum – Baseline Data Collection for Gas Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County, California*. September.

Orion Environmental Associates. 2013. *Special-Status Plant Survey Report. Pacific Gas & Electric Company, Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County, California.* Prepared for Pacific Gas and Electric Company. September 20.

_____. 2014. Vegetation Sampling Data Excel Spreadsheet.

_____. 2016. *Field-flagging Marin Western Flax on PG&E Line 109 Crystal Springs Pipeline Replacement Project.* September.

Pacific Gas & Electric (PG&E). 2014. *Gas Pipeline Rights-of-Way Management*. Utility Standard TD-4490S. Published November 26.

San Francisco Planning Department. 2016. *Final Mitigated Negative Declaration. PG&E Gas Transmission Line 109 Cañada Road, Bunker Hill, and Crystal Springs Pipeline Replacement Project*. May.

San Francisco Public Utilities Commission. 2016. SFPUC Pathogen BMP – Propagation and Seed Collecting DRAFT (Adapted from Phytosphere Research 2016). June 6, 2016.

Western ECI. 2014. Arborist Evaluation for R-048, Crystal Springs. L-109_4C. Order # 30897896. Prepared by Dan Hunzeker for Michael Pintacura, PG&E Land Consultant. June 5.

Appendix A FIGURES

LEGEND

Service Layer Credits: Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

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FIGURE1
PROJECT LOCATION
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing

2016 Fire Break

- Disked Area
- Mowed Area

Vegetation

- Coast live oak woodland
- Non-native grassland
- Non-native shrubland
- Non-native woodland
- Road
- Serpentine bunchgrass grassland

Note:
Vegetation was mapped by Orion Environmental in 2013 and groundtruthed and revised on August 2016 by Nomad Ecology.

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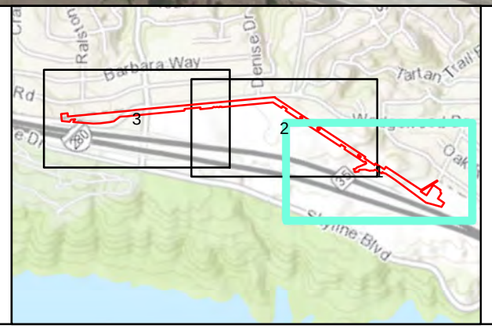

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FIGURE 2
MAP 1 OF 3
VEGETATION MAP
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 16, 2016

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LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing

2016 Fire Break

- Disked Area
- Mowed Area

Vegetation

- Coast live oak woodland
- Non-native grassland
- Non-native shrubland
- Non-native woodland
- Road
- Serpentine bunchgrass grassland

Note:
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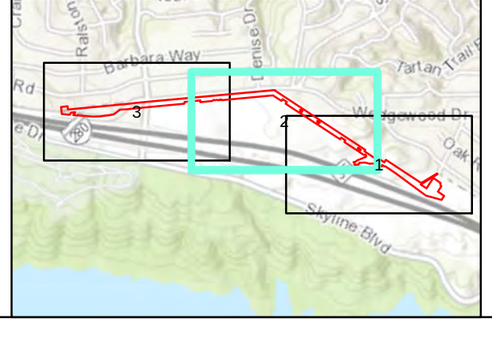

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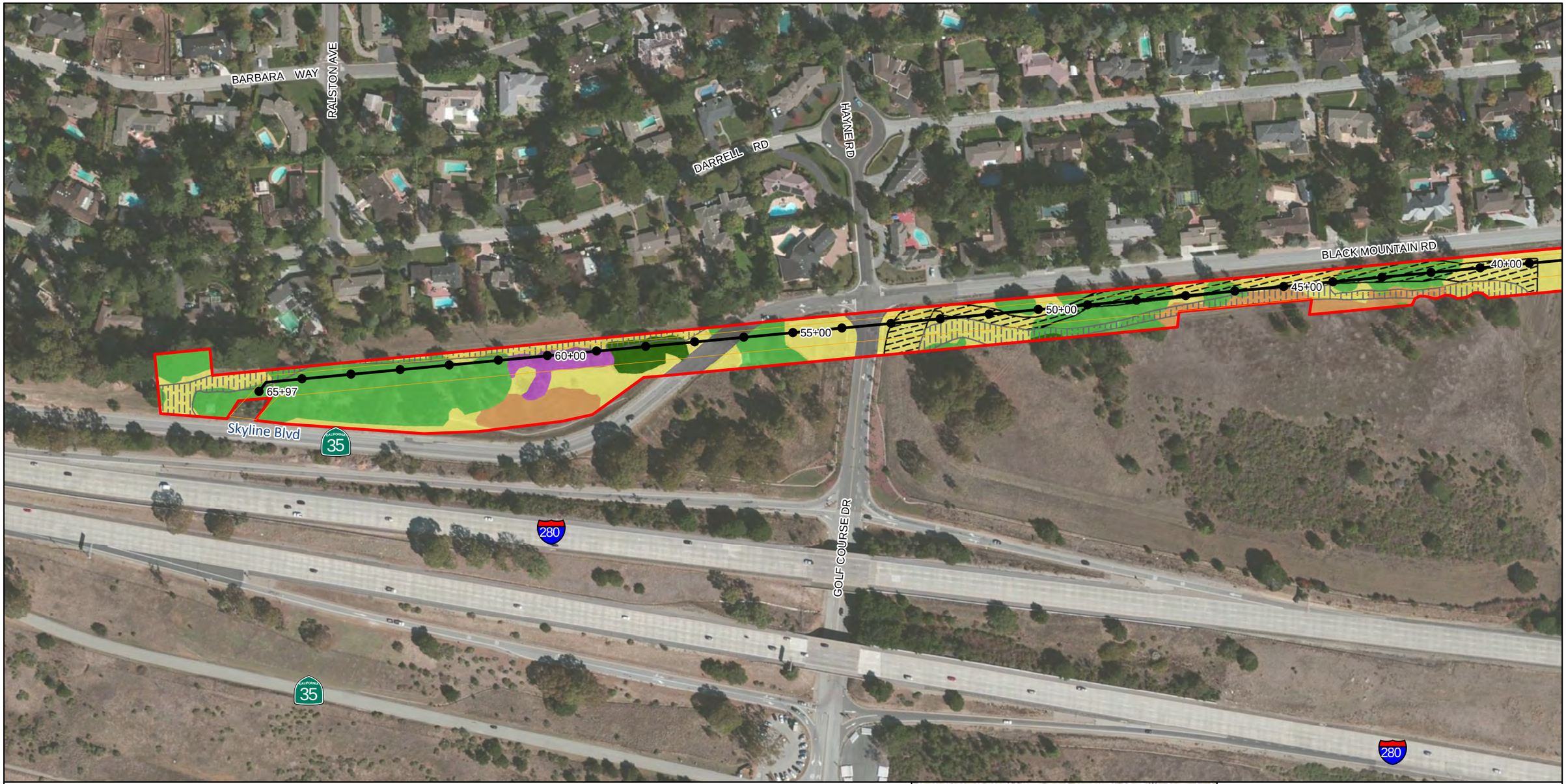
FIGURE 2
MAP 2 OF 3
VEGETATION MAP
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 16, 2016



LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing

2016 Fire Break

- Disked Area
- Mowed Area

Vegetation

- Coast live oak woodland
- Non-native grassland
- Non-native shrubland
- Non-native woodland
- Road
- Serpentine bunchgrass grassland

Note:
Vegetation was mapped by Orion Environmental in 2013 and groundtruthed and revised on August 2016 by Nomad Ecology.

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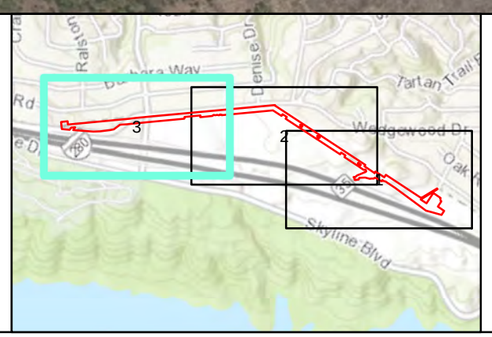

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FIGURE 2
MAP 3 OF 3
VEGETATION MAP
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 16, 2016

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Crystal Springs lessingia (Lessingia arachnoidea) Inside Work Area 215,414 plants
- Serpentine Grassland
- Marin dwarf flax (*Hesperolinon congestum*)

2016 Fire Break

- Disked Area
- Mowed Area

Note:
Marin dwarf flax was surveyed for and mapped by Orion in April 2016. Crystal Springs lessingia was mapped and numbers of individuals estimated in August 2016 by Nomad Ecology.

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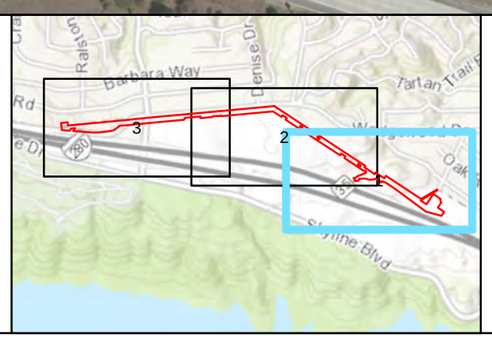

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FIGURE 3
MAP 1 OF 3
RARE PLANTS IN WORK AREA
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Crystal Springs lessingia (Lessingia arachnoidea) Inside Work Area 215,414 plants
- Serpentine Grassland
- Marin dwarf flax (*Hesperolinon congestum*)

2016 Fire Break

- Disked Area
- Mowed Area

Note:
Marin dwarf flax was surveyed for and mapped by Orion in April 2016. Crystal Springs lessingia was mapped and numbers of individuals estimated in August 2016 by Nomad Ecology.

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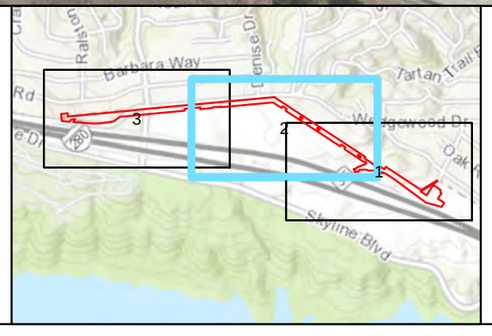

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FIGURE 3
MAP 2 OF 3
RARE PLANTS IN WORK AREA
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

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LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Crystal Springs lessingia (Lessingia arachnoidea) Inside Work Area 215,414 plants
- Serpentine Grassland
- Marin dwarf flax (*Hesperolinon congestum*)

2016 Fire Break

- Disked Area
- Mowed Area

Note:
Marin dwarf flax was surveyed for and mapped by Orion in April 2016. Crystal Springs lessingia was mapped and numbers of individuals estimated in August 2016 by Nomad Ecology.

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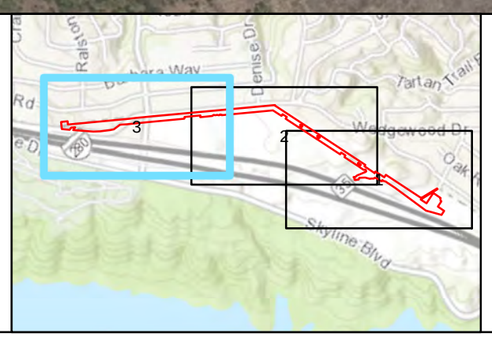

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FIGURE 3
MAP 3 OF 3
RARE PLANTS IN WORK AREA
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Serpentine Grassland

Weed Areas

- French broom
- Italian thistle
- Scotch broom
- Spanish broom
- Bristly ox-tongue
- Bull thistle
- Harding grass
- Poison hemlock
- Privet
- Stinkwort
- Teasel

Weed Points (signifies several individuals)

- English ivy
- Acacia
- Bull thistle
- Cotoneaster
- Hawthorn
- Stinkwort
- Sweet fennel
- Teasel

Note:
Weed locations were mapped by Nomad Ecology during preconstruction surveys conducted on August 9 and 24, 2016. There may be additional locations of invasive weeds in the dense non-native woodland located in the work area north of Skyline Blvd.

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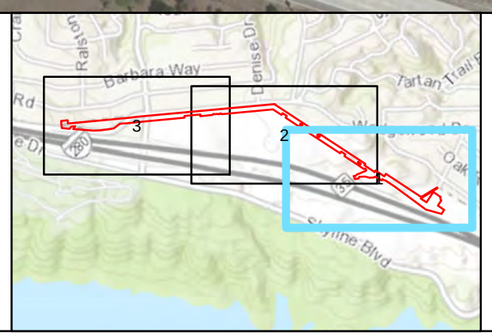

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FIGURE 4
MAP 1 OF 3
BASELINE INVASIVE WEED MAPPING
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEP 26, 2016

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Serpentine Grassland

Weed Areas

- French broom
- Italian thistle
- Scotch broom
- Spanish broom
- Bristly ox-tongue
- Bull thistle
- Harding grass
- Poison hemlock
- Privet
- Stinkwort
- Teasel

Weed Points (signifies several individuals)

- English ivy
- Acacia
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- Hawthorn
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- Teasel

Note:
Weed locations were mapped by Nomad Ecology during preconstruction surveys conducted on August 9 and 24, 2016. There may be additional locations of invasive weeds in the dense non-native woodland located in the work area north of Skyline Blvd.

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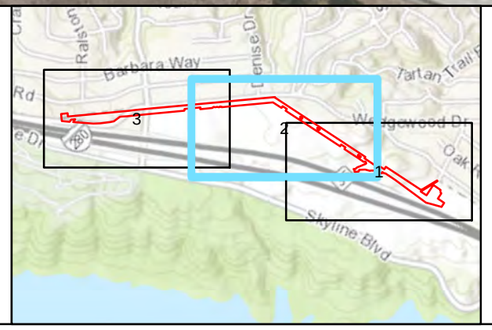

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FIGURE 4
MAP 2 OF 3
BASELINE INVASIVE WEED MAPPING
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEP 26, 2016

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Serpentine Grassland

Weed Areas

- French broom
- Italian thistle
- Scotch broom
- Spanish broom
- Bristly ox-tongue
- Bull thistle
- Harding grass
- Poison hemlock
- Privet
- Stinkwort
- Teasel

Weed Points (signifies several individuals)

- English ivy
- Acacia
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Note:
Weed locations were mapped by Nomad Ecology during preconstruction surveys conducted on August 9 and 24, 2016. There may be additional locations of invasive weeds in the dense non-native woodland located in the work area north of Skyline Blvd.

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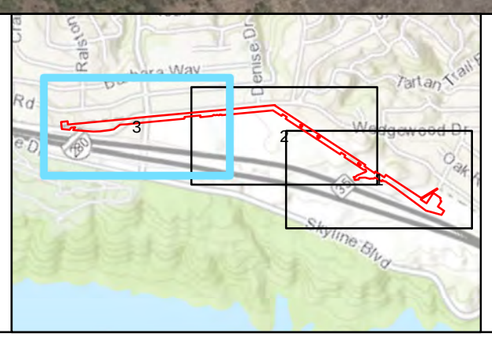

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FIGURE 4
MAP 3 OF 3
BASELINE INVASIVE WEED MAPPING
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEP 26, 2016

Appendix B CRYSTAL SPRINGS LESSINGIA TECHNICAL MEMORANDUM

March 3, 2016

Revised September 25, 2016

Chrissie Klinkowski, M.S.
Senior Biologist
Pacific Gas & Electric Company Environmental - Gas
Transmission 6111 Bollinger Canyon Road 3rd Floor,
3230B San Ramon, CA 94583

Technical Memorandum - Crystal Springs Lessingia ***(Lessingia arachnoidea)*** Restoration on the Gas Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County, California.

Dear Ms. Klinkowski,

This technical memorandum provides the proposed methodology to restore Crystal Springs lessingia ***(****Lessingia arachnoidea*; California Rare Plant Rank 1B.2) in the Gas Line 109 Crystal Springs Pipeline Replacement Project within the San Francisco Public Utilities Commission's (SFPUC) Peninsula Watershed.

2013 CRYSTAL SPRINGS LESSINGIA SURVEYS

Protocol-level special-status plant surveys were conducted for the project on select dates in 2013 by Orion Environmental Associates (Orion Environmental Associates 2013). Crystal Springs lessingia was observed and mapped within the project area in August 2013 (Orion Environmental Associates 2013). Based on census data collected in plots and mapped extents of colonies, it was estimated there were 20,412 Crystal Springs lessingia individuals in 0.99 acre within the work area (Orion Environmental Associates 2013).

2016 CRYSTAL SPRINGS LESSINGIA SURVEYS

Crystal Springs lessingia in the work area was mapped in August 2016 by Nomad Ecology (Nomad Ecology 2016b). The methodology and results are detailed in the Baseline Data Collection Technical Memorandum (Nomad Ecology 2016b). The number of Crystal Springs lessingia individuals within the work area was estimated using a combination of direct counting (census) and estimation based on sampling. The boundary of the colonies were mapped using GPS with sub-meter accuracy. The colonies were photographed to document the existing condition. General notes on phenology (flowering, seeding) were obtained concurrent with the surveys. A total of 215,414 Crystal Springs lessingia individuals were counted and/or estimated in the work area within a 2.02-acre area. This is a substantial increase from 2013 surveys.

CRYSTAL SPRINGS LESSINGIA ECOLOGY AND STATUS

Crystal Springs lessingia, a California endemic known primarily from San Mateo County in the vicinity of the Crystal Springs Reservoir, is designated a California Rare Plant Rank 1B.2 species indicating it is rare and moderately threatened in California. It is an annual herb in the sunflower (Asteraceae) family. This species has pink to lavender flowers, cobwebby tomentose phyllaries, and an erect stem with ascending branches (Baldwin et al. 2012). It is differentiated from other ***Lessingia*** species by these characters as well as having glandless cauline leaves, basal leaves that are withered at flower and a short triangular style-branch appendage. Crystal Springs lessingia is an annual species, which means that in one growing season, a plant grows from seed, blooms, sets seed, and dies.

Crystal Springs lessingia blooms from July to October (CNPS 2016, Jepson Flora Project 2016). This species has an indeterminate flowering pattern; that is, it tends to have only a few flower heads open at a time. Early flowers mature and shed their seed while later flowers develop, and individual plants continue to produce flowers and shed relatively small quantities of seed over a period of several months, often for as long as conditions are suitable.

Crystal Spring lessingia is recorded from San Mateo and Sonoma counties, however occurrences from Sonoma County need taxonomic verification (CNPS 2016). This species is supported by serpentinite soils in cismontane woodlands, coastal scrub, valley and foothill grasslands near the coast at elevations from 197 to 656 feet (60 to 200 meters). It is often found on roadsides (CNPS 2016).

CRYSTAL SPRINGS LESSINGIA RESTORATION

The goal of this plan is to minimize impacts to Crystal Springs lessingia plants within the work area. Crystal Springs lessingia is a deep rooted annual that is not suitable for transplanting. Therefore seed collection and sowing is the recommended approach. Seed was collected prior to the start of construction, stored during construction, and distributed in the work area once construction is complete. Topsoil and surface material in occupied habitat will also be salvaged. The seeding methodology, described below, was developed based on discussion with Staci Markos, Assistant Director for Development & Outreach for the Jepson Herbarium and author of the ***Lessingia*** treatment in the Jepson Manual (Markos pers. comm. 2015).

Pre-Construction Seed Collection and Storage

Crystal Springs lessingia was monitored throughout the summer of 2015 to track phenology and to determine when seeds were mature and ready for collection. Seed was collected from the gas line pipeline right-of-way (ROW) and project work area October 2, 5, and 6, 2015. Seed was collected by collecting whole plants and putting them in paper bags. Inflorescences were stored indoors in paper bags for several weeks to allow seeds to further mature. Seed were separated from other plant material (stems, inflorescence branches, and flowering parts) by hand sorting them in plastic containers. Seeds and fine chaff were stored in sealed paper envelopes indoors in a cool, dry, dark storage room. The number of seeds collected and stored is estimated to be 100,000 seeds. Seed will be collected in late September following the same methodology.

Surface Material Salvage

As detailed in Section 3.4 of the VRP, topsoil will be stockpiled and replaced on site to preserve the existing soil seed bank. In addition to stockpiling topsoil, the surface material (the top 3 inches) from any scraping or grading that occurs within occupied Crystal Springs lessingia habitat will be salvaged and stockpiled in identified upland work areas within the temporary construction easement. Salvaged surface material in occupied habitat will be kept separate from any other stored soil and spoils and labeled.

Post-Construction Seeding Methodology

The planting area will be prepared as detailed in the VRP. This includes stockpiling topsoil material,

backfilling soil, soil surface preparation, and seeding with an appropriate native seed mix. The site will be seeded with the native seed mix when construction is complete. Crystal Springs lessingia will be seeded after the site is prepared for seeding but before or during handseeding of the native seed mix.

The collected seed will be hand broadcast in the impact area in areas where it originally occurred and in close proximity to existing undisturbed populations. Seeds should be broadcast on the soil surface and lightly raked in to facilitate soil and seed contact. Ideally, seeding of Crystal Springs lessingia should occur in the fall prior to the first rains, but may need to be seeded later depending on the timing of construction.

REFERENCE POPULATION SAMPLING

The goal of sampling a reference population is to track annual variation in natural population abundance over several years to determine population trends. These trends are desired for two reasons: 1) to determine how the baseline population estimates, provided by Orion Environmental Associates 2013, compare to population trends from several years of sampling; and 2) to correlate natural population trends with the population monitoring for restored Crystal Springs lessingia populations within project impact areas to compare abundance against an undisturbed reference condition.

Reference sites for Crystal Springs lessingia were established and sampled prior to the start of construction as detailed in the Baseline Data Collection Technical Memorandum (Nomad Ecology 2016b) included in Appendix D of the VRP. The number of Crystal Springs lessingia individuals within established reference sites were estimated using a sampling methodology. A portion of the population was sampled to extrapolate the total number of individuals in that colony. In future years of monitoring, the reference sites will be sampled following the methodology used in 2016.

PERFORMANCE CRITERION

The goal of the Crystal Springs lessingia restoration is to reestablish a population of Crystal Springs lessingia in the work area within five years following the completion of construction. The number of plants in the work areas will be monitored annually for five years to determine if this goal has been met. The performance criterion for Crystal Springs lessingia is that 95 percent of the preconstruction number of plants will be established in the work area at the end of five years. At a minimum, the success criteria shall be met for the final 2 years of the monitoring period. If the criterion is not met by the end of the monitoring period, additional management and monitoring shall be required until the success criteria are met. The numbers of Crystal Springs lessingia counted in the reference plots each year will be compared to the 2016 pre-construction reference plot numbers to adjust the yearly plant targets. For example, if only half of the plants known to occur in the reference plots are present in any given year, the target number of plants for the reestablished population in the work area will be adjusted (lowered) proportionately.

Based on the 2016 sampling, 95 percent of the pre-construction number of plants is 204,643 plants (215,414 plants impacted x 95%). Annual monitoring will be performed by a census (count all of the plants) in the work area or sampling following the 2016 baseline sampling methodology as detailed in the Baseline Data Collection Technical Memorandum (Nomad Ecology 2016b) included in Appendix D of the VRP. The number of Crystal Springs lessingia individuals within the work area will be estimated or counted depending on the number of individuals present to see if performance criteria are met. During monitoring, the phenological stage of development of the Crystal Springs lessingia plants (e.g., in leaf, bud, flower, or senesced) will also be tracked in both the reference population and the plants reestablished in the work area.

If the number of plants do not reach this performance criterion, or if data from earlier years suggest the site is not on a trajectory to meet this success criterion, then adaptive management actions will be developed and supplemental activities may be performed. These could include supplemental seed collection and direct sowing.

Monitoring will be carried out as specified in the VRP. Monitoring will include a noxious weed component. Target invasive weed species (as defined in the Revegetation Plan) in the work area and adjacent reference population will be identified and the extent of any infestations will be mapped and included in the annual monitoring reports. If invasive weed cover exceeds that of the reference site (as detailed in the performance standards in the Revegetation Plan), then weed control will be initiated. If it is determined that invasive weeds are preventing the lessingia restoration area from meeting performance criterion, then PG&E will consult with SFPUC and CDFW regarding invasive weed control and remedial measures. Given the implementation may be time sensitive, if no response has obtained from either agency within 3 weeks, PG&E will implement the measures as planned.

As specified in the VRP, monitoring activities, including methods, results, and a discussion of any remedial measures proposed, will be described in annual reports. Annual monitoring results will be submitted by February 1 of the following year.

Please feel free to contact me at (925) 228-1027 if you have any questions.

Sincerely,

Erin L. McDermott Principal
ISA Certified Arborist - WE7318A
Botanist, Wetland & GIS Specialist
Nomad Ecology

PERSONAL COMMUNICATION

Markos, Staci. 2015. Personal communication with Erin McDermott on April 27 and 29, 2015.

REFERENCES

Baldwin, B.G., D.H. Goldman, D. J. Keil, R. Patterson, TJ. Rosatti, and D.H. Wilken, editors. 2012. *The* Jepson manual: vascular plants of California, second edition. University of California Press, Berkeley.

California Native Plant Society (CNPS). 2016. Inventory of Rare and Endangered Plants of California. 6th Edition.

Jepson Flora Project. 2016. California Native Plant Society. Sacramento, CA. Accessed from http://www.rareplants.cnps.org/Jepson Flora Project. 2015. Jepson eFlora, http://ucjeps.berkeley.edu/IJM.html.

Nomad Ecology. 2016a. Draft Vegetation Restoration Plan for PG&E Gas Transmission Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County, California.

Nomad Ecology. 2016b. Draft Technical Memorandum – Baseline Vegetation Data Collection for Gas Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County, California.

Orion Environmental Associates. 2013. Special-Status Plant Survey Report. Pacific Gas & Electric Company, Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County, California. Prepared for Pacific Gas & Electric.

United States Department of Agriculture, Natural Resources Conservation Service. 2015. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed 4/23/2015

Appendix C WEED MANAGEMENT PLAN TECHNICAL MEMORANDUM

January 31, 2017, revised February 2017

Robert Vogt, M.S.
Senior Biologist
Pacific Gas & Electric Company
Environmental - Gas Transmission
6111 Bollinger Canyon Road

San Ramon, CA 94583

Technical Memorandum – Weed Management Plan for Gas Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County, California.

Dear Mr. Vogt,

This Technical Memorandum includes the Invasive Weed Management Plan for the Gas Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County. Please note that relevant portions of this plan, drafted in September 2016, were implemented during tree removal activities in fall 2016.

POTENTIAL INVASIVE WEED IMPACTS

Project-related activities may potentially introduce or spread invasive weed species[1] within the work areas. Several invasive weed species known to be present on the Peninsula Watershed and tracked by SFPUC (Nomad Ecology 2009) were recorded in the project area (Orion Environmental Associates 2013). Additional field surveys were performed by Nomad in August 2016 to map the locations of invasive weeds and identify if any new species of invasive weeds occur.

Several invasive weed species were identified during weed surveys and were recorded in the work areas during preconstruction surveys conducted in August 2016 (Table 1). These include: French broom (*Genista monspessulana*), Scotch broom (*Cytisus scoparius*), stinkwort (*Dittrichia graveolens*), Italian thistle (*Carduus pycnocephalus*), bull thistle (*Cirsium vulgare*), Harding grass (*Phalaris aquatica*), poison hemlock (*Conium maculatum*), privet (*Ligustrum sp*.), English ivy (*Hedera helix*), acacia (*Acacia* sp.), cotoneaster (*Cotoneaster* sp.), hawthorn (*Crataegus monogyna*), yellow starthistle (*Centaurea solstitialis*), teasel (*Dipsacus sativus*), bristly ox-tongue (*Helminthotheca echioides*), and sweet fennel (*Foeniculum vulgare*). Figures showing the location of noxious weeds are included in Appendix A of the VRP.

These weed species will be considered target invasive weeds for monitoring and possible control as part of this plan. Portions of the right of way are currently disked for fire control (see Photographs in Appendix F of the VRP). The percent cover of weeds following restoration that will be considered acceptable is based on existing baseline cover data and comparison to reference sites and is addressed in Section 4.1 of the VRP, Success Criteria.

[1] For the purposes of this document, invasive weeds are plant species that are listed on the California Noxious Weed List (CDFA 2016) or have a Cal-IPC Weed Ranking Definition of High (Cal-IPC 2016). Some (but not all) species with a Cal-IPC Weed Ranking Definition of Moderate will also be considered invasive weeds particularly if they are a species of high concern for the SFPUC Watershed. Plants that are considered Moderate or High shall not be used in re-vegetation areas.

Table 1. Invasive Weeds Observed in the Vicinity of the Project Area

Common Name Scientific Name	California Invasive Plant Council Rank (Cal-IPC 2016)*	California Department of Food and Agriculture Noxious Weed List (CDFA 2016)**	Location on Crystal Springs Project Site
acacia *Acacia sp.*	Limited-Moderate (depending on species)	On List	North of Hayne Rd., one tree in between stations 56+00 and 55+00 near the transmission tower. Northeast of Skyline Blvd., multiple trees between stations 59+00 and 65+00. Additional plants may be present in the dense non-native woodland and scrub north of Skyline Blvd.
Italian thistle *Carduus pycnocephalus* subsp. *pycnocephalus*	Moderate	On List	One population in access easement in project area southeast of Caltrans rest stop; between stations 2+00 and 3+00.
bull thistle *Cirsium vulgare*	Moderate	On List	Multiple patches throughout project work area. Southeast of Caltrans rest stop near station 1+00. Two patches directly east of Caltrans rest stop, between stations 11+00 and 11+88. One patch between stations 18+00 and 19+00. One patch straddling the gas line, between stations 22+00 and 23+00. One patch at station 25+00, overlapping with a teasel weed patch. One patch near station 31+00. Two patches parallel to Black Mountain Rd.: one patch near station 37+00, one patch on the western edge of the work area between stations 51+00 and 52+00.
poison hemlock *Conium maculatum*	Moderate	---	One patch on scrub edge between stations 60+00 and 62+00, next to multiple *Acacia* sp. trees.
Cotoneaster *Cotoneaster sp.*	Moderate	---	Two individuals directly west of gas line between stations 62+00 and 63+00. Additional plants may be present in the dense non-native woodland and scrub north of Skyline Blvd.
hawthorn *Crataegus monogyna*	Limited	---	Two individuals directly west of gas line between stations 25+00 and 26+00. Additional plants may be present in the dense non-native woodland and scrub north of Skyline Blvd.
Scotch broom *Cytisis scoparius*	High	On List	One patch straddling the eastern project work area boundary between stations 21+00 and 22+00. Overlapping with French broom weed patch.

Common Name Scientific Name	California Invasive Plant Council Rank (Cal-IPC 2016)*	California Department of Food and Agriculture Noxious Weed List (CDFA 2016)**	Location on Crystal Springs Project Site
teasel *Dipsacus sativus*	Moderate	---	Multiple patches throughout project work area. One large patch in straddling the gas line at station 19+00. One patch overlapping with bull thistle weed patch at station 25+00. One patch straddling the western project work area boundary between stations 32+00 and 33+00. One patch slightly overlapping project work area western edge between stations 37+00 and 39+00. Two patches near the Hayne Rd. and Skyline Blvd. intersection: one small patch near station 54+00, one larger patch near station 55+00. One larger patch northeast of Skyline Blvd., straddling the eastern project work area boundary between stations 58+00 and 60+00.
stinkwort *Ditrichia graveolens*	Moderate	On List	In scattered locations from Station 45+00 to the northern end of the project. Plants are growing adjacent to Black Mountain Road in mowed roadside areas. These plants were hand pulled in September 2016, bagged, and removed from site.
sweet fennel *Foeniculum vulgare*	High	---	Present in one location by the Caltrans rest stop on the edge of the project area.
French broom *Genista monspessulana*	High	On List	Several patches scattered throughout the project area, primarily in the understory of non-native woodland. One patch near Station 22+00. One patch near Station 50+00. Several patches in the non-native woodland and shrubland at the north end of the project area between Stations 62+00 and 66+00/
English ivy *Hedera helix*	High	---	Present in one location at the northern end of the project area (Station 65+00). One small individual present.
bristly ox-tongue *Helminthotheca echiodes*	---	---	Present in large patches in three locations, all adjacent to Bunker Hill Road and Skyline Blvd. Stations 32+00 to 34+00, Stations 37+00 to 39+00, and Stations 54+00 to 55+00, primarily in mowed areas.
privet *Ligustrum sp.*	---	---	One dense patch present just south of Skyline Blvd under the transmission right-of-way near Station 56+00.
Harding grass *Phalaris aquatica*	Moderate	---	Several patches at the southern and northern ends of the project area. Several patches on the south end of the project from Stations 0+00 to 5+00 in the understory of trees. One patch near Station 41+00. Abundant from north of Hayne Road to the northern end of the project area. The access road from Skyline Blvd. to the northern end of the project area is characterized by dense Harding grass in the road and adjacent.
Spanish broom *Spartium junceum*	High	On List	One patch in the project area near Station 31+00.

The project also has the potential to spread soil borne pathogens. Implementation of minimization measures summarized for reducing the spread of invasive weeds, as well as additional sanitation measures, will reduce the likelihood that soil borne pathogens are introduced or spread in the project area.

The project also has the potential to spread non-native annual grass species from non-native grassland portions of the work area into the serpentine bunchgrass grassland portion of the work area. Non-native annual grass species including ripgut brome *(Bromus diandrus),* wild oats *(Avena fatua),* and Italian ryegrass *(Festuca perennis)* are present in abundance on site in non-native annual grassland/disturbed portions of the work area. Non-native annual grasses are known to pose a threat to serpentine grasslands in the region. The project will minimize the introduction, spread, and/or proliferation of non-native grasses in serpentine grassland portions of the work area. Implementation of minimization measures will reduce the likelihood that non-native grasses that have been observed under existing conditions at the site prior to the start of work, will be spread into serpentine grassland portions of the work area. Additionally, the site is subject to current conditions beyond PG&E control that could affect success criteria. Activities observed onsite during the preparation of this plan include regular SFPUC maintenance of a fuel break and use of access roads, as well as local residents trespassing within the right of way. These activities could be a potential source of weeds and pathogens or restoration habitat damage unrelated to PG&E's construction or restoration activities.

The restoration area will be monitored post-construction and invasive weeds will be controlled as part of this plan. The percent cover of invasive weeds throughout the project and non-native annual grasses in serpentine grassland that is acceptable is based on existing baseline cover data and comparison to reference sites and is addressed in Section 4.1 of the VRP, Success Criteria.

INVASIVE WEED, NON-NATIVE GRASS AND SOIL BORNE PATHOGEN MINIMIZATION MEASURES

The following invasive weed spread minimization measures are based on Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (Cal-IPC 2012a) and Preventing the Spread of Invasive Plants: Best Management Practices for Transportation and Utility Corridors (Cal-IPC 2012b).

Measures to be Implemented Before and During Construction

Baseline Invasive Weed Surveys

Data has been collected on populations of invasive weed species in the work area and along access roads during preconstruction surveys performed in August 2016. Data collected included the extent and location of target invasive weed species, and a cover estimate within the extent boundaries. All weeds on the CDFA noxious weed list as well as Cal-IPC species with a rank of High and Moderate were surveyed for and mapped. The location of weeds identified and mapped during the surveys in August 2016 are shown on Figures provided in Appendix A of the VRP.

Baseline Vegetation Mapping

The extent and boundary of serpentine grassland on site was carefully mapped in August 2016 to plan for soil management during construction to minimize introducing non-native annual grasses into serpentine grassland areas. The location of serpentine grassland is shown on Figures provided in Appendix A of the VRP.

Invasive Weed Control during Tree Removal

Tree removal began in fall 2016 prior to the start of ground disturbing construction activities in spring 2017. The measures below, drafted in September 2016, were implemented for that tree removal and applicable measures will be implemented for ROW clearance and grading again in 2017.

No ground disturbance will occur as part of tree removal activities. The tree removal crews will access the site through a mowed access road in the right-of-way. Vehicles used for tree removal will arrive on site clean and free of soils and plant material. Any vehicles that arrives on site and need to be cleaned will be directed to the wash station established for the Crystal Springs project. Stinkwort, which was located along the access road, was handpulled and removed from the site so that the tree removal vehicles would not spread this species on site.

The crews will undergo training as detailed below under Environmental Training. All tree trimmings will be chipped on site and removed from the site. No woody debris or wood chips will be left on site. All small branches and leaves that are left on site will be confined to the non-native woodland areas. No debris will be spread into serpentine grassland. Care will be taken not to spread soil from the non-native woodland areas into the serpentine grassland areas.

Work Site Preparation

The entire work area is expected to be mowed or scraped prior to the start of construction in spring 2017, after tree removal is complete in fall 2016. Whenever possible, serpentine areas will be mowed and not scraped. All access for project construction will be within the established work area that has been mowed or scraped. The soil surface will be disturbed the *minimum* amount necessary to complete construction activities, which will consequently will help minimize the proliferation of invasive weeds and non-native grasses and forbs. Areas that can be mowed rather than scraped will be identified during preconstruction meetings. Mowing will be conducted in sections prior to scraping to avoid spreading non-native annual grass propagules into the serpentine grassland. Areas that contain invasive weed species or are dominated by non-native species will be scraped and the topsoil handled as specified below to avoid the spread of non-native plant propagules. The differentiation of these areas will be mapped and included in the annual restoration monitoring reports provided to SFPUC and CDFW.

Topsoil Management

Soil disturbance and transport will be minimized to the extent possible and topsoil placement during and following construction will be carefully managed so that topsoil from non-native grassland or other habitats is not combined with serpentine grassland topsoil. The topsoil, where scraping and excavation is necessary, shall be salvaged and stockpiled separately in upland construction work areas. Serpentine grassland topsoil will be salvaged and stockpiled separately from non-native grassland soil and clearly labeled. Non-native woodland and shrubland topsoil will also be stockpiled separately. All topsoil shall be stored in such a way that it is protected from non-native plant propagules, but minimizes the risk of overheating and killing the native plant propagules. This shall include placing the stored topsoil where it is not in contact with non-native grassland soil and protecting it with weed-free straw mulch or other suitable cover. Following construction, the salvaged topsoil (with the exception of topsoil containing a prevalence of non-native plant species) will be spread over the disturbed area from which it was removed, and the area will be graded to match the preconstruction natural grade. Only serpentine grassland topsoil will be spread in serpentine grassland areas. Once the salvaged topsoil has been spread and the area returned to the pre-existing topography, the area will be revegetated as detailed in Section 4 of the VRP, Revegetation Activities.

In areas such as fire breaks, access roads, and non-native woodland areas that have been determined by professional judgement of a qualified botanist to have a substantial population of non-native plant species, the topsoil will be scraped and stockpiled separately, taking care not to spread the topsoil and invasive weed and non-native plant propagules it contains. No special topsoil preservation measures will be undertaken in these areas. Topsoil from the trench in these areas will be stockpiled during construction activities and will be buried below the subsoil during backfill or offhauled, and the soils from deeper in the trench placed on the surface, where feasible. Areas where topsoil will be buried due to the presence of invasive weeds or high non-native cover will be based on the species present and absolute cover. These areas will be identified by a qualified restoration specialist during grading. After initial restoration, the fire breaks will be exempt from continued management/monitoring.

Invasive Weed Control Adjacent to the Work Area

Prior to and during construction, where feasible, invasive weeds outside of the work area that have the potential to spread into the work area via wind-borne propagules will be controlled. Control will include mowing or cutting and disposal of propagules since soil disturbance outside of the work area is not allowed.

Environmental Training

Invasive weed identification and avoidance measures will be included in the preconstruction environmental tailboard meeting that will be given to all construction personnel. The training will include field identification of invasive plants in the project area, reproductive biology of invasive plants, and invasive plant prevention Best Management Practices. The training will also include a summary of serpentine grassland, the rare plants associated with serpentine grassland, and threats to serpentine grassland including non-native annual grasses and forbs. The training will also include a summary of *Phytophthora*, its issues, spread, and Best Management Practices based on SFPUC's BMPS for Pathogens (SFPUC 2016). The biological monitor will ensure that construction staff understand provisions for invasive and non-native plant prevention and soil-borne pathogen spread prevention throughout the project. Invasive and non-native plant and soil-borne pathogen considerations will be routinely addressed during regular tailboard meetings. The monitoring biologist shall ensure that all staff have participated in the training by establishing and keeping a sign-in sheet that will record attendees.

Cleaning of Equipment and Vehicles

All equipment and material arriving on site will be clean and free of soils and plant material except for materials such as coir or fiber rolls which are made with plant material themselves; those will be kept clean of foreign plant material and soils. Wash stations will be established near the work area access points to local roadways. Contractor vehicles and equipment that have been used or driven off-road prior to arriving at the proposed project sites will be cleaned upon arriving on site at the on-site wash stations before entering further into the work site, to minimize bringing invasive weed propagules, plant pathogens, insects, and soil from elsewhere onto the project. Vehicles as described that require washing will not access the work site without using one of the wash stations. In compliance with the MND, vehicle cleaning will remove soil, seeds, and plant parts from the undercarriage, tires, sideboards, tailgates, and grills of all vehicles and equipment.

The construction workers will also brush off soil and plant material off of their boots at the wash station and decontaminate with quaternary ammonia solution or Isopropyl alcohol (70-90%). In lieu of multiple decontaminations, crew personnel can choose to have two pairs of boots (one cleaned prior to entry to SFPUC and one for use outside SFPUC) if they so choose. In this case, the boots would only be washed

once prior to entry to SFPUC property, and be left on site. The monitoring biologist will verify the condition of the equipment and vehicles for proper cleaning before entering the project site.

Boots worn during restoration implementation and any hand-equipment such as shovels, spades, trowels, will also be brushed clean, washed in the vehicle wash station or immediately prior to being brought on site, and sprayed with a 0.525% sodium hypochlorite concentrations (5000 ppm available chlorine) bleach solution or preferably a 70-90% ethyl alcohol (ethanol) or isopropyl alcohol (isopropanol) solution (such as Lysol disinfectant or a prepared solution) to sanitize the equipment for invasive plant and soil borne pathogen control. The chart below will be used to prepare bleach solutions. For example, adding 100 ml of 5.25% bleach to 900 ml of water will make 1000 ml of 0.525% NaOCl solution. If using 8.3% bleach, 100 ml of bleach would be added to 1480 ml of water to make 1490 ml of 0.525% NaOCl.

Dilutions of commonly available bleach products needed to obtain approximately 0.525% sodium hypochlorite concentrations (5000 ppm available chlorine).

Percent sodium hypochlorite in bleach	Parts bleach	Parts water	Diluted bleach percent sodium hypochlorite
5.25%	1	9	0.525%
6.0%	1	10.4	0.526%
8.25%	1	14.6	0.529%
8.3%	1	14.8	0.525%

Ongoing Invasive Weed Surveys

The project area and access routes will be periodically surveyed for invasive weeds throughout project construction so invasive weed species that were not detectable prior to the start of construction (because they geminate or grow in different seasons) will be detected. Invasive weeds that are detected during periodic inspections in the work area will be mowed, or removed and seeds or flowers will be placed in garbage bags and removed from the site.

Weed Free Materials

All construction material sources (including erosion control materials) will be weed-free. Only rice straw or weed-free straw or fiber roll logs will be used[2].

Measures to be Implemented Post Construction

Restoration

The site will be revegetated as soon as possible with locally collected materials to reduce the likelihood of invasive weed and non-native plant establishment. All restoration activities will follow this VRP. All seed mixes will be weed free and will contain an analysis label detailing the contents of the seed mix. Revegetation activities are detailed in Section 3 of the VRP.

Annual Monitoring

The site will be monitored annually for five years. Monitoring includes an invasive weed component. Success criteria and monitoring methodology are detailed in Section 4 of the VRP, Success Criteria, Monitoring, and Reporting.

[2]To decrease the possibility of introducing pathogens (including *Phytophthora)* from a plant nursery to the site, container stock will not be used for revegetation.

Remedial Activities

Invasive weed species will be removed and controlled in all revegetated areas during the five-year monitoring period as necessary to stay on track to meet success criteria. Non-native plant species, including annual grasses, will be controlled in serpentine grassland areas as necessary to keep the site on track to meet success criteria. For details on remedial activities including when they will be initiated, please refer to Section 4 of the VRP, Success Criteria, Monitoring, and Reporting.

Please feel free to call me at (925) 228-1027 if you have any questions.

Sincerely,

Erin L. McDermott
Principal
ISA Certified Arborist – WE7318A
Botanist, Wetland & GIS Specialist
Nomad Ecology, LLC

Appendix D 2016 BASELINE DATA TECHNICAL MEMORANDUM

February 22, 2017

Robert Vogt, M.S.
Senior Biologist
Pacific Gas & Electric Company
Environmental - Gas Transmission
6111 Bollinger Canyon Road
San Ramon, CA 94583

Technical Memorandum – Baseline Data Collection for Gas Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County, California.

Dear Mr. Vogt,

This Technical Memorandum includes baseline special-status plant species and vegetation information to supplement the Vegetation Restoration Plan (VRP; Nomad 2016) for the Gas Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County. The data included in this Technical Memorandum was collected prior to the preparation of the VRP.

This technical memorandum contains the following additional baseline information.

- Sampling and mapping of Crystal Springs lessingia (*Lessingia arachnoidea*; CRPR 1B.2) in the work area and unimpacted Crystal Springs lessingia reference sites.
- Baseline vegetation data collection in Serpentine Grassland and Non-Native Grassland in the work area, and baseline vegetation data collection in potential Serpentine Grassland Reference Sites.

CRYSTAL SPRINGS LESSINGIA COUNTING AND MAPPING IN THE WORK AREA AND REFERENCE SITES

Crystal Springs Lessingia Overview

Crystal Springs lessingia restoration is addressed in detail in Appendix B of the VRP. Per the VRP, Crystal Springs lessingia in the work area was counted prior to the start of construction to quantify the number of plants impacted. Per the VRP, success criteria require that 95 percent of the preconstruction number of Crystal Springs lessingia plants will be established at the end of five years with the numbers adjusted based on annual comparison to reference sites. Per the VRP, the numbers of Crystal Springs lessingia counted in the reference sites each year will be compared to the numbers of Crystal Springs lessingia in the reference sites in 2016 to adjust the yearly plant targets. For example, if only half of the plants known to occur in the reference sites are present in any given year, the target number of plants for the reestablished population in the work area will be adjusted (lowered) proportionately. This adjustment is because the numbers of Crystal Springs lessingia can fluctuate widely between years.

Crystal Springs lessingia is an annual plant species that can be present in varying locations and numbers every year solely due to natural variables such as the amount and timing of precipitation, seed dispersal, dormancy, and microscale recruitment patterns. Crystal Springs lessingia varies spatially and in abundance annually as demonstrated by the results of field work from 2013 to 2016: the 2013 rare plant surveys (during which Crystal Springs lessingia in the study area was mapped and estimates made of population size), map updates in 2014 and 2015 (during which Crystal Springs lessingia in the study area was remapped), and the Crystal Springs lessingia census and mapping in 2016 presented in this report. These data show that the numbers and locations of Crystal Springs lessingia in the project area varied annually.

Reference populations of Crystal Springs lessingia will be sampled annually during the project monitoring period. The goal of sampling reference populations is to track annual variation in natural population abundance over several years to determine population trends, as the numbers of plants in both the restoration and reference areas are expected to vary each year. Information on trends is desired for two reasons: 1) to determine how the baseline population estimates, estimated by Orion Environmental Associates in 2013 and then counted by Nomad Ecology in 2016, compare to population trends from several years of sampling; and 2) to correlate natural population trends with the population monitoring for restored Crystal Springs lessingia populations within project impact areas to compare abundance against an undisturbed reference condition.

Counting each individual of Crystal Springs lessingia can be very time consuming. During annual monitoring, the number of Crystal Springs lessingia individuals within the reference sites will be estimated or censused (e.g., each plant observed is counted) depending on the size of the colony. If counting each individual plant is infeasible due to overall abundance, a portion of the population will be sampled to extrapolate the total number of individuals in that colony. The goal of sampling is to estimate the annual population size of Crystal Springs lessingia in the work area or each of the reference sites. When sampling the population size, some error is associated with the sample (the difference between the sample estimate and the actual number of individuals in the population). A confidence interval will be used to assess that error following standard statistical methods (Elzing et al. 1998). For this sampling effort we used two confidence intervals: 80% and 95%. An 80% confidence level was used to show a narrower potential range that the population estimate could fall within, as opposed to a wider potential range generated by a 95% confidence interval. As expected due to the high degree of patchiness within the population typical of abundance patterns in this annual species, a 95% confidence interval showsan extremely wide range.

Crystal Springs Lessingia – Crystal Springs Work Area

Work Area Data Collection

Crystal Springs lessingia in the work area was surveyed and mapped on August 16, 2016 by Nomad botanists Jaclyn Inkster and Gregg Weber. The locations of Crystal Springs Lessingia mapped in the work area during the field effort are shown in Figure 1 in Attachment A. Baseline and reference site plots are also shown in Figure 1 in Attachment A.

During mapping, Crystal Springs lessingia plants were in flower and were clearly visible and countable. They ranged from 10 to 100 cm in height. The boundaries of the work area were determined using a handheld submeter accurate GPS unit that had the GIS shapefile of the work area loaded into it. The boundaries of Crystal Springs lessingia in the work area were mapped as polygons surrounding the perimeter of the population that was within the work area. When the polygon was mapped, a determination was made if the number of Crystal Springs lessingia in that patch could be feasibly censused (e.g., each plant observed was counted) or if it needed to be sampled.

There were a total of 18 Crystal Springs lessingia patches in the work area (Table 1 and Figure 1). 13 Crystal Springs lessingia patches in the work area were censused and 5 Crystal Springs lessingia patches

Table 1. Estimated and Counted Number of Crystal Springs Lessingia in Work Area in 2016

Lessingia Work area Patch ID	Work Area Location (Relative to L109 centerline stations)	Area (Acres)	Survey Method	Number of Sample quadrats (1m²)	Mean Density: Individuals/ m² (± 80% CI)	Lessingia Individuals in 2016 (± 80% CI)	Mean Density: Individuals/ m² (± 95% CI)	Lessingia Individuals in 2016 (± 95% CI)
1	South of 0+00	0.007	Census	NA	0.90	26	0.90	26
2	0+00 to 1+00	0.017	Census	NA	0.99	68	0.99	68
3	1+00 to 10+00	0.273	Census	NA	0.89	986	0.89	986
4	2+00 to 5+00	0.084	Sample Estimate	17	23.35 (± 14.61)	7,917 (± 4,800)	23.35 (± 21.65)	7,917 (± 7,341)
5	2+00 to 3+00	0.032	Census	NA	4.16	536	4.16	536
6	5+00 to 8+00	0.170	Sample Estimate	33	31.06 (± 8.55)	21,432 (± 5,900)	31.06 (± 13.08)	21,432 (± 9,023)
7	6+00 to 9+00	0.089	Sample Estimate	19	3.68 (± 2.00)	1,334 (± 725)	3.68 (± 3.06)	1,334 (± 1,108)
8	14+00 to 19+00	0.679	Sample Estimate	133	11.68 (± 2.52)	32,099 (± 6,941)	11.68 (± 3.86)	32,099 (±10,615)
9	23+00 to 24+00	0.030	Census	NA	23.66	2,863	23.66	2,863
10	24+00 to 25+00	0.015	Census	NA	0.58	36	0.58	36
11	26+00 to 27+00	0.019	Census	NA	0.20	15	0.20	15
12	27+00 to 29+00	0.087	Census	NA	3.29	1,153	3.29	1,153
13	29+00 to 30+00	0.051	Census	NA	3.51	720	3.51	720
14	30+00 to 31+00	<0.001	Census	NA	1.00	1	1.00	1
15	41+00 to 43+00	0.077	Census	NA	3.11	970	3.11	970
16	43+00 to 45+00	0.056	Census	NA	9.83	2,241	9.83	2,241
17	44+00 to 48+00	0.084	Census	NA	1.57	537	1.57	537
18	59+00 to 62+00	0.252	Sample Estimate	51	139.69 (± 43.43)	142,480 (± 44,297)	139.69 (± 66.42)	142,480 (± 67,747)
TOTAL (All)	**South of 0+00 to 62+00**	**2.022**	**Census or Sample Estimate**	**253**	**26.41***	**215,414 (± 62,663)**	26.41*	**215,414 (± 95,834)**
Total (Patches 1-17)	**South of 0+00 to 48+00**	**1.770**	**Census or Sample Estimate**	**202**	**9.58***	**72,933 (± 18, 365)**	9.58*	**72,933 (± 28,087)**

* The mean density of Lessingia individuals for the entire work area was calculated by weighting the mean density of a patch by the proportion of the area the respective patch comprised in the sum of the patch areas.

were sampled (Table 1). The decision whether to census or sample was made based on the density of individuals in the patch and the size of the patch. Census is the preferred monitoring method when feasible because no summary statistics are required to analyze the results or the precision of the estimate (Elzing et al. 1998). Plants were censused where it was feasible. Due to the large size of some of the work area patches and the number of Crystal Springs lessingia individuals present in 2016, a census was not feasible for all patches as it would have taken a field crew several days or weeks to complete. Therefore, the number of Crystal Springs lessingia individuals within the specific patches was estimated by sampling. A portion of the population was sampled to extrapolate the total number of individuals. Based on the data, patches that were censused had less than 3,000 plants.The number of Crystal Springs lessingia in each patch in the work area was counted or estimated on August 31 and September 2, 2016 by

Nomad botanists Erin McDermott, Claire Brown, Jaclyn Inkster, Gregg Webber, and Michael Park, and Nomad biologist Erick Mahood. The boundaries of the work area were determined in the field using a handheld submeter accurate GPS unit, that had the GIS shapefile of the work area loaded on it. A tape measure pulled tight between stakes was used to clearly mark the boundaries of the work area in the field.

In the 13 patches that were censused, tape measures were used to divide the Crystal Springs lessingia patches into 1-meter wide lanes. One-meter-square quadrats were placed in the lanes consecutively to count all individuals inside each quadrat, and to ensure no plants were counted twice. The number of plants per quadrat was recorded.

In the five areas that were sampled, a 1-meter-square quadrat was placed at a randomly generated location and the number of individuals in the quadrat was counted and recorded on paper data sheets. Prior to conducting field work, the random locations were generated for each of the five sample patches in GIS by overlaying a grid of 1-meter-square cells on the mapped Crystal Springs lessingia patch, generating the GPS coordinates of the east corner of each cell, numbering the coordinates consecutively, and randomly selecting GPS coordinates. The number of random points per patch was determined based on the square area of each patch, and reflects roughly 5% of the patch total area. A handheld GPS unit was used to navigate to each randomly generated sampling location in the field and a labeled pin flag was placed at the location of the point. The 1-meter-square quadrat was oriented so that the pin flag was placed consistently in the southeast corner of the quad. A total of 253 quadrats were sampled among the five sample estimate patches in the work area.

Sampling data were entered into an Excel spreadsheet and all statistical calculations were completed in Excel. For work area patches that were sampled (not censused) (Table 1 and Figure 1), the sampling data was used to estimate the mean density of individuals per square meter and a confidence interval (CI) for density per square meter using the standard deviation, number of samples, and an alpha value of 0.20 or 0.05 (for the 80% or 95% CI respectively). The mean density and patch area size were used estimate the population size of each work area patch. The mean density of Lessingia individuals for the entire work area was estimated by weighting the mean density of a given patch by the proportion of the area that the respective patch comprised, to account for the size of patch.The mean number of individuals for each work area patch was estimated, along with 80% and 95% confidence intervals. An 80% confidence level was used to show a narrower potential range that the population estimate could fall within, as opposed to the wider potential range generated by a 95% confidence interval. Due to the high degree of variation in individual plant numbers between samples which is typical of abundance patterns in this annual species, using a 95% confidence interval resulted in an extremely wide range in number of individuals.

Work Area Results

Crystal Springs lessingia was mapped in serpentine grasslands throughout the project area. The locations of Crystal Springs lessingia mapped in the work area during the field effort are shown in Figure 1 in Attachment A. Baseline and reference site plots are also shown in Figure 1 in Attachment A.

As shown in Table 1, a total of 215,414 individuals were counted and/or estimated in the work area within a 2.02-acre area. For the five patches that were sampled, the number of individuals was estimated using both an 80% and a 95% confidence interval. Within a given patch, some 1-meter-square quads sampled had hundreds of individuals while others had zero. This degree of variation resulted in a total estimate of Crystal Springs lessingia for the work area that has a large range. At 80% confidence interval, the estimate of number of individuals in the work areas is 215,414 ± 62,663, or between 152,751 and 278,077 individuals. At 95% confidence interval, the estimate of number of individuals in the work areas is 215,414 ± 95,834, or between 119,580 and 311,248 individuals.

This is a substantial apparent increase in individuals from the results of 2013 surveys during which it was estimated there were 20,412 Crystal Springs lessingia individuals in 0.99 acres within the work area

(Orion Environmental Associates 2013). This indicates that the distribution of Crystal Springs lessingia in the work area appears to have increased in size (doubled from 0.99 acre to 2.02 acre), increased in number of individuals (from 20,412 to 215,414 individuals), and increased in density (from 20,618 plants/acre to 106,640 plants/acre) from 2013 to 2016. It should be noted that the number of individuals in 2013 were estimated with a smaller level of effort than that used in 2016. Much of the increase in number of individuals is attributed to Patch 18, which is discussed in detail below.

One patch of Crystal Springs lessingia in the work area (Patch 18) was not representative of the rest of the work area as it had a much higher mean density (140 individuals per square meter) than any of the other work area patches, which had mean densities ranging from 0.20 plants per square meter to 31 plants per square meter. The majority of the patches (12 of the 18) had mean densities of less than 5 individuals per square meter. Patch 18 accounts for 66% of the total number of Crystal Springs lessingia estimated in the work area (142,480 individuals of 215,414 total individuals) in an area that accounts for 12% of the total occupied area (0.25 acre of 2.02 acre total occupied area). Patch 18 is located in a staging area used for a prior PG&E project. In addition, Crystal Springs lessingia was not observed in this location in 2013, 2014, or 2015. Therefore this patch is not representative of the rest of the work area due to its high density; large number of individuals; the fact that Crystal Springs lessingia was not observed in prior years; and because this area was used as a staging area for other projects. As a result, Table 1 includes a total for all patches, and a separate total for Patches 1-17.

In 2016, the area occupied by Crystal Springs lessingia in the work area expanded compared to the area occupied in previous years. Many of these new areas where Crystal Springs lessingia was present in 2016 exhibited a very low density (a mean density of less than 5 individuals per square meter). This suggests that in 2016, temperature and rainfall conditions were more conducive to germination and growth, resulting in presence of Crystal Springs lessingia in marginal habitat where lessingia were not observed in prior years under different rainfall and temperature conditions. In future years, it is possible that Crystal Springs lessingia will again not be present in these marginal habitat areas, and the number of individuals will decrease.

Future Work Area Data Collection

As detailed in the VRP, Crystal Springs lessingia individuals in the restored work area will be mapped and counted during annual monitoring. The annual monitoring will follow the same sample methodology as the 2016 baseline data collection. If it is feasible to count the number of plants in a patch, they will be censused. Where the number of individuals is too large to census readily, the number of individuals will be estimated from sampling data using the same methodology as employed in 2016. Since Patch 18 is not representative of the project site, it will continue to be tracked separately from Patches 1-17, as well as combined to get total numbers of Crystal Springs lessingia for the site.

Crystal Springs Lessingia –Crystal Springs Reference Sites

Reference Site Selection

Reference sites were selected on August 9 and 16, 2016 by Nomad botanists Erin McDermott, Jaclyn Inkster, and Gregg Weber. These reference sites will be sampled during annual monitoring. Three permanent reference sites (between 0.30 and 0.46 acres in size) were selected. On these dates, boundaries of Crystal Springs lessingia were mapped using a submeter accurate GPS. Due to the large size of the reference sites and the number of Crystal Springs lessingia individuals present in 2016, a census was not practical as it would have taken a field crew several days or weeks to complete this task. The population was sampled to extrapolate the total number of individuals in each reference site. In future years, the reference sites will continue to be sampled, unless the population is small enough during a sampling year

that census is feasible (which has the potential to occur based on observed annual fluctuations in Crystal Springs lessingia numbers).

The size of the reference sites was chosen so that they were large enough to capture change in Crystal Springs lessingia populations but small enough to be feasibly sampled. If reference sites were too small, the spatial expansion or contraction of populations or changes in abundance due to annual variation might not be captured (for example if populations expanded outside of the reference site and not within it). Similarly, if reference sites were too small, changes in abundance and extent cannot be assumed to accurately represent change over the entire population or to be representative of the entire population. The spatial variability described above within these populations is demonstrated by the results of the 2013 rare plant surveys, map updates in 2014 and 2015, and the Crystal Springs lessingia census and mapping presented in this report.

The reference site locations were chosen based on several factors, specifically their proximity to the work area, the similarity of Crystal Springs lessingia densities, and spatial variability based on mapping in 2014, 2015, and 2016. All three reference sites contain areas of dense Crystal Springs lessingia and areas with dispersed plants, similar to the work area. The reference sites are described below.

Reference Site 1 is directly adjacent to the work area and has similar serpentine grassland vegetation as the work area and the other reference sites. The vegetation is characterized by purple needlegrass (*Stipa pulchra*), California oatgrass (*Danthonia californica*), oats (*Avena* sp.), Italian ryegrass (*Festuca perennis*), common tarweed (*Madia elegans*), hayfield tarweed (*Hemizonia congesta* subsp. *luzulifolia*) and willow lettuce (*Lactuca saligna*). Reference Sites 2 and 3 are slightly more removed from the work area as there were not any other areas with sufficient Crystal Springs lessingia directly adjacent to the work area. Reference Sites 2 and 3 have similar vegetation to Reference Site 1 and the work areas.

The above combination of reference sites was chosen because these reference sites include sites that are variable spatially year to year (Crystal Springs lessingia was not present in prior years), spatially consistent year to year (Crystal Springs lessingia was present in prior years), and spatially intermediate (Crystal Springs lessingia was present but a much smaller population). These reference sites will provide a representative subsample of the plant community, and may provide valuable information about annual Crystal Springs lessingia population dynamics which can be used to extrapolate likely population trends about Crystal Springs lessingia population variation in the work area.

Reference Site Sampling

Crystal Springs lessingia was sampled in the reference sites on August 29, 2016 by Nomad botanists Gregg Weber, Jaclyn Inkster, Michael Park, and Claire Brown. In each reference site, a 1-meter-square quadrat was placed at randomly generated locations and the number of individuals in the quadrat was counted and recorded on paper data sheets. Prior to conducting field work, the random locations were generated in GIS by overlaying a grid of 1-meter-square cells on the entire reference site, generating the GPS coordinates of the southeast corner of each cell, numbering the coordinates consecutively, and randomly selecting 61-94 quadrats per reference site. A handheld GPS unit was used to navigate to each randomly generated sampling location in the field and a labeled pin flag was placed at the location of the point. The 1-meter-square quadrat was oriented so that the pin flag was placed consistently in the southeast corner of the quadrat. In each reference site, 61-94 quadrats were counted for a total of 249 quadrats. This represents roughly 5% of the sampling area of each reference site.

Areas characterized as low density generally contained less than 10 individuals per square meter. Areas with high density generally contained greater than 10 and up to 800 individuals per square meter .

Sampling data were entered by hand into an Excel spreadsheet and all statistical calculations were completed in Excel. For each reference site, the sampling data was used to calculate mean density of individuals per square meter and a confidence interval for density per square meter using the standard

deviation, number of samples, and alpha values of both 0.05 and 0.20 for 95% and 80% confidence intervals respectively. The mean density and mean density confidence interval were used to calculate the population estimate based on the area of the reference site. The number of individuals for each reference site was calculated, along with a lower population estimate and an upper population estimate (80% confidence interval and 95% confidence interval). The standard deviation is a measure that is used to quantify the amount of variation or dispersion of a set of data values. The standard deviations are large in this sampling due to the substantial variation in density in the sampled quadrats. An 80% confidence level was used to narrow the population estimate and a 95% confidence interval was used to show the variability.

Reference Site Results

The number of estimated Crystal Springs lessingia in the three reference sites are shown below in Table 2 and Table 3. The results of 2016 reference site sampling show that density varied considerably among the reference site 1-meter-square quadrats, meaning that some quadrats had zero or only a few individuals, and some had numerous plants (up to 800 individuals). This is demonstrated by the confidence intervals in the population estimates. Visual observations of plant densities correlate with the sampling data. Photographs of select sample quadrats are provided in Attachment B.

Table 2. Estimated Number of Crystal Springs Lessingia in Reference Sites Using 80% CI

Reference Site	Number of Sample Quadrats ($1M^2$)	Area (Acres)	Mean Density [Number of Plants / Square Meter (±80% Confidence Interval)]	Number of Individuals Estimated in 2016 [Number of Plants (±80% Confidence Interval)]	Lower Population Estimate	Upper Population Estimate
Crystal Springs lessingia Reference Site 1	94	0.457	21 (± 3.9)	39,734 (± 7,202)	32,532	46,936
Crystal Springs lessingia Reference Site 2	61	0.300	16 (± 4.5)	18,932 (± 5,459)	13,473	24,391
Crystal Springs lessingia Reference Site 3	94	0.463	42 (± 12.2)	78,211 (± 22,933)	55,278	101,144
Total	**249**	**1.220**	**NA**	**136,877 (± 35,594)**	**101,283**	**172,471**

Table 3. Estimated Number of Crystal Springs Lessingia in Reference Sites Using 95% CI

Reference Site	Number of Sample Quadrats ($1M^2$)	Area (Acres)	Mean Density [Number of Plants / Square Meter (±95% Confidence Interval)]	Number of Individuals Estimated in 2016 [Number of Plants (±95% Confidence Interval)]	Lower Population Estimate	Upper Population Estimate
Crystal Springs lessingia Reference Site 1	94	0.457	21 (± 6.0)	39,734 (± 11,014)	28,720	50,748
Crystal Springs lessingia Reference Site 2	61	0.300	16 (± 6.9)	18,932 (± 8,349)	10,583	27,281
Crystal Springs lessingia Reference Site 3	94	0.463	42 (± 18.7)	78,211 (± 35,073)	43,138	113,284
Total	**249**	**1.220**	**NA**	**136,877 (± 54,437)**	**82,440**	**191,314**

Future Reference Site Sampling

During annual monitoring events, Crystal Springs lessingia in the reference sites will be sampled when the plants are recognizable and robust (generally July through August, but may be earlier or later depending on temperature and rainfall). The reference sites will be sampled following the methodology used in 2016. Random sampling locations in each reference site will be re-generated in GIS each year as described above; the sampling locations are not permanent. The sampling data will be used to calculate the mean density of individuals per quadrat, and the range of low and high expected population estimates for each reference site using an 80% confidence interval (alpha value of 0.20) and a 95% confidence interval (alpha value of 0.05). Reference site population estimates will be compared to the restoration area population estimates or census to determine trends.

BASELINE VEGETATION SAMPLING AND REFERENCE SITE ESTABLISHMENT

Overview

Baseline data on plant species cover and composition was collected in serpentine grassland and non-native grassland vegetation in the work areas and in potential serpentine grassland reference sites in August and September 2016.

The goal of the sampling is to establish baseline conditions for plant species composition and cover prior to the start of construction, document the similarity and differences of the work areas and potential reference sites pre-construction, and to select final reference sites that were similar to work area sites. Per the VRP, success criteria for the project are based on annual comparison of vegetation data in the work area to preselected reference sites. A map of the locations of serpentine grassland and non-native grassland on site is included in Attachment A.

August is not the optimum time of year for collecting vegetation cover data in grasslands because early season species will have senesced. Dominant late season species and native and non-native grasses, as well as some early-season perennials, were identifiable during the August sampling. Project construction is planned for March of 2017. Additional vegetative cover data may be obtained in spring 2017 in the work area and potential reference sites to add to and update the fall dataset, compare late-season vegetative cover to early-season cover, and verify that the species composition is similar between the work area and reference sites. Any additional data collected will be reported in the As-Built Report. Annual vegetation monitoring activities following construction will occur in the spring.

At the time of the sampling, it was infeasible to establish non-native grassland references sites as all areas of non-native grassland adjacent to the work area were either disked or mowed.

2016 Potential Serpentine Grassland Reference Site Selection

Per the VRP, a minimum of two final reference sites will be chosen for serpentine grassland.

Three potential serpentine grassland reference sites (labeled 1-3) were chosen and of these the most similar to the work areas will be chosen to be final potential reference sites, with SFPUC and CDFW review. Potential reference sites were chosen to be as similar to the work areas as possible in plant species composition, topography, percent cover, and other variables. Reference site options were limited due to space constraints on site (the site is surrounded by a residential neighborhood, a mowed or disked access road, and Highway 280). Plant species composition data collected in both the work area and potential reference sites are to be used to select final reference sites that are similar to work area sites (e.g., they varied only by a few percent in cover class categories, on average).The location of potential reference sites is shown Figure 2 in Attachment A. Photographs of the potential reference sites are included in Attachment B.

The three potential serpentine grassland reference sites include an area directly east of the work area and south of the Caltrans rest stop (Reference Site 1), an area west of the work area and north of the Caltrans rest stop (Reference Site 2), and an area west of the work area, southwest of the intersection of Black Mountain Rd. and Hayne Rd. (Reference Site 3) (Figure 2 in Attachment A).

The final reference sites will be established with approval from SFPUC and CDFW and will be used in future annual monitoring reports to show progress towards meeting the percent cover success criterion. The methods used to collect data in the work area and potential reference sites are described below.

2016 Baseline Serpentine Grassland Vegetation Data Collection in the Work Area and in Potential Serpentine Grassland Reference Sites

Baseline vegetation data in serpentine grassland in the work area and potential reference sites were collected on August 31 and September 2, 2016.

Work Area Serpentine Grassland Sampling

On August 31, 2016, baseline vegetation data in the reference areas were collected by Nomad botanists Erin McDermott, Claire Brown, Gregg Weber, Mike Park, and Jaclyn Inkster. A total of 71 1-meter-square quadrats were randomly distributed throughout the serpentine grassland work area. The locations for placing the quadrats were chosen using GIS. Prior to conducting the sampling field work, mapped serpentine grasslands in the work area that overlapped with mowed areas were excluded from sampling. The remaining work area serpentine grasslands were divided into eight subunits to organize the sampling effort, and were labeled 1-8. The subunits were all of different sizes and each included continuous areas of serpentine grassland. Random locations were generated in GIS by overlaying a grid of 1-meter-square cells on the eight work area subunits, generating the GPS coordinates of the southeast corner of each cell, numbering the coordinates consecutively, and randomly selecting 2-19 coordinates per area. A total of 71 quadrats were distributed throughout the eight work area subunits, surveyed in one day by four people, representing 1% of serpentine grasslands in the work area. The quadrats were distributed among the eight subunits based on the size of the grassland, so that the number of quadrats was proportional to the size of the subunit. A handheld GPS unit was used to navigate to each randomly-generated sampling location in the field and a labeled pin flag was placed at the location of the point. The 1-meter-square quadrat was oriented so that the pin flag was placed consistently in the southeast corner of the quad. Cover was estimated in each quad as detailed below.

Reference Site Serpentine Grassland Sampling

On September 2, 2016, baseline vegetation data in the work area were collected by Nomad botanists Claire Brown, Gregg Weber, Mike Park, and Jaclyn Inkster. Serpentine grasslands adjacent to the work area were scouted on August 16, 2016 by Nomad botanists Jaclyn Inkster and Gregg Weber to determine suitability for use as reference sites. The dominant species were recorded and notes and photos were taken characterizing similarity to the work area. Three areas that were similar to the work area were established as potential serpentine grassland reference areas. Dominant species of the work area and reference sites are included in the results section below.

A total of 45 random, 1-meter-square quadrats were randomly distributed throughout the serpentine grassland reference sites. The locations for placing the quadrats were chosen using GIS. Random locations were generated in GIS by overlaying a grid of 1-meter-square cells on the three reference areas, generating the GPS coordinates of the southeast corner of each cell, numbering the coordinates consecutively, and randomly selecting 9 to 26 GPS coordinates per potential reference site. A total of 45 quadrats in the reference areas were sampled, which represents approximately 1% of each reference site and the reference sites overall.

Data Collection and Analysis

Within each of the 1-meter-square quadrats placed in the serpentine grassland work area and potential reference sites, absolute cover of plants was visually estimated and recorded for the quadrat as a whole and for each individual plant species using the California Native Plant Society's (CNPS) method for estimating cover values (CNPS 2014). The CNPS method for estimating cover values uses a "bird's eye view" looking from above and estimating cover for the living plants only (CNPS 2014). Litter/duff is not included in these estimates and the porosity of the vegetation is taken into consideration when estimating percent cover (CNPS 2014). Percent cover diagrams were used to facilitate cover estimates. Cover estimates were recorded on data sheets.

Data were entered into an Excel spreadsheet and percent cover calculated for the four categories of plant cover viewed as most ecologically relevant. These categories include: native species cover, non-native species cover, native grass cover, and non-native grass cover. For all the work area subunits combined and reference areas combined, the means and standard errors for the summary categories were weighted by the proportion of the area each of the subunits or reference areas comprised in the total area of the serpentine grasslands. Estimated mean absolute cover values were reported for all categories and standard error values are reported in tables and graphs for all serpentine grassland vegetation data.

Results of Serpentine Grassland Sampling

Work Area – Serpentine Grassland

Dominant species in the work area included California oatgrass, purple needlegrass, wild oats, common madia, and soft chess (*Bromus hordeaceus*). Total cover in the serpentine grassland quadrats in the work area subunits ranged from 15% to 59% cover and averaged 42% cover (Table 4). Native plant cover ranged from 7% to 40% and averaged 22%. Native grass cover ranged from 5% to 27% cover and averaged 15%. Non-native plant cover ranged from 4% to 33% and averaged 24%. Non-native grass cover ranged from 4% to 32% and averaged 24% which demonstrated that the majority of non-native cover in the plots was non-native grasses (Table 4).

Table 4. Summary of Absolute Cover Data for Random Quadrats Located in Serpentine Grasslands in the Work Area (mean ± SE)

SERPENTINE GRASSLAND WORK AREA SUBUNIT ID	AREA (ACRES)	NUMBER OF 1M^2 SAMPLE QUADRATS	TOTAL PERCENT COVER OF ALL SPECIES	NATIVE PLANT PERCENT COVER	NATIVE GRASS PERCENT COVER	NON-NATIVE PLANTS PERCENT COVER	NON-NATIVE GRASS PERCENT COVER
1	0.408	11	59 (± 6.0)	28 (± 7.2)	24 (± 7.1)	31 (± 8.9)	30 (± 8.7)
2	0.545	13	40 (± 6.6)	40 (± 6.6)	14 (± 3.9)	23 (± 5.3)	22 (± 5.3)
3	0.801	19	46 (± 5.7)	13 (± 3.1)	10 (± 3.3)	33 (± 5.1)	32 (± 5.1)
4	0.061	2	19 (± 5.6)	15 (± 4.6)	12 (± 3.5)	4 (± 1.0)	4 (± 1.0)
5	0.478	11	45 (± 10.9)	29 (± 6.2)	27 (± 6.2)	16 (± 7.9)	16 (± 7.9)
6	0.180	4	15 (± 5.6)	7 (± 2.2)	5 (± 1.8)	8 (± 5.6)	8 (± 3.4)
7	0.128	3	26 (± 3.8)	17 (± 3.7)	14 (± 4.6)	9 (± 5.9)	9 (± 5.9)
8	0.312	8	38 (± 6.5)	9 (± 2.7)	5 (± 2.9)	29 (± 6.4)	27 (± 6.2)
Average	0.364	8.9	**42 (± 3.8)**	**22 (± 4.0)**	**15 (± 2.7)**	**24 (± 3.0)**	**24 (± 3.0)**
Total	**2.913**	**71**	NA	NA	NA	NA	NA

The data are displayed for each of the subunits. The subunits range in size from very small (0.061 acre) with 2 quadrats sampled, to large (0.801 acre) with 19 quadrats sampled. Some of the subunits were dominated by native plant species (subunits 2, 4, 5, 7), some were dominated by non-native plant species (subunit 3, 8), and some were co-dominated by natives and non-natives (subunit 1, 6). Subunits 4 and 6

had low absolute cover but a large portion of the total cover was composed of natives. Subunit 8 overlapped with Crystal Springs lessingia work area Patch 18; the serpentine sampling quadrats contained low cover (0-3%) of Crystal Springs lessingia. The variability of the work area is likely due to its length; it is a linear project that contains a variety of microhabitats. Although the serpentine grassland is variable in the work area, because the data is displayed for each subunit, the percent cover values appear to vary widely between subunits. If the data were lumped for analysis (instead of presenting each subunit), the site would appear to be more uniform. Although variability between subunits in the work area is high, when averaged across the entire work area, values are similar to those in the reference sites.

Potential Reference Sites - Serpentine Grassland

Table 5 shows the summary of each potential reference site and mean cover values for all the reference sites. Overall the potential reference sites were very similar to the quadrats in the work area. Total cover in the potential reference sites ranged from 46% to 51% cover and averaged 49% cover (Table 5). Native plant cover ranged from 15% to 19% cover and averaged 18% cover. Native grass cover ranged from 14% to 17% cover and averaged of 15%. Non-native plant cover ranged from 31% to 33% cover and averaged 32% cover. Non-native grass cover ranged from 30% to 32% cover and averaged 31% cover.

The reference sites appear to be very similar to each other based on the data, with little variability between reference sites, compared to the variability between the work area subunits. This is likely because the reference sites comprise a much smaller area than the work area and are not long and linear with a diversity of microhabitats.

Figures 4-9 show each mean estimated cover value for the work area, for potential reference sites combined,and for each potential reference site graphically represented with standard error bars.

Table 5. Summary of Absolute Cover Data Random Quadrats Located in Potential Serpentine Grassland Reference Sites (mean ± SE)

SERPENTINE GRASSLAND REFERENCE SITE ID	AREA (ACRES)	NUMBER OF 1M^2 SAMPLE QUADS	TOTAL PERCENT COVER OF ALL SPECIES	NATIVE PLANT PERCENT COVER	NATIVE GRASS PERCENT COVER	NON-NATIVE PLANT PERCENT COVER	NON-NATIVE GRASS PERCENT COVER
1	0.457	26	51 (± 4.4)	19 (± 2.9)	14 (± 2.8)	33 (± 4.7)	32 (± 4.6)
2	0.224	10	46 (± 6.6)	15 (± 4.1)	14 (± 2.8)	31 (± 6.2)	31 (± 6.2)
3	0.261	9	49 (± 6.6)	19 (± 3.0)	17 (± 2.8)	31 (± 7.9)	30 (± 7.8)
Average	0.314	15	**49 (± 4.5)**	**18 (± 2.3)**	**15 (± 1.2)**	**32 (± 1.0)**	**31 (± 1.1)**
Total	**0.943**	**45**	NA	NA	NA	NA	NA

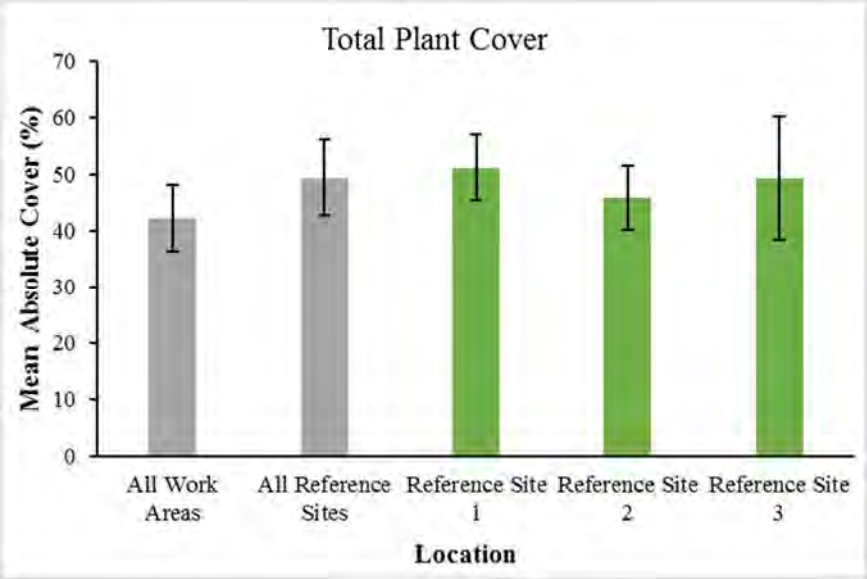


Figure 4. Mean Total Plant Cover with Standard Error for the Serpentine Grassland Work Area and Potential Serpentine Grassland Reference Sites

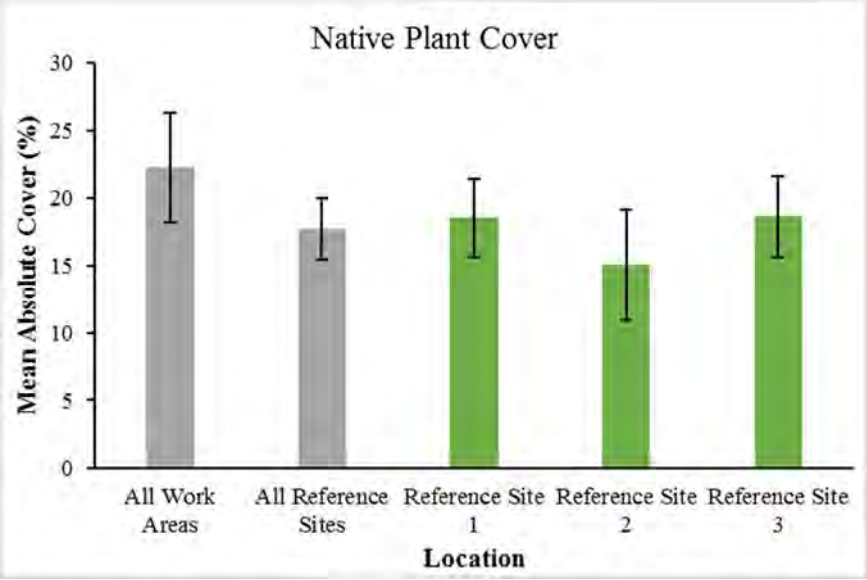


Figure 5. Mean Native Plant Cover with Standard Error for the Serpentine Grassland Work Area and Potential Serpentine Grassland Reference Sites

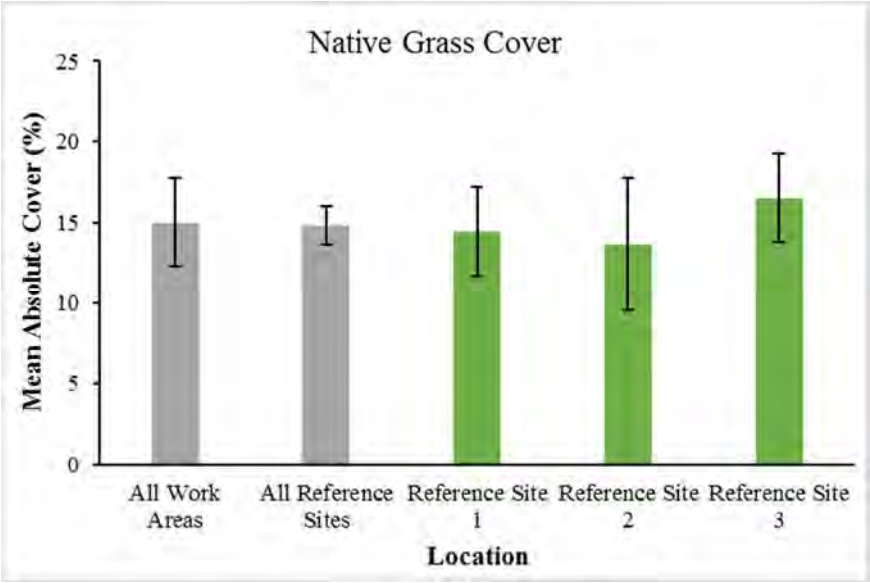


Figure 6. Mean Native Grass Cover with Standard Error for the Serpentine Grassland Work Area and Potential Serpentine Grassland Reference Sites

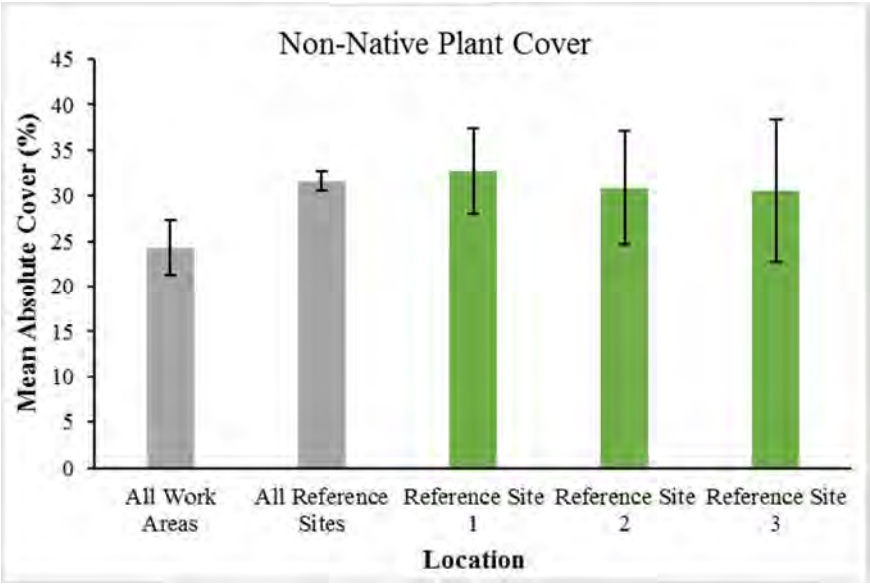


Figure 7. Mean Non-Native Plant Cover with Standard Error for the Serpentine Grassland Work Area and Potential Serpentine Grassland Reference Sites

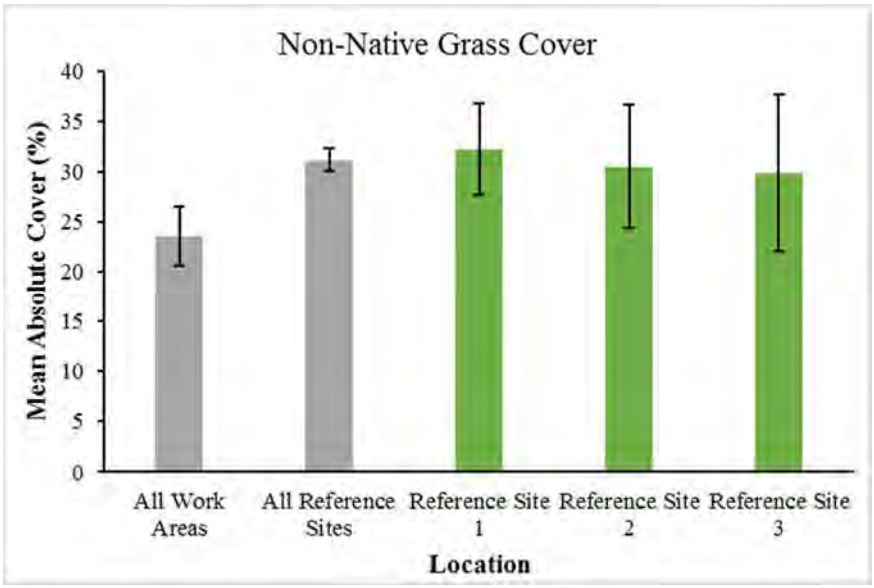


Figure 8. Mean Non-Native Grass Cover with Standard Error for the Serpentine Grassland Work Area and Serpentine Grassland Potential Reference Sites

Overview of Results and Assessment of Individual Potential Serpentine Grassland Reference Sites

The work area baseline data was compared to the potential reference site summary data to determine which potential reference sites are most similar. Figures 1-5 show all three potential reference sites combined are similar in all categories to the work area. Each of the potential reference sites is discussed individually below.

Potential Reference Site 1 is located directly west of the work area and south of the Caltrans rest stop. It overlaps almost entirely with Crystal Springs lessingia Reference Site 1. It was dominated by California oatgrass, purple needlegrass, wild oats, and Italian ryegrass. Other characteristic species include Crystal Springs lessingia, naked buckwheat (*Eriogonum nudum*), and common madia. Native plant cover, and native grass cover are very similar to the work area; the averages differ by only a few percent or less. Total plant cover, non-native plant cover and non-native grass cover averages are slightly higher than the work area (Tables 4 and 5; Figures 1-5). Even if the means for these three categories are not similar to the average of all the serpentine grasslands in the work area, these numbers are very similar to the serpentine grasslands in the work area that are near Reference Site 1 such as serpentine grassland work areas 1 and 3 (Tables 4 and 5). The plant species present in Potential Reference Site 1 are very similar to the work area likely because it is immediately adjacent. Overall, this reference site does not differ significantly from the work area and can be considered a good reference for comparing future restoration efforts, particularly when combined with the other potential reference sites.

Potential Reference Site 2 is slightly removed to the west of the work area, north of the CalTrans rest stop. Roughly 1/3 of this reference site overlaps with Crystal Springs lessingia Reference Site 2. It was dominated by California oatgrass, purple needlegrass, wild oats, and Italian ryegrass. Other characteristic species include hayfield tarweed, Crystal Springs lessingia, willow lettuce, and common madia. This reference site is similar to the total cover and native grass cover of the work area average. Reference Site 2 is less similar to the work area mean for native plant cover, non-native plant cover and non-native grass cover, however, this site is very similar in these categories to work area serpentine grassland subunits 1, 3, and 8 (Tables 4 and 5). The plant species present in Potential Reference Site 2 are very similar to the

work area even though it is slightly removed from the work area. Overall, Reference Site 2 is very similar to the work area and can be considered a good reference for comparison with future restoration of serpentine grasslands, particularly in combination with the other potential serpentine grassland reference sites.

Potential Reference Site 3 is slightly removed from the work area, southwest of the intersection of Black Mountain Rd. and Hayne Rd. It is roughly 100 meters north of Crystal Springs lessingia Reference Site 3. It was dominated by California oatgrass, purple needlegrass, soft chess, Italian ryegrass, and hayfield tarweed. Other characteristic species include blue-eyed grass (*Sisyrinchium bellum*), Crystal Springs lessingia, and willow lettuce. Total plant cover, native grass cover, non-native plant cover, and non-native grass cover was slightly higher than the work area. Native plant cover was slightly lower than the work area.

Crystal Springs lessingia was present in some of the sampling quadrats in all three potential reference sites, indicating similarity to the serpentine grassland in the work area. Potential Reference Site 3 appears to be suitable for comparison to future restoration efforts of serpentine grasslands, particularly in combination with the other potential serpentine grassland reference sites.

2016 Baseline Non-Native Grassland Vegetation Data Collection in the Work Area

Non-native grasslands were sampled in the work area on September 22, 2016 by Nomad botanists Jaclyn Inkster, Claire Brown, and Mike Park. Prior to conducting field work the areas that were mowed or disked were removed from consideration for sampling. One of these grasslands had an unusual ditch/culvert (between stations 39+00 and 40+00) that was not representative of the non-native grassland features in the work area, therefore it was removed from the assessment. The remaining five non-native grasslands that were great the 500 square meters-square were selected for potential sampling. Random locations in the four remaining non-native grassland work area subunits were generated in GIS by overlaying a grid of 1-meter-square cells on the four subunits, generating the GPS coordinates of the southeast corner of each cell, numbering the coordinates consecutively, and randomly selecting 8-18 GPS coordinates per subunit. A total sample size of 50 quadrats among the four non-native grasslands was determined since that was the number of quadrats three botanists could feasibly accomplish in one day. 1-meter-square quadrats were placed at the randomly generated locations where all identifiable vascular plant species and absolute cover of each was recorded on paper data sheets.

Cover was collected in each 1-meter-square quadrat using the same methodology as in the serpentine grassland.

Data were entered into an Excel spreadsheet and percent cover calculated for the categories of plant cover viewed as most ecologically important. These categories include: native species cover, non-native species cover, native grass cover, and non-native grass cover. The means and standard errors for the summary categories for all the work areas combined was weighted by the proportion of the area each of the four non-native grassland subunits comprised in the total area of the non-native grasslands. Estimated mean absolute cover values were reported for all categories and standard error values are reported in tables and figures for all serpentine non-native grassland vegetation data.

Results of Non-Native Grassland Sampling

Work Area – Non-Native Grassland

Total cover in the non-native grassland quadrats in the work area ranged from 15% to 48% cover and averaged 34% cover (Table 6). Native plant cover ranged from 0.2% to 15% and averaged 5%. Native grass cover ranged from 0% to 15% cover and averaged of 4%. Non-native plant cover ranged from 15% to 47% and averaged 29%. Non-native grass cover ranged from 7% to 46% cover and averaged 24% cover (Table 6).

Table 6. Summary of Absolute Cover Data in Random Quadrats Located in Work Area Non-Native Grasslands (mean ± SE)

NON-NATIVE GRASSLAND WORK AREA SUBUNIT ID	AREA (ACRES)	NUMBER OF 1M^2 SAMPLE QUADRATS	TOTAL PERCENT COVER OF ALL SPECIES	NATIVE PLANT PERCENT COVER	NATIVE GRASS PERCENT COVER	NON-NATIVE PLANT PERCENT COVER	NON-NATIVE GRASS PERCENT COVER
1	0.127	8	48 (± 4.4)	0.5 (± 0.3)	0.4 (± 0.3)	47 (± 4.4)	46 (± 4.3)
2	0.263	14	15 (± 2.7)	0.2 (± 0.2)	0.2 (± 0.2)	15 (± 2.7)	7 (±1.8)
3	0.223	18	45 (± 1.8)	15 (± 3.8)	15 (± 3.9)	30 (± 3.4)	28 (± 3.4)
4	0.163	10	43 (± 6.9)	4 (± 4.0)	0	39 (± 6.4)	34 (± 5.9)
Average	0.194	12.5	**34 (± 7.3)**	**5 (± 3.2)**	**4 (± 3.3)**	**29 (± 6.1)**	**24 (± 7.2)**
Total	**0.776**	**50**	NA	NA	NA	NA	NA

Potential Reference Sites – Non-Native Grassland

Non-native grassland reference sites were not chosen or sampled in 2016 because all non-native grassland areas outside of the project area had been mowed or disked and were not suitable for collecting plant species cover data. Non-native grassland reference sites will be chosen in spring 2017, prior to disking or mowing. Any additional data collected will be reported in the As-Built Report.

Please feel free to call me at (925) 228-1027 if you have any questions.

Sincerely,

Erin L. McDermott
Principal
ISA Certified Arborist – WE7318A
Botanist, Wetland & GIS Specialist
Nomad Ecology, LLC

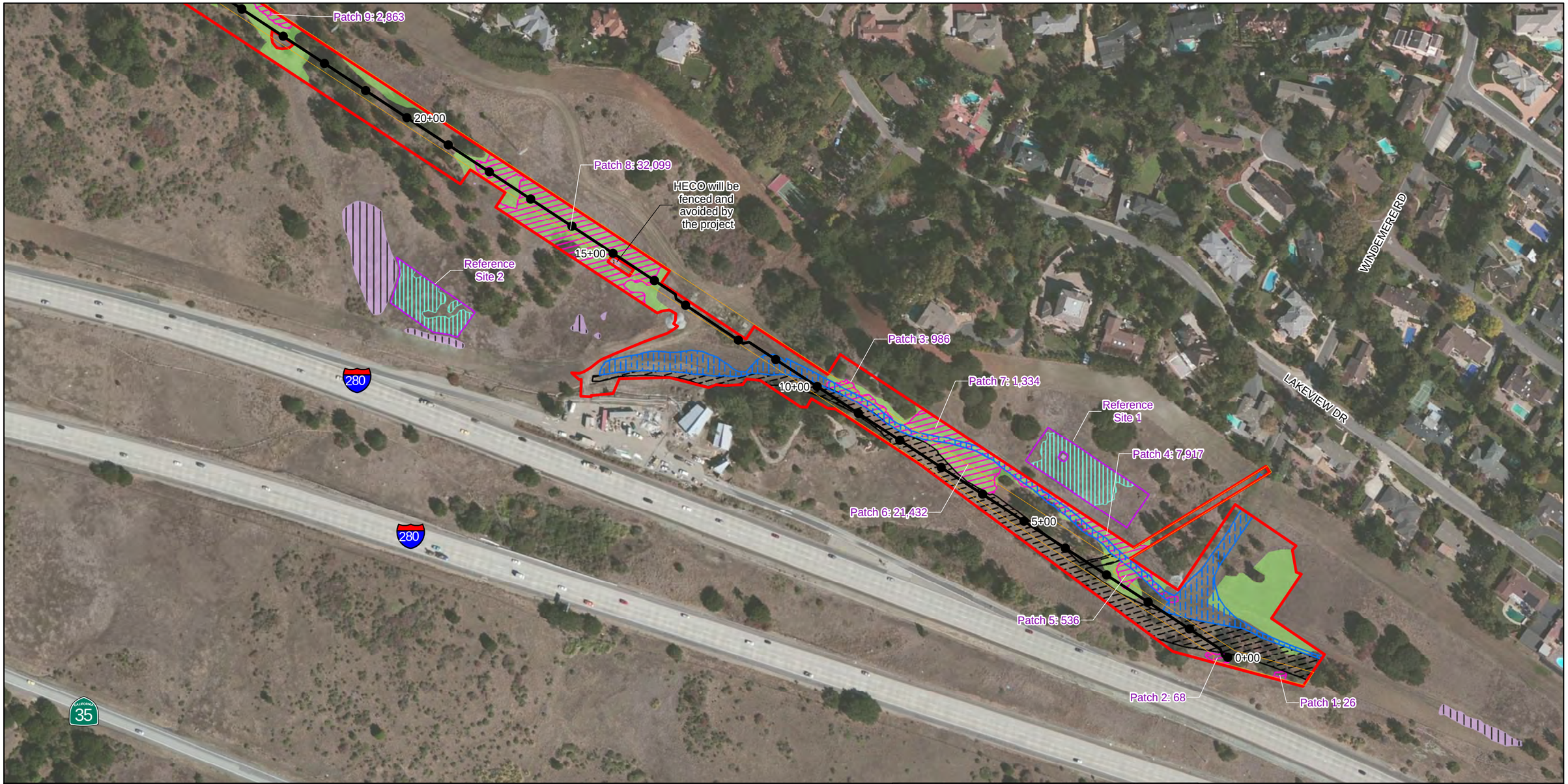
REFERENCES

California Native Plant Society (CNPS). 2014. California Native Plant Society/Department of Fish and Game Protocol for Combined Vegetation Rapid Assessment and Releve Sampling Field Form.

Elzing, CL, DW Salzer, and JW Willoughby. 1998. Measuring and Monitoring Plant Populations. BLM/RS/ST-98/005+1730.

Orion Environmental Associates. 2013. Special-Status Plant Survey Report. Pacific Gas & Electric Company, Line 109 Crystal Springs Pipeline Replacement Project, San Mateo County, California. Prepared for Pacific Gas & Electric.

Attachment A FIGURES



LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Crystal Springs Lessingia Reference Sites
- Crystal Springs lessingia (Lessingia arachnoidea) Inside Work Area 215,414 plants
- Crystal Springs lessingia (*Lessingia arachnoidea*) in Reference Sites
- Serpentine Grassland
- Marin dwarf flax (*Hesperolinon congestum*)

2016 Fire Break

- Disked Area
- Mowed Area

Note:
Marin dwarf flax was surveyed for and mapped by Orion in April 2016. Crystal Springs lessingia was mapped and numbers of individuals estimated in August 2016 by Nomad Ecology. All mapped Marin dwarf flax populations and a 5 foot buffer of the populations were excluded from reference sites.

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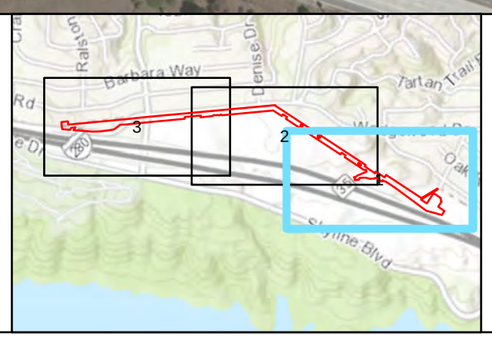

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FIGURE 1
MAP 1 OF 3
LOCATIONS OF CRYSTAL SPRINGS LESSINGIA IN THE WORK AREA AND BASELINE AND REFERENCE SITE PLOTS
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

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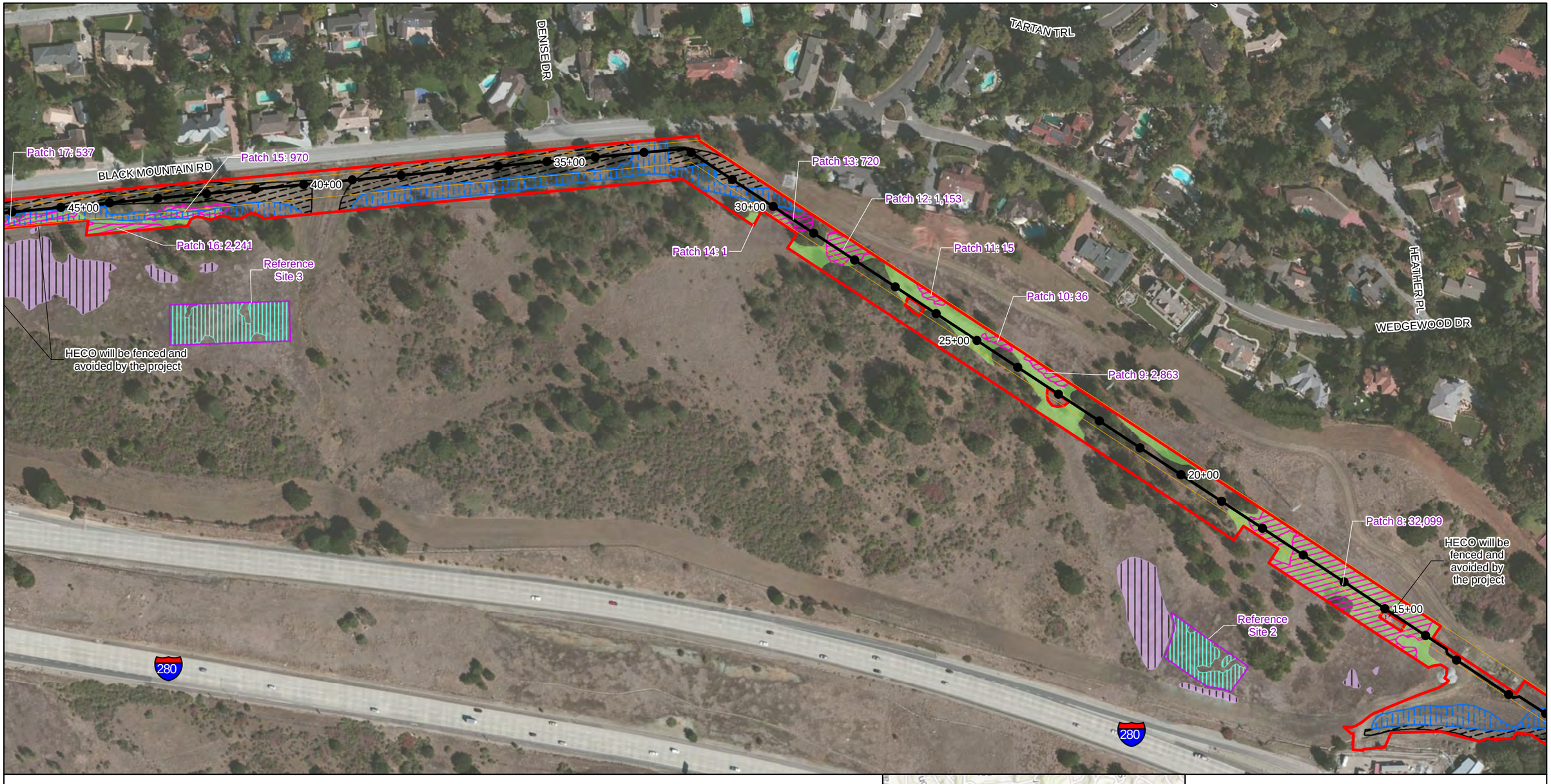

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Crystal Springs Lessingia Reference Sites
- Crystal Springs lessingia (Lessingia arachnoidea) Inside Work Area 215,414 plants
- Crystal Springs lessingia (*Lessingia arachnoidea*) in Reference Sites
- Serpentine Grassland
- Marin dwarf flax (*Hesperolinon congestum*)

2016 Fire Break

- Disked Area
- Mowed Area

Note:
Marin dwarf flax was surveyed for and mapped by Orion in April 2016. Crystal Springs lessingia was mapped and numbers of individuals estimated in August 2016 by Nomad Ecology. All mapped Marin dwarf flax populations and a 5 foot buffer of the populations were excluded from reference sites.

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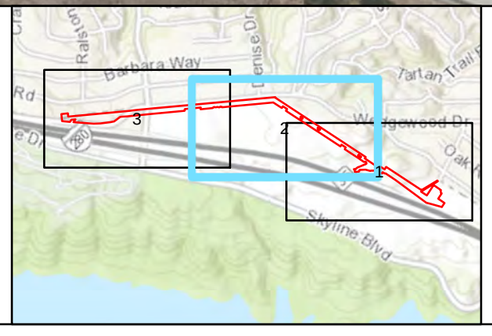

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FIGURE 1
MAP 2 OF 3
LOCATIONS OF CRYSTAL SPRINGS LESSINGIA IN THE WORK AREA AND BASELINE AND REFERENCE SITE PLOTS
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

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LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Crystal Springs Lessingia Reference Sites
- Crystal Springs lessingia (Lessingia arachnoidea) Inside Work Area 215,414 plants
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2016 Fire Break

- Disked Area
- Mowed Area

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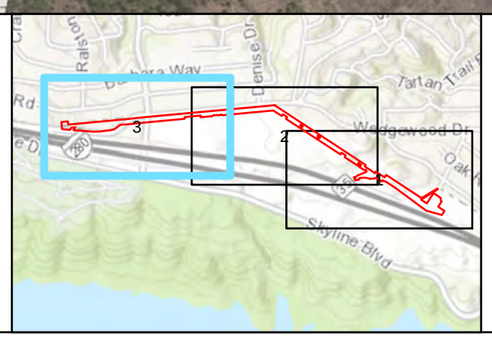

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FIGURE 1
MAP 3 OF 3
LOCATIONS OF CRYSTAL SPRINGS LESSINGIA IN THE WORK AREA AND BASELINE AND REFERENCE SITE PLOTS
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

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Serpentine Subunit: 5
Serpentine Subunit: 4
20+00
Serpentine Subunit: 3
15+00
10+00
Serpentine Subunit: 2
5+00
Serpentine Subunit: 1
0+00
2
1
280
280
35
WINDEMERE RD
LAKEVIEW DR

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Random locations where sample data was collected
- Serpentine bunchgrass grassland potential reference sites
- Serpentine Bunchgrass Grassland in the Work Area
- Marin dwarf flax (*Hesperolinon congestum*)

2016 Fire Break

- Disked Area
- Mowed Area

Note:
Vegetation was mapped by Orion Environmental in 2013 and groundtruthed and revised on August 9, 2016 by Nomad Ecology. All mapped Marin dwarf flax populations and a 5 foot buffer of the populations were excluded from reference sites.

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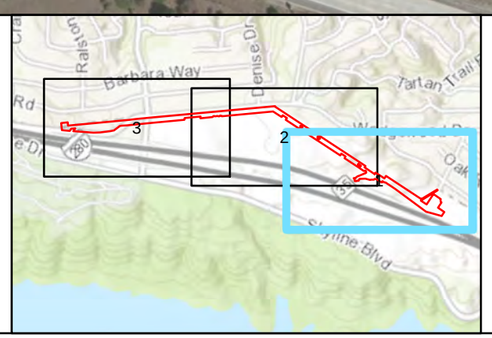

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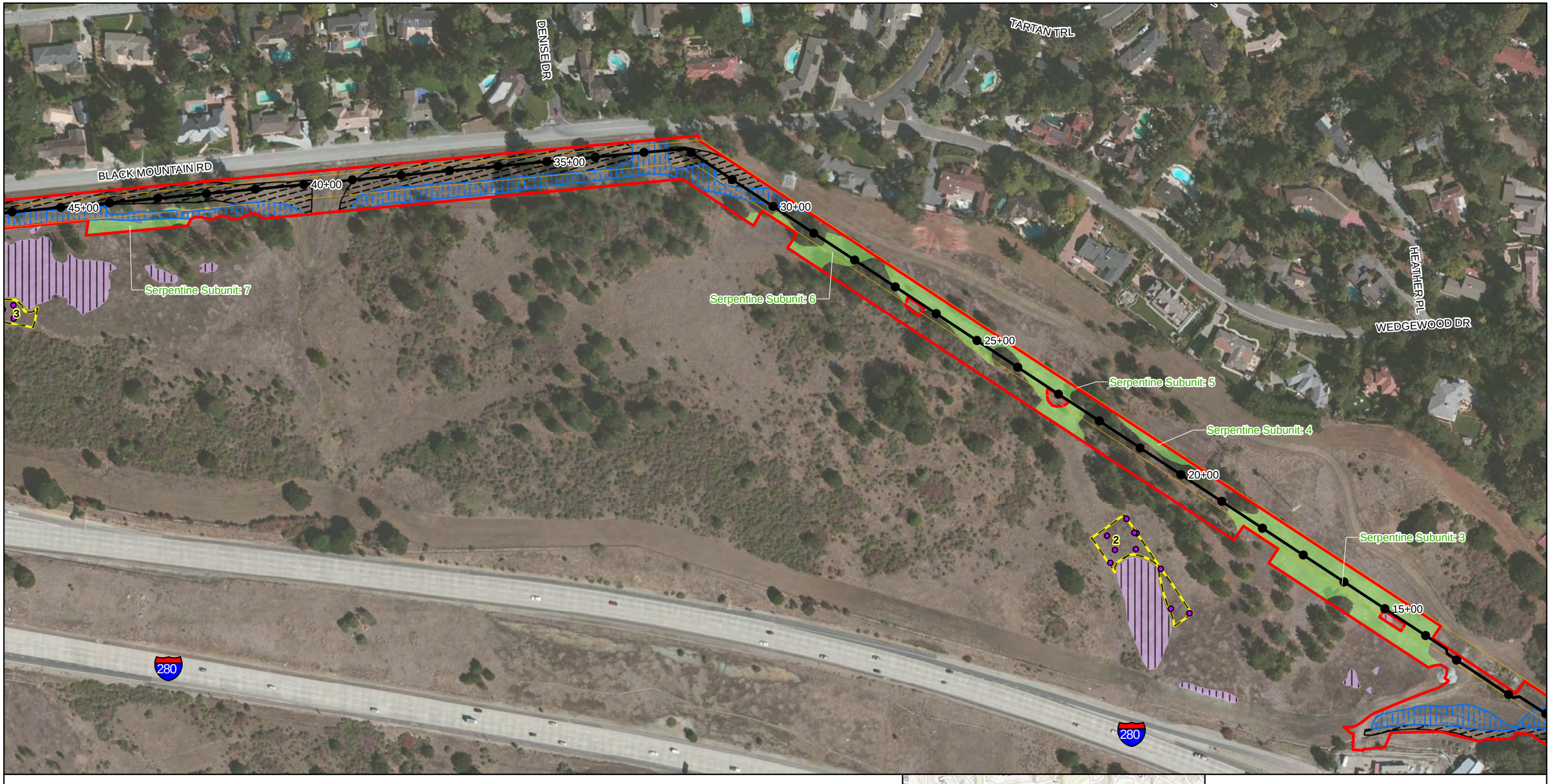
FIGURE 2
MAP 1 OF 3
SERPENTINE GRASSLAND IN THE WORK AREA AND POTENTIAL REFERENCE SITES
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016



LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Random locations where sample data was collected
- Serpentine bunchgrass grassland potential reference sites
- Serpentine Bunchgrass Grassland in the Work Area
- Marin dwarf flax (*Hesperolinon congestum*)

2016 Fire Break

- Disked Area
- Mowed Area

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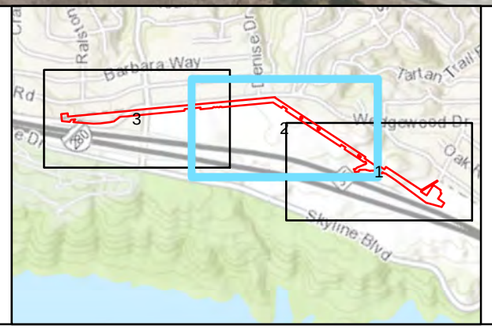

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FIGURE 2
MAP 2 OF 3
SERPENTINE GRASSLAND IN THE WORK AREA AND POTENTIAL REFERENCE SITES
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Random locations where sample data was collected
- Serpentine bunchgrass grassland potential reference sites
- Serpentine Bunchgrass Grassland in the Work Area
- Marin dwarf flax (*Hesperolinon congestum*)

2016 Fire Break

- Disked Area
- Mowed Area

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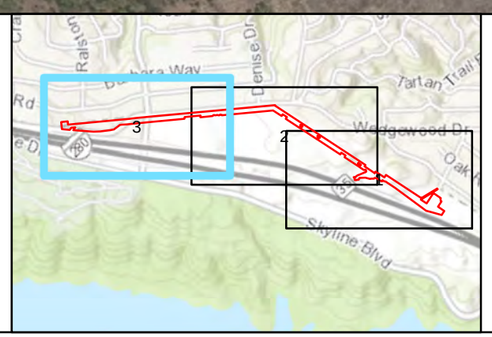

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FIGURE 2
MAP 3 OF 3
SERPENTINE GRASSLAND IN THE WORK AREA AND POTENTIAL REFERENCE SITES
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Random locations where sample data was collected
- Non-Native Grassland in the Work Area

2016 Fire Break

- Disked Area
- Mowed Area

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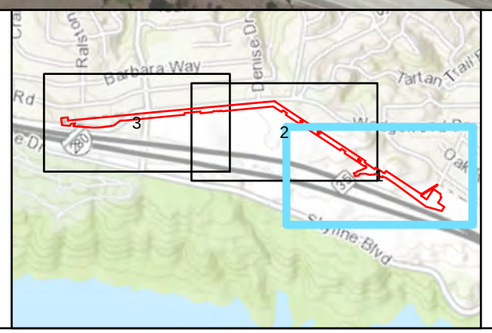

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FIGURE 3
MAP 1 OF 3
NON-NATIVE GRASSLAND IN THE WORK AREA
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Random locations where sample data was collected
- Non-Native Grassland in the Work Area

2016 Fire Break

- Disked Area
- Mowed Area

Note:
Vegetation was mapped by Orion Environmental in 2013 and groundtruthed and revised on August 9, 2016 by Nomad Ecology.

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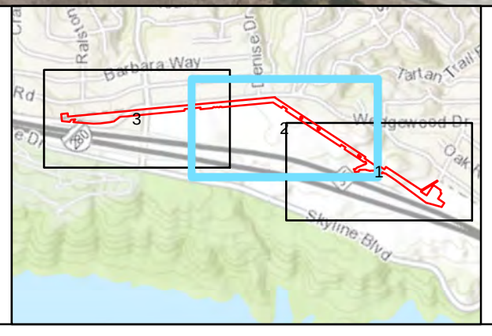

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FIGURE 3
MAP 2 OF 3
NON-NATIVE GRASSLAND IN THE WORK AREA
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

BARBARA WAY
RALSTON AVE
DARRELL RD
HAYNE RD
BLACK MOUNTAIN RD
40+00
45+00
50+00
55+00
60+00
65+97
Skyline Blvd
35
280
GOLF COURSE DR

LEGEND

- Work Area
- Permanent Easement
- Line 109
- Stationing
- Random locations where sample data was collected
- Non-Native Grassland in the Work Area

2016 Fire Break

- Disked Area
- Mowed Area

Note:
Vegetation was mapped by Orion Environmental in 2013 and groundtruthed and revised on August 9, 2016 by Nomad Ecology.

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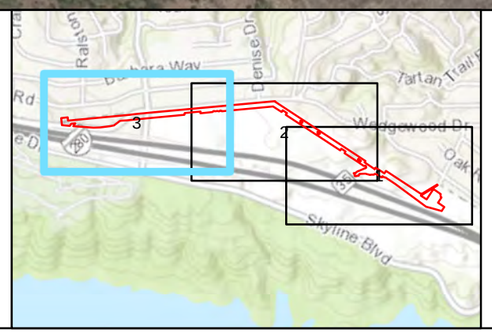

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FIGURE 3
MAP 3 OF 3
NON-NATIVE GRASSLAND IN THE WORK AREA
LINE 109 CRYSTAL SPRINGS
PIPELINE REPLACEMENT PROJECT
SEPTEMBER 26, 2016

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Attachment B Photo Appendix

Crystal Springs Lessingia Sampling Photos

Photo 1. Crystal Springs Lessingia growing in mowed access road. Direction: Northwest. 8/24/16

Photo 2. Crystal Springs Lessingia in serpentine grassland in work area north of Skyline Blvd. Direction: Northwest. 8/9/2016.

Photo 3. Dense patch of Crystal Springs Lessingia adjacent to work area. Direction: Southeast. 8/16/16

Photo 4. Counting Crystal Springs Lessingia in work area subunit by counting all individuals in a quadrat placed consecutively in a 1 meter wide lane. Direction: Southeast. 8/24/16

Photo 5. Sampling quadrat in work area with high density of Crystal Springs Lessingia. 8/24/16

Photo 6. Sampling quadrat in work area with high density of Crystal Springs Lessingia. 8/24/16

Photo 7. Sampling quadrat in work area with low density of Crystal Springs Lessingia. 8/24/16

Photo 8. Sampling quadrat in work area with low density of Crystal Springs Lessingia. 8/24/16

Photo 9. Sampling quadrat in work area with low density of Crystal Springs Lessingia. 8/24/16

Photo 10. Crystal Springs Lessingia Reference Site 1. Direction: South. 8/16/16

Photo 11. Crystal Springs Lessingia Reference Site 2. Direction: Northwest. 9/26/16

Photo 12. Crystal Springs Lessingia Reference Site 3. Direction: Northwest. 9/26/16

Serpentine Grassland Baseline Vegetation Sampling

Photo 13. File No. 20160902_125423. Serpentine grassland vegetation in the work area in the sampling quad. 9/2/16

Photo 14. File No. 124254. Serpentine grassland vegetation in the work area in the sampling quad. 9/2/16

Photo 15. File No. 105626. Serpentine grassland vegetation in the work area in the sampling quad. 9/2/16

Photo 16. File No. 4579. Serpentine grassland vegetation in the work area in the sampling quad. 9/2/16

Photo 17. File No. 4582. Serpentine grassland vegetation in the work area in the sampling quad. 9/2/16

Photo 18. File No. 229. Serpentine grassland vegetation in the work area in the sampling quad. 9/2/16

Photo 19. File No. 100415. Potential serpentine grassland Reference Site 1. Direction: North. 8/31/16

Photo 20. File No. 100418. Potential serpentine grassland Reference Site 1. Direction: West. 8/31/16

Photo 21. File No. 114002. Potential serpentine grassland Reference Site 2. Direction: North. 8/31/16

Photo 22. File No. 134217. Potential serpentine grassland Reference Site 3. Direction: Southeast. 8/31/16

Photo 23. File No. 134439. Potential serpentine grassland Reference Site 3. Direction: West. 8/31/16

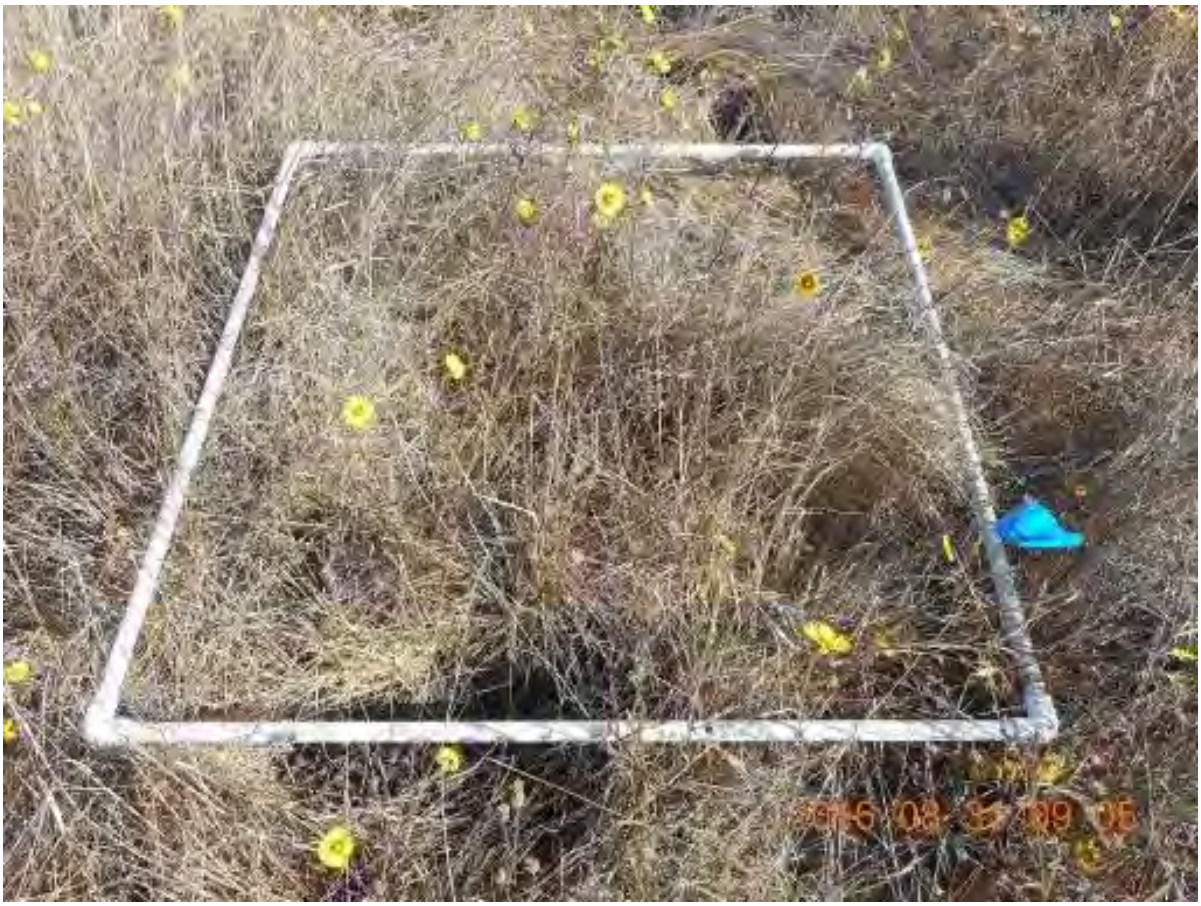

Photo 24. File No. 199. Sampling quad in potential serpentine grassland Reference Site 1. 8/31/16

Photo 25. File No. 202. Sampling quad in potential serpentine grassland Reference Site 1. 8/31/16

Photo 26. File No. 207. Sampling quad in potential serpentine grassland Reference Site 2. 8/31/16

Photo 27. File No. 216. Sampling quad in potential serpentine grassland Reference Site 2. 8/31/16

Photo 28. File No. 221. Sampling quad in potential serpentine grassland Reference Site 3. 8/31/16

Photo 29. File No. 223. Sampling quad in potential serpentine grassland Reference Site 3. 8/31/16

Non-native Grassland Baseline Vegetation Sampling

Photo 30. Non-native grassland in the work area. Direction: Northwest. 9/27/16

Photo 31. Non-native grassland sampling in work area. Direction: East. 9/26/16

Photo 32. Non-native grassland sampling in work area. Direction: East. 9/26/16

Photo 33. Non-native grassland sampling in work area. Direction: East. 9/26/16

Photo 34. File No. 282. Non-native grassland sampling quadrat in the work area. 9/22/16

Photo 35. File No. 284. Non-native grassland sampling quadrat in the work area. 9/22/16

Photo 36. File No. 290. Non-native grassland sampling quadrat in the work area. 9/22/16

Photo 37. File No. 295. Non-native grassland sampling quadrat in the work area. 9/22/16

Appendix E CEQA AND NEPA MEASURES ADDRESSED IN RESTORATION PLAN

APPENDIX E – CEQA and NEPA Measures Addressed in Restoration Plan

CEQA IS/MND

- M-BI-1e
- M-BI-1f
- M-BI-5

NEPA EA

- BR-3
- BR-12
- BR-14

Please see table below for cross-reference to the appropriate Revegetation Plan and Appendices sections and figures addressing the particular measures listed in the CEQA and NEPA documents

Compliance ID	Title	Description/ /*Restoration Plan Section*

BI-1e/	**Fragrant Fritillary Protection Measures**	A qualified biologist shall conduct surveys for fragrant fritillary within suitable habitat of the Cañada Road and Bunker Hill segments in the same year prior to construction and during the appropriate blooming period, to ensure that any plants that were not blooming during previous surveys are identified, as well as to obtain specific locations of previously identified plants. Prior to surface-disturbing activity, the locations of individuals within the construction work area shall be flagged and documented in the field using a sub-meter accuracy global positioning system (GPS) unit. The extent of the colonies shall be staked and marked in the field, and their boundaries collected using a sub-meter accuracy GPS. ` Bulbs and seeds shall be collected by hand prior to mechanical topsoil salvage. Biologists shall record the approximate average depth at which bulbs are collected so that they can be replanted at the same average depth during site restoration. Topsoil salvaged from these areas shall be stored separately from other materials. Any bulbs exposed during the stripping of topsoil, as described in M-BI-1f, Habitat Protection Measures, shall be collected and stored until construction is complete. After collection, bulbs and seeds shall be stored in a cool and dry location. Colonies removed during construction shall be restored. The restoration area for a colony shall be the extent of the removed colony, unless otherwise specified through agreement between the SFPUC and PG&E prior to restoration. If bulbs and seeds cannot be replanted by November 1, they will be properly stored and replanted the following fall, September 1 to October 31. The Vegetation Restoration Plan, as required in Mitigation Measure M-BI-1f, shall contain the following specific monitoring and performance criteria for the restoration of fragrant fritillary: • Areas replanted with fragrant fritillary bulbs and seeds shall be monitored for a minimum period of 5 years. • Flowering fragrant fritillary shall be censused annually within the work area and an adjacent reference population. The number of detectable fragrant fritillary in leaf and/or flower is expected to vary in the work area and in the reference site from year to year, depending on precipitation, herbivory and other ecological variables. • Restoration will be considered to have been a success if, in addition to success criteria identified for the overall vegetation restoration area, for the final period of 2 years of monitoring, the number of individual fragrant fritillary in the restoration area is at least 70 percent of the number censused in the construction work area during the 2015 blooming season (350 plants), as adjusted annually based on reference site plant counts. The numbers of fragrant fritillary counted in the reference population each year will be compared to the 2015 pre-construction reference population number to adjust the yearly plant targets. For example, if only half of the plants known to occur in the undisturbed reference population are present in any given year, the target number of plants for the reestablished population in the work area will be adjusted (lowered) proportionately. • If the number of plants does not reach the performance criterion or if data from earlier years suggest the site is not on a trajectory to meet this success criterion, then adaptive management actions will be developed and supplemental activities may be performed. These could include supplemental salvage and transplantation, seed collection and plant propagation (on site only), or seed collection and direct sowing.

Compliance ID	Title	Description/ /*Restoration Plan Section*

M-BI-1f	**Habitat Protection Measures**	*Note there are no riparian or wetland areas within our work zones on this segment.* The following general habitat protection measures shall be implemented for the proposed project: • Prior to construction, PG&E shall coordinate with the SFPUC to prepare and implement an Invasive Weed Control Plan that will include measures to reduce the potential introduction or spread of noxious weeds. The plan will ensure that equipment and material arriving on site is clean and free of soils and plant material, and will include tire-wash requirements for equipment that has been driven off-road prior to arriving at the proposed project sites. *Please see Weed Management Plan in Appendix C.* Riparian and other wetland areas within the proposed project sites shall be denoted as environmentally sensitive areas and will be avoided during construction, to the extent practicable, or as otherwise directed by the regulatory agencies. *Note there are no riparian or wetland areas within our work zones on this segment* • Special-status plant colonies that have been identified for avoidance shall be fenced to prevent encroachment by construction activities. • Crystal Springs lessingia individuals that cannot be avoided in areas to be cleared or grubbed shall have seed or vegetative material containing seed collected at the appropriate time, to be stored and distributed on top of the salvaged topsoil when it is redistributed. *Seed has been collected and will be used during restoration. Please see Appendix B* • The topsoil from trenching through grasslands, and other plant communities with predominantly native plant species, shall be salvaged and stockpiled separately in upland construction work areas. Topsoil shall be stored in such a way that it is protected from invasive propagules, but does not overheat and kill off the native plant propagules. This shall include placing the stored topsoil where it is not in contact with non-native grassland soil and protecting it with weed-free straw mulch or other suitable cover. Following construction, the salvaged topsoil will be spread over the disturbed area from which it was removed, and the area will be graded to match the pre-construction natural grade. Once the salvaged topsoil has been spread and the area returned to the pre-existing topography, the area will be revegetated with locally collected (where possible) native grassland species. If topsoil in grasslands has a substantial population of non-native plant species, as identified in the Vegetation Restoration Plan, it may be buried below the subsoil during backfill, and the serpentine soils from deeper in the trench placed on the surface. *Please see Section 3.4 Site Preparation and Weed Management Plan in Appendix C.* • Existing topography shall be restored to pre-project conditions to the extent possible. For herbaceous and grass-dominated riparian areas, it is expected that revegetation will naturally occur once the topography is restored using topsoil salvage requirements. Riparian areas will be revegetated with an appropriate mix of native plants, including species such as creeping wild rye, meadow barley, blue wild rye, arroyo willow,

Compliance ID	Title	Description/ /*Restoration Plan Section*
		California bay, and coast live oak, as shall be detailed in the Vegetation Restoration Plan. . *See Section 3 for grassland restoration and tree planting; note no riparian vegetation is found on Crystal Springs.* • Prior to the start of construction, PG&E shall develop a Vegetation Restoration Plan in coordination with the SFPUC and the appropriate resource agencies. PG&E shall submit the Vegetation Restoration Plan to CDFW and SFPUC for review and approval. The Vegetation Restoration Plan shall include the following measures: o Mitigation shall consist of a minimum 1:1 ratio of on-site restoration of sensitive habitats and plant communities, including needlegrass grassland, serpentine grassland, riparian areas, coast live oak woodland, and shrublands. Tree replacement ratios shall be 3:1 for native oak trees. o The plan will identify specific areas of topsoil to be salvaged during construction for re-spreading, as well as areas where topsoil carries a greater percentage of non-native species; in the latter areas, topsoil may be buried under fresher material. PG&E shall develop seed mixes for each plant community, consisting of locally collected native species. Following construction, the sites will be prepared and stabilized with coir or weed-free rice straw (or jute netting material in steeper areas), and vegetation will be restored using the defined seed mixes appropriate to each area.

M-BI-1f	**Habitat Protection Measures (Cont'd)**	*i)* Additional plantings of shrubs and tree propagules will be completed in the appropriate plant communities during the fall or winter immediately following construction. Replacement shall occur within the temporary construction work spaces and adjacent areas, as determined in coordination with the SFPUC Natural Resources and Lands Management Division and other applicable resource agencies. *Please see Section 3.7* ii) Non-native trees, such as Monterey pine, Monterey cypress, and eucalyptus, shall be replaced with native tree species if they meet the definition of "Significant" trees in the San Mateo County Significant Tree Ordinance (see Impact BI-1e). *Please see Sections 2.2 and 3.7*. iii) To minimize the temporal loss of trees and shrubs, when site conditions permit, a variety of native trees and shrubs with different growth rates shall be planted to ensure that nest and roost sites will be available in the short term for birds and bats. *Please see Sections 2.2 and 3.7*. PG&E will be responsible for ensuring that the Vegetation Restoration Plan is implemented under the guidance of a qualified biologist. The plan shall be designed such that it meets the following success criteria, or other equally protective success criteria, as approved by the resource agencies: • The restored site is composed of a mix of appropriate native species appropriate for each site, as outlined in the Vegetation Restoration Plan *Please see Sections 3.5 and 3.7* • Cover of non-native invasive weed species shall not exceed 20 percent within serpentine grassland areas. This criterion may be revised, if approved by CDFW, if it is deemed that achieving 20 percent cover is not reasonable due to the presence of high levels of non-native invasive weeds adjacent to the project area. *Please see Section 4.* • The restored site has at least 75 percent of the preconstruction baseline cover. -*Please see Section 4;* • After revegetation and restoration are completed, monitoring shall be conducted by a restoration specialist or biologist for a minimum of 5 years. The sponsor can choose to continue monitoring for an additional year for each year of below-average precipitation during the monitoring period. If by the end of monitoring the approximately 5.8 acres of serpentine grasslands temporarily disturbed by construction fails to meet the restoration success criteria, then PG&E shall provide for additional off-site mitigation at a ratio of two acres for each acre of serpentine grassland that fails to achieve success criteria, unless otherwise approved by the applicable regulatory agencies. Serpentine grasslands shall be evaluated as separate units based on their location along a given pipeline segment (i.e., Bunker Hill), or obvious breaks in the continuity or composition of the serpentine grassland communities within a given pipeline segment. Serpentine units for the purposes of monitoring the success criteria shall be identified in the Vegetation Restoration Plan. *Please see revised Section 4;* Off-site mitigation

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		could include funding of serpentine grassland restoration, such as through the Presidio Trust Stewardship Program in San Francisco. Funding would be tied to the number of acres of serpentine grasslands restored through actions that may include tree and brush removal, exotic species management, grassland cover management (i.e., mowing, grazing, rotational tarping, and reseeding), and monitoring.

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M-BI-5	**Habitat Protection Measures**	A qualified arborist shall conduct a pre-construction tree survey of the riparian and oak woodland areas, identifying each tree to species and providing diameter at breast height. Any tree removal, pruning, or work within the drip line of trees—other than in paved areas—will be reviewed and approved by a PG&E arborist or their designee. All trimming and removal shall be conducted by a PG&E arborist. *Please see Section2.2.* Tree trimming and removal shall be minimized to what is required to implement the proposed project, and PG&E will evaluate the feasibility of further minimizing impacts on native trees through selective narrowing of construction work areas or other construction practices, and/or through a contractor incentive program to avoid trees. PG&E will clearly show Tree Protection Zones on project drawings. Any Significant or Heritage Trees, as defined in the San Mateo County Tree Ordinances, that cannot be avoided will be documented and replaced at a minimum 3:1 ratio. Tree replacement, maintenance, and monitoring requirements shall be included with the Vegetation Restoration Plan described in Mitigation Measure M-BI-1f, Habitat Protection Measures. The newly planted trees shall be monitored for a minimum of 7 years. *Please see Section 2.2, and 4.2.4.*
BR-3	**Marin Western Flax**	• A qualified biologist shall flag the Marin Western Flax populations with highly-visible flagging prior to work. Only approved work areas and access will be used by all vehicles, equipment, and personnel for staging, and work activities. On the Bunker Hill Segment a population will be avoided through use of HDD boring underneath the population. On Crystal Springs, the populations will either be avoided through fencing, bored under, or otherwise as approved by the resource agencies. Marin western flax will be avoided to the greatest extent practicable. *Please see Section 2.3.* • Before vehicles are brought onto work sites, they shall be cleaned of weeds, seeds, and soil. This can be accomplished via hand wash, power spray, dry brushing, compressed air, hand picking, etc. Vehicles parked in areas with invasive weeds will also be cleaned before driving in areas with sensitive plants. Proposed Project activities will minimize foot traffic and disturbance to the amount required to perform work safely, *Please see Weed Management Plan in Appendix C.*
BR-12	**Pre-construction Tree Surveys and Tree Removal**	• A qualified arborist would conduct a preconstruction tree survey of the oak woodland areas, recording diameter at breast height (DBH) information and identifying each tree to species. Any tree removal, pruning, or work within the drip line of trees, other than in paved areas, must be reviewed and approved by a PG&E-approved arborist or their designee. A PG&E-approved arborist will be required to conduct all tree trimming and removal. *Please see Section 2.2* • Tree removal is to be conducted outside of the bird nesting season to the extent possible. If this is not feasible, a qualified biologist will perform a preconstruction survey for active nests prior to tree removal….. *Please see Section 3.4 Site Preparation*
BR-14	**Invasive Species Control**	• An Invasive Weed Control Plan would be prepared that would include measures to reduce the potential introduction or spread of noxious weeds. Coordination with GGNRA and SFPUC and applicable resource

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		agencies regarding invasive plant species would be conducted prior to construction. All equipment arriving onsite must be clean and free of soils and plant material. BMPs would include tire wash requirements for equipment arriving onsite that has been driven off-road prior to arriving on the project site. Equipment arriving on-site will be inspected by the biological monitor for mud or soil that could harbor invasive weed seed. *Please see Weed Management Plan in Appendix C.*

Appendix F Photo Appendix

Photo 1. Serpentine grassland in southernmost portion of the project area. Direction: Southeast. 8/9/2016.

Photo 2. Disced fuel break near south end of project Harding grass is visible under the Monterey Pine trees. Mowed access road is visible. Direction: North. 8/9/2016.

Photo 3. Mowed access road and shoulder and disced fuel break near valve lot and Caltrans rest stop. Direction: South. 8/9/2016.

Photo 4. Mowed access road and mowed and disced fuel break near valve lot and Caltrans rest stop. Direction: North. 8/9/2016.

Photo 5. Serpentine grassland in project area north of the valve lot. Direction: North. 8/9/2016.

Photo 6. Serpentine grassland in project area north of the valve lot. Direction: South. 8/9/2016.

Photo 7. Serpentine grassland in project area in gaps in the non-native woodland. Direction: West. 8/9/2016.

Photo 8. Serpentine grassland in project area in gaps in the non-native woodland. Direction: North. 8/9/2016.

Photo 9. Mowed non-native grassland in project area adjacent to Black Mountain Road. Direction: Southeast. 8/9/2016.

Photo 10. Disced and mowed non-native grassland in project area adjacent to Black Mountain Road. Direction: Southeast. 8/9/2016.

Photo 11. Mowed access road adjacent to non-native woodland in project area north of Skyline Blvd. Direction: Northwest. 8/9/2016.

Photo 12. Mowed access road adjacent to non-native woodland in project area north of Skyline Blvd. Direction: Southeast. 8/9/2016.

Photos of Invasive Weeds in the Project Area

Photo 13. Scotch broom and teasel adjacent to project area. Direction: West. 8/9/2016.

Photo 14. French broom in understory of non-native woodland. Direction: Southeast. 8/9/2016.

Photo 15. Bristly ox-tongue in project area adjacent to Black Mountain Road. Direction: Southeast. 8/9/2016.

Photo 16. Stinkwort adjacent to Black Mountain Road. 8/9/2016.

Photo 17. Teasel, stinkwort, and Harding grass in project area south of Skyline Blvd. Direction: West. 8/9/2016.

Photo 18. Harding grass and Acacia in project area north of Skyline Blvd. Direction: Southwest. 8/9/2016.

Photo 19. Teasel and Acacia in project area north of Skyline Blvd. Direction: North. 8/9/2016.