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28 March 2013

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RE: Desalination Project for the City of Santa Cruz and Soquel Creek Water District
Report on Habitat Assessment for Overwintering Monarch Butterflies

Dear Heidi:

This letter reports the findings of my recent habitat assessment survey throughout the project area for the **scwd**² Regional Seawater Desalination Project to determine if any portions function as winter roosting sites or overwintering habitat for the Monarch butterfly (*Danaus plexippus*), or support such habitat. My habitat assessment was undertaken to provide information for inclusion in this project's environmental impact report (EIR). In addition, background information on the winter roosting habitat for the Monarch and recommendations for project planning are presented. This report has taken over one year to complete due to various changes that occurred in the project since the time of my site visit and changes to policies for protection of the Monarch's overwintering habitat due to the City's updated and recently adopted 2030 General Plan.

REGULATORY SETTING

The Monarch butterfly is not a State or Federally listed endangered or threatened species. Nonetheless, under the City of Santa Cruz's Local Coastal Program and General Plan 2030 and its associated EIR the Monarch butterfly is treated as a sensitive species due to the restricted geographic range of its wintering habitat and its recognition by the California Natural Diversity Data Base (CNDDB) as a "special animal". Currently occupied and formerly occupied Monarch butterfly overwintering sites are also identified in the City's Local Coastal Program and recently adopted General Plan 2030 as potential sensitive habitat areas. In the General Plan 2030 what is described and depicted as "potential Monarch butterfly habitat" focuses on Eucalyptus, Monterey Pine, or Monterey Cypress tree stands that potentially could or are known to support overwintering Monarch butterfly roosts and do not always include the full foraging (nectar and water) ranges of the butterfly (which could include additional portions of the City depending upon the particular overwintering site). If a project is within or adjacent to the "potential Monarch butterfly habitats" mapped in the General Plan 2030, then further studies must be conducted to confirm whether Monarchs are, in fact, using the area and if the project will have impacts. According to the Local Coastal Program and General Plan 2030, development projects should

analyze potential impacts to overwintering sites and identify avoidance and mitigation measures to minimize impacts. This analysis should consider activities within and outside the actual “overwintering sites” that could influence the Monarch’s use of the overwintering sites (i.e. smoke infiltration into overwintering sites, pesticide application near overwintering sites, elimination of nectar plants, etc). At this time the City does not have a specific Monarch butterfly management plan applicable to the project area.

PROJECT DESCRIPTION

Various components of the desalination project would be located within the City of Santa Cruz, unincorporated Santa Cruz County, City of Capitola, and offshore in the Pacific Ocean. Offshore components of this project were not evaluated in my habitat assessment because the Monarch butterfly overwinters in terrestrial habitats. Components of the proposed desalination project would include a seawater intake and conveyance system, a seawater desalination facility, a brine disposal and conveyance system, and improvements to the water supply delivery system. Specific details about each of these components, as well as maps of proposed locations for these components, are presented in the Environmental Impact Report in preparation by URS Corporation.

OVERWINTERING HABITAT OF THE MONARCH BUTTERFLY

Monarchs cannot survive the colder winter months of most parts of North America. For this reason, Monarch butterflies travel to their wintering areas during the fall months of each year. Monarchs that live west of the Rocky Mountains migrate to coastal areas of California, while those that live east of the Rockies travel to a few sites in the mountains of Central Mexico. In coastal California, winter roosting sites range from northern Baja California to southern Mendocino County. Although most winter roosting sites in California are usually located within 0.5 to 1 mile of the coast (Weiss et al. 1991, Nagano and Lane 1985), roosts have been found as far inland as Bakersfield in Kern County (Davenport 1983), Saline Valley in Inyo County (Nagano and Lane 1985), and Fairfield in Solano County (Fadem and Shapiro 1979).

Along the Santa Cruz County coastline, there are several locations where Monarchs form winter roosts between Moore Creek just north of the City of Santa Cruz and Watsonville (California Natural Diversity Data Base 2011; Nagano and Lane 1985; Sakai et al. 1989). These occurrences from the aforementioned cited references (as well as other references that are not cited herein) of roosting Monarchs resulted in the City of Santa Cruz identifying several “potential” Monarch habitat locations. They include the trees where roosting Monarchs were observed plus additional surrounding areas delineated in circles of varying diameters, as illustrated by Map EQ-9 of the City’s 1993 General Plan. Basically, this means that at some time in the past several decades, Monarchs were observed roosting during the fall or winter within those circled areas. Many of these observations occurred in the 1970’s and 1980’s, but more recently Monarchs have not been observed at some of these former overwintering locations. As part of the draft EIR for the City’s 2030 General Plan, EcoSystems West Consulting Group (2009) updated the aforementioned map of sensitive habitat areas within the city limits (General Plan 2030, Figure 4.8-3). The updated map includes delineation of “potential Monarch butterfly habitat.” This delineation was based on previous observations; known roost sites as of 2006 surveys; and the presence of suitable, but unoccupied habitat for the Monarch based on the 2006

surveys. During its 2006 surveys, EcoSystems West Consulting Group (2009) confirmed 18 of the 36 mapped locations as active Monarch butterfly roost sites but was unable to confirm Monarch usage of the other 18 mapped sites, thus these unoccupied locations were considered “potential habitat.”

In California, clustering behavior begins once migrating Monarchs reach their overwintering sites in the fall. Two types of clustering occur:

- a) temporary aggregations that are transient clusters of short duration; and
- b) permanent (also called “full-term”) roosts that are long term (past the winter solstice) hibernar clusters which also possess the environmental conditions that allow the butterflies to mate in January and February before their spring dispersal (Urquhart 1960).

In the fall months, typically in September and October, numerous, generally small temporary aggregations are formed, especially in areas where nectar plants are plentiful near the coast. These temporary aggregations in the fall are also referred to as autumnal roosts or clusters. Monarchs at many of these sites disperse to permanent roosting sites as nectar sources, air temperature, and day length decrease. Some sites may serve as permanent roosts one year and temporary aggregations another year, or a mixture of the two. Also, some locations may occasionally not be used for either purpose. The permanent roosts are also referred to as winter roosts.

Thus, roost sites are generally characterized by groves of trees of mixed height and diameter, usually with an understory of brush. Often there is a small clearing within a stand of trees, or formed by a combination of the trees and surrounding topography, to provide shelter for the butterfly. Trees in all directions that surround those upon which the Monarchs cluster provide primary and secondary wind protection to the active roost trees and are part of the roost site. These roost sites protect the butterfly from prevailing on-shore winds, winds during storms, freezing temperatures, and exposure to the sun. The vegetation serves as a thermal “blanket” which moderates extreme weather conditions (Calvert and Brower 1982).

Overwintering habitat for the Monarch consists of autumnal and winter roost trees (i.e., where the clusters of Monarchs form), plus surrounding trees that provide primary and secondary wind protection, shade, as well as sources of nectar and water. Since overwintering Monarchs may stay at a roost site for several months, adult butterflies often forage at flowers of a variety of plant species that bloom at different times during the overwintering period. Some roost sites have adequate nectar plants and water sources such that the roost site provides the full overwintering habitat for the Monarch. But other roost sites may lack an adequate diversity or abundance of nectar plants, so Monarchs will forage on plants that grow beyond the boundaries of the roost site. Similarly, adults obtain water from dew on foliage, but may also seek other water sources outside of the roost site.

Research has demonstrated that forest canopy structure is a primary determinant of microclimatic conditions in forest stands, and is undoubtedly an important factor in the Monarch’s selection of particular locations as overwintering roosts (Leong 1990; Sakai et al. 1989; Weiss et al. 1991). Many of the best overwintering sites provide a heterogeneous mixture

of habitat conditions and resultant microclimatic conditions that assist the Monarchs in surviving seasonal changes in climatic conditions during the winter. For example, overwintering habitats must provide wind protected roost locations (usually tree branches that are 15-50 feet above ground), with buffered temperatures, relatively high humidity, and filtered sunlight throughout the fall and winter months. As weather conditions and exposure to sunlight vary over the winter months, high habitat heterogeneity at an overwintering site permits the Monarch roosts to satisfy their thermoregulatory needs by moving from tree to tree in response to changes in weather conditions. Thus during the early part of the overwintering period (October – November), when daily temperature maxima are relatively high, Monarchs tend to cluster in locations that provide brief morning insolation, with mid-day and afternoon shade. Later in the season (December – February), when temperature maxima are lower, they tend to roost in trees that receive afternoon sunlight. Trees surrounding roost locations, known as windbreak or buffer trees, provide both wind protection and ameliorate microclimatic conditions near the roost trees. Buildings can also afford wind protection depending upon their height and locations relative to the roost trees.

A number of roost sites in coastal California are located in groves of introduced trees. Favored trees for Monarch roosts include, Blue Gum (*Eucalyptus globulus*), River Gum (*E. camaldulensis*), Monterey Pine (*Pinus radiata*), and Monterey Cypress (*Cupressus macrocarpa*), although a number of other native and introduced species of trees are also utilized (Lane 1993). Clusters typically form between about 15 and 50 feet above ground, but have been observed as low as 6 feet and as high as 75 feet.

Roost sites are protected from winds by a combination of tree cover (i.e., spatial configuration and density) and topography. Gullies, canyons, creek drainages, and the lee sides of hills are areas where Monarchs will roost, if the appropriate tree cover is present. Although the butterflies are inactive on colder, rainy, or foggy days, they will fly from the cluster on warmer, sunny days to obtain the water and nectar that are needed to sustain the butterflies through the winter. Thus, a nearby source of water and an abundance of fall and winter-blooming nectar plants are also important factors in determining where the butterflies will roost. Monarchs can obtain water from natural or man-made bodies of water, runoff from sprinklers, and dew on vegetation (Nagano and Lane 1985). Important nectar plants at many winter roosting sites include, *Eucalyptus* trees, Coyote Bush (*Baccharis*), wild mustard (*Brassica*), and Bottlebrush (*Callistemon*), although other native and introduced species will be used if available.

In concluding this discussion, I would like to emphasize that although a number of basic features are important determinants in the suitability of a particular location to serve as an overwinter roosting site by the Monarch butterfly, there is also an interaction of these factors that is only beginning to be understood by researchers. Also, because features of a site can change due to the growth of trees and understory vegetation, thinning or removal of trees and brush, changes in nectar plant abundance, etc., Monarch usage of a particular site may vary from year-to-year and for longer durations. Indeed, new roosting sites continue to be discovered in California as conditions become favorable, even in areas where roosts were not previously observed. Similarly, when habitat quality deteriorates at locations that previously supported winter roosts, Monarchs will cease to roost at these sites. Clearing of brush and thinning of trees are common vegetation management practices that have adversely impacted Monarch roosting sites, even on public lands (Nagano and Lane 1985; Weiss et al. 1991).

SURVEY METHODS

Prior to my visit to the project's study area, I reviewed various background materials provided by the City's Water Department or its environmental consultant, URS Corporation. These items included a preliminary draft of the project description, various maps and GIS shapefiles of the project area, the locations of specific features, and environmental reports for a couple of projects located near the proposed desalination plant site. I initially visited the study area for the desalination project on November 22, 2011, and surveyed the entire study area by walking throughout selected portions and by driving throughout other portions. During my survey of the project's study area and the surrounding neighborhoods, I noted the presence of various plants and features that are known to be important to the Monarch butterfly at occupied overwintering roosting sites (see Background Information). In particular, I searched for the favored trees that are used as roosts, examined the spatial configuration and density of favored trees, sheltered areas within the groves of roosting trees, trees that provide primary and secondary wind protection, nectar plants, and water sources. This was a one-day, habitat assessment survey that relied on existing information, observations of existing habitat conditions made during my site visit, and my prior experience with Monarchs and their habitat at other overwintering locations.

Also on November 22nd, 2011 I visited two currently known winter roost sites for the Monarch at Natural Bridges State Beach and Moran Lake County Park. Adult Monarchs were active at both of these sites. Activities observed included roosting, flying, and foraging.

On December 7th, 2012 I revisited the proposed, alternative desalination plant sites. Two adult Monarchs were observed foraging at alternative desalination plant site, A-2.

ANALYSIS OF POTENTIAL IMPACTS

To reiterate, a Monarch's roost site consists of the trees upon which the butterflies cluster, as well as surrounding trees in all directions that provide primary and secondary wind protection. Monarch overwintering habitat includes the roost site, plus nectar plants and water sources. Sufficient diversity and abundance of nectar plants and water sources may occur within some roost sites, but at other roost sites Monarchs may fly some distance from the roost trees to obtain nectar and water, including existing residential and even urban areas.

Most components of the proposed desalination project are unlikely to impact the Monarch butterfly's roosting habitat because they are not located in groves of trees with a spatial configuration that is appropriate for a Monarch roost site. For example, many of the conveyances to transport water or brine will be located under paved streets. Off-street locations for other portions of these conveyances cross grasslands, scrub, and ruderal habitats as well as landscaped areas that lacked the types of trees favored by roosting Monarchs. Portions of the desalination project area are situated within or near one of the Monarch overwintering locations. According to the 2030 General Plan, if a project is within or adjacent to the mapped "potential habitat," then further studies must be conducted to confirm whether Monarchs are, in fact, using the area and if the project will have impacts. The remainder of this section discusses specific locations where there might be potential Monarch issues depending upon the selection of a specific project

component alternative that is under consideration in the Draft EIR. However, my one-day habitat assessment was too brief to collect any new information on the presence or absence of Monarchs at these locations or to collect new data on how they use the identified potential habitat areas.

Historically, two Monarch roost sites were located in the southern portion of DeLaveaga Park (Nagano and Lane 1985), near where new project water lines would be connected to the existing storage tanks located southeast of the Santa Cruz Emergency Facility and near the 16th hole of the golf course off of Brookwood Drive. I drove slowly on several roads surrounding the periphery of and within the park and golf course and hiked in the vicinity of both historical roost sites and did not see any Monarchs during my brief site visit. Since it was sunny and temperatures were in the 60's (F), I would have expected to observe at least a few adults at or near this location if they were roosting there. Various nectar plants known to be utilized by the Monarch occur widely throughout the park and as landscaping in the yards of neighboring residences. Although Monarchs were not observed during a brief visit in the fall, it is possible that they could roost here at an earlier or later time in the overwintering period. The proposed project would result in trenching for pipeline installation in this area, but would not result in permanent vegetation removal or above ground facilities. For this reason I do not expect the project-related work at this location to impact Monarchs or their overwintering sites should they still roost at these historical locations.

The McGregor pump station, to be upgraded with the proposed project, will be located northwest of and adjacent to New Brighton State Beach, where Monarchs were observed roosting at two locations in the mid- and late-1980's (Sakai et al. 1989). One roost site was located immediately west of New Brighton Road on the park's eastern boundary, while a second site was situated just beyond the park's boundaries between the railroad tracks and the ocean near the southwestern corner of the park. The proposed location of the pump station is characterized by a dense mix of trees, including both deciduous and coniferous species, with no sheltered opening where Monarchs could roost. During my site visit on November 22nd, no Monarchs were observed here or at either of the aforementioned historical roost sites associated with New Brighton State Beach; however, a more thorough survey consisting of multiple visits throughout the several-month overwintering period would be necessary to confirm whether Monarchs still overwinter at these historical roost sites. The McGregor pump station upgrade would not result in expansion of the building or any additional vegetation removal. For this reason I do not expect the project-related work at these locations to impact Monarchs or their overwintering sites should they still roost at these locations.

The Draft EIR identifies three alternative locations for the desalination plant, which are adjacent to the Harmony Foods Corporation facility (2200 Delaware Ave.) and situated north of Delaware Avenue and east of Natural Bridges Drive in western Santa Cruz. These alternative locations are referred to as A-1 (northwest portion), A-2 (southwest portion), and A-3 (northeast portion). The 2030 General Plan mapped area of potential Monarch habitat includes the lower portion of the proposed desalination plant site alternative A-2 and the area south of Delaware Avenue in Natural Bridges State Beach, which is across the street from the plant site alternative A-2. The table below describes each site and how it may be associated with the Monarch's roost site at neighboring Natural Bridges State Beach (NBSB). It also describes the closest location to the tree stand within NBSB that supports active roost trees and the primary and at least some of

the secondary windbreak trees. I emphasize that this analysis is based on existing information, my observations that occurred during a brief site visit as part of my one-day assessment for the desalination project, and not on any additional studies of the habitat or Monarch usage of these sites.

Alternative Desalination Plant Site	Size, Land Use and Plant Community(ies)	Potential Monarch Habitat Function(s)	Approximate Shortest Distance To Roost Site on NBSB
A-1	4.4 acre undeveloped lot with ruderal grassland; periodically mowed; northern portions used periodically for construction staging and storage and storage of firewood	Plants growing at the lot suggest potential for adult foraging, especially on herbaceous plants; dew on vegetation	415 ft.
A-2	4.0 acre undeveloped lot with a mixture of trees, shrubs, and ruderal grassland; wetland with willows in SW corner; eastern portion periodically used for construction staging and storage.	Potential for secondary windbreak protection for NBSB roost site; adult foraging on trees, shrubs, and herbaceous plants; dew on vegetation	70 ft.
A-3	6.7 acre undeveloped lot with ruderal grassland; wetland swale in NE portion; periodically mowed; portions occasionally used for storage and stockpiling.	Potential for adult foraging, especially on herbaceous plants; muddy banks of the ditch and swale may be sources of water for adults along with dew on vegetation	325 ft.

Desalination plant sites A-1 and A-3 are not currently developed with any buildings and primarily characterized by ruderal grassland that is periodically mowed. The northern side of A-1 is used periodically for firewood storage and construction staging and storage. Small portions of A-3 are occasionally used for minor storage and stockpiling. A row of trees line the boundaries of A-1 and A-3 and the driveway to the Harmony Foods facility. A-1 also has a few short trees and shrubs that grow along portions of its western boundary. Periodic mowing of both sites favors the growth of a variety of primarily annual plants that serve as nectar sources for overwintering Monarchs. Coyote bush (*Baccharis*), a native shrub that Monarchs may visit for nectar, grows in a couple of locations at A-3. Adult butterflies could also obtain dew on the

vegetation. A-3 has a ditch and small depressional area that may temporarily pond water, but these features were dry at the time of my visit.

Located in the coastal zone, desalination plant site A-2 also is not developed with any buildings and is characterized by a mix of trees, shrubs, and herbaceous vegetation. According to City staff, the eastern portion of the site is periodically used for construction staging and storage. The sensitive habitat map prepared by EcoSystems West Consulting Group (General Plan 2030 EIR, Figure 4.8-3) identifies A-2 as “potential Monarch butterfly habitat.” At the time of my 2011 assessment, the drainage in the southwestern portion of A-2 supported willows (*Salix*) and *Rubus*. Coyote bush (*Baccharis*) also grew in a few scattered locations. These trees, vine, and shrub are known to be utilized by foraging Monarch adults. Trees and shrubs that grow at A-2 may also provide some secondary windbreak protection for the Monarchs that overwinter at NBSB, but it was beyond the scope of this one-day habitat assessment survey to definitively determine this. Anemometers and other weather instruments would need to be placed at various locations at A-2 and NBSB and monitored throughout the full overwintering period to provide the information needed to determine whether these trees and shrubs provide windbreak protection. If a future study determines that they do not provide windbreak protection, but adult Monarch forage there, then the trees and shrubs at A-2 would be considered part of the Monarch’s overwintering foraging habitat for NBSB, but not part of the roost site at NBSB.

At the time of my initial site visit on November 22nd, 2011, I observed a couple of ruderal plants (e.g., *Brassica*, *Raphanus*) growing in the ruderal portions of A-1, A-2, and A-3 surrounding the existing Harmony Foods facility, but no Monarchs were foraging on them as most were not yet flowering. More individuals of both plants would normally flower later in the winter and early spring and could provide nectar resources for the Monarchs at that time. Dayton (2004) reported that overwintering Monarchs often nectar on ruderal plants such as *Oxalis*, *Brassica*, and *Raphanus* that grow in the disturbed fields surrounding the facility in late winter, as well as ornamental *Myoporum* (*Myoporum laetum*) trees that are part of the landscaping. These “disturbed fields” referred to by Dayton are presumed to include all or some portions of alternative desalination plant sites A-1, A-2, and A-3. Although there are ongoing operations surrounding the Harmony Food building that could deter Monarchs from being in the immediate vicinity of that building, the vacant lots are somewhat buffered from routine activities by trees and the paved areas for vehicles. Although I did not observe any Monarch foraging activity during my initial habitat assessment survey, I did observe two adult Monarchs foraging at A-2 during my December 7th, 2012 visit. Thus, given this more recent observation, Dayton’s prior observations there, the known nectar plant species present, and the proximity of overwintering Monarchs at NBSB, foraging at these sites is assumed to still occur. Additional surveys throughout the winter and early spring would be needed to confirm the extent to which these nectar plants and water sources are actually utilized by overwintering Monarchs at this time, as most nectar plants were not flowering and the water sources were dry at the times of my visits.

I anticipate that adult Monarchs probably visit these plants to obtain nectar when they are flowering. Since other vacant land east of the Harmony Foods facility is currently being developed, the remaining nectar resources at the three alternative desalination plant sites could assume a greater role in future years to provide foraging habitat for Monarchs that overwinter at NBSB. Thus, the loss of potential foraging habitat for any period of time could potentially

impact overwintering Monarchs at NBSB. However, due to the lack of information about the degree of foraging usage of these alternative plant sites compared to NBSB and other nearby properties where foraging occurs, the extent of this impact is unknown. The recommendations for project planning presented in the next section of this report assume that Monarchs are currently using the three proposed desalination plant sites for foraging habitat.

No Monarch butterflies were observed roosting in the trees located at the three alternative proposed desalination plant sites. A-2 has the greatest tree cover, but the spatial arrangement of the resident trees is not optimal for Monarchs to roost there.

According to weather data by Rob Franks of the nearby Long Marine Lab of the University of California, Santa Cruz, winds in the Santa Cruz area come from all directions. Before, during, and after storm events winds often come from the west, northwest, and north. Thus, the trees and shrubs on A-2 may provide secondary windbreak protection for the Monarchs that overwinter at NBSB. In order to confirm that these trees and shrubs are providing secondary wind protection for the overwintering site at NBSB, a study of the wind patterns in the area would need to be conducted throughout the Monarch's entire overwintering period. In the absence of such a study, the following analysis assumes that the trees present on site A-2 provide secondary wind protection to the overwintering site at NBSB.

Construction of the desalination plant at alternative site A-2, which lies closest to and directly north of NBSB, would result in removal of numerous trees that potentially provide secondary windbreak protection and is identified in the City's General Plan 2030 as potential Monarch butterfly habitat. Since these trees may be part of the Monarch roost site at NBSB, their removal would not comply with Local Coastal Program and General Plan policies protecting overwintering sites. While new buildings on site A-2, with heights of 24 to 36 feet, would offer secondary wind protection, depending upon their configuration and shorter heights they may not adequately replace the potential wind break provided by existing on-site trees. Additionally, there have been several trees planted at NBSB recently as part of a restoration project. However, these trees will take time to mature and it is unclear at what level these trees could replace any wind break that may be provided by existing trees on A-2. In contrast, both alternative sites A-1 and A-3 are characterized primarily by herbaceous vegetation and lack significant tree cover, so construction of the desalination plant at either of these locations would not result in loss of trees that provide secondary wind protection to the NBSB roost trees.

To summarize, construction of the proposed desalination plant at alternative site A-2 would likely have a greater impact on overwintering Monarchs at NBSB and their overwintering habitat than construction at either alternative site A-1 or A-3. The trees and shrubs growing on A-2 may provide secondary windbreak protection to the active roost trees in NBSB. A mixture of known tree, shrub, and herbaceous nectar plants also grow there. In contrast, the alternative sites A-1 and A-3 primarily provide potential foraging habitat for adult Monarch in the form of herbaceous nectar plants.

RECOMMENDATIONS FOR PROJECT PLANNING

As previously discussed, Monarch Butterfly overwintering sites are protected in the City

of Santa Cruz's Local Coastal Program and newly updated General Plan 2030. In the General Plan 2030 what is described and depicted as "potential Monarch butterfly habitat" focuses on Eucalyptus, Monterey Pine, or Monterey Cypress tree stands that potentially could or are known to support over-wintering Monarch butterfly roosts and do not always include the full foraging (nectar and water) ranges of the butterfly (which could include additional portions of the City depending upon the particular overwintering site). If a project is within or adjacent to the "potential Monarch butterfly habitats" mapped in the General Plan 2030, then further studies must be conducted to confirm whether Monarchs are, in fact, using the area and if the project will have impacts. According to the Local Coastal Program and General Plan 2030, development projects should analyze potential impacts to overwintering sites and identify avoidance and mitigation measures to minimize impacts. This analysis should consider activities within and outside the actual "overwintering sites" that could influence the Monarch's use of the overwintering sites (i.e. smoke infiltration into overwintering sites, pesticide application near overwintering sites, elimination of nectar plants, etc.).

General recommendations for the Monarch's overwintering sites are identified in the City's recently adopted General Plan 2030 and include:

- a) avoidance of take of individuals and overwintering habitat;
- b) buffers to maintain suitable habitat conditions; and
- c) avoid construction activities during the winter roosting season.

There is no specific buffer distance noted in the General Plan for this proposed project area and other relevant Monarch-related terms are not defined, which complicates applying the City's general recommendations to evaluate impacts of this proposed project. For example, I suspect the City's use of the phrases "overwintering site" and "overwintering habitat" actually refer to the "roost site" (i.e., roost trees, plus primary and secondary wind protection trees) as defined in this habitat assessment report. Also, the City has not prepared a Monarch butterfly management plan for this specific area. For these reasons, the general project planning recommendations I provide in the remainder of this section are focused on foraging habitat and windbreak protection to benefit the overwintering Monarchs. I suggest that the City explore opportunities to work with California State Parks at NBSB to support its ongoing habitat enhancement efforts to benefit overwintering Monarchs there. State Parks has planted Coast Live oak (*Quercus agrifolia*) and Monterey Cypress trees to enhance wind protection and to replace various Eucalyptus trees that have died or are in decline at the Monarch's NBSB roost site. Also, the Land Trust of Santa Cruz County manages the nearby Antonelli Pond site and might be interested in assisting with Monarch habitat enhancement efforts.

I recommend planting several nectar plant species preferred by foraging adult Monarchs at the selected desalination plant site, at NBSB, or at other areas in proximity to NBSB. Suggested nectar plants include Bottlebrush (*Callistemon citrinus*), California lilac (*Ceanothus cuneatus* var. *cuneatus*), Pride of Madeira (*Echium fastuosum*), Escalonia (*Escalonia* spp.), Australia tea tree (*Leptospermum laevigatum*), Holly leaf cherry (*Prunus ilicifolia*), Carolina cherry (*Prunus caroliniana*), California blackberry (*Rubus* spp.), Lauraltinus (*Viburnum tinus*), Seaside heliotrope (*Heliotropium curassavicum*), Rosemary (*Rosemarinus officinalis*), Lantana (*Lantana montevidensis*), Mexican bush sage (*Salvia leucantha*), Black sage (*Salvia melifera*), and willows (*Salix hindsiana*, *S. lucida*, and *S. lasiolepis*). The willows and cherries can also

function as lower windscreen trees, if necessary. Nectar plants should be selected to provide nectar throughout the fall and winter months, so several different plant taxa will need to be utilized. Also, the nectar plants utilized will ultimately depend upon existing habitat types at the habitat enhancement area(s) that are utilized. Nectar plants should be located in sunlit areas, preferably on the southern and western portions of the desalination plant site that are away from vehicular traffic and human activity. These nectar plants should be planted and available to overwintering Monarchs as soon as possible after removal of existing plants. A qualified biologist specializing in Monarch butterflies should review the planting plans. These recommendations are based on limited information on the site and assume the Monarchs are using the area for foraging. Additional field studies would be needed to precisely characterize the degree, timing, and nature of Monarch foraging at the alternative desalination plant sites and in the surrounding area, but was beyond the scope of my habitat assessment.

If alternative site A-2 is selected for construction of the desalination plant, trees known to function as wind protection for Monarch roost sites should be planted there, especially in the area immediately north of Delaware Avenue. Faster growing tree species should be utilized as several years of survival and growth by any replacement trees will be required to fully replace the wind protection function provided by the trees that are removed due to the project. A mixture of tall, medium, and short tree species should be utilized to provide the best wind protection. Under ideal circumstances, the replacement trees would be planted and sufficient time allowed for them to reach maturity before any existing trees are removed from A-2 to avoid the loss of secondary wind protection for the NBSB roost site. Alternatively, mature trees should be planted. If enough area to support the tree planting is not available onsite to sufficiently replace secondary wind protection of the NBSB roost provided by the existing trees on A-2, then the replacement trees should be planted in areas north of the roost sites within NBSB. For other projects in the City of Santa Cruz, replacement trees have been planted at a minimum ratio of 2:1 (replacement trees: removed trees). In this case, the ratio could vary depending upon how many trees are ultimately removed by the project, their locations on A-2, if replacement plantings occur at A-2 or NBSB, and the types of trees used to avoid any timelag in the loss of wind protection while replacement trees mature (i.e., initial overplanting with future thinning of replacement trees may be appropriate).

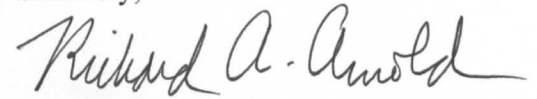
Evergreen tree species that provide good windscreen function include Coast redwood (*Sequoia sempervirens*), Monterey Cypress, Swamp mahogany (*Eucalyptus robusta*), Sydney blue gum (*Eucalyptus saligna*), Coolibah (*Eucalyptus microtheca*). The aforementioned evergreens should be planted in the drier locations of the southwestern portion of the desalination site A-2. In the wetter portions, California white alder (*Alnus rhombifolia*), Red alder (*Alnus rubra*), and willows (*Salix hindsiana*, *S. lucida*, and *S. lasiolepis*) would be appropriate trees for this purpose. If the replacement trees have not matured sufficiently to provide replacement wind protection before the on-site trees at A-2 are removed, impacts to the NBSB roost site from removal of trees on A-2 could occur. In the absence of additional field data from a study of the wind patterns and butterfly use in the area, my analysis assumes that the trees on A-2 are providing secondary wind protection to NBSB roost trees.

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If you have any questions about my report, please contact me.

Sincerely,

A handwritten signature in cursive script that reads "Richard A. Arnold". The signature is written in dark ink and is positioned above the printed name and title.

Richard A. Arnold, Ph.D.
President

cc: Ann Sansevero, URS Corporation