APPENDIX D

Lighting Visual Impact Assessment
Vallier Design Associates, Inc.

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LIGHTING VISUAL IMPACT ASSESSMENT
Chevron Richmond Refinery Long Wharf Maintenance and Efficiency Project

Chevron Products Company
City of Richmond
County of Contra Costa, California

Vallier Design Associates, Inc.
March 2016
Chevron LWMEP Visual Lighting Impact Assessment

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Purpose of Study

Lighting modifications were not analyzed in the Visual Impact Assessment (VIA) that was submitted to the California State Lands Commission with the Initial Study Checklist for the Richmond Refinery Long Wharf Maintenance & Efficiency Project (LWMEP or Project) on October 28, 2015. That VIA evaluated potential visual impacts anticipated to occur as a result of the proposed Project during the daytime, and included a more detailed description of the Project scope and construction activities than is contained in this Lighting Visual Impact Assessment (LVIA).

The purpose of this LVIA is to evaluate and document potential visual impacts anticipated to occur as a result of the lighting upgrade component of the proposed Project and to suggest measures to lessen any potentially significant impacts that are identified.

Visual impacts are demonstrated by documenting existing lighting conditions at the Project site, determining the degree of change that would occur as a result of the modifications, and predicting how the affected viewer would respond to, or perceive, the lighting changes.

Project Description

The Project site is located in the San Francisco Bay just south of the Richmond Bridge and west of Point Richmond, California. There are a number of different land uses in the vicinity of the Project site: to the north is the Richmond-San Rafael Bridge (also known as John T. Knox Freeway /Interstate 580); to the east and south are hillside residences and a regional park as well as a few small pocket parks. The Richmond Long Wharf (Wharf) is completely surrounded by water except for the causeway where it connects to the land. The Wharf operates under a lease agreement with the California State Lands Commission, and is used to offload crude oil from vessels into storage tanks as well as for loading refined petroleum onto vessels.

Figure 1: Project Site and Surroundings *Aerial image courtesy of Google Earth*

The proposed upgrades to the lighting are a necessary component of the Project, which has the objectives of bringing the Wharf into compliance with the current California Building Code Section 31F (Marine Oil Terminal Engineering and Maintenance Standards or MOTEMS) for compliance with seismic standards; increasing reliability of the existing equipment; and improving operational efficiency and safety.

Project Background

The Chevron Long Wharf was originally constructed between 1945-1947; the extent of the original construction was limited to the Main Wharf and the Causeway. Over the years, changes have been made to update or repair the existing structure. In the process, some of these changes have increased the overall size of the structure, bringing it to the size and configuration that it is today.

Project Location and Setting

The Project location and setting provides the context for determining the type and degree of changes expected to be made to the existing visual environment. The terms ***visual character*** and ***visual quality*** are used to describe the visual environment. These terms are described in more detail below.

Unlike most study sites which may be immediately adjacent to another land use, the Wharf is physically separated from other land uses by virtue of it being surrounded by water. The view from across the water to the Wharf is how the viewer observes the structure of the Wharf and its docked vessels.

The Wharf consists of the 4,200 foot-long Causeway that extends into the Bay from the land in a southerly direction. Perpendicular to the Causeway are the Berths which extend 3,480 feet, from end to end. Because the Wharf is mostly a flat structure at the surface of the water, it is less conspicuous than the larger tanker vessels that dock there. There are, however, some permanent structures associated with the Wharf that extend anywhere from 10 feet to 78 feet above the water, including marine loading arms, cranes, and operator buildings.

Figure 2: Chevron Richmond Long Wharf *Aerial image courtesy of Google Earth*

Permitting and Approval Requirements

Chevron will need to obtain permits and approvals from the following entities before proceeding with construction of the Project:

Table 1 - Required Environmental Permits and Approvals

Agency	Permit, Approval or Consultation
California Regional Water Quality Control Board (RWQCB)	Clean Water Act Section 401 Water Quality Certification
United States Army Corps of Engineers (USACE)	Clean Water Act Section 404 – Nationwide Permit #3 (maintenance)
California Department of Fish and Wildlife (CDFW)	California Endangered Species Act – Incidental Take Permit
National Marine Fisheries Service (NMFS)	Biological Opinion for listed fish species
National Marine Fisheries Service (NMFS)	Marine Mammal Protection Act – Incidental Harassment Authorization
Bay Conservation and Development Commission (BCDC)	Amendment to Refinery Long Wharf Permit No. M1987.015

Construction Activities

Construction activities for the Project would consist of pile driving, installation of new, upgraded cranes, elevated fire monitors, gangway towers, standoff fenders, barrier pile clusters, and mooring dolphins. Construction activities will take place at Berths 1-4 only. No work will occur at Berths 5, 7, 9, 11, and A/B. Viewed all together, Project construction is relatively minor since most of the work involves replacement or upgrading existing equipment.

Table 2 - Project Scope Summary

Scope	Berth 1	Berth 2	Berth 3	Berth 4
Vessel Access Gangways	Replace	Add	Add	N/A
Fire Monitor	Add 1 new	Add 1 new	Add 1 new	N/A
Dolphins/ Hooks	Add: -1 new 24' x 20' hook dolphin -1 new 24' x 25' breasting dolphin -1 new 13' x 26' breasting point	Replace 1 bollard with 1 hook	N/A	Add 2 new 36' x 20' dolphins with standoff fenders (two per dolphin)
Fenders	Add 2 new standoff fenders	Add 4 new standoff fenders	N/A	Add double fenders
Cranes	N/A	Replace: -1 auxiliary crane -1 vapor crane -1 main hose crane	N/A	N/A
Structural Retrofit	N/A	N/A	N/A	Seismic retrofit of loading platform Add 4 barrier pile clusters
Catwalk	Replace and reconfigure existing catwalk	N/A	N/A	Install 2 new catwalks for access to dolphins

Proposed Lighting Changes

The initial VIA evaluated anticipated physical changes to be made at the Wharf as required by MOTEMS, seismic safety, and operational efficiency. This LVIA addresses the anticipated effects of modified lighting at the Wharf, which is required as part of the Project.

The proposed lighting modifications are outlined in the Table 3 below. The total light intensity (expressed in lumens, the amount of light emitted per second in a unit solid angle by a point source of one candle intensity) is shown for the existing lighting at the Wharf, and for each of the proposed Project modifications. The increases from lighting modifications are added to the existing lighting totals, and the percentage change shown.

Table 3 - Light Intensity Summary (Lumens)

	Berth 1	Berth 2	Berth 3	Berth 4	Causeway	Total
Existing Facility	2,254,300	2,879,700	4,271,700	2,571,500	2,294,400	14,271,600
New Fenders	-	-	-	34,500		34,500
New Vessel Access Fixed Gangway Structure	34,500	34,500	34,500	-		103,500
New Mooring Dolphin and Hooks	11,500	-	-	-		11,500
Retrofit / Temporary Lighting	-	-	-	195,500 See Note 1		195,500
TOTAL Permanent New Lighting	2,299,300	2,914,200	4,306,200	2,606,200	2,294,400	14,421,100
TOTAL w/ Temporary Lighting	2,299,300	2,914,200	4,306,200	2,801,700	2,294,400	14,616,600
% CHANGE Permanent New Lighting	2.04%	1.20%	0.81%	1.34%	0.00%	1.05%
% change w/ Temporary Lighting	2.04%	1.20%	0.81%	8.9%	0.00%	2.41%

Note 1: An existing light pole at the north east corner of the Berth 4 loading platform will be relocated. The existing pole will be taken down to allow for construction and a temporary set of lights (1,700 watts total) will be installed immediately adjacent to the construction area. After construction, the permanent 8,000 watt light pole will be re-installed approximately 15 feet from its present location on the new retrofit platform, and the temporary 1,700 watt lights will be removed. The calculated net change in luminosity at Berth 4 excludes the temporary reduction at Berth 4 (20%) due to the change from 8,000 watt (existing) to 1,700 watt (temporary). There is no net luminosity change at Berth 4 due to the relocation of the existing 8,000 light pole.

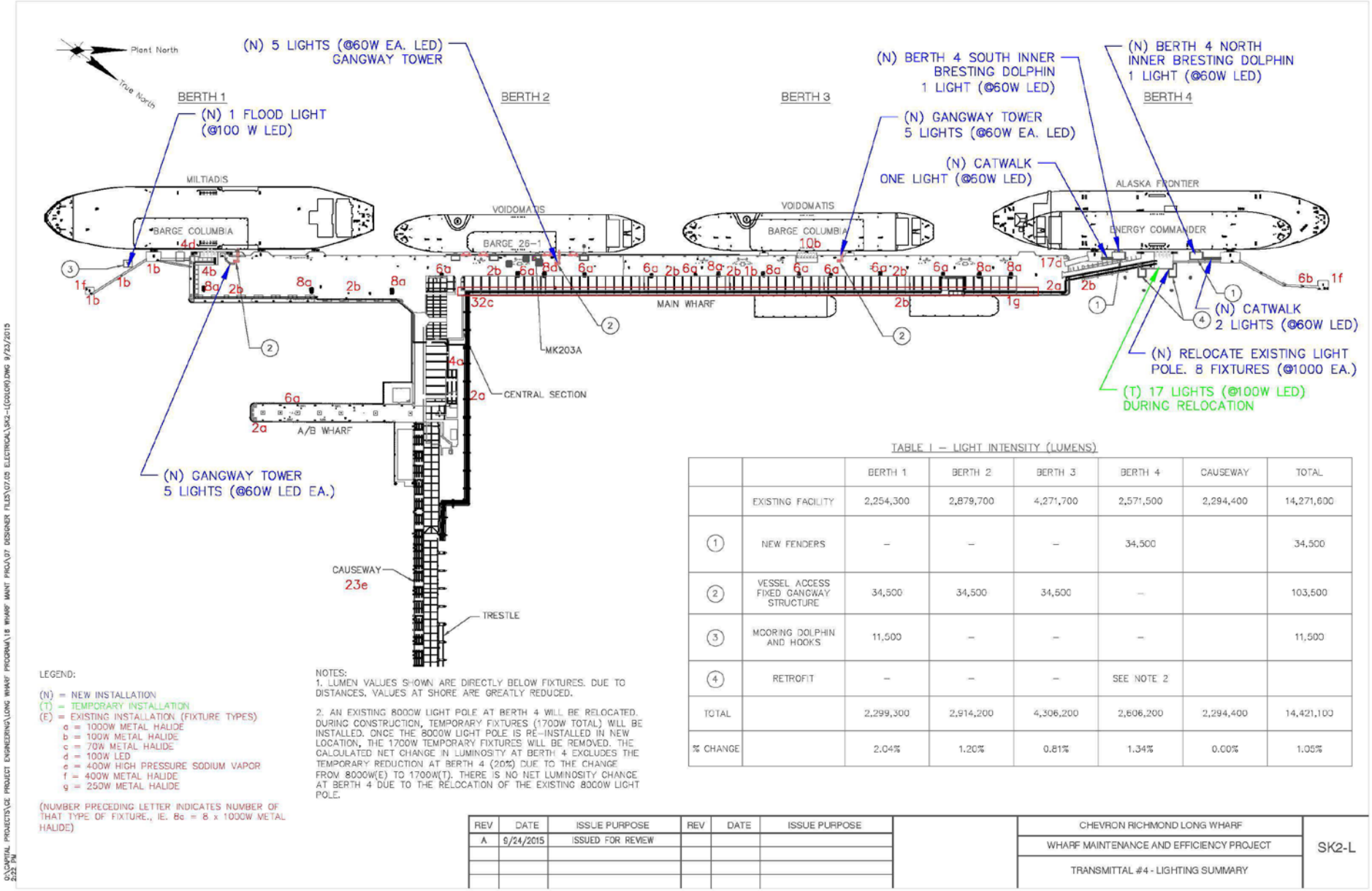

TABLE I – LIGHT INTENSITY (LUMENS)

		BERTH 1	BERTH 2	BERTH 3	BERTH 4	CAUSEWAY	TOTAL
	EXISTING FACILITY	2,254,300	2,879,700	4,271,700	2,571,500	2,294,400	14,271,600
1	NEW FENDERS	–	–	–	34,500		34,500
2	VESSEL ACCESS FIXED GANGWAY STRUCTURE	34,500	34,500	34,500	–		103,500
3	MOORING DOLPHIN AND HOOKS	11,500	–	–	–		11,500
4	RETROFIT	–	–	–	SEE NOTE 2		
TOTAL		2,299,300	2,914,200	4,306,200	2,606,200	2,294,400	14,421,100
% CHANGE		2.04%	1.20%	0.81%	1.34%	0.00%	1.05%

Figure 3: Additional Lighting Summary Plan Diagram

For the Berths requiring lighting modifications (Berths 1, 2, 3, and 4), the permanent increase in lighting intensity ranges from 0.81% to 2.04%, with an overall increase of 1.05%. These increases are small and would be considered insignificant based on the numerical increase in lumens.

Study Method

The following steps were taken to assess visual impacts from lighting modifications proposed as part of the Project:

- Define the Project location and setting
- Identify visual assessment areas and key views
- Analyze existing visual resources
- Determine anticipated changes and viewer response
- If necessary, propose mitigation measures to offset visual impacts

To determine the potential effects of the Project on the visual environment, a site investigation was made and notes and photographs were taken. The site visit and photographs were then used to determine the existing scenic value of the visual resources, both adjacent to and within the Project area.

Lighting Visual Assessment Areas and Key Views

For the purposes of the original VIA, and for this LVIA, the Project site was divided into a series of key views or visual assessment areas. Each key view has its own visual character and quality, and the key views were chosen:

Table 4 - Key Views Summary

View No.	Location	Distance to Project Site
1	View from the Richmond-San Rafael Bridge overlook	+/- 3,330 feet
2	View from the residential neighborhood at the northern end of Western Drive	+/- 4,770 feet
3	View from the residential neighborhood on Clarence Street	+/- 5,470 feet
4	View from the beach at Keller Beach Park	+/- 6,480 feet
5	View from the end of the dock at Ferry Point	+/- 6,700 feet

Figure 4: The Richmond Long Wharf and Key Views

For the residential viewers who are physically closest to the Wharf, the character of the view out to the Wharf is industrial in nature, particularly during daylight hours. As one gets further away from the Wharf, viewers such as the residents on the hillside looking out to the Bay have a less concentrated view of the Wharf and its structures, and have an overall wider view of the Bay with the Marin hills in the background. When the sky is dark, these features are less visible. For viewers from the Keller Beach Park and the Ferry Point dock, the Richmond-San Rafael Bridge is more visually dominant than the structure of the Wharf, even when the sky is dark.

Visual Quality and Visual Character

The assessment of visual resource changes is done through an analysis of existing conditions, a determination of how changes may impact the visual resources of the site, and implementation of design features to help minimize any anticipated impacts. An important part of the process is to

define both the *visual character* and *visual quality* of the Project site as experienced by public viewers from surrounding viewpoints.

When evaluating the visual quality of a site, the following concepts are considered:

- **Vividness** – Vividness refers to the degree to which the impression of the landscape is memorable. In particular, how contrasting landscape elements create a distinct visual pattern.
- **Intactness** – Intactness refers to the integrity of the visual order of the natural and built environment, as well as the degree to which it is free of visual intrusion.
- **Unity** – Unity refers to the extent to which visual resources combine to form a coherent, harmonious pattern.

In judging visual quality, all three of these concepts must be considered in combination.

The *visual character* of the Project site is fairly uniform but varies somewhat depending on the view. The predominant character of the setting is of a commercial wharf structure in the Bay, adjacent to a hillside residential neighborhood to the east, and bounded by a bridge (a major vehicular thoroughfare) to the north.

Lighting Visual Impact

Below is an evaluation of Project-related changes to the nighttime lighting in Views 1 through 5. Before and after images are presented for each view, followed by a narrative description of the features that would be seen. In all cases, as shown in Table 3 above, Project lighting upgrades result in a very minor change to the existing views based on the increase in lighting intensity. Also, the lumen values shown are calculated directly below the lighting fixtures. In general, primarily due to the distance of the light fixtures from viewer locations, lumen values at the shoreline are greatly reduced.

The evaluation of the nighttime lighting changes is done in a similar manner to the assessment done for changes as perceived in daylight. The biggest difference between the two is that the perception of the view is different at night in the dark than it is in the daylight. For example, the assessment of a

view might be rated as high in daylight, whereas in the dark this assessment may change based on the decreased ambient light and visibility, and the presence of artificial lighting.

During daylight, docked vessels, specific structures, and other Wharf features are more discernible to viewers than at nighttime. Viewers at nighttime will instead see artificial lighting as the prominent feature at the Wharf. New nighttime light sources have the potential to increase ambient nighttime illumination levels and result in spillover of light onto adjacent properties.

The proposed Project may have a significant impact related to changes in lighting if it would create a new source of substantial light and glare which would adversely affect nighttime views in the area.

Viewers and Viewer Response

The viewers referred to in this analysis are those individuals whose views (Views 1 through 5) will be changed in some way as a result of the Project.

Viewers' responses to changed conditions are influenced by their exposure to the site and the changed conditions. Viewer exposure is affected by three things: location, quantity, and duration. Location refers to the position of the viewer relative to the object. Quantity refers to the number of viewers who see the object. Duration refers to the length of time the viewer is exposed to the object.

A further delineation of viewer response has to do with viewer sensitivity. Viewer sensitivity is strongly related to visual preference. Several factors affect viewer sensitivity, such as: awareness, activity, and local values. Visual change in the landscape heightens viewer awareness. For example, a drive through a familiar suburban neighborhood may not be experienced with the same level of awareness as a drive by the same individual through a redwood grove. Local values also affect viewer response through expectations and aspirations. For example, if a landscape has a historical significance to a community, then any change to it could be seen as a potential impact.

Types of Viewers

The types of viewers considered for this study are individuals viewing the landscape as pedestrians, residents, and vehicular drivers.

Visual Impact

The evaluation of lighting visual impact depends upon the degree of change, the scenic quality of the area that is changed taking into account the reduced visibility of surroundings, and the sensitivity of the viewers who experience the change. Impacts can be short term, such as the disturbance of construction, or long term such as the visual presence of new permanent lighting. The amount and kind of change affecting the visual resource considered in combination with the viewer response determines the level of visual impact.

Below is an evaluation of project-related changes in Views 1 through 5. Before and after images are presented for each view followed by a narrative description of the features that would be seen.

Lighting Impact to Viewers – View 1 (San Rafael Bridge and Overlook)

Figure 5: View 1 Existing Conditions

Figure 6: View 1 Photo Simulation Showing Lighting Upgrade

Figure 7: View 1 Labeled Simulation

During daylight, the scene from View 1 is predominantly of the water and the hills of Marin in the background. The viewers from this viewpoint are people driving across the bridge and sightseers stopping at the overlook. At night, it is reasonably expected that viewers are less inclined to stop at the overlook. For those individuals driving across the bridge, the scene of the Wharf passes by quickly and is partially obstructed by the bridge structure itself.

In the original VIA, View 1 is described as having a high visual quality based on the view of the natural beauty of the Bay in combination with the Marin hills in the background. In contrast, at night the hills in the background are less visible, and instead of sunlight reflecting off of the water there is the reflection of the existing Wharf lighting on the surface of the water in the foreground. The dominant elements the viewer is aware of in this view are the lights of the Wharf and their reflection on the water. As a result, the nighttime assessment of View 1 is that it is of medium visual quality.

Because of the distance of the overlook across the water (approximately 3,330 feet) and the speed (65 mph) at which most drivers on the bridge viewers are perceiving the view to the Wharf, changes in lighting at the Wharf would be difficult to recognize from this vantage point, and it is likely that the lighting changes would be not be obvious to the casual viewer.

In the context of the site, and as demonstrated by the simulated view, the additional lights are not visually prominent. Also, because the lighting improvements involve only a few additional fixtures interspersed with the existing lighting, and due to the view distance and/or driving speed, the changes would be difficult to notice. When considered with the small increase in lighting intensity as shown in Table 3, the overall visual impact from the new lights would be negligible.

Lighting Impact to Viewers – View 2 (Western Drive – Pt. Richmond)

Figure 8: View 2 Existing Conditions

Figure 9: View 2 Photo Simulation Showing Lighting Upgrade

Figure 10: View 2 Labeled Simulation

During daylight, the scene from View 2 is predominantly of the water and the Marin hills in the background. The viewers from this viewpoint are people walking, driving, or living on Western Drive in Point Richmond.

In the original VIA, View 2 is described as somewhat more industrial than natural in character. The Long Wharf dominates the view in the foreground. The structure of the Wharf Causeway and its support structure are clearly visible. The view of the Marin hills in the background is far less prominent than during daylight. The daytime and nighttime visual quality of this view is medium.

Because the distance from the shore to the Wharf appears shortest at this viewpoint (approximately 4,770 feet), this view has the highest sensitivity of the five views in this study. In addition, the majority of viewers from this viewpoint are residents of Point Richmond, and the duration of time that a viewer might look at the Wharf from this viewpoint is longer. Given this condition, it is possible that a residential viewer from this vantage point may notice the new Berth 1 and 3 gangway lights and the Berth 1 lighting.

However, in the context of the site, and as demonstrated by the simulated view, the additional lights are not visually prominent. Also, because the lighting improvements involve only a few additional fixtures interspersed with the existing lighting, and due to the view distance of nearly one mile, the changes would be difficult to notice. When considered with the small increase in lighting intensity as shown in Table 3, the overall visual impact from the new lights would be negligible.

Lighting Impact to Viewers – View 3 (Clarence Street – Pt. Richmond)

Figure 11: View 3 Existing Conditions

Figure 12: View 3 Photo Simulation Showing Lighting Upgrade

Figure 13: View 3 Labeled Simulation

During daylight, View 3 is predominantly a view of the San Francisco Bay with Mount Tamalpais in the background. The viewers from this viewpoint are primarily residents of and visitors to the hillside neighborhood. From View 3 on Clarence Street, the viewer is higher in elevation on the side of the hill than in Views 1 and 2. From this angle, the structure of the Long Wharf and the vessels moored at the Wharf stands out in the foreground. The original VIA determined View 3 to be of medium visual quality during daylight.

At night, the Bay in the foreground and hills in the background are much less visible, however, scattered lights are visible on the Marin hills. The most concentrated grouping of lights are at Berth 4 and these tend to stand out, as does the one brightest light at Berth 1. The intensity of the lights will change, however, depending on the presence or absence of ships at Berth. The visual quality in this nighttime view is medium.

The approximate distance between the viewer and the Wharf in this view is 5,470 feet. In addition, the majority of viewers from this viewpoint would be residents of the Point Richmond neighborhood, and therefore the duration of time that a viewer might look at the Wharf from this

viewpoint is longer. Given this condition, it is possible that a residential viewer from this vantage point may notice the new Berth 1 and 3 gangway lights and the Berth 1 floodlight.

However, in the context of the site, and as demonstrated by the simulated view, the additional lights do not stand out. Also, because the lighting improvements involve only a few additional fixtures interspersed with the existing lighting, and due to the view distance of over one mile, the changes would be difficult to notice. When considered with the small increase in lighting intensity as shown in Table 3, the overall visual impact from the new lights would be negligible.

Lighting Impact to Viewers – View 4 (Keller Beach Park)

Figure 14: View 4 Existing Conditions

Figure 15: View 4 Photo Simulation Showing Lighting Upgrades

Figure 16: View 4 Labeled Simulation

During daylight, the scene from View 4 is predominantly of the water in the foreground and Mount Tamalpais in the background. Viewers from this viewpoint are residents, people walking along the shoreline, or sitting on Keller Beach, and viewers are essentially at eye level with the structure of the Wharf.

In the original VIA, View 4 describes the appearance of the Long Wharf as a thin black line on the surface of the water. Unless there are vessels moored at it, viewers might not notice the Long Wharf at this distance (approximately 6,480 feet). In contrast, the Richmond-San Rafael Bridge is clearly visible in the distance. The daytime visual quality of View 4 is high.

At night, the Wharf is visible primarily because it is well lit, although the presence or absence of ships at the Berths also affects its visual presence. Its appearance as a thin black line is much less obvious than during daylight. However, the reflection of the Wharf lighting on the water is visible. To the north, the lighted structure of the Richmond-San Rafael Bridge is prominent in this view. The nighttime visual quality of View 4 is high.

In the context of the site, and as demonstrated by the simulated view, the additional lights do not stand out. Also, because the lighting changes involve only a few additional fixtures that would be interspersed with the existing lighting, and due to the view distance of well over one mile, the changes would be difficult to notice. When considered with the small increase in lighting intensity as shown in Table 3, the overall visual impact from the new lights would be negligible.

Lighting Impact to Viewers – View 5 (Ferry Point)

Figure 17: View 5 Existing Conditions

Figure 18: View 5 Photo Simulation Showing Lighting Upgrades

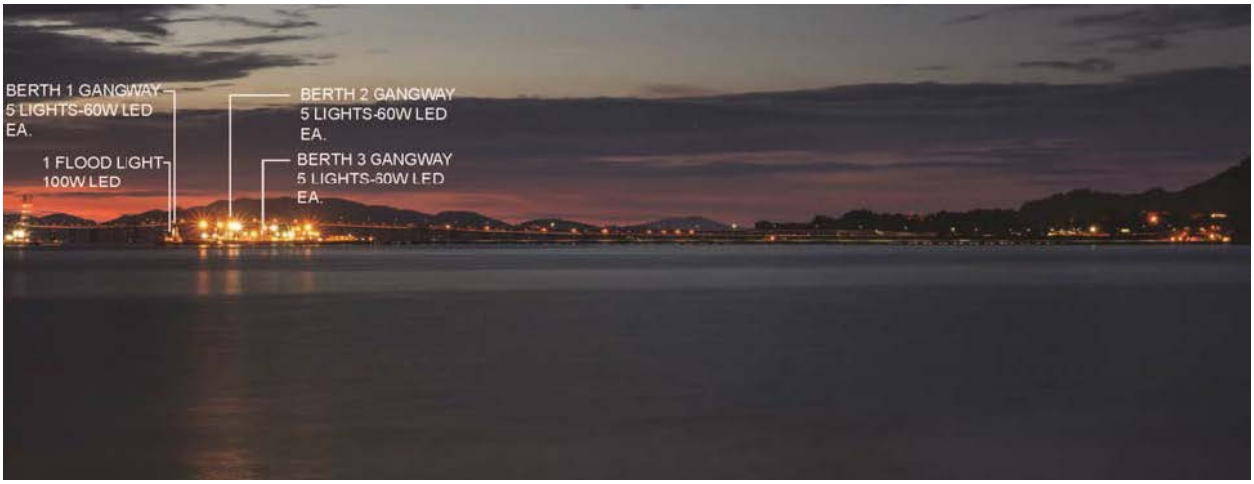

Figure 19: View 5 Labeled Simulation

During daylight, the scene from View 5 is predominantly of the water. The hills of Richmond are visible to the right of the scene and the hills of Marin are visible to the left and in the distance. From this angle, the Long Wharf and the Richmond-San Rafael Bridge are lined up so that it is hard to tell if the line at the surface of the water is part of the Long Wharf structure or part of the bridge. The vessels moored at the berths are the only real indication that the Wharf is present. The daytime visual quality of View 5 is medium-high.

At night from this viewpoint, the viewer sees the collection of lights on the Wharf as a grouping rather than in a line, which makes a strong visual impression. The viewers from this viewpoint are primarily park visitors, but also neighbors and possibly individuals who work nearby. The nighttime visual quality of View 5 is medium.

Given the distance from the viewpoint to the Wharf (approximately 6,700 feet) and the concentrated view of the lights, it is likely that the additional new lights would be noticeable.

However, in the context of the site, and as demonstrated by the simulated view, the additional lights are not visually prominent. Also, because the lighting improvements involve only a few additional fixtures interspersed with the existing lighting, and due to the view distance of well over one mile, the changes would be difficult to notice. When considered with the small increase in lighting intensity as shown in Table 3, the overall visual impact from the new lights would be negligible.

Lighting Design Measures

Given the proximity of the Wharf to residential and other viewers, the proposed new lighting would include certain design measures to minimize any potential visual impacts, including:

1. To minimize stray light resulting from new lighting, lights would be light-emitting diode (LED) and would be shielded and adjusted such that light is cast downward and confined as much as possible to the immediate work area.
2. Prismatic glass reflectors would be used to minimize the spread of the illumination.
3. Dark colored shade accessories would be used to contain and prevent stray light and would be dark sky compliant.
4. Lighting fixtures would be appropriate in scale, intensity, and height to the use they are serving.
5. New lighting fixtures will be evaluated through the design process to ensure that Project lighting would be sensitive to, and compatible with the surrounding community.

The analysis of each viewpoint above was made with the assumption that all new lighting would incorporate these five design measures.

Lighting Visual Impact Summary

The proposed Project may have a significant impact related to changes in lighting if it would create a new source of substantial light which would adversely affect nighttime views in the area.

To evaluate the visual impact of the proposed lighting changes, the same five representative views selected for the daytime simulations were selected for study. The evaluation took into account the Project's implementation of the lighting design measures (above) that would minimize any visual impact from the new lighting. Computer simulations of the lighting changes as viewed from the five viewpoints were performed. The simulated views all differ very little form the corresponding baseline photo.

Overall, the simulations and evaluation indicate that the visual change resulting from the proposed new lighting for the Project would not change existing views to any significant extent. Therefore, although the proposed Project would add new sources of artificial lighting to the Long Wharf that would increase ambient lighting levels, this change would be small, and would not significantly alter

the existing lighting environment currently experienced in the area. This is primarily due to the distance to the Wharf from the viewpoints.

When considered together with the lighting intensity data shown in Table 3 (the Project would increase illumination levels overall by only 1.05%), lighting changes as a result of the Project change would be considered a less than significant impact and no mitigation measures are necessary.