CALIFORNIA COASTAL COMMISSION
SAN DIEGO AREA
7575 METROPOLITAN DRIVE, SUITE 103
SAN DIEGO, CA 92108-4421
(619) 767-2370

Th20c

CDP NO. 6-16-0989 (SEAWORLD SAN DIEGO)

MAY 11, 2017

EXHIBITS

Table of Contents

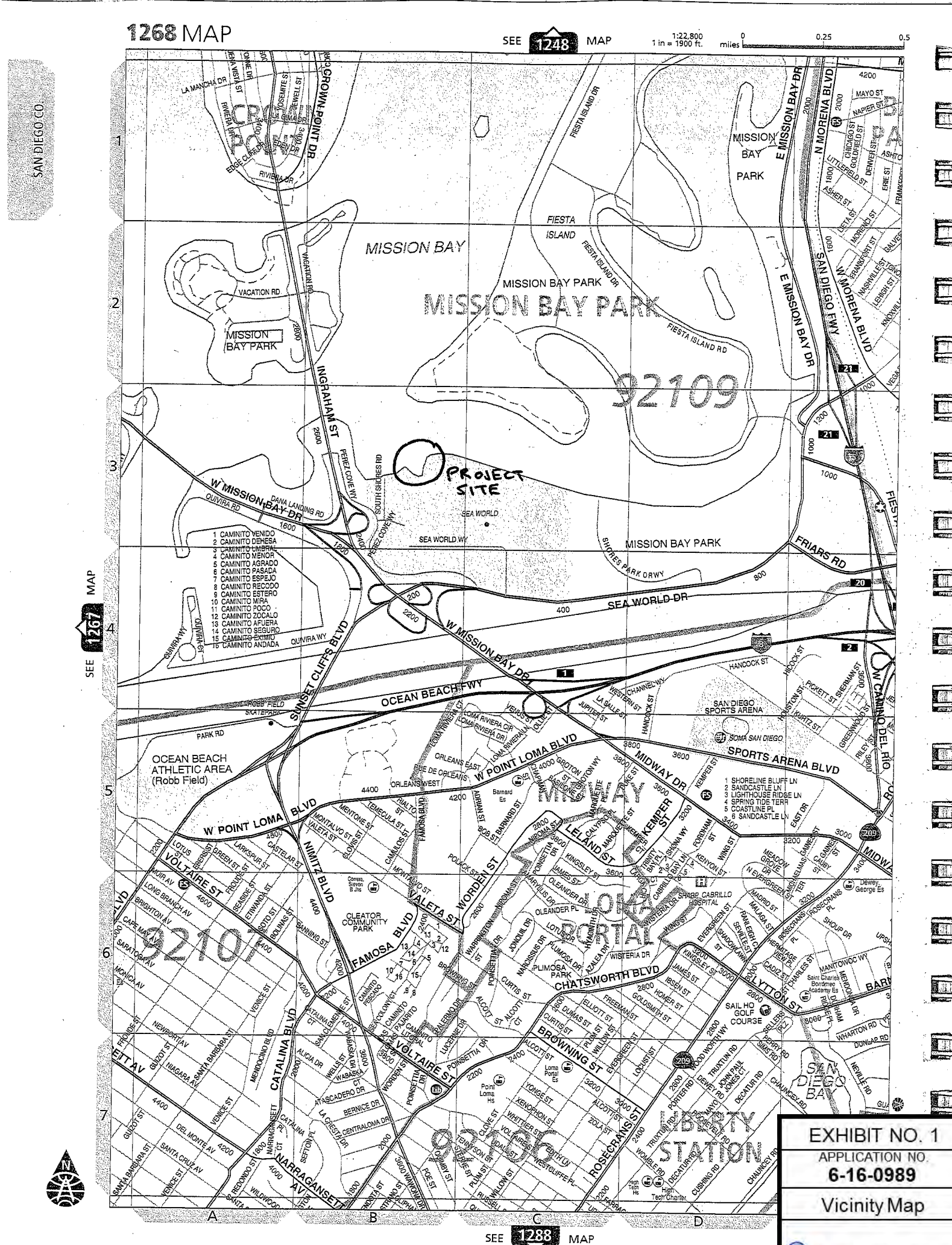

EXHIBIT NO. 1
APPLICATION NO.
6-16-0989
Vicinity Map
California Coastal Commission

Hibiscus Ln
Stony Point nesting area
Waterfront Stadium
Fiesta Island Rd
Dana Landing Rd
W Mission Bay Dr
Quivira Rd
Ingraham St
Perez Cove Way
SeaWorld
S Shores Rd
Mission Bay Pwky
Sea World Dr
Old Sea World Dr
© 2016 Google
Google Earth
1994
Imagery Date: 11/8/2016 32°46'01.95" N 117°13'33.43" W elev 16 ft eye alt 7066 ft

California Coastal Commission

EXHIBIT NO. 2

APPLICATION NO. 6-16-0989

Aerial View

EXHIBIT NO. 3

APPLICATION NO.
6-16-0989

Site Photos

California Coastal Commission


theme park archive

January 31, 2017

Jonna Engel
Ecologist
California Coastal Commission

Re: 2016325-00 Sea World San Diego
Cirque Nighttime Show – Revised Photometric Calculations

Dear Jonna,

We are the lighting designers who ran the photometry calculations for the proposed Cirque Nighttime Show on behalf of Sea World San Diego. In an effort to help relay the information for all to understand in the accompanying photometric layout, we are submitting this letter to clarify how these calculations were constructed and how the light from the fixtures will be directed.

The calculations were run using a technical software program called AGi32 by Lighting Analysts in order to accurately model the light output of specific light fixtures for a particular layout. This software has been an industry standard for many years and we have used it to provide simulated lighting calculations on a variety of projects in the past.

The process began with importing a 2D CAD drawing of the current site plan into AGi32 at the defined scale and then basic 3D models were constructed to simulate the nearby structures (such as the stands and structures on the center island) based off of the existing drawings and pictures provided. Lastly, masses at varying levels were created to represent the changing elevations of the topography.

Exp received direction from members of the Sea World show team on fixture types and locations for the proposed live show. The photometric data for each fixture type were imported into the AGi file and each fixture was placed at a specific mounting height as indicated by the Sea World show team. Each fixture was then oriented as necessary to light the intended area as indicated below:

- Fixtures mounted to existing poles in the stands (type E11) will be used to light the front of performer poles at the bottom of the stands. Fixtures are at a higher elevation than poles and the fixtures will be aimed down to illuminate the performers on the poles at the bottom of the stands.
- Spotlight fixtures (type E9) will mount to the front edge of the stadium walkway and will aim to light performer poles directly adjacent to the fixtures. These fixtures will be on only during pole act for approximately 7 minutes per show.
- Flood light fixtures (type E4) will mount to the front edge of the stadium walkway surface and will aim downward toward the barge to illuminate water between stadium and barge.
- A follow spot (type E6) will be located temporarily on either end of the stadium and will be operated by a member of the SeaWorld crew during the show to illuminate performers on the

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barge as well as aerial performers in the water between the stadium and the barge. These fixtures will also function for safety in the event of a water rescue. These fixtures will be stored inside when not in use.

- Gobo projectors (type E5) will surface mount at ground level and will project patterns onto the barge and on the surface of the water directly in front of the barge. These fixtures will have moving heads and an adjustable focus.

- Fixtures will also be mounted to the existing towers on either end of the stadium. Fixtures (Type E2) will aim to light the front of the barge. Egg crate louvers and top hat (glare shields) will be installed to restrict beam and prevent spill light from the fixtures. Fixtures (type E7) will also mount on towers and aim to illuminate the water between the stadium and the barge. Barn doors will be installed on each fixture to prevent beam from spilling outside of stadium.

- Fixtures (type E5) on the island will be moving heads that project pattern on adjacent walls and illuminate silk act taking place on the towers next to the stadium.

- Fixtures (type E3) on the island will be used to wash scenic elements on the island. Each fixture will be fitted with barn doors to restrict the beam to the scenic element.

- Fixtures along the water edge (type E8) will aim to light trees along the east side of the stadium. Fixtures will be placed near base of tree and light the underside of the canopy. Narrow beam angles will prevent spill away from tree.

- Fixtures on barge (type E10) will mount at top of barge and aim down to provide safety lighting for performers when swimming behind barge.

- Fixtures on barge (type E1 and E10 located on top platform) will focus on upper level of performance space of barge.

- Linear LED tape fixtures (type L1) will mount at front of barge at lower platform and will focus on back barge wall.

Lastly, calculation grids were inserted at 0ft (sea level), as well as 1ft and 2ft above sea level as indicated by the topographic information. Each grid contains individual points at a 10' x 10' spacing showing light levels to the nearest thousandth of a footcandle. Using the light fixture data for each fixture along with the surrounding 3D geometry the software calculates the illumination level (in foot candles) at those specific points. For comparison, light levels on the ground on an evening with a full moon and clear sky would be approximately 0.01 fc (0.108 lux).

Following the installation of the proposed light fixtures, exp can submit documentation (in the form of a field report following a site visit) that the fixtures were installed per the design documents and that all accessories to aid in light control (barn doors, egg crate louvers, and top hat glare shields) were in place.

Please see the submitted layout accompanying this letter for your review.

Sincerely,

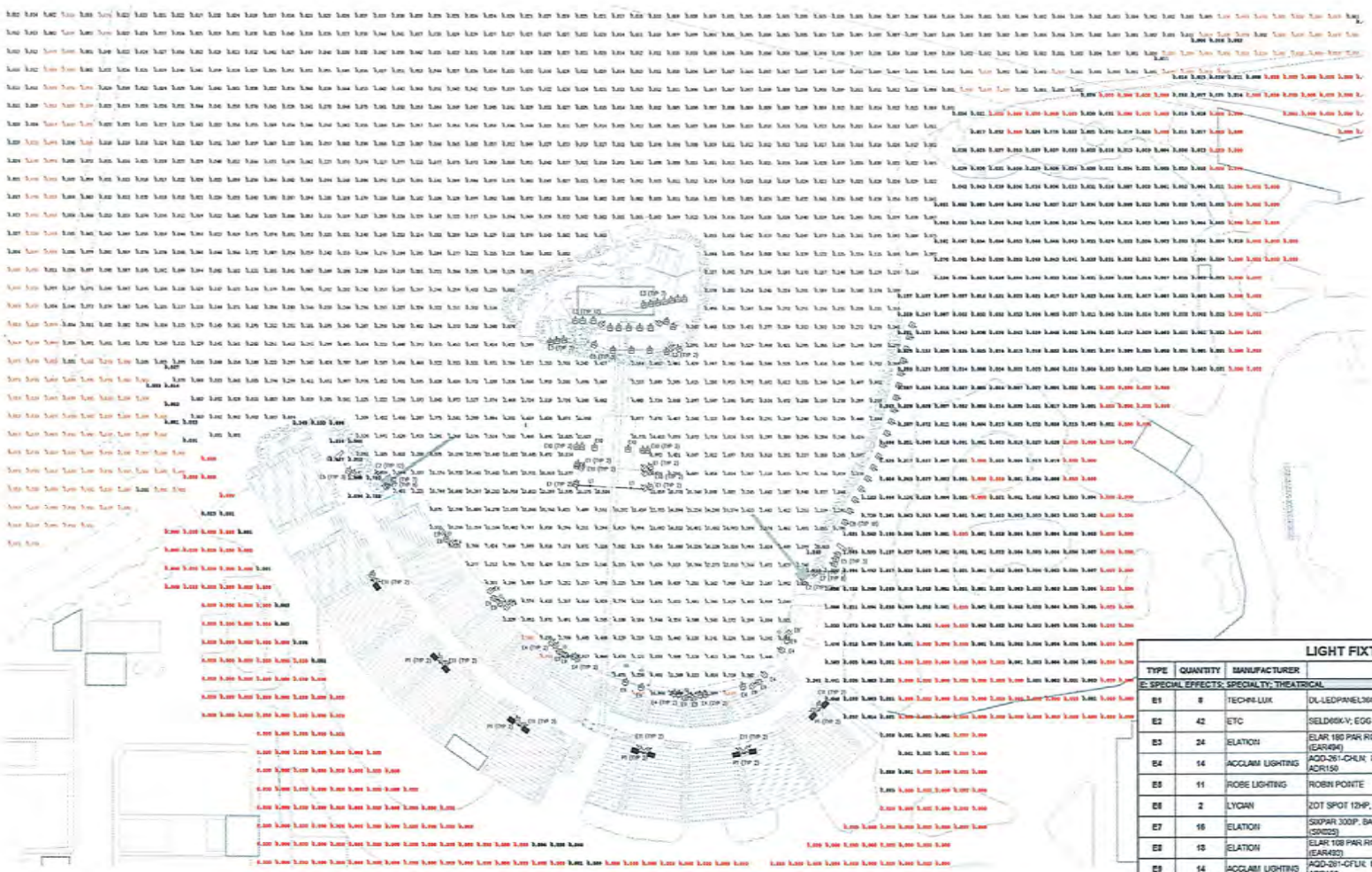
Lindsay Dixon
Lighting Designer

Brandon J. Lemonier, P.E. LEED A.P.
Project Manager

exp U.S. Services Inc.

LKD/BJL:lkd

Cc: Alexander Llerandi, California Coastal Commission
Cc: Darlene Walter, SeaWorld San Diego



LIGHT FIXTURE SCHEDULE

TYPE	QUANTITY	MANUFACTURER	PART NO	DESCRIPTION
E: SPECIAL EFFECTS; SPECIALTY; THEATRICAL				
E1	8	TECHNI-LUX	DL-LEDPANEL36CW; TOP HAT AND SHROUD	RGB LED PANEL
E2	42	ETC	SELD60K-V; EGG CRATE LOUVERS AND TOP HATS	RGB WASH - WIDE BEAM
E3	24	ELATION	ELAR 180 PAR RGBWA; BARN DOORS (EAR494)	RGBWA SPOT
E4	14	ACCLAIM LIGHTING	AQD-261-CHLN DMX CONTROLLER ACR150	RGBW FLOOD FOR WATER
E5	11	ROBE LIGHTING	ROBIN POINTE	MOVING PATTERN PROJECTORS
E6	2	LYCIAN	ZOT SPOT 12HP, 4926 BALLAST	FOLLOW SPOT
E7	16	ELATION	500PAR 300IP, BARN DOORS (3040025)	RGBAW FLOOD
E8	13	ELATION	ELAR 108 PAR RGBW (EAR482)	RGBW TREE ACCENTS
E9	14	ACCLAIM LIGHTING	AQD-261-CFLN DMX CONTROLLER ACR150	RGBW NARROW FLOOD FOR POLES
E10	10	TECHNI-LUX	DL-LEDPANEL36WB TOP HAT AND SHROUD	WHITE LED PANEL
E11	12	ELATION	500PAR 200IP (-500X13)	RGBAW FLOOD
L: LINEAR				
L1	2	FLEXARAY	FAIT24-5.9-RGBCW-SS-EN	EXTERIOR LINEARLED TAPE LIGHT
P: POLE				
P1	6	CREE	CSQ-A-DA-6ME-40K-DIM	LED POLE TOP HEAD

Enlarged View

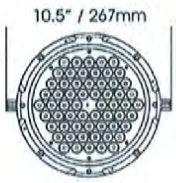
ELATION ARCHITECTURAL

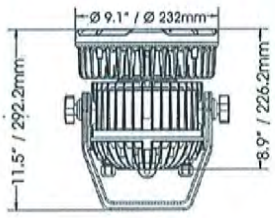
LED Lighting Solutions

ELAR 180 PAR RGBWA Data Sheet

PRODUCT FEATURES

. 60 x 3 Watt RGBWA LED's
. 9° Beam, 22° field, (10° lens)
. 4 Digit LED display
. Manual mode on board Control
. Auto Mode
. Built In Color Macros
. Smooth Color Mixing Flicker Free
. Rugged Die Cast Aluminum Case
. Split Yoke up-light bracket
. IP Power Link up to 4pcs
. Separate logic and LED enclosure
. Waterproof IP65
. Heat sink cooling





TECHNICAL SPECIFICATIONS

. **DMX Channels:** 4 DMX modes – 5/6/8/10 Channels
. **Control:** USITT DMX-512, 3pin DMX in-out cable supplied and power input 120v AC ppg connector
. **Color:** Smooth Color Mixing, Camera ready
. **Strobe:** 25 flashes per second
. **Dimmer:** 0- 100% Smooth Dimming via DMX
. **Cooling:** Convection cooled heat sinks
. **Cable Plug Type:** IP Power in-out/Data in-out
. Cables include Edison 120v plug & 3pin XLR's
. **LED's Source:** 60 x 3W Single LXHL 12 Red, 12 Green 12 Blue, 12 White, 12 Amber
. **Lux:** 10,930 lux / 1,015 fc @ 8'/2.5m
. **LED Life:** 100,000 hours based on LED manufactures' test data
. **Approvals:** cETLus approved

ENVIRONMENTAL SPECIFICATIONS

. **Max Ambient Temperature:** 113°F/45°C
. **IP Level:** IP 65

ELECTRICAL SPECIFICATIONS

. **Ballast:** Electronic Power supply
. **Power Supply:** 120-240V 50/60Hz
. **Power Consumption:** 185W
. **Dimensions:** (LxWxH) 8.9" x 10.5" x 9" / 226x267x232mm
. **Weight:** 16.5 lbs. (7.5 Kgs)

exp.
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Maitland, FL 32751
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Cirque Nighttime Show Upgrades
Sea World San Diego

TYPE
E3

Created: 01.06.17
Revised:

CUTSHEET FOR REFERENCE ONLY. REFER TO FIXTURE SCHEDULE FOR PART NUMBERS AND ADDITIONAL INFORMATION.

ETC® Installation Guide

Selador Desire® Series D40/D60 XTI Grid Louver

The Desire Series D40/D60 XTI Grid Louver provides visual cut off and glare reduction from any angle while minimizing light loss. The Grid Louver installs securely under the trim ring of both the D40XTI and the D60XTI.

WARNING: ***Do not use the fixture with a damaged power lead. If the power lead (cord set) is damaged it must be replaced.***

Do not expose the interior of the fixture to moisture. Do not stand in water while installing or servicing the fixture.

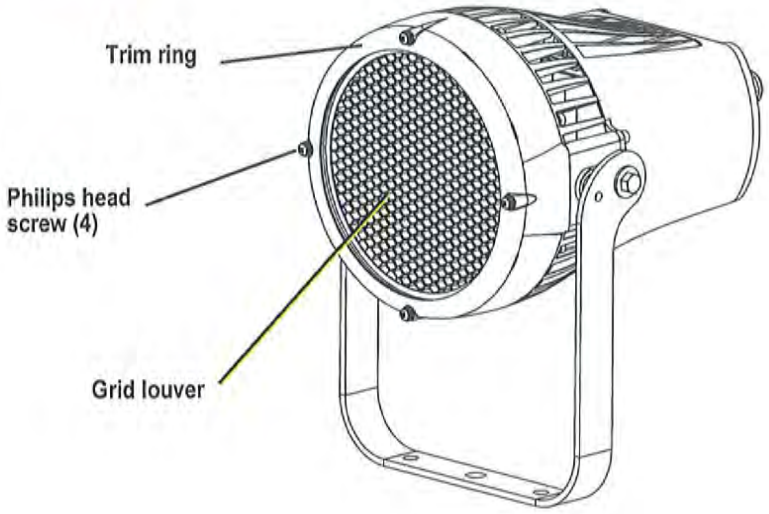
Failure to follow these warnings can result in serious injury or death.

CAUTION: *Do not use the fixture if glass lens is deeply scratched or cracked. Damaged lenses must be replaced.*

Do not mount the fixture on or near combustible surfaces.

Installation

The Grid Louver is installed behind the front ring of the DXTI fixture with four stainless steel screws. An optional glass lens (not included) can be placed on top of the Grid Louver to keep the Grid Louver free of debris. Reference the *Desire Series D40/D60 XTI Installation Instructions* for information on electrical requirements and installing the fixture. The installation instructions are available for download at www.etcconnect.com.



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London, UK ▪ Unit 26-28, Victoria Industrial Estate, Victoria Road, London W3 6UU, UK ▪ Tel +44 (0)20 8896 1000 ▪ Fax +44 (0)20 8896 2000
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Holzkirchen, DE ▪ Ohmstrasse 3, 83607 Holzkirchen, Germany ▪ Tel +49 (80 24) 47 00-0 ▪ Fax +49 (80 24) 47 00-3 00
Hong Kong ▪ Rm 1801, 18/F, Tower 1 Phase 1, Enterprise Square, 9 Sheung Yuet Road, Kowloon Bay, Kowloon, Hong Kong ▪ Tel +852 2799 1220 ▪ Fax +852 2799 9325
Service: (Americas) service@etcconnect.com ▪ (UK) service@etceurope.com ▪ (DE) techserv-hoki@etcconnect.com ▪ (Asia) service@etcasia.com
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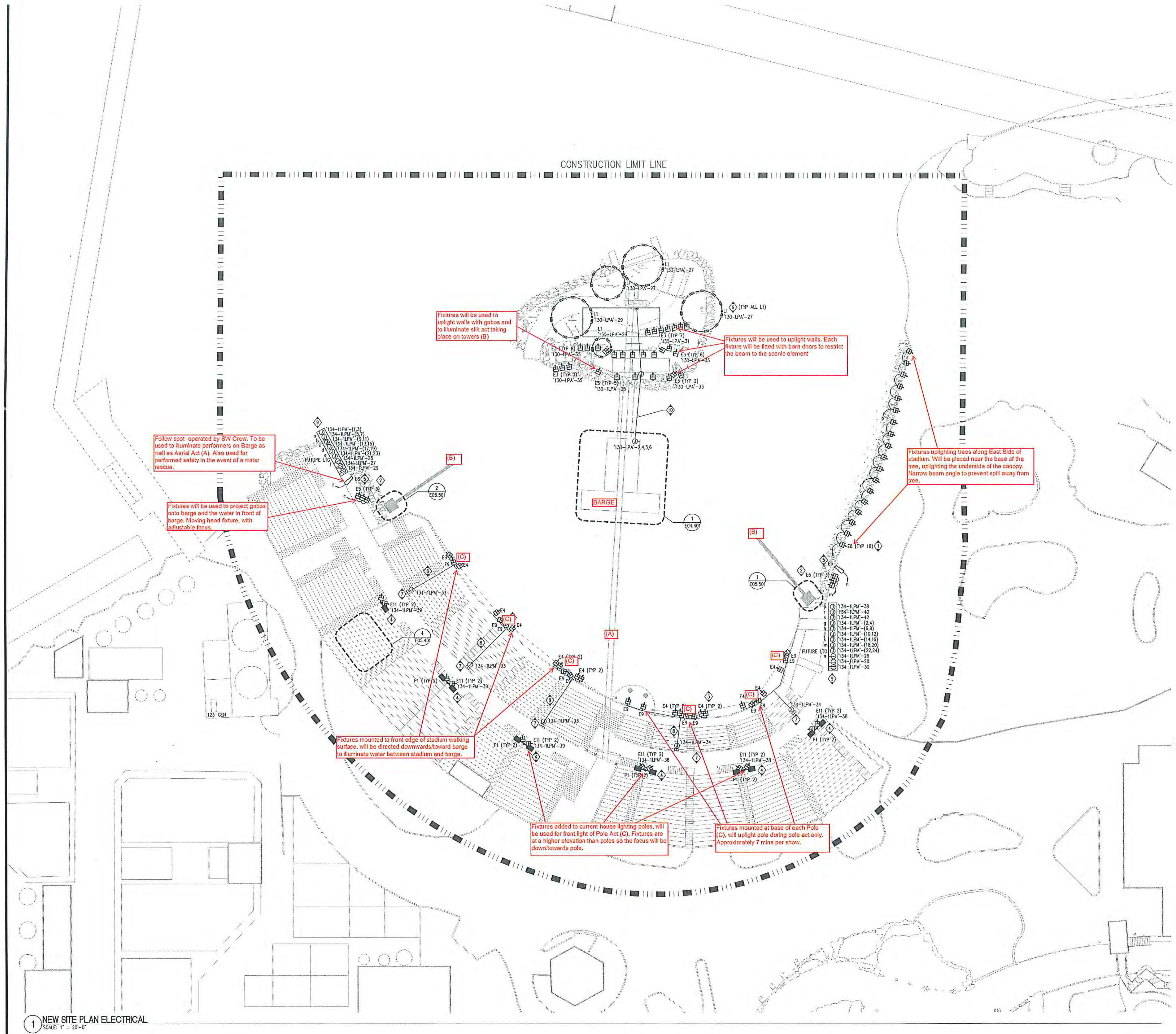
7410M2130 ▪ Rev B ▪ Released 2014-02 ▪ ETC intends this document to be provided in its entirety.


CONSTRUCTION LIMIT LINE
Fixtures will be used to uplight walls with gobos and to illuminate silk act taking place on towers (B)
Fixtures will be used to uplight walls. Each fixture will be fitted with barn doors to restrict the beam to the scenic element
(TYP ALL L1)
L1 '130-LPA'-27
E3 (TYP 6) '130-LPA'-33
E3 (TYP 2) '130-LPA'-33
BARGE
'130-LPA'-2,4,5,6
E04.401
Follow spot- operated by SW Crew. To be used to illuminate performers on Barge as well as Aerial Act (A). Also used for performed safety in the event of a water rescue.
Fixtures will be used to project gobos onto barge and the water in front of barge. Moving head fixture, with adjustable focus.
'134-1LPM'-(1,3)
'134-1LPM'-(5,7)
'134-1LPM'-(9,11)
'134-1LPM'-(13,15)
'134-1LPM'-(17,19)
'134-1LPM'-(21,23)
'134-1LPM'-25
'134-1LPM'-27
'134-1LPM'-29
FUTURE LTG
E6
E5 (TYP 3)
E05.501
(B)
(A)
(C)
Fixtures uplighting trees along East Side of stadium. Will be placed near the base of the tree, uplighting the underside of the canopy. Narrow beam angle to prevent spill away from tree.
E8 (TYP 18)
'134-1LPM'-38
'134-1LPM'-40
'134-1LPM'-42
Fixtures mounted to front edge of stadium walking surface, will be directed downwards/toward barge to illuminate water between stadium and barge.
Fixtures added to current house lighting poles, will be used for front light of Pole Act (C). Fixtures are at a higher elevation than poles so the focus will be down/towards pole.
Fixtures mounted at base of each Pole (C), will uplight pole during pole act only. Approximately 7 mins per show.
E11 (TYP 2) '134-1LPM'-39
E11 (TYP 2) '134-1LPM'-38
P1 (TYP 2)
E4 (TYP 2)
E9
'134-1LPM'-33
'134-1LPM'-34
123-GEN

1 NEW SITE PLAN ELECTRICAL
SCALE: 1" = 20'-0"

KEY NOTES:

1. FIXTURE E8 SHALL AIM TO LIGHT TREES ALONG WATER EDGE. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL POWERCON AND XLR CABLE FROM RECEPTACLE AT THE BASE OF THE EAST TOWER TO FIRST FIXTURE IN CIRCUIT.
2. FIXTURES E5 SHALL BE LOCATED ON CONCRETE PAD NEAR BASE OF BUNGEE TOWER. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL POWERCON AND XLR CABLES FROM RECEPTACLE AT BASE OF TOWER TO FIRST FIXTURE IN CIRCUIT. OWNER TO PROVIDE EXTERIOR RATED TEMPEST DOME ENCLOSURE FOR FIXTURES.
3. FIXTURES E9 AND E4 SHALL MOUNT TO UNISTRUT APPROXIMATELY 1'-0" ABOVE THE WALKWAY LEVEL. FIXTURES E4 SHALL AIM OUT TO LIGHT WATER IN BAY AND FIXTURES E9 SHALL AIM UP TO LIGHT PERFORMERS ON POLES.
4. FIXTURES E11 SHALL MOUNT TO TOP OF EXISTING POLE. EXISTING HOUSE LIGHTS TO BE REPLACED WITH P1 FIXTURES. CONTRACTOR TO REUSE EXISTING CONDUCTORS FROM OLD HOUSE LIGHTS FOR P1 FIXTURES. ELECTRICAL CONTRACTOR SHALL FURNISH AND INTALL 0-10V DIMMING SIGNAL FROM ETC GATEWAY LOCATED IN ELECTRICAL ROOM FOR HOUSE LIGHTS AT TOP OF POLE.
5. FIXTURES E6 SHALL BE MOVED TO INTERIOR LOCATION WHEN NOT IN USE. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL POWERCON CABLE FROM RECEPTACLE AT THE BASE OF THE NEAREST TOWER TO LIGHT FIXTURE.
6. FIXTURES L1 SHALL BE LOCATED AT EACH TOWER TO INTERNALLY LIGHT ORBS.
7. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL 'A36H2408SS6LP3PT' PENTAIR NEMA 4X ENCLOSURE, OR EQUIVALENT. FOR E9 AND E4 POWER SUPPLIES MOUNTED BELOW CONCRETE SEATING, MINIMUM 3'-0" ABOVE ROCKS. PROVIDE M14 6-PIN IP67 IP68 WATERPROOF CONNECTOR CABLE PLUG SOCKET WITH CAP FOR EACH LIGHT CONNECTED TO ENCLOSURE.
8. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL SLOTTED BOTTOM, SOLID TOP, FIBERGLASS CABLE TRAY UNDER CONCRETE SEATING AREA. TRANSITION FROM CABLE TRAY TO NEMA 4X ENCLOSURE USING CONDUIT WITH A SEAL TIGHT FITTING.
9. ELECTRICAL CONTRACTOR SHALL FURNISH AND INTALL 4"X4", LENGTH AS REQUIRED, NEMA 4X STAINLESS STEEL RACEWAY FOR RECEPTACLES TO POWER SHOW LIGHTING. EACH LOCATION WILL HAVE (6)NAC3FX-W POWERCON CONNECTORS WITH WEATHER-PROOF CAP, (1)NEMA 5L-20R, AND (2)NEMA 5-20R. THE RACEWAY NEAREST THE EAST TOWER WILL HAVE (3)ADDITIONAL NAC3FX-W POWERCON CONNECTERS WITH CAPS FOR THE E8 FIXTURES LIGHTING THE TREES. POWERCON CONNECTORS SHALL BE WIRED TO SOOW CABLE WITH 0'-6" OF SLACK, PENETRATING THROUGH BOTTOM OF RACEWAY. PENETRATIONS FOR CABLE TO USE SEAL TIGHT FITTINGS TO MAINTAIN NEMA 4X RATING. MOUNT RACEWAY ALONG CONCRETE WALLS NEAR TOWERS OUTSIDE OF GUEST VIEW, CONFIRM FINAL LOCATION WITH ARCHITECT/OWNER PRIOR TO ELECTRICAL ROUGH-IN.
10. PROVIDE (4)P7271-SP 2#10,#10G SUBMERSIBLE CABLES FROM PANEL '130-1LPA' TO JUNCTION BOXES ON EDGE OF ISLAND THEN TO JUNCTION BOXES ON BARGE. CONTRACTOR TO PROVIDE STRAIN RELIEVE AT JUNCTION BOXES ON BOTH THE ISLAND AND BARGE. CIRCUITS TO FEED LIGHTING AND RECEPTACLES ON BARGE.

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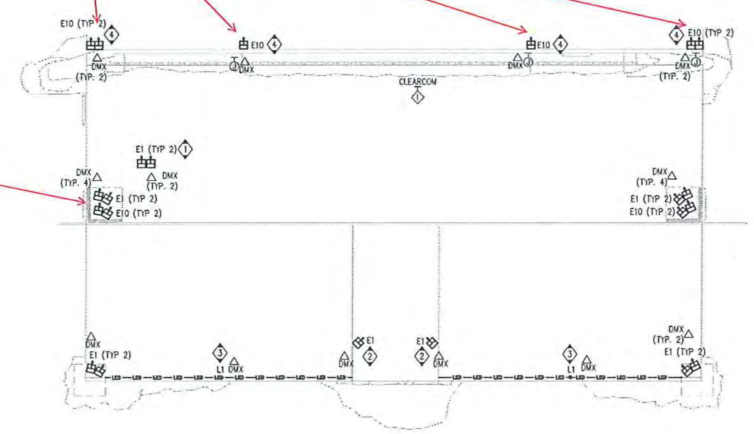
2016325-00

SeaWorld. SAN DIEGO
CIRQUE NIGHTTIME SHOW
San Diego, CA

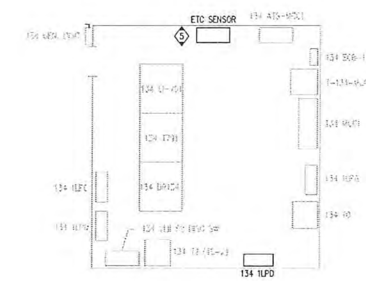
ISSUE FOR BID AND PERMIT

NEW SITE PLAN ELECTRICAL

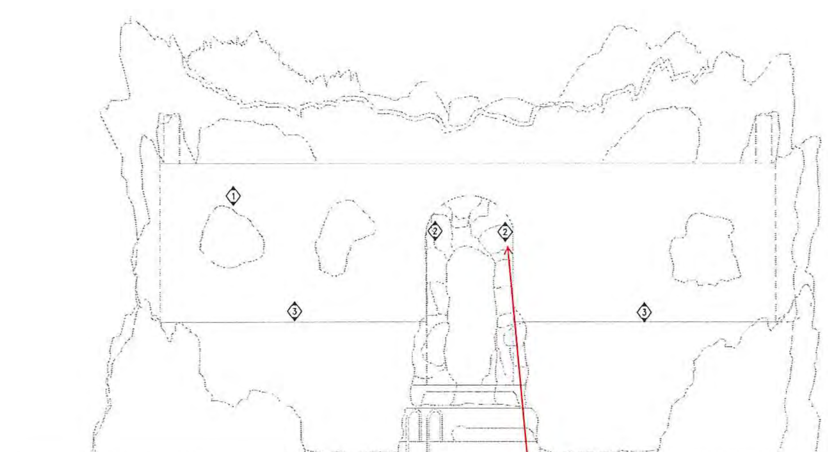
DATE January 6, 2017	
DR LKD/BJB	CK BJL
EXP 2016325	CLIENT SEA
SHEET NUMBER E03.301	



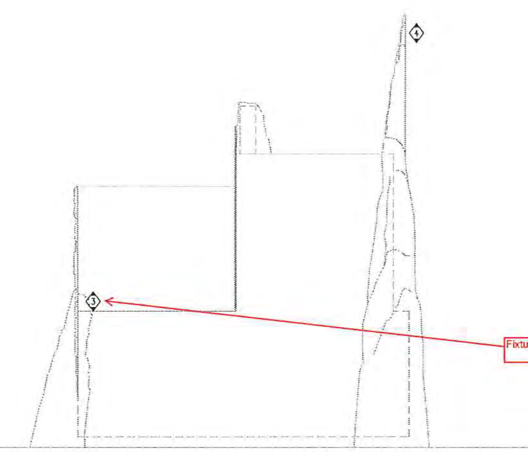
1 ENLARGED BARGE PLAN
SCALE: 1/4" = 1'-0"



4 ENLARGED ELECTRICAL ROOM
SCALE: N.T.S



2 ENLARGED BARGE FRONT ELEVATION
SCALE: 1/4" = 1'-0"



3 ENLARGED BARGE SIDE ELEVATION
SCALE: 1/4" = 1'-0"

KEY NOTES:

1. FIXTURE SHALL MOUNT INSIDE CAVE AT WINDOW OPENING.
2. FIXTURES SHALL MOUNT INSIDE CAVE OPENING.
3. LINER FIXTURE SHALL MOUNT ALONG FRONT EDGE OF TRAMPOLINE LEVEL.
4. FIXTURES SHALL MOUNT AT TOP OF BARGE AND AIM DOWN TO LIGHT WATER BELOW
5. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL (1)ETC SENSOR GATEWAY FOR HOUSE LIGHTING CONTROL. GATEWAY SHALL BE CONNECTED TO DMX SYSTEM AND HOUSE LIGHT 0-10V SIGNAL CABLE.

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exp.
www.exp.com
2016325-00

Ride Disclaimer:
Outlines, sketches or references of a possible "Ride" or "Rides" or use of any "ride" terms such as "coaster", "merry-go-round", trade names, etc. on this drawing are for purpose of location, general identification and adjacency only. Peckham, Guyton, Albers & Viets, Inc. and all engineers or companies listed on this drawing (herein after referred to as Architect/Engineer) hereby gives notice that the "Ride" however shown or referenced on this drawing is not in any way, shape or form the creation or responsibility of the Architect/Engineer. Its design, structural support, manufacture, erection, approval, acceptance, operation, safety, maintenance and all of its function, characteristics or appurtenances are not a part of the Architect/Engineer's work. Such functions are to be performed by others engaged by the Owner for such purpose, or by Owner's personnel.

Accessibility for Persons with Disabilities:
This drawing contains layouts and elements critical to providing Access for Disabled Persons. Contractor shall provide verification and certification of Compliance with the applicable accessibility regulations.

Design Intent:
Outlines, sketches, or references of possible theming, exhibits, and graphics on this drawing are for design intent, to show or describe the character, scope, relationships, forms, size and appearance of the Project, major materials and systems, in general, their quality levels, performance standards, requirements, or criteria. Engineered design, means, methods, manufacture, installation, code compliance, operation, safety, and warranties are to be provided by the Contractor, including engineering documentation signed and sealed by a qualified Engineer licensed to practice by the authority having jurisdiction. The Architect/Designer's review of submittals is for the purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

REVISION NO.	REVISION DATE

SeaWorld.
SAN DIEGO

CIRQUE NIGHTTIME SHOW
San Diego, CA

ISSUE FOR BID AND PERMIT

ENLARGED FLOOR PLANS ELECTRICAL

DATE January 6, 2017	
DR LKD/BJB	CK BJL
EXP 2016325	CLIENT SEA
SHEET NUMBER E04.401	

KEY NOTES:

1. FIXTURE SHALL SURFACE MOUNT TO NEW TRUSS ARM ON EXISTING TOWER. FIXTURES SHALL AIM OUT TO LIGHT BARGE/ISLAND. ELECTRICAL CONTRACTOR SHALL FRUNISH AND INSTALL POWERCON AND DMX CABLES FROM RECEPTACLES AT THE BASE OF THE TOWER TO FIRST FIXTURE IN CIRCUIT. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL STRAIN RELIEF FOR CABLES AT CONNECTION POINTS ON TOWER.

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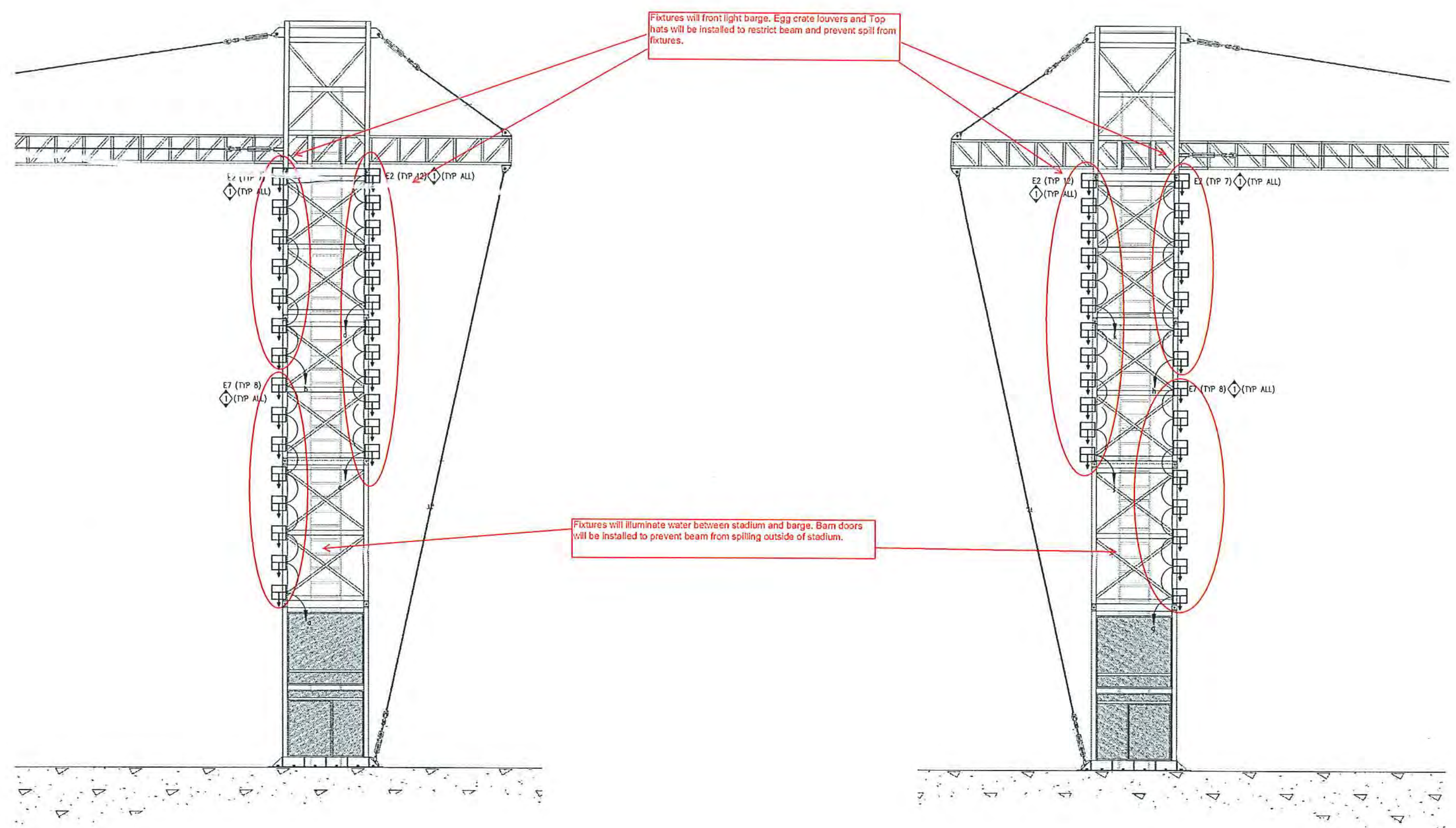
2016325-00



1 EAST TOWER ELEVATION
SCALE: 1/4" = 1'-0"

2 WEST TOWER ELEVATION
SCALE: 1/4" = 1'-0"

SeaWorld.
SAN DIEGO

CIRQUE NIGHTTIME SHOW
San Diego, CA

ISSUE FOR BID AND PERMIT

ELEVATIONS
ELECTRICAL

DATE January 6, 2017	
DR LKD/BJB	CK BJL
EXP 2016325	CLIENT SEA
SHEET NUMBER E05.501	

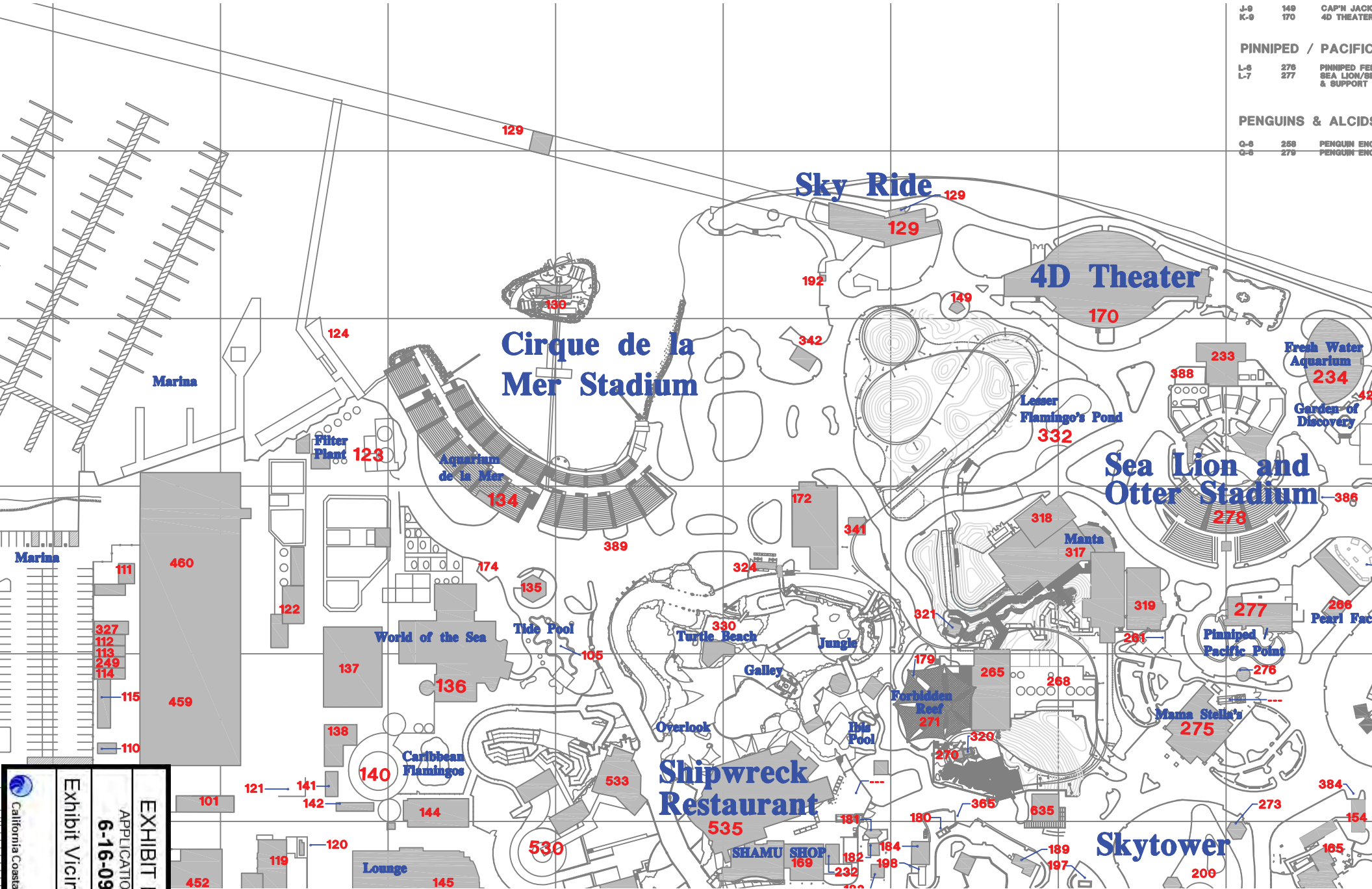


EXHIBIT NO. 5

APPLICATION NO. 6-16-0989

Exhibit Vicinity Map

California Coastal Commission

CALIFORNIA COASTAL COMMISSION
SOUTH CENTRAL COAST AREA
89 SOUTH CALIFORNIA ST., SUITE 200
VENTURA, CA 93001
(805) 585-1800

MEMORANDUM

FROM: Jonna D. Engel, Ph.D., Senior Ecologist, Technical Services Ecology Group

TO: Alexander Llerandi, Coastal Program Analyst

SUBJECT: SeaWorld's "Cirque Twilight" Show

DATE: May 8, 2017

Documents Reviewed:

Merkel & Assc. March 20, 2017. Letter Report to Sea World, Attention: Darlene Walter. Biological Analysis of Lighting Effects for the SeaWorld Cirque Twilight Show.

EXP. February 22, 2017. Letter Report to Sea World. Attention: Darlene Walter. Re: 2016325-00 Sea World San Diego, Cirque Nighttime Show – Show Light Levels.

SeaWorld/AquaticaSeaWorld's Waterparks. February 6, 2017. Letter to Alexander Llerandi. Re: Permit Application, Cirque Stadium. From Darlene K. Walter, PMP. Vice President Engineering, SeaWorld

EXP U.S. Services Inc. January 31, 2017. Letter to Jonna Engel. Re: Sea World San Diego; Cirque Nighttime Show, Revised Photometric Calculations. From: Lindsay Dixon, EXP Lighting Designer and Brandon J. Lemonier, P.E. LEED A.P., EXP Project Manager.

SeaWorld/AquaticaSeaWorld's Waterparks. December 2, 2016. Letter to Alexander Llerandi. Re: Coastal Development Application 6-16-0989. From Darlene K. Walter, PMP. Vice President Engineering, SeaWorld

EXP U.S. Services Inc. December 2, 2016. Letter to Alexander Llerandi. Re: Sea World San Diego; Cirque Nightime Show, Photometric Calculations. From: Lindsay Dixon, EXP Lighting Designer.

SeaWorld is proposing to add a night version of their "Cirque de la Mer" acrobatic water show during summer months. To add the new show, "Cirque Twilight", SeaWorld is proposing to install 112 light fixtures of various sizes, wattages, intensities, and heights in the grandstands, along the shoreline, and on the man-made island within Waterfront Stadium. This is a significant addition of artificial night lighting into a developed seaside

area that also supports sensitive native animals. We have been asked to review the potential impacts of SeaWorld's Cirque Twilight night lighting on the natural resources in the area. To do so we have reviewed the setting and the documents cited above, studied light properties and peer reviewed literature on organisms and light, and consulted with agency biologists.

Mission Bay

Waterfront Stadium is on SeaWorld's northern shoreline, adjacent to the open waters of Mission Bay Park. Mission Bay is a saltwater bay or lagoon located south of the Pacific Beach community of San Diego. Mission Bay is a developed area surrounded by the larger San Diego metropolis that supports water sports of every kind from sailing, kite surfing, and stand-up paddle boarding to jet skiing and wake boarding. Along the edge of the bay there are a multitude of things to do during the day and night including shopping, eating out, walking and biking, volleyball, picnicking, concerts, and bonfires. Despite all of the development and human activities, numerous native animals spend all or part of their lives in Mission Bay. Several species of marine mammals including harbor seals and bottlenose dolphin frequent bay waters, numerous species of shorebirds, terns and gulls, and pelagic birds live and/or forage in the bay, and the bay is full of marine invertebrates and fish. While Mission Bay is clearly far from a quiet or pristine ocean lagoon, it continues to provide important habitat for many species of native animals for part or all of their life cycles.

Development and artificial night lighting go hand in hand and Mission Bay and its surroundings are no exception; it is far from a dark sky setting. However, as stated above, Mission Bay continues to support numerous native animals. Of special concern is a nesting colony of state and federally endangered California least terns approximately 900 feet north of Waterfront Stadium at Stony Point on Fiesta Island. California least terns also have a state rarity ranking of S2[1]. The California least terns have used Stony Point for nesting for over 20 years. While the terns have apparently become acclimated to the existing ambient noise and light conditions in Mission Bay, we do not know if they are at risk or thriving under the current conditions nor do we know what might tip the scales to their detriment. As USFWS biologist, Sandy Vissman stated (Pers. Comm. April 26, 2017), we can assume that additional artificial night lights will not be a beneficial addition to the surroundings for the California least terns.

The Coastal Commission is tasked with protecting sensitive coastal resources. Section 30107.5 of the Coastal Act defines Environmentally Sensitive Areas as:

> *Any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and development.*

The state and federally endangered and state ranked S2, California least tern, is a very rare species and therefore its nesting colony at Stony Point meets the definition of

[1] Global and state level 2 communities and species are identified as "imperiled – at high risk of extinction due to very restricted range, very few populations (often 20 or fewer) steep declines, or other factors".

environmentally sensitive habitat area or ESHA. Section 30240 of the Coastal Act, "Environmentally sensitive habitat areas; adjacent developments"; requires that ESHA is protected as follows:

> *(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas.*
>
> *(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.*

Properties of Light and Light Measurements

Light or electromagnetic radiation that is visible to the human eye is called "visible light" and has a wavelength range from approximately 380 nanometers (nm) to about 740 nm and occurs along the electromagnetic radiation spectrum between "invisible" infrared radiation, with longer wavelengths, and "invisible" ultraviolet radiation, with shorter wavelengths. All electromagnetic radiation is emitted and absorbed in tiny units called photons, and exhibits properties of both waves and particles which is referred to as the wave–particle duality. Two key characteristics of light are intensity and wavelength or frequency. Light varies in its intensity (the number of photons per unit area) and in its spectral content (expressed by wavelength)[2]. The most common measure of light intensity (the amount of light falling on a specific area) is called illuminance; the standard measure of illuminance is footcandles which express the intensity of light incident on a surface weighted for the spectral sensitivity of the human eye. Footcandle (fc) measurements place more emphasis on wavelenths of light that human eyes detect best and less on wavelengths that humans do not see as well[3]. In other words, footcandles are correlated to human brightness perception. This inherent property of footcandles limits our ability to assess the impacts of light on wildlife which are known to exhibit a wide range of light intensity and wavelength sensitivities.

Adverse impacts from artificial night light can take several forms including light trespass or spill, sky glow, and glare. Light trespass occurs when unwanted artificial light spills onto an adjacent property lighting an area that would otherwise be dark[4]. Illuminance or illumination is the measure used to detect light trespass. Sky glow and glare are measured as luminance or physical brightness (measured in footlamberts[5]). Sky glow is the bright halo that appears over urban areas at night, a product of light being scattered by water droplets or particles in the air and from reflectance of lights on objects on the ground. Sky glow is intensified when there is a low cloud ceiling or foggy

[2] Hecht, E. Optics (4th Edition). 2002. Addison-Wesley Longman, Inc. 698 pgs.
[3] Rich, C. & T. Longcore (Eds.) 2006. Ecological Consequences of Artificial Night Lighting. Island Press, Washington. 458 pgs.
[4] Chepesiuk, R. 2009. Missing the Dark: Health effects of light pollution. Environmental Health Perspectives. v. 117 (1): A20-A-27
[5] Footlamberts, like footcandles, are based upon the human perception of light; that is it is weighted for human light sensitivity and the wavelengths that humans see (visible light).

conditions because light refracts off water particles in the air. Sky glow may be perceived as the presence of brightness within a field of view and can include directly viewing a light source. Glare is defined as visual discomfort resulting from high contrast in brightness levels and is created by light that shines horizontally.

Approximately 30% (depending on the type of surface) of all light directed to a surface is reflected and contributes to sky glow. In addition, a portion of the light directed to a surface is reflected off air particulates including dust and water vapor and this also contributes to sky glow. Short wave-length blue light is the largest contributor of this scatter known as 'rayleigh scatter'.

Animals and Light (Electromagnetic Radiation)

The pivotal role of light (electromagnetic radiation) in organismal biology raises the potential that there will be significant impacts on plants and animals from artificial night lights. The source of natural light is the sun, moon, and stars. Light is used by plants and animals to infer a wide range of information from their environment. One of the most important roles of light for both plants and animals is regulation of their biological clocks or circadian rhythms on a daily, weekly, seasonal, and annual basis. Light information that contributes to the establishment of circadian rhythms includes daylength, light intensity, and light wavelength. In animals, eyes ranging from very simple to complex are the organ that collects light from the environment.

Animals typically fall into one of several patterns of daily activity. Diurnal animals are active during the day; nocturnal animals are active at night; crepuscular animals are active at dawn and dusk; and 24-hour pattern animals have activity bursts during the night, dawn, and dusk. Thus daily behavioral activities such as resting, sleeping, foraging, and eating occur at different times for different animals such that a single habitat is partitioned into temporal niches regulated by light.

Most predators are specifically adapted to hunt under particular light conditions (intensity, wavelength) and in most natural habitats, there is a distinct "changing of the guard", from a suite of animals that are active during the day to a suite of animals that are active at dusk or dawn and/or at night. Introducing artificial night lights to an area will change the ambient setting and may adversely impact animals. Likely effects of artificial night lighting on animals include avoidance, disorientation, disruption of foraging patterns, increased predation risk, disruption of biological clocks, increased mortality on roads, and disruption of dispersal movements through artificially lighted landscapes[6].

Daylength, light intensity, and light wavelength also play a significant role in regulating patterns of seasonal life-cycle activity such as flowering in plants and migration, dispersal, hibernation, and reproduction in animals. The internal mechanism of the biological clock is responsible for the hormonal, physiological, and anatomical

[6] Rich & Longcore. 2006. Op Cit.

preparation that these activities require[7]. Although not the only parameter, the changing length of day (photoperiod) is the most predictive environmental cue for the seasonal timing of physiology and behavior[8]. Sensitivity to the length of day is often so acute that many species can detect discrepancies in natural light as short as one minute[9]. For many species the stages of their life cycle are set by daylength; research has shown that reproduction cycles are disrupted when artificial night light interferes with species' natural detection systems[10]. Artificial night lights may also interfere with the accurate discernment of seasonal periods of weather conditions, food availability and/or predator activity which is crucial for survival of many species.

Alternation of light and dark regulates and resets the biological clock and depending on the timing, light can advance or delay circadian rhythms. The illuminance required to reset biological clocks varies from species to species; lower light levels are required to reset the clocks in nocturnal rodents than in humans[11]. In addition to daylength and light intensity, wavelength of light is a factor in the regulation of the biological clock. Blue light gives a physiological signal to humans and other organisms that it is daytime; when artificial night lights include light in the blue wavelength range, circadian rhythms can be disrupted[12]. Blue wavelengths are present in virtually all light sources so their elimination requires special lights or filters which appear amber.

Significant adverse impacts from artificial night lighting include increased predation risk, disruption of reproduction, nest abandonment, disruption of foraging patterns, lit area avoidance, disorientation, and disruption of biological clocks, to name a few. Any one or a combination of these impacts can lead to reduced survival and/or an increase in mortality. While the impacts of light trespass or spill, sky glow, and glare may be deemed inconsequential from a human perspective, we believe the artificial night lights for the Cirque Twilight show have the potential to adversely impact the California least tern nesting colony at Stony Point.

Artificial Night Lighting Design for Cirque Twilight

SeaWorld's show team designed the fixture types and locations for the proposed Cirque Twilight show. The show team has the light fixtures (lighting system) placed at various points in and around the stadium and directed primarily at the barge and island stage areas. SeaWorld hired EXP, an electrical engineering company, to analyze the lighting for Cirque Twilight. EXP ran the software model ,AGi32, developed by Lighting Analysts, to simulate light trespass within the lease area. EXP incorporated into the

[7] Gaston, K.J., T.W. Davies, J. Bennie & J. Hopkins. 2012. Reducing the ecological consequences of night-time light pollution: options and developments. Journal of Applied Ecology. v. 49:1256-1266

[8] Zivkovic, B. July 9, 2007. Clock Tutorial #16: Photoperiodism - Models and Experimental Approaches". A Blog Around the Clock. ScienceBlogs.

[9] Ibid

[10] Kempenaers, B., P. Borgström, P. Loës, E. Schlicht and M. Valcu. September 16, 2010. Light is the Friend of Lovers: Artificial night lightin affects songbird behaviour and reproduction. Current Biology, Published online.

[11] Revell, V.L., H.J. Burgess, C.J. Gazda, M.R. Smith, L.F. Fogg & C.I. Eastman. January 2006. Advancing human circadian rhythms with afternoon melatonin and morning intermittent bright light. Journal of Clininical Endocrinology and Metabolism. v. 91(1): 54–59.

[12] Gaston et al. 2012. Op. Cit.

model the IES fixture "files" or specifications that were available[13]. The model provided potential light trespass values at 10' by 10' spacing intervals outward from Marine Stadium into the Mission Bay surroundings. While EXP provided values for light trespass, they did not analyze the potential skyglow or glare from the Cirque Twilight show. While we are concerned about light trespass, we also know that skyglow and glare are important properties of light that should be analyzed. For instance, a number of the night show lights are directed right at the water. Water is a very reflective surface and this may result in significant skyglow.

While we appreciate that SeaWorld hired the biological consulting firm, Merkel & Associates, to review EXP's light show analysis, we respectfully point out that they are not environmental lighting specialists. While Merkel & Associates provide a valuable review, it was not comprehensive enough to determine if the proposed night light show provides the lighting necessary for the show while simultaneously being the least environmentally damaging night light show possible. To accomplish this, the night light show review must include;

1) Evaluation of the proposed light locations, heights, and shielding/visors,
2) Evaluation of the luminaire specifications such as type of light (e.g. metal halide, LED, conventional), light intensity, and light wavelengths,and,
3) Evaluation of the potential sky glow and glare produced by the show.

We are very pleased to learn that SeaWorld has hired environmental lighting specialists Benya Burnett Consultancy to review the Cirque Twilight show per the requirements listed above. Depending on the results of Benya Burnett Consultancy's review, SeaWorld may be required to modify the night light show to incorporate design recommendations and light fixtures with the best visor and light direction technology and light intensity and wavelength specifications to reduce light trespass, sky glow, and glare.

California Least Tern Nesting Colony Monitoring

As detailed above, artificial night lighting has the potential to adversely impact organisms in numerous ways. Learning about and understanding these impacts is an emerging field of study. We are requiring SeaWorld to incorporate the latest and best lighting design and technology which is expected to minimize or avoid adverse environmental impacts of the night light show to the greatest extent possible. Nevertheless, we are requiring monitoring for evidence of adverse effects on the California least tern nesting colony because of its nearby proximity on Stony Point. Cirque Twilight is a new nighttime show in a venue that has not hosted nighttime shows in the past and the monitoring is designed to identify whether or not the show impacts the California least tern nesting colony in any unanticipated way. If adverse impacts are identified by qualified California least tern monitors, we are requiring SeaWorld to suspend operation of the show and submit a revised set of lighting parameters that will ensure that the adverse impacts are unlikely to occur during future performances.

[13] Not all fixture manufacturers provide IES with their fixture files.

As part of SeaWorld's proposal for the Cirque Twilight show, SeaWorld is proposing to reduce their nightly summertime fireworks display to a total of 14 summer nights. As with artificial night lighting, the potential adverse environmental impacts of fireworks are not fully known or understood but it is hard to imagine that explosive bursts of noise and light are not extremely disturbing to native wildlife[14]. We believe that this is a very positive move for the California least tern nesting colony and other native wildlife within Mission Bay. With the significant reduction in nightly summer fireworks, the requirement for the least environmentally damaging night show lighting design possible, and the requirement for California least tern nesting colony monitoring, we believe the Cirque Twilight show has been designed to prevent impacts that will significantly degrade the tern nesting colony and will likely be compatible with the persistence of the California least tern nesting colony.

[14] Many pet owners who have temporarily or permanently lost their cat(s) or dog(s) can attest to this.