Comment Letters Received on the Initial Study

Comment Letter From		Date of Letters
A.	Michael McWalters	September 25, 2016
B.	Betsy Stern	October 11, 2016
C.	County of Santa Clara Parks and Recreation Department	October 17, 2016
D.	Department of Transportation	October 17, 2016
E.	M.R. Wolfe & Associates	October 17, 2016
F.	Ada E. Marquez	October 17, 2016
G.	Santa Clara Valley Audubon Society, Citizens Committee to Complete the Refuge, Sierra Club - Loma Prieta Chapter, and Committee for Green Foothills	October 17, 2016

A. RESPONSES TO COMMENTS FROM MICHAEL MCWALTERS, DATED SEPTEMBER 25, 2016:

COMMENT A-1: I live in the manufactured home park (labeled 2) for sound and noise. I've read many things regarding Top Golf, all of them have complaints of NOISE. Top Golf in Alexandria, SLC, Kansas City and Roseville have huge complaints regarding noise. The one is Austin sells $525,000 a month in alcohol. That is a ton of money, which this site has a new land owner and most likely will close as the new land owner wants to redevelop the land. Alexandria will most likely close and be moved as the noise is a concern to many and the land owner will not renew the lease with top golf. How will Top Golf and the City of San Jose make sure that I'm not going waking up by a live band or loud music at 11pm?

> **RESPONSE A-1:** Noise impacts from the proposed project are discussed in *Section 4.12 Noise* of the Initial Study. Measurements taken in the vicinity of the commenter's residence show existing ambient noise levels range from 62 to 64 dBA Ldn. A noise assessment completed for the project (based in part upon noise measurements taken at the existing Roseville Topgolf facility) concluded that average noise levels in this area would not increase as a result of the project (refer to Table 4.12-4 in the Initial Study). Noise from the project would not exceed the thresholds established by the City of San Jose to determine significant noise impacts.

The project applicant will be required to comply with all applicable noise regulations in the City's General Plan and Municipal Code. The project applicant will be conditioned to implement various noise control strategies to reduce the levels of noise reaching nearby properties. All amplified sound at the facility, including noise from music at the outdoor terrace, would be connected to a noise limiter, allowing for a single volume control over the entire facility. The project applicant would be required to retain a sound engineer to conduct a noise evaluation once a week for the first four weeks of operation. Sound levels would be reconfigured as needed to ensure noise is within all applicable regulations. The project applicant will also be required to provide a contact person whom the community may contact during operations with noise concerns.

COMMENT A-2: Since Mayor Sam Liccardo sits on the VTA board I would expect that only 200 parking spaces should be available and EVERYONE ELSE CAN TAKE THE VTA AND BUS to attend Top Golf. That's what your department is striving for. I am opposed to 1400 parking places, its obnoxious. Take the bus or light rail. Planning rams this car issue in apartments and now it's time to move it to big business.

> **RESPONSE A-2:** The amount of parking proposed by the project is consistent with the requirements of the City's Municipal Code Chapter 20.90.060. The project applicant is proposing to provide 1,183 on-site spaces, and is not requesting a reduction in the number of parking spaces. Pursuant to the project's Development Standards, the commercial/retail use is required to have one vehicle parking space per 225 square feet of floor area, and the hotel use is required to have one vehicle parking space per guest room plus one per employee. The City is requiring that the project provide parking for the Topgolf facility based on the number of hitting bays at a rate of 3.75 vehicle parking spaces per hitting bay. Additional parking may be allowed for the Topgolf facility, pursuant to the projects Development Standards, up to 4.25 vehicle parking spaces if parking demand for the Topgolf facility warrants additional parking spaces. The Planned Development Zoning's Development Standard states any sequential development permit will include details of the final parking arrangement.

COMMENT A-3: Traffic is also a concern, how will they manage DRUNK PEOPLE and DRUNK DRIVERS? Let's face it, this is a NIGHTCLUB/BAR and ENTERTAINMENT CENTER where alcohol is served and people DO AND WILL get drunk. Will there be additional police in our area to address the issue of DUI? In addition Mayor Sam Liccardo was opposed to a girly bar for executives in downtown San Jose. He stated that it was too close to schools. Let's not forget that San Jose has CLOSED MANY BARS in downtown over the past decade. One being SJ Live, for drunken behavior and fights broke out. Isn't it odd that San Jose no longer wants BIG BAR in downtown so you will toss them out in Alviso. Where a limited number of complaints will come in. If this is built SAN JOSE WILL DIVIDE US. This is better suited for the Coyote Valley.

> **RESPONSE A-3:** Traffic impacts from the proposed project are discussed in *Section 4.16 Transportation* of the Initial Study. An analysis of the potential for drunk drivers is not required under CEQA, and the comment does not pertain to the conclusions of the Initial Study/Mitigated Negative Declaration. A development project cannot be conditioned to require any changes to police patrols, which are established by the police department. The project would incrementally increase demand for fire and police services. The proposed increase in development on the project site is accounted for in the planned growth for the City. This increase in demand would not result in a substantial adverse physical impact associated with a need for new facilities in order to maintain acceptable levels of services or performance objectives.

COMMENT A-4: Our manufactured home park currently receives a MAX OF 5.0 MB/S FROM AT&T INTERNET. How pathetic is that in Silicon Valley? When this object is built, I am 100 percent sure that all utility, phone and other lines will be buried. We are currently 600 feet from this site. I know fiber optic is currently in Alviso, but AT&T will not provide us with faster internet. Will this company deliver fiber optic to our park, if not we will than we will be the only area in Alviso with slow DSL service. I feel discriminated against. Who can I talk to regarding this issue? I can even give the owner of our park to this person.

RESPONSE A-4: This comment is acknowledged and will be considered by the decision makers. As the comment does not pertain to the analysis or conclusions of the Initial Study/Mitigated Negative Declaration, no further response is required.

COMMENT A-5: My last concern. I am very disappointed that I haven't received any information regarding this proposed project or any paperwork from the planning department. I've received stuff in the mail from SJ Planning Dept. regarding the Trommwell Crow and the other developer, but NO PAPERWORK WAS SENT TO ME REGARDING THIS PROJECT. I've also left a message with District 4 Fred Buzo regarding my disappointment.

RESPONSE A-5: This comment is acknowledged and will be considered by the decision makers. All applicable noticing requirements were followed by the City during the noticing for this project. On site notice was installed at the project site within 10 days of the filing of the application for this project. Over 1,400 notices of the June 16, 2016 community meeting were sent to property owners, residents and other interested parties within a 1000-foot radius of the project site. As the comment does not pertain to the conclusions of the Initial Study/Mitigated Negative Declaration, no further response is required.

B. RESPONSES TO COMMENTS FROM BETSY STERN, DATED OCTOBER 11, 2016:

COMMENT B-1: I am responding to the Mitigated Negative Declaration for TopGolf at Terra Project.

In reference to Appendix I, 2.6.4 NEIGHBORHOOD STREETS, where is the mitigation that will protect the pedestrians (especially the children and parents) going to and from George Mayne Elementary School while, in addition to increased traffic due to the physical presence of TopGolf, TopGolf will be serving alcohol from 9:00 am until 2:00 am, and this will have a direct impact on the increase in traffic accidents. Although the sale of alcohol itself doesn't fit into an MND, the impact of drunk driving does -- to the environment and to people.

The rezoning of this property to allow for an entertainment center that serves alcohol from 9:00 am to 2:00 am and is directly across the street from an elementary school is absolutely unconscionable.

> **RESPONSE B-1:** Traffic impacts from the proposed project, including impacts related to pedestrians, are discussed in *Section 4.16 Transportation* of the Initial Study. No significant impacts related to pedestrian facilities were identified in the Initial Study, and, therefore, no mitigation is required.
>
> In order to address the increase traffic along N. 1st Street and in the surrounding neighborhood, the project would construct a median island along the project frontage, enhanced crosswalk with flashing beacons at Grand Blvd. and N. 1st Street, a new traffic signal at N 1st Street and Trinity Park with protected pedestrian crosswalks. In addition, buffered bike lanes would be installed along North Taylor Street between Gold Street and Liberty Street.
>
> In order to serve alcoholic beverages on site, the project applicant would be required to have a license from the State Department of Alcohol and Beverage Control (ABC) and meet all the requirements thereof.

C. RESPONSES TO COMMENTS FROM COUNTY OF SANTA CLARA PARKS AND RECREATION DEPARTMENT, DATED OCTOBER 17, 2016:

COMMENT C-1: The County of Santa Clara Parks and Recreation Department (the Department) has reviewed the proposed Topgolf at Terra Project. The proposed project includes changing the Planned Development Rezoning from the CIC Combined Industrial Commercial and R-M Multiple Residence Residential Zoning Districts to the CIC (PD) Planned Development Zoning District (PDC16-013). In addition to this amendment, the proposed project would amend the Alviso Specific Plan development standards for building heights (GPT16-001).

The developed Regional Trail S3 (Guadalupe Sub-Regional Trail) spans west of the project site, while a proposed San Francisco Bay Trail with an on-street bike route spans north of the project site. The approval of the proposed land use designation change and amendment to the Alviso Specific Plan will not adversely impact the existing adjacent recreational and commuter trails within the Countrywide Trails Master Plan.

PDC16-013 and GPT16-001 change does not impact the Trails Element of the Parks and Recreation Chapter of the 1995 General Plan. The Department has no further comments.

RESPONSE C-1: This comment is acknowledged and will be considered by the decision makers. No further response is required.

D. RESPONSES TO COMMENTS FROM DEPARTMENT OF TRANSPORTATION, DATED OCTOBER 17, 2016:

COMMENT D-1: Thank you for continuing to include the California Department of Transportation (Caltrans) in the environmental review process for the above-referenced project. In tandem with the Metropolitan Transportation Commission's (MTC) Sustainable Communities Strategy (SCS), Caltrans new mission signals a modernization of our approach to evaluating and mitigating impacts to the State Transportation Network (STN). We aim to reduce vehicle miles traveled (VMT) by tripling bicycle and doubling both pedestrian and transit travel by 2020. Our comments are based on the Mitigated Negative Declaration (MND). Please also refer to the previous comment letter, dated January 19, 2016, on this project and incorporated herein.

Project Understanding
The proposed project is located immediately adjacent to the north of State Route (SR) 237, on the east side of the Guadalupe River, and south of N. 1st Street. It would replace Pin High Golf Center, an existing driving range and golf facility located on the eastern portion of the site at 4701 N. 1st Street, as well as remove a recreational vehicle storage area located on the site's western portion. The proposed project will consist of the following:

- A 13.5-acre Topgolf entertainment complex in the southern portion of site, which would comprise of 125 hitting bays, an outdoor field enclosed by netting, and a 3-story structure with a full-service restaurant, a bar, lounges, corporate/event meeting space, and a family entertainment area. Additionally, these Topgolf facilities are anticipated to be open as late as 2:00AM and would be supported by an adjacent 460-space paved parking lot.
- A 200-room hotel spanning 6.8 acres on the western portion of the site.
- A retail component consisting of five structures totaling 100,000 square feet (or 100 KSF).
- 5.8 acres of undeveloped land on the southeast corner of the project site would remain undeveloped.

Lead Agency
As the lead agency, the City of San Jose (City) is responsible for all project mitigation, including any needed improvements to the STN. The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures.

> **RESPONSE D-1:** All mitigation measures for traffic impacts are described in *Section 4.16 Transportation* of the Initial Study. As required by CEQA (Section 15097), a Mitigation Monitoring and Reporting Program (MMRP) will be adopted with the Initial Study/Mitigated Negative Declaration. The MMRP will include the impacts of the project, mitigation for those impacts, the relative responsibilities of various City departments for various aspects of the monitoring and reporting, and general standards for determining project compliance with the mitigation measures or revision and related conditions of approval. The Initial Study did not identify any significant impacts to state highways or mitigation measures that would require improvements to state highways.

COMMENT D-2: *Traffic Impacts*

1. N. 1st Street/SR 237 Overpass: The MND states that the project will add a third northbound left-turn lane from N. 1st Street onto the westbound (WB) SR 237 on-ramp. The on-ramp should also be widened, so it can provide enough storage on the SR 237 on-ramp. The project should provide analysis for the above operation for Caltrans review and comments.

   RESPONSE D-2: The Initial Study does not state that the project would add a third northbound left-turn lane from N. 1st Street on the westbound (WB) SR 237 on-ramp. This roadway improvement is not proposed by the project and is not required as part of any CEQA mitigation. The Initial Study does identify significant impacts at the intersection of N. 1st Street and the SR 237 westbound on-ramps under both background-plus-project and cumulative-plus-project conditions (refer to Impact TRAN-1 and Impact C-TRAN-1). Mitigation is identified to reduce the impacts to a less than significant level (refer to MM TRAN-1 and MM C-TRAN-1) that would require the project to contribute fair share payment toward required improvements at this intersection. As described on page 218 of the Initial Study, on December 17, 2013, the City Council modified the North San José Area Development Policy (NSJADP) to allow projects outside the policy area boundary (such as the proposed project) that contribute trips to intersections within the policy area to pay the North San José (NSJ) traffic impact fee as fair share fees to fund traffic mitigation. Therefore, it would be appropriate for the proposed project to pay the NSJ impact fee for its contribution to impacted intersections within the NSJADP boundary, even though the project is not within the NSJADP boundary. The payment of the NSJ impact fee would provide a proportional fair share payment toward the required improvements to the N. First Street and SR 237 intersections, and would constitute effective mitigation of the project's impacts.

   Based on the administrative record, there is substantial evidence to conclude that traffic generated from the proposed project will be below the City's threshold for significant impact on the environment with the proposed mitigation described above.

COMMENT D-3: 2) Ramp Capacity: A ramp-capacity analysis should be performed on the Great America Parkway/SR 237 on-ramp for both the eastbound (EB) and WB side of SR 237. If the queue on these ramps back up onto the City streets, then mitigation is necessary to widen the ramps.

RESPONSE D-3: Pages 224-225 of the Initial Study and Chapter 9 of Appendix I include a discussion of vehicle queuing at the on-ramp mentioned in the comment. As stated in the Initial Study, the City has no adopted thresholds of significance related to vehicle queues at intersections. However, for CEQA purposes, the City analyzes impacts to intersections based on the level of service thresholds of significance. Based on the City's adopted thresholds, no significant level of service impacts were identified at the intersection of Great America Parkway and the SR 237 on-ramps.

COMMENT D-4: 3) Queue Analysis: Please provide the 95th percentile queue analysis for the following intersections:

- Great America Parkway/SR 237 WB off-ramp.
- Great America Parkway/SR 237 EB off-ramp.
- Great America Parkway/Gold Street Connector.

- N. 1st Street/SR 23 7 WB off-ramp.
- N. 1st Street/SR 237 EB off-ramp.
- N. 1st Street/Hoglar Way.

If the findings of the analysis result in queues that extend onto the freeway that extend beyond the through lane storage between intersections or left-turn pocket storage, then the project should fully mitigate these impacts.

> **RESPONSE D-4:** Chapter 10 in Appendix I presents the results of the left-turn queue evaluation at locations that would add a minimum of 10 vehicles to a dedicated left-turn movement in at least one of the peak hours. Table 22 in Appendix I presents the results of the left-turn queue analysis at selected locations, which include Great America Parkway/SR 237 Eastbound Ramps, Great America Parkway/Gold Street Connector, and N. 1st Street/SR 237 Eastbound Ramps. As shown in the table, these locations were not projected to have queues that would extend outside of their respective available storage lengths under existing and background conditions with and without the project in place.
>
> Based on the project trip assignment, the proposed project would not add more than 10 vehicle trips (if any) to dedicated left-turn movements at Great America Parkway/SR 237 Westbound Ramps, N. 1st Street/SR 237 Westbound Ramps, and N. 1st Street/Holgar Way. Thus, these locations were not evaluated in the queueing assessment.
>
> Based on the administrative record, there is substantial evidence to conclude that traffic generated from the proposed project will be below the City's threshold for significant impact on the environment and there is no substantial evidence to support a fair argument that traffic generated from the proposed project will create a significant impact.

COMMENT D-5: 4) Freeway Segment Analysis: The 2,300 vehicle per hour per lane (vhl) capacity stated in the report for Freeway Segment analysis is too high, based on passenger car equivalent volume. If this capacity is used, then all of the count volumes need to be adjusted to passenger car equivalent volumes.

> **RESPONSE D-5:** The Congestion Management Plan (CMP) range of densities for freeway segment level of service is presented in the CMP guidelines and are also reported in the VTA's 2014 CMP Monitoring and Conformance Report. Additionally, the City of San Jose's Traffic Impact Analysis Handbook states that the 2,300 vhl capacity for six-lane or larger freeway segments is ideal and shall be used for the freeway segment analysis. Since this analysis is consistent with other area-wide studies and governing jurisdiction guidelines, the 2,300 vhl capacity used in this TIA's freeway segment analysis is appropriate.

COMMENT D-6: 4) Figure 2.0-2 Vicinity Map: The Vicinity Map of the Initial Study Report has SR 237 mislabeled as SR 87. Please correct the Figure to accurately depict the State facility as SR 237.

> **RESPONSE D-6:** A revised figure is included in the *Revisions to the Text of the Initial Study*, below.

COMMENT D-7: *Vehicle Trip Reduction*

Transportation Demand Management (TDM) programs should be documented with annual monitoring reports by an onsite TDM coordinator to demonstrate effectiveness. Suggested TDM strategies include working with the Santa Clara Valley Transportation Authority (VTA) to decrease headway times and improve way-finding on bus lines to provide a better connection between the project, the Great America Station, and regional destinations and providing:

- Membership in a transportation management association.
- Transit subsidies and/or EcoPasses to all employees.
- Ten percent vehicle parking reduction.
- Transit and trip planning resources.
- Carpool and vanpool ride-matching support.
- Carpool and clean-fuel parking spaces.
- Secured bicycle storage facilities.
- Bicycles for employee uses to access nearby destinations.
- Showers, changing rooms and clothing lockers.
- Fix-it bicycle repair station(s).
- Transportation and commute information kiosk.
- Outdoor patios, outdoor areas, furniture, pedestrian pathways, picnic and recreational areas.
- Nearby walkable amenities.
- Kick-off commuter event at full occupancy.
- Employee transportation coordinator.
- Emergency Ride Home program.
- Bicycle route mapping resources and bicycle parking incentives.

Please refer to "Reforming Parking Policies to Support Smart Growth," a MTC study funded by Caltrans, for sample parking ratios and strategies that support compact growth. Reducing parking supply can encourage active forms of transportation, reduce regional VMT, and lessen future traffic impacts on SR 237 and other nearby State facilities. These smart growth approaches are consistent with the MTC's Regional Transportation Plan (RTP)/SCS goals and would meet Caltrans Strategic Management Plan.

> **RESPONSE D-7:** Caltrans' recommendations regarding vehicle trip reduction are acknowledged and will be considered by the decision makers. As described on page 126 of the Initial Study, the project is not required to implement a TDM program in order to comply with the City's GHG Reduction Strategy. Additionally, a TDM program is not identified as mitigation for significant transportation impacts. No formal TDM is currently proposed by the project applicant or required to mitigate any CEQA impacts. The amount of parking proposed by the project is consistent with the requirements of the City's Municipal Code Chapter 20.90.060.

COMMENT D-8: *Traffic Impact Fees*

Given the project's contribution to area traffic and its proximity to SR 237, the project should contribute fair share traffic impact fees toward the Caltrans sponsored planned construction of the auxiliary lanes on both EB and WB sides of SR 237 between the Zanker Road interchange and the N. 1st Street interchange. Also, the project should contribute to the SR 237 Express Lanes Project. These

contributions would be used to lessen future traffic congestion and improve transit in the project vicinity.

> **RESPONSE D-8:** The Initial Study/Mitigated Negative Declaration did not identify any project-generated significant traffic impacts to freeway segments requiring mitigation such as payment of fair share traffic impact fees.

COMMENT D-9: *Voluntary Contribution Program*

We encourage the City to participate in the VTA's voluntary contribution program and plan for the impact of future growth on the regional transportation system. Contributions by the City funding regional transportation programs would improve the transportation system by reducing congestion and improving mobility on major roadways throughout the San Francisco Bay Area.

> **RESPONSE D-9:** The comment is acknowledged and will be considered by the decision makers.

COMMENT D-10: *Bridges, Trestles, Culverts and Other Structures in Riparian Environments*

Some project level activities may affect riparian flow patterns upstream of bridges, trestles, culverts or other structures for which Caltrans holds responsibility. Please ensure your project level environmental documents include hydrological studies to determine whether such impacts will occur, and to identify appropriate mitigation measures.

> **RESPONSE D-10:** Impacts to the Guadalupe River are discussed in *Sections 4.4 Biological Resources* and *4.8 Hydrology and Water Quality* of the Initial Study. No project-generated impacts were identified that would affect riparian flow patterns upstream of bridges, trestles, culverts or other structures for which Caltrans holds responsibility.
>
> Based on the administrative record, there is substantial evidence to conclude that hydrological impacts of the project will be below the City's threshold for significant impact on the environment and there is no factual basis to support a fair argument that the project will create a significant hydrological impact.

COMMENT D-11: *Habitat Restoration and Management*

Project level activities related to habitat restoration and management should be done in coordination with local and regional Habitat Conservation Plans, and with Caltrans where our programs share stewardship responsibilities for habitats, species and/or migration routes.

> **RESPONSE D-11:** This comment is acknowledged and will be considered by the decision makers. As discussed in *Section 4.4 Biological Resources* of the Initial Study, the project would comply with the requirements of the Santa Clara Valley Habitat Conservation Plan. All impacts to biological resources would be reduced to a less than significant level with implementation of identified mitigation measures.

COMMENT D-12: *Sea Level Rise*

The effects of sea level rise may have impacts on transportation facilities located in the project area. Executive Order (EO) S-13-08 directs State agencies to plan for potential impacts by considering a range of sea level rise scenarios for the years 2050 and 2100. Higher water levels may increase erosion rates, change environmental characteristics that affect material durability, lead to increased groundwater levels and change sediment movement along shores and at estuaries and river mouths, as well as affect soil pore pressure at dikes and levees on which transportation facilities are constructed. All these factors must be addressed through geotechnical and hydrological studies conducted in coordination with Caltrans.

> **RESPONSE D-12:** This comment regarding existing transportation facilities in the project area is acknowledged and will be considered by the decision makers. As the comment does not pertain to the conclusions or analysis of the Initial Study/Mitigated Negative Declaration, no further response is required.

COMMENT D-13: *Encroachment Permit*

Please be advised that any work, staging, or traffic control that encroaches onto the State right-of-way (ROW) requires an encroachment permit that is issued by Caltrans. To apply, a completed encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating State ROW must be submitted to: David Salladay, District Office Chief, Office of Permits, California Department of Transportation, District 4, P.O. Box 23660, Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. See this website for more information: www.dot.ca.gov/hq/traffops/developserv/permits.

> **RESPONSE D-13:** The project does not propose any work within a State ROW. If the project were to encroach on any State ROW, the required encroachment permit procedures would be followed.

E. RESPONSES TO COMMENTS FROM M.R. WOLFE & ASSOCIATES, DATED OCTOBER 17, 2016:

COMMENT E-1: Please accept the following comments on the above-referenced mitigated negative declaration, submitted on behalf of Organizacion Comunidad de Alviso ("OCDA"). OCDA is an unincorporated association of residents, citizens, property owners, taxpayers, and electors residing in the Alviso community of San José, who will be directly affected by any adverse environmental impacts that the Topgolf project ("Project") may generate.

We have reviewed the initial study and proposed mitigated negative declaration ("IS/MND") together with its various technical appendices. As explained below, the City's proposed reliance on a MND for this large-scale retail/hotel/recreational project in lieu of a full environmental impact report ("EIR") is improper. Evidence contained in (or missing from) the IS/MND shows that the Project – the first of its kind in the City -- may have one or more significant environmental impacts notwithstanding the mitigation measures identified in the MND. Under these circumstances the California Environmental Quality Act ("CEQA") requires the City to prepare and circulate an EIR before it may lawfully approve the Project.

I. Traffic Impacts

The Transportation Impact Analysis ("TIA") appended to the IS/MND states that existing (i.e., baseline) traffic conditions were based on traffic counts obtained from the City. Although most of the counts were taken in 2015 or 2016, some are as old as 2013 (see pp. 208 - 211 of the Appendix I PDF comprising counts for North First and Tasman). Other counts date from 2014 (see Appx I PDF pages 257-258; 260 -261; 263-266, comprising respectively counts of Great America Parkway with SR 237 westbound ramps, Great America Parkway with eastbound SR 237 ramps and Vista Montana with West Tasman). Still other count data is of indeterminate age – 2014 or older (pp. 178, 183, 228, 259, and 262, comprising respectively data for the key intersections of N. First with SR 237 westbound ramps, N. First with SR 237 eastbound ramps, N. First with Montague Expressway, Great America with SR 237 westbound ramps and Great America with SR 237 eastbound ramps; dates on these sheets are dates on which data was entered into data base or extracted from data base; actual count date is indeterminately older).

The TIA should have used growth factors to update older count data to approximate current levels. No such adjustment is documented. As the City should aware, North San Jose has seen substantial new development in recent years, and reasonable growth factor adjustments (or new counts) are thus essential to fair representation of existing conditions in this area. It is also noteworthy that Levi's Stadium, which has major effects on weekday as well as weekend traffic in the area, did not open for events until July, 2014. If the existing conditions data base is understated, the analysis is skewed to minimize disclosure of project traffic impacts. Please circulate a revised TIA that reflects current traffic count data, or growth-adjusted earlier data before taking any action to approve the Project.

> **RESPONSE E-1:** As noted on pages 22 and 46 of Appendix I to the Initial Study, the analysis of existing traffic conditions was based on traffic counts obtained from the City of San Jose and supplemented with new manual turning-movement counts collected in 2015. Additionally, as noted in Section 4.16.1.4 of the Initial Study, existing conditions (and by extension the baseline for the analysis of transportation impacts) were established at the time the City initiated the traffic analysis for the proposed project in February 2016. At this time,

all but one of the traffic counts utilized in the analysis were 18 months old or newer. There is no information in the administrative record that would indicate the traffic count is outdated or that the result of the traffic analysis would change with updated traffic count of today's date.

At one intersection, N. 1st Street/Tasman Drive, counts were utilized that were older than 18 months. At this intersection, new counts were completed in September 2015. However, intersection counts completed in 2013 showed greater volumes than those completed in 2015. The City utilized the 2013 counts in order to yield more conservative results since the 2013 volumes were higher than 2015 volumes. The Initial Study, therefore, established an appropriate and conservative baseline for the evaluation of impacts resulting from the project.

The comment also mentions Levi's Stadium. Events at Levi's Stadium are not a regular occurrence and counts for the project were conducted during typical AM and PM weekday peak hour conditions in October 2015 or March 2016. Additionally, Levi's Stadium is located roughly three miles south of the project site and event traffic is unlikely to have any significant effect on traffic within the immediate project area.

COMMENT E-2: The TIA's trip generation analysis, documented in Appendix I, Table 10, used the average trip generation rate for shopping centers from ITE Trip Generation, 9th Edition to estimate the gross trip generation (trip generation before reductions for internalization and passerby attraction) for the Project's retail component. However, trip generation varies by shopping center size with very large centers having lower than average generation per square footage, small ones having greater than average generation per square foot. Because of this, the ITE document advises use of the regression equation provided in the document rather than the average rate. The retail floor area in the Topgolf Project falls in the area where actual generation by the regression equation is greater than the average rate. Please update the trip generation analysis accordingly.

RESPONSE E-2: Consistent with the Department of Public Works' Transportation Impact Analysis Handbook, average trip generation rates for the shopping center land use were used in the analysis. The use of average trip generation rates is standard practice and appropriate for the proposed project because it accounts for variability of the final composition of the specific retail uses at the project site. The regression equation, or fitted curve, recommended by the commenter looks at a specific set of parameters. Given that the specific retail uses are currently unknown, it is speculative to rely on the specific retail use parameters of the regression equation. There is information in the administrative record to support the use of average trip generation rate for shopping centers.

COMMENT E-3: The TIA's trip generation analysis assumes that 25 percent of the daily and PM peak trips to the Project's retail component would be attracted from existing traffic passing the site. While this is ordinarily a conventional assumption, it is inappropriate with respect to this Project for two reasons. First, the limited amount of traffic passing the site makes attracting 25 percent of the Project's retail traffic from regular passers-by unsustainable. Second, the retail to be developed on the site is unlikely to be attractive to passers-by given the socioeconomics of the local community who comprise the passerby traffic.

RESPONSE E-3: The 25 percent pass-by reduction for retail uses during daily and PM peak hour traffic is based on a review of ITE's Trip Generation Handbook, 3rd Edition (2014) and a review of pass-by reductions for retail uses made in other Santa Clara County TIAs. It is a

typical and standard reduction that is applied in traffic analyses throughout Santa Clara County. No data or supporting information is provided in the comment that would demonstrate this is an unreasonable assumption. The assumptions made in the comment are speculative and there is no information in the administrative record to support such assumptions.

COMMENT E-4: The TIA reports that under the original assumption of 117,000 square feet of retail space, the Project was found to cause a significant impact on a freeway segment. After reducing the retail component by 7,000 square feet, the TIA finds a reduction in overall PM peak generation of about 20 net trips (after discounting for internalization and passers-by), thereby avoiding the freeway impact. Had the TIA properly accounted for the gross PM peak retail trip generation and for realistic passer-by attraction, the result would have been substantially more trips generated per 1,000 square feet, such that the removal of just 7,000 square feet would not eliminate the freeway impact.

RESPONSE E-4: As described in Responses E-2 and E-3, the trip generation and pass-by reduction assumptions utilized in the traffic analysis are standard rates and are appropriate for the proposed project. No data or supporting information is provided in the comment that would demonstrate the TIA relies on unreasonable assumptions. The assumptions made in the comment are speculative and there is no information in the administrative record to support such assumptions.

Based on the administrative record, there is substantial evidence to conclude that freeway traffic generated from the proposed project will be below the City's threshold for significant impact on the environment and there is no substantial evidence to support a fair argument that traffic generated from the proposed project will create a significant traffic impact to any freeway segments.

COMMENT E-5: The TIA also indicates that the Project could add 21 to 28 percent to traffic on Gold Street. The Project traffic assignment on Appendix I, Figure 8 shows the project adding 136 trips to Gold Street in the PM peak, which is a 20.4 percent increase in the existing Gold Street PM peak traffic of 666 shown on Appendix I, Figure 6. But if the Project trip distribution route information displayed on Appendix I, Figure 7 is combined with the project trip generation information contained on Appendix I, Table 10, Project trips could add some 32 percent to traffic on Gold Street. And if the gross retail trip generation and passer-by attraction had been properly estimated as detailed in the points above, the percent increase on Gold would be even greater.

RESPONSE E-5: As stated on pages 11 and 135 and shown in Table 21 of the TIA, the project could add 21 percent to the average daily trips (ADT) on Gold Street at its intersection with Moffatt Street, and add 28 percent to the ADT on a segment of N. Taylor Street between Gold Street and Liberty Street. Gold Street would not experience a 28 percent increase in ADT.

The comment states that Gold Street could experience a 32 percent increase in ADT, but it is unclear how this percentage was derived and is speculative. As noted in Table 21, the project's addition to the ADT on Gold Street was estimated by applying the same proportionality or ratio between the PM peak hour project trip generation and the daily project trips to the project's PM peak hour roadway segment volumes. This methodology

yields an ADT increase of 21 percent. It should be noted that this data is provided in the TIA in the context of a discussion of traffic added to neighborhood streets in Alviso. This discussion was included in Appendix I, but not the text of the Initial Study, at the request of the City and is intended for informational and transportation planning purposes only. The discussion is not an analysis of the project's impacts under CEQA. The project's impacts under CEQA are analyzed in *Section 4.16 Transportation* of the Initial Study, where significant transportation impacts are analyzed and associated mitigation measures are identified.

As described in Responses E-2 and E-3, the trip generation and pass-by reduction assumptions utilized in the traffic analysis are standard rates and are appropriate for the proposed project.

COMMENT E-6: The TIA also includes an analysis of Project impacts on Alviso neighborhood streets, finding that the Project would increase average daily trips on Gold Street at Moffatt Street by 21 percent, and on North Taylor Street between Gold and Liberty Streets by 28 percent. The TIA then identifies various "potential transportation improvements." The listed improvements, which include installation of bulb-outs, speed feedback signs, roundabouts, raised crosswalks and the like, are not identified as mitigation measures in the IS itself. The TIA in essence has found potentially significant traffic impacts on Alviso neighborhood streets and recommended mitigation measures for them, that the IS/MND has failed to disclose. At a minimum, the IS/MND should be updated to specify these measures as binding mitigation measures that the Project applicant and/or the City will be required to implement if the Project is ultimately approved.

RESPONSE E-6: The comment is referring to pages 102-104 of Appendix I to the Initial Study, which includes a discussion of traffic added to neighborhood streets in Alviso. This discussion was included in Appendix I, but not the text of the Initial Study, at the request of the City and is intended for informational and transportation planning purposes only. The discussion is not an analysis of the project's impacts under CEQA. The project's impacts under CEQA are analyzed in *Section 4.16 Transportation* of the Initial Study, where significant transportation impacts are analyzed and associated mitigation measures are identified.

The potential transportation improvements referenced in the comment are provided in Appendix I as examples of traffic calming options that could help slow down motorists and/or keep unwanted through traffic out of the area. These measures are not mitigation measures for any identified significant transportation impacts, and are, therefore, presented as recommendations only, should the City desire to achieve traffic calming in the area. Of the recommendations listed in Appendix I, the City will require the project to implement bulb-outs at all four corners of the North Taylor and Liberty Street intersection, as well as buffered bicycle lanes on North Taylor Street between Gold Street and Liberty Street. In addition, the project would construct a median island along the project frontage, enhanced crosswalk with flashing beacons at Grand Blvd. and N. 1st Street, a new traffic signal at N 1st Street and Trinity Park with protected pedestrian crosswalks.

Based on the administrative record, there is substantial evidence to conclude that traffic generated from the proposed project will be below the City's threshold for significant impact on the environment with the proposed mitigation described in the Initial Study/Mitigated

Negative Declaration, and there is no substantial evidence to support a fair argument that traffic generated from the proposed project will create a significant traffic impact to neighborhood streets.

COMMENT E-7: In sum, the City should correct the foregoing flaws and inconsistencies in a revised TIA circulated for further public review and comment.

RESPONSE E-7: For the reasons described in Responses E-1 through E-7, the Initial Study provides an adequate analysis of the project's transportation impacts, and therefore, a revised TIA is not necessary.

Based on the administrative record, there is substantial evidence to conclude that traffic generated from the proposed project will be below the City's threshold for significant impact on the environment with the proposed mitigation described in the Initial Study/Mitigated Negative Declaration.

COMMENT E-8: II. Air Quality Impacts

The Project uses CalEEMod to calculate Project emissions. The model appears to rely on unsubstantiated input parameters to estimate Project emissions. For example, the CalEEMod output files for the Hotel/Retail portion of the Project model the parking lot with 178 spaces, but then assigned a lot acreage of zero to this land use (Appendix A, p. 55). Meanwhile, according to figures presented in the IS/MND itself, the surface parking lots are in fact a part of the total lot acreage (IS/MND, p. 13, p. 39). As such, the parking lot land use should have an acreage assigned to it in the CalEEMod model. By failing to include this, pollutant emissions, such as fugitive dust and VOCs, from grading and asphalt paving have been underestimated. Please correct this omission in a revised initial study.

RESPONSE E-8: Based on the information contained in this comment, the CalEEMod input parameters were revised to include the correct number of parking spaces and parking lot acreage. The revised air quality modeling results are attached as Attachment B to these responses to comments. It should be noted that the total site acreage assumed in the original CalEEMod input parameters was correct, but the acreage of the parking lot areas was included in the acreage assigned to the land use categories proposed for the site, such as retail and hotel. The revised modeling did not indicate any new significant air quality impacts that were not already identified and disclosed in the Initial Study.

COMMENT E-9: The IS/MND finds a potentially significant air quality impact from emissions of NOx during Project construction. (IS/MND p. 65.) It then claims this impact would be reduced to a less than significant level with mitigation measure MM AQ-1.1, which provides: "[a]ll diesel-powered construction equipment larger than 50 horsepower and operating on site for more than two (2) continuous days shall meet U.S. EPA particulate matter emissions standards for Tier 4 engines or equivalent" (IS/MND, p. 65). The IS/MND does not, however, explain or document the feasibility of this mitigation measure. The assumption that a combined total of 75 pieces of construction equipment for both the TopGolf Complex and Hotel/Retail components of this Project will be equipped with Tier 4 engines is dubious, given that current regulations do not require construction fleets to consist of solely Tier 4 equipment, and that retrofitting older equipment with Tier 4 engines is extremely expensive. Please explain how the City plans to enforce this mitigation measure.

RESPONSE E-9: As required by CEQA (Section 15097), a Mitigation Monitoring and Reporting Program (MMRP) will be adopted with the Initial Study/Mitigated Negative Declaration. The MMRP will include the impacts of the project, mitigation for those impacts, the relative responsibilities of various City departments for various aspects of the monitoring and reporting, and general standards for determining project compliance with the mitigation measures or revision and related conditions of approval. The project will be required to implement MM AQ-1.1 as described in the Initial Study, and will print these requirements on construction documents, contracts, and/or project plans. Mitigation requiring the use of Tier 4 engines in construction equipment has been successfully implemented in other projects in San Jose, including the Communications Hill 2 project, which is currently under construction.

COMMENT E-10: The IS/MND calculated average daily construction emissions by averaging annual emissions over 396 workdays. (Table 4.3-4, IS/MND, p. 65). This averaging period appears to be based on the CalEEMod default schedule used to model the TopGolf Complex. At the same time, construction of the Retail/Hotel component of the Project was done using a Project-specific construction schedule provided by the applicant, which assumes construction over 300 work days. However, the annual emissions from both the TopGolf Complex and the Retail/Hotel are spread over a 396 day averaging period instead of using a 396 day averaging period for the TopGolf Complex and a 300 day averaging period for the Hotel Retail Component, and adding the average daily emissions with each other. By using a larger averaging period to estimate the Retail/Hotel average daily emissions, the Project's average daily construction emissions are underestimated. Please address this inconsistency in a revised Air Quality analysis.

RESPONSE E-10: The calculation of construction emissions was completed using methodology recommended by the Bay Area Air Quality Management District (BAAQMD). In Appendix B of the 2012 BAAQMD CEQA Air Quality Guidelines, BAAQMD provides direction on the averaging of daily construction emissions, stating, "The average daily emissions of each pollutant that would occur throughout the entire construction period should be identified and compared with the lead agency's threshold of significance."[1] Following the direction of the BAAQMD guidelines, the project's total construction emissions were averaged over the entire construction period.

As noted in Response E-8, the air quality modeling for the project was updated to ensure the assumptions used as input parameters precisely match the project description in the Initial Study. The revisions to the modeling include updating the overall construction period to 24 months. It should be noted that the 18-month assumption used in the initial modeling was accurate when the modeling was completed. However, subsequent to the modeling effort, the applicant requested that the project description be revised to include 24 months for construction. This revision was due to a potential later start date to construction of certain portions of the proposed project, not an increase in the overall amount of construction. The overall amount of proposed construction has not changed from the original modeling effort. The revised air quality modeling results are attached as Attachment B to these responses to comments, and summarized in *Revisions to the Text of the Initial Study*, below. The revised modeling did not indicate any new significant air quality impacts that were not identified in the Initial Study.

[1] BAAQMD. *California Environmental Quality Act Air Quality Guidelines*. Updated May 2012.

COMMENT E-11: III. Health Impacts from Diesel Exhaust Emissions

The IS/MND includes a health risk assessment ("HRA") in Appendix A for exposing nearby sensitive receptors to hazardous pollutant emissions during Project construction. Specifically, the ISCST3 dispersion model was used to predict concentrations of diesel particulate matter (DPM) and PM2.5 at affected sensitive receptor locations. The ISCST3 output files do not appear to have been provided, however. This makes it impossible for the public to verify the accuracy or legitimacy of the various assumptions that the dispersion model relied upon. Because the public is entitled to review and comment upon all technical information relied upon in the IS/MND (CEQA Guidelines § 15072(g)(4)), please circulate the ISCST3 for a minimum 20-day review period before any action is taken to approve the Project**.**

> **RESPONSE E-11:** The ISCT3 output files are included in Attachment B to these responses to comments.
>
> CEQA Guidelines § 15072(g)(4) states that "The address or addresses where copies of the proposed negative declaration or mitigated negative declaration including the revisions developed under Section 15070(b) and all documents referenced in the proposed negative declaration or mitigated negative declaration are available for review. This location or locations shall be readily accessible to the public during the lead agency's normal working hours." Section 2.3 of the Initial Study discloses the address where documents associated with the Initial Study are available for review. The ISCST3 output files were available throughout the circulation period and could have been viewed at any time upon request. The assumptions used as input parameters for the model were disclosed in Appendix A, as were the results of the modeling.

COMMENT E-12: The IS/MND does not include a HRA for the Project's operational phase. Diesel-powered delivery truck trips associated with the hotel and retail land uses of the Project will undoubtedly produce significant quantities of DPM emissions, exposing nearby sensitive receptors in Alviso to a potentially significant direct and/or cumulative health risk. The City should prepare and circulate a HRA that evaluates the Project's individual and cumulative operational health risks prior to taking action to approve the Project.

> **RESPONSE E-12:** There is nothing unique about the project that would suggest an unusual volume of diesel truck deliveries compared with other hotel or retail projects. The cumulative health risk portion of the air quality analysis addressed health risks from vehicle trips based on cumulative plus project volumes obtained from the project traffic report. The trip generation assumptions used in the air quality modeling for the project include a typical rate of truck delivery trips for the proposed uses on the site. The cumulative roadway volumes would include future heavy-duty truck trips in the project area from cumulative conditions plus implementation of the project. As discussed on page 11 of air quality report (Appendix A), the HRA completed for cumulative plus project conditions indicated no significant health risk resulting from vehicle and truck trips, including those generated by project.

COMMENT E-13: IV. Noise Impacts

The Noise Assessment appended to IS/MND does not appear to have evaluated the Project's cumulative traffic noise impacts in the manner required by CEQA. Under CEQA, a legally adequate cumulative impact analysis requires an agency first to determine whether will be a significant cumulative noise impact from the Project in combination with other past, present, and future projects in the vicinity, i.e., whether all relevant projects together will generate noise exceeding the City's noise standards at the affected locations. See CEQA Guidelines, § 15130; Communities for a Better Environment v. California Resources Agency (2002) 103 Cal.App.4th 98. If the agency in fact finds a significant cumulative impact, it must then separately determine whether the project's contribution to that impact is "cumulatively considerable." Id. The IS/MND's Noise Assessment does not adhere to this mandatory two-step approach.

We would note that the Noise Assessment indicates that traffic noise levels at 7 affected roadway segments already exceed the City's residential noise standard of 60 dB, and will continue to do so with the Project. This suggest there is already a significant cumulative noise impact, thus triggering a duty to ascertain, using specific significance thresholds, whether the Project's contribution to it in the future is cumulatively considerable. The City should prepare and circulate a legally adequate cumulative traffic noise analysis before taking any action to approve the Project.

> **RESPONSE E-13:** The discussion of cumulative noise impacts in the Initial Study was revised to more clearly state that the project would neither result in a significant cumulative noise impact nor would it make a cumulatively considerable contribution to one (refer to *Revisions to the Text of the Initial Study*, below). Pages 34 and 35 of Appendix H to the Initial Study were also revised in a similar manner (refer to Attachment C). The conclusion of the Initial Study, which in Section 4.18.2.3 states that the project "…would not result in or make a considerable contribution to significant cumulative noise impacts," is unaffected by these revisions.
>
> Based on the administrative record, there is substantial evidence to conclude that noise generated from the proposed project will be below the City's threshold for significant cumulative noise impact and there is no substantial evidence to support a fair argument that noise generated from the proposed project will create a significant cumulative noise impact.

COMMENT E-14: V. Conclusion

Under CEQA, an agency may rely on a negative declaration or mitigated negative declaration only if there is no substantial evidence whatsoever that a project may have a significant environmental impact. CEQA Guidelines, § 15064(f)(3). While a fair argument of environmental impact must be based on substantial evidence, CEQA places the burden of environmental investigation on government rather than the public. "If a local agency has failed to study an area of possible environmental impact, a fair argument may be based on the limited facts in the record. Deficiencies in the record may actually enlarge the scope of fair argument by lending a logical plausibility to a wider range of inferences." Sundstrom v. County of Mendocino (1988) 202 Cal.App.3d 296, 311.

Here, the foregoing deficiencies, errors and omissions render the IS/MND inadequate to support approval of the Project under CEQA. The City should prepare a full EIR that contains new/revised analyses discussed above before taking any action to approve the Project.

Thank you for your consideration of this comments and concerns.

RESPONSE E-14: The comment letter raised questions regarding assumptions and methodologies utilized in the Initial Study and technical appendices. Responses E-1 through E-13, as well as revisions to the Initial Study and technical appendices, provide clarification on how the conclusions of the Initial Study were reached and adequately respond to the questions raised in the comment letter. None of the revisions or responses result in changes to the conclusions of the Initial Study, and the comment letter provides no substantial evidence that the conclusions of the Initial Study are incorrect. Based on the administrative record, there is substantial evidence to conclude that impacts generated from the proposed project will be below the City's thresholds for significant impact on the environment with the proposed mitigation discussed in the Initial Study/Mitigated Negative Declaration. There is no substantial evidence to support a fair argument that noise generated from the proposed project will create a significant cumulative noise impact. Based on the conclusions of the Initial Study, a Mitigated Negative Declaration is appropriate for the proposed project.

F. RESPONSES TO COMMENTS FROM ADA E. MARQUEZ, DATED OCTOBER 17, 2016:

COMMENT F-1: In regards to Topgolf IS/MND File No. PDC16-013, Planned Development Rezoning from the CIC Combined Industrial Commercial and R-M Multiple Residence Residential Zoning Districts to the CIC(PD) Planned Development Zoning District to allow up approximately 110,000 square feet of commercial/retail space, a 200 room hotel, approximately 72,000 square feet of indoor/outdoor recreation use (Topgolf) and late night use. File No. GPT16-001: General Plan Text Amendment to amend the Alviso Specific Plan to change the development standards for height under the "Village Area Guidelines for Commercial Development" to include a maximum allowable building height of 65 feet in certain areas and a maximum allowable non-building structure height of 170 feet in certain areas.

An EIR should be prepared per CEQA for the following inadequacies and lack of quantitative analyses:

1. GHG's : This project does not conform to the General Plan and therefore cannot use the Greenhouse Gas Reduction to replace a separate analysis.

Per The City of San Jose Greenhouse Gas Reduction Strategy: The City chose the Establishment of a GHG Reduction Target (updated December 2015) per BAAQMD CEQA Guidelines (May 2011) thresholds for assessing the required reduction in GHG by the year 2020: Meeting the plan efficiency threshold of 6.6 metric tons of CO2 equivalent per service population per year (MT CO2e/SP/year)." However, the IS/MND does not disclose thresholds for their analysis of greenhouse gases. In addition, the IS/MND fails to disclose the following information:
a) The IS/MND does not disclose the environmental baseline for greenhouse gases in the City of San Jose;
b) Does not disclose existing GHG's emissions around the project's perimeter and cumulative GHGs impacts. The document is inadequate by disclosing qualitatively only "Existing On-Site Emissions" of the Golf Center, RV storage area, on-site electricity and transportation. Per CEQA, what are other sources in Alviso emit greenhouses gases, both stationary and mobile sources, approved projects, and future projects?
c) Does not provide quantitative analysis of GHG's of the project for approximately 110,000 square feet of commercial/retail space, a 200 room hotel, approximately 72,000 square feet of indoor/outdoor recreation use (Topgolf), separately and cumulatively.

RESPONSE F-1: As described in Section 4.7.3 of the Initial Study, in jurisdictions where a qualified GHG Reduction Strategy has been reviewed under CEQA and adopted by the decision makers, compliance with the GHG Reduction Strategy would reduce a project's contribution to cumulative GHG emission impacts to a less than significant level. The Initial Study goes on to state the following:

> "Although the project proposes a text amendment to the Alviso Master Plan to allow increased building heights for the Topgolf and hotel structures, the proposed uses are consistent with the General Plan designations set for the site in the Land Use/Transportation Diagram, and the amount of development proposed is within the range assumed for the site in the General Plan. The proposed height increases would not increase the amount of allowed development on the site, nor

> would the proposed development differ from the assumptions of future land uses on the site utilized when the City developed its GHG Reduction Strategy. Therefore, the City's GHG Reduction Strategy would still apply to this project, and the project would be consistent with Mandatory Criteria 1."

Mandatory Criteria 1 requires consistency with the City's General Plan Land Use/ Transportation Diagram (use and density). Since the proposed project would be consistent with the City's GHG Reduction Strategy, GHG emissions from the proposed project would be less than significant.

Based on the administrative record, there is substantial evidence to conclude that greenhouse gas emissions generated from the proposed project will be below the City's thresholds for significant impact on the environment, and there is no substantial evidence to support a fair argument that greenhouse gas emissions generated from the proposed project will create a significant impact. Based on the conclusions of the Initial Study, a Mitigated Negative Declaration is the appropriate CEQA document for the proposed project.

COMMENT F-2: d) The City of San Jose per CEQA section 15065, must prepare an EIR to disclose the cumulative impacts of this project and other projects in Alviso:

a. The project has the potential to achieve short-term environmental goals to the disadvantage of long-term environmental goals.
b. The project has possible environmental effects that are individually limited but cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects. (CEQA Statutes and Guidelines, 2016)

RESPONSE F-2: The proposed project would not preclude the City from meeting its long-term environmental goals because the proposed project would be required to implement mitigation measures to reduce impacts to less than significant levels and would be required to comply with all applicable regulatory requirements. Item "a" in the above comment refers to a former CEQA checklist question that is no longer included in Appendix G of the CEQA Guidelines. For this reason, it is not addressed in the Initial Study. The analysis and conclusions of the Initial Study/Mitigated Negative Declaration are based on existing environmental setting conditions, policy and regulatory conditions, proposed project characteristics, and, where applicable, project-specific technical studies detailing both long- and short-term potential impacts.

The remainder of the above comment refers to the project's cumulative impacts. Cumulative impacts are discussed in Section 4.18.2 of the Initial Study, which concluded that the project would not result in or make a considerable contribution to a significant cumulative impact.

Based on the administrative record, there is substantial evidence to conclude that impacts generated from the proposed project will be below the City's thresholds for significant cumulative impact on the environment, and there is no substantial evidence to support a fair argument that impacts generated from the proposed project will create a significant cumulative impact. Based on the conclusions of the Initial Study, a Mitigated Negative Declaration is the appropriate CEQA document for the proposed project.

COMMENT F-3: e) Disclose quantitatively, how much this project will reduce GHGs by implementation of the Greenhouses Gas Reduction Strategy for the hotel, retail, and the Topgolf? This project fails to comply with the Reduction Strategy, "This Diagram was specifically designed to minimize greenhouse gas emissions along with other environmental impacts by guiding the City's future growth in a form which will reduce the need for automobile travel while also promoting transit use, bicycling and walking as alternative means of mobility instead of automobiles." Disclose how the City will "maximize the future share of transit, pedestrian and bicycle use as transportation modes, focusing almost all new employment and residential growth in areas with a high degree of transit access, proximity to services and designed in a way to foster those transportation modes" per the City's Strategy. GHG analysis must show evidence significant impact will not occur (Mejia v. City of Los Angeles (2005) 130 Cal. App. 4th 322).

> **RESPONSE F-3:** As described in response F-3 and Section 4.7.3 of the Initial Study, in jurisdictions where a qualified GHG Reduction Strategy has been reviewed under CEQA and adopted by the decision makers, compliance with the GHG Reduction Strategy would reduce a project's contribution to cumulative GHG emission impacts to a less than significant level. The project proposes a Planned Development (PD) rezoning of the site, and would be consistent with the conditions applied to the newly created PD zoning. New structures would comply with the San Jose Green Building Ordinance (Policy 6-32) and the California Green Building Code (CALGreen). The project includes improvements to pedestrian and bicycle facilities in the project area. The project, therefore, would be consistent with Mandatory Criteria of the GHG Reduction Strategy. Since the proposed project would be consistent with the City's GHG Reduction Strategy, GHG emissions from the proposed project would be less than significant.

COMMENT F-4: 2. Air Quality Impact Analysis is inadequate for the following reasons per BAAQMD CEQA Guidelines Updated May 2011 as cited in this IS/MND.
a. Inconsistent information for the duration of construction, square footage of the hotel, and the amount of parking spaces in the project description and the technical report Appendix A. Therefore, the IS/MND provides inaccurate analyses and significance levels for construction and TACs to sensitive receptors, elementary school, youth center, library, park, and residents.
b. In the IS/MD, please disclose impacts to sensitive receptors from mobile sources and cumulative sources per CEQA from existing, approve, and future projects.
c. Disclose air quality analysis with correct project description for Community Risk and Hazard Impacts; and cumulative air quality impacts on human health per BAAQMD CEQA.

> **RESPONSE F-4:** As noted in Response E-8, the air quality modeling for the project was updated to ensure the assumptions used as input parameters precisely match the project description in the Initial Study. The revisions to the modeling include updating the overall construction duration, square footage of the hotel, and number of proposed parking spaces. The revised air quality modeling results are attached as Attachment B to these responses to comments, and summarized in *Revisions to the Text of the Initial Study*, below. None of the conclusions of the Initial Study were affected by these revisions.
>
> *Section 4.3 Air Quality* of the Initial Study, utilizing information in the air quality analysis contained in Appendix A, discloses all required air quality impacts resulting from the project. Based on the administrative record, there is substantial evidence to conclude that air

emissions generated from the proposed project will be below the City's thresholds for significant impact on the environment, and there is no substantial evidence to support a fair argument that air emissions generated from the proposed project will create a significant impact.

COMMENT F-5: (Children's Environmental Health Protection Act (Senate Bill 25, Escutia, Chapter 731, Statutes of 1999, Health2 and Safety Code Sections 39669.5 et seq.) The Air Quality and the Hazards sections do not disclose this project is specifically subject to BAAQMD's Regulation 11, Rule 2. (Asbestos Demolition, Renovation, and Manufacturing) and California Code of Regulations, Section 93105.

RESPONSE F-5: The buildings to be demolished on the site were constructed in 1993, after the use of asbestos in building materials had been prohibited in 1978, and are not expected to contain asbestos containing materials (ACMs). However, as described in the Initial Study, unknown ACMs may exist in soils on the site due to historic unregulated dumping of waste materials in the project vicinity. The Initial Study identifies a significant impact related to the potential exposure of construction workers and the public to hazardous materials, including asbestos, during construction (Impact HAZ-1). The Initial Study identifies mitigation measures to reduce this impact to a less than significant level, including the preparation and implementation of an Asbestos Dust Mitigation Plan, should asbestos be detected in soil samples taken on the site (MM HAZ-1.1 through 1.5). The Asbestos Dust Mitigation Plan would be submitted to BAAQMD for review and approval prior to project grading activities. The mitigation identified in the Initial Study would ensure the project would not result in significant impacts related to ACMs, and that the project would comply with all relevant regulations related to asbestos, including BAAQMD's Regulation11, Rule 2, and California Code of Regulations Section 93105.

COMMENT F-6: Construction Emissions: "A total of up to 50,000 cubic yards (c.y.) of fill would be imported to the site. The project would require minimal cut on the site, mostly limited to the removal of existing paved surfaces, which would result in the off-haul of up to 20,000 tons of materials. The project proposes weekend (Saturday-Sunday) construction hours, 9:00 AM to 5:00 PM, as part of their Planned Development (PD) Permit. The duration of construction for all project elements would be roughly 24 months." (p.11)

However, according to Appendix A, "The project would require up to 50,000 cubic yards (cy) of soil import for the hotel/retail component, which was entered into the model. The anticipated 20,000 tons of demolition for the hotel/retail component was also entered into the model. In addition, 25,000 cy of asphalt is anticipated during the paving phase and was entered based on 16cy per truck. The anticipated construction schedule assumes that the project would be built out over a period of approximately 18 months beginning in 2017, or an estimated 396 construction workdays (assuming an average of 22 construction days per month).(p.5)

The IS/MD fails to disclose accurate information on construction emissions and duration which will expose sensitive receptors: George Elementary School, Alviso Library, Alviso Community Center, the park, and families of Alviso to TAC's, PM's, and hazardous materials that exceed thresholds such as, asbestos, TPH, pesticides, arsenic, lead, beryllium and cadmium, and VOCs.

RESPONSE F-6: As noted in Response E-8, the air quality modeling for the project was updated to ensure the assumptions used as input parameters precisely match the project description in the Initial Study. The revisions to the modeling include updating the overall construction period to 24 months. It should be noted that the 18 month assumption used in the initial modeling was accurate when the modeling was completed. Subsequent to the modeling effort, however, the applicant requested that the project description include 24 months for construction. This revision was due to a potential later start date for construction of certain portions of the proposed project, not an increase in the overall amount of construction. The overall amount of proposed construction has not changed from the original modeling effort. The revised air quality modeling results are attached as Attachment B to these responses to comments, and summarized in *Revisions to the Text of the Initial Study*, below. The minor revisions to in the input parameters used in the air quality modeling did not result in changes to any impact conclusions in the Initial Study, which determined that that project would result in less than significant impacts with mitigation.

COMMENT F-7: Technical Report Appendix A; (p.10) Explain why meteorological data set of 1996-2000 was used for dispersion modeling to predict concentrations of DPM and PM2.5 near sensitive receptors? A current environmental baseline must be used for CEQA analysis.

RESPONSE F-7: BAAQMD states in their "Recommended Methods for Screening and Modeling Local Risks and Hazards" that the ISCST3 meteorological data available from the District "provide reasonable approximations of common meteorological conditions" for impact evaluation. Use of the Alviso meteorological data utilized in the air quality analysis is consistent with BAAQMD's recommended impact evaluation methods for CEQA and is the most current meteorological dataset available from BAAQMD for use with the model in the project area. Therefore, it is an appropriate environmental baseline for this air quality analysis.

COMMENT F-8: The TAC's from construction emissions of residential cancer risks 47.9 in one million for infant exposure and 0.8 in one million for adult exposure exceeds BAAQMD thresholds. However, this must be reanalyzed with current baseline data and for George Mayne elementary school. PM2.5 thresholds exceed also for residential receptor location, but current baseline is needed as well.

RESPONSE F-8: As described in response F-7, the baseline meteorological data used is in the analysis is the most recent available for the project area. The air quality analysis includes an evaluation of impacts to sensitive receptors at George Mayne Elementary School. As described on page 67 of the Initial Study, the project would be required to implement mitigation measures that would reduce impacts related to construction TACs to a less than significant level (MM AQ-1.1 and MM AQ-1.2).

COMMENT F-9: For cumulative construction risk: Appendix A incorrectly identified N. Taylor Street/N. 1st Street as 1,000 feet from the project site and nearby receptors.

RESPONSE F-9: The comment misinterprets language in Appendix A which describes how all potential sources of TACs within 1,000 feet of the sensitive receptor most affected by project construction were considered. N. Taylor Street/N. 1st Street was identified as a source

of TACs within this 1,000-foot radius. TAC emissions from N. Taylor Street/N. 1st Street were analyzed at a distance of 50 feet from the roadway.

COMMENT F-10: The Technical Report did not analyze significant cumulative impacts of "the total of all past, present, and foreseeable future sources within a 1,000 foot radius (or beyond where appropriate) from the fence line of a source, or from the location of a receptor, plus the contribution from the project" for TACs and PM 2.5/PM 10(BAAQMD, 2011, p. 5-15). Please correctly disclose and analyze the correct roadways with traffic volumes (North First Street and Highway 237), correct distance for stationary sources, and correct PM2.5, PM10, cancer and non-cancer risks, and adequate mitigation measures per BAAQMD for operational impacts.

RESPONSE F-10: As described in Response F-9, the air quality analysis considered all potential sources of TACs within 1,000 feet of the sensitive receptor most affected by project construction, as recommended by BAAQMD. Highway 237 is over 2,000 feet from this receptor. No stationary sources were identified within this 1,000-foot radius.

The air quality analysis was revised to include in its evaluation of cumulative impacts the Midpoint at 237 Project, also known as the Trammel Crow Project (refer to Attachment B and *Revisions to the Text of the Initial Study*). The addition of cumulative emissions associated with this project did not result in changes to the conclusions of the Initial Study, which determined that the project would result in less than significant impacts with mitigation.

COMMENT F-11: The IS/MND and technical report fails to disclose quantitative reduction of mitigation measures to protect sensitive receptors in Alviso from both construction, stationary, and mobile sources.

RESPONSE F-11: Page 12 of Appendix A and page 67 of the Initial Study include discussions of the quantitative reductions in impacts achieved by identified mitigation measures.

COMMENT F-12: The technical report and the IS/MND also failed to disclose the cumulative exposure of ROG, NOx, and local CO from this project, approved projects, and future projects in the General Plan and other amendments, mobile sources from Highway 237, and existing stationary sources. (CCR §15355, §15130) (PRC §21083(b), CCR §15065) The City must prepare an EIR to disclose Substantial Adverse effects of Human per CEQA.

RESPONSE F-12: Air pollution, by nature, is primarily a cumulative impact. The significance thresholds utilized by the City for criteria pollutants (i.e., ROG, NOx, and CO) represent the levels at which a project's individual emissions of criteria pollutants and precursors would result in a cumulatively considerable contribution to the region's air quality conditions, as determined by BAAQMD. Therefore, the analysis of criteria pollutant impacts in the Initial Study is an analysis of the project's contribution to cumulative air quality impacts. The Initial Study determined that the project would not result in significant emissions of criteria pollutants (e.g., ROG, NOx, and CO) during project operation. The Initial Study identified mitigation measures (MM AQ-1.1 and MM AQ-1.2) to reduce temporary emissions of NOx during construction to a less than significant level.

Based on the administrative record, there is substantial evidence to conclude that air emissions generated from the proposed project will be below the City's thresholds for significant cumulative impact on the environment, and there is no substantial evidence to support a fair argument that air emissions generated from the proposed project will create a significant cumulative impact. Based on the conclusions of the Initial Study, a Mitigated Negative Declaration is the appropriate CEQA document for the proposed project.

COMMENT F-13: 3. Hydrology Project Description and Mitigation Measures: The IS/MND's significance levels for all hydrological impacts concluded "Less than Significant Impact" in the checklist and "Impacts Evaluation". The document fails to disclose Mitigations are required per CEQA. The project description chapter does not disclose details of the design features and best management practices. For example, "Project-specific Low Impact Development Measures would be determined as part of the PD Permit Process; Detailed design of any detention area(s) would be subject to review and approval during the project PD permit process (pp.10-11). Therefore, the Hydrology chapter must identify the mitigations required to adequately conclude reduction of the project impacts (Lotus v. Department of Transportation (2014) 223 Cal.App.4th 64). The purpose of CEQA is to inform the decision-makers and informed public participation (CEQA Statutes and Guidelines, 2016).

RESPONSE F-13: The Initial Study concluded that the project would not result in significant hydrology and water quality impacts; therefore, no mitigation measures are required. As described in the Initial Study, the project would be required to comply with the City of San José's Post-Construction Urban Runoff Policy 6-29 and the RWQCB Municipal Regional NPDES permit (MRP)/C.3 requirements. Page 233 of the Initial Study goes on to state that, "In order to meet these requirements, stormwater runoff from the site would be collected via new onsite catch basins, most of which would be located in proposed bio-retention areas on-site (refer to Figure 3.0-12). Stormwater collected in the bio-retention areas would be treated prior to discharge to the City's storm drain system. The proposed treatment facilities would be numerically sized and would have sufficient capacity to treat the runoff entering the storm drainage system consistent with the NPDES requirements." The precise design of these facilities would be determined during the PD Permit Process, and would be subject to review and approval by the City for compliance with relevant requirements from the NPDES permit.

COMMENT F-14: Transportation: The project requires an EIR to fully disclose the cumulative impacts of this project's daily 6,915 daily new vehicle trips in Alviso, plus approved and future projects and mitigations measures. The Transportation chapter includes inadequate mitigation measures that fails to disclose how much of the project's percent contribution to the North San Jose Area Traffic Impact Fee (TIF), the timeline for payment and improvements in the Alviso community specifically or exactly where the improvements will occur, monitoring and reporting responsibility, consequences if the fees are not paid to the City, etc. For example, the document states that this "project's cumulative traffic represents 25% or more of the increase in total traffic volume from background traffic conditions to cumulative conditions". Intersection 5: N. First Street & SR 237 Westbound Ramps (LOS E, PM peak hour) (p.220). Furthermore, "A significant cumulative impact is deemed mitigated to a less than significant level by the City of San Jose if the measures implemented would restore the intersection LOS to background conditions or better at non-protected intersections (p.220)." Since the IS/MND only includes the "payment of the TIF would represent a fair share" as mitigation measure, an EIR is required to disclose an unmitigated significant impact,

when the traffic impact fee mitigation will paid, the timeline for improvements in Alviso, and monitoring and reporting. The families and children in Alviso are entitled as City of San Jose residents to full disclosure per CEQA. (CCR §15355, §15130) (PRC §21083(b), CCR §15065).

RESPONSE F-14: An analysis of the project's cumulative traffic impacts is included on pages 218-224 of the Initial Study, as well as Section 7.0 of Appendix I. The Initial Study concluded that the project would result in significant impacts at the intersection of N. First Street and SR 237 Westbound Ramps under cumulative plus project conditions (Impact C-TRAN-1). The Initial Study identifies mitigation that would reduce the impact to less than significant (MM C-TRAN-1). As described in the Initial Study, the payment of the NSJ impact fee would provide a proportional fair share payment toward the required improvements to the N. First Street and SR 237 intersection, and would constitute effective mitigation of the project's impacts. Payment would be based on the project's percent contribution of added traffic at the impacted intersection. As shown on Table 4.16-10, the project's contribution to the significant cumulative impact at this intersection would be 55 percent.

As required by CEQA (Section 15097), a Mitigation Monitoring and Reporting Program (MMRP) will be adopted with the Initial Study/Mitigated Negative Declaration. The MMRP will include the impacts of the project, mitigation for those impacts, the relative responsibilities of various City departments for various aspects of the monitoring and reporting, and general standards for determining project compliance with the mitigation measures.

Based on the administrative record, there is substantial evidence to conclude that traffic generated from the proposed project will be below the City's thresholds for significant impact on the environment with the proposed mitigation described above, and there is no substantial evidence to support a fair argument that traffic generated from the proposed project will create a significant impact. Based on the conclusions of the Initial Study, a Mitigated Negative Declaration is the appropriate CEQA document for the proposed project.

COMMENT F-15: In January 2017, SB 1000 (Leyva) will require General Plan updates to identify disproportionately environmental impacted communities and implement an Environmental Justice element. Alviso is a unique community, the residents are disproportionately impacted by numerous environmental impacts such as TAC's, PM2.5, Union Pacific Railroad, Highway 237, South Bay Asbestos/NPL site, methane vapor from numeorus surrounding landfills7, diesal generators, Calpine Energy Plant, SJWPCP, Midpoint@237 Office and Industrial Project's trucks, and many other proposed projects. According to BAAQMD (2011), diesel PM from mobile sources is the most predomoniate TAC in the Bay Area which accounts for over 80% of the inhalation cancer risk in the Bay Area. I hope that with the implementation of SB 1000 Planning for Healthy Communities Act, vulnerabale communities in the City of San Jose, like Alviso, will finally be acknowledged and receive equitable enviromental protection and informed public participation accessibility.

RESPONSE F-15: This comment is acknowledged and will be considered by the decision makers. As the comment does not pertain to the analysis or conclusions of the Initial Study/Mitigated Negative Declaration, no further response is required.

G. RESPONSES TO COMMENTS FROM SANTA CLARA VALLEY AUDUBON SOCIETY, CITIZENS COMMITTEE TO COMPLETE THE REFUGE, SIERRA CLUB - LOMA PRIETA CHAPTER, AND COMMITTEE FOR GREEN FOOTHILLS, DATED OCTOBER 17, 2016:

COMMENT G-1: Santa Clara Valley Audubon Society (SCVAS), the Citizens Committee to Complete the Refuge (CCCR), and the Loma Prieta Chapter of the Sierra Club (SCLP) are local environmental organizations focused on the conservation of our natural resources and biological diversity. Our members appreciate birds and wildlife along the Bay and creek corridors, and are always concerned when development proposals are adjacent to the Don Edwards National Wildlife Refuge, the Bay, or creek corridors. We believe the project will impose significant and unavoidable impacts to the Alviso community, to migratory birds, and to our members who enjoy recreation on the Guadalupe Creek Trail.

The project proposes to redevelop the site with a Topgolf entertainment complex, a 5 story 65-ft tall hotel and retail space. The proposed Topgolf entertainment complex would be located on the southern portion of the site and would include a three-story structure reaching up to 54 feet in height that would be enclosed on the north, east and west sides. The south side of the structure, facing the Guadalupe River Trail and the river, will be open to the environment. The building includes roughly 120 hitting bays which would face south toward a 5.2-acre lighted artificial turf field enclosed by poles and netting that would reach up to 170- feet in height at a setback of 100- ft from Guadalupe River and the Creek Trail. Each hitting bay can accommodate up to six players at a time. Hitting bays include seating, television screens and overhead speakers providing amplified music. The facility would also include a full-service restaurant, bar, lounges, rooftop entertainment area, corporate/event meeting space, and a family entertainment area with games. Entertainment will be offered every day, morning to 2AM in the morning. Thus, the Topgolf can be reasonably expected to attract thousands of visitors every day (employees, restaurant, bar and events visitors, and several groups of up to 6 people at each of 120 bays each day).

The surrounding land uses include sensitive ecological features (creek, bay) and a plethora of sensitive land-uses that accommodate sensitive receptors: George Mayne Elementary school (500+ students), Alviso Branch Library, Residences (including a mobile home park), and the Guadalupe Creek Trail where people go to exercise and to enjoy nature. Most of the Project area is currently ruderal open space, is dark at night, and is relatively quiet. If the Project is permitted, tall buildings, expansive parking, overwhelming netting, excessive noise, traffic, light, and air pollution will impose significant and unavoidable operations-related impacts to the creek corridor and to nearby residents and sensitive receptors, changing the character of the Alviso community forever.

We believe an Environmental Impact Report (EIR) must be prepared for the Project to allow full study of the project specific and cumulative impacts, offer and evaluate alternatives. It is likely that decision makers will have to make a declaration of overriding considerations to allow the project to proceed as described.

> **RESPONSE G-1:** The comment incorrectly describes the hotel and retail portion of the project. As described in Section 3.2 of the IS/MND, the proposed hotel would be four stories and up to 65 feet in height. The proposed retail space would be one to two story structures up to 40 feet in height.

The project site is currently developed with a driving range facility and paved parking area utilized for RV storage. The driving range facility includes 90-foot tall netting and field lighting that operates during nighttime hours. A three-acre area on the far western end of the site that is currently undeveloped would be the only ruderal area developed as a result of the project. As discussed in Section 4.1.3 of the IS/MND, the project would not substantially degrade the existing visual character or quality of the site and its surroundings with implementation of policies from the City's Commercial Design Guidelines and the Alviso Master Plan's Village Area Guidelines for Commercial Development.

The Initial Study fully evaluated all proposed elements of the project and determined that the project would not result in significant unavoidable environmental impacts, including cumulative impacts. No data or supporting information is provided in the comment that would demonstrate that this determination is unreasonable. Based on the conclusions of the Initial Study, a Mitigated Negative Declaration is appropriate for the proposed project. There is substantial evidence in the administrative record to conclude that the environmental impacts generated from the proposed project will be below the City's threshold for significant impact on the environment with the proposed mitigation described in the Initial Study/Mitigated Negative Declaration. Based on the conclusions of the Initial Study, a Mitigated Negative Declaration is the appropriate CEQA document for the proposed project.

COMMENT G-2: <u>The project is incompatible with the Alviso Master Plan (Plan)</u>

The Alviso Master Plan was the result of a lengthy public process that engaged the entire Alviso community and multiple stakeholders for years (a 24-participants task force, multiple public meetings, 5+ years of planning). The Plan aimed at "full build-out" to year 2020 and beyond stating, "It is important to set forth a vision now to avoid piecemeal development and to better respond to potential development pressure within the community". Clearly, the Alviso Master Plan was created with the exact intent of preventing speculative projects such as the Topgolf@Terra.

When the Alviso Specific Plan was developed, height considerations were an integral part of the discussion. The intent was to preserve the unique characteristics of Alviso, and it was agreed upon that taller building and structures did not fit in with the character of the community. The Plan's objectives allowed for economic development, but also included:

- Maintain the small town character, strong community identity, and neighborhoods
- Allow for new development at, or at least compatible with, the scale and intensity of existing development within specific areas
- Beautify Alviso
- Preserve and protect Alviso's strong natural amenities, including the Guadalupe River, Coyote Creek, and baylands.

The Project is not compatible with these objectives: it does not beautify Alviso (rather the opposite), degrades the small town character, is incompatible with the scale and intensity of existing development, and harms Alviso's natural amenities along the Guadalupe River as well as the birds and wildlife at the Don Edwards National Wildlife Refuge, a major bird migratory destination only a half mile away from the project site.

Therefore, the proposed text amendment to the Alviso Master Plan (section 3.2.5, page 121) that allows tall buildings (up to 65-feet) and 170-foot tall structures (poles, netting) must be considered a potentially significant and unavoidable impact to land use.

Mitigation for the impact on land use should be considered (i.e. elimination of this aspect of the proposed Project).

RESPONSE G-2: The proposed text amendment to the Alviso Master Plan would allow increased building and netting heights on the site. The text amendment would only apply to the project site, and would not affect allowed building heights throughout the remainder of the Alviso Master Plan area. The environmental impacts of the proposed text amendment are analyzed throughout the Initial Study, with special attention paid to potential impacts to aesthetics, biological resources, and land use. The Initial Study determined that no significant environmental impacts would result from the proposed text amendment.

The comment lists objectives contained within the Alviso Master Plan. A project's consistency with a Master Plan is not based on its consistency with the Plan's objectives, but rather its consistency with policies adopted to achieve those objectives. As described in the Initial Study, the project would be consistent with relevant policies in the Alviso Master Plan, with the exception of policies related to height limits. The proposed uses and site design are consistent with the Alviso Master Plan. The Alviso Master Plan includes design guidelines that promote the preservation and enhancement of the existing small town quality of Alviso, while allowing for new commercial and industrial development along North 1st Street near Highway 237. These design guidelines offer flexibility for larger-scale development provided that new development contributes to the unique design and architecture of Alviso. With the exception of the recreation facility and hotel, the majority of the height of the buildings would be consistent with the existing Alviso Master Plan height requirements of 40 feet. The proposed buildings would be similar in scale to existing structures on nearby properties. As described in Section 4.1.3 of the Initial Study/Mitigated Negative Declaration, the proposed net poles would be substantially taller than any surrounding structures, including those currently under construction on the adjacent property. However, the net poles would not block views in the same nature as a solid structure, and the netting between the poles would be mostly transparent. 90-foot tall net poles and netting associated with the existing driving range facility are currently present on the site. Although the proposed net poles and netting would be taller than those currently on the site, the visual effect would be similar to existing conditions. The project proposes the text amendment to the Alviso Master Plan referenced above in order to achieve consistency with relevant height limit policies.

Final architectural design of project structures would be subject to review by the City for consistency with relevant policies in the Alviso Master Plan prior to issuance of building permits.

Based on the administrative record, there is substantial evidence to conclude that land use impacts from the proposed project will be below the City's threshold for significant impact on the environment and there is no substantial evidence to support a fair argument that the proposed project will create a significant impact to land use.

COMMENT G-3: <u>The aesthetic impacts of the proposed Project are significant and unavoidable</u>

The MND states, in one sentence, that the proposed Project will have no aesthetic impacts. This finding seems to overlook the fact that the Project will include structures up to 170 feet in height. This would be far higher than any other nearby structure and should be considered a significant impact.

Tall golf netting such as this can has a significant visual impact to the environment, and often elicit pronounced negative response from the public. For our members who frequent the Guadalupe Creek Trail, the Bay Trail, and the Don Edwards National Wildlife Refuge, the proposed 170-ft poles and netting (and the noise-generating, tall buildings) will violate the sense- of-place end enjoyment of recreation and bird watching north of HWY 237, along the River and the Bay. While the existing 90-ft tall fences are not visually pleasing, replacing them with 170-ft netting creates a much stronger imposition and further degrades the enjoyment of sky, vistas and nature.

Thus, the 170-ft tall poles and netting will impose significant, unavoidable aesthetic impacts. The finding that the impacts are less than significant is not justified. Instead, the visual impact of this high a structure should be further analyzed and found to be a significant impact. Lowering the height or, better yet, eliminating this aspect of the Project altogether should be considered as mitigation.

> **RESPONSE G-3:** The aesthetics impacts of the proposed project are thoroughly analyzed in *Section 4.1 Aesthetics* of the Initial Study. The discussion spans 30 pages and includes 16 graphics and six photos. Included in the 16 graphics are 12 photosimulations depicting day and night conditions both with and without the project from six different viewpoints. The factors mentioned in the comment were carefully considered when completing the analysis in the Initial Study. After a thorough evaluation, based on adopted City policies and the City's longstanding methodology for analyzing such impacts, the City concluded that the proposed project would not result in significant aesthetics impacts. There is no substantial evidence to support a fair argument that the proposed project will create a significant unavoidable aesthetic impact.

COMMENT G-4: <u>The change to the Envision 2040 General Plan must be vetted in Citywide community outreach due to Growth Inducing Impacts</u>

The proposed text amendment to the Alviso Master Plan (section 3.2.5, page 12) applies by extension the Envision 2040 General Plan. It is reasonable to expect that such a substantial change (from a height limit of 40 feet to that of 170 feet) – a change that changes the skyline of North San Jose all the way to the downtown area - should have visually-significant growth- inducing impacts, encouraging other property owners in the City of San Jose to seek modifications that would allow them to exceed existing height limitations for various structures on rooftops etc. This is a potentially significant impact and should be acknowledged.

Furthermore, there was no outreach to the entire San Jose community regarding this change to the Envision 2014 General Plan. An amendment of such citywide significance should be communicated in a transparent, citywide process.

> **RESPONSE G-4:** As described in the Initial Study and in Response G-2, above, the language of the proposed text amendment to the Alviso Master Plan specifically limits the

height increases to the project site. The text amendment would not apply to other properties in Alviso or the rest of the City. The text amendment, therefore, would not result in citywide growth-inducing impacts. Any citywide change proposed under a General Plan amendment would require separate community outreach and environmental review.

COMMENT G-5: Cumulative impacts

The project IS/MND fails fully evaluate cumulative impacts of project-related noise and air quality criteria pollutants during operations.

Section 15355 of the CEQA Guidelines states: "Cumulative impacts" refers to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.

(a) The individual effects may be changes resulting from a single project or a number of separate projects.

(b) The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

Important direction to the practical use of this definition is found in Section 15130 of the CEQA Guidelines: “As defined in Section 15355, a cumulative impact consists of an impact which is created as a result of the combination of the project evaluated in the EIR together with other projects causing related impacts.”

Several projects are currently in the process of permitting, or have been recently permitted, or are under construction in Alviso in the immediate vicinity of the project site:

Alviso near / along North First Street
PD13-039 Trammel Crow Distribution Center
PDC15-016: Residence Inn by Marriott & Fairfield Inn and Suites by Marriott Project PDC14-004, PD14-007: Midpoint at 237 Office and Hotel Project
C14-010: 237 at North First St. Homewood Suites Hotel

America Center Area (Gold St/237 access)
PDC 15-058 & PD15-053: America Center Phase III Project (Build 192,350 sq ft. office building and expand existing garage.)
PDC15-016: Residence Inn and Fairfield Inn & Suites America Center Court Project (aka Marriott Hotels)
PDC15-058 and PD15-053 America Center Planned Development Zoning and Planned Development Permit and Subsequent Environmental Impact Report (SEIR). Zanker Road/McCarthy Blvd access
C15-054: Cilker Property, Rezoning from A/PD to LI (Light Industrial)

The IS/MND fails to evaluate the Project’s cumulative impacts associated with the projects identified above.

RESPONSE G-5: The Initial Study includes a full and adequate analysis of cumulative impacts (refer to Section 4.18.2). The analysis takes into account the projects listed above. Appendix C of the TIA includes a list of projects used in the analysis of background and cumulative conditions. For example, the analysis of cumulative air quality, noise, and transportation impacts all utilize cumulative traffic volumes that include the above-mentioned projects, as well as other projects in the area that would result in additional traffic on nearby roadways. The Initial Study determined that the project would not result in or make a considerable contribution to a significant cumulative impact.

COMMENT G-6: Cumulative Air Quality impacts require additional analysis

Air pollution impacts on sensitive receptors from hundreds of weekday and weekend car trips during operations of the Project should be evaluated cumulatively, combined with the impacts of air pollution from Hwy 237, truck trip operations at the Trammel Crowe Distribution Center and car trips to and from the newly constructed and planned hotels and office buildings in the vicinity.

RESPONSE G-6: The Initial Study includes a full and adequate analysis of cumulative air quality impacts. As discussed in response G-5, the analysis of cumulative air quality impacts accounts for the cumulative traffic volumes that include the above-mentioned projects. Please refer to *Section 4.3 Air Quality* and Appendix A of the Initial Study, as well as Attachment B to these responses to comments and *Revisions to the Text of the Initial Study*, which include a specific discussion regarding the Trammel Crow project.

COMMENT G-7: The IS/MND proposes that the Project will not result in a cumulatively considerable net increase of any criteria pollutant for which the project region is classified as non-attainment under an applicable federal or state ambient air quality standard including releasing emissions which exceed quantitative thresholds for ozone precursors. The IS/MND states (page 68), "As described above in the response to checklist question "b", the project would not result in a considerable net increase of any criteria pollutant with implementation of mitigation measures." But offers no mitigation measures for operation-related air pollution.

RESPONSE G-7: Emissions of criteria pollutants from the proposed project would occur in two forms: ongoing operational emissions and temporary construction emissions. As discussed in Section 4.3.3 of the Initial Study, operational emissions would not exceed thresholds of significance, and no mitigation is required. Temporary emissions of NOx during the construction period, however, would exceed the threshold of significance for average daily emissions. A significant impact is identified for emissions of NOx during construction (Impact AQ-1), and mitigation is identified to reduce this impact to a less than significant level (MM AQ-1.1 and MM AQ-1.2).

COMMENT G-8: These cumulative impacts are significant and potentially unavoidable and likely to affect the health of the students and teachers of the George Mayne elementary school, visitors to the Alviso Branch Library, residences of nearby residences and the Summerset Mobile Home Park across the Guadalupe River from the Project Site.

Please provide a comprehensive analysis in an EIR to fully study, disclose and mitigate cumulative operations-related air quality impacts. Please offer mitigations including a Traffic Management Plan.

RESPONSE G-8: As stated in Response G-6, the Initial Study includes a full and adequate analysis of cumulative air quality impacts. This analysis includes an evaluation of construction period and operational impacts to nearby sensitive receptors such as residential uses and students at George Mayne Elementary School. The Initial Study identifies mitigation measures where needed to reduce impacts to a less than significant level. No data

or supporting information is provided in the comment that would demonstrate this is an unreasonable conclusion. A Traffic Management Plan is not required as a mitigation measure to reduce air quality impacts to a less than significant level. Because no significant unavoidable air quality impacts were identified in the Initial Study, a Mitigated Negative Declaration is the appropriate CEQA document and an EIR is not required.

Based on the administrative record, there is substantial evidence to conclude that cumulative air emissions resulting from the construction and operation of the proposed project will be below the City's threshold for significant impact on the environment and there is no substantial evidence to support a fair argument that air emissions from the construction and operation of the proposed project will create a significant cumulative impact.

COMMENT G-9: Noise impacts are likely to prove significant and unavoidable

The IS/MND inadequately addresses the significance of noise impacts on the community of Alviso. There should be an analysis of noise impacts from the Project after it is developed, both on a project specific and cumulative levels. The proposed Project will generate noise into the evening, within close proximity to Alviso residents and to sensitive species in the Alviso area. The MND for the project specifically points out that "late night use" would be part of the Project (MND, page 1). These noise impacts should be explained and mitigation adopted if needed.

RESPONSE G-9: Noise impacts from the proposed project are analyzed in *Section 4.12 Noise*, and cumulative noise impacts are discussed in Section 4.18.2.3. The noise analysis takes into account nighttime noise and utilizes a weighted noise measurement that applies an additional 10 dB penalty to nighttime noise when determining average noise levels resulting from the project. As discussed in Response A-1, the noise analysis concluded that average noise levels in this area would not increase as a result of project operation (refer to Table 4.12-4 in the Initial Study). Noise from the project would not exceed the thresholds established by the City of San Jose to determine significant noise impacts. The Initial Study did not identify significant noise impacts, and no mitigation is required. Based on the administrative record, there is substantial evidence to conclude that noise resulting from the proposed project will be below the City's threshold for significant impact on the environment and there is no substantial evidence to support a fair argument that the proposed project will create a significant unavoidable noise impact.

COMMENT G-10: Sensitive Receptors

The IS/MND defines sensitive receptors to the project, "an existing residence located on the southern corner of N. First Street and Liberty Street, adjacent to the northwest boundary of the site. Residences are also located across N. First Street, Liberty Street, and Moffat Street from the site. Additionally, George Mayne Elementary School is located across N. First Street from the site." The IS/MND's analysis must include the Alviso Branch Library as a sensitive receptor. Additionally, people who utilize the Guadalupe Park Trail and guests of nearby hotels should also be included as sensitive receptors.

RESPONSE G-10: Although the Alviso Branch Library was not mentioned in the text quoted in the comment, it was considered a sensitive receptor in the noise analysis completed for the project (refer to page 7 of Appendix H to the Initial Study). Noise impacts to the library were determined to be less than significant.

The City considers exterior noise levels of 65 dBA Ldn "normally acceptable" for outdoor recreational uses, which would include trails. As shown in Figure 4.12-2 of the Initial Study, noise levels from the project would not exceed 65 dB at the trail. Additionally, users of the

trail would only experience project-generated noise for a brief period of time as they pass by the site.

The nearest sensitive residential receptors evaluated in the noise analysis are located closer to the site than any nearby hotels. As a result, the finding of less than significant noise impacts to these residential receptors would extend to any nearby hotels that are located at further distances from the site.

COMMENT G-11: Noise monitoring survey, average inadequate, effects of noise

The IS/MND states, "a noise monitoring survey was completed at various locations near the site on Wednesday December 16, 2016 and Thursday December 17, 2016". As these dates have not yet occurred, we ask that this statement be clarified.

RESPONSE G-11: The erroneous dates provided in the Initial Study are the result of a typo. The dates should read 2015 instead of 2016. This text has been corrected in the *Revisions to the Text of the Initial Study*, below.

COMMENT G-12: It seems that the proposed noise monitoring survey did not include the George Mayne Elementary School or the Alviso Branch Library as study locations. In order to measure the full impact of the Project, a noise monitoring survey must include the Alviso Branch Library and George Mayne Elementary School and should be completed during days that the elementary school is in session, outdoors and in a classroom.

RESPONSE G-12: Measurements of existing ambient noise levels were taken on the east side of N. 1st Street in the vicinity of the school and library. While the noise survey location was not directly in front of these uses, the ambient noise measurements taken at this location provide a reasonable baseline for existing noise levels along this segment of N. 1st Street.

COMMENT G-13: The noise monitoring survey measured the "Ldn...the average energy level intensity of noise over a given period of time such as the noisiest hour". Results from the noise monitoring survey show that the average ambient noise was measured between 65 dB and 66 dB at the residences on North First Street. The maximum noise was measured between 74-88 dB during daytime hours and 71-81 dB during nighttime hours at the residences on North First Street.

Noise levels of above 55 decibels outside and 45 decibels indoors have been shown to be preventing and interfering with activities and creating feelings of annoyance, leading to observable impairments in reading comprehension and memory skills in children. San Jose's Envision San Jose 2040 General Plan Comprehensive Update, Noise Background Report, 2009 states, "Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA DNL with open windows and 65-70 dBA DNL if the windows are closed" and "When the DNL increases to 70dBA, the percentage of the population highly annoyed increases to about 12 percent of the population."

Given its location near the George Mayne elementary school, the proper measure for the Project's noise impact to sensitive receptors should be the noise generated during operation hours, when music is ongoing and guests are active. This is because children who live near the project will be affected during the school day, afternoon activities, homework preparation, evening relaxation, and bedtime. They will not be able to escape to the Alviso Park or library, since the noise will invade these places as well. For an accurate analysis of the impact of noise, Project specific noise impacts should be analyzed for the operation hours only (no averaging with quiet-time hours.

RESPONSE G-13: The City's thresholds of significance for evaluating noise impacts are based on day-night average noise levels (Ldn or DNL). For this reason, noise impacts from the project are calculated in terms of average noise levels.

The calculation of the average noise levels generated by the project only considers hours when the project is in operation. Hours when the project is not operating are not included in the calculation of average noise levels. Additionally, noise generated by the project during nighttime hours (after 10:00 PM) receives an additional 10 dB penalty due to the increased sensitivity of nearby receptors during these nighttime hours. This penalty is then factored into the average. As discussed in Section 4.12.3 of the Initial Study/Mitigated Negative Declaration, noise generated by the proposed project, including all on-site sources combined, would meet the City's exterior noise criteria at the property line of the nearest noise-sensitive land uses. Based upon the above process utilized by the City in evaluating noise impacts, the project was determined to not result in significant noise impacts.

COMMENT G-14: Cumulative Noise Analysis

The IS/MND failed to include a study of the cumulative noise generated by the activities, traffic, construction, and aircraft noise surrounding the project site. Further, the MND only includes noise impacts generated during the construction phase of the project and fails to analyze noise impacts during operation hours.

Noise generation from Topgolf@Terra operations, including traffic related noise as well as outdoor music and noise generating guest activities (cheering, thumping) must be analyzed cumulatively with noise generated by traffic and nearby activities, including the upcoming operations of the Trammel Crow Distribution Center (for example, trucks traffic, backing up and beeping at the nearby Distribution Center). The study and analysis should focus on the George Mayne elementary school since it is located between the Distribution Center and the Project site, but cumulative impacts should also be evaluated for other sensitive receptor locations.

RESPONSE G-14: *Section 4.12 Noise* includes a full evaluation of noise impacts resulting from the project, including both construction and operational noise. Cumulative noise impacts are analyzed in Section 4.18.2.3. Since operational noise generated by the project would be well below existing ambient noise levels at the nearest sensitive receptors (refer to Table 4.12-4 in the Initial Study), the primary way the project would contribute to cumulative noise impacts is through an increase in traffic noise on surrounding roadways. As mentioned in Response E-13, the discussion on pages 34 and 35 of Appendix H of the Initial Study was revised to more clearly state that the project would neither result in a significant cumulative noise impact nor would it make a cumulatively considerable contribution to one. The conclusion of the Initial Study, which in Section 4.18.2.3 states that the project "…would not result in or make a considerable contribution to significant cumulative noise impacts," is unaffected by these revisions.

Based on the administrative record, there is substantial evidence to conclude that noise resulting from the proposed project will be below the City's threshold for significant impact on the environment and there is no substantial evidence to support a fair argument that the proposed project will create a significant cumulative noise impact.

COMMENT G-15: Conclusions (Noise)

The failure to adequately analyze and mitigate noise impacts after the project is built (operation hours) and cumulative noise impacts means that potentially significant and unavoidable impacts to

sensitive receptors have not been disclosed. The City must prepare an Environmental Impact Report to provide transparency and inform the public and decision makers of noise impacts.

The noise generation and cumulative noise impacts are significant to the extent that the project may not accomplish compliance with the City of San Jose's General Plan Envision 2040 GOAL EC-1, 1.1, Goal EC-1 - "Community Noise Levels and Land Use Compatibility: Minimize the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies". The obvious mitigation would be to restrict the hours of operation to eliminate noise during the school hours, and at night. We recommend that the Topgolf portion of the Project not operate after 9 PM.

> **RESPONSE G-15:** As described in Responses G-9 through G-14, the Initial Study adequately analyzed the project's noise impacts. The project would not result in noise levels in excess of the City's adopted thresholds of significance, including those based on General Plan policies. Because no significant noise impacts were identified, no mitigation is required. The recommendation will be considered by the decision makers.

COMMENT G-16: Biological Impacts

Congdon's Tarplant
Impact Bio-1 identifies potentially significant impacts to Congdon's Tarplant, and offers to mitigate by establishing other populations of the plant onsite. What evidence does the City have that such mitigation can be successful? Can the City produce any documents providing substantial evidence that this mitigation would reduce the impact to less than significant? In particular, are there documents from previous projects that used the same mitigation successfully?

> **RESPONSE G-16:** Please refer to Attachment D to these responses to comments, which includes documentation of successful Congdon's Tarplant mitigation utilizing methods similar to those described in mitigation measures MM BIO-1.1 and MM BIO-1.2 in the Initial Study. The mitigation measures identified in the Initial Study include requirements for ongoing monitoring to ensure success and contingency planning if specific performance criteria are not met.

COMMENT G-17: Nesting Birds
Many of the bird species that nest in this area are ground or shrub nesting birds. Pre-construction nesting bird surveys (and burrowing owl surveys) should include the entire project site, and not be limited to trees.

> **RESPONSE G-17:** Please refer to *Revisions to the Text of the Initial Study*, below, where mitigation measure MM BIO-3.2 has been revised to clarify that all potential nesting substrates will be investigated during the preconstruction survey for nesting birds.

COMMENT G-18: Netting and birds
Since 1987, the San Francisco Bay Bird Observatory (SFBBO, an avian research organization) operates the Coyote Creek Field Station at Coyote Creek, at a similar distance from the Bay to the location of the Project site. Research at the station is based on the use of mist-nets to capture birds in the creek corridor, banding the birds with uniquely numbered, federally-issued bands, and analyzing the data to study the bird community of the region and migration patterns.

The attached SFBBO Species List indicates that 249 species protected by the Migratory Bird Treaty Act, including multiple rare and endangered species, breed or otherwise use habitat of lower Coyote Creek and most likely, Guadalupe River. The list also identifies 52 species that are currently listed by a government agency, by the State of the Birds 2016 report or by the National Audubon Society.

These include Federal and California threatened and endangered migratory species such as the Willow Flycatcher and Swainson's Hawk. In addition, note State and Federal Species of Special Concern such as Burrowing Owl, San Francisco Common Yellowthroat, Nuttel's Woodpecker, Painted Bunting, Loggerhead Shrike, and Long-billed Curlew.

RESPONSE G-18: The comment, citing data from the Coyote Creek Field Station at Coyote Creek, states that 249 species protected by the Migratory Bird Treaty Act, including multiple rare and endangered species, breed or otherwise use habitat of lower Coyote Creek and most likely, Guadalupe River. While the City appreciates this information, it is the City's opinion that the bird data from lower Coyote Creek are not entirely representative of conditions along the lower Guadalupe River near the project site. The Coyote Creek data are from an area with a much broader array and higher quality of habitats than those that are present near the project site. The Coyote Creek Field Station is located on Lower Coyote Creek. In this region, habitat is characterized by a mature cottonwood and willow riparian forest, including broad riparian restoration areas, and broad grassy overflow channels. In addition, many of the waterbirds included on the list of species at this location were apparently recorded in the nearby Reach 1A Waterbird Pond, which is specifically managed for the benefit of waterbirds, and the adjacent diked marsh.

In contrast, the reach of the Guadalupe River adjacent to the project site has been channelized, and woody riparian vegetation is completely absent. Marsh habitat occupies portions of the channel, but the marsh is dominated by emergent vegetation that does not provide the structural complexity found along lower Coyote Creek. Although a VTA wetland mitigation site is present to the southwest of the project site on the far side of the Guadalupe River, the marsh present in this location is intended to be fully tidal and is not managed specifically as waterbird habitat. In addition, the level of urban development on both sides of the Guadalupe River near the project site is higher than what occurs along lower Coyote Creek. Therefore, because of the relatively low quality and heterogeneity of habitat types present along the Guadalupe River adjacent to the project site in comparison to lower Coyote Creek, the variety of bird species that use this reach of the Guadalupe River as habitat is expected to be much lower than what has been recorded along Coyote Creek.

In addition, many of the special-status species that are referred to in the comment letter are not rare or declining birds locally and are listed (e.g., as federal species of concern) for reasons that do not apply in the South Bay. For example, the willow flycatcher formerly nested commonly in riparian habitats on the Santa Clara Valley floor, but local populations were extirpated by the late 1960s. This species still occurs as an uncommon migrant in the project area, moving between wintering areas in Mexico and breeding areas to the north. However, migrant willow flycatchers occurring in the project area are likely from breeding populations outside the state, and, therefore, would not be individuals from the state-listed California population or the federally listed subspecies extimus that resides in riparian habitat of southern California. In other words, willow flycatchers occurring as migrants in the South Bay are not from special-status populations. Further, many of the special-status species referred to occur in the northern San Jose area only as infrequent transients or vagrants (e.g., Swainson's hawk, painted bunting).

COMMENT G-19: The City of San Jose recognizes the importance of the lower Guadalupe River corridor for bird migration in its 2010 General Plan Envision 2040 in Goal ER-7 – Wildlife Movement and the City's Riparian Corridor ordinance. Goal ER-7 states,

- In the area north of Highway 237 design and construct buildings <u>and structures</u> using bird-friendly design and practices to reduce the potential for bird strike for species associated with the baylands or the riparian habitats of lower Coyote Creek. (emphasis added).

The MND acknowledges that the 170-ft tall netting is a potentially significant impact to birds (Impact Bio-7). The proposed mitigation (MM BIO-7.1) is borrowed from methods used to reduce collision of large birds with powerlines. These mitigations are not likely to reduce the risk for millions of night-flying migratory passerines and shorebirds that visit the Don Edwards National Wildlife Refuge or fly through near the Bay and along the Guadalupe River. Even for day flying birds, these deterrents require a much closer spacing than 15-feet for many bird species.

It is our expert opinion that the risk to migratory birds remains significant after mitigation (see also attached expert opinion from Dr. Christine Sheppard, American Bird Conservancy).

> **RESPONSE G-19:** The City appreciates the commenter's concern regarding the potential impact of the proposed netting on migratory birds, and potential bird strikes with the proposed netting were considered significant in the Initial Study. During preparation of the Initial Study, considerable research was conducted into previous precedents for requiring flight diverters on golf course netting or for such netting being considered a significant impact to birds under CEQA. However, no precedent was found for impacts of such netting on birds being considered significant, or any documentation that substantial impacts to birds resulted from such netting. As a result, the City's decision to consider the impact of netting from the proposed project potentially significant and to require mitigation measures was both cautious and conservative.
>
> The comment letter, including the letter from the American Bird Conservancy, does not provide any justification for the opinion that the risk to migratory birds due to the construction of the netting would remain significant after mitigation. The commenter indicates that it is their expert opinion. They also cite the expert opinion of Dr. Christine Sheppard of the American Bird Conservancy. Dr. Sheppard indicates that, based on her review of a meta-analysis of studies on this type of device (Barriento et al. 2012), it is her conclusion that wire markers do not address local, smaller species, nor will they warn night-flying migrants. However, the study cited by Dr. Sheppard concludes that wire markers result in a significant reduction in avian mortality at power lines. Similarly, the Avian Power Line Interaction Committee's 2012 *Reducing Avian Collisions with Powers Lines* states that most studies have shown a reduction in collisions and/or an increase in behavioral avoidance at marked lines when compared to unmarked lines. Further, Jenkins et al. (2010) concluded that any sufficiently large line marking device that thickens the appearance of a power line for at least 7.8 inches in length and is placed with at least 16.4 to 32.8 foot spacing is likely to lower collision rates by 50 to 80 percent. The City has taken a conservative approach to the spacing of net markers. Mitigation measure MM BIO-7.1 limits the maximum distance between marking devices, and/or between such marking devices and support poles, to 15 feet. Although such markers are typically used for larger birds, it is the City's opinion that they will also help smaller birds see the netting. The netting is not like glass, completely invisible to birds, and at many angles it is highly visible (based on an assessment of the Topgolf location in Roseville by the City's biological consultant). The diverters were included as mitigation to help birds see what many will already be able to see – that there is netting present.
>
> The commenter writes "The measures outlined are intended to reduce diurnal collisions of large water birds with power lines.... Unfortunately, these products will not address local, smaller species, nor will they warn night-flying migrants." The City included glow-in-the dark diverters in mitigation measure MM BIO-7.1 (both the referenced net marking devices, Mark BM-AG (After Glow) and the FireFlys, glow in the dark) to reduce impacts on night-flying migrants. Nevertheless, the City has revised MM BIO-7.1 to clarify that net marking devices will glow in the dark (refer to *Revisions to the Text of the Initial Study*, below).

The commenter provides no justification for the statement that flight diverters on the netting do not address smaller species. The diverters will make the netting more evident to birds, and if the diverters glow in the dark they will address night-flying migrants. Further, per Christine Sheppard of the American Bird Conservancy, as cited in the San Francisco Planning Department's Standards for Bird-Safe Buildings (2011), nocturnal migrants typically fly at an altitude of approximately 2,000 feet, well above the height of the proposed nets. It is the City's opinion that it is locally flying birds that are most likely to fly at the altitude of the proposed project nets. Although numerous waterbirds are known to congregate at the Don Edwards San Francisco National Wildlife Refuge to the north of the project site, because the area surrounding the proposed project site is heavily urbanized and contains no habitats of high value to estuarine birds using the Don Edwards San Francisco National Wildlife Refuge, it is not expected that large numbers of waterbirds will be flying over or through the project site at altitudes low enough for substantial bird-strike mortality to occur.

In addition to the mitigation required for the proposed netting, the Initial Study also identifies mitigation to reduce the potential for bird strikes on the buildings proposed for the site (MM BIO-6.1). The mitigation requires implementation of bird-safe design features in the proposed buildings.

For these reasons, the mitigation measures identified in the Initial Study are adequate to reduce potential impacts related to bird strikes to a less than significant level.

COMMENT G-20: Light may attract birds

We are concerned with the potential negative impacts of light that this project will impose upon nearby sensitive habitats. The project site is located 100 feet away from the Guadalupe River and about half a mile away from the Don Edwards National Refuge. Due to the close proximity of these sensitive areas, light emitted from Topgolf may have significant negative impacts on birds and wildlife.

Our primary concern is that night-flying migratory birds may become attracted to the light, causing increased collisions with the 170-ft tall netting. (see attached opinion from Dr. Christine Sheppard, American Bird Conservancy).

In accordance with the Alviso Master Plan, new development should be designed "as not to create glare or other negative impacts to nearby sensitive habitats, including baylands, riparian corridors, and other biotic communities". The Topgolf development does not align with the Alviso Master Plan in that it will create significant glare and negative impacts on surrounding sensitive habitats.

RESPONSE G-20: Impacts of the proposed field lighting on biological resources is addressed on page 91 of the Initial Study, which concluded that the project would result in a less than significant impact. The existing driving range facility on the site includes field lighting and netting. Therefore, the lighting and netting proposed by the project would not create a new source of overhead light compared to existing conditions. In fact, the field lighting proposed by the project would reduce the number of light standards on the site, and place them at a lower height than those that currently exist on the site. Currently, there are 10 light standards on the site, with four located behind the existing hitting area facing east, three on top of the southern net poles facing north, and three on top of the northern net poles facing south, all at a height of approximately 90 feet. The proposed project would include a total of six light standards located on top of the proposed Topgolf structure at a height of 64 feet, all facing east, away from the Bay and Guadalupe River. Additionally, the lights would be

directed downward with an aluminum reflector, light hood, and visor to direct light onto the field and reduce the amount of glare and spill light.

COMMENT G-21: Loss of Open Space

Open spaces in the Alviso area are particularly important due to Alviso's proximity to the Don Edwards National Wildlife Refuge and other open space areas such as the burrowing owl preserve of the Water Pollution Control Plant, where the only relatively sizeable population of burrowing owls persists in the South Bay region. Many bird species common to the National Wildlife Refuge and creek corridors utilize the remaining ruderal and open spaces in the Alviso area for upland foraging or roosting.

When the Alviso Specific Plan was adopted, the City Council discussed a goal that, on the large open spaces in Alviso, one-third of the land should remain in open space when they are developed. At the time, Council discussed the Planning Recommendation of a 1 acre/2 acre open space ratio requirement and recommended that the Administration provide Council with information on the percentage of open space achieved at the beginning of the development process to enable Council to determine the maximum open space achievable and if no land is available, Council consider requiring financial mitigation funds in-lieu for purchase and restoration of habitat and removal of illegal fill.

The MND should analyze impacts to open space in Alviso due to the proposed project. We assert that those impacts should be found significant. Mitigation for the impact should be considered, including leaving one-third of the property in open space or preserving alternate open space in the Alviso area, with management of that area designed to maximize benefits to rare plants, wetlands, and Burrowing owls, as well as for the more common species found in the Alviso area.

> **RESPONSE G-21:** The area of the project site proposed for redevelopment is not considered open space. The eastern portion of the project site is developed with a driving range facility, and the western portion is developed with a paved parking area utilized for RV storage. Two areas of the site are currently undeveloped. A 5.8-acre undeveloped area at the far eastern end of the site would remain undeveloped with the proposed project. A three-acre area on the far western end of the site that is currently undeveloped and consists of ruderal grassland would be developed as part of the project. This area consists of a vacant lot that has been fenced off and is regularly disturbed with disking. It is surrounded on all sides by urban development. As discussed in *Section 4.4 Biology* in the Initial Study, this area is not considered valuable habitat for any special-status species. The project would not result in significant impacts related to the loss of open space.

COMMENT G-22: Potential Impacts on Aerial Activity of Emergency Services

The Initial Study fails to analyze the potential impact of the 170' net structure on local, aerial activity of emergency services as may occur in the vicinity of the Project. Helicopters from multiple agencies, commonly fly along SR 237 regarding traffic problems. It is also known that the County Sheriff's Department flies helicopters in the Alviso area to respond to boating problems along Alviso Slough and the South Bay. It is also possible that a flooding or earthquake event could produce a situation involving use of helicopters for emergency evacuation in Alviso. Nothing in the Initial Study shows that any effort was made to evaluate whether or not the height of the nets would impact these services.

We note that in the Hazards Environmental checklist in Section 4.8.2, the Initial Study responds as "No Impact" to: "Would the project: Impair implementation of, or physically interfere with, an adopted emergency response plan or emergency evacuation plan?" (P. 137, question g). In

discussion, in Section 4.8.3, p. 141, we find analysis is limited to "adopted" plans with no evidence of analysis nor consideration of cross-jurisdictional public safety activity in the area.

Further we find that Section 4.14, Public Services, fails to analyze potential interference on the aerial response actions of Public Safety organizations.

In an area where helicopter activity is common, these findings are inadequate and need to be reviewed in full Environmental Impact Report.

> **RESPONSE G-22:** As described on page 134 of the Initial Study, none of the proposed structures on the project site, including the 170-foot high net poles, would exceed the Federal Aviation Regulations (FAR) Part 77 thresholds requiring Federal Aviation Administration (FAA) airspace safety review.
>
> The discussion in Section 4.8.2 of the Initial Study adequately analyzes the project's impacts in relation to the threshold of significance under CEQA, which specifically refers to "adopted" emergency response and emergency evacuation plans. The Initial Study also adequately analyzes the project's impacts to Public Services (Section 4.14), in which the CEQA checklist question asks if a project would "Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services…". In response to both CEQA thresholds identified above, the project would result in less than significant impacts.
>
> Based on the administrative record, there is substantial evidence to conclude that the proposed project will be below the City's threshold for significant impact to emergency services, and there is no substantial evidence to support a fair argument that the proposed project will create a significant impact to emergency services. Based on the conclusions of the Initial Study, a Mitigated Negative Declaration is the appropriate CEQA document for the proposed project.

COMMENT G-23: Our groups have reasonable concerns and have provided substantial evidence that the IS/MND has not adequately evaluated project impacts, and that mitigation measures are not sufficient. This project may impose significant, unavoidable impacts to the environment. We ask the City of San Jose to require an Environmental Impact Report for this Project in order to provide full transparency and in-depth analysis of the issues we have brought up. An EIR is also needed in order to explore alternative locations for the Topgolf@Terra project. We believe that moving the Entertainment Complex part of the project to an area that is not as environmentally sensitive may avoid most of the significant impacts to birds, wildlife and the environment, to the health and well-being of elementary school children, and to the Alviso community.

> **RESPONSE G-23:** As described in Responses G-1 through G-22, the Initial Study adequately analyzes the project's impacts under CEQA, and no substantial evidence has been provided to invalidate the conclusions of the Initial Study. Because the Initial Study did not identify any significant unavoidable impacts, an Environmental Impact Report is not required, and a Mitigated Negative Declaration is appropriate level of CEQA review for the proposed project.

Revisions to the Text of the Initial Study

The following section contains text revisions to the *Topgolf @ Terra Project Initial Study*, dated September 2016.

Underlining depicts text added, while ~~strikeouts~~ depict text deleted.

Page 5: **REPLACE** *Figure 2.0-2* with the attached revised figure.

Page 65: **REVISE** *Table 4.3-4* as shown.

Table 4.3-4: Construction Criteria Pollutant Emissions				
Scenario	**ROG**	**NOx**	**PM_{10} Exhaust**	**$PM_{2.5}$ Exhaust**
Topgolf Entertainment Complex construction emissions (tons)	~~4.46 tons~~ 3.75 tons	~~7.76 tons~~ 10.27 tons	~~0.38 tons~~ 0.52 tons	~~0.35 tons~~ 0.49 tons
Hotel/Retail construction emissions (tons)	~~3.27 tons~~ 2.75 tons	~~6.07 tons~~ 7.05 tons	~~0.28 tons~~ 0.33 tons	~~0.26 tons~~ 0.31 tons
Total construction emissions (tons)	~~7.73 tons~~ 6.50 tons	~~13.83 tons~~ 17.32 tons	~~0.66 tons~~ 0.85 tons	~~0.61 tons~~ 0.80 tons
Average daily emissions (pounds)[1]	~~39.0 lbs.~~ 25.0 lbs.	~~69.8 lbs.~~ 66.6 lbs.	3.3 lbs.	3.1 lbs.
BAAQMD Thresholds (pounds per day)	*54* lbs.	*54* lbs.	*82* lbs.	*54* lbs.
Exceed Threshold?	No	**Yes**	No	No
With Tier 4 Construction Mitigation				
Topgolf Entertainment Complex construction emissions (tons)	~~3.97 tons~~ 3.07 tons	~~2.57 tons~~ 3.02 tons	~~0.06 tons~~ 0.07 tons	~~0.05 tons~~ 0.07 tons
Hotel/Retail construction emissions (tons)	~~2.90 tons~~ 2.30 tons	~~2.31 tons~~ 2.43 tons	~~0.03 tons~~ 0.04 tons	~~0.03 tons~~ 0.04 tons
Total construction emissions (tons)	~~6.87 tons~~ 5.37 tons	~~4.88 tons~~ 5.45 tons	~~0.09 tons~~ 0.11 tons	~~0.08 tons~~ 0.11 tons
Average daily emissions (pounds)[1]	~~34.7 lbs.~~ 20.7 lbs.	~~24.6 lbs.~~ 21.0 lbs.	~~0.5 lbs.~~ 0.4 lbs.	~~0.4 lbs.~~ 0.4 lbs.
BAAQMD Thresholds (pounds per day)	*54* lbs.	*54* lbs.	*82* lbs.	*54* lbs.
Exceed Threshold?	No	No	No	No
Notes: [1]Assumes ~~396~~ 520 workdays.				

Page 65: **REVISE** *Section 4.3.3, Impacts Evaluation*, as shown.

MM AQ-1.1: All diesel-powered construction equipment larger than 50 horsepower and operating on site for more than two (2) continuous days shall meet U.S. EPA NOx and particulate matter emissions standards for Tier 4 engines or equivalent.

Page 67: **REVISE** *Section 4.3.3, Impacts Evaluation*, as shown.

The maximum modeled annual residential diesel particulate matter (DPM) concentration (i.e., from construction exhaust) was ~~0.243~~ 0.208 μg/m^3, which is below the threshold of 0.3 μg/m^3. The maximum computed hazard index (HI) based on this DPM concentration is ~~0.05~~ 0.04, which is below the significance threshold of 1.0. The maximum HI for a school child would be ~~0.02~~ 0.016, which is also below the significance threshold.

Results of the assessment indicate that the maximum increased residential cancer risks would be ~~47.9~~ 63.4 in one million for an infant exposure and ~~0.8~~ 1.1 in one million for an adult exposure. The maximum increased cancer risk for a school child exposure at the George Mayne Elementary School was ~~2.8~~ 3.6 in one million. The maximum residential excess cancer risk would be greater than the significance threshold of 10 in one million.

The maximum-modeled annual $PM_{2.5}$ concentration, which is based on combined exhaust and fugitive dust emissions, was 0.4 μg/m^3, occurring at the residential MEI. The maximum annual $PM_{2.5}$ concentration at the George Mayne Elementary School was ~~0.2~~ 0.1 μg/m^3. The maximum annual $PM_{2.5}$ concentration at the MEI residential receptor location would exceed the significance threshold of 0.3 μg/m^3.

Impact AQ-2: Construction of the proposed project could expose offsite sensitive receptors to substantial risks and hazards related to TACs. **[Significant Impact]**

Mitigation Measures: Implementation of mitigation measures MM AQ-1.1 and MM AQ-1.2, identified above, would reduce construction TAC impacts to a less than significant level. Implementation of Mitigation Measure AQ-1.1 is considered to reduce exhaust emissions by five percent. Implementation of Mitigation Measure AQ-1.2 would further reduce on-site diesel exhaust emissions. This would reduce the cancer risk proportionally, such that the mitigated risk would be ~~less than 3.4~~ 4.7 in one million and the maximum annual $PM_{2.5}$ concentration would be reduced to 0.1 μg/m3. **[Less Than Significant Impact With Mitigation]**

Page 68: **REVISE** *Section 4.3.3, Impacts Evaluation*, as shown.

Cumulative TAC impacts associated with construction of the project were assessed by predicting the combined community risk impacts from the project and nearby sources at the sensitive receptor most affected by project construction. A review of the project area identified traffic on N. First Street and operation of the Midpoint @ 237 (Trammel Crow) project as the only other sources of TAC emissions that could adversely affect the project construction MEIs. No additional stationary sources of TACs (e.g., emergency backup generators or gas stations) were identified within 1,000 feet of the site. All other roadways near the construction MEIs are assumed to

have average daily traffic (ADT) volumes of below 10,000 or below the BAAQMD screening criteria.

For local roadways, BAAQMD has provided a screening calculator to determine if roadways with traffic volumes of over 10,000 vehicles per day may have a significant effect on a proposed project. Based on the cumulative plus project volumes obtained from the project traffic report, and assuming that ADT is approximately ten times the peak hour volume, N. First Street would have an ADT volume of 11,820 in the project area. Using the BAAQMD *Roadway Screening Analysis Calculator* for Santa Clara County for east-west directional roadways and at a distance of approximately 50 feet north of the roadway, estimated cancer risk from N. First Street at the construction MEIs would be 5.0 per million and $PM_{2.5}$ concentration would be 0.1 $\mu g/m^3$. Chronic or acute HI for the roadway would be below 0.03.

A community risk assessment completed for the Midpoint @ 237 project found that incremental residential cancer risk from operation of the project would be 1.4 in one million. Incremental cancer risk at the George Mayne Elementary School would 0.6 in one million. Annual $PM_{2.5}$ concentrations for both residential and school receptors were found to be <0.01 μg/m3.[2]

Therefore, when ~~added to the community risk from construction~~ all cumulative sources are added together, cumulative cancer risk would be ~~52.9~~ 69.8 in one million, ~~and~~ $PM_{2.5}$ concentration would be 0.5 $\mu g/m^3$, and the maximum HI would be 0.08, which would be below the significance thresholds of 100 in one million, ~~and~~ 0.8 $\mu g/m^3$, and 10.0, respectively. **[Less Than Significant Impact]**

Page 84: **REVISE** *Section 4.4.3, Impacts Evaluation*, as shown.

MM BIO-1.2: If a population of Congdon's tarplant is identified in the project impact area, mitigation for loss of individuals shall be conducted. Mitigation shall be achieved by establishing a new population of Congdon's tarplant in the diked brackish marsh and California annual grassland habitats that occur in the basins at the south portion of the site. These naturally-occurring~~This~~ areas ~~shall not be developed by the~~ are located outside of the Project's proposed development area and contain suitable habitat types for establishing a new population. Mitigation shall be a 1:1 ratio (impact:mitigation) of plant establishment on an acreage basis.

Annual monitoring for a period of three years shall include quantitative sampling of the Congdon's population to determine the number of plants that have germinated and set seed. This monitoring shall continue annually for a period of at least three years post construction, or ~~until success criteria have been met; once annual monitoring has documented that~~ when a self-sustaining population of this annual species has been successfully established on site ~~this mitigation measure shall be determined to have been met and the project applicant released from further responsibility~~.

Establishment of the plant population shall be subject to a Habitat Mitigation and Monitoring Plan (HMMP). To ensure the success of mitigation sites required for

[2] Illingworth & Rodkin, Inc. Midpoint at 237 Project – Construction and Operational Health Risk Assessment San Jose, California. February 6, 2014.

compensation of permanent impacts on Congdon's tarplant, the Project proponent shall retain a qualified biologist to prepare an HMMP. The HMMP shall be submitted to the City's Supervising Environmental Planner for review and approval prior to the start of construction. The HMMP shall include, at a minimum, the following information:

- A summary of habitat and species impacts and the proposed mitigation for each element
- A description of the location and boundaries of the mitigation site(s) and description of existing site conditions
- A description of any measures to be undertaken to enhance (e.g., through focused management) the mitigation site for special-status species
- Identification of an adequate funding mechanism for long-term management
- A description of management and maintenance measures intended to maintain and enhance habitat for the target species (e.g., weed control, fencing maintenance)
- A description of habitat and species monitoring measures on the mitigation site, including specific, objective performance criteria, monitoring methods, data analysis, reporting requirements, monitoring schedule, etc. Monitoring will document compliance with each element requiring habitat compensation or management. At a minimum, performance criteria will include a minimum 1:1 mitigation ratio for the number of plants in the impacted population (at least one plant preserved for each plant impacted).
- A contingency plan for mitigation elements that do not meet performance or final success criteria within described periods; the plan will include specific triggers for remediation if performance criteria are not met and a description of the process by which remediation of problems with the mitigation site (e.g., presence of noxious weeds) will occur
- A requirement that the project proponent will be responsible for monitoring the replanted area, as specified in the HMMP, for at least three (3) years post-construction. ~~; during this period a~~Annual reporting ~~will~~shall be provided to the City's Supervising Environmental Planner.

Page 90: **REVISE** *Section 4.4.3, Impacts Evaluation*, as shown.

MM BIO-3.2: If it is not possible to schedule construction activities between September 1 and January 31, a qualified ornithologist shall conduct a preconstruction survey for nesting raptors and other migratory breeding birds within all potential nesting substrates (e.g., trees, shrubs, buildings) onsite ~~trees~~ as well as all ~~trees~~ nesting substrates within 250 feet of the site to identify active bird nests that may be disturbed during project construction.

MM BIO-3.3: If an active nest is found in or close to work areas to be the construction area to be disturbed by these work activities, the ornithologist shall, ~~(~~in

consultation with the California Department of Fish and Wildlife (CDFW), ~~shall~~ designate a construction-free buffer zone (typically 300 feet for raptors and 100 feet for non-raptors) ~~to be established~~ around the nest to ensure that no nests of species protected by the Federal Migratory Bird Treaty Act (MBTA) and California Fish and Game Code will be disturbed during construction activities. The buffer shall remain in place until the breeding season has ended and/or a qualified ornithologist has determined that the young birds have fledged and/or nest is no longer active.

Page 92: **REVISE** *Section 4.4.3, Impacts Evaluation*, as shown.

MM BIO-4.3: Following construction of the proposed project, temporary impact zones, on any disturbed ground that will not be under hardscape, landscaped, or maintained, shall be reseeded with a native seed mixture approved by the Supervising Environmental Planner. Seed mixtures applied for erosion control shall be composed of native species appropriate for the site in order to provide long-term erosion control and slow colonization by invasive nonnatives.

Page 95: **REVISE** *Section 4.4.3, Impacts Evaluation*, as shown.

MM BIO-5.1: The project proponent shall implement Conditions 3 and 12 of the HCP to reduce construction impacts to streams, wetlands, and riparian habitat. These HCP conditions require avoidance of wetlands and require construction setbacks for streams and riparian area during construction.

Condition 3. This condition consists of avoidance and minimization measures outlined in Table 6-2 of the Habitat Plan. All personnel working within or adjacent to the stream setback (i.e., those people operating ground-disturbing equipment) will be trained by a qualified biologist in these avoidance and minimization measures, in the permit obligations under ~~USAVE~~U.S. Army Corps of Engineers (USACE), and permit obligations under the HCP. Training materials shall be submitted to the City's Supervising Environmental Planner upon request.

Condition 12. The following conditions shall be printed on all plans and contract documents for the Project, and implemented by the project proponent or contractors during construction:

- All wetlands and ponds to be avoided by covered activities shall be temporarily staked in the field by a qualified biologist to ensure that construction equipment and personnel avoid these features.
- Fencing shall be erected along the outer edge of the project area, between the project area and a wetland or pond.
- Appropriate erosion control measures (e.g., fiber rolls, filter fences, vegetative buffer strips) shall be used on site to reduce siltation and runoff of contaminants into wetlands, ponds, streams, or riparian woodland/scrub. Filter fences and mesh shall be of material that will not trap reptiles and

amphibians. Erosion control blankets shall be used as a last resort because of their tendency to biodegrade slowly and trap reptiles and amphibians.

- Erosion-control measures shall be placed between the wetland or pond and the outer edge of the project site. Fiber rolls used for erosion control shall be certified as free of noxious weed seed.
- Vehicles and equipment shall be parked on pavement, existing roads, and previously disturbed areas.
- No construction or maintenance vehicles shall be refueled within 200 feet of avoided wetlands and ponds unless a bermed and lined refueling area is constructed and hazardous material absorbent pads are available in the event of a spill.
- All organic matter shall be removed from nets, traps, boots, vehicle tires, and all other surfaces that have come into contact with ponds, wetlands, or potentially contaminated sediments. Items should be rinsed with clean water before leaving each site.
- Used cleaning materials (e.g., liquids) shall be disposed of safely, and if necessary, taken off site for proper disposal. Used disposable gloves should be retained for safe disposal in sealed bags.

Page 97: **REVISE** *Section 4.4.3, Impacts Evaluation*, as shown.

MM BIO-6.1: The project proponent shall incorporate the following bird-safe features into the building design, in accordance with City Council Policy 6-34, Riparian Corridor Protection and Bird-Safe Design to the satisfaction of the Director of PBCE:

- Façade Treatments. No more than 10 percent of the surface area of façades between the ground and 60 feet above ground shall have untreated glazing. Examples of bird-friendly glazing treatments include the use of opaque glass, the covering of clear glass surface with patterns, the use of paned glass with fenestration patterns, and the use of external screens over non-reflective glass.
- Funneling of flight paths. The design of the buildings shall avoid the funneling (i.e., directing) of flight paths along buildings or trees towards a building façade.
- Skyways, walkways, or glass walls. Glass skyways or walkways and freestanding glass walls shall not be incorporated into the buildings' design.

Page 100: **REVISE** *Section 4.4.3, Impacts Evaluation*, as shown.

MM BIO-7.1: Net marking devices, such as FireFlys or BirdMark BM-AG that glow in the dark, shall be placed along all sections of the netting perimeter rope and rib lines to form vertical rows of flight diverters in the center of each area of netting

between support poles. The maximum distance between such marking devices, and/or between such marking devices and support poles, shall be 15 feet. **[Less Than Significant Impact With Mitigation]**

Page 162: **REVISE** *Section 4.12.1.1, Existing Noise Conditions,* as shown.

A noise monitoring survey was completed at various locations near the site on Wednesday December 16, ~~2016~~ 2015 and Thursday December 17, ~~2016~~ 2015.

Page 238: **REVISE** *Section 4.18.2.3, Cumulative Noise Impacts,* as shown.

Operational noise generated by the project would be more than 10 dBA Ldn below existing ambient noise levels at the nearest sensitive receptors (refer to Table 4.12-4). A difference of nine dB or less between a noise source and existing ambient noise levels that are higher than the noise source is required in order for the noise source to increase ambient noise levels by one dB.[3] Operational noise from the project, therefore, would not increase existing average ambient noise levels at the nearest sensitive receptors. As a result, ~~T~~the primary way the project would contribute to cumulative noise impacts is through an increase in traffic noise on surrounding roadways. As discussed in Section 4.12 Noise, traffic trips associated with the proposed project would increase ambient noise levels on the adjacent residential streets. The proposed project, combined with other pending and approved projects in the immediate area would further increase ambient noise levels over existing conditions. It should be noted that the Midpoint at 237 project, otherwise known as the Trammel Crow project, is of particular concern to local residents for its effect on cumulative noise levels at George Mayne Elementary School. A noise analysis completed for the Trammel Crow project determined that average project-generated noise levels at the school would be 50 dB Ldn, which is more than 10 dB below existing ambient noise levels. Additionally, traffic generated by the Trammel Crow project is included in the cumulative traffic volumes utilized in the cumulative noise analysis for the proposed project. Please note that truck routes established for the Trammel Crow project require trucks accessing the facility to use Disk Drive and Nortech Parkway, meaning that trucks from this facility would not pass by the school.

A significant cumulative traffic noise impact would be identified if existing sensitive receptors would be exposed to substantial cumulative traffic noise levels and if the project would make a "cumulatively considerable" contribution to the overall traffic noise level increase. A substantial increase would occur if: a) the noise level increase is five dBA Ldn or greater, where the resulting future noise level is below what is considered "normally acceptable" for the affected land use in the General Plan, or b) the noise level increase is three dBA Ldn or greater, where the resulting future noise level is higher than what is considered "normally acceptable" in the General Plan. Sensitive receptors in the project vicinity include residential uses, a school, a library, and a community center. The City considers "normally acceptable" exterior noise levels to be 60 dBA Ldn for residential and institutional uses (such as schools,

[3] Michael Thill, Illingworth & Rodkin, Inc. Personal Communication. August 15, 2016.

libraries, and community centers), and 65 dBA Ldn for outdoor sports and recreation, neighborhood parks, and playgrounds. The City's General Plan states that for sites with exterior noise levels of 60 dBA Ldn or more, such as the sensitive receptors in the project vicinity, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that the 45 dBA Ldn interior noise standard would be met.

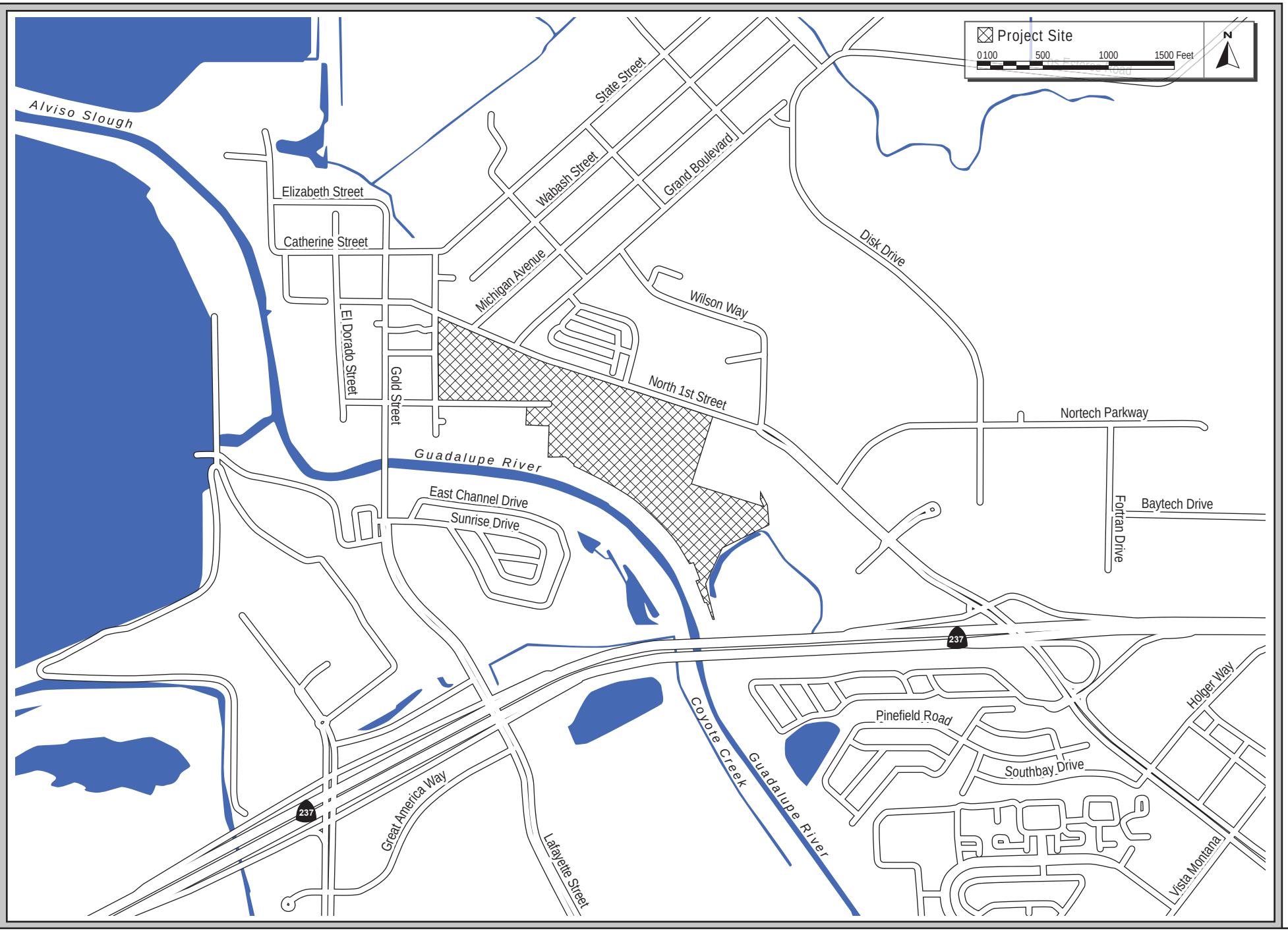
A detailed analysis of cumulative traffic noise levels, both with and without the project, is provided in Appendix H. The ~~two~~ three roadway segments to which the project would contribute the most traffic noise under cumulative conditions are on N. First Street between Trinity Park Drive and Nortech Parkway, on N. Taylor Street between Gold Street and Liberty Street, and on Nortech Parkway between N. First Street and Disk Drive. Since no sensitive receptors are located along the frontage of Nortech Parkway, no further discussion of cumulative traffic noise along this segment is warranted. ~~The project would increase cumulative traffic noise levels on along those roadway segments by 1.9 and 1.8 dBA Ldn, respectively, which are both below the significance threshold of three dBA Ldn.~~

On N. Taylor Street between Gold Street and Liberty Street, sensitive receptors along the roadway frontage consist of single-family residences. The cumulative plus project traffic noise level on this roadway segment is estimated to be 67 dB Ldn at a distance of 50 feet from the center of the roadway. As discussed previously, standard construction practices reduce residential interior noise levels by 25 dB Ldn compared to exterior noise levels. As a result, interior spaces in residences along this roadway segment would not experience noise levels in excess of the City's 45 dB Ldn standard. Sensitive receptors along this roadway segment, therefore, would not be exposed to a significant cumulative traffic noise impact.

On N. First Street between Trinity Park Drive and Nortech Parkway, the existing sensitive receptors along the roadway segment consist of a school, a library, and a community center. Cumulative plus project traffic noise levels along this roadway segment are estimated to be 68.1 dB Ldn at a distance of 50 feet from the center of the roadway. It should be noted that the building facades of these uses are located at distances of at least 85 feet from the center of the roadway and, therefore, actual noise levels at these receptors would be lower than 68.1 dB Ldn. Utilizing the same calculation methodology, traffic noise levels were estimated at distances further than 50 feet from the center of the roadway to more accurately determine noise levels at the sensitive uses. At a distance of 85 feet, existing traffic noise levels are estimated to be 60.5 dB Ldn, and cumulative plus project traffic noise levels are estimated to be 64.6 dB Ldn. Using a conservative assumption of 20 dB Ldn in noise attenuation achieved by standard construction practices for institutional uses such as libraries, community centers, and schools, interior noise levels in these uses would be reduced to at least 44.6 dB Ldn in the areas closest to the roadway, resulting in a less than significant cumulative traffic noise impact to the interior spaces of these land uses. To analyze the cumulative traffic noise levels experienced by sensitive receptors utilizing outdoor common recreation areas associated with these land uses, cumulative plus project traffic noise levels were calculated at the closest common outdoor use areas to the roadway. A communal gardening area is located roughly 85

feet from the center of the roadway, and a children's playground is located roughly 100 feet from the center of the roadway. As mentioned previously, at a distance of 85 feet, existing traffic noise levels are estimated to be 60.5 dB Ldn, and cumulative plus project traffic noise levels are estimated to be 64.6 dB Ldn, which is below the City's "normally acceptable" noise level of 65 dB Ldn for outdoor sports and recreation, neighborhood parks, and playgrounds. Similarly, existing traffic noise levels are estimated to be 59.5 dB Ldn at a distance of 100 feet, and cumulative plus project traffic noise levels are estimated to be 63.6. Both locations would experience an increase of 4.1 dB Ldn under cumulative plus project conditions, which is below the five dB Ldn threshold and would be considered a less than significant cumulative impact.

The project, therefore, would not result in or make a considerable contribution to significant cumulative noise impacts. **[Less than Significant Impact]**



VICINITY MAP (REVISED)

FIGURE 2.0-2

Attachment A

Copies of Comment Letters Received on the Initial Study

From: Michael McWalters <mmcwalters@earthlink.net>
Sent: Sunday, September 25, 2016 12:08 PM
To: Berry, Whitney
Subject: Alviso Top Golf Part 2

Hello Whitney,
Are you the correct person to write my concerns to? Here is a list of my concerns.

I live in the manufactured home park (labeled 2) for sound and noise. I've read many things regarding Top Golf, all of them have complaints of NOISE. Top Golf in Alexandria, SLC, Kansas City and Roseville have huge complaints regarding noise. The one is Austin sells $525,000 a month in alcohol. That is a ton of money, which this site has a new land owner and most likely will close as the new land owner wants to redevelop the land. Alexandria will most likely close and be moved as the noise is a concern to many and the land owner will not renew the lease with top golf. How will Top Golf and the City of San Jose make sure that I'm not going waking up by a live band or loud music at 11pm?

Since Mayor Sam Liccardo sits on the VTA board I would expect that only 200 parking spaces should be available and EVERYONE ELSE CAN TAKE THE VTA AND BUS to attend Top Golf. That's what your department is striving for. I am opposed to 1400 parking places, its obnoxious. Take the bus or light rail. Planning rams this car issue in apartments and now it's time to move it to big business.

Traffic is also a concern, how will they manage DRUNK PEOPLE and DRUNK DRIVERS? Let's face it, this is a NIGHTCLUB/BAR and ENTERTAINMENT CENTER where alcohol is served and people DO AND WILL get drunk. Will there be additional police in our area to address the issue of DUI? In addition Mayor Sam Liccardo was opposed to a girly bar for executives in downtown San Jose. He stated that it was too close to schools. Let's not forget that San Jose has CLOSED MANY BARS in downtown over the past decade. One being SJ Live, for drunken behavior and fights broke out. Isn't it odd that San Jose no longer wants BIG BAR in downtown so you will toss them out in Alviso. Where a limited number of complaints will come in. If this is built SAN JOSE WILL DIVIDE US. This is better suited for the Coyote Valley.

Our manufactured home park currently receives a MAX OF 5.0 MB/S FROM AT&T INTERNET. How pathetic is that in Silicon Valley? When this object is built, I am 100 percent sure that all utility, phone and other lines will be buried. We are currently 600 feet from this site. I know fiber optic is currently in Alviso, but AT&T will not provide us with faster internet. Will this company deliver fiber optic to our park, if not we will than we will be the only area in Alviso with slow DSL service. I feel discriminated against. Who can I talk to regarding this issue? I can even give the owner of our park to this person.

My last concern. I am very disappointed that I haven't received any information regarding this proposed project or any paperwork from the planning department. I've received stuff in the mail from SJ Planning Dept. regarding the Trommwell Crow and the other developer, but NO PAPERWORK WAS SENT TO ME REGARDING THIS PROJECT. I've also left a message with District 4 Fred Buzo regarding my disappointment.

Sincerely,

Michael McWalters
2052 Gold Street #36
Alviso, Ca 95002
408-262-4406
408-209-9814

From: Betsy Stern <betsysternmusic@gmail.com>
Sent: Tuesday, October 11, 2016 5:01 PM
To: Berry, Whitney
Subject: Response to Mitigated Negative Declaration for TopGolf at Terra Project

Dear Ms. Berry,

I am responding to the Mitigated Negative Declaration for TopGolf at Terra Project.

In reference to Appendix I, 2.6.4 NEIGHBORHOOD STREETS, where is the mitigation that will protect the pedestrians (especially the children and parents) going to and from George Mayne Elementary School while, in addition to increased traffic due to the physical presence of TopGolf, TopGolf will be serving alcohol from 9:00 am until 2:00 am, and this will have a direct impact on the increase in traffic accidents. Although the sale of alcohol itself doesn't fit into an MND, the impact of drunk driving does -- to the environment and to people.

The rezoning of this property to allow for an entertainment center that serves alcohol from 9:00 am to 2:00 am and is directly across the street from an elementary school is absolutely unconscionable.

Yours sincerely,

Betsy Stern

County of Santa Clara

Parks and Recreation Department

298 Garden Hill Drive
Los Gatos, California 95032-7669
(408) 355-2200 FAX 355-2290
Reservations (408) 355-2201
www.parkhere.org

17 October 2016

Whitney Berry
Department of Planning, Building, and Code Enforcement
City of San Jose
200 East Santa Clara Street, 3rd Floor Tower
San Jose, CA 95113

Subject: PDC16-013, GPT16-001 Topgolf at Terra Project

The County of Santa Clara Parks and Recreation Department (the Department) has reviewed the proposed Topgolf at Terra Project. The proposed project includes changing the Planned Development Rezoning from the CIC Combined Industrial Commercial and R-M Multiple Residence Residential Zoning Districts to the CIC (PD) Planned Development Zoning District (PDC16-013). In addition to this amendment, the proposed project would amend the Alviso Specific Plan development standards for building heights (GPT16-001).

The developed Regional Trail S3 (*Guadalupe Sub-Regional Trail*) spans west of the project site, while a proposed San Francisco Bay Trail with an on-street bike route spans north of the project site. The approval of the proposed land use designation change and amendment to the Alviso Specific Plan will not adversely impact the existing adjacent recreational and commuter trails within the *Countrywide Trails Master Plan.*

PDC16-013 and GPT16-001 change does not impact the Trails Element of the Parks and Recreation Chapter of the 1995 General Plan. The Department has no further comments.

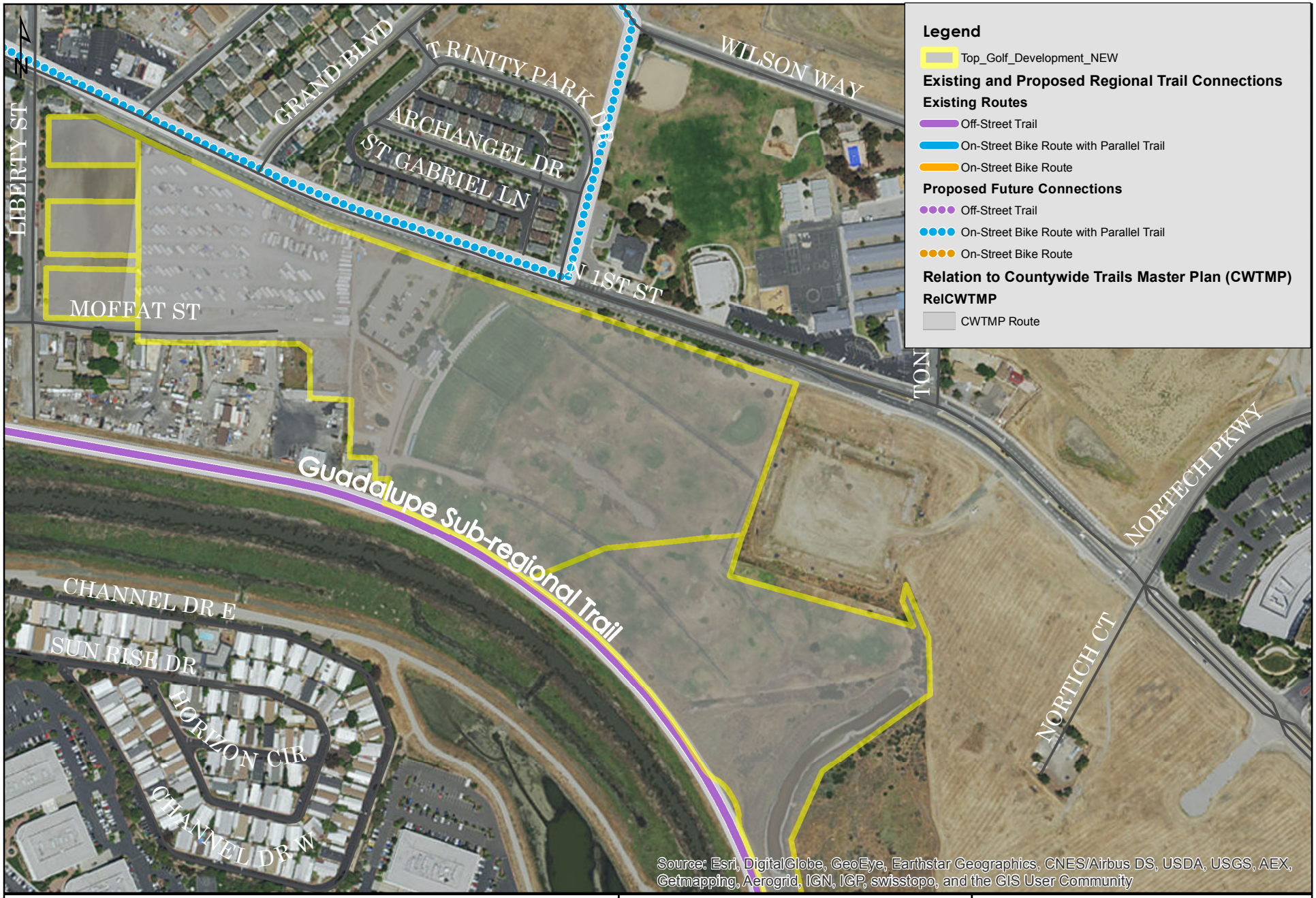
The Recreation Department appreciates the opportunity to provide comments. If you should have any questions or concerns, please contact me, commercial 408.355.2228 or by email Cherise.Orange@prk.sccgov.org.

Sincerely,

Cherise Orange
Cherise Orange
Associate Planner

Board of Supervisors: Mike Wasserman, Dave Cortese, Ken Yeager, S. Joseph Simitian, Cindy Chavez

County Executive: Jeffrey V. Smith



SANTA CLARA COUNTY PARKS

This map generated by the County of Santa Clara Department of Parks and Recreation. The GIS files were compiled from various sources. While deemed reliable, the Department assumes no liability.

Title: Topgolf @ Terra Project	Comments: No impact to CTMP	
Date: 17 Oct 2016	Created By: C Orange	Scale: 0 0.0125 0.025 0.05 Miles

DEPARTMENT OF TRANSPORTATION
DISTRICT 4
P.O. BOX 23660
OAKLAND, CA 94623-0660
PHONE (510) 286-5528
FAX (510) 286-5559
TTY 711
www.dot.ca.gov

Serious Drought.
Help save water!

October 17, 2016

04-SCL-2016-00049
SCL237216
SCL/237/PM R6.5
SCH# 2016092036

Ms. Whitney Berry
Department of Planning
City of San Jose
200 E. Santa Clara Street, Tower 3
San Jose, CA 95113

Dear Ms. Berry:

Terra @ Topgolf Project – Mitigated Negative Declaration

Thank you for continuing to include the California Department of Transportation (Caltrans) in the environmental review process for the above-referenced project. In tandem with the Metropolitan Transportation Commission's (MTC) Sustainable Communities Strategy (SCS), Caltrans new mission signals a modernization of our approach to evaluating and mitigating impacts to the State Transportation Network (STN). We aim to reduce vehicle miles traveled (VMT) by tripling bicycle and doubling both pedestrian and transit travel by 2020. Our comments are based on the Mitigated Negative Declaration (MND). Please also refer to the previous comment letter, dated January 19, 2016, on this project and incorporated herein.

Project Understanding
The proposed project is located immediately adjacent to the north of State Route (SR) 237, on the east side of the Guadalupe River, and south of N. 1st Street. It would replace Pin High Golf Center, an existing driving range and golf facility located on the eastern portion of the site at 4701 N. 1st Street, as well as remove a recreational vehicle storage area located on the site's western portion. The proposed project will consist of the following:

- A 13.5-acre Topgolf entertainment complex in the southern portion of site, which would comprise of 125 hitting bays, an outdoor field enclosed by netting, and a 3-story structure with a full-service restaurant, a bar, lounges, corporate/event meeting space, and a family entertainment area. Additionally, these Topgolf facilities are anticipated to be open as late as 2:00 AM and would be supported by an adjacent 460-space paved parking lot.
- A 200-room hotel spanning 6.8 acres on the western portion of the site.
- A retail component consisting of five structures totaling 100,000 square feet (or 100 KSF).

- 5.8 acres of undeveloped land on the southeast corner of the project site would remain undeveloped.

Lead Agency
As the lead agency, the City of San Jose (City) is responsible for all project mitigation, including any needed improvements to the STN. The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures.

Traffic Impacts
1. N. 1st Street/SR 237 Overpass: The MND states that the project will add a third northbound left-turn lane from N. 1st Street onto the westbound (WB) SR 237 on-ramp. The on-ramp should also be widened, so it can provide enough storage on the SR 237 on-ramp. The project should provide analysis for the above operation for Caltrans review and comments.

2. Ramp Capacity: A ramp-capacity analysis should be performed on the Great America Parkway/SR 237 on-ramp for both the eastbound (EB) and WB side of SR 237. If the queue on these ramps back up onto the City streets, then mitigation is necessary to widen the ramps.

3. Queue Analysis: Please provide the 95th percentile queue analysis for the following intersections:

   - Great America Parkway/SR 237 WB off-ramp.
   - Great America Parkway/SR 237 EB off-ramp.
   - Great America Parkway/Gold Street Connector.
   - N. 1st Street/SR 237 WB off-ramp.
   - N. 1st Street/SR 237 EB off-ramp.
   - N. 1st Street/Hoglar Way.

   If the findings of the analysis result in queues that extend onto the freeway that extend beyond the through lane storage between intersections or left-turn pocket storage, then the project should fully mitigate these impacts.

4. Freeway Segment Analysis: The 2,300 vehicle per hour per lane (vhl) capacity stated in the report for Freeway Segment analysis is too high, based on passenger car equivalent volume. If this capacity is used, then all of the count volumes need to be adjusted to passenger car equivalent volumes.

5. Figure 2.0-2 Vicinity Map: The Vicinity Map of the Initial Study Report has SR 237 mislabeled as SR 87. Please correct the Figure to accurately depict the State facility as SR 237.

Vehicle Trip Reduction
Transportation Demand Management (TDM) programs should be documented with annual monitoring reports by an onsite TDM coordinator to demonstrate effectiveness. Suggested TDM

strategies include working with the Santa Clara Valley Transportation Authority (VTA) to decrease headway times and improve way-finding on bus lines to provide a better connection between the project, the Great America Station, and regional destinations and providing:

- Membership in a transportation management association.
- Transit subsidies and/or EcoPasses to all employees.
- Ten percent vehicle parking reduction.
- Transit and trip planning resources.
- Carpool and vanpool ride-matching support.
- Carpool and clean-fuel parking spaces.
- Secured bicycle storage facilities.
- Bicycles for employee uses to access nearby destinations.
- Showers, changing rooms and clothing lockers.
- Fix-it bicycle repair station(s).
- Transportation and commute information kiosk.
- Outdoor patios, outdoor areas, furniture, pedestrian pathways, picnic and recreational areas.
- Nearby walkable amenities.
- Kick-off commuter event at full occupancy.
- Employee transportation coordinator.
- Emergency Ride Home program.
- Bicycle route mapping resources and bicycle parking incentives.

Please refer to "Reforming Parking Policies to Support Smart Growth," a MTC study funded by Caltrans, for sample parking ratios and strategies that support compact growth. Reducing parking supply can encourage active forms of transportation, reduce regional VMT, and lessen future traffic impacts on SR 237 and other nearby State facilities. These smart growth approaches are consistent with the MTC's Regional Transportation Plan (RTP)/SCS goals and would meet Caltrans Strategic Management Plan.

Traffic Impact Fees
Given the project's contribution to area traffic and its proximity to SR 237, the project should contribute fair share traffic impact fees toward the Caltrans sponsored planned construction of the auxiliary lanes on both EB and WB sides of SR 237 between the Zanker Road interchange and the N. 1st Street interchange. Also, the project should contribute to the SR 237 Express Lanes Project. These contributions would be used to lessen future traffic congestion and improve transit in the project vicinity.

Voluntary Contribution Program
We encourage the City to participate in the VTA's voluntary contribution program and plan for the impact of future growth on the regional transportation system. Contributions by the City funding regional transportation programs would improve the transportation system by reducing congestion and improving mobility on major roadways throughout the San Francisco Bay Area.

Bridges, Trestles, Culverts and Other Structures in Riparian Environments
Some project level activities may affect riparian flow patterns upstream of bridges, trestles, culverts or other structures for which Caltrans holds responsibility. Please ensure your project level environmental documents include hydrological studies to determine whether such impacts will occur, and to identify appropriate mitigation measures.

Habitat Restoration and Management
Project level activities related to habitat restoration and management should be done in coordination with local and regional Habitat Conservation Plans, and with Caltrans where our programs share stewardship responsibilities for habitats, species and/or migration routes.

Sea Level Rise
The effects of sea level rise may have impacts on transportation facilities located in the project area. Executive Order (EO) S-13-08 directs State agencies to plan for potential impacts by considering a range of sea level rise scenarios for the years 2050 and 2100. Higher water levels may increase erosion rates, change environmental characteristics that affect material durability, lead to increased groundwater levels and change sediment movement along shores and at estuaries and river mouths, as well as affect soil pore pressure at dikes and levees on which transportation facilities are constructed. All these factors must be addressed through geotechnical and hydrological studies conducted in coordination with Caltrans.

Encroachment Permit
Please be advised that any work, staging, or traffic control that encroaches onto the State right-of-way (ROW) requires an encroachment permit that is issued by Caltrans. To apply, a completed encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating State ROW must be submitted to: David Salladay, District Office Chief, Office of Permits, California Department of Transportation, District 4, P.O. Box 23660, Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. See this website for more information: www.dot.ca.gov/hq/traffops/developserv/permits.

Should you have any questions regarding this letter, please contact Brian Ashurst at (510) 286-5505 or brian.ashurst@dot.ca.gov.

Sincerely,

Lisa Carboni

for PATRICIA MAURICE
District Branch Chief
Local Development - Intergovernmental Review

c: Scott Morgan, State Clearinghouse
Robert Swierk, Santa Clara Valley Transportation Authority (VTA) – electronic copy

m | r | wolfe
& associates, p.c.
attorneys-at-law

October 17, 2016

By E-mail
Acknowledgement of Receipt Requested

Whitney Berry, Environmental Project Manager
Department of Planning, Building and Code Enforcement
City of San José
200 E. Santa Clara Street
San José, CA 95113
Email: Whitney.Berry@sanjoseca.gov

Re: Proposed Mitigated Negative Declaration for Topgolf @ Terra Project; File No. GPT16-001

Dear Ms. Berry:

Please accept the following comments on the above-referenced mitigated negative declaration, submitted on behalf of Organizacion Comunidad de Alviso ("OCDA"). OCDA is an unincorporated association of residents, citizens, property owners, taxpayers, and electors residing in the Alviso community of San José, who will be directly affected by any adverse environmental impacts that the Topgolf project ("Project") may generate.

We have reviewed the initial study and proposed mitigated negative declaration ("IS/MND") together with its various technical appendices. As explained below, the City's proposed reliance on a MND for this large-scale retail/hotel/recreational project in lieu of a full environmental impact report ("EIR") is improper. Evidence contained in (or missing from) the IS/MND shows that the Project – the first of its kind in the City -- may have one or more significant environmental impacts notwithstanding the mitigation measures identified in the MND. Under these circumstances the California Environmental Quality Act ("CEQA") requires the City to prepare and circulate an EIR before it may lawfully approve the Project.

I. Traffic Impacts

The Transportation Impact Analysis ("TIA") appended to the IS/MND states that existing (i.e., baseline) traffic conditions were based on traffic counts obtained from the City. Although most of the counts were taken in 2015 or 2016, some are as old as 2013 (*see* pp. 208 - 211 of the Appendix I PDF comprising counts for North First and Tasman). Other counts date from 2014 (*see* Appx I PDF pages 257-258; 260 -261; 263-266, comprising respectively counts of Great America Parkway with SR 237 westbound ramps, Great America Parkway with eastbound SR 237 ramps and Vista Montana with West Tasman). Still other count data is of indeterminate age – 2014 or older (pp. 178, 183, 228, 259, and 262, comprising respectively data for the key intersections of N. First with SR 237 westbound ramps, N. First with SR 237 eastbound ramps, N. First with Montague Expressway, Great America with SR 237 westbound ramps and Great America with SR 237 eastbound ramps; dates on these sheets are dates on which data was entered into data base or extracted from data base; actual count date is indeterminately older).

The TIA should have used growth factors to update older count data to approximate current levels. No such adjustment is documented. As the City should aware, North San Jose has seen substantial new development in recent years, and reasonable growth factor adjustments (or new counts) are thus essential to fair representation of existing conditions in this area. It is also noteworthy that Levi's Stadium, which has major effects on weekday as well as weekend traffic in the area, did not open for events until July, 2014. If the existing conditions data base is understated, the analysis is skewed to minimize disclosure of project traffic impacts. Please circulate a revised TIA that reflects current traffic count data, or growth-adjusted earlier data before taking any action to approve the Project.

The TIA's trip generation analysis, documented in Appendix I, Table 10, used the average trip generation rate for shopping centers from ITE *Trip Generation, 9th Edition* to estimate the gross trip generation (trip generation before reductions for internalization and passerby attraction) for the Project's retail component. However, trip generation varies by shopping center size with very large centers having lower than average generation per square footage, small ones having greater than average generation per square foot. Because of this, the ITE document advises use of the regression equation provided in the document rather than the average rate. The retail floor area in the Topgolf Project falls in the area where actual generation by the regression equation is greater than the average rate. Please update the trip generation analysis accordingly.

The TIA's trip generation analysis assumes that 25 percent of the daily and PM peak trips to the Project's retail component would be attracted from existing

traffic passing the site. While this is ordinarily a conventional assumption, it is inappropriate with respect to this Project for two reasons. First, the limited amount of traffic passing the site makes attracting 25 percent of the Project's retail traffic from regular passers-by unsustainable. Second, the retail to be developed on the site is unlikely to be attractive to passers-by given the socioeconomics of the local community who comprise the passerby traffic.

The TIA reports that under the original assumption of 117,000 square feet of retail space, the Project was found to cause a significant impact on a freeway segment. After reducing the retail component by 7,000 square feet, the TIA finds a reduction in overall PM peak generation of about 20 net trips (after discounting for internalization and passers-by), thereby avoiding the freeway impact. Had the TIA properly accounted for the gross PM peak retail trip generation and for realistic passer-by attraction, the result would have been substantially more trips generated per 1,000 square feet, such that the removal of just 7,000 square feet would not eliminate the freeway impact.

The TIA also indicates that the Project could add 21 to 28 percent to traffic on Gold Street. The Project traffic assignment on Appendix I, Figure 8 shows the project adding 136 trips to Gold Street in the PM peak, which is a 20.4 percent increase in the existing Gold Street PM peak traffic of 666 shown on Appendix I, Figure 6. But if the Project trip distribution route information displayed on Appendix I, Figure 7 is combined with the project trip generation information contained on Appendix I, Table 10, Project trips could add some 32 percent to traffic on Gold Street. And if the gross retail trip generation and passer-by attraction had been properly estimated as detailed in the points above, the percent increase on Gold would be even greater.

The TIA also includes an analysis of Project impacts on Alviso neighborhood streets, finding that the Project would increase average daily trips on Gold Street at Moffatt Street by 21 percent, and on North Taylor Street between Gold and Liberty Streets by 28 percent. The TIA then identifies various "potential transportation improvements." The listed improvements, which include installation of bulb-outs, speed feedback signs, roundabouts, raised crosswalks and the like, are not identified as mitigation measures in the IS itself. The TIA in essence has found potentially significant traffic impacts on Alviso neighborhood streets and recommended mitigation measures for them, that the IS/MND has failed to disclose. At a minimum, the IS/MND should be updated to specify these measures as binding mitigation measures that the Project applicant and/or the City will be required to implement if the Project is ultimately approved.

In sum, the City should correct the foregoing flaws and inconsistencies in a revised TIA circulated for further public review and comment.

II. Air Quality Impacts

The Project uses CalEEMod to calculate Project emissions. The model appears to rely on unsubstantiated input parameters to estimate Project emissions. For example, the CalEEMod output files for the Hotel/Retail portion of the Project model the parking lot with 178 spaces, but then assigned a lot acreage of zero to this land use (Appendix A, p. 55). Meanwhile, according to figures presented in the IS/MND itself, the surface parking lots are in fact a part of the total lot acreage (IS/MND, p. 13, p. 39). As such, the parking lot land use should have an acreage assigned to it in the CalEEMod model. By failing to include this, pollutant emissions, such as fugitive dust and VOCs, from grading and asphalt paving have been underestimated. Please correct this omission in a revised initial study.

The IS/MND finds a potentially significant air quality impact from emissions of NOx during Project construction. (IS/MND p. 65.) It then claims this impact would be reduced to a less than significant level with mitigation measure MM AQ-1.1, which provides: "[a]ll diesel-powered construction equipment larger than 50 horsepower and operating on site for more than two (2) continuous days shall meet U.S. EPA particulate matter emissions standards for Tier 4 engines or equivalent" (IS/MND, p. 65). The IS/MND does not, however, explain or document the feasibility of this mitigation measure. The assumption that a combined total of 75 pieces of construction equipment for both the TopGolf Complex and Hotel/Retail components of this Project will be equipped with Tier 4 engines is dubious, given that current regulations do not require construction fleets to consist of solely Tier 4 equipment, and that retrofitting older equipment with Tier 4 engines is extremely expensive. Please explain how the City plans to enforce this mitigation measure.

The IS/MND calculated average daily construction emissions by averaging annual emissions over 396 workdays. (Table 4.3-4, IS/MND, p. 65). This averaging period appears to be based on the CalEEMod default schedule used to model the TopGolf Complex. At the same time, construction of the Retail/Hotel component of the Project was done using a Project-specific construction schedule provided by the applicant, which assumes construction over 300 work days. However, the annual emissions from both the TopGolf Complex and the Retail/Hotel are spread over a 396 day averaging period instead of using a 396 day averaging period for the TopGolf Complex and a 300 day averaging period for the Hotel Retail Component, and adding the average daily emissions with each other. By using a larger averaging period to estimate the Retail/Hotel average daily emissions, the Project's average daily

construction emissions are underestimated. Please address this inconsistency in a revised Air Quality analysis.

III. Health Impacts from Diesel Exhaust Emissions

The IS/MND includes a health risk assessment ("HRA") in Appendix A for exposing nearby sensitive receptors to hazardous pollutant emissions during Project construction. Specifically, the ISCST3 dispersion model was used to predict concentrations of diesel particulate matter (DPM) and PM2.5 at affected sensitive receptor locations. The ISCST3 output files do not appear to have been provided, however. This makes it impossible for the public to verify the accuracy or legitimacy of the various assumptions that the dispersion model relied upon. Because the public is entitled to review and comment upon all technical information relied upon in the IS/MND (CEQA Guidelines § 15072(g)(4)), please circulate the ISCST3 for a minimum 20-day review period before any action is taken to approve the Project.

The IS/MND does not include a HRA for the Project's operational phase. Diesel-powered delivery truck trips associated with the hotel and retail land uses of the Project will undoubtedly produce significant quantities of DPM emissions, exposing nearby sensitive receptors in Alviso to a potentially significant direct and/or cumulative health risk. The City should prepare and circulate a HRA that evaluates the Project's individual and cumulative operational health risks prior to taking action to approve the Project.

IV. Noise Impacts

The Noise Assessment appended to IS/MND does not appear to have evaluated the Project's cumulative traffic noise impacts in the manner required by CEQA. Under CEQA, a legally adequate cumulative impact analysis requires an agency first to determine whether will be a significant cumulative noise impact from the Project in combination with other past, present, and future projects in the vicinity, i.e., whether all relevant projects together will generate noise exceeding the City's noise standards at the affected locations. *See* CEQA Guidelines, § 15130; *Communities for a Better Environment v. California Resources Agency* (2002) 103 Cal.App.4th 98. If the agency in fact finds a significant cumulative impact, it must then *separately* determine whether the project's contribution to that impact is "cumulatively considerable." *Id.* The IS/MND's Noise Assessment does not adhere to this mandatory two-step approach.

We would note that the Noise Assessment indicates that traffic noise levels at 7 affected roadway segments already exceed the City's residential noise standard of 60 dB, and will continue to do so with the Project. This suggest there is already a

significant cumulative noise impact, thus triggering a duty to ascertain, using specific significance thresholds, whether the Project's contribution to it in the future is cumulatively considerable. The City should prepare and circulate a legally adequate cumulative traffic noise analysis before taking any action to approve the Project.

V. Conclusion

Under CEQA, an agency may rely on a negative declaration or mitigated negative declaration only if there is no substantial evidence whatsoever that a project may have a significant environmental impact. CEQA Guidelines, § 15064(f)(3). While a fair argument of environmental impact must be based on substantial evidence, CEQA places the burden of environmental investigation on government rather than the public. "If a local agency has failed to study an area of possible environmental impact, a fair argument may be based on the limited facts in the record. Deficiencies in the record may actually enlarge the scope of fair argument by lending a logical plausibility to a wider range of inferences." *Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296, 311.

Here, the foregoing deficiencies, errors and omissions render the IS/MND inadequate to support approval of the Project under CEQA. The City should prepare a full EIR that contains new/revised analyses discussed above before taking any action to approve the Project.

Thank you for your consideration of this comments and concerns.

Yours sincerely,

M. R. WOLFE & ASSOCIATES, P.C.

Mark R. Wolfe
On behalf of Organizacion Comunidad de Alviso

MRW:sa
cc: OCDA

3189 Salem Drive
San Jose, CA 95127
(408) 835-1795
adaemarquez@gmail.com

October 17, 2016

City of San Jose
200 East Santa Clara Street
San Jose, CA 95113

Dear Ms. Berry:

In regards to Topgolf IS/MND File No. PDC16-013, *Planned Development Rezoning from the CIC Combined Industrial Commercial and R-M Multiple Residence Residential Zoning Districts to the CIC(PD) Planned Development Zoning District to allow up approximately 110,000 square feet of commercial/retail space, a 200 room hotel, approximately 72,000 square feet of indoor/outdoor recreation use (Topgolf) and late night use. File No. GPT16-001: General Plan Text Amendment to amend the Alviso Specific Plan to change the development standards for height under the "Village Area Guidelines for Commercial Development" to include a maximum allowable building height of 65 feet in certain areas and a maximum allowable non-building structure height of 170 feet in certain areas.*

<u>An EIR should be prepared per CEQA for the following inadequacies and lack of quantitative analyses:</u>

1. **<u>GHG's : This project does not conform to the General Plan and therefore cannot use the Greenhouse Gas Reduction to replace a separate analysis.</u>**

Per The City of San Jose Greenhouse Gas Reduction Strategy[1]: The City chose the *Establishment of a GHG Reduction Target (updated December 2015) per* BAAQMD CEQA Guidelines (May 2011) thresholds for assessing the required reduction in GHG by the year 2020: Meeting the plan efficiency threshold of 6.6 metric tons of CO2 equivalent per service population per year (MT CO2e / SP / year)." However, the IS/MND does not disclose thresholds for their analysis of greenhouse gases. In addition, the IS/MND fails to disclose the following information:

a) The IS/MND does not disclose the environmental baseline for greenhouse gases in the City of San Jose;
b) Does not disclose existing GHG's emissions around the project's perimeter and cumulative GHGs impacts. The document is inadequate by disclosing qualitatively only "Existing On-Site Emissions" of the Golf Center, RV storage area, on-site electricity and transportation. Per CEQA, what are other sources in Alviso emit greenhouses gases, both stationary and mobile sources, approved projects, and future projects?

[1] http://www.sanjoseca.gov/index.aspx?NID=3687

c) Does not provide quantitative analysis of GHG's of the project for approximately 110,000 square feet of commercial/retail space, a 200 room hotel, approximately 72,000 square feet of indoor/outdoor recreation use (Topgolf), separately and cumulatively.

d) The City of San Jose per CEQA section 15065, must prepare an EIR to disclose the cumulative impacts of this project and other projects in Alviso:

   a. The project has the potential to achieve short-term environmental goals to the disadvantage of long-term environmental goals.

   b. The project has possible environmental effects that are individually limited but cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects. (CEQA Statutes and Guidleines, 2016)

e) Disclose quantitatively, how much this project will reduce GHGs by implementation of the Greenhouses Gas Reduction Strategy for the hotel, retail, and the Topgolf?

This project fails to comply with the Reduction Strategy, "This Diagram was specifically designed to minimize greenhouse gas emissions along with other environmental impacts by guiding the City's future growth in a form which will reduce the need for automobile travel while also promoting transit use, bicycling and walking as alternative means of mobility instead of automobiles." Disclose how the City will "maximize the future share of transit, pedestrian and bicycle use as transportation modes, focusing almost all new employment and residential growth in areas with a high degree of transit access, proximity to services and designed in a way to foster those transportation modes" per the City's Strategy. GHG analysis must show evidence significant impact will not occur (Mejia v. City of Los Angeles (2005) 130 Cal. App. 4th 322).

2. **<u>Air Quality Impact Analysis is inadequate for the following reasons per BAAQMD CEQA Guidelines Updated May 2011 as cited in this IS/MND.</u>**

   a. Inconsistent information for the duration of construction, square footage of the hotel, and the amount of parking spaces in the project description and the technical report Appendix A. Therefore, the IS/MND provides inaccurate analyses and significance levels for construction and TACs to sensitive receptors, elementary school, youth center, library, park, and residents.

   b. In the IS/MD, please disclose impacts to sensitive receptors from mobile sources and cumulative sources per CEQA from existing, approve, and future projects.

   c. Disclose air quality analysis with correct project description for Community Risk and Hazard Impacts; and cumulative air quality impacts on human health per BAAQMD CEQA.

(Children's Environmental Health Protection Act (Senate Bill 25, Escutia, Chapter 731, Statutes of 1999, Health[2] and Safety Code Sections 39669.5 et seq.)[3]. The Air Quality and the Hazards sections do not disclose this project is specifically subject to BAAQMD's **<u>Regulation 11, Rule 2</u>**

[2] This tract either contains or is nearby **15** hazardous waste generators. The hazardous waste percentile for this census tract is **88**, meaning the number and type of hazardous waste generators and sites is higher than **88%** of the census tracts in California. http://oehha.ca.gov/calenviroscreen

[3] This tract either contains or is within a kilometer of **10** Groundwater Cleanup site(s). The cleanups percentile for this census tract is **82**, meaning the number and type of groundwater threats is higher than **82%** of the census tracts in California. The data was downloaded and analyzed in Spring 2014] [This tract either contains or is nearby **19** solid waste facilities. The solid waste percentile for this census tract is **100**, meaning the number and type of facilities is higher than **100%** of the census tracts in California.] (2014) http://oehha.ca.gov/calenviroscreen

(Asbestos Demolition, Renovation, and Manufacturing) and California Code of Regulations, Section 93105.[4]

> **Construction Emissions:** *"A total of up to 50,000 cubic yards (c.y.) of fill would be imported to the site. The project would require minimal cut on the site, mostly limited to the removal of existing paved surfaces, which would result in the off-haul of up to 20,000 tons of materials. The project proposes weekend (Saturday-Sunday) construction hours, 9:00 AM to 5:00 PM, as part of their Planned Development (PD) Permit. The duration of construction for all project elements would be roughly 24 months." (p.11)*

However, according to Appendix A, *"The project would require up to 50,000 cubic yards (cy) of soil import for the hotel/retail component, which was entered into the model. The anticipated 20,000 tons of demolition for the hotel/retail component was also entered into the model. In addition, 25,000 cy of asphalt is anticipated during the paving phase and was entered based on 16cy per truck. The anticipated construction schedule assumes that the project would be built out over a period of approximately 18 months beginning in 2017, or an estimated 396 construction workdays (assuming an average of 22 construction days per month).(p.5)*

- The IS/MD fails to disclose accurate information on construction emissions and duration which will expose sensitive receptors: George Elementary School, Alviso Library, Alviso Community Center, the park, and families of Alviso to TAC's, PM's, and hazardous materials that exceed thresholds such as, asbestos, TPH, pesticides, arsenic, lead, beryllium and cadmium, and VOCs.
    - Technical Report Appendix A; (p.10) Explain why meteorological data set of 1996-2000 was used for dispersion modeling to predict concentrations of DPM and PM2.5 near sensitive receptors? A current environmental baseline must be used for CEQA analysis.
    - The TAC's from construction emissions of residential cancer risks 47.9 in one million for infant exposure and 0.8 in one million for adult exposure exceeds BAAQMD thresholds. However, this must be reanalyzed with current baseline data and for George Mayne elementary school. PM2.5 thresholds exceed also for residential receptor location, but current baseline is needed as well.
    - For cumulative construction risk: Appendix A incorrectly identified N. Taylor Street/N. 1st Street as 1,000 feet from the project site and nearby receptors.
    - The Technical Report did not analyze significant **cumulative impacts** of "*the total of all past, present, and foreseeable future sources within a 1,000 foot radius (or beyond where appropriate) from the fence line of a source, or from the location of a receptor, plus the contribution from the project*" for TACs and $PM_{2.5}$/PM_{10}(BAAQMD, 2011, p. 5-15). Please correctly disclose and analyze the correct roadways with traffic volumes (North First Street and Highway 237), correct distance for stationary sources, and correct PM2.5, PM10, cancer and non-cancer risks, and adequate mitigation measures per BAAQMD for operational impacts.

[4] NOTES: *Communities for a Better Environment v. California Resources Agency (2002) 103 Cal. App. 4th 98. Regarding the use of regulatory standards and thresholds of significance, the court invalidated a State CEQA Guidelines requirement for Lead Agencies to rely on adopted environmental standards to determine significance. The court held that this requirement conflicted with CEQA's standard for determining whether to prepare an EIR whenever it can be fairly argued on the basis of substantial evidence that a project may have a significant environmental impact. Oro Fino Gold Mining Corp. v. County of El Dorado (1990) 225 Cal.App.3d 872.*

- The IS/MND and technical report fails to disclose quantitative reduction of mitigation measures to protect sensitive receptors in Alviso from both construction, stationary, and mobile sources.
- The technical report and the IS/MND also failed to disclose the cumulative exposure of ROG, NOx,, and local CO from this project, approved projects, and future projects in the General Plan and other amendments, mobile sources from Highway 237, and existing stationary sources. [5](CCR §15355, §15130) (PRC §21083(b), CCR §15065) T**he City must prepare an EIR to disclose Substantial Adverse effects of Human per CEQA.**[6]

3. **Hydrology Project Description and Mitigation Measures:** The IS/MND's significance levels for all hydrological impacts concluded "Less than Significant Impact" in the checklist and "Impacts Evaluation". The document fails to disclose Mitigations are required per CEQA. The project description chapter does not disclose details of the design features and best management practices. For example, *"Project-specific Low Impact Development Measures would be determined as part of the PD Permit Process; Detailed design of any detention area(s) would be subject to review and approval during the project PD permit process (pp.10-11).* Therefore, the Hydrology chapter must identify the mitigations required to adequately conclude reduction of the project impacts (*Lotus v. Department of Transportation (2014) 223 Cal.App.4th 64).* The purpose of CEQA is to inform the decision-makers and informed public participation (CEQA Statutes and Guidelines, 2016).
4. **Transportation:** The project requires an EIR to fully disclose the cumulative impacts of this project's daily 6,915 daily new vehicle trips in Alviso, plus approved and future projects and mitigations measures. The Transportation chapter includes inadequate mitigation measures that fails to disclose how much of the project's percent contribution to the North San Jose Area Traffic Impact Fee (TIF), the timeline for payment and improvements in the Alviso community specifically or exactly where the improvements will occur, monitoring and reporting responsibility, consequences if the fees are not paid to the City, etc. For example, the document states that this "project's cumulative traffic represents 25% or more of the increase in total traffic volume from background traffic conditions to cumulative conditions". Intersection 5: N. First Street & SR 237 Westbound Ramps (LOS E, PM peak hour) (p.220). Furthermore, *"A significant cumulative impact is deemed mitigated to a less than significant level by the City of San Jose if the measures implemented would restore the intersection LOS to background conditions or better at non-protected intersections (p.220)."* Since the IS/MND only includes the "payment of the TIF would represent a fair share" as mitigation measure, an EIR is required to disclose an unmitigated significant impact, when the traffic impact fee mitigation will paid, the timeline for improvements in Alviso, and monitoring and reporting. The families and children in

---

[5] A project would have a significant **cumulative impact** if the total of all past, present, and foreseeable future sources within a 1,000 foot radius (or beyond where appropriate) from the fence line of a source, or from the location of a receptor, plus the contribution from the project, exceeds the following: Non- compliance with a qualified Community Risk Reduction Plan;
An excess cancer risk levels of more than 100 in one million from all local sources ; a chronic hazard (non-cancer) index greater than 10 from all local sources ; 0.8 µg/m3 annual average PM2.5 from all sources. (BAAQMD, 2011, p. 2-2)

[6] BAAQMD **operational thresholds of significance (project)**: Compliance with Qualified Community Risk Reduction Plan OR (TAC and PM)) An excess cancer risk level of more than 10 in one million, or non-cancer risk greater than 1.0 HI from a single source would be significantly cumulatively considerable contribution;
Ambient PM2.5 increase: > 0.3 µg/m3 annual average from a single source would be significant
Zone of Influence: 1,000-foot radius from property line of source or receptor

Alviso are entitled as City of San Jose residents to full disclosure per CEQA. (CCR §15355, §15130) (PRC §21083(b), CCR §15065).

In January 2017, SB 1000 (Leyva) will require General Plan updates to identify disproportionately environmental impacted communities and implement an Environmental Justice element. Alviso is a unique community, the residents are disproportionately impacted by numerous environmental impacts such as TAC's, PM2.5, Union Pacific Railroad, Highway 237, South Bay Asbestos/NPL site, methane vapor from numeorus surrounding landfills[7], diesal generators, Calpine Energy Plant, SJWPCP, Midpoint@237 Office and Industrial Project's trucks, and many other proposed projects. According to BAAQMD (2011), diesel PM from mobile sources is the most predomoniate TAC in the Bay Area which accounts for over 80% of the inhalation cancer risk in the Bay Area. I hope that with the implementation of SB 1000 *Planning for Healthy Communities Act*, vulnerabale communities in the City of San Jose, like Alviso, will finally be acknowledged and receive equitable enviromental protection and informed public participation accessibility.

Thank you,
Ada E. Márquez

October 17th, 2016

Whitney Berry, Environmental Project Manager
City of San Jose
Whitney.Berry@sanjoseca.gov

RE: Initial Study/Mitigated Negative Declaration for the Topgolf@Terra Project (Project)

Dear Ms. Berry,

Santa Clara Valley Audubon Society (SCVAS), the Citizens Committee to Complete the Refuge (CCCR), and the Loma Prieta Chapter of the Sierra Club (SCLP) are local environmental organizations focused on the conservation of our natural resources and biological diversity. Our members appreciate birds and wildlife along the Bay and creek corridors, and are always concerned when development proposals are adjacent to the Don Edwards National Wildlife Refuge, the Bay, or creek corridors. We believe the project will impose significant and unavoidable impacts to the Alviso community, to migratory birds, and to our members who enjoy recreation on the Guadalupe Creek Trail.

The project proposes to redevelop the site with a Topgolf entertainment complex, a 5 story 65-ft tall hotel and retail space. The proposed Topgolf entertainment complex would be located on the southern portion of the site and would include a three-story structure reaching up to 54 feet in height that would be enclosed on the north, east and west sides. The south side of the structure, facing the Guadalupe River Trail and the river, will be open to the environment. The building includes roughly 120 hitting bays which would face south toward a 5.2-acre lighted artificial turf field enclosed by poles and netting that would reach up to 170- feet in height at a setback of 100-ft from Guadalupe River and the Creek Trail. Each hitting bay can accommodate up to six players at a time. Hitting bays include seating, television screens and overhead speakers providing amplified music. The facility would also include a full-service restaurant, bar, lounges, rooftop entertainment area, corporate/event meeting space, and a family entertainment area with games. Entertainment will be offered every day, morning to 2AM in the morning. Thus, the Topgolf can be reasonably expected to attract thousands of visitors every day (employees, restaurant, bar and events visitors, and several groups of up to 6 people at each of 120 bays each day).

The surrounding land uses include sensitive ecological features (creek, bay) and a plethora of sensitive land-uses that accommodate sensitive receptors: George Mayne Elementary school (500+ students), Alviso Branch Library, Residences (including a mobile home park), and the

Guadalupe Creek Trail where people go to exercise and to enjoy nature. Most of the Project area is currently ruderal open space, is dark at night, and is relatively quiet. If the Project is permitted, tall buildings, expansive parking, overwhelming netting, excessive noise, traffic, light, and air pollution will impose significant and unavoidable operations-related impacts to the creek corridor and to nearby residents and sensitive receptors, changing the character of the Alviso community forever.

We believe an Environmental Impact Report (EIR) must be prepared for the Project to allow full study of the project specific and cumulative impacts, offer and evaluate alternatives. It is likely that decision makers will have to make a declaration of overriding considerations to allow the project to proceed as described.

<u>The project is incompatible with the Alviso Master Plan (Plan)</u>

The Alviso Master Plan was the result of a lengthy public process that engaged the entire Alviso community and multiple stakeholders for years (a 24-participants task force, multiple public meetings, 5+ years of planning). The Plan aimed at "full build-out" to year 2020 and beyond stating, "It is important to set forth a vision now to avoid piecemeal development and to better respond to potential development pressure within the community". **Clearly, the Alviso Master Plan was created with the exact intent of preventing speculative projects such as the Topgolf@Terra.**

When the Alviso Specific Plan was developed, height considerations were an integral part of the discussion. The intent was to preserve the unique characteristics of Alviso, and it was agreed upon that taller building and structures did not fit in with the character of the community. The Plan's objectives allowed for economic development, but also included:

- Maintain the small town character, strong community identity, and neighborhoods
- Allow for new development at, or at least compatible with, the scale and intensity of existing development within specific areas
- Beautify Alviso
- Preserve and protect Alviso's strong natural amenities, including the Guadalupe River, Coyote Creek, and baylands.

The Project is not compatible with these objectives: it does not beautify Alviso (rather the opposite), degrades the small town character, is incompatible with the scale and intensity of existing development, and harms Alviso's natural amenities along the Guadalupe River as well as the birds and wildlife at the Don Edwards National Wildlife Refuge, a major bird migratory destination only a half mile away from the project site.

Therefore, the proposed text amendment to the Alviso Master Plan(section 3.2.5, page 12[1]) that

[1] Page 55: Village Area Guidelines for Commercial Development, Section 5 Development Standards, Subsection A. (added language is underlined)

allows **tall buildings (up to 65-feet) and 170-foot tall structures (poles, netting) must be considered a potentially significant and unavoidable impact to land use.**

Mitigation for the impact on landuse should be considered (i.e. elimination of this aspect of the proposed Project).

The aesthetic impacts of the proposed Project are significant and unavoidable

The MND states, in one sentence, that the proposed Project will have no aesthetic impacts. This finding seems to overlook the fact that the Project will include structures up to 170 feet in height. This would be far higher than any other nearby structure and should be considered a significant impact.

Tall golf netting such as this can has a significant visual impact to the environment, and often elicit pronounced negative response from the public[2][3][4]. For our members who frequent the Guadalupe Creek Trail, the Bay Trail, and the Don Edwards National Wildlife Refuge, the proposed 170-ft poles and netting (and the noise-generating, tall buildings) will violate the sense-of-place end enjoyment of recreation and bird watching north of HWY 237, along the River and the Bay. While the existing 90-ft tall fences are not visually pleasing, replacing them with 170-ft netting creates a much stronger imposition and further degrades the enjoyment of sky, vistas and nature.

Thus, the 170-ft tall poles and netting will impose significant, unavoidable aesthetic impacts. The finding that the impacts are less than significant is not justified. Instead, the visual impact of this high a structure should be further analyzed and found to be a significant impact. Lowering the height or, better yet, eliminating this aspect of the Project altogether should be considered as mitigation.

The change to the Envision 2040 General Plan must be vetted in Citywide community outreach

---

Height: 40 feet, 2 stories above flood elevation. For properties on the west side of North First Street between Liberty and Tony P. Santos Streets, the maximum allowable building height shall not exceed 65 feet, 5 stories above flood elevation. Non-building structural uses, including structures on top of or attached to buildings, such as but not limited to, energy saving devices, wireless communication antennae, net poles, and other associated structures through the development project review shall establish a specific height, not to exceed the maximum allowable height of 170 feet on sites with non-residential or non-urban land use designations.

[2] http://www.loudountimes.com/news/article/new_topgolf_location_will_open_this_september441

[3] http://www.daytondailynews.com/news/local/west-chester-new-topgolf-almost-county-tallest-building/bNxanFgh8tF65HdQrsZbRO/

[4] http://www.sfgate.com/bayarea/article/New-Golf-Fences-Driving-North-Bay-Residents-Crazy-2980615.php

due to Growth Inducing Impacts

The proposed text amendment to the Alviso Master Plan (section 3.2.5, page 12) applies by extension the Envision 2040 General Plan. It is reasonable to expect that such a substantial change (from a height limit of 40 feet to that of 170 feet) – a change that changes the skyline of North San Jose all the way to the downtown area - should have visually-significant growth-inducing impacts, encouraging other property owners in the City of San Jose to seek modifications that would allow them to exceed existing height limitations for various structures on rooftops etc. This is a potentially significant impact and should be acknowledged.

Furthermore, there was no outreach to the entire San Jose community regarding this change to the Envision 2014 General Plan. An amendment of such citywide significance should be communicated in a transparent, citywide process.

Cumulative impacts

The project IS/MND fails fully evaluate cumulative impacts of project-related noise and air quality criteria pollutants during operations.

Section 15355 of the CEQA Guidelines states: "Cumulative impacts" refers to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.

(a) The individual effects may be changes resulting from a single project or a number of separate projects.

(b) The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

Important direction to the practical use of this definition is found in Section 15130 of the CEQA Guidelines: "As defined in Section 15355, a cumulative impact consists of an impact which is created as a result of the combination of the project evaluated in the EIR together with other projects causing related impacts."

Several projects are currently in the process of permitting, or have been recently permitted, or are under construction in Alviso in the immediate vicinity of the project site:

Alviso near / along North First Street
PD13-039 Trammel Crow Distribution Center
PDC15-016: Residence Inn by Marriott & Fairfield Inn and Suites by Marriott Project
PDC14-004, PD14-007: Midpoint at 237 Office and Hotel Project

C14-010: 237 at North First St. Homewood Suites Hotel

America Center Area (Gold St/237 access)
PDC 15-058 & PD15-053: America Center Phase III Project (Build 192,350 sq ft. office building and expand existing garage.)
PDC15-016: Residence Inn and Fairfield Inn & Suites America Center Court Project (aka Marriott Hotels)
PDC15-058 and PD15-053 America Center Planned Development Zoning and Planned Development Permit and Subsequent Environmental Impact Report (SEIR). Zanker Road/McCarthy Blvd access
C15-054: Cilker Property, Rezoning from A/PD to LI (Light Industrial)

The IS/MND fails to evaluate the Project's cumulative impacts associated with the projects identified above.

Cumulative Air Quality impacts require additional analysis
Air pollution impacts on sensitive receptors from hundreds of weekday and weekend car trips during operations of the Project should be evaluated cumulatively, combined with the impacts of air pollution from Hwy 237, truck trip operations at the Trammel Crowe Distribution Center and car trips to and from the newly constructed and planned hotels and office buildings in the vicinity.

The IS/MND proposes that the Project will not result in a cumulatively considerable net increase of any criteria pollutant for which the project region is classified as non-attainment under an applicable federal or state ambient air quality standard including releasing emissions which exceed quantitative thresholds for ozone precursors. The IS/MND states (page 68), "As described above in the response to checklist question "b", the project would not result in a considerable net increase of any criteria pollutant with implementation of mitigation measures." But offers no mitigation measures for operation-related air pollution.

These cumulative impacts are significant and potentially unavoidable and likely to affect the health of the students and teachers of the George Mayne elementary school, visitors to the Alviso Branch Library, residences of nearby residences and the Summerset Mobile Home Park across the Guadalupe River from the Project Site.

Please provide a comprehensive analysis in an EIR to fully study, disclose and mitigate cumulative operations-related air quality impacts. Please offer mitigations including a Traffic Management Plan.

Noise impacts are likely to prove significant and unavoidable

The IS/MND inadequately addresses the significance of noise impacts on the community of Alviso. There should be an analysis of noise impacts from the Project after it is developed, both

on a project specific and cumulative levels. The proposed Project will generate noise into the evening, within close proximity to Alviso residents and to sensitive species in the Alviso area. The MND for the project specifically points out that "late night use" would be part of the Project (MND, page 1). These noise impacts should be explained and mitigation adopted if needed.

Sensitive Receptors

The IS/MND defines sensitive receptors to the project, "an existing residence located on the southern corner of N. First Street and Liberty Street, adjacent to the northwest boundary of the site. Residences are also located across N. First Street, Liberty Street, and Moffat Street from the site. Additionally, George Mayne Elementary School is located across N. First Street from the site."[5] The IS/MND's analysis must include the Alviso Branch Library as a sensitive receptor. Additionally, people who utilize the Guadalupe Park Trail and guests of nearby hotels should also be included as sensitive receptors.

Noise monitoring survey, average inadequate, effects of noise

The IS/MND states, "a noise monitoring survey was completed at various locations near the site on Wednesday December 16, 2016 and Thursday December 17, 2016"[6]. As these dates have not yet occurred, we ask that this statement be clarified.

It seems that the proposed noise monitoring survey did not include the George Mayne Elementary School or the Alviso Branch Library as study locations. In order to measure the full impact of the Project, a noise monitoring survey must include the Alviso Branch Library and George Mayne Elementary School and should be completed during days that the elementary school is in session, outdoors and in a classroom.

The noise monitoring survey measured the "Ldn...the average energy level intensity of noise over a given period of time such as the noisiest hour".[7] Results from the noise monitoring survey show that the average ambient noise was measured between 65 dB and 66 dB at the residences on North First Street.[8] The maximum noise was measured between 74-88 dB during daytime hours and 71-81 dB during nighttime hours at the residences on North First Street.[9]

Noise levels of above 55 decibels outside and 45 decibels indoors have been shown to be preventing and interfering with activities and creating feelings of annoyance, leading to observable impairments in reading comprehension and memory skills in children[10][11]. San Jose's

[5] Initial Study 4.12.1.2 page 164
[6] Initial Study 4.12.1.1 page 162
[7] Initial Study 4.12.1.1 page 162
[8] Initial Study Table 4.12-1 page 164
[9] Initial Study Table 4.12-1 page 164
[10] Textbook of Children's Environmental Health, edited by Philip J. Landrigan, Ruth A. Etzel. page 386. 2014
[11] Clark, C. & Stansfeld, S. A. (2007). The effects of transportation noise on health and cognitive development: A review of recent evidence. Journal of Comparative Psychology, Vol 20(2-3), 145-158.

Envision San Jose 2040 General Plan Comprehensive Update, Noise Background Report, 2009 states, "Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA DNL with open windows and 65-70 dBA DNL if the windows are closed" and "When the DNL increases to 70dBA, the percentage of the population highly annoyed increases to about 12 percent of the population."[12]

Given its location near the George Mayne elementary school, the proper measure for the Project's noise impact to sensitive receptors should be the **noise generated during operation hours**, when music is ongoing and guests are active. This is because children who live near the project will be affected during the school day, afternoon activities, homework preparation, evening relaxation, and bedtime. They will not be able to escape to the Alviso Park or library, since the noise will invade these places as well. For an accurate analysis of the impact of noise, Project specific noise impacts should be analyzed for the operation hours only (no averaging with quiet-time hours.

Cumulative Noise Analysis

The IS/MND failed to include a study of the cumulative noise generated by the activities, traffic, construction, and aircraft noise surrounding the project site. Further, the MND only includes noise impacts generated during the construction phase of the project and fails to analyze noise impacts during operation hours.

Noise generation from Topgolf@Terra operations, including traffic related noise as well as outdoor music and noise generating guest activities (cheering, thumping) must be analyzed cumulatively with noise generated by traffic and nearby activities, including the upcoming operations of the Trammel Crow Distribution Center (for example, trucks traffic, backing up and beeping at the nearby Distribution Center). The study and analysis should focus on the George Mayne elementary school since it is located between the Distribution Center and the Project site, but cumulative impacts should also be evaluated for other sensitive receptor locations.

Conclusion (Noise)

The failure to adequately analyze and mitigate noise impacts after the project is built (operation hours) and cumulative noise impacts means that potentially significant and unavoidable impacts to sensitive receptors have not been disclosed. The City must prepare an Environmental Impact Report to provide transparency and inform the public and decision makers of noise impacts.

[12] Envision San Jose 2040 General Plan Comprehensive Update, Noise Background Report, 2009, page 3 (https://www.sanjoseca.gov/DocumentCenter/Home/View/511)

The noise generation and cumulative noise impacts are significant to the extent that the project may not accomplish compliance with the City of San Jose's General Plan Envision 2040 GOAL EC-1, 1.1, Goal EC-1 – "Community Noise Levels and Land Use Compatibility: Minimize the impact of noise on people through noise reduction and suppression techniques, and through appropriate land use policies". The obvious mitigation would be to restrict the hours of operation to eliminate noise during the school hours, and at night. We recommend that the Topgolf portion of the Project not operate after 9 PM.

Table EC-1: Land Use Compatibility Guidelines for Community Noise in San José

LAND USE CATEGORY	EXTERIOR NOISE EXPOSURE (DNL IN DECIBELS (DBA)) 55	60	65	70	75	80
1. Residential, Hotels and Motels, Hospitals and Residential Care[1]						
2. Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds						
3. Schools, Libraries, Museums, Meeting Halls, Churches						
4. Office Buildings, Business Commercial, and Professional Offices						
5. Sports Arena, Outdoor Spectator Sports						
6. Public and Quasi-Public Auditoriums, Concert Halls, Amphitheaters						

[1]Noise mitigation to reduce interior noise levels pursuant to Policy EC-1.1 is required.

Normally Acceptable:

- Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable:

- Specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

Unacceptable:

- New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

<u>Biological impacts</u>

<u>Congdon's tarplant</u>

Impact Bio-1 identifies potentially significant impacts to Congdon's Tarplant, and offers to mitigate by establishing other populations of the plant onsite. What evidence does the City have that such mitigation can be successful? Can the City produce any documents providing substantial evidence that this mitigation would reduce the impact to less than significant? In particular, are there documents from previous projects that used the same mitigation successfully?

<u>Nesting Birds</u>

Many of the bird speciess that nest in this area are ground or shrub nesting birds. Pre-construction nesting bird surveys (and burrowing owl surveys) should include the entire project site, and not be limited to trees.

<u>Netting and birds</u>

Since 1987, the San Francisco Bay Bird Observatory (SFBBO, an avian research organization) operates the Coyote Creek Field Station at Coyote Creek, at a similar distance from the Bay to the location of the Project site. Research at the station is based on the use of mist-nets to capture birds in the creek corridor, banding the birds with uniquely numbered, federally-issued bands, and analyzing the data to study the bird community of the region and migration patterns.

The attached SFBBO Species List indicates that 249 species protected by the Migratory Bird Treaty Act, including multiple rare and endangered species, breed or otherwise use habitat of lower Coyote Creek and most likely, Guadalupe River. The list also identifies 52 species that are currently listed by a government agency, by the State of the Birds 2016 report or by the National Audubon Society. These include Federal and California threatened and endangered migratory

species such as the Willow Flycatcher and Swainson's Hawk. In addition, note State and Federal Species of Special Concern such as Burrowing Owl, San Francisco Common Yellowthroat, Nuttel's Woodpecker, Painted Bunting, Loggerhead Shrike, and Long-billed Curlew.

The City of San Jose recognizes the importance of the lower Guadalupe River corridor for bird migration in its 2010 General Plan Envision 2040 in Goal ER-7 – Wildlife Movement and the City's Riparian Corridor ordinance. Goal ER-7 states,

- In the area north of Highway 237 design and construct buildings **and structures** using bird-friendly design and practices to reduce the potential for bird strike for species associated with the baylands or the riparian habitats of lower Coyote Creek. (emphasis added).

The MND acknowledges that the 170-ft tall netting is a potentially significant impact to birds (Impact Bio-7). The proposed mitigation (MM BIO-7.1) is borrowed from methods used to reduce collision of large birds with powerlines. These mitigations are not likely to reduce the risk for millions of night-flying migratory passerines and shorebirds that visit the Don Edwards National Wildlife Refuge or fly through near the Bay and along the Guadalupe River. Even for day flying birds, these deterrents require a much closer spacing than 15-feet for many bird species.

It is our expert opinion that the risk to migratory birds remains significant after mitigation (see also attached expert opinion from Dr. Christine Sheppard, American Bird Conservancy).

Light may attract birds

We are concerned with the potential negative impacts of light that this project will impose upon nearby sensitive habitats. The project site is located 100 feet away from the Guadalupe River and about half a mile away from the Don Edwards National Refuge. Due to the close proximity of these sensitive areas, light emitted from Topgolf may have significant negative impacts on birds and wildlife.

Our primary concern is that night-flying migratory birds may become attracted to the light, causing increased collisions with the 170-ft tall netting.[13] (see attached opinion from Dr. Christine Sheppard, American Bird Conservancy).

In accordance with the Alviso Master Plan, new development should be designed "as not to create glare or other negative impacts to nearby sensitive habitats, including baylands, riparian corridors, and other biotic communities"[14]. The Topgolf development does not align with the Alviso Master Plan in that it will create significant glare and negative impacts on surrounding sensitive habitats.

[13] Letter from Dr. Christine Sheppard, American Bird Conservancy
[14] Alviso Master Plan, Environmental Mitigation, pg 118

Loss of Open Space

Open spaces in the Alviso area are particularly important due to Alviso's proximity to the Don Edwards National Wildlife Refuge and other open space areas such as the burrowing owl preserve of the Water Pollution Control Plant, where the only relatively sizeable population of burrowing owls persists in the South Bay region. Many bird species common to the National Wildlife Refuge and creek corridors utilize the remaining ruderal and open spaces in the Alviso area for upland foraging or roosting.

When the Alviso Specific Plan was adopted, the City Council discussed a goal that, on the large open spaces in Alviso, one-third of the land should remain in open space when they are developed. At the time, Council discussed the Planning Recommendation of a 1 acre/2 acre open space ratio requirement and recommended that the Administration provide Council with information on the percentage of open space achieved at the beginning of the development process to enable Council to determine the maximum open space achievable and if no land is available, Council consider requiring financial mitigation funds in-lieu for purchase and restoration of habitat and removal of illegal fill[15].

The MND should analyze impacts to open space in Alviso due to the proposed Project. We assert that those impacts should be found significant. Mitigation for the impact should be considered, including leaving one-third of the property in open space or preserving alternate open space in the Alviso area, with management of that area designed to maximize benefits to rare plants, wetlands, and Burrowing owls, as well as for the more common species found in the Alviso area.

Potential Impacts on Aerial Activity of Emergency Services

The Initial Study fails to analyze the potential impact of the 170' net structure on local, aerial activity of emergency services as may occur in the vicinity of the Project. Helicopters from multiple agencies, commonly fly along SR 237 regarding traffic problems. It is also known that the County Sheriff's Department flies helicopters in the Alviso area to respond to boating problems along Alviso Slough and the South Bay. It is also possible that a flooding or earthquake event could produce a situation involving use of helicopters for emergency evacuation in Alviso. Nothing in the Initial Study shows that any effort was made to evaluate whether or not the height of the nets would impact these services.

We note that in the Hazards Environmental checklist in Section 4.8.2, the Initial Study responds as "No Impact" to: "Would the project: Impair implementation of, or physically interfere with, an adopted emergency response plan or emergency evacuation plan?" (P. 137, question g). In discussion, in Section 4.8.3, p. 141, we find analysis is limited to "adopted" plans with no evidence of analysis nor consideration of cross-jurisdictional public safety activity in the area.

[15] http://www3.sanjoseca.gov/clerk/1998_CnclMins/12_07_98GPMin.htm Minutes of the San Jose City Council meeting, December 7 1008.

Further we find that Section 4.14, Public Services, fails to analyze potential interference on the aerial response actions of Public Safety organizations.

In an area where helicopter activity is common, these findings are inadequate and need to be reviewed in full Environmental Impact Report.

Our groups have reasonable concerns and have provided substantial evidence that the IS/MND has not adequately evaluated project impacts, and that mitigation measures are not sufficient. This project may impose significant, unavoidable impacts to the environment. We ask the City of San Jose to require an Environmental Impact Report for this Project in order to provide full transparency and in-depth analysis of the issues we have brought up. An EIR is also needed in order to explore alternative locations for the Topgolf@Terra project. We believe that moving the Entertainment Complex part of the project to an area that is not as environmentally sensitive may avoid most of the significant impacts to birds, wildlife and the environment, to the health and well-being of elementary school children, and to the Alviso community.

Thank you,

Shani Kleinhaus, PH.D.
Environmental Advocate
Santa Clara Valley Audubon Society

Eileen McLaughlin,
Board Member
Citizens Committee to Complete the Refuge

Michael Ferreira
Executive Committee Chair
Sierra Club-Loma Prieta Chapter

Alice Kaufman,
Legislative Advocate
Committee for Green Foothills

Attachment

AMERICAN BIRD CONSERVANCY

Bringing back the birds

October 17, 2016

Dear Dr. Kleinhaus,

I have reviewed the material outlining the proposed Topgolf facility in the area of San Jose. My primary concern would be with the netting itself and support structures. The measures outlined are intended to reduce diurnal collisions of large water birds with power lines; I have attached a recent meta-analysis of studies on this type of device. Unfortunately, these products will not address local, smaller species, nor will they warn night-flying migrants. This is compounded they the facility's location with respect to the Guadeloupe River and a wetland area, which may be stopover sites for migrants, bringing them low enough to hit the nets.

A concentration of bright lights, as illustrated in the video http://topgolf.com/us/, could be of serious concern, especially as the area is lit until late in the evening. This might actually bring night migrants towards the facility, causing collisions with the net. The net itself likely does not present a strong enough signal to stop local birds flying towards it and this could result in birds trapped in the netting itself.

Christine Sheppard, Ph.D.
Bird Collisions Campaign Manager
American Bird Conservancy

office 646 661 1862
cell 914 261 8277

collisions.abcbirds.org

Attachment

Coyote Creek Field Station Species List

Compiled by the San Francisco Bay Bird Observatory, June 17 2016

For additional details, contact:

Josh Scullen, jscullen@sfbbo.org
Dan Wenny, dwenny@sfbbo.org

SAN FRANCISCO BAY BIRD OBSERVATORY

Date Range

SFBBO data originate from mist-netting operations, point count surveys, and breeding bird surveys conducted between 1982 - 2015.

eBird data includes all recorded species entered as of mid-June, 2016

Data Notes

Source	SFBBO: indicates species detected during mist-netting operations, point count surveys, and/or breeding bird surveys, from 1982 - 2015 eBird: indicates species recorded in eBird for the Coyote Creek Field Station location and 3 adjacent hotspots along Coyote Creek, as of June 17, 2016
Species Code	4-letter species code Subspecies are indicated by Species Code / Subspecies Code (example: Audubon's Warbler is listed as "YRWA/AUWA") The dataset is currently sorted by this column
Status in Coyote Creek area	Resident: species are present at CCFS year-round Migrant: species pass through CCFS during spring (March - June) and/or fall (August - October) migration. Wintering: species are present at CCFS during winter months (approximately October - March) escaped: indicates species that are likely non-wild captive birds or escaped pets
California Status	SSC-1: Bird Species of Special Concern - First Priority SSC-2: Bird Species of Special Concern - Second Priority SSC-3: Bird Species of Special Concern - Third Priority Threatened: State Threatened Endangered: State Endangered
California Endangered Species List:	http://www.dfg.ca.gov/wildlife/nongame/t_e_spp/bird.html
California Bird Species of Special Concern:	http://www.dfg.ca.gov/wildlife/nongame/ssc/birds.html

State of the Birds Watch List 2016	x: On the North American Bird Conservation Initiative Watch List for 2016 http://www.stateofthebirds.org/2016/resources/species-assessments/?__hstc=75100365.33c5c4cc061d8120eb76cb854cd70677.1466099657998.1466188824130.1466191335722.4&__hssc=75100365.1.1466191335722&__hsfp=1333291337#_ga=1.19765560.1414109025.1466099656

Audubon Watch List 2007	yellow list: rare and/or declining red list: highest conservation concern http://www.audubon.org/sites/default/files/documents/watchlist2007-technicalreport.pdf

US Fish and Wildlife Service	BCC: Bird of Conservation Concern BCC Focal Species: Species for which USFWS is prioritizing research and planning for conservation Endangered: the indicated population is on the Federal Endangered Species list
USFWS Focal Species List:	https://www.fws.gov/migratorybirds/pdf/management/BMCFocalSpecies.pdf
USFWS Birds of Conservation Concern 2008:	https://www.fws.gov/migratorybirds/pdf/management/BCC2008.pdf

Source	Species Code	Common Name	*Scientific Name*	Status at Coyote Creek Field Station	California Status	SOTB Watch List 2016	Audubon Watch List 2007	USFWS
SFBBO	ACWO	Acorn Woodpecker	*Melanerpes formicivorus*	Resident				
eBird	AGWT	Green-winged Teal	*Anas crecca*	Winter				
SFBBO	ALHU	Allen's Hummingbird	*Selasphorus sasin*	Migrant		x	yellow list	BCC
SFBBO	AMAV	American Avocet	*Recurvirostra americana*	Resident				
SFBBO	AMCO	American Coot	*Fulica americana*	Winter				
SFBBO	AMCR	American Crow	*Corvus brachyrhynchos*	Resident				
SFBBO	AMGO	American Goldfinch	*Carduelis tristis*	Resident				
SFBBO	AMKE	American Kestrel	*Falco sparverius*	Resident				
SFBBO	AMPI	American Pipit	*Anthus rubescens*	Winter				
SFBBO	AMRE	American Redstart	*Setophaga ruticilla*	Migrant				
SFBBO	AMRO	American Robin	*Turdus migratorius*	Resident				
eBird	AMWI	American Wigeon	*Anas americana*	Winter				
SFBBO	AMWI	American Wigeon	*Anas americana*	Winter				
SFBBO	ANHU	Anna's Hummingbird	*Calypte anna*	Resident				
SFBBO	ASFL	Ash-throated Flycatcher	*Myiarchus cinerascens*	Migrant				
eBird	AWPE	American White Pelican	*Pelecanus erythrorhynchus*	Winter				
SFBBO	BARS	Barn Swallow	*Hirundo rustica*	Migrant				
eBird	BBPL	Black-bellied Plover	*Plucialis squatarola*	Winter				
SFBBO	BCHU	Black-chinned Hummingbird	*Archilochus alexandri*	Migrant				
SFBBO	BCNH	Black-crowned Night-Heron	*Nycticorax nycticorax*	Resident				
SFBBO	BEKI	Belted Kingfisher	*Ceryle alcyon*	Resident				
SFBBO	BEWR	Bewick's Wren	*Thryomanes bewickii*	Resident				
SFBBO	BGGN	Blue-gray Gnatcatcher	*Polioptila caerulea*	Migrant				
SFBBO	BHCO	Brown-headed Cowbird	*Molothrus ater*	Resident				
SFBBO	BHGR	Black-headed Grosbeak	*Pheucticus melanocephalus*	Migrant				
SFBBO	BLGR	Blue Grosbeak	*Passerina caerulea*	Migrant				
SFBBO	BLPH	Black Phoebe	*Sayornis nigricans*	Resident				
SFBBO	BLPW	Blackpoll Warbler	*Setophaga striata*	Migrant				
SFBBO	BNOW	Barn Owl	*Tyto alba*	Resident				
SFBBO	BNST	Black-necked Stilt	*Himantopus mexicanus*	Resident				
eBird	BOPU	Bonaparte's Gull	*Chroicocephalus philadelphia*	Winter				
SFBBO	BRBL	Brewer's Blackbird	*Euphagus cyanocephalus*	Resident				
SFBBO	BRCR	Brown Creeper	*Certhia americana*	Winter				
SFBBO	BRSP	Brewer's Sparrow	*Spizella breweri*	Migrant				
SFBBO	BRTH	Brown Thrasher	*Toxostoma rufum*	Migrant				

Source	Species Code	Common Name	*Scientific Name*	Status at Coyote Creek Field Station	California Status	SOTB Watch List 2016	Audubon Watch List 2007	USFWS
SFBBO	BTYW	Black-throated Gray Warbler	*Setophaga nigrescens*	Migrant				BCC
eBird	BUFF	Bufflehead	*Bucephala albeola*	Winter				
SFBBO	BUOR	Bullock's Oriole	*Icterus bullockii*	Migrant				
eBird	BUOW	Burrowing Owl	*Athene cunicularia*	Resident	SSC-2			BCC Focal Species
SFBBO	BUSH	Bushtit	*Psaltriparus minimus*	Resident				
SFBBO	BWWA	Black-and-white Warbler	*Mniotilta varia*	Migrant				
eBird	CAEG	Cattle Egret	*Bubulcus ibis*	Migrant				
eBird	CAGU	California Gull	*Larus californica*	Winter				
SFBBO	CAHU	Calliope Hummingbird	*Stellula calliope*	Migrant			yellow list	BCC
SFBBO	CALT	California Towhee	*Melozone crissalis*	Resident				
eBird	CANG	Canada Goose	*Branta canadensis*	Resident				
SFBBO	CAQU	California Quail	*Callipepla californica*	Resident				
eBird	CATE	Caspian Tern	*Hydroprogne caspia*	Winter				
SFBBO	CATH	California Thrasher	*Toxostoma redivivum*	Migrant		x	yellow list	
SFBBO	CAVI	Cassin's Vireo	*Vireo cassinii*	Migrant				
eBird	CAWA	Canada Warbler	*Cardellina canadensis*	Migrant				BCC
SFBBO	CBCH	Chestnut-backed Chickadee	*Poecile rufescens*	Resident				
SFBBO	CCSP	Clay-colored Sparrow	*Spizella pallida*	Migrant				
SFBBO	CEWA	Cedar Waxwing	*Bombycilla cedrorum*	Winter				
SFBBO	CHSP	Chipping Sparrow	*Spizella passerina*	Migrant				
SFBBO	CITE	Cinnamon Teal	*Anas cyanoptera*	Resident				
SFBBO	CLSW	Cliff Swallow	*Petrochelidon pyrrhonota*	Migrant				
eBird	COGO	Common Goldeneye	*Bucephala clangula*	Winter				
SFBBO	COHA	Cooper's Hawk	*Accipiter cooperii*	Resident				
SFBBO	COHU	Costa's Hummingbird	*Calypte costae*	Migrant		x	yellow list	BCC
eBird	COME	Common Merganser	*Mergus merganser*	Winter				
SFBBO	COMO	Common Gallinule	*Gallunula chloropus*	Resident				
SFBBO	COPO	Common Poorwill	*Phalaenoptilus nuttallii*	Migrant				
SFBBO	CORA	Common Raven	*Corvus corax*	Resident				
eBird	COTE	Common Tern	*Sterna hirundo*	Migrant				
SFBBO	COWA	Connecticut Warbler	*Oporornis agilis*	Migrant		x		
SFBBO	COYE	San Francisco Common Yellowthroat	*Geothlypis trichas sinuosa*	Resident	SSC-3			BCC
SFBBO	CSWA	Chestnut-sided Warbler	*Setophaga pensylvanica*	Migrant				
eBird	DCCO	Double-crested Cormorant	*Phalacrocorax auritus*	Resident				

Source	Species Code	Common Name	*Scientific Name*	Status at Coyote Creek Field Station	California Status	SOTB Watch List 2016	Audubon Watch List 2007	USFWS
SFBBO	DEJU	Dark-eyed Junco	*Junco hyemalis*	Winter				
SFBBO	DEJU/ ORJU	Oregon Junco	*Junco hyemalis oregonus*	Winter				
SFBBO	DEJU/ SCJU	Slate-colored Junco	*Junco hyemalis hyemalis*	Winter				
SFBBO	DOWO	Downy Woodpecker	*Picoides pubescens*	Resident				
SFBBO	DUFL	Dusky Flycatcher	*Empidonax oberholseri*	Migrant				
SFBBO	DUNL	Dunlin	*Calidris alpina*	Migrant				
SFBBO	EAKI	Eastern Kingbird	*Tyrannus tyrannus*	Migrant				
eBird	EUCD	Eurasian Collared-Dove	*Streptopelia decaocto*	Resident				
SFBBO	EUST	European Starling	*Sturnus vulgaris*	Resident				
SFBBO	EVGR	Evening Grosbeak	*Coccothraustes vespertinus*	Migrant				
SFBBO	FOSP	Fox Sparrow	*Passerella iliaca*	Winter				
eBird	FOTE	Forster's Tern	*Sterna forsteri*	Resident				
eBird	FRGU	Franklin's Gull	*Leucophaeus pipixcan*	Migrant				
SFBBO	GADW	Gadwall	*Anas strepera*	Resident				
SFBBO	GBHE	Great Blue Heron	*Ardea herodias*	Resident				
SFBBO	GCKI	Golden-crowned Kinglet	*Regulus satrapa*	Winter				
SFBBO	GCSP	Golden-crowned Sparrow	*Zonotrichia atricapilla*	Winter				
SFBBO	GHOW	Great Horned Owl	*Bubo virginianus*	Resident				
SFBBO	GOEA	Golden Eagle	*Aquila chrysaetos*	Winter				BCC Focal Species
SFBBO	GRCA	Gray Catbird	*Dumetella carolinensis*	Migrant				
SFBBO	GREG	Great Egret	*Ardea alba*	Resident				
SFBBO	GRFL	Gray Flycatcher	*Empidonax wrightii*	Migrant				
SFBBO	GRHE	Green Heron	*Butorides virescens*	Resident				
SFBBO	GRSP	Grasshopper Sparrow	*Ammodramus savannarum*	Migrant	SSC-2			
SFBBO	GRYE	Greater Yellowlegs	*Tringa melanoleuca*	Winter				
eBird	GTGR	Great-tailed Grackle	*Quiscalus mexicanus*	Migrant				
SFBBO	GTTO	Green-tailed Towhee	*Pipilo chlorurus*	Migrant				
eBird	GWGU	Glaucous-winged Gull	*Larus glaucescens*	Winter				
SFBBO	HAFL	Hammond's Flycatcher	*Empidonax hammondii*	Migrant				
SFBBO	HAWO	Hairy Woodpecker	*Picoides villosus*	Resident				
eBird	HERG	Herring Gull	*Larus argentatus*	Winter				
SFBBO	HETH	Hermit Thrush	*Catharus guttatus*	Winter				
SFBBO	HEWA	Hermit Warbler	*Setophaga occidentalis*	Migrant				
SFBBO	HOFI	House Finch	*Haemorhous mexicanus*	Resident				
eBird	HOME	Hooded Merganser	*Lophodytes cucullatus*	Winter				

Source	Species Code	Common Name	*Scientific Name*	Status at Coyote Creek Field Station	California Status	SOTB Watch List 2016	Audubon Watch List 2007	USFWS
SFBBO	HOOR	Hooded Oriole	*Icterus cucullatus*	Migrant				
SFBBO	HOSP	House Sparrow	*Passer domesticus*	Resident				
SFBBO	HOWA	Hooded Warbler	*Setophaga citrina*	Migrant				
SFBBO	HOWR	House Wren	*Troglodytes aedon*	Winter				
SFBBO	HUVI	Hutton's Vireo	*Vireo huttoni*	Migrant				
SFBBO	INBU	Indigo Bunting	*Passerina cyanea*	Migrant				
SFBBO	KEWA	Kentucky Warbler	*Geothlypis formosa*	Migrant		x	yellow list	BCC
SFBBO	KILL	Killdeer	*Charadrius vociferus*	Resident				
SFBBO	LAGO	Lawrence's Goldfinch	*Spinus lawrencei*	Migrant		x	yellow list	BCC
SFBBO	LAZB	Lazuli Bunting	*Passerina amoena*	Migrant				
eBird	LBCU	Long-billed Curlew	*Numenius americanus*	Winter		x		BCC Focal Species
SFBBO	LBDO	Long-billed Dowitcher	*Limnodromus scolopaceus*	Winter		x		
SFBBO	LEFL	Least Flycatcher	*Empidonax minimus*	Migrant				
SFBBO	LEGO	Lesser Goldfinch	*Carduelis psaltria*	Resident				
SFBBO	LEOW	Long-eared Owl	*Asio otus*	Migrant	SSC-3	x		
SFBBO	LESA	Least Sandpiper	*Calidris minutilla*	Migrant				
SFBBO	LEYE	Lesser Yellowlegs	*Tringa flavipes*	Migrant		x		BCC
SFBBO	LISP	Lincoln's Sparrow	*Melospiza lincolnii*	Winter				
SFBBO	LOSH	Loggerhead Shrike	*Lanius ludovicianus*	Resident	SSC-2			BCC
eBird	MAGO	Marbled Godwit	*Limosa fedoa*	Winter			yellow list	BCC Focal Species
SFBBO	MALL	Mallard	*Anas platyrhynchos*	Resident				
SFBBO	MAWA	Magnolia Warbler	*Setophaga magnolia*	Migrant				
SFBBO	MAWR	Marsh Wren	*Cistothorus palustris*	Resident				
eBird	MEGU	Mew Gull	*Larus canus*	Winter				
SFBBO	MERL	Merlin	*Falco columbarius*	Winter				
SFBBO	MGWA	MacGillivray's Warbler	*Oporornis tolmiei*	Migrant				
eBird	MOBL	Mountain Bluebird	*Sialia currucoides*	Migrant				
SFBBO	MODO	Mourning Dove	*Zenaida macroura*	Resident				
SFBBO	NAWA	Nashville Warbler	*Vermivora ruficapilla*	Migrant				
SFBBO	NOFL	Northern Flicker	*Colaptes auratus*	Winter				
SFBBO	NOFL/ FLIN	Flicker Intergrade	*Colaptes auratus auratus x cafer*	Winter				
SFBBO	NOFL/ RSFL	Red-shafted Flicker	*Colaptes auratus cafer*	Winter				
SFBBO	NOFL/ YSFL	Yellow-shafted Flicker	*Colaptes auratus auratus*	Winter				

Source	Species Code	Common Name	*Scientific Name*	Status at Coyote Creek Field Station	California Status	SOTB Watch List 2016	Audubon Watch List 2007	USFWS
SFBBO	NOHA	Northern Harrier	*Circus cyaneus*	Resident	SSC-3			
SFBBO	NOMO	Northern Mockingbird	*Mimus polyglottos*	Resident				
SFBBO	NOPA	Northern Parula	*Setophaga americana*	Migrant				
eBird	NOPI	Northern Pintail	*Anas acuta*	Winter				
eBird	NOSH	Northern Shoveler	*Anas clypeata*	Winter				
SFBBO	NOWA	Northern Waterthrush	*Parkesia noveboracensis*	Migrant				
SFBBO	NRWS	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Migrant				
SFBBO	NSWO	Northern Saw-whet Owl	*Aegolius acadicus*	Winter				
SFBBO	NUWO	Nuttall's Woodpecker	*Picoides nuttallii*	Resident			yellow list	BCC
SFBBO	OATI	Oak Titmouse	*Baeolophus inornatus*	Resident		x	yellow list	BCC
SFBBO	OCWA	Orange-crowned Warbler	*Vermivora celata*	Migrant				
SFBBO	OSFL	Olive-sided Flycatcher	*Contopus cooperi*	Migrant	SSC-2	x	yellow list	BCC
eBird	OSPR	Osprey	*Pandion haliaetus*	Winter				
SFBBO	OVEN	Ovenbird	*Seiurus aurocapilla*	Migrant				
SFBBO	PABU	Painted Bunting	*Passerina ciris*	Migrant			yellow list	BCC Focal Species
SFBBO	PAWR	Pacific Wren	*Troglodytes pacificus*	Winter				
SFBBO	PBGR	Pied-billed Grebe	*Podilymbus podiceps*	Resident				
SFBBO	PEFA	Peregrine Falcon	*Falco peregrinus*	Winter				BCC
SFBBO	PESA	Pectoral Sandpiper	*Calidris melanotos*	Migrant		x		
SFBBO	PISI	Pine Siskin	*Carduelis pinus*	Winter				
eBird	PRFA	Prairie Falcon	*Falco mexicanus*	Winter				BCC
SFBBO	PUFI	Purple Finch	*Haemorhous purpureus*	Winter				
SFBBO	RBGR	Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Migrant				
eBird	RBGU	Ring-billed Gull	*Larus delawarensis*	Winter				
SFBBO	RBSA	Red-breasted Sapsucker	*Sphyrapicus ruber*	Winter				
SFBBO	RCKI	Ruby-crowned Kinglet	*Regulus calendula*	Winter				
eBird	REDH	Redhead	*Aythya americana*	Winter				
SFBBO	REVI	Red-eyed Vireo	*Vireo olivaceus*	Migrant				
SFBBO	RITD	Ringed Turtle-Dove	*Streptopelia roseogrisea*	escaped?				
eBird	RNDU	Ring-necked Duck	*Aythya collaris*	Winter				
SFBBO	RNEP	Ring-necked Pheasant	*Phasianus colchicus*	Resident				
SFBBO	RNPH	Red-necked Phalarope	*Phalaropus lobatus*	Migrant				
SFBBO	ROPI	Rock Pigeon	*Columba livia*	Resident				
SFBBO	ROWR	Rock Wren	*Salpinctes obsoletus*	Migrant				
SFBBO	RSHA	Red-shouldered Hawk	*Buteo lineatus*	Resident				
SFBBO	RTHA	Red-tailed Hawk	*Buteo jamaicensis*	Resident				

Source	Species Code	Common Name	*Scientific Name*	Status at Coyote Creek Field Station	California Status	SOTB Watch List 2016	Audubon Watch List 2007	USFWS
eBird	RUDU	Ruddy Duck	*Oxyura jamaicensis*	Winter				
eBird	RUFF	Ruff	*Philomachus pugnax*	Migrant				
SFBBO	RUHU	Rufous Hummingbird	*Selasphorus rufus*	Migrant		x		BCC
SFBBO	RWBL	Red-winged Blackbird	*Agelaius phoeniceus*	Resident				
SFBBO	SAPH	Say's Phoebe	*Sayornis saya*	Winter				
eBird	SATH	Sage Thrasher	*Oreoscoptes montanus*	Migrant				BCC
SFBBO	SAVS	Savannah Sparrow (Bryant's)	*Passerculus sandwichensis alaudinus*	Resident	SSC-3			
SFBBO	SBDO	Short-billed Dowitcher	*Limnodromus griseus*	Migrant		x		BCC
eBird	SCTA	Scarlet Tanager	*Piranga olivacea*	Migrant				
SFBBO	SEPL	Semipalmated Plover	*Charadrius semipalmatus*	Migrant				
SFBBO	SESA	Semipalmated Sandpiper	*Calidris pusilla*	Migrant		x	yellow list	
SFBBO	SNEG	Snowy Egret	*Egretta thula*	Resident				
SFBBO	SORA	Sora	*Porzana carolina*	Winter				BCC
SFBBO	SOSP	Song Sparrow	*Melospiza melodia*	Resident				
SFBBO	SOSP	Marin Song Sparrow	*Melospiza melodia gouldii*	Resident				
SFBBO	SOSP	Alameda Song Sparrow	*Melospiza melodia pusillula*	Resident	SSC-2			BCC
SFBBO	SOVI	Solitary Vireo	*Vireo (sp)*	Migrant				
SFBBO	SPSA	Spotted Sandpiper	*Actitis macularius*	Migrant				
SFBBO	SPTO	Spotted Towhee	*Pipilo maculatus*	Winter				
SFBBO	SSHA	Sharp-shinned Hawk	*Accipter striatus*	Winter				
eBird	STJA	Steller's Jay	*Cyanocitta stelleri*	Resident				
eBird	STSA	Sharp-tailed Sandpiper	*Calidris acuminata*	Winter				
eBird	STSA	Stilt Sandpiper	*Calidris himantopus*	Winter			yellow list	
SFBBO	SUTA	Summer Tanager	*Piranga rubra*	Migrant	SSC-1			
eBird	SWHA	Swainson's Hawk	*Buteo swainsoni*	Winter	Threatened		yellow list	BCC
SFBBO	SWSP	Swamp Sparrow	*Melospiza georgiana*	Winter				
SFBBO	SWTH	Swainson's Thrush	*Catharus ustulatus*	Migrant				
SFBBO	TEWA	Tennessee Warbler	*Oreothlypis peregrina*	Migrant				
eBird	THGU	Thayer's Gull	*Larus thayeri*	Winter			yellow list	
SFBBO	THWH	Townsend's X Hermit Warbler Hybrid	*Setophaga townsendi x occidentalis*	Migrant				
SFBBO	TOWA	Townsend's Warbler	*Setophaga townsendi*	Migrant				
SFBBO	TRBL	Tricolored Blackbird	*Agelaius tricolor*	Resident	SSC-1	x	red list	BCC Focal Species
SFBBO	TRES	Tree Swallow	*Tachycineta bicolor*	Migrant				
SFBBO	TUVU	Turkey Vulture	*Cathartes aura*	Resident				

Source	Species Code	Common Name	*Scientific Name*	Status at Coyote Creek Field Station	California Status	SOTB Watch List 2016	Audubon Watch List 2007	USFWS
SFBBO	VASW	Vaux's Swift	*Chaetura vauxi*	Migrant	SSC-2			
SFBBO	VATH	Varied Thrush	*Ixoreus naevius*	Winter				
SFBBO	VESP	Vesper Sparrow	*Pooecetes gramineus*	Migrant				
SFBBO	VGSW	Violet-green Swallow	*Tachycineta thalassina*	Migrant				
eBird	VIRA	Virginia Rail	*Rallus limicola*	Winter				BCC
SFBBO	VIWA	Virginia's Warbler	*Oreothlypis virginiae*	Migrant		x	yellow list	BCC
SFBBO	WAVI	Warbling Vireo	*Vireo gilvus*	Migrant				
SFBBO	WBNU	White-breasted Nuthatch	*Sitta carolinensis*	Resident				
SFBBO	WCSP	White-crowned Sparrow	*Zonotrichia leucophrys*	Winter				
SFBBO	WCSP/ GWCS	Gambel's White-crowned Sparrow	*Zonotrichia leucophrys gambelii*	Winter				
SFBBO	WCSP/ PSWS	Puget Sound White-crowned Sparrow	*Zonotrichia leucophrys pugetensis*	Winter				
eBird	WEBL	Western Bluebird	*Sialia mexicana*	Resident				
SFBBO	WEFL	Western (Pacific Slope) Flycatcher	*Empidonax difficilis*	Migrant				
eBird	WEGU	Western Gull	*Larus occidentalis*	Winter				
SFBBO	WEKI	Western Kingbird	*Tyrannus verticalis*	Migrant				
SFBBO	WEME	Western Meadowlark	*Sturnella neglecta*	Winter				
SFBBO	WESA	Western Sandpiper	*Calidris mauri*	Migrant			yellow list	
SFBBO	WESJ	Western Scrub-Jay	*Aphelocoma californica*	Resident				
eBird	WESO	Western Screech-Owl	*Megascops kennicotti*	Resident				
SFBBO	WETA	Western Tanager	*Piranga ludoviciana*	Migrant				
SFBBO	WEWA	Worm-eating Warbler	*Helmitheros vermivora*	Migrant				BCC
SFBBO	WEWP	Western Wood-pewee	*Contopus sordidulus*	Migrant				
eBird	WGWH	Western x Glaucous-winged Gull (hybrid)	*Larus occidentalis x glaucescens*	Winter				
SFBBO	WIFL	Willow Flycatcher	*Empidonax traillii*	Migrant	Endangered		yellow list	Endangered (*E. t. extimus*)
SFBBO	WIFL/ TRFL	Traill's Flycatcher	*Empidonax alnorum/traillii*	Migrant				
eBird	WILL	Willet	*Tringa semipalmata*	Winter				
eBird	WIPH	Wilson's Phalarope	*Phalaropus tricolor*	Winter				
SFBBO	WISN	Wilson's Snipe	*Gallinago delicata*	Winter				BCC
SFBBO	WIWA	Wilson's Warbler	*Wilsonia pusilla*	Migrant				
eBird	WODU	Wood Duck	*Aix sponsa*	Winter				
SFBBO	WPWA	Western Palm Warbler	*Setophaga palmarum palmarum*	Migrant				

Source	Species Code	Common Name	*Scientific Name*	Status at Coyote Creek Field Station	California Status	SOTB Watch List 2016	Audubon Watch List 2007	USFWS
SFBBO	WREN	Wrentit	*Chamaea fasciata*	Migrant		x	yellow list	
eBird	WRSA	White-rumped Sandpiper	*Calidris fuscicollis*	Winter			yellow list	
SFBBO	WTKI	White-tailed Kite	*Elanus leucurus*	Resident				
SFBBO	WTSP	White-throated Sparrow	*Zonotrichia albicollis*	Winter				
SFBBO	WTSW	White-throated Swift	*Aeronautes saxatalis*	Resident				
SFBBO	YBCH	Yellow-breasted Chat	*Icteria virens*	Migrant	SSC-3			
eBird	YBCU	Yellow-billed Cuckoo	*Coccyzus americanus*	Migrant	Endangered			Threatened *(C. a. occidentalis)*
SFBBO	YEWA	Yellow Warbler	*Setophaga petechia*	Resident	SSC-2			BCC
SFBBO	YHBL	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Migrant	SSC-3			
SFBBO	YRWA	Yellow-rumped Warbler	*Setophaga coronata*	Winter				
SFBBO	YRWA/ AUWA	Audubon's Warbler	*Setophaga coronata auduboni*	Winter				
SFBBO	YRWA/ MYWA	Myrtle Warbler	*Setophaga coronata coronata*	Winter				
SFBBO	ZSHY	Zonotrichia Sparrow Hybrid	*Zonotrichia leucophrys x atricapilla*	Winter				

Wire Marking Results in a Small but Significant Reduction in Avian Mortality at Power Lines: A BACI Designed Study

Rafael Barrientos*¤a, Carlos Ponce, Carlos Palacín, Carlos A. Martín¤b, Beatriz Martín¤c, Juan Carlos Alonso

Departamento de Ecología Evolutiva, Museo Nacional de Ciencias Naturales (CSIC), Madrid, Spain

Abstract

Background: Collision with electric power lines is a conservation problem for many bird species. Although the implementation of flight diverters is rapidly increasing, few well-designed studies supporting the effectiveness of this costly conservation measure have been published.

Methodology/Principal Findings: We provide information on the largest worldwide marking experiment to date, including carcass searches at 35 (15 experimental, 20 control) power lines totalling 72.5 km, at both transmission (220 kV) and distribution (15 kV–45 kV) lines. We found carcasses of 45 species, 19 of conservation concern. Numbers of carcasses found were corrected to account for carcass losses due to removal by scavengers or being overlooked by researchers, resulting in an estimated collision rate of 8.2 collisions per km per month. We observed a small (9.6%) but significant decrease in the number of casualties after line marking compared to before line marking in experimental lines. This was not observed in control lines. We found no influence of either marker size (large *vs.* small spirals, sample of distribution lines only) or power line type (transmission *vs.* distribution, sample of large spirals only) on the collision rate when we analyzed all species together. However, great bustard mortality was slightly lower when lines were marked with large spirals and in transmission lines after marking.

Conclusions: Our results confirm the overall effectiveness of wire marking as a way to reduce, but not eliminate, bird collisions with power lines. If raw field data are not corrected by carcass losses due to scavengers and missed observations, findings may be biased. The high cost of this conservation measure suggests a need for more studies to improve its application, including wire marking with non-visual devices. Our findings suggest that different species may respond differently to marking, implying that species-specific patterns should be explored, at least for species of conservation concern.

Citation: Barrientos R, Ponce C, Palacín C, Martín CA, Martín B, et al. (2012) Wire Marking Results in a Small but Significant Reduction in Avian Mortality at Power Lines: A BACI Designed Study. PLoS ONE 7(3): e32569. doi:10.1371/journal.pone.0032569

Editor: Steve Votier, University of Plymouth, United Kingdom

Received October 14, 2011; **Accepted** January 30, 2012; **Published** March 1, 2012

Copyright: © 2012 Barrientos et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Funding: RB was contracted within the project CGL2008-02567 of the Dirección General de Investigación, Spanish Ministry of Science and Innovation and later supported by a postdoctoral grant from Junta de Comunidades de Castilla-La Mancha. C. Ponce, C. Palacín, CM and BM were supported by contracts CSIC-HENARSA. This study was carried out within the "Preventive, corrective and compensatory measures to balance the impact of the M-50 and R-2 highways on the population of great bustards and other steppe-land birds in the Important Bird Area Talamanca-Camarma and the Site of Community Importance Cuenca de los ríos Jarama y Henares", supported by a contract HENARSA-CSIC. Additional financial support was provided by project CGL2008-02567 of the Dirección General de Investigación, Spanish Ministry of Science and Innovation. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

* E-mail: rafael.barrientos@uclm.es

¤a Current address: Área de Zoología, Departamento de Ciencias Ambientales, Facultad de Ciencias del Medio Ambiente, Universidad de Castilla-La Mancha, Toledo, Spain
¤b Current address: Departamento de Zoología y Antropología Física, Facultad de Biología, Universidad Complutense de Madrid, Madrid, Spain
¤c Current address: Fundación Migres, Huerta Grande, Pelayo, Algeciras, Cádiz, Spain

Introduction

Bird collisions with electric power lines have raised conservation concerns since the early 1900s, but it was not until the 1970s that biologists and engineers began to realize the extent of this problem [1,2]. Today the number of power lines is increasing worldwide at an annual rate of approximately 5% [3]. Mortality from collisions with power lines and other electric utility structures has been documented for some 350 bird species [4]. However, until a cumulative impacts assessment of power line mortality is conducted, the real level of mortality will remain uncertain [5]. Only some crude estimates of the importance of the problem, all of them based on extrapolations, are available. For example, in the Netherlands it has been found that bird collisions with power lines may cause one million deaths per year [6]. In the United States [5], it is estimated that power lines may kill up to 175 million birds annually, and it is estimated that bird collisions with power structures, including transmission (≥70 kV, usually with ground-

wire and wires at more than one height) and distribution (<70 kV, commonly without ground-wire and all the wires at the same height) lines, could approach one billion avian fatalities per year worldwide [7]. Fortunately, these values are probably overestimated since most of the studies are usually carried out on power lines that cause an important number of fatalities. Nevertheless, these figures allow conservationists to speculate that mortality due to collisions with power lines represents a serious threat for population viability in many species, at least in those that undergo higher collision risks, and that this threat is not equal for all species. Indeed, birds with low manoeuvrability, i.e., those with high wing loading and low aspect, such as bustards, pelicans, waterfowl, cranes, storks, and grouse, are among the species most likely to collide with power lines [2,8]. Species with narrow visual fields are also at high collision risk as they do not see the wires [9,10]. Despite this potentially important conservation problem, few studies have analyzed in detail how these losses affect population trends. For instance, it has been estimated that collision-related losses might equal up to 90% of the annual number of grouse harvested by hunting in Norway [11]. Based on ring-recovery data [12], it has been assessed that 25% of juveniles and 6% of adult white storks (*Ciconia ciconia*) die annually in Switzerland due to power lines (although these data also include electrocutions). It has also been estimated that 30% of Denham's bustards (*Neotis denhami*) die annually by collisions with power lines in South Africa [13].

Researchers and managers have used several methods to reduce collisions, including the removal of the static wire [14,15]. However, the most popular measure has been the attachment of spirals, plates, swivels, or spheres (collectively known as *bird flight diverters*) to the static wire in order to increase visibility [3,16,17,18]. While a recent review concluded that marking static wires reduces the overall number of bird casualties at power lines, it also called attention to the fact that there are a surprisingly small number of well-designed, peer-reviewed studies to support this [19]. Furthermore, there remain many gaps in the research in this area, with several important details still unresolved; for example, the comparative effectiveness of various currently available marker types [19]. To confirm diverter effectiveness, and to study all details of this conservation measure in depth is especially important because despite the high costs of wire marking (e.g., 1,100–2,600 US$ per marked kilometre in South Africa, [20]; 6,000€ in Spain; [21]), the application of this conservation measure is rapidly increasing worldwide.

As stated above, it has been shown that the presence of flight diverters was associated with a decrease in bird collisions [19]. However, the large differences in wire-marking techniques constrained the ability to evaluate potential differences among methods (e.g., different performance based on diverter traits) in that review. To complement such an approach, in the present study we designed the largest field experiment to date, to investigate: (i) the effectiveness of wire marking in reducing collisions; and the roles of (ii) power line type (transmission *vs.* distribution), and (iii) spiral size on marking effectiveness. We expected that: (i) the attachment of spirals would reduce bird mortality [19]; (ii) the effectiveness of marking would be higher in transmission lines because power line type influences the frequency of reactions to marked spans [22]. Morkill & Anderson [22] found that whooping cranes (*Grus americana*) reacted more than expected to transmission lines (345 kV, 27 m high) whereas the opposite was true in distribution lines (69 kV, 12 m high). It is worth noting that transmission lines in our study accumulate a larger number of collisions of those groups of birds especially prone to collision, such as bustards, storks or waterfowl (see below) compared to distribution lines. Therefore, the improvement margin once spirals are attached is greater in transmission lines; and, (iii) larger spirals may be more effective in increasing the visibility of wires [23,24], reducing collisions to a larger extent.

Methods

Study Area

The study was conducted in five important bird areas (IBAs) in central Spain (see [25] for details), which are also the main dry cereal farmland areas in the Madrid region. The terrain is flat to slightly undulating, with a mean elevation of c. 750 m a.s.l. These areas are primarily dedicated to cereal cultivation (mainly wheat *Triticum aestivum* and barley *Hordeum* spp.), with minor fields of legumes *Vicia* spp., grapevines *Vitis vinifera* and olive *Olea europaea* groves. Most cereal is grown in a traditional 2-year rotation system that creates a dynamic mosaic of ploughed, cereal and stubble patches over the region. Small patches of natural vegetation (holm oaks *Quercus ilex*, and scrubland of *Retama* spp. and *Thymus* spp.) remain dispersed across the cereal matrix. Cereal fields are harvested in late June to early July. Stubbles and fallows are also used for sheep grazing [26].

Study species

We considered all birds that we found dead under the power lines in the study area. We discarded the dead birds found beside poles whose cause of death could be attributed to electrocution. However, since not all species have the same collision risk [2,8,9], it is worth noting that the study area holds significant populations of threatened species which are prone to high collision rates due to their low manoeuvrability, high speed flight and/or poor vision [2,8,9], such as the great bustard *Otis tarda* (c. 1500 individuals; [27]), little bustard *Tetrax tetrax* (c. 2600 individuals; [28]), pin-tailed sandgrouse *Pterocles alchata* and black-bellied sandgrouse *P. orientalis* (c. 150 and 200 individuals, respectively, [29]).

Study design and power line monitoring

The study was carried out using a before-after-control-impact (BACI) design, i.e. monitoring power lines before and after the placement of spirals, combined with the use of controls during similar time intervals. Between August 2001 and December 2010 we surveyed bird collisions monthly at 22 different power lines, 7 of them transmission (220 kV) and 15 distribution (15 kV–45 kV) lines, totalling 16.1 and 27.0 km, respectively (Table 1). Fifteen of these lines were our *experimental* lines, i.e. to which spirals were attached. These were monitored once per month for two complete years (one year *before* and one year *after* wire marking). Another 7 lines to which no spirals were attached were used as *control* lines and were monitored also once per month for two complete years. Because no more non-marked control lines were available, in addition to these 7 control lines we also used as controls the second of 10 two-year and the third of 3 three-year surveys carried out at experimental lines once spirals were attached to them (Table 1). These surveys can be considered as *controls* since once the line was marked no changes occurred in the factor presence/absence of spirals and thus no changes were expected between years in the variable under study, i.e. collision rate. The resulting number of power lines (35) and the total length surveyed monthly (72.5 km) for all study years make our study both the most detailed and that with the largest number of power lines monitored to date (for instance, the mean number of power lines per study was 1.9 in a recent review, see Appendix S2 in [19]).

One month before the beginning of each monitoring year we removed all carcasses under the power line. Each monthly search

Table 1. Power line name, type of line (transmission or distribution), design (experimental or control) and number of years monitored after spiral attachment.

Power line	Type	Length (km)	Design	Times after
Aranjuez E-O	Distribution	2.0	Control	One
Aranjuez N-S I	Transmission	2.0	Experimental	One
Aranjuez N-S II	Transmission	4.1	Experimental	One
Belvis-Cobeña	Transmission	3.0	Experimental	Three
Camarma-Fresno	Distribution	2.0	Experimental	Two
Camarma-Meco	Transmission	1.6	Experimental	Two
Camarma-Torote	Transmission	2.1	Experimental	Three
Campo Real-Valdilecha	Distribution	3.2	Experimental	Two
Daganzo-Alcalá	Distribution	0.9	Control	One
Daganzo-Fresno Rio	Distribution	1.1	Control	One
Daganzo-Torote	Transmission	1.8	Experimental	Three
El Colegio	Distribution	3.0	Experimental	Two
La Cueva-El Casar	Distribution	1.5	Control	One
Mesones	Distribution	2.0	Control	One
Pinto	Transmission	1.5	Experimental	Two
Pozuelo-Valdilecha	Distribution	2.6	Experimental	Two
Quer	Distribution	1.4	Experimental	One
San Martín de la Vega	Distribution	1.7	Experimental	Two
Valdepiélagos-Talamanca I	Distribution	2.2	Experimental	One
Valdepiélagos-Talamanca II	Distribution	0.5	Control	One
Valdetorres-La Jara	Distribution	1.4	Control	One
Villanueva-Quer	Distribution	1.5	Experimental	One

doi:10.1371/journal.pone.0032569.t001

for bird carcasses was carried out by one observer walking at a slow, regular pace parallel to the wires but making zigzags to reasonably visually cover a 25 m band at each side of the vertical of the central conductor wire. The observer surveyed first one side along the line (e.g. the 25 m band on the right side), and then he/she returned to the starting point surveying the other side (25 m band on the left side). All remains found were identified to the species level and removed to avoid double counts. When the species was unknown (<2% of the cases), the carcass was assigned to one of the four sizes considered (see below). We recorded a carcass when the remains found consisted of more than five feathers in a square meter, because a smaller number of feathers cannot safely be interpreted as a collision, since they could have been lost by a bird during preening, moulting or fighting [30]. Carcass searches were not performed in June because crop height may lead to unrealistically low carcass detection figures. July surveys were always carried out after cereal harvesting. However, it is worth noting that in our rather structurally-homogeneous study area, there was no relationship between vegetation height or cover and carcass detection rates [25].

Potential detection biases such as site- or year-dependent carcass removal by scavengers or variation in carcass detection due to habitat heterogeneity are minimized in our study, since we used a BACI design combined with the use of control power lines at the same time intervals. Furthermore, potential outbreaks in scavenger populations are unexpected because predator control is widespread in our study region [31]. However, since monthly search frequencies may be adequate to detect medium- to large-sized corpses, but are insufficient for smaller birds, we used equations from [25] to adjust our mortality estimates in relation to search periodicity and carcass size (Table 2), because both can influence mortality estimates. The correction of field data is important because larger carcasses are detected by researchers more easily than smaller ones, and because the longer time elapsed between consecutive searches and the smaller the size of the carcasses, the larger the effect of scavengers on corpse disappearance [25]. Ideally, surveys to evaluate carcass losses should be carried out in each study area before undertaking further mortality studies [25], because detection rates can differ among study areas (e.g., due to habitat biases, [30]). Therefore, we used our own correction equations instead of others recently published (e.g., [32]). Observers were previously trained in order to minimize potential biases due to their different levels of expertise in carcass searches [25].

In addition to testing the effectiveness of line marking as a means to reduce bird collision rate, we also evaluated two potential sources of variation in marking efficiency: power line type and spiral size. Whereas all transmission lines were equipped with large spirals (35 cm diameter and 1 m length, Figure 1a), either large or small spirals (10 cm of diameter and 24 cm m long, Figure 1b) were attached to distribution lines, with the same spiral size attached to all the spans of a given power line. We compared (i) the differences in marking efficiency in transmission *vs.* distribution lines when equipped with large spirals; and (ii) the efficiency of large *vs.* small spirals to reduce bird mortality in distribution lines.

Unfortunately, we have no data on flight frequencies to estimate collision rates associated with our different designs, but in the study of marking effectiveness alone we used the corresponding *controls* to

Table 2. Equations from [25] used in our study to correct numbers of dead birds found at the power line, in order to account for removal by scavengers or missed observations during carcass searches.

Equation	
A_n (Detectability)	A_1 : Large = (no. carcasses found+1)*100/71.7 A_2 : Medium = (no. carcasses found+1)*100/55.8 A_3 : Small = (no. carcasses found+1)*100/32.1 A_4 : Very small = (no. carcasses found+1)*100/33.3
B_n (Periodicity and scavenging)	B_1 : Large = 0.744+28.063*log10(days) B_2 : Medium = −1.751+41.880*log10(days) B_3 : Small = −6.623+58.111*log10(days) B_4 : Very small = 13.538+60.342*log10(days)
C_n (Correction)	$(A_n*B_n)/100$
Mortality estimate $_n$	A_n+C_n

Different equations are given for the four size categories specified in [25] (see Table 3 for their weights). We first corrected the number of carcasses found in the field by their size-dependent detectability (A). Second, we applied equation B for different carcass sizes where "days" is the number of days elapsed from the last visit. Third, we obtained a correction for every size category. Finally, we added C to A to obtain the mortality estimates for each category. The mortality estimate for a given power line was the sum of mortality estimates for the four carcass sizes.

doi:10.1371/journal.pone.0032569.t002

evaluate potential changes in bird mortality associated with changes in bird population densities. Furthermore, power lines of different categories were surveyed in the same study area, minimizing the effect of potential local differences in bird densities.

Statistical analyses

As a basic first analytical approach we tested whether there was a trend in the number of bird carcasses found after marking the line compared to before marking. This was done considering each power line as a sample unit, and comparing the number of decreases and increases in casualties recorded after marking (in the case of experimental lines), or in the second survey year compared to the first year (in the case of control lines). These comparisons were performed using the two-tailed sign test for small samples [33]. The same test was carried out using the total *estimated* number of dead birds, i.e. after correcting the number of casualties recorded during the field surveys [25]. To confirm the observed trends, we checked the differences in the accumulated numbers of *estimated* deaths before-after marking (first-second year in the case of controls) and experimental lines-control lines by means of a chi-squared test.

As a second approach we used a Generalized Linear Mixed Model (GLMM) of various independent factors on the monthly estimated collision rate, after applying corrections proposed by [25] to the number of carcasses found to account for carcass losses due to removal by scavengers or to being overlooked by observers. For this analysis we considered one month as a time lapse long enough to allow the use of carcass search results in different months as statistically independent. We performed three GLMMs with Poisson error distributions and log link functions. The three analyses shared the same dependent variable, the *estimated* number of dead birds per month, and standardizing per kilometre of power line [30]. They also shared the random factor (power line). The models were fitted by maximizing the log-likelihood using the Laplacian approximation in R-Program 2.11.1 ([34]; *lmer* in *lme4* package). The three analyses were the following: (i) Marking effectiveness alone: We evaluated the effect of wire marking on bird mortality with two fixed factors, 'Marked *vs.* non-marked', with two levels, and 'First survey year *vs.* second survey year', also with two levels. This analysis includes both lines marked in the second year, but not in the first, and control lines. (ii) Power line type: We explored the effect of the power line type by including a factor with two levels (transmission and distribution) in the sample of power lines marked with large spirals. (iii) Spiral size: We studied the effect of spiral size through a factor with two levels (large and small) in the sample of distribution power lines.

In order to evaluate the importance of correcting for corpse losses, we performed a *sensitivity analysis* with a second group of GLMM tests where the dependent variable was the raw number of carcasses (i.e., those found in the field, without correction per losses) per km per month. All other parameters remained constant. This was only a methodological approach, as all the findings were based on the above-mentioned *estimated* mortality.

Finally, to study the specificity of the patterns found, we re-analyzed our data from a species-specific point of view. However, most of the species did not allow analyzing them with a GLMM procedure because they were not well represented in all the power lines along the study area. We thus proceeded with Wilcoxon paired-sample tests for the three most common species: (i) doves (rock and domestic doves and wood pigeons, all together), (ii) great bustards and (iii) little bustards. We took into account the changes in mortality (first year *vs.* second year) for the whole power line and separating experimental and control lines. We made these species-specific calculations after correcting the number of casualties recorded during the field surveys, i.e., with *estimated* mortality.

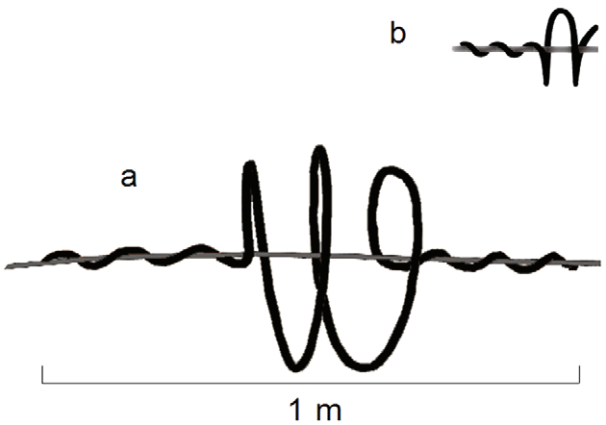


Figure 1. Spirals used in our experiments. Difference in size between large (a) and small (b) can be appreciated.

doi:10.1371/journal.pone.0032569.g001

Results

We found 521 carcasses of 45 bird species, 19 of conservation concern (Table 3). Among experimental lines, most showed a decline in mortality after line marking compared to before line marking (11 lines with a decrease, 4 with an increase; $P = 0.10$, two-tailed sign test). The overall decrease in the number of carcasses recorded in the sample of 15 experimental lines was 88 birds (189 birds before marking, 101 birds after marking, 47% reduction in observed casualties). In control lines we did not observe a significant trend (10 lines with a decrease, 5 with an increase, 5 remained constant, $P = 0.30$, two-tailed sign test), with an overall reduction of 20%.

The 521 dead birds found represent 14,282 estimated bird collisions, an average 8.2 collisions per month and km, after

Table 3. Species found dead under power lines in the present study and their size following [25]: XS (<50 g), S (50–150 g), M (150–600 g) and L (>600 g).

Species	Size	Carcasses found	SPEC
Cattle Egret *Bubulcus ibis*	L	9	Non-SPEC
White Stork *Ciconia ciconia*	L	24	SPEC 2
Mallard *Anas platyrhynchos*	L	4	Non-SPEC
Shoveler Duck *A. clypeata*	L	1	Non-SPEC
Black Kite *Milvus migrans*	L	2	SPEC 3
Cinereous Vulture *Aegypius monachus*	L	2	SPEC 1
Marsh Harrier *Circus aeruginosus*	L	1	Non-SPEC
Sparrowhawk *Accipiter nisus*	M	1	Non-SPEC
Common Buzzard *Buteo buteo*	L	1	Non-SPEC
Common Kestrel *Falco tinnunculus*	M	6	SPEC 3
Red-legged Partridge *Alectoris rufa*	M	10	SPEC 2
Common Quail *Coturnix coturnix*	S	3	SPEC 3
Common Moorhen *Gallinula chloropus*	M	2	Non-SPEC
Little Bustard *Tetrax tetrax*	L	57	SPEC 1
Great Bustard *Otis tarda*	L	73	SPEC 1
Stone Curlew *Burhinus oedicnemus*	L	12	SPEC 3
Lapwing *Vanellus vanellus*	M	19	Non-SPEC
Black-headed Gull *Larus ridibundus*	L	2	Non-SPEC
Pin-tailed Sandgrouse *Pterocles alchata*	M	6	SPEC 3
Rock/Domestic Dove *Columba livia*	M	130	Non-SPEC
Wood Pigeon *C. palumbus*	M	49	Non-SPEC
Common Swift *Apus apus*	S	1	Non-SPEC
European Roller *Coracias garrulus*	S	4	SPEC 2
Crested Lark *Galerida cristata*	XS	1	SPEC 3
Skylark *Alauda arvensis*	S	14	SPEC 3
Barn Swallow *Hirundo rustica*	XS	1	SPEC 3
Meadow Pipit *Anthus pratensis*	XS	7	Non-SPEC
Robin *Erithacus rubecula*	XS	1	Non-SPEC
Northern Weather *Oenanthe oenanthe*	XS	1	SPEC 3
Blackbird *Turdus merula*	S	1	Non-SPEC
Reed Warbler *Acrocephalus scirpaceus*	XS	1	Non-SPEC
Melodious Warbler *Hippolais polyglotta*	XS	1	Non-SPEC
Subalpine Warbler *Sylvia cantillans*	XS	3	Non-SPEC
Orphean Warbler *S. hortensis*	XS	1	SPEC 3
Blackcap *S. atricapilla*	XS	2	Non-SPEC
Common Chiffchaff *Phylloscopus collybita*	XS	4	Non-SPEC
Willow Warbler *P. trochilus*	XS	3	Non-SPEC
Magpie *Pica pica*	M	28	Non-SPEC
Jackdaw *Corvus monedula*	M	1	Non-SPEC
European Starling *Sturnus vulgaris*	S	1	SPEC 3
Spotless Starling *S. unicolor*	S	8	Non-SPEC
House Sparrow *Passer domesticus*	XS	3	SPEC 3
European Serin *Serinus serinus*	XS	1	Non-SPEC
Linnet *Carduelis cannabina*	XS	3	SPEC 2
Corn Bunting *Emberiza calandra*	XS	7	Non-SPEC
Undetermined medium-sized bird	M	3	—
Undetermined passerine	XS	6	—

Table 3. Cont.

Figures are numbers of carcasses found during the whole study period (2001–2010). Note that statistical analyses were made both with raw data and after applying correction equations proposed by [25] to field data shown in this table. The conservation status is based on [43] criteria: 'SPEC 1': European species of global conservation concern; 'SPEC 2': Species having global populations concentrated in Europe and an unfavourable conservation status in Europe; 'SPEC 3': species having global populations not concentrated in Europe but an unfavourable conservation status in Europe; and, 'Non-SPEC': species having global populations not concentrated in Europe and a favourable conservation status in Europe.

doi:10.1371/journal.pone.0032569.t003

accounting for carcass removal by scavengers and missed observations during surveys. Significantly more experimental lines showed a decrease in the number of estimated casualties after line marking compared to before line marking (12 lines with a decrease, 3 with an increase; $P = 0.04$, two-tailed sign test). The overall difference in the sample of 15 lines was 316 birds (3,300 estimated birds before marking, 2,984 birds after marking, 9.6% reduction in estimated mortality). The control sample did not show significant before-after differences (10 lines with a decrease, 10 with an increase, $P = 1.0$, two-tailed sign test; total estimated casualties: 4,067 before and 3,931 after marking, 3.3% reduction). A chi-squared test with the former data (3,300, 2,984, 4,067 and 3,931) confirmed the difference between experimental and control samples in the reduction of estimated casualties ($\chi^2 = 3.90$, $P = 0.048$).

In the GLMM considering all monthly surveys, the number of estimated collisions per kilometre was significantly reduced in experimental power lines after marking, while it remained similar in controls (Table 4i.a; Figure 2). This model explained 96.4% of the deviance. The effectiveness of large spirals was similar in transmission and distribution power lines (Table 4ii.a; Figure 3). The model explained 99.6% of the deviance. Spirals of different sizes had similar marking effectiveness when attached to distribution lines (Table 4iii.a; Figure 4), with 98.8% of the deviance explained by the model. The comparisons with uncorrected raw data (Table 4i.b, ii.b and iii.b) showed different statistical differences (e.g., in 'marked *vs.* non-marked'), highlighting the importance of correcting field data.

Regarding species-specific patterns, doves did not show significant differences in the six treatments, regarding marking effectiveness alone (Wilcoxon paired-sample test, marked *vs.* non-marked, $Z = 0.87$, $P = 0.39$; first survey year *vs.* second survey year, $Z = 0.00$, $P = 1.00$), power line type (transmission lines, $Z = 0.41$, $P = 0.68$; distribution lines, $Z = 0.41$, $P = 0.68$) or spiral size (large spirals, $Z = -0.32$, $P = 0.75$; small spirals, $Z = -0.50$, $P = 0.62$).

In contrast, great bustard mortality was reduced only after marking of transmission lines (transmission lines, $Z = 2.04$, $P = 0.04$; distribution lines, $Z = 0.00$, $P = 1.00$) or only when marking with large spirals (large spirals, $Z = 2.00$, $P = 0.046$; small spirals, $Z = -0.71$, $P = 0.48$), being not significant regarding marking effectiveness alone (marked *vs.* non-marked, $Z = 1.81$, $P = 0.07$; first survey year *vs.* second survey year, $Z = 0.00$, $P = 1.00$).

In the little bustard, wire marking reduced mortality ($Z = 2.47$, $P = 0.01$), whereas statistical differences were not found for controls ($Z = 0.50$, $P = 0.62$) or for power line type (transmission lines, $Z = 1.79$, $P = 0.07$; distribution lines, $Z = 1.15$, $P = 0.25$) or spiral size (large spirals, $Z = 1.22$, $P = 0.22$; small spirals, $Z = 0.00$, $P = 1.00$).

Table 4. Parameter estimates from the Generalized Linear Mixed Model for marking effectiveness alone model (i), power line type model (ii) and spiral size model (iii).

(i.a) Marking effectiveness alone (n = 770) (with corrections)				
	Estimate	**SE**	**z**	***P***
Intercept	2.34	0.09	27.31	<0.0001
Marked *vs.* non-marked	−0.08	0.04	−2.13	0.03
First survey year *vs.* second survey year	−0.04	0.03	1.57	0.12
(i.b) Marking effectiveness alone (n = 770) (without corrections)				
	Estimate	**SE**	**z**	***P***
Intercept	−1.20	0.20	−6.35	<0.0001
Marked *vs.* non-marked	−0.30	0.16	−1.90	0.06
First survey year *vs.* second survey year	0.47	0.14	3.46	<0.0001
(ii.a) Power line type (n = 242) (with corrections)				
	Estimate	**SE**	**z**	***P***
Intercept	2.10	0.11	18.49	<0.0001
Power line type	0.11	0.14	0.78	0.44
(ii.b) Power line type (n = 242) (without corrections)				
	Estimate	**SE**	**z**	***P***
Intercept	−1.71	0.32	−5.42	<0.0001
Power line type	0.75	0.38	1.99	0.05
(iii.a) Spiral size (n = 176) (with corrections)				
	Estimate	**SE**	**z**	***P***
Intercept	2.10	0.08	25.12	<0.0001
Spiral size	0.10	0.12	0.88	0.38
(iii.b) Spiral size (n = 176) (without corrections)				
	Estimate	**SE**	**z**	***P***
Intercept	−1.75	0.36	−4.92	<0.0001
Spiral size	0.65	0.49	1.32	0.19

We show GLMM with (a) and without (b) corrections for carcass losses due to researcher overlooking and removing by scavengers. Estimate, standard error (SE), statistic value (z) and statistical significance (*P*) are provided.

doi:10.1371/journal.pone.0032569.t004

Discussion

Our results show a slight (overall, 9.6%, after correcting for carcass removal by scavengers and missed observations), but significant reduction in bird mortality after flight diverters were attached to power lines. Regardless of statistical significance, a slight mortality reduction may be very biologically relevant in areas, species or populations of high conservation concern. It is important to note that overall mortality reduction values were not the same if calculated using raw numbers of dead birds found, i.e. before correcting for carcass removal by scavengers and missed observations. This is because correction factors differ between species [25]. Thus, uncorrected mortality values would lead to incorrect conclusions, and special care should be taken when dealing with certain birds of conservation concern. Neither the type of line (transmission *vs.* distribution) marked with large spirals, nor the size of spirals in distribution lines influenced the magnitude of mortality reduction when we assessed overall mortality in all species together. However, great bustard mortality showed reductions when lines were marked with large spirals, and also considering only transmission lines.

The effectiveness of wire marking in reducing bird mortality through collision has been recently reviewed by Barrientos et al. [19]. However, in that study, different markers were combined since available sample sizes did not allow inclusion of marker type as a factor in the analysis. Thus, despite spirals of different sizes and colours being the most frequently employed bird flight diverters, half of the studies included in Barrientos et al. [19] referred to other device types (see Appendix in [19]). The present study suggests that the mortality reduction found in that review was not due to the inclusion of other markers, and that the most widely used spirals are effective. The present study also overcomes a common problem detected in Barrientos et al. [19], namely that sample sizes are generally small. Here we based our conclusions on a large sample including two-year monthly surveys at 15 experimental and 20 control power lines, covering 72.5 km. Moreover, these lines were distributed over a relatively large geographical area, encompassing most farmland areas used by steppe birds in our study region. This overall low (9.6%) reduction could be greater in some places (e.g., migration corridors, power lines close to resting sites, etc), or could represent a valuable reduction for endangered species with high collision risk. Thus, a

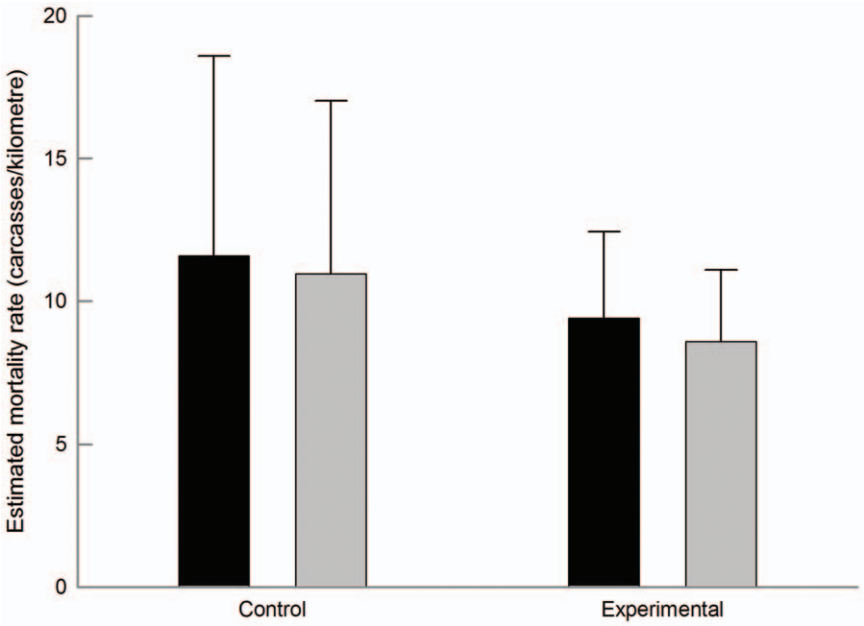


Figure 2. Number of estimated carcasses per kilometre (mean ± SE) before (black) and after (grey bars) marking in control (left) and experimentally marked (right) power lines. Sample sizes were 219 and 165 in each period for control and experimental power lines, respectively.
doi:10.1371/journal.pone.0032569.g002

detailed evaluation of mortality due to collision should be carried out before deciding where to attach spirals as a bird protection measure in relatively large conservation areas.

Some of the species found dead in our study are among those suggested in previous studies to be the most likely to collide with power lines [2,8], namely those with low maneuverability such as bustards, storks or waterfowl. These species usually fly higher than, for instance, many passerines, and thus most of their collisions are expected to be with transmission lines. Indeed, if we consider the data from the first year only, i.e. before attaching spirals, transmission lines in our study accumulated 71% (n = 42) of all great bustards found dead in all lines, 50% (n = 50) of all little bustards *Tetrax tetrax*, 83% (n = 12) of all white storks *Ciconia ciconia* and 100% (n = 3) of all ducks *Anas* spp., despite the fact that transmission lines represented only 36% of the total length of power lines surveyed. In their study with whooping cranes, Morkill

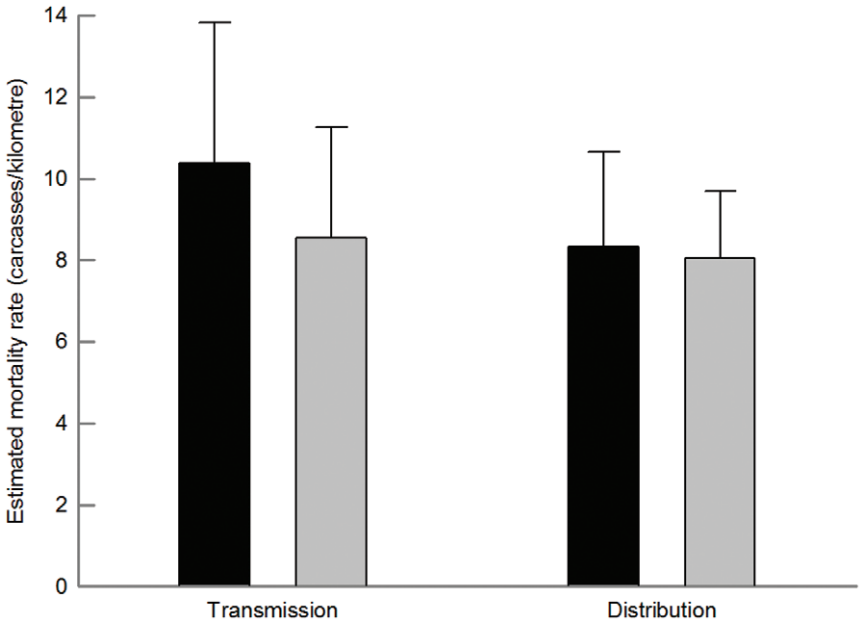


Figure 3. Number of estimated carcasses per kilometre (mean ± SE) before (black) and after (grey bars) marking in transmission (left) and distribution (right) power lines. Sample sizes were 77 and 44 in each period for transmission and distribution power lines, respectively.
doi:10.1371/journal.pone.0032569.g003

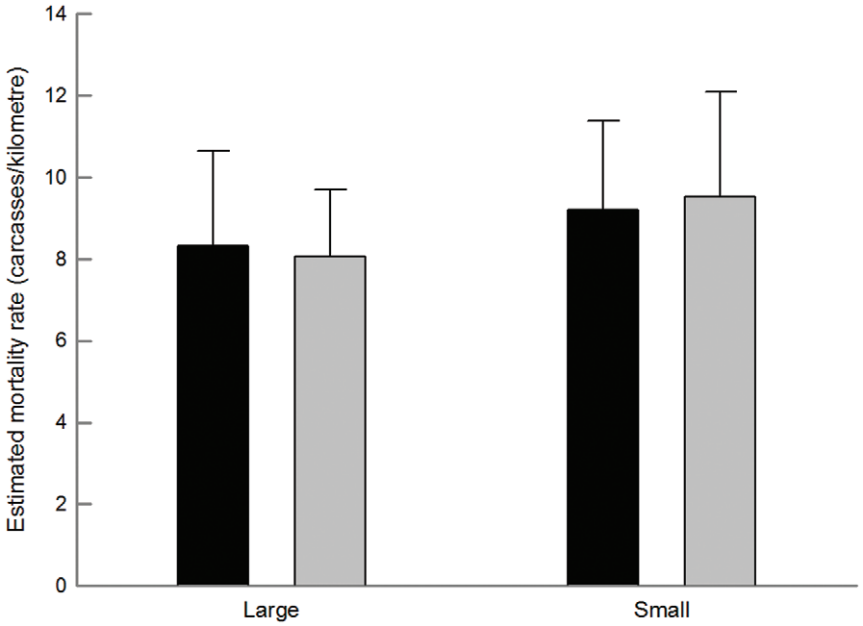


Figure 4. Number of estimated carcasses per kilometre (mean ± SE) before (black) and after (grey bars) marking in distribution power lines marked with large (left) and small (right) spirals. See Figure 1 for more details. Sample sizes were 44 in all cases.
doi:10.1371/journal.pone.0032569.g004

& Anderson [22] found that birds reacted more than expected to transmission lines and less to distribution lines. However, we did not find a significant difference in mortality reduction in marked transmission lines compared to marked distribution lines when we considered all species together. When looking at species-specific patterns, only the great bustard showed a slight mortality reduction in marked transmission lines. Although some studies found that species suffering high collision mortality may show a tendency to avoid areas with transmission lines (e.g. little bustard, [35]), collision with transmission lines is still one of the most important sources of mortality in these species [35,36]. Thus, as suggested in Barrientos et al. [19], it is possible that at least some of these particularly sensitive species do not properly respond to conventional marking methods (see below).

Although one would expect that large flight diverters are more effective than small diverters in increasing the visibility of marked wires, other authors that have used spirals of different sizes [23,24] did not statistically test for differences among them. Our study explores this possibility for the first time. Considering all species together, our results suggest that the decrease in collision rate is independent of spiral size, and thus it seems reasonable to conclude that the main advantage of marking is already achieved with small spirals, with larger spirals being unnecessary. This could imply interesting applied findings. For example, small diverters do not apply excessive weight to the wire. Large devices can constitute a problem for this reason especially in high winds, contributing to the downing of power lines, especially if devices are frozen [14,22]. However, a flagship species like the great bustard showed mortality reduction with larger spirals, suggesting that, at least for this species, large spirals work better.

Despite our study being, to our knowledge, the largest published field experiment, and ca. 310,000 € were spent to mark 33.7 kilometres of power lines in our study area, few conclusions can be drawn beyond the general effectiveness of bird flight diverters in reducing collision mortality. We found differences in effectiveness when we compared markers in transmission versus distribution lines, or when we compared spirals of different sizes in distribution lines only with one species (although we could carry out species-specific analyses only with three species). However, it is worth noting that even after marking, bird collisions in our study area were still high, especially for some endangered species usually showing high collision risks (e.g. great and little bustards). Several non-mutually exclusive explanations could account for this. First, it is possible that the generally low probability of collision (0.21-0.05 birds per 1,000 crossings; [19]) makes it very difficult to find differences even with well-designed experiments. If this is the case, huge experimental designs would be necessary to find larger differences and extract stronger conclusions. Second, it has been argued that bad weather or light conditions can increase bird collisions, especially if birds have problems with flight control [14,37]. For most birds, sustained slow flight is costly or aerodynamically impossible [38,39], and hence reducing speed is an unlikely mechanism to increase safety under bad weather or light conditions. Third, collisions frequently occur even under low wind and good visibility conditions [40]. Recent studies [9,10] suggest that some species, which undergo high collision rates (e.g. bustards and storks) have narrow fields of view in the frontal plane, hindering their ability to see the way ahead. Fourth, Martin [10] suggests that birds flying in open airspace above vegetation could relax –by means of either behavioural or evolutionary adaptations- the monitoring of this airspace since it is a highly predictable environment, usually clear of hazards. In other words, birds of some species could simply not look ahead during flight. Indeed, frontal vision in birds is not a high-resolution vision [10]. Instead, the best resolution occurs in the lateral vision, which most birds employ to detect conspecifics (very important in social species like bustards or storks) and predators, or in identify foraging opportunities. All of these may be more important for a bird than simply looking ahead during flight into open airspace [10]. Fifth, anecdotal events can have potentially important effects on collisions. For instance, Sastre et al. [41] suggest that human-related disturbances causing flight response can increase the probability of collision of great bustards with power lines. Sixth, regarding the effectiveness evaluation of different devices, it is also

plausible that misguided approaches have been used to date. For instance, whereas bird flight diverters are usually coloured with a single colour bright to the human eye [19], a recent review [10] recommends the use of black-and-white diverters, which reflect highly or absorb strongly across the full spectrum of ambient light. Thus, it is possible that the few valuable studies carried out to date that compared the effectiveness of different colours for a certain bird flight diverter [42] actually compared colours too close in the spectrum to identify differences in their effectiveness. Since it is recognized that the colour vision of birds extends into the ultraviolet range, thus broadening, compared with humans, the range of stimuli to which the avian eye can respond [10], the use of ultraviolet-devices should be investigated.

In summary of the above-mentioned explanations, and given that is seems clear that no single type of marker will be equally effective for all bird species, we acknowledge that the importance of type and size of bird flight diverters is not yet clear and should be confirmed in future studies. Our study does not pretend to be comprehensive in this respect, and regarding the different susceptibilities of different bird species or groups to collision [see 2,8], and particularly the mortality reductions obtained for specific models of flight diverters should be further investigated. In this sense, we encourage researchers to explore the effectiveness of non-visual diverters. Finally, we highly recommend the identification of mortality hot-spots based on the number of individuals killed and the vulnerability of the species involved [e.g. 44]. Taking into account the economic cost of marking, it is likely more useful to attach flight diverters to these hot-spots rather than to do it to whole sections of power line.

Acknowledgments

We thank A. García Fernández and M. Carrasco for their assistance during the field work. We also thank J. Camaño and J. Velasco of HENARSA, and the electric companies Iberdrola, Unión Fenosa and Red Eléctrica de España for their cooperation. S. Young reviewed the English.

Author Contributions

Conceived and designed the experiments: JCA C. Palacín CM. Performed the experiments: RB C. Ponce BM CM. Analyzed the data: C. Ponce RB JCA. Contributed reagents/materials/analysis tools: C. Ponce RB JCA. Wrote the paper: RB C. Ponce JCA.

References

1. APLIC (Avian Power Line Interaction Committee) (2006) Suggested practices for avian protection on power lines: state of the art in 2006. Washington: Edison Electric Institute and Sacramento: California Energy Commission. 227 p.
2. Bevanger K (1998) Biological and conservation aspects of bird mortality caused by electric power lines. Biol Conserv 86: 67–76.
3. Jenkins AR, Smallie JJ, Diamond M (2010) Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conserv Int 20: 263–278.
4. Manville AM, II (1999) The ABC's of avoiding bird collisions at communication towers: the next steps. In: Avian interactions with utility and communication structures. Workshop proceedings. Palo Alto: Electric Power Research Institute. pp 85–104.
5. Manville AM, II (2009) Towers, turbines, power lines, and buildings: steps being taken by the U.S. Fish and Wildlife Service to avoid or minimize take of migratory birds at these structures. In Ralph CJ, Rich, eds. Tundra to tropics: connecting birds, habitats, and people. Proceedings 4th international Partners in Flight conference. McAllen: Partners in Flight. pp 262–272.
6. Koops FBJ (1994) Collision victims of high-tension lines in The Netherlands and effects of marking. In: Red Eléctrica Española. First technical sessions on power lines and the environment. Madrid: REE. pp 51–57.
7. Hunting K (2002) A roadmap for PIER research on avian collisions with power lines in California. Technical report P500–02-071F. Sacramento: California Energy Commission. 69 p.
8. Janss GFE (2000) Avian mortality from power lines: a morphologic approach of a species-specific mortality. Biol Conserv 95: 353–359.
9. Martin GR, Shaw JM (2010) Bird collisions with power lines: failing to see the way ahead? Biol Conserv 143: 2695–2702.
10. Martin GR (2011) Understanding bird collisions with man-made objects: a sensory ecology approach. Ibis 153: 239–254.
11. Bevanger K (1995) Estimates and population consequences of tetraonid mortality caused by collisions with high tension power lines in Norway. J Appl Ecol 32: 745–753.
12. Schaub M, Pradel R (2004) Assessing the relative importance of different sources of mortality from recoveries of marked animals. Ecology 85: 930–938.
13. Shaw JM (2009) The end of the line for South Africa's national bird? Modelling power line collision risk for the Blue Crane. MS thesis. Cape Town: University of Cape Town.
14. Beaulaurier DL (1981) Mitigation of bird collisions with transmission lines. Portland: Bonneville Power Administration. 105 p.
15. Bevanger K, Brøseth H (2001) Bird collisions with power lines: an experiment with ptarmigan (*Lagopus* spp.). Biol Conserv 99: 341–346.
16. APLIC (Avian Power Line Interaction Committee) (1994) Mitigating bird collisions with power lines: the state of the art in 1994. Washington: Edison Electric Institute. 78 p.
17. Hebert E, Reese E, eds. Avian collision and electrocution: an annotated bibliography. Publication P700–95-001. Sacramento: California Energy Commission. 115 p.
18. Alonso JC, Alonso JA, Muñoz-Pulido R (1994) Mitigation of bird collisions with transmission lines through groundwire marking. Biol Conserv 67: 129–134.
19. Barrientos R, Alonso JC, Ponce C, Palacín C (2011) Meta-analysis of the effectiveness of marked wire in reducing avian collisions with power lines. Conserv Biol 25: 893–903.
20. Kruger R (2001) A risk based approach to the cost of implementing raptor mitigation measures on Eskom distribution networks in South Africa. In:, , Carlton Rproj (2001) Avian interactions with utility and communication structures. Workshop proceedings. Palo Alto: Electric Power Research Institute. pp 229–246.
21. Alonso JC, Martín CA, Palacín C, coordinators (2005) Proyecto de medidas preventivas, correctoras y ompensatorias de la afección de la M-50 y de la Autopista de Peaje R-2 a la población de avutardas y otras aves esteparias de la IBA Talamanca-Camarma, y al LIC Cuenca de los ríos Jarama y Henares. Madrid: Museo Nacional de Ciencias Naturales (CSIC). 37 p.
22. Morkill AE, Anderson SH (1991) Effectiveness of marking powerlines to reduce sandhill crane collisions. Wildlife Society Bulletin 19: 442–449.
23. Koops FBJ, de Jong J (1982) Vermindering van draadslachtoffers door markering van hoogspanningsleiden in de omgeving van Heerenveen. Elektrotechniek 60: 641–646.
24. Anderson MD (2002) The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Report 1. Johannesburg: Eskom. 25 p.
25. Ponce C, Alonso JC, Argandona G, Fernández AG, Carrasco M (2010) Carcass removal by scavengers and search accuracy affect bird mortality estimates at power lines. Anim Conserv 13: 603–612.
26. Ponce C, Bravo C, García de León D, Magaña M, Alonso JC (2011) Effects of organic farming on plant and arthropod communities: A case study in Mediterranean dryland cereal. Agric Ecosyst Environ 141: 193–201.
27. Alonso JC, Martín CA, Palacín C, Magaña M, Martín B (2003) Distribution, size and recent trends of the Great Bustard (*Otis tarda*) population in Madrid region, Spain. Ardeola 50: 21–29.
28. García de la Morena EL, Bota G, Ponjoan A, Morales MB (2006) El sisón común en España. I Censo Nacional (2005). Madrid: SEO/BirdLife. 159 p.
29. Martín CA, Palacín C, Martín B, Ponce C, Sastre P, Bravo C (2011) Abundancia y distribución de la ganga ortega (*Pterocles orientalis*) y la ganga ibérica (*Pterocles alchata*) en la Comunidad de Madrid. Anuario Ornitológico de Madrid 2009–2010. In press.
30. Bevanger K (1999) Estimating bird mortality caused by collision and electrocution with power lines; a review of methodology. In: Ferrer M, Janss GFE, eds. Birds and power lines. Collision, electrocution and breeding. Madrid: Quercus. pp 29–56.
31. Virgós E, Travaini A (2005) Relationship between small-game hunting and carnivore diversity in central Spain. Biodiv Conserv 14: 3475–3486.
32. Huso MMP (2011) An estimator of wildlife fatality from observed carcasses. Environmetrics 22: 318–329.
33. Siegel S, Castellan NJ (1988) Nonparametric statistics for the behavioural sciences, 2nd edn. McGraw-Hill, New York.
34. R Development Core Team (2009) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna. Available at: http://www.R-project.org. Last accessed: 17/01/2012.
35. Silva JP, Santos M, Queirós L, Leitão D, Moreira F, et al. (2010) Estimating the influence of overhead transmission power lines and landscape context on the density of little bustard *Tetrax tetrax* breeding populations. Ecol Model 221: 1954–1963.
36. Martín B (2008) Dinámica poblacional y viabilidad de la avutarda común en la comunidad de Madrid. PhD Thesis. Universidad Complutense de Madrid, Madrid.

37. Savereno AJ, Savereno LA, Boettcher R, Haig SM (1996) Avian behavior and mortality at power lines in coastal South Carolina. Wild Soc Bull 24: 636–648.
38. Norberg UM (1990) Vertebrate Flight: Mechanics, Physiology, Morphology, Ecology and Evolution. Zoophysiology Series, Vol. 27. Berlin: Springer Verlag. 291 p.
39. Biewener AA (2003) Animal Locomotion. Oxford: Oxford University Press. 281 p.
40. Drewitt AL, Langston RHW (2008) Collision effects of wind-power generators and other obstacles on birds. Annals of the New York Academy of Sciences 1134: 233–266.
41. Sastre P, Ponce C, Palacín C, Martín CA, Alonso JC (2009) Disturbances to great bustards (*Otis tarda*) in central Spain: human activities, bird responses and management implications. Eur J Wildl Res 55: 425–432.
42. Calabuig CP, Ferrer M (2009) Análisis de la eficacia y la vida útil de la señalización anticolisión "salvapájaros" en líneas de transporte de energía eléctrica. Seville: REE, SAU, and CSIC. 41 p.
43. BirdLife International (2004) Birds in Europe: population estimates, trends and conservation status. Cambridge: BirdLife International. 374 p.
44. Quinn M, Alexander S, Heck N, Chernoff G (2011) Identification of bird collision hotspots along transmission power lines in Alberta: an expert-based geographic information system (GIS) approach. J Environ Inform 18: 12–21.

Attachment

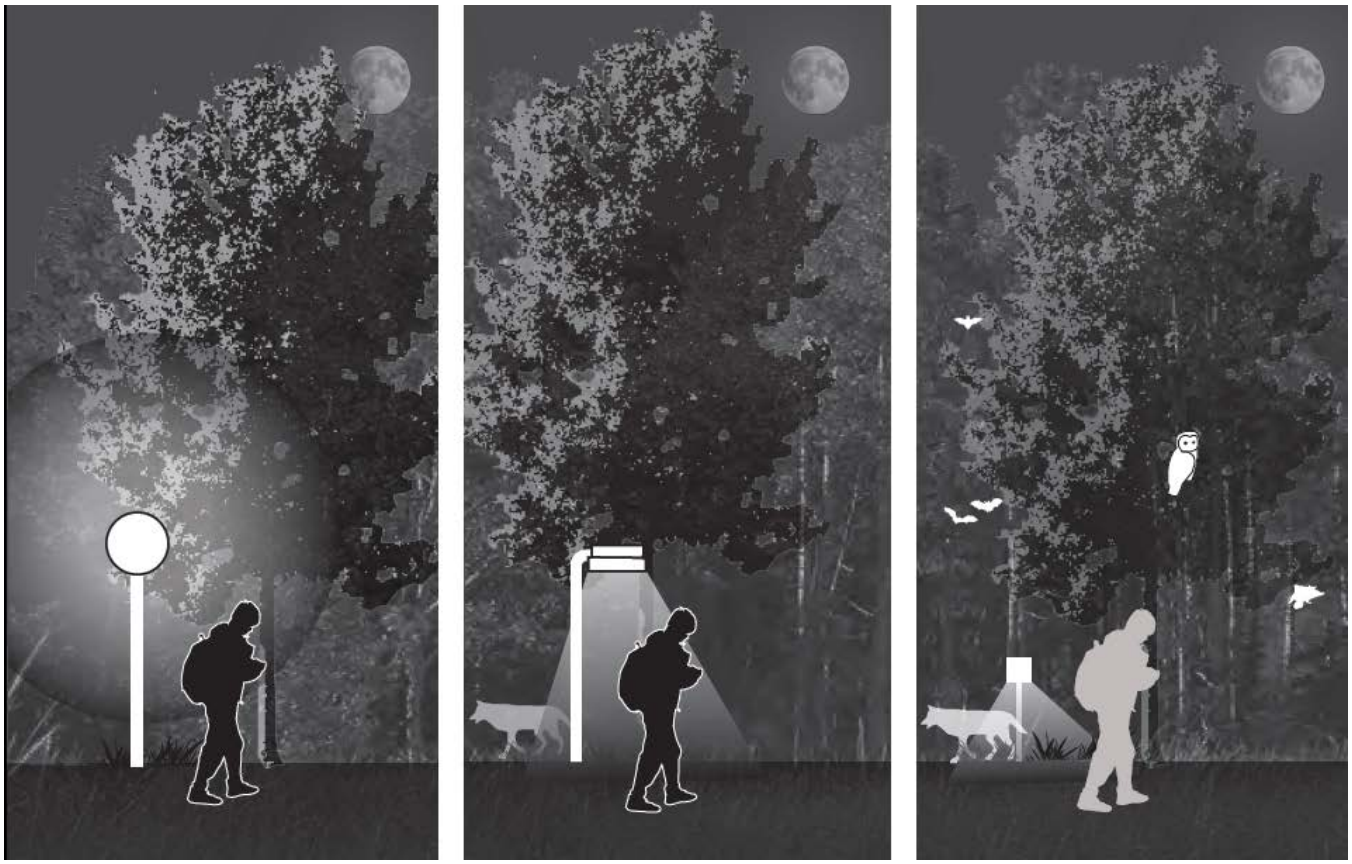
National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Artificial Night Lighting and Protected Lands

Ecological Effects and Management Approaches

Natural Resource Report NPS/NRSS/NSNS/NRR—2016/1213



The Urban Wildlands Group

USC School of Architecture

USC Dornsife
Dana and David Dornsife College of Letters, Arts and Sciences

ON THE COVER
Example of controlling light direction to reduce environmental consequences
Illustration by Leigha DelBusso

Artificial Night Lighting and Protected Lands

Ecological Effects and Management Approaches

Natural Resource Report NPS/NRSS/NSNS/NRR—2016/1213

Travis Longcore[1,2,3] and Catherine Rich[1] with illustrations by Leigha DelBusso[2]

[1] The Urban Wildlands Group
P.O. Box 24020
Los Angeles, CA 90024

[2] School of Architecture
University of Southern California
Los Angeles, CA 90089

[3] Spatial Sciences Institute
Dornsife College of Letters, Arts and Sciences
University of Southern California
Los Angeles, CA 90089

May 2016

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data, and whose background and expertise put them on par technically and scientifically with the authors of the information.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/nrpm/). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

Please cite this publication as:

Longcore, T., and C. Rich. 2016. Artificial night lighting and protected lands: Ecological effects and management approaches. Natural Resource Report NPS/NRSS/NSNS/NRR—2016/1213. National Park Service, Fort Collins, Colorado.

NPS 999/132629, May 2016

Contents

Page

Figures v

Executive Summary ix

Acknowledgments xi

Introduction 1

Effects of Artificial Night Lighting on Natural Ecosystems 1

- Natural patterns of light and dark 1
- Coastal dunes, beaches, and shorelines 5
- Deserts and scrublands 7
- Wetlands and rivers 8
- Islands, oceans, and reefs 11
- Grasslands 13
- Deciduous and evergreen forests 15
- Alpine and tundra habitats 16
- Urban environments 18

Mitigating the Effects of Lighting on Protected Lands 20

- Approaches to minimize lighting impacts 20
  - Need 20
  - Spectrum 21
  - Intensity 26
  - Direction 26
  - Duration 28
- Lighting situations 30
  - Communication towers 31
  - Night hiking and mountain biking 31
  - Campsite lighting 31
  - Off-road vehicles 32
  - Monuments 32
  - Light-assisted fishing 32

Contents (continued)

Page

Security lighting 33

Bridges 33

Roadway lighting 33

Energy production installations 35

Indoor lighting 36

Lighthouses 36

Billboards 36

Literature Cited 39

Figures

Page

Figure 1. Natural horizontal illumination during the day, sunset, and at night (Beier 2006) 2

Figure 2. Relative sensitivity to light across the visual spectrum for honeybees (Menzel and Greggers 1985), moths (Cleve 1964), and human photopic vision (CIE 1932)..... 3

Figure 3. Proportion of major animal groups that are nocturnal. Area of markers is proportional to the number of species known in the group..... 4

Figure 4. Beach environments are vulnerable to the effects of anthropogenic light because of their open nature..... 5

Figure 5. Lights in desert scrublands are visible for long distances and night lighting affects a disproportionate fraction of the wildlife because high daytime temperatures induce nocturnal activity patterns. 8

Figure 6. Lights along rivers and streams can disrupt predator–prey interactions, such as seals hunting salmon under lights. 9

Figure 7. Light in wetlands can suppress diel vertical migration of zooplankton and influence foraging behavior of amphibians. 10

Figure 8. Two tadpoles of the same age and kept in 12:12 L:D lighting. 11

Figure 9. Cruise ships and squid boats are just two of the sources of artificial lighting on the oceans that attract seabirds and migrating songbirds. 12

Figure 10. Grasslands are vulnerable to disruption from even distant lights because of their open character. 14

Figure 11. Illumination in deciduous forest (Buchanan 2006). 15

Figure 12. Species of the deciduous forest are adapted to the lower light levels found under the canopy 16

Figure 13. Alpine habitats can be affected by distant lights and those from recreational and industrial facilities. 17

Figure 14. Predator–prey interactions are affected by artificial lights during long nights on the tundra. 18

Figure 15. Cities are affected by altered light environments, which are exploited by synanthropic species such as crows and some bat species..... 19

Figure 16. A pale-colored path can be just as effective as electric lights in some park situations. 21

Figure 17. Yellow light that does not contain blue or ultraviolet wavelengths attracts far fewer insects..... 22

Figures (continued)

Page

Figure 18. Green lighting designed to minimize attraction of birds developed by Philips. Shell is using these lights on an oil platform in Alaska and Philips is adding the lights to its regular catalog 23

Figure 19. Green lights have been investigated for use on offshore structures and shown to be less attractive to birds. 24

Figure 20. Red light does not disrupt dark-adapted vision and is therefore appropriate for campsites and locations used for astronomical observation. 25

Figure 21. Illumination of a stairway at a campground by two low-intensity red bulbs instead of by a bright white spotlight (Wagner et al. undated). 25

Figure 22. The more focused light can be on its target, the less it will affect other species. 27

Figure 23. Embedded lights allow wayfinding with minimal intensity and good directional control. 27

Figure 24. A full cutoff shield being installed on an existing light on the lodge at Yellowstone National Park 28

Figure 25. Motion- and heat-detecting lights provide illumination only when it is needed. 29

Figure 26. Timed lights may affect species negatively during the transitional period of dusk, but may reduce impacts later at night. 30

Figure 27. Embedded roadway lighting. These LED lights installed in the pavement are not visible to sea turtles nesting on the adjacent beach and are well received by motorists and pedestrians (Bertolotti and Salmon 2005) 35

Two natural forms of light at night — from the moon and bioluminescent plankton — contrast with coastal urban lighting in New Jersey, United States. Artificial lighting dramatically changes the intensity and spectrum of light available at night and homogenizes the nocturnal visual environment over space and time. Photograph by Flickr user catalano82 is reproduced with permission.

Executive Summary

Artificial night lighting represents a growing challenge for managers of parks and protected lands. The disruption of natural patterns of light and dark, which have been more or less reliable for millions of years, has a range of adverse consequences for wildlife across taxonomic groups and landscape types. This document reviews effects of artificial night lighting by habitat type and discusses the approaches available to land managers to mitigate and avoid certain adverse effects of artificial night lighting.

Coastal dunes, beaches, and shorelines are a transition zone between terrestrial and aquatic habitats. They often contain gradients of lighting influence from developed shorelines to darker lakes and oceans. Sea turtles are prominent victims of these disrupted lighting regimes. The foraging decisions of many other species are influenced by lighting conditions, embodying tradeoffs between predation risk and dietary needs.

Deserts and scrublands are open habitats with few barriers to light transmission. They are also often hot in the day, with large proportions of nocturnal and crepuscular species avoiding thermal stress. Many nocturnal desert species prefer low illumination levels and have good visual performance under the faint light of the darkest nights.

Wetlands and rivers are often dark spots surrounded by lights, especially when close to human settlement. Movement of species into and out of wetlands and streams is influenced by lights, as is the movement of animals, such as fishes or aquatic invertebrates, up and down rivers and streams. Downwelling light mediates most predator–prey interactions in the water column. Changing light levels cause predators and prey to change depth. Small prey species are influenced by the phase of the moon, and lighting can degrade conditions favorable to successful foraging. Emerging research demonstrates that lighting influences the developmental rates of wetland organisms such as amphibians.

Islands, oceans, and reefs are increasingly influenced by lights from onshore sources, hydrocarbon extraction platforms, fishing vessels, and all manner of ships. Downwelling light is also a dominant factor in structuring ecosystem processes in marine water columns, and many organisms are sensitive to extremely small changes in light levels. Extensive vertical migrations are driven by changes in surface illumination. Changes in surface lighting can have effects hundreds of meters below the surface. Lighting will alter reproduction and predator–prey interactions, and can attract organisms across wide areas.

Grasslands are also open habitats with few barriers to block lights. Research shows influence of lighting on nesting behavior of birds, distribution of predators, and signaling by bioluminescent organisms such as fireflies.

Deciduous and evergreen forests can block light and reduce its influence, but also contain communities of forest floor species adapted to lighting levels much dimmer than in exposed habitats. Therefore even low levels of light can influence foraging times or timing of reproductive activity.

Alpine and tundra habitats are well represented in protected lands. Many species have annual rhythms designed to avoid the harsh winter that are potentially disrupted by lighting cues. In alpine habitats, the slope of the land potentially exposes habitats to direct glare from downslope sources in addition to light reflected in the atmosphere.

Finally, *urban environments* have many artificial light sources, but still can support significant biodiversity in the form of both resident and migratory species. Migratory birds are attracted to lighted structures at night and collide with windows during the day. Some bat species are attracted to insects found under city lights, while others avoid them.

Mitigation of adverse effects of anthropogenic light in these different habitats is guided in five ways:

1. Need. Creative solutions are often available to avoid use of lights where they are not absolutely necessary. Especially in natural areas, managers should exercise discretion in limiting the lighting infrastructure.
2. Spectrum. Although no color of light is benign in all situations, managers should avoid lights that have ultraviolet or blue light (shorter wavelengths) and in general use lights with red and yellow hues.
3. Intensity. Reducing the intensity of lights can often improve visibility for humans by reducing the contrast between light and shadow, allowing people to see a larger area than they might otherwise be able to discern. Guidelines for lighting intensity from the lighting industry should not be followed when trying to reduce impacts to wildlife, because they are usually higher than necessary for human vision and do not take into account impacts to wildlife.
4. Direction. Lights should be shielded such that they only cast light where it is needed, and never be directed upwards.
5. Duration. Timers and motion detectors can reduce the time a light is on and may therefore reduce impacts. Curfew hours for lights can also enhance visitor experience.

In this report, many lighting situations are considered, including communication towers, night hiking and mountain biking, campsite lighting, off-road vehicles, monuments, light-assisted fishing, security lighting, bridges, roadway lighting, energy production installations, indoor lighting, lighthouses, and billboards. With careful planning and collaboration, usually with nearby jurisdictions, managers of parks and other protected lands can be leaders in the control of light pollution and increase enjoyment of natural lands from inner city parks to wilderness areas.

Acknowledgments

This research was funded by the National Park Service Night Skies Program through a cooperative agreement with The Urban Wildlands Group. Illustrations were funded by the University of Southern California School of Architecture's Graduate Research Scholar Program. We thank Chad Moore, Kurt Fristrup, Jeremy White, Jim Von Haden, and three anonymous reviewers for constructive and insightful comments. We furthermore thank Karen Treviño and acknowledge the Natural Sounds and Night Skies Division for its support.

Introduction

Americans have long recognized that parks and protected lands can provide opportunities to see and enjoy the solitude of unspoiled nature, where the natural rhythms of life are allowed to flourish with minimal influence from humans. Managers of parks and protected lands balance the need to provide visitor facilities with the impacts of such infrastructure on the environment. Although night lighting may be a requirement for visitors in some circumstances, scientific research has documented a range of adverse consequences of night lighting on ecosystems and wildlife. The effects of lighting on species and ecosystems can be reduced, and in some instances avoided altogether. This report provides examples of assessing the impacts of night lighting on wildlife, and presents options to retrofit and design lighting that minimize impacts to wildlife and the nocturnal environment.

Extensive outdoor (and indoor) electric lighting is a recent phenomenon. Thomas Edison commercialized the electric light bulb in the late 1880s, and outdoor use was largely limited to cities until well into the 1900s. Electric lights were introduced in city centers as replacements for gas lamps in the late 1880s, with lethal effects on wildlife. Nearly 1,000 migratory birds were killed in collisions after being attracted to an electric light tower in Decatur, Illinois in 1886 (Gastman 1886). Significant outdoor lighting spread with the rural electrification programs of the 1930s and 1940s. More recently, other significant sources of outdoor lighting have spread across large swaths of the globe, primarily through illumination of human settlements and associated transportation infrastructure. Other sources of artificial night lighting have proliferated as well. Lighting associated with oil and gas development illuminates large terrestrial and offshore regions. Similarly, light-assisted fishing operations illuminate oceans in many regions and oceangoing freighters and passenger ships introduce mobile light sources along oceanic routes. Together, these and other light sources introduce novel lighting conditions that have no historical precedent in natural ecosystems. Natural patterns of darkness are lost or endangered globally (Bennie et al. 2015, Duffy et al. 2015, Marcantonio et al. 2015).

This document is divided into two sections. The first section reviews the effects of artificial night lighting on major habitat types. No single solution can mitigate all adverse effects of artificial night lighting. We therefore attempt to generalize the concerns that typify each biome. The second section provides recommendations for management approaches to minimize impacts from lighting. We address the characteristics of lights in terms of need, spectrum, intensity, direction, and duration, with reference to biomes in which each method of control would be applicable. This discussion addresses common lighting applications — roadways, parking, and walkways — as well as specialized situations like night hiking and mountain biking, vanity lighting, communication towers, and light-assisted fishing.

Effects of Artificial Night Lighting on Natural Ecosystems

Natural patterns of light and dark

In the natural world, sources of light are either very predictable or notably ephemeral. The dominant and structuring source of light is the sun, through daylight and the reflected light of moonlight.

Patterns and intensity of sunlight and moonlight vary with geographic location, weather, and time, but they have certain predictable characteristics. For example, the daily, monthly, and seasonal patterns of moonlight and sunlight incident upon the Earth's atmosphere are only rarely interrupted (e.g., by a solar eclipse). Once the sun has set, the brightest possible constant light source is a full moon until the sun rises again (**Figure 1**). The length of the night varies by season and latitude and these patterns are, in the timescale of biological activity, fixed. Weather influences illumination during the day, and does not, with the exception of lightning, increase nocturnal illumination. Fires, lightning, bioluminescence, starlight, airglow, and zodiacal light contribute to nighttime illumination under natural conditions, and these transient sources are brief, rare, or dim in comparison with sunlight and moonlight.

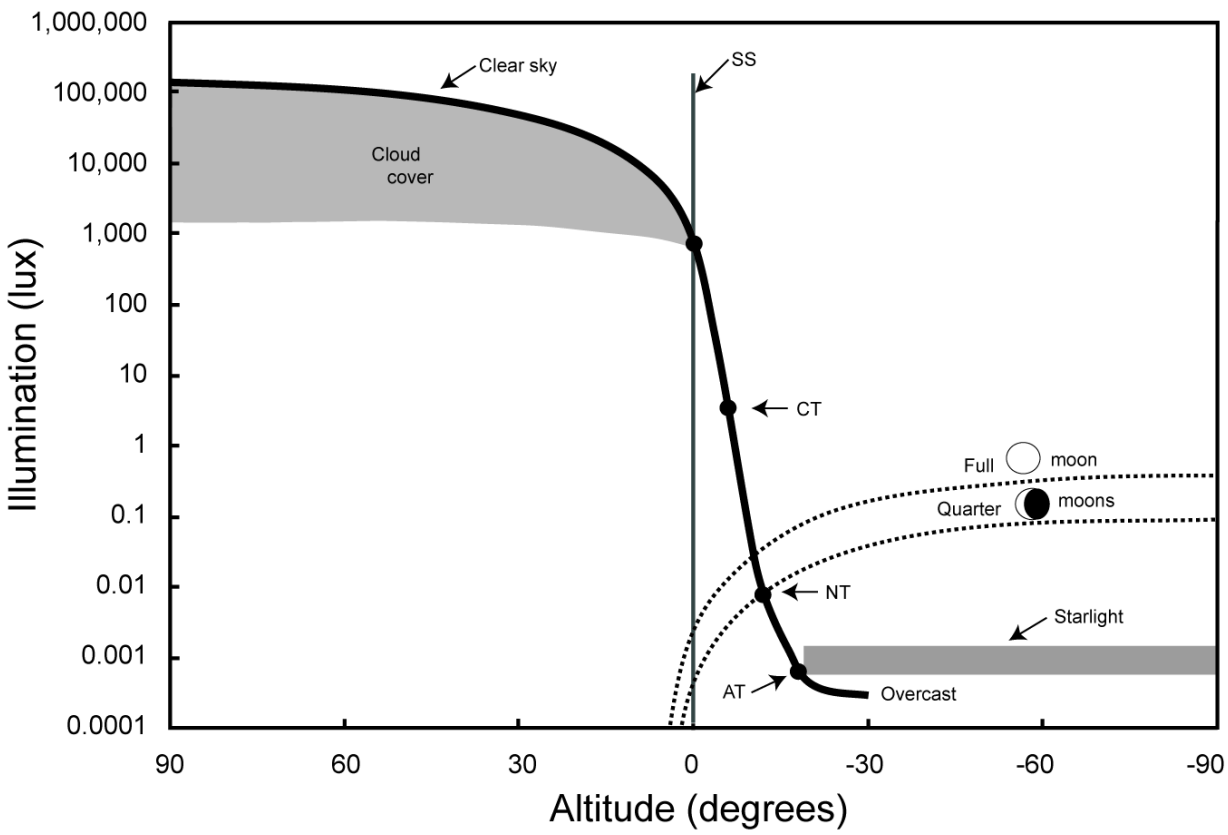


Figure 1. Natural horizontal illumination during the day, sunset, and at night (Beier 2006). Horizontal illumination on the y-axis; x-axis shows altitude above the horizon for the sun and moon. SS = sunset, CT = civil twilight, NT = nautical twilight, AT = astronomical twilight. Modified with permission from Beier (2006).

Light falling on a surface is often measured in lux, a unit of illuminance that sums electromagnetic energy after filtering in accordance with the daytime (photopic) sensitivity of the human eye. Light emitted from a source is often measured in lumens, a unit of luminance that also accounts for the photopic spectral sensitivity of the human eye. Measurements of lux and lumens place more weight on wavelengths to which the human eye responds most strongly, and less on those wavelengths to which the human eye is less sensitive. Similar measurements can be customized for the optic spectral

sensitivities of different species by re-weighting the calculations to emphasize different wavelengths of light (Gal et al. 1999 and **Figure 2**).

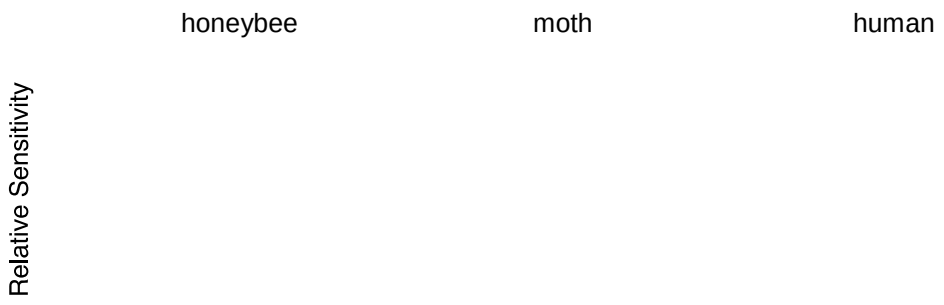


Figure 2. Relative sensitivity to light across the visual spectrum for honeybees (Menzel and Greggers 1985), moths (Cleve 1964), and human photopic vision (CIE 1932).

Outdoor illumination during the day ranges from 100,000 lux in full sunlight to 1,000 lux on a cloudy day (**Figure 1**). Dusk and dawn are transitions into and out of much darker conditions. These transitions are also characterized by predictable changes in the relative intensities of the wavelengths of light. As dusk falls, blue light increases, especially when the moon is new or not present. With moonlight, this blue pulse is diminished or absent and moonlight itself is red-shifted relative to sunlight (Sweeney et al. 2011). Both airglow and zodiacal light also contain more red light than daylight. Variations in illuminance and color trigger many behavioral and physiological processes (Sweeney et al. 2011, Walmsley et al. 2015). Circadian, circannual, and circalunar rhythms are linked to the predictable changes in the light environment. Light triggers can be at different illuminations depending on the environment. What is extraordinarily dim in one environment may be bright in another. For example, the illumination at which activity takes place on a forest floor is on average dimmer than illumination levels triggering the same activity for similar organisms in open grassland. Illumination that is within the natural range of variation on a beach may be far brighter than anything experienced at night at ground level in a dense forest.

Life evolved with predictable daily, monthly, and seasonal patterns of light and dark, and these patterns underlie the natural rhythms of nearly all living organisms. Artificial night lighting has long been known to affect these patterns. Nocturnal species, which represent the majority of some major taxonomic groups (**Figure 3**), are obviously vulnerable, as are diurnal or crepuscular species whose behavioral niches can be distorted by lighting. Concern about adverse effects of lighting dates to

descriptions of the “destruction” of birds at lighthouses in the late 1800s (Allen 1880) and even the first electric urban lighting (Kumlien 1888). Mortality of hatchling sea turtles at lights was identified as a conservation issue in the 1960s (McFarlane 1963). Verheijen coined the term *photopollution* in 1985 (Verheijen 1985), which was followed by Ken Frank’s classic review of the effects of lighting on moths (Frank 1988), and a series of unpublished reports (Outen 1998), conference proceedings (Schmiedel 2001), and research reports from Europe (De Molenaar et al. 2000, Kolligs 2000). In 2004, we described *ecological light pollution* as “artificial light that alters the natural patterns of light and dark in ecosystems” (Longcore and Rich 2004).

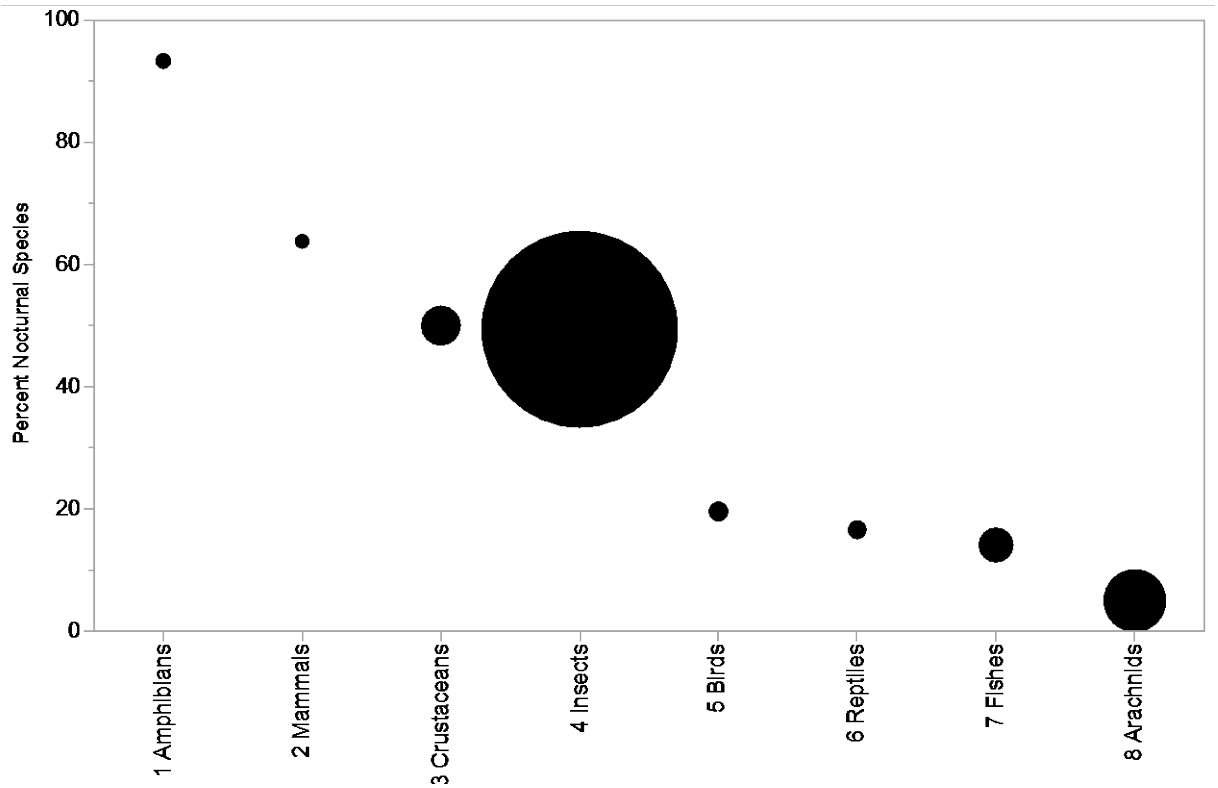


Figure 3. Proportion of major animal groups that are nocturnal. Area of markers is proportional to the number of species known in the group. Data from Hölker et al. (2010).

The disruptions caused by artificial night lighting occur whenever the natural patterns of light and dark are changed. This means that very low lighting levels (far below that of the full moon) can have important effects.

Reviews of the effects of artificial night lighting on different taxonomic groups can be found in Rich and Longcore (2006). Resource managers dealing with questions about specific groups of organisms should consult this source, which contains chapters on mammals, birds, reptiles and amphibians, fishes, invertebrates, and plants. Taxonomically specific information is essential to devise lighting systems that minimize impacts on sensitive species when lighting is necessary. Sensitive species should be identified relative to a specific area and might include both those species that have a formal designation as being threatened or endangered or any species of concern that would be sensitive to

changes in nocturnal illumination. Nocturnal, crepuscular, and diurnal species can be affected by nighttime lighting conditions.

In the sections that follow, we present short reviews of the effects of artificial night lighting in different habitat types.

Coastal dunes, beaches, and shorelines

Coastal dunes and beaches are generally open environments with low vegetation adapted to moving sand (**Figure 4**). Dunes present unique environmental conditions that are often quite distinct from their surroundings, and they are often populated by endemic species that thrive in these unique conditions. Coastal endemic species are often a focus of management concern because of the development pressure on coastal ecosystems in the United States (Schlacher et al. 2007a). Dunes are also ecological transition zones between land and water; light from development in coastal dunes illuminates adjacent water bodies, and animals such as turtles move from water to land to nest. Shorelines are essential for organisms such as amphibians and aquatic insects that have biphasic life cycles.

Figure 4. Beach environments are vulnerable to the effects of anthropogenic light because of their open nature. Hatchling sea turtles are easily disoriented by onshore lights or sky glow and patterns of nocturnal foraging by shorebirds are also affected.

On a beach or coast under natural conditions, the view toward the land is almost always darker than the view toward the water. This is a function of landward vegetation and topography blocking light

from the sky (Salmon 2006), in addition to moonlight and starlight reflected off the water. Organisms can use this pattern for orientation. Artificial lighting on the shore or from cities and other coastal development can reverse the natural conditions; the landward horizon becomes brighter, while the water is darker (Salmon 2006).

Stray light and sky glow from coastal development spread across and into many dune and shoreline environments. As in many environments, nocturnal activity near shorelines is significant (Salmon 2006). Beaches and coasts also regularly experience foggy and high-aerosol conditions, which scatter light and thereby amplify the local effects of lights (Kyba et al. 2011).

Artificial lighting has adverse consequences for sea turtles because the darkest horizon is no longer the landward horizon. Indeed, the lethal effects of lights on sea turtles have led to increased awareness of the adverse effects of artificial night lighting in general. Female sea turtles avoid illuminated beaches as nest sites, and hatchings are fatally affected by lights visible from beaches (Salmon 2003, 2006). This phenomenon was first recorded by MacFarlane (1963), and aversion of females to lights was confirmed experimentally by Witherington (1992). Habitat degradation by lights is caused both by lights adjacent to dunes and beaches and by regional sky glow (Salmon 2006).

As a general rule, additional light — whether moonlight or anthropogenic light — increases foraging efficiency of predators and reduces activity of prey (Longcore and Rich 2004, Rich and Longcore 2006, Seligmann et al. 2007). This phenomenon has been shown many times in different habitats. On dunes, Bird et al. (2004) investigated the effects of lighting on foraging behavior of beach mice. Bird et al. (2004) used low-pressure sodium lights and yellow incandescent “bug” lights, which are commonly employed on beaches in Florida because they have limited effects on sea turtle hatchlings. They found that foraging by beach mice was significantly decreased in proximity to both types of turtle-friendly lights. Similar behavior by prey species has been shown for both natural and anthropogenic light. For example, ghost crabs are active only at night, and avoid activity under both the full moon (Schlacher et al. 2007b) and artificial light (Christoffers 1986). The exception to this pattern is that prey species that flock or school together can be aided by additional light that facilitates communal vigilance (Nightingale et al. 2006).

Effects from lights on beaches and shorelines may also affect aquatic ecosystems. For example, lights affect the predator–prey dynamics of fishes and marine mammals (Hobson 1965, Hobson et al. 1981, Yurk and Trites 2000, Nightingale et al. 2006).

Shorebirds sometimes forage at night (Dugan 1981, Burger and Gochfeld 1991, Rohweder and Baverstock 1996). Various explanations have been proposed: as a defense against predation (Robert et al. 1989, McNeil et al. 1992, Thibault and McNeil 1994), as a result of slightly higher invertebrate activity on beaches at night (Dugan 1981, Evans 1987), and as a response to visual cues that are available due to higher levels of natural or anthropogenic light (Dwyer et al. 2012). Predator defenses of shorebirds are different during the night compared with the day; in an observational study, some proportion of Dunlins freeze and limit vocalizations as a defense at night while all individuals in a

flock fly away in response to predators during the day (Mouritsen 1992). Owls are the major nocturnal predator of shorebirds and are aided by additional light when foraging (Clarke 1983). Timing of foraging by shorebirds, therefore, probably depends on tradeoffs between risks of becoming prey with ability to detect their own prey. Whether birds are flocking and have sufficient light for the associated communal predator vigilance probably also interacts with these factors.

Artificial night lighting on dunes and beaches can therefore have a variety of effects on species. Predator–prey relations are disrupted and key reproductive behaviors can be inhibited. Beaches and dunes also provide a gateway to adjacent water bodies, which have no barriers to block the propagation of light. Because there is usually less anthropogenic light at beaches and on shorelines than in surrounding urban or suburban areas, park visitors often use beaches and dunes to gaze at the night sky. Beaches and dunes should be kept as free from the influence of artificial lights as possible, with special attention paid to ensuring that any lights installed are absolutely necessary and that no lights are directly visible from the beach and points offshore.

Deserts and scrublands

Deserts and scrublands are open habitats with few barriers to the spread of light (**Figure 5**). Many animal species in hot deserts and scrublands adopt nocturnal behaviors to conserve water and avoid daytime temperature maxima. This shift to nocturnal activity may increase seasonally with higher temperature (Kronfeld-Schor and Dayan 2008). Consequently, artificial night lighting has the potential to change the ecology of these environments by disrupting the natural patterns of light and dark relied upon by a large proportion of fauna.

Desert animals can have narrow preferences for illumination levels. These preferences may be related to foraging opportunities, predation risk, or physiological requirements. For example, *Leucorchestris arenicola*, a trapdoor spider endemic to the Namib Desert, exhibits exclusively nocturnal activity patterns (Nørgaard et al. 2006). Males are active only during dark moonless nights, when they are able to navigate hundreds of meters across dune environments using only faint ambient light from stars, airglow, and zodiacal light (Nørgaard et al. 2006). For a species such as this, addition of illumination from any source in its habitat would eliminate its preferred habitat conditions.

Desert rodents also exhibit specific illumination preferences to manage their risk of becoming prey (Grigione and Mrykalo 2004, Beier 2006). Some species are active at twilight, others after twilight, and some during the darkest periods of moonless nights (Grigione and Mrykalo 2004, Upham and Hafner 2013). Anthropogenic light can disrupt these patterns; even the light from a camp lantern equivalent to a quarter moon (~10^{-2} lux) was sufficient to substantially inhibit foraging by a suite of rodent species (Kotler 1984). Those species vulnerable to this disruption lack other predator avoidance abilities such as exceptional hearing (Kotler 1984, Kotler 1985). Because many desert animals exhibit circalunar patterns in their activities, especially predaceous arthropods such as scorpions (Skutelsky 1996, Tigar and Osborne 1999) and granivorous small mammals (Price et al. 1984, Daly et al. 1992, Upham and Hafner 2013), it follows that any artificial light that produces light equivalent to even a quarter moon can alter these patterns.

Figure 5. Lights in desert scrublands are visible for long distances and night lighting affects a disproportionate fraction of the wildlife because high daytime temperatures induce nocturnal activity patterns.

Scrubland environments share many characteristics with deserts, especially in Mediterranean climates. A disproportionate number of species is nocturnal at high temperatures, and the open vegetation structure of drier scrublands allows for light to propagate for unusually long distances.

Perry and Fisher (2006) describe the decline of nocturnal snake species in the scrublands of southern California. Long-nosed snake (*Rhinocheilus lecontei*), a nocturnal species, showed a pattern of decline consistent with the gradient of light pollution as estimated by satellite imagery (Fisher and Case, unpub. data). Otherwise suitable scrub habitats, which supported other diurnal species of snakes, lacked long-nosed snakes. The authors hypothesized that decreases in numbers of the snake's small-mammal prey, also associated with light pollution, were responsible for the decline (Perry and Fisher 2006).

Wetlands and rivers

In some places, wetlands and lakes are the last refuges of a natural night on the landscape (**Figure 6**). The difficulty of developing wetlands often leaves them as the only remaining unlighted sites in urban and suburban regions. Many aquatic organisms depend on daily cycles of light and dark and artificial lights disrupt critical behaviors in many species (Moore et al. 2006, Perkin et al. 2011, Henn et al. 2014).

Figure 6. Lights along rivers and streams can disrupt predator–prey interactions, such as seals hunting salmon under lights.

Wetlands are often geographically fragmented, occurring as isolated patches or as linear features stretching across the landscape. Linear features are susceptible to disturbances such as artificial night lighting because they have a high edge-to-area ratio. They also tend to induce development along their edges, which leads to lighting from urban development on either side. Similarly, small wetlands are especially vulnerable to disturbances from their surroundings.

Aquatic invertebrates are important components of wetland ecosystems and provide an example of the sensitivity of wetlands to lighting levels (**Figure 7**). Many aquatic invertebrates migrate up and down in wetlands during the course of a night and day. This "diel vertical migration" presumably results from a need to avoid predation during lighted conditions so many zooplankton forage near water surfaces only during dark conditions. Light dimmer than that of a half moon ($<10^{-1}$ lux) is sufficient to influence the vertical distribution of aquatic invertebrates, and indeed diel vertical migration follows a lunar cycle. When constant light from human development is added to the natural nocturnal illumination of the moon and stars, the darkest conditions are never experienced, and the magnitude of diel migrations (both range of vertical movement and number of individuals migrating) is decreased, which has been shown experimentally for *Daphnia* (Moore et al. 2000). Disruption of diel vertical migration by artificial lighting may have significant detrimental effects on ecosystem health. Moore et al. (2000) conclude that "[decreases in] vertical migration of lake grazers may contribute to enhanced concentrations of algae in both urban lakes and coastal waters. This

condition, in turn, often results in deterioration of water quality (i.e. low dissolved oxygen, toxicity, and odor problems)."

Figure 7. Light in wetlands can suppress diel vertical migration of zooplankton and influence foraging behavior of amphibians.

Amphibians found in nearshore and wetland habitats also are particularly vulnerable to artificial lighting. Amphibians are highly sensitive to light and can perceive increases in illumination that are impossible for humans to detect (Hailman and Jaeger 1976). A rapid increase in illumination causes a temporary reduction in visual acuity, from which the recovery time may be minutes to hours (Buchanan 1993, Buchanan 2006). In this manner, a simple flash of headlights can arrest activity of a frog for hours (Perry et al. 2008). Amphibians are also sensitive to changes in ambient illumination from sky glow. Frogs in an experimental enclosure ceased mating activity during night football games when lights from a nearby stadium increased sky glow (Buchanan 2006). In an experiment to investigate the effects of intermittent artificial light, male green frogs called less and moved more when exposed to the light of a handheld flashlight (Baker and Richardson 2006).

In naturally lit environments, some amphibians will forage only at extremely low light levels, and foraging times are partitioned among species with different lighting level preferences (Jaeger and Hailman 1976). The squirrel tree frog (*Hyla squirrela*) orients and forages at lighting levels as low as 10^{-6} lux and stops foraging at illumination above 10^{-3} lux (Buchanan 1998). The western toad (*Bufo*

boreas) forages only at illuminations between 10^{-1} and 10^{-5} lux, while the tailed frog (*Ascaphus truei*) forages only during the darkest part of the night below 10^{-5} lux (Hailman 1984).

Laboratory experiments indicate that the development of amphibians is influenced by artificial light (Wise and Buchanan 2006, Wise 2007). Light interferes with the production of the hormone melatonin, which is involved in regulating many important functions, including sexual development, thermoregulation, adaptation of eyes to the dark, and skin coloration (Wise and Buchanan 2006, Wise 2007). Current research shows that artificial lighting slows larval amphibian development in the laboratory (**Figure 8**). The influence of artificial lighting on such physiological processes in the field is currently not well known, but the potential for lighting to harm amphibians and other wetland species is evident.

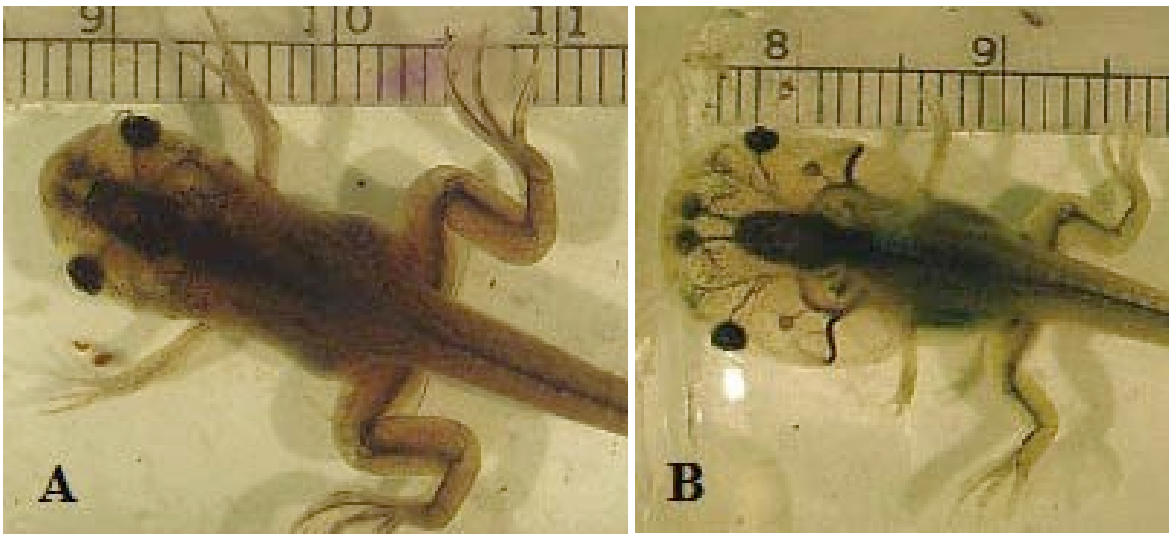


Figure 8. Two tadpoles of the same age and kept in 12:12 L:D lighting. (A) was kept in the equivalent of very dark night (10^{-4} lux) in the dark phase, while (B) was exposed to artificially bright illumination in the dark phase and is not yet metamorphosing (reprinted from Wise 2007).

Fishes are also highly attuned to natural ambient light conditions, with lighting levels influencing the distribution of predaceous species and the foraging behavior of their prey (Nightingale et al. 2006, Becker et al. 2013). Laboratory experiments have shown that the timing of downstream migration of salmon (*Salmo salar*) fry is significantly delayed and disrupted by lights of a similar illumination and spectrum as streetlights (Riley et al. 2013). Nocturnal downstream drift of insects is also delayed by artificial lighting (Henn et al. 2014).

Islands, oceans, and reefs

Light propagates unimpeded across open water, and its reach is extended beyond the curvature of the Earth by reflection off high clouds. Fog can increase local impacts of bright lights. Although light shining directly down on water tends to penetrate rather than reflect, light coming in at an angle is reflected. This physical property of water exacerbates the effects of coastal lighting as it is reflected and propagates out from the shoreline. Island, ocean, and reef environments are affected by artificial

light sources that range from light-assisted fishing to urban sky glow to offshore hydrocarbon facilities (Davies et al. 2014) (**Figure 9**).

Figure 9. Cruise ships and squid boats are just two of the sources of artificial lighting on the oceans that attract seabirds and migrating songbirds.

In 1999, Xantus's murrelets (*Synthliboramphus hypoleucus*) nesting on Santa Barbara Island, part of Channel Islands National Park off the coast of southern California, were dying at twice the average annual rate. Park managers suspected this increase in mortality was directly related to a recent increase in fishing boats equipped with dusk-to-dawn floodlights to attract squid. Squid boats typically have 30,000 watts of light per boat. The number of squid boats increased dramatically in the 1990s, and in 1999 intense squid fishing occurred during murrelet nesting season (spring, while historically fishing was during fall and winter), and near important murrelet breeding islands. Managers believed that the nesting seabirds, without the safety of darkness, were subject to increased predation, especially from barn owls (*Tyto alba*). During the 1999 season, an unprecedented 165 dead Xantus's murrelets were found on Santa Barbara Island. Most of the dead were killed by barn owls, while five were victims of western gulls (*Larus occidentalis*). Researchers also recorded high nest abandonment closest to the most intensive squid boat activity. Faced with these observations, managers closed the areas around the islands to squid fishing, and death rates for the birds returned to normal. The excluded areas were subsequently incorporated into a permanent marine preserve with no fishing allowed to allow for replenishment of fish stocks. Also, the California Fish and Game

Commission listed Xantus's murrelet under the California Endangered Species Act, citing artificial night lighting as one of the major threats to the species.

Nearly all seabirds are nocturnal, and an adverse response to decidedly unnatural conditions such as those suffered by Xantus's murrelets should not be surprising (Montevecchi 2006). Years of studies have shown that nocturnal seabirds are less active during moonlit nights, and those that are active suffer more predation during those times. Seabird chicks are directly affected by lighting levels; they are far less likely to be fed by adults during bright nights (Riou and Hamer 2008). Seabirds are attracted to lights perhaps because they naturally cue in on bioluminescent plankton to find prey (Montevecchi 2006). They have, therefore, long suffered from collisions with light sources on and adjacent to the ocean, including lighthouses, cruise ships, fishing vessels, lighted buoys, oil derricks, and streetlights on and near islands where they nest (Rodríguez and Rodríguez 2009, Rodrigues et al. 2012, Wilhelm et al. 2013); many of these collisions are fatal. Where lights correspond with critical habitat or high-use zones such as feeding or breeding areas, or migratory routes, the effects could be significant.

Other sources of artificial night lighting threaten the nighttime environment of the oceans. Cruise ships are pervasive, large, and are often brightly illuminated. Ships in the path of bird migrations, or near undersea food sources, may attract both migratory birds and foraging seabirds, which collide with the ships and can be stunned or killed. Anecdotal accounts have emerged where cruise ship staff frantically work to clear the decks of dead birds before passengers awake in the morning. Offshore hydrocarbon extraction platforms are also significant sources of light, and attract and kill birds through collision, exhaustion, and even by incineration in flares burning off natural gas. Many of these birds are long-distance migrants, and the losses at oil platforms may affect regional and global breeding populations.

Coral reefs are also threatened by artificial night lighting. Lighting has been used as a proxy for other impacts (urban development, intense fishing, hydrocarbon extraction) to assess risk to coral reefs on a global scale (Aubrecht et al. 2008). Aubrecht et al. (2008) also illustrated how artificial lighting would adversely impact reefs directly. Corals themselves are highly sensitive to light and synchronize spawning according to lunar cycles (Jokiel et al. 1985, Gorbunov and Falkowski 2002). Many coral reef species exhibit marked light-driven diel cycles or synchronize reproduction by monthly cycles (Sebens and DeRiemer 1977, Bentley et al. 2001, Levy et al. 2001). Predator–prey interactions are influenced by light levels, with diel vertical migration of both zooplankton (Yahel et al. 2005) and planktivorous fishes observed (Leis 1986). Natural light signals, such as bioluminescence, are important to marine organisms (Johnsen 2012), and can both attract and repel fishes (Holzman and Genin 2003, 2005). Artificial lighting at similar and greater intensity must affect a range of marine organisms. Experimental investigation has now confirmed that lighting affects the colonization of marine invertebrates on surfaces (Davies et al. 2015).

Grasslands

Like other open habitats, light has few barriers in grasslands (**Figure 10**). Lights can thereby influence both illumination and direct glare over hundreds of meters or more, depending on

topography. Artificial night lighting can be expected to influence habitat use and behavior of grassland species.

The lights of a road bisecting wet grassland in the Netherlands were shown to influence the spatial distribution of black-tailed godwit (*Limosa limosa*), a rare ground-nesting bird (De Molenaar et al. 2000, De Molenaar et al. 2006). When road lights were turned on during a breeding season, the birds nested slightly farther away from the road, with the effect extending 300 m (984 ft) from the lights. Birds that arrived first to the breeding area nested farther from the lights while those arriving later nested closer (De Molenaar et al. 2000, De Molenaar et al. 2006). The same research group investigated the behavior of mammals in wet grasslands and showed that some species (polecat, *Mustela putorius*, stout, *Mustela erminea*, weasel, *Mustela nivalis*, and fox, *Vulpes vulpes*) were more likely to take paths near lights, while other species were not influenced or preferred darker areas (De Molenaar et al. 2003). Such differences in habitat use have the potential to change predation rates and distribution of prey species as well (Lima 1998).

Figure 10. Grasslands are vulnerable to disruption from even distant lights because of their open character. Fireflies, often found in wet grasslands, can have their signals disrupted or be excluded by high illumination, while some grassland bird species, such as black-tailed godwit (*Limosa limosa*), have been shown to avoid streetlights in selecting nest sites (De Molenaar et al. 2006).

Fireflies are another group of grassland species that can be adversely affected by artificial night lighting (Lloyd 2006). Because light is used for firefly communication, both for sexual behavior and

in some interspecific interactions (where females attract males of other species to capture and eat them), any disruption of the ability to see light will have adverse effects. Artificial light washes out the signals used for communication and is potentially contributing to the decline of fireflies and other organisms that rely on bioluminescent communication (Lloyd 2006, Hagen and Viviani 2009, Bird and Parker 2014).

Deciduous and evergreen forests

Although the structural complexity of forests blocks light and reduces its propagation, species that inhabit the forest floor are sensitive to illumination at levels appropriate to the darker nighttime environment there (**Figure 11**). A review of the research on forest species shows some general patterns that illustrate the potential for lights to affect wildlife behavior.

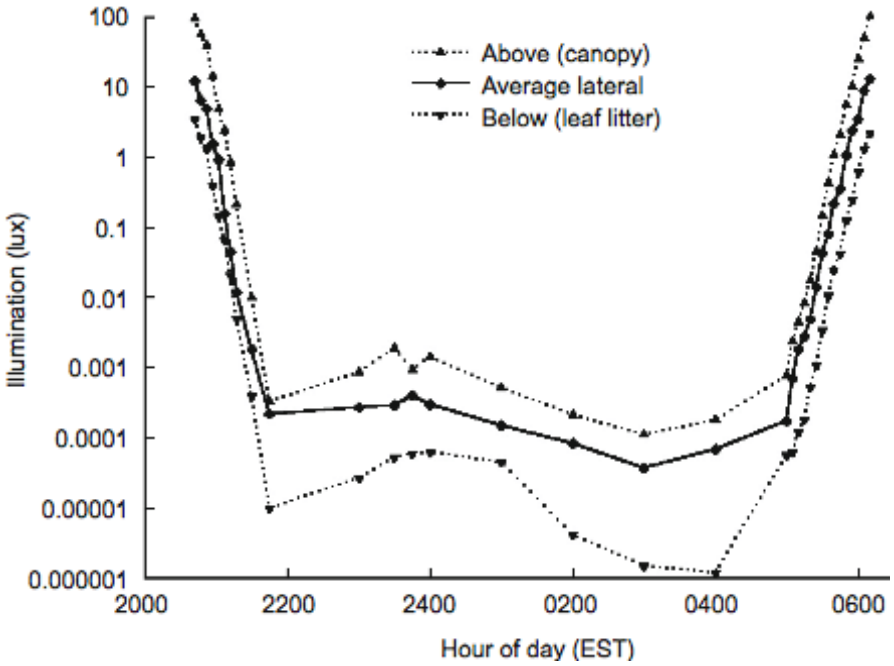


Figure 11. Illumination in deciduous forest (Buchanan 2006). Reprinted with permission.

As in many other ecosystems, salamanders in forests exhibit reactions to light equivalent to moonlight, under which foraging is reduced or delayed (Wise 2007) (**Figure 12**). This has been shown experimentally with dim artificial lights installed in a forest environment (Wise 2007). In two different experiments, lighting delayed the emergence time of nocturnal mammals (DeCoursey 1986, Barber-Meyer 2007) and reduced foraging activity (Barber-Meyer 2007). For sugar gliders, a nocturnal forest mammal native to Australia, light equivalent to that produced by streetlights (7–12 lux) reduced the time individuals were active at night (Barber-Meyer 2007).

In other instances, reproductive behavior can be affected by artificial lighting. The leafcutter ant *Atta texana* usually undertakes nuptial flights approximately 15 minutes before dawn, but in instances where security lights from homes and businesses were visible, the colonies flew 15 minutes after dawn (Moser et al. 2004). This change in timing interferes with behaviors that are carefully

synchronized across colonies. Furthermore, artificial lights are also attractive to the flying ants and, as a result, may both decrease mating success and increase predation at the lights (Moser et al. 2004).

Figure 12. Species of the deciduous forest are adapted to the lower light levels found under the canopy. Flying squirrels and salamanders will delay their foraging under artificial lights.

Alpine and tundra habitats

Alpine and tundra habitats are disproportionately represented in parks and other protected lands. They are on average less developed than other habitat types but can be, and are, developed for recreational and industrial infrastructure. Control of artificial lighting in alpine and tundra habitats is important to avoid disruptions of predator–prey interactions and to avoid disrupting annual rhythms that are entrained by day length.

The topography of mountainous habitats also makes them vulnerable to sky glow from distant sources (**Figure 13**). Because sky glow brightens horizons, areas of steep slopes are positioned to be exposed to that light. In these locations, the aspect of the slope becomes important. Those facing bright horizons will be substantially brighter than nearby locations facing a different direction and therefore will be exposed to far less artificial lighting.

As in other habitats, predator–prey interactions in alpine environments are mediated by illumination (**Figure 14**). For example, small mammals of rocky outcrops typical of alpine regions are often nocturnal, foraging in open areas at night and retreating to the safety of outcrops for shelter (Kramer

and Birney 2001). In experimental conditions one such species, long-eared mouse (*Phyllotis xanthopygus*), foraged less under 1.5 and 3.0 lux treatments (up to very bright moonlight) when compared with a 0.0 lux control (Kramer and Birney 2001). Similar results have been found for snowshoe hares (Gilbert and Boutin 1991), which are subject to more predation under brighter nocturnal conditions, especially during the winter (Griffin et al. 2005). Such small mammals depend on natural darkness for foraging to keep up body weight (Vasquez 1994).

Figure 13. Alpine habitats can be affected by distant lights and those from recreational and industrial facilities.

Circannual rhythms are found in most animals, but the environmental conditions that influence them are less well understood because of the long period necessary to conduct experimental research (Beier 2006). Light appears to have a large influence in setting these cycles, although temperature is also important (Beier 2006). Light can be important in determining when species react to the seasons (e.g., hibernation, Hock 1955), and consequently disrupting these signals has the potential to put species out of phase with climate. In alpine and tundra environments, where conditions change so dramatically between the seasons, appropriate synchronization of activities is important. For example, reindeer (*Rangifer tarandus*) eyes change seasonally to reflect different wavelengths of light; color of the tapetum lucidum shifts from yellow in the summer to blue in the winter, which is associated with increased retinal sensitivity during the dark winter nights (Stokkan et al. 2013). Captive reindeer exposed to sodium vapor streetlights, not directly visible but just over the horizon,

are reported to have green eyes in the winter, not completing the normal transition from yellow to blue, and with reduced visual sensitivity (Yong 2013).

Figure 14. Predator–prey interactions are affected by artificial lights during long nights on the tundra.

Urban environments

Even though urban environments have many sources of artificial lighting at night, variations within already light-polluted environments still make a difference to wildlife (**Figure 15**). For example, American crows (*Corvus brachyrhynchos*) choose roost sites in urban areas that are on average more brightly illuminated than non-roost sites (Gorenzel and Salmon 1995). Presumably, this allows the communal predator response behaviors of the flock to operate more efficiently, reducing predation from owls. Elevated populations of this native species have adverse consequences for other native species for which the crows are predators. In another example, urban-tolerant bat species are influenced by the degree of illumination on the exit hole of their roosts. Nightly emergence is delayed by illumination of the exit hole, which reduces fitness of individuals in the colony and can eliminate the colony altogether (Boldogh et al. 2007). Because of the importance of bats as consumers of insects, and their conservation status, the adverse impacts of lighting are concerning (Stone et al. 2015).

Cities are also sites of mortality for nocturnally migrating birds, which are attracted to lights. Birds die either in collisions with buildings at night, or during the day when they attempt to regain their orientation and continue migration. This phenomenon is well documented in Chicago, Toronto, New York, and Washington, D.C. A notable example in a national park is the ongoing mortality of

nocturnal migrant birds at the Washington Monument, which started when it was illuminated (Overing 1938).

The profusion of light in urban areas also has spillover effects on surrounding natural areas and open spaces within cities. For example, extremely high levels of ambient light are measured in the Santa Monica Mountains National Recreation Area near Los Angeles, with all-sky brightness exceeding natural levels by 18.4 times and maximum nocturnal vertical illuminance 32.4 times brighter than natural levels (J. White and C. Moore, pers. comm.). Although it is difficult to address the multitude of sources of light, it is worthwhile for parks to incorporate lighting and the night sky as part of their education, outreach, and engagement in communities adjacent to and near parks (Aubé and Roby 2014).

Figure 15. Cities are affected by altered light environments, which are exploited by synanthropic species such as crows and some bat species.

The evidence from across habitat types indicates that artificial lighting at night is either proven to, or has the potential to, disrupt the natural behavior of wildlife species, sometimes with lethal consequences. From this context we can identify practices that can reduce and minimize the effects of lighting in parks and other lands managed for natural resource values.

Mitigating the Effects of Lighting on Protected Lands

Knowledge about the effects of lighting on wildlife continues to grow. All indications are that lighting can have cumulative and additive consequences that are especially important for vulnerable species. Many general approaches to minimizing the effects of artificial lighting on wildlife are known. To reduce effects on certain target species, these mitigations may need to be adapted to craft desirable solutions for specific locations. In the following two sections, considerations for developing such mitigation measures are discussed. First we introduce the attributes of nighttime lighting that might be manipulated — spectrum, intensity, direction, and duration — and how different groups of species might be affected by them. Then we review the many contexts in which light is used (e.g., security lighting, vanity lighting, communication towers) and identify preferred mitigation strategies for them.

Approaches to minimize lighting impacts

The impacts of artificial lighting to wildlife can be reduced in five ways: 1) avoiding use of lighting that is not needed, 2) controlling color spectrum, 3) limiting light intensity, 4) managing the direction of light emissions, and 5) limiting the duration of light output. For some of these characteristics, a single approach applies in all instances. For others, the recommendation depends upon the context of use or the species that might be affected. A combination of mitigation approaches is likely to be more effective (e.g., reducing intensity and adjusting color spectrum) than would be any approach taken individually.

Need

The first question that should be asked about artificial lighting, especially in natural areas, is whether it is in fact needed. In some situations, a creative solution, such as the choice of a pale color for a pathway, curb, or steps, is all that is needed to guide visitors (**Figure 16**). In others, lighting can be left to the visitor to provide in the form of headlights or a flashlight. Only when the need is demonstrated and necessary for visitor experience, safety, or security, should lights be installed.

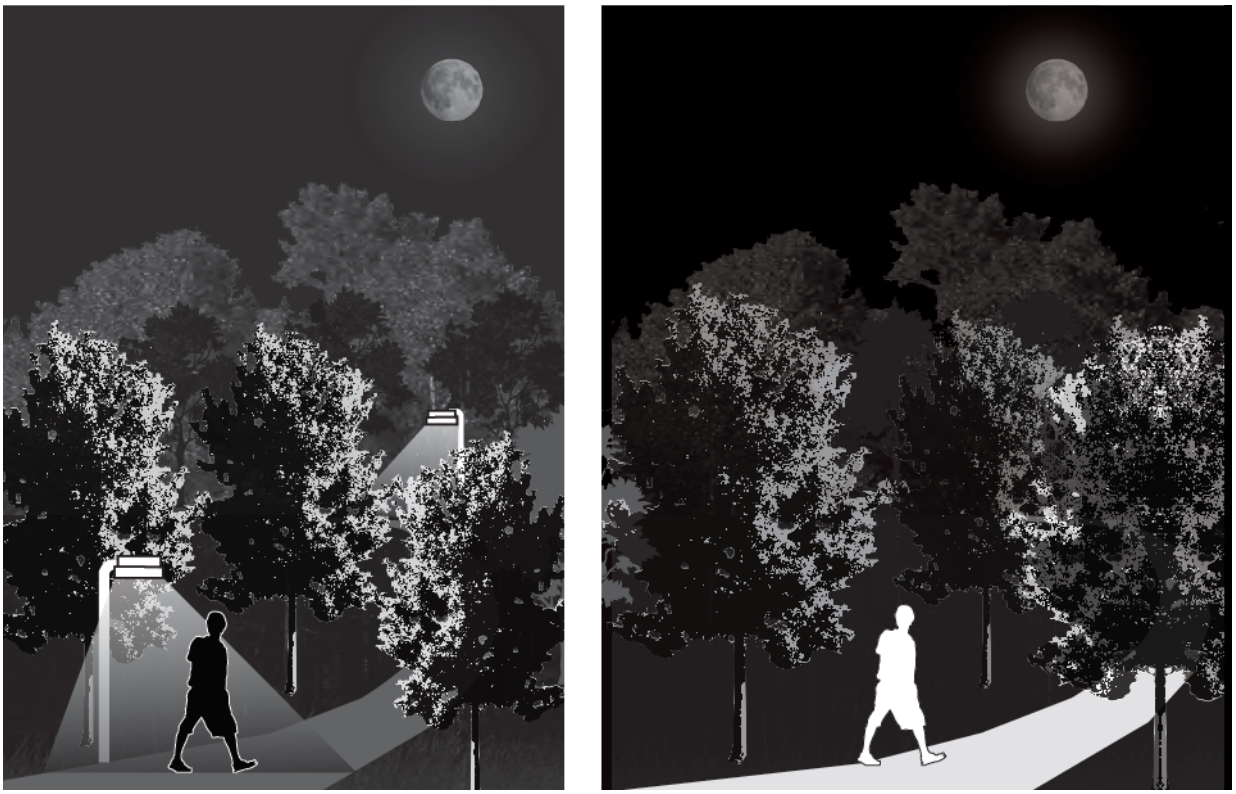


Figure 16. A pale-colored path can be just as effective as electric lights in some park situations.

Spectrum

It is tempting to believe that a certain spectrum of light will minimize the effects of lighting in all situations. Unfortunately, no universal solution exists. Rather, it is possible to identify spectra of light that have shown to affect wildlife less in certain contexts. The only 100% wildlife-friendly light is one that is switched off or never installed.

The higher efficiency of high-pressure and low-pressure sodium lamps resulted in their widespread adoption in street lighting applications and security lighting, replacing the older mercury vapor lamp technology. Recently, however, full-spectrum light sources such as metal halide lamps, compact fluorescent lamps, and LEDs are becoming more common (Gaston 2013). Full-spectrum lights appear white, in contrast with other lights such as sodium vapor lamps that appear yellow or orange. Earlier technologies, such as mercury vapor lamps, were also full-spectrum, but have largely been replaced by sodium vapor lamps. LEDs are more efficient than older lamps used for outdoor lighting, and have greater color rendition than sodium vapor light sources. This return to white light sources brings certain advantages for human use, but includes a wider range of wavelengths, potentially impacting more species (Stone et al. 2012) and exacerbating sky glow (Aubé et al. 2013).

The combination of colors that make up a full-spectrum light is described by the correlated color temperature (CCT) of the light. CCT is measured in degrees Kelvin and corresponds to the appearance of light that would be emitted from an idealized “black body” if it were heated to that temperature. Lower CCTs are dominated by yellow and other longer wavelengths, while higher

CCTs are dominated by blue and other shorter wavelengths. For example, an incandescent bulb has a CCT of around 2400–2800 K, while a metal halide lamp has a CCT of 4000 K and direct sunlight 4800 K. LEDs are offered in many color temperatures, from 6500 K to 2700 K, and can also contain mixes of colors that do not have color temperatures associated with them (i.e., “off the black body curve”) and are measured in other ways. High-pressure sodium lamps have a CCT of around 1800 K and low-pressure sodium lamps, which are all yellow, do not have an associated color temperature.

One general rule is to avoid any light that has emissions in the ultraviolet spectrum and adjacent short wavelengths. Ultraviolet light is not visible to humans, yet is visible to other species. Insects are highly attracted to ultraviolet light and their attraction and mass death at lights would be dramatically reduced by eliminating ultraviolet light from general use (Frank 1988, Eisenbeis and Hassel 2000, Eisenbeis 2006, Frank 2006). Mercury vapor lamps are high in ultraviolet radiation, while other commonly used outdoor lamps (e.g., metal halide, fluorescent) have some ultraviolet as well. LEDs have no ultraviolet emissions and therefore attract fewer insects than lamps of comparable intensity and color temperature that do have some ultraviolet emissions (Poiani et al. 2015, Longcore et al. 2015).

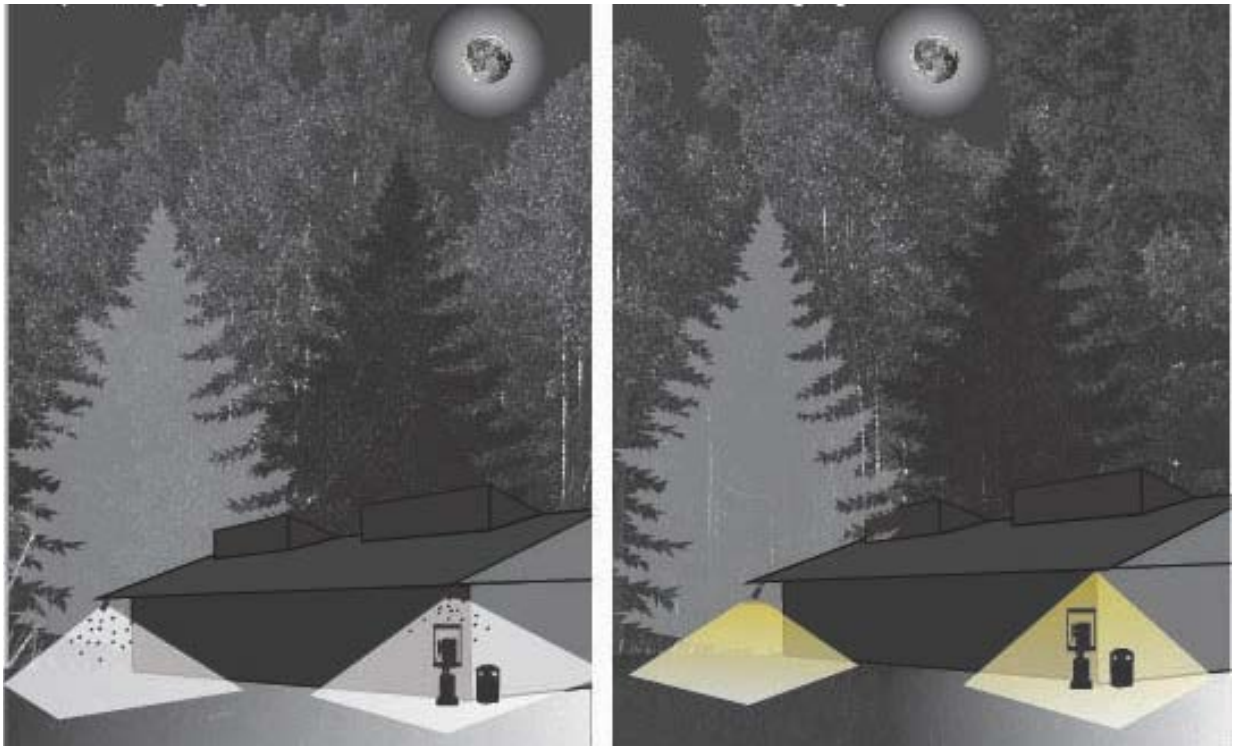


Figure 17. Yellow light that does not contain blue or ultraviolet wavelengths attracts far fewer insects.

Insects are also attracted to light in the short visible wavelengths (e.g., violet and blue) (**Figure 17**). Full-spectrum lighting that allows good color rendering for human vision is not advisable from the standpoint of ecological effects because it contains light in the blue spectrum (Eisenbeis and Eick 2011). All lights heavy in the blue portion of the spectrum, such as fluorescent lights, metal halide lights, and full-spectrum LED lights, will have greater impacts on insects than lights with longer

wavelengths (e.g., low-pressure sodium vapor lamps or yellow/amber LEDs) (Eisenbeis and Eick 2011, Pawson and Bader 2014, Poiani et al. 2015, Longcore et al. 2015). If full-spectrum lighting is required, then the lowest possible color temperature is recommended (Longcore et al. 2015).

Blue light contains the most biologically active wavelengths for physiological processes such as the production of hormones and the timing of daily activities (Beier 2006, Brainard et al. 2015). This concern has been best expressed relative to human health (Pauley 2004, Brainard et al. 2015), but blue light also disrupts circadian rhythms in wildlife. To minimize disruption to circadian rhythms, shorter wavelengths such as blue and violet should be avoided. They might also be avoided to minimize influence on species that are phototactic to blue light, such as many frog species that have a blue light preference whereby they move toward blue light, presumably as an escape mechanism that leads them away from vegetation (and into water) in times of danger (Hailman and Jaeger 1974, Buchanan 2006); these preferences can vary depending on the intensity of illumination, however (Buchanan 2006).

Figure 18. Green lighting designed to minimize attraction of birds developed by Philips. Shell is using these lights on an oil platform in Alaska and Philips is adding the lights to its regular catalog. Photograph courtesy of Joop Marquenie.

Birds are able to orient to the Earth's magnetic field under monochromatic blue or green light, but such navigational ability apparently does not function under lights that are only red or yellow. The molecular mechanism that allows detection of the Earth's magnetic field requires light of a certain wavelength to be activated (Ritz et al. 2009), which presumably explains the inability of migratory birds to orient under light that lacks those wavelengths (Wiltschko et al. 1993, Wiltschko and Wiltschko 1995). Dutch researchers have experimented with the use of specially designed lamps that contain blue and green light at coastal locations and on offshore platforms to see if the number of attracted and disoriented birds is decreased (van de Laar 2007, Poot et al. 2008). Results show blue

and green lights influence birds less than red and full-spectrum (white) light, although the effects on other species have not been documented in the scientific literature (**Figure 18**; **Figure 19**).

Figure 19. Green lights have been investigated for use on offshore structures and shown to be less attractive to birds.

In other situations, light that includes longer wavelengths appears to attract few insects and does not disrupt orientation of sea turtle hatchlings. For this reason, yellow lights are commonly identified as being wildlife-friendly (**Figure 17**). These same lights, however, reduce the foraging activity of native beach mice (some species of which are endangered) along the Florida coastlines where turtle-friendly lighting is recommended (Bird et al. 2004). Fireflies are vulnerable to impacts from yellow light because it is this part of the spectrum that is used by those species flying after dusk (Lloyd 2006).

Red light appears to disrupt the orientation capabilities of birds, but it seems to have the least effect on other species (**Figure 20**). Few insects are attracted to red light and dark-adapted eyes are not bleached by red light, making it the spectrum of choice for stargazers. In low-light environments in parks, red light might be preferable where lights are needed for safety reasons (**Figure 21**).

Figure 20. Red light does not disrupt dark-adapted vision and is therefore appropriate for campsites and locations used for astronomical observation.

Figure 21. Illumination of a stairway at a campground by two low-intensity red bulbs instead of by a bright white spotlight (Wagner et al*.* undated).

Through all the considerations for different taxa, a few general lessons emerge to guide use of spectrum: 1) the choice of color significantly affects the degree of biological disruption; 2) narrow-spectrum lights are preferable to broad-spectrum sources (i.e., white light); 3) ultraviolet light should be avoided; 4) blue and shorter wavelengths increase biological responses and generally should be avoided; and 5) concerns about individual species in an area may influence the choice of least disruptive color for lights.

Intensity

Land and facility managers have great latitude in selecting the intensity and quantity of lighting used. From a wildlife perspective, discretion should be exercised to use the minimum amount of light required. This can be accomplished by significantly decreasing the luminous output commonly specified by lighting designers. Land managers should not rely on standards promulgated by professional societies to guide lighting levels for natural areas because these are generally developed for urban/suburban areas with little to no regard for wildlife. Rather, every effort should be made to reduce the intensity of lights and still achieve the desired function.

Reduction in lighting intensity benefits species in the vicinity of lighting and also reduces the reflection of light in the atmosphere. The glow of lighted areas can thereby be reduced, decreasing impacts to natural systems and park visitor experience in wildlands. Often, illumination levels can be reduced without adverse consequence for human activity. In fact, reducing the contrast between light and dark areas increases the ability of humans to see. The human eye adapts to the brightest light in view. As the eye adapts to bright lights, acuity in darker areas is lost. Bright lights plunge the surrounding areas into dark shadows, while with dimmer lights the eye is able to retain some of its ability to see in darker areas.

Direction

Shielding lights is a common mitigation measure to reduce impacts to natural lands and species (**Figure 22**). Usually this involves shielding a fixture so that little or no light is emitted above the horizontal plane, and less than 10% of the light is emitted within ten degrees below the horizontal plane. This is the definition of a full cutoff lighting fixture. Shielding in this manner greatly reduces (but does not eliminate) sky glow. Light still reflects off the ground and scatters, so reduction in intensity should be combined with shielding. Downward-directed lights may still have adverse ecological consequences such as attracting insects and species that feed on the insects (e.g., bats, frogs, birds), or directing light into sensitive habitats such as wetlands and rivers.

Land managers should endeavor to shield lights beyond full cutoff to ensure that light falls only on the intended surfaces. Such mitigation will minimize direct glare, which can affect the orientation of organisms across distances (Reed et al. 1985, Telfer et al. 1987, Beier 1995, Longcore and Rich 2004); this will also minimize the area that is artificially illuminated. Design solutions to achieve these goals include the use of embedded lights to illuminate important surfaces (**Figure 23**) and simple retrofits to shield existing lights (**Figure 24**).

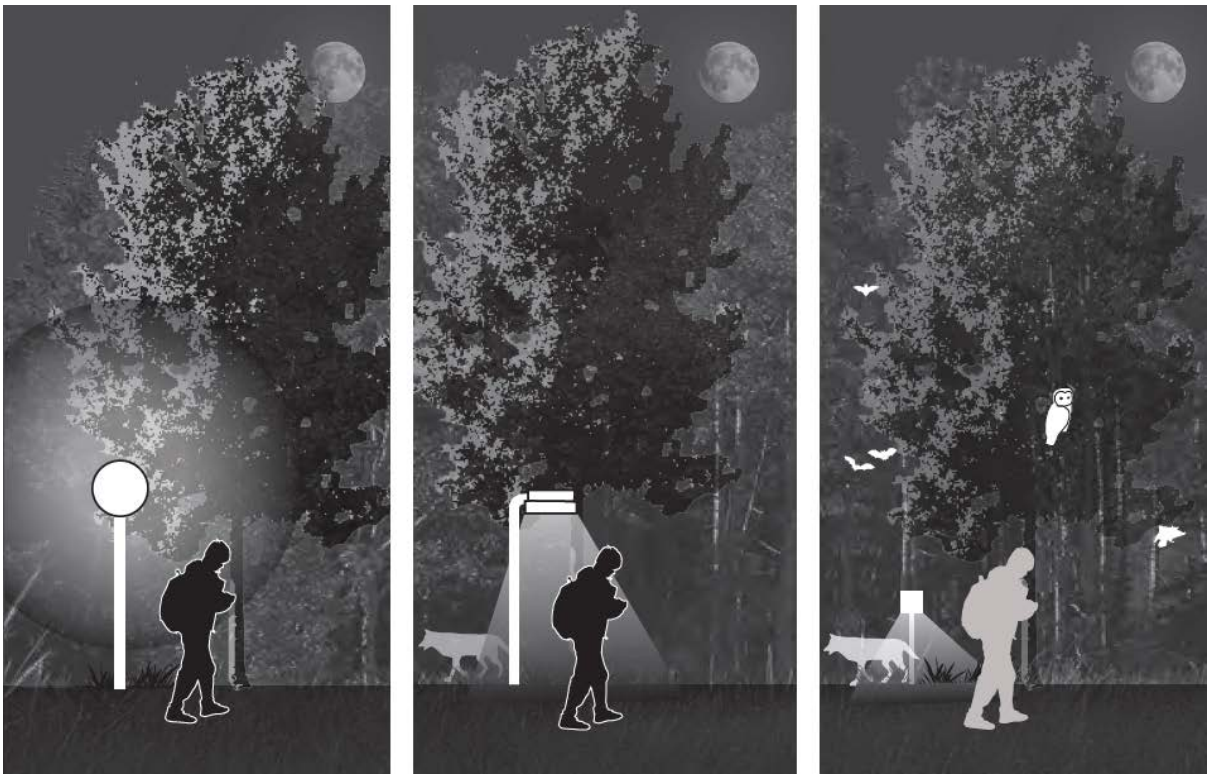


Figure 22. The more focused light can be on its target, the less it will affect other species.

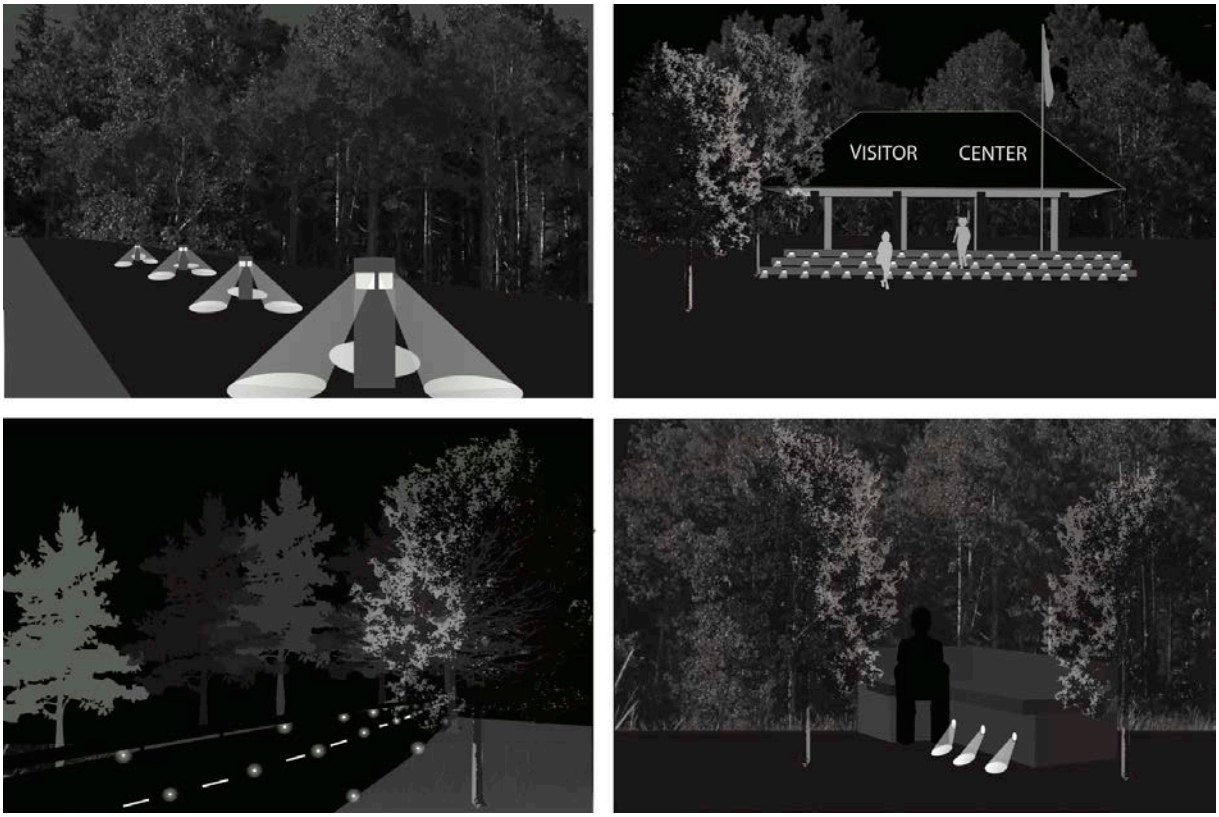


Figure 23. Embedded lights allow wayfinding with minimal intensity and good directional control.

Figure 24. A full cutoff shield being installed on an existing light on the lodge at Yellowstone National Park. This previously unshielded light was visible across the lake and from the backcountry. Photograph by Travis Longcore.

Duration

Impacts from lighting can be reduced by changing the duration of illumination. This approach reduces some impacts, but it may have some adverse consequences for those species sensitive to a changing light environment and so should be implemented with these limitations in mind. One common way to reduce the duration of illumination is to install a motion detector so that a light is only on when there is activity in a particular area (**Figure 25**). Although this limits the amount of time lights are on, lights that go on and off at irregular intervals may disrupt the nocturnal behavior of some species. For example, green frogs (*Rana clamitans*) reduce calling behavior and move away when a light is shined on them (Baker and Richardson 2006); return to a dark-adapted state can take hours (Buchanan 2006).

Figure 25. Motion- and heat-detecting lights provide illumination only when it is needed.

Another restriction on duration is setting a time for lights to be extinguished each night (**Figure 26**). For example, the lights that illuminate Mount Rushmore are only on for a few hours each night. This approach, known as part-night lighting, reduces impacts by allowing darkness during the late night and early morning hours. Depending on the timing of the lighting, darkness can be maintained for the majority of the activity period for a target species (Day et al. 2015). This approach, however, may still disrupt activities during the specific light conditions at dusk that are required by other species (Longcore et al. 2003, Day et al. 2015). Rather than a smooth range of illumination conditions occurring as the sun goes down and darkness falls, sites will experience a single illumination level until the lights are turned off. Many groups of species share resources across lighting levels; that is, one species may forage at dusk, another right after dusk, and another in the dark of night (Hailman 1984). Increased illumination, even on a temporary basis at dusk or dawn, reduces the time available for critical behaviors and could eliminate them altogether if a species prefers the transitional lighting levels of dusk when lights are illuminated. If artificial lighting eliminates a significant period of potential activity time for a species, the long-term consequences will be negative. In studies of bats, part-night lighting has been found to be ineffective in avoiding the activity periods of most species in the locations studied (Azam et al. 2015, Day et al. 2015).

Figure 26. Timed lights may affect species negatively during the transitional period of dusk, but may reduce impacts later at night.

There may be instances where avoiding lighting during a particular time when animals are active is an appropriate way to mitigate impacts. Many species are active during the crepuscular periods of dusk and dawn. If lighting can be avoided until after dark, or closer to dark, certain impacts on those species might be avoided. Setting photodetectors to activate lights only at very low levels of illumination will avoid the biologically active crepuscular period, reduce insect attraction, and limit light to after civil twilight when it is really needed.

Whenever lights are required, reducing their intensity or turning them off during periods they are not needed should always reduce impacts. For example, the Dutch government has mitigated lighting impacts on sensitive wet grassland habitats by turning off roadway lighting at 11 P.M. and replacing it with 7-watt incandescent bulbs halfway up the light standards (De Molenaar et al. 2006). These lights allow for wayfinding and have not changed the number of accidents occurring on the road.

Lighting situations

In addition to controlling for spectrum, intensity, direction, and duration, mitigation measures can be devised for many other situations in which lighting might be installed in parks. In the sections that follow, we discuss the issues involved with mitigating impacts from a series of different situations that might be faced by a park manager.

Communication towers

Each tower in the United States that is taller than 200 ft (61 m) must have obstruction lighting in accordance with Federal Aviation Administration (FAA) guidelines. Lighting is a primary factor resulting in the attraction to and mortality of birds at towers. An estimated 6.8 million birds per year are killed at tall towers (Longcore et al. 2012), including many species of conservation concern (Longcore et al. 2013). Reviews of previous work, and subsequent studies, have shown that mortality can be reduced by using a lighting system that has flashing lights only, whether these are strobe lights or red flashing lights (Gehring and Kerlinger 2007). White strobe lights have long been approved as lighting on towers and the FAA has updated its regulations to allow red flashing lights only (see FAA Advisory Circular 70/7460-1K). It is also important that towers do not have ground-level lighting around them because these lights can attract birds that then collide with tower guy wires (Longcore et al. 2008). Another option for tower lighting is an audio-visual warning system like OCAS (http://www.ocasinc.com). This approach uses radar to detect nearby aircraft, activating marker lights and emitting a verbal warning on aviation band radio. It is essentially a motion detector for tower lighting.

Night hiking and mountain biking

Night hiking and mountain biking have become popular activities in natural areas. The lights used in these activities, especially those used in mountain biking, have become brighter in recent years. For example, full-spectrum LED lights that emit 3,600 lumens (approximately the same as a 200-watt incandescent bulb) are advertised for use by bikers. Activities such as these expose wildlife to unnatural disturbance at night; this affects behaviors both because of the disturbance itself and because of the potential bleaching of eye pigments ("blinding") from which recovery time can take minutes to hours.

Managers can mitigate the impacts of night hiking and biking by employing various strategies. These include:

1. Restrict the time of month when illuminated nocturnal recreation is allowed to the days before and after the full moon. In this manner animals are allowed the darkest part of the month as a refuge from disturbance.
2. Restrict the total luminous intensity of lights used in these activities.
3. Set curfews for illuminated nocturnal recreation.
4. Restrict nocturnal recreation activities to areas that are already disturbed by night lighting, leaving more remote wildland areas protected from nocturnal disturbance.

Campsite lighting

Although "traditional" camping with firelight and flashlights is certainly still a popular activity, more and brighter portable lights are being brought to campsites. Large arrays of lights are readily available and increasingly used by campers. Such lights can degrade the nighttime camping experience for other campers and will have greater impacts on wildlife than a campfire or small personal flashlight. Park managers might consider establishing guidelines for nighttime lighting at campsites, including limits on overall illumination, lighting curfews, and recommendations to use

flashlights instead of area lighting. Lighting restrictions could be established in conjunction with quiet hours, and address portable lanterns and recreational vehicle lights. In especially dark areas, managers could recommend the use of red filters on flashlights. Such actions should be paired with minimizing lighting from the existing infrastructure (e.g., converting lights on bathrooms to low-intensity red lamps).

Off-road vehicles

Deserts and beaches often accommodate vehicular recreation. Vehicles commonly have 1,000–1,500 lumens of forward-facing light, and because this is concentrated in a fairly narrow cone, the light intensity can be very high, with low-beam headlights exceeding 4,000 candela on axis (candela is a unit measuring the brightness of a light emitted in a particular direction). For wildlife along the axis of the headlight, the intensity of a directional headlight is equivalent to an unrestricted 100,000-lumen light source (Schoettle et al. 2004). This disruption can be an intermittent impact or, in some situations, a chronic one. For example, vehicles on a beach will often park with the headlights kept on, in which case multiple headlights will be directed into the shoreline environment and have the effect of a much larger number of streetlights due to their concentrated and directed nature. The most effective mitigation would be to prohibit vehicles from these environments during sensitive times for wildlife. Additional mitigations may include restricting headlights to when the vehicle is moving or requiring low beams only.

Monuments

Parks must consider the need to preserve natural and cultural resources when making decisions related to lighting cultural monuments. For example, the Washington Monument is bathed in white light and is known to attract and kill migratory birds (Overing 1938). Because the Washington Monument has been illuminated at night since the 1930s and is so powerfully symbolic of Washington, D.C., it is not feasible to propose elimination of lighting altogether. Limitation on the hours of illumination is probably the best management action in such situations. Lighting for monuments should be designed to illuminate the monument only, and with the lowest intensity possible. Bright lighting that might have been required to accommodate photography in the past is no longer needed with current digital imaging technology.

Lighting schemes at monuments could also play a role in pest management. At the Lincoln Memorial, the lights are turned on at twilight when midges and gnats fly over from the Potomac River and onto the Memorial. This in turn attracts many spiders that weave webs on the monument and require extensive and frequent cleaning (C. Moore, pers. comm.). It might be possible to turn the lights on slightly later, after the crepuscular period, or to change the spectrum of light used to eliminate short blue and ultraviolet wavelengths. In such a manner the lighting scheme then becomes part of an Integrated Pest Management program.

Light-assisted fishing

Offshore lighting poses threats both to aquatic and terrestrial ecosystems. Light has a long history of use as a method to attract fishes for capture. In artisanal fisheries, dim lamps may be used on small human-powered boats. Current industrial-scale fisheries, however, use extremely bright lights

(equivalent to 30,000 watts incandescent) to attract squid and other fishes. Even boats that do not use lights to attract their catch operate during the night and are highly illuminated. Illumination in this manner affects behavior of fishes (Nightingale et al. 2006) and other aquatic organisms (Forsythe et al. 2004). Lighting is also implicated in the mortality of seabirds in fisheries (Dick and Donaldson 1978, Carter et al. 2000). Spillover light on seabird nesting colonies has the potential to increase predation on vulnerable species (Keitt et al. 2004). Park managers should take action to reduce fishing activity with disruptive lighting near sensitive island habitats and in marine protected areas. A range of options is available to do so, including outright bans, limiting light-assisted fishing by phase of the moon (to dates around the full moon), and limiting total luminance allowed in protected waters.

Security lighting

Managers are often faced with pressure to install security lighting in hopes of decreasing illegal activity. The evidence that increased illumination reduces crime is unclear at best (Tien et al. 1977, Sherman et al. 1997), and dimming or shutting off lights may in fact reduce crime (Steinbach et al. 2015). Some schools use a “dark campus” approach, wherein all lights are extinguished at a certain hour. Lights seen after this time are then quickly recognized as indicative of unauthorized activity (Mizon 2012). Park managers should think very carefully about installation of any dusk-to-dawn security lighting. It has very little chance of being effective if staff members are not on site to observe activity. Complete darkness at night for areas in parks and protected areas that are off-limits and unoccupied should be considered in consultation with law enforcement.

Bridges

Bridges can introduce artificial lighting into natural areas through roadway lighting for safety or through architectural lighting. Both of these have the potential to disrupt natural habitats. For example, harbor seals used the lights on the Puntledge Bridge in British Columbia to form a “feeding line” and intercept outmigrating juvenile salmonid smolts (Yurk and Trites 2000). Extinguishing these lights led to a decrease in salmon mortality. Other studies document increased predation on fishes under illuminated bridges and docks (Nightingale et al. 2006). For bridges with tall structures, illumination of these towers may result in attraction of migratory birds. Such lighting should be avoided to the extent possible, such that obstruction lighting is limited to red flashing lights (if lighting is required by the FAA) and any roadway lighting is carefully directed onto the roadway with little or no spillover into the river. Furthermore, use of yellow light is preferable under most circumstances to minimize the attraction of insects, although selection of yellow lights alone will not eliminate the effects of lighting on foraging behavior of mammals (Bird et al. 2004). Other considerations with bridges include the synergistic effects of lighting and polarization that misleads insects and may even result in bridges being dispersal barriers along rivers (Horváth et al. 2009, Málnás et al. 2011).

Roadway lighting

Roadway lighting is a major source of outdoor illumination and contributes significantly to sky glow. In a study of lighting in Tucson, Arizona, roadway lighting accounted for 12% of upward directed lighting, following only commercial lights (36%) and sports fields (32%) as a proportion of total

uplight (Luginbuhl et al. 2009). To maintain natural illumination conditions inside parks, managers must work with communities outside park boundaries to address these sources. Inside park boundaries, managers must make the decision whether roadway lighting is necessary in the first place, and if so, what characteristics it should have. To minimize impacts on wildlife, roadway lighting should be avoided to the extent possible, and where used should only be designed for the required intensity. The recommended lighting for a local road with low pedestrian conflict in the United States is 3–4 lux (ANSI/IES RP-8-14), which is more than 30 times brighter than the full moon's maximum intensity, so no roadway lighting is ecologically trivial. Recommended illumination for most roadways ranges from 6–15 lux (ANSI/IES RP-8-14).

One issue with reducing illumination for roadways is a concern that any reduction will increase traffic collisions. Studies of changes to roadway lighting in England and Wales, however, found no significant effect on number of traffic collisions from part-night lighting, switching off roadway lighting entirely, or changing the spectrum of roadway lighting (Steinbach et al. 2015).

Where light is essential, fixtures should be full cutoff and shielded to minimize glare from any non-road site, especially in areas with known sensitive species. The best overall choice for spectrum is probably yellow (e.g., low-pressure sodium or yellow/amber LED), but technical considerations may lead to use of a broader spectrum (e.g., high-pressure sodium). Yellow/amber LED streetlight fixtures are commercially available in response to demand for lighting with minimal impacts on bats (e.g., Innolumis bat lamp from the Netherlands) and other wildlife (e.g., Star Friendly® lights, C&W Energy Solutions).

Other alternatives are available to further reduce the impacts of street lighting. Embedded roadway lighting (**Figure 27**) has been investigated in Florida as a way to minimize impacts on nesting sea turtles (Bertolotti and Salmon 2005). Such lights may be useful in locations where snow plowing is not necessary. Another alternative is the use of dynamic lighting systems that decrease illumination based on the time of day or traffic volume so that lights are extinguished by a certain time at night or at a percentage of peak traffic (Collins et al. 2002).

Interested park managers can consult reviews on the impacts of light from street lighting systems, which recommend against full-spectrum lamps because of ecological, physiological, and dark-sky impacts (Falchi et al. 2011, Bierman 2012).

Vehicles along roads can cause the type of periodic changes in lighting levels that can affect animal behavior (Baker and Richardson 2006) and influence views of the night sky (Luginbuhl et al. 2009). Birds, especially migratory species and seabirds, can be attracted to vehicle headlights (Gauthreaux and Belser 2006). Although additional research on this topic would be welcome, managers can mitigate impacts from headlights by providing shielding of sensitive receptors using a range of physical barriers, including berms, dense shrubs, or even walls in particularly sensitive areas.

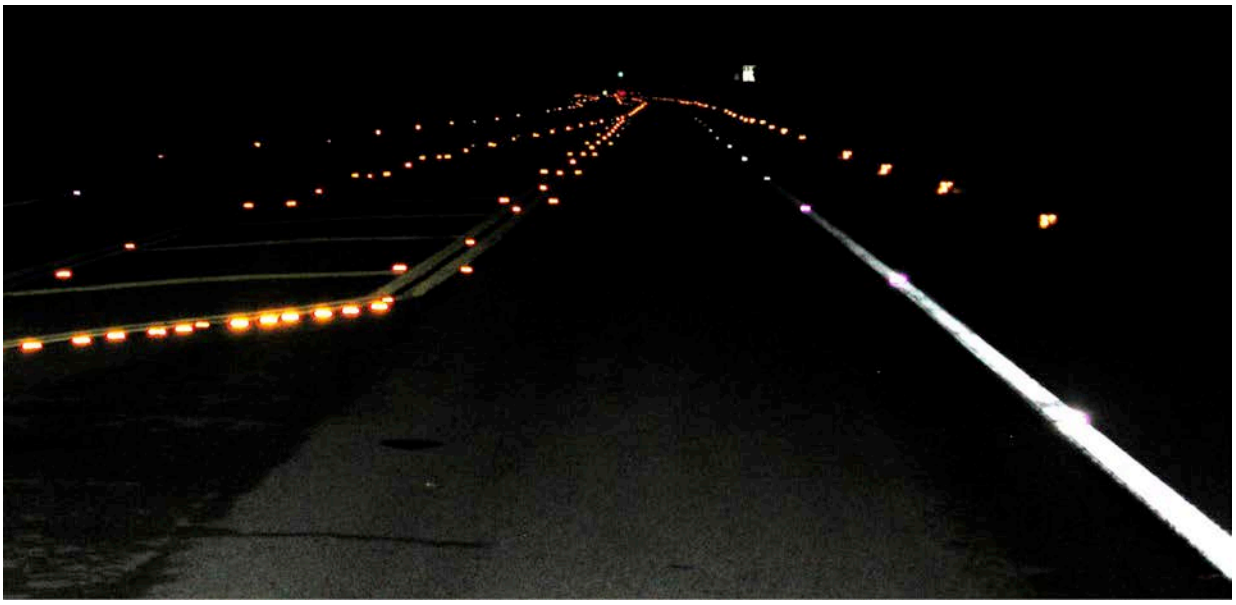


Figure 27. Embedded roadway lighting. These LED lights installed in the pavement are not visible to sea turtles nesting on the adjacent beach and are well received by motorists and pedestrians (Bertolotti and Salmon 2005). Photograph courtesy of Michael Salmon.

Energy production installations

Efforts to increase domestic energy production have resulted in pressure to explore and extract fossil fuels and develop industrial-scale facilities for wind and solar energy both on land and water. Energy production facilities have the potential to affect natural resources on park properties that may be found intermixed with other public and private lands approved for such activities. The direct impacts of such activities are of great conservation concern, but are not discussed here. In the event that such facilities are evaluated in the environmental review process, the following recommendations could be made to minimize the impacts of artificial night lighting.

Wind energy installations are generally illuminated with red flashing lights at the corners of arrays of turbines. Not all turbines have obstruction lighting. Researchers documenting mortality of animals (both bats and birds) at wind turbines have concluded that these flashing lights do not attract birds, but that constant illumination of ancillary structures on the ground is associated with increased bird mortality at nearby turbines (Kerlinger 2004, Kerlinger et al. 2010). Wind turbines currently are estimated to kill on the order of 100,000 (Kerlinger et al. 2011) and 573,000 (Smallwood 2013) birds per year, with this number likely to grow 30-fold in the next 20 years to meet federal goals for renewable energy. Ensuring that lighting is only red flashing with no steady-burning lights on any accessory structures would reduce mortality of nocturnal migrant birds, but would not mitigate the significant bat mortality that is associated with wind turbines (Kunz et al. 2007, Smallwood 2013).

Solar power plants are proposed and being built in open desert areas near parks and protected natural lands. Such facilities should not require dusk-to-dawn night lighting. If security lighting is desired, the recommendation should be made that it be fully shielded, low intensity, and on a motion detector.

Oil and natural gas facilities are often brightly illuminated at night. This light can have adverse consequences for any habitat in which it is found. For example, offshore oil platforms attract seabirds, usually to their detriment (Wiese et al. 2001, Montevecchi 2006). Terrestrial oil and gas facilities are often the only sources of light in remote open spaces. Parks can work with existing facilities to retrofit lights. For marine facilities, some initially positive data have been collected suggesting that using a green light on an offshore platform reduces the number of birds that are attracted to it (van de Laar 2007, Poot et al. 2008). By retrofitting the platform from white lights to green lights, Dutch researchers documented a reduction in the number of birds observed circling a platform (van de Laar 2007). The cause of this reduction could have been the wavelength of light used, or an overall decrease in lighting intensity that was a byproduct of the lighting change. The research shows that decreasing illumination and restricting the spectrum of light is a promising approach to reducing impacts to biological resources while still maintaining safe operations.

Indoor lighting

Although outdoor lighting is usually the focus of efforts to reduce impacts of night lighting on wildlife, indoor lighting should be considered as well. Indoor lighting may contribute substantially to ecological light pollution. In the extreme example of all-glass structures, greenhouses in Germany attract insects and migratory birds (Abt and Schultz 1995, Kolligs 2000). Furthermore, office buildings in urban cores can contribute as much to sky glow as billboards or roadway lighting (Oba et al. 2005). In darker environments, even the lights from a residence may have some effect on local wildlife behavior and degrade the experience of visitors in adjacent natural areas. Managers can be aware of these issues and seek to shield interior lights through use of curtains. This also gives an additional reason to cluster developments within parks. For urban areas and office buildings, guidelines are available to minimize the effects on birds, including through steps to reduce interior illumination (New York City Audubon Society 2007).

Lighthouses

The fatal attraction of birds to lighthouses has been observed for well over a century (Dutcher 1884, Miller 1897, Hansen 1954). In the United States, mortality of birds is more commonly reported on the East Coast than on the West Coast (Allen 1880, Merriam 1885), although mortality has been recorded on the West Coast as well (Squires and Hanson 1918). There has been some conflicting research on lighting color and flashing since the early 1900s (see review in Gauthreaux and Belser 2006), but the view has solidified that mortality can be decreased through the use of a flashing rather than constant light (Baldwin 1965, Jones and Francis 2003, Gauthreaux and Belser 2006). It is important that the light itself flashes, extinguishing completely between flashes, rather than the flashing effect being created by a rotating beam that remains illuminated. Reduction in lighting intensity also reduces bird mortality (Jones and Francis 2003).

Billboards

Billboards and other signage can affect wildlife behavior when illuminated. For example, light from a single billboard was sufficient to change the concealment behavior of juvenile salmon in a stream (Contor and Griffith 1995). While the significance of such behavioral changes is unknown, illumination of billboards and other signs should be controlled to minimize cumulative effects of

lighting on wildlife, especially as digital billboards proliferate. Illumination from a typical digital billboard proposed for installation in endangered species habitat in southern California would have caused lighting levels to exceed 10^{-1} lux (equivalent to that of a full moon) up to 1,000 ft (305 m) from the sign, according to the lighting engineers for the applicant (Longcore 2015; the proposal was not approved). Such intense lighting has the potential to influence nearby sensitive resources and contribute to sky glow.

Conclusion

Light pollution within parks and protected lands can have a measurable impact upon the habitat quality of the park, even if the light itself originates outside of the park's administrative boundary. Minimizing ecological impacts requires that land managers adopt an ethic of using only the minimum light necessary for human needs and being cautious when introducing light into or near a natural landscape. This report provides examples of the range of negative consequences that may arise from artificial night lighting. Though not a compendium of information for every species and every environment, it should provide adequate evidence for reasonable management of lighting in natural areas.

Park managers should first inventory their resources and determine if and where sensitive species or habitats exist. This information can then guide the development of the prescription of lighting zones within a park where different levels of lighting are allowed, depending on the uses and experiences desired for those zones. Lighting zones may be designed to minimize wildlife impacts only or also to integrate other aspects of a park experience. The most sensitive zone would have a prohibition on outdoor lighting or impose restrictions that define a narrow range of allowable artificial lighting. Looser restrictions that still provide adequate mitigation would be delineated for developed areas in parks and those with substantial human nighttime activity. In all instances, mitigation should address spectrum, intensity, direction, and duration. When all four aspects are addressed, mitigations can be effective at reducing ecological disruption from artificial night lighting.

Literature Cited

Abt, K. F., and G. Schultz. 1995. Auswirkungen der Lichtemissionen einer Großgewächshausanlage auf den nächtlichen Vogelzug [Impact of light emissions from a large illuminated greenhouse on nocturnal bird migration]. Corax **16**:17–29.

Allen, J. A. 1880. Destruction of birds by light-houses. Bulletin of the Nuttall Ornithological Club **5**:131–138.

Aubé, M., and J. Roby. 2014. Sky brightness levels before and after the creation of the first International Dark Sky Reserve, Mont-Mégantic Observatory, Québec, Canada. Journal of Quantitative Spectroscopy & Radiative Transfer **139**:52–63.

Aubé, M., J. Roby, and M. Kocifaj. 2013. Evaluating potential spectral imapcts of various artificial lights on melatonin suppression, photosynthesis, and star visibility. PLoS ONE **8**:e67798.

Aubrecht, C., C. D. Elvidge, T. Longcore, C. Rich, J. Safran, A. E. Strong, C. M. Eakin, K. E. Baugh, B. T. Tuttle, A. T. Howard, and E. H. Erwin. 2008. A global inventory of coral reef stressors based on satellite observed nighttime lights. Geocarto International **23**:467–479.

Azam, C., C. Kerbiriou, A. Vernet, J. F. Julien, Y. Bas, L. Plichard, J. Maratrat, and I. Le Viol. 2015. Is part-night lighting an effective measure to limit the impacts of artificial lighting on bats? Global Change Biology **21**:4333–4341.

Baker, B. J., and J. M. L. Richardson. 2006. The effect of artificial light on male breeding-season behaviour in green frogs, *Rana clamitans melanota*. Canadian Journal of Zoology **84**:1528–1532.

Baldwin, D. H. 1965. Enquiry into the mass mortality of nocturnal migrants in Ontario: final report. Ontario Naturalist **3**:3–11.

Barber-Meyer, S. M. 2007. Photopollution impacts on the nocturnal behaviour of the sugar glider (*Petaurus breviceps*). Pacific Conservation Biology **13**:171–176.

Becker, A., A. K. Whitfield, P. D. Cowley, J. Järnegren, and T. F. Næsje. 2013. Potential effects of artificial light associated with anthropogenic infrastructure on the abundance and foraging behaviour of estuary-associated fishes. Journal of Applied Ecology **50**:43–50.

Beier, P. 1995. Dispersal of juvenile cougars in fragmented habitat. Journal of Wildlife Management **59**:228–237.

Beier, P. 2006. Effects of artificial night lighting on terrestrial mammals. Pages 19–42 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Bennie, J., J. P. Duffy, T. W. Davies, M. E. Correa-Cano, and K. J. Gaston. 2015. Global trends in exposure to light pollution in natural terrestrial ecosystems. Remote Sensing **7**:2715–2730.

Bentley, M. G., P. J. W. Olive, and K. Last. 2001. Sexual satellites, moonlight and the nuptial dances of worms: the influence of the moon on the reproduction of marine animals. Earth, Moon and Planets **85–86**:67–84.

Bertolotti, L., and M. Salmon. 2005. Do embedded roadway lights protect sea turtles? Environmental Management **36**:702–710.

Bierman, A. 2012. Will switching to LED outdoor lighting increase sky glow? Lighting Research & Technology **44**:449–458.

Bird, B. L., L. C. Branch, and D. L. Miller. 2004. Effects of coastal lighting on foraging behavior of beach mice. Conservation Biology **18**:1435–1439.

Bird, S., and J. Parker. 2014. Low levels of light pollution may block the ability of male glow-worms (*Lampyris noctiluca* L.) to locate females. Journal of Insect Conservation **18**:737–743.

Boldogh, S., D. Dobrosi, and P. Samu. 2007. The effects of the illumination of buildings on house-dwelling bats and its conservation consequences. Acta Chiropterologica **9**:527–534.

Brainard, G. C., J. P. Hanifin, B. Warfield, M. K. Stone, M. E. James, M. Ayers, A. Kubey, B. Byrne, and M. Rollag. 2015. Short-wavelength enrichment of polychromatic light enhances human melatonin suppression potency. Journal of Pineal Research **58**:352–361.

Buchanan, B. W. 1993. Effects of enhanced lighting on the behaviour of nocturnal frogs. Animal Behaviour **45**:893–899.

Buchanan, B. W. 1998. Low-illumination prey detection by squirrel treefrogs. Journal of Herpetology **32**:270–274.

Buchanan, B. W. 2006. Observed and potential effects of artificial night lighting on anuran amphibians. Pages 192–220 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Burger, J., and M. Gochfeld. 1991. Human activity influence and diurnal and nocturnal foraging of sanderlings (*Calidris alba*). Condor **93**:259–265.

Carter, H. R., D. L. Whitworth, J. Y. Takekawa, T. W. Keeney, and P. R. Kelly. 2000. At-sea threats to Xantus' murrelets (*Synthliboramphus hypoleucus*) in the Southern California Bight. Pages 435–447 *in* D. R. Browne, K. L. Mitchell, and H. W. Chaney, editors. Proceedings of the fifth California Islands symposium. U.S. Minerals Management Service, Camarillo, California.

Christoffers, E. W., III. 1986. Ecology of the ghost crab *Ocypode quadrata* (Fabricius) on Assateague Island, Maryland and the impacts of various human uses of the beach on their distribution and abundance. Dissertation. Michigan State University, East Lansing, Michigan.

CIE. 1932. Commission Internationale de l'Éclairage Proceedings, 1931. Cambridge University Press, Cambridge.

Clarke, J. A. 1983. Moonlight's influence on predator/prey interactions between short-eared owls (*Asio flammeus*) and deermice (*Peromyscus maniculatus*). Behavioral Ecology and Sociobiology **13**:205–209.

Cleve, K. 1964. Der Anflug der Schmetterlinge an künstliche Lichtquellen [The flight of moths at artificial light sources]. Mitteilungen der dutschen Entomologischen Gesellschaft **23**:66–76.

Collins, A., T. Thurrell, R. Pink, and J. Feather. 2002. Dynamic dimming: the future of motorway lighting? Lighting Journal **67**:25–33.

Contor, C. R., and J. S. Griffith. 1995. Nocturnal emergence of juvenile rainbow trout from winter concealment relative to light intensity. Hydrobiologia **299**:179–183.

Daly, M., P. R. Behrends, M. I. Wilson, and L. F. Jacobs. 1992. Behavioural modulation of predation risk: moonlight avoidance and crespuscular compensation in a nocturnal desert rodent, *Dipodomys merriami*. Animal Behaviour **44**:1–9.

Davies, T. W., M. Coleman, K. M. Griffith, and S. R. Jenkins. 2015. Night-time lighting alters the composition of marine epifaunal communities. Biology Letters **11**:20150080.

Davies, T. W., J. P. Duffy, J. Bennie, and K. J. Gaston. 2014. The nature, extent, and ecological implications of marine light pollution. Frontiers in Ecology and the Environment **12**:347–355.

Day, J., J. Baker, H. Schofield, F. Mathews, and K. J. Gaston. 2015. Part-night lighting: implications for bat conservation. Animal Conservation **18**:512–516.

De Molenaar, J. G., R. J. H. G. Henkens, C. ter Braak, C. van Duyne, G. Hoefsloot, and D. A. Jonkers. 2003. Road illumination and nature, IV. Effects of road lights on the spatial behaivour of mammals. Alterra, Green World Research, Wageningen, The Netherlands.

De Molenaar, J. G., D. A. Jonkers, and M. E. Sanders. 2000. Road illumination and nature. III. Local influence of road lights on a black-tailed godwit (*Limosa l. limosa*) population. DWW Ontsnipperingsreeks deel 38A, Delft.

De Molenaar, J. G., M. E. Sanders, and D. A. Jonkers. 2006. Road lighting and grassland birds: local influence of road lighting on a black-tailed godwit population. Pages 114–136 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

DeCoursey, P. J. 1986. Light-sampling behavior in photoentrainment of a rodent circadian rhythm. Journal of Comparative Physiology A **159**:161–169.

Dick, M. H., and W. Donaldson. 1978. Fishing vessel endangered by crested auklet landings. Condor **80**:235–236.

Duffy, J. P., J. Bennie, A. P. Durán, and K. J. Gaston. 2015. Mammalian ranges are experiencing erosion of natural darkness. Scientific Reports **5**:12042.

Dugan, P. J. 1981. The importance of nocturnal foraging in shorebirds: a consequence of increased invertebrate prey activity. Pages 251–260 *in* N. V. Jones and W. J. Wolff, editors. Feeding and survival strategies of estuarine organisms. Plenum Press, New York.

Dutcher, W. 1884. Bird notes from Long Island, N.Y. Auk **1**:174–179.

Eisenbeis, G. 2006. Artificial night lighting and insects: attraction of insects to streetlamps in a rural setting in Germany. Pages 281–304 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Eisenbeis, G., and K. Eick. 2011. Studie zur Anziehung nachtaktiver Insekten an die Straßenbeleuchtung unter Einbeziehung von LEDs [Attraction of nocturnal insects to street lights — a study of lighting systems, with consideration of LEDs]. Natur und Landschaft **86**:298–306.

Eisenbeis, G., and F. Hassel. 2000. [Attraction of nocturnal insects to street lights – a study of municipal lighting systems in a rural area of Rheinhessin (Germany)]. Natur und Landschaft **75**:145–156.

Evans, A. 1987. Relative availability of the prey of wading birds by day and by night. Marine Ecology – Progress Series **37**:103–107.

Falchi, F., P. Cinzano, C. D. Elvidge, D. M. Keith, and A. Haim. 2011. Limiting the impact of light pollution on human health, environment and stellar visibility. Journal of Environmental Management **92**:2714–2722.

Forsythe, J., N. Kangas, and R. T. Hanlon. 2004. Does the California market squid (*Loligo opalescens*) spawn naturally during the day or at night? A note on the successful use of ROVs to obtain basic fisheries biology data. Fishery Bulletin **102**:389–392.

Frank, K. D. 1988. Impact of outdoor lighting on moths: an assessment. Journal of the Lepidopterists' Society **42**:63–93.

Frank, K. D. 2006. Effects of artificial night lighting on moths. Pages 305–344 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Gal, G., E. R. Loew, L. G. Rudstam, and A. M. Mohammadian. 1999. Light and diel vertical migration: spectral sensitivity and light avoidance by *Mysis relicta*. Canadian Journal of Fisheries and Aquatic Science **56**:311–322.

Gastman, E. A. 1886. Birds killed by electric light towers at Decatur, Ill. American Naturalist **20**:981.

Gaston, K. J. 2013. A green light for efficiency. Nature **497**:560–561.

Gauthreaux, S. A., Jr., and C. G. Belser. 2006. Effects of artificial night lighting on migrating birds. Pages 67–93 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Gehring, J., and P. Kerlinger. 2007. Avian collisions at communications towers: II. The role of Federal Aviation Administration obstruction lighting systems. State of Michigan.

Gilbert, B. S., and S. Boutin. 1991. Effect of moonlight on winter activity of snowshoe hares. Arctic and Alpine Research **23**:61–65.

Gorbunov, M. Y., and P. G. Falkowski. 2002. Photoreceptors in the cnidarian hosts allow symbiotic corals to sense blue moonlight. Limnology and Oceanography **47**:309–315.

Gorenzel, W. P., and T. P. Salmon. 1995. Characteristics of American crow urban roosts in California. Journal of Wildlife Management **59**:638–645.

Griffin, P. C., S. C. Griffin, C. Waroquiers, and L. S. Mills. 2005. Mortality by moonlight: predation risk and the snowshoe hare. Behavioral Ecology **16**:938–944.

Grigione, M. M., and R. Mrykalo. 2004. Effects of artificial night lighting on endangered ocelots (*Leopardus paradalis*) and nocturnal prey along the United States-Mexico border: a literature review and hypotheses of potential impacts. Urban Ecosystems **7**:65–77.

Hagen, O., and V. R. Viviani. 2009. Investigation of the artificial night lighting influence in firefly (Coleoptera: Lampyridae) occurrence in the urban areas of Campinas and Sorocaba municipalities [extended abstract].*in* Anais do IX Congresso de Ecologia do Brasil, São Lourenço.

Hailman, J. P. 1984. Bimodal nocturnal activity of the western toad (*Bufo boreas*) in relation to ambient illumination. Copeia **1984**:283–290.

Hailman, J. P., and J. G. Jaeger. 1974. Phototactic responses to spectrally dominant stimuli and use of colour vision by adult anuran amphibians: a comparative survey. Animal Behaviour **22**:757–795.

Hailman, J. P., and J. G. Jaeger. 1976. A model of phototaxis and its evaluation with anuran populations. Behaviour **56**:289–296.

Hansen, L. 1954. Birds killed at lights in Denmark 1886–1939. Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening **116**:269–368.

Henn, M., H. Nichols, Y. Zhang, and T. H. Bonner. 2014. Effect of artificial light on the drift of aquatic insects in urban central Texas streams. Journal of Freshwater Ecology **29**:302–318.

Hobson, E. S. 1965. Diurnal–nocturnal activity of some inshore fishes in the Gulf of California. Copeia **1965**:291–302.

Hobson, E. S., W. N. McFarland, and J. R. Chess. 1981. Crepuscular and nocturnal activities of Californian nearshore fishes, with consideration of their scotopic visual pigments and the photic environment. Fishery Bulletin **79**:1–30.

Hock, R. J. 1955. Photoperiod as stimulus for onset of hibernation. Federation Proceedings **14**:73–74.

Holzman, R., and A. Genin. 2003. Zooplanktivory by a nocturnal coral-reef fish: effects of light, flow, and prey density. Limnology and Oceanography **48**:1367–1375.

Holzman, R., and A. Genin. 2005. Mechanisms of selectivity in a nocturnal fish: a lack of active prey choice. Oecologia **146**:329–336.

Horváth, G., G. Kriska, P. Malik, and B. Robertson. 2009. Polarized light pollution: a new kind of ecological photopollution. Frontiers in Ecology and the Environment **7**:317–325.

Jaeger, R. G., and J. P. Hailman. 1976. Phototaxis in anurans: relation between intensity and spectral preferences. Copeia **1976**:92–98.

Johnsen, S. 2012. The optics of life: a biologist's guide to light in nature. Princeton University Press, Princeton.

Jokiel, P. L., R. Y. Ito, and P. M. Liu. 1985. Night irradiance and synchronization of lunar release of planula larvae in the reef coral *Pocillopora damicornis*. Marine Biology **88**:167–174.

Jones, J., and C. M. Francis. 2003. The effects of light characteristics on avian mortality at lighthouses. Journal of Avian Biology **34**:328–333.

Keitt, B. S., B. R. Tershy, and D. A. Croll. 2004. Nocturnal behavior reduces predation pressure on black-vented shearwaters *Puffinus opisthomelas*. Marine Ornithology **32**:173–178.

Kerlinger, P. 2004. Attraction of night migrating birds to FAA and other types of lights. Curry & Kerlinger, LLC, Cape May, New Jersey.

Kerlinger, P., J. Gehring, and R. Curry. 2011. Understanding bird collisions at communication towers and wind turbines: status of impacts and research. Birding **43**:44–51.

Kerlinger, P., J. L. Gehring, W. P. Erickson, R. Curry, A. Jain, and J. Guarnaccia. 2010. Night migrant fatalities and obstruction lighting at wind turbines in North America. Wilson Journal of Ornithology **122**:744–754.

Kolligs, D. 2000. Ökologische Auswirkungen künstlicher Lichtquellen auf nachtaktive Insekten, insbesondere Schmetterlinge (Lepidoptera) [Ecological effects of artificial light sources on nocturnally active insects, in particular on moths (Lepidoptera)]. Faunistisch-Oekologische Mitteilungen Supplement **28**:1–136.

Kotler, B. P. 1984. Risk of predation and the structure of desert rodent communities. Ecology **65**:689–701.

Kotler, B. P. 1985. Owl predation on desert rodents which differ in morphology and behavior. Journal of Mammalogy **66**:824–828.

Kramer, K. M., and E. C. Birney. 2001. Effect of light intensity on activity patterns of Patagonian leaf-eared mice, *Phyllotis xanthopygus*. Journal of Mammalogy **82**:535–544.

Kronfeld-Schor, N., and T. Dayan. 2008. Activity patterns of rodents: the physiological ecology of biological rhythms. Biological Rhythm Research **39**:193–211.

Kumlien, L. 1888. Observations on bird migration at Milwaukee. Auk **5**:325–328.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers in Ecology and the Environment **5**:315–324.

Kyba, C. C. M., T. Ruhtz, J. Fischer, and F. Hölker. 2011. Cloud coverage acts as an amplifier for ecological light pollution in urban ecosystems. PLoS ONE **6**:e17307.

Leis, J. M. 1986. Vertical and horizontal distribution of fish larvae near coral reeefs at Lizard Island, Great Barrier Reef. Marine Biology **90**:505–516.

Levy, O., L. Mizrahi, N. E. Chadwick-Furman, and Y. Achituv. 2001. Factors controlling the expansion behavior of *Favia favus* (Cnidaria: Scleractinia): effects of light, flow, and planktonic prey. Biological Bulletin **200**:118–126.

Lima, S. L. 1998. Stress and decision making under the risk of predation: recent developments from behavioral, reproductive, and ecological perspectives. Advances in the Study of Behavior **27**:215–290.

Lloyd, J. E. 2006. Stray light, fireflies, and fireflyers. Pages 345–364 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Longcore, T. 2015. Review of biological impacts analysis in Mitigated Negative Declaration for State Route 78 Digital Sign, City of Oceanside, California. Land Protection Partners, Los Angeles.

Longcore, T., H. L. Aldern, J. F. Eggers, S. Flores, L. Franco, E. Hirshfield-Yamanishi, L. N. Petrinec, W. A. Yan, and A. M. Barroso. 2015. Tuning the white light spectrum of light emitting diode lamps to reduce attraction of nocturnal arthropods. Philosophical Transactions of the Royal Society B: Biological Sciences **370**:20140125.

Longcore, T., and C. Rich. 2004. Ecological light pollution. Frontiers in Ecology and the Environment **2**:191–198.

Longcore, T., C. Rich, and S. A. Gauthreaux, Jr. 2008. Height, guy wires, and steady-burning lights increase hazard of communication towers to nocturnal migrants: a review and meta-analysis. Auk **125**:485–492.

Longcore, T., C. Rich, J. M. Marzluff, and B. Nightingale. 2003. Peer review of artificial light and noise impact analysis in Sand Point Magnuson Park Drainage, Wetland/Habitat Complex and Sports Fields/Courts Project Final Environmental Impact Statement. Land Protection Partners, Los Angeles.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D. G. Bert, L. M. Sullivan, E. Mutrie, S. A. Gauthreaux, Jr., M. L. Avery, R. L. Crawford, A. M. Manville, II, E. R. Travis, and D. Drake. 2012. An estimate of avian mortality at communication towers in the United States and Canada. PLoS ONE **7**:e34025.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D. G. Bert, L. M. Sullivan, E. Mutrie, S. A. Gauthreaux, Jr., M. L. Avery, R. L. Crawford, A. M. Manville, II, E. R. Travis, and D. Drake. 2013. Avian mortality at communication towers in the United States and Canada: which species, how many, and where? Biological Conservation **158**:410–419.

Luginbuhl, C. B., G. W. Lockwood, D. R. Davis, K. Pick, and J. Selders. 2009. From the ground up I: light pollution sources in Flagstaff, Arizona. Publications of the Astronomical Society of the Pacific **121**:185–203.

Málnás, K., L. Polyák, É. Prill, R. Hegedüs, G. Kriska, G. Dévai, G. Horváth, and S. Lengyel. 2011. Bridges as optical barriers and population disruptors for the mayfly *Palingenia longicauda*: an overlooked threat to freshwater biodiversity? Journal of Insect Conservation **15**:823–832.

Marcantonio, M., S. Pareeth, D. Rocchini, M. Metz, C. X. Garzon-Lopez, and M. Neteler. 2015. The integration of artificial night-time lights in landscape ecology: a remote sensing approach. Ecological Complexity **22**:109–120.

McFarlane, R. W. 1963. Disorientation of loggerhead hatchlings by artificial road lighting. Copeia **1963**:153.

McNeil, R., P. Drapeau, and J. D. Goss-Custard. 1992. The occurrence and adaptive significance of nocturnal habits in waterfowl. Biological Reviews **67**:381–419.

Menzel, R., and U. Greggers. 1985. Natural phototaxis and its relationship to colour vision in honeybees. Journal of Comparative Physiology A **157**:311–321.

Merriam, C. H. 1885. Preliminary report of the committee on bird migration. Auk **2**:53–65.

Miller, G. S., Jr. 1897. Winge on birds at the Danish lighthouses. Auk **14**:415–417.

Mizon, B. 2012. Light pollution: responses and remedies. Springer-Verlag, London.

Montevecchi, W. A. 2006. Influences of artificial light on marine birds. Pages 94–113 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Moore, M. V., S. J. Kohler, and M. S. Cheers. 2006. Artificial light at night in freshwater habitats and its potential ecological effects. Pages 365–384 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Moore, M. V., S. M. Pierce, H. M. Walsh, S. K. Kvalvik, and J. D. Lim. 2000. Urban light pollution alters the diel vertical migration of *Daphnia*. Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie **27**:779–782.

Moser, J. C., J. D. Reeve, J. M. S. Bento, T. M. C. Della Lucia, R. S. Cameron, and N. M. Heck. 2004. Eye size and behaviour of day- and night-flying leafcutting ant alates. Journal of Zoology, London **264**:69–75.

Mouritsen, K. N. 1992. Predator avoidance in night-feeding dunlins *Calidris alpina*: a matter of concealment. Ornis Scandinavica **23**:195–198.

New York City Audubon Society. 2007. Bird-safe building guidelines. New York City Audubon Society, New York.

Nightingale, B., T. Longcore, and C. A. Simenstad. 2006. Artificial night lighting and fishes. Pages 257–276 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Nørgaard, T., J. R. Henschel, and R. Wehner. 2006. The night-time temporal window of locomotor activity in the Namib Desert long-distance wandering spider, *Leucorchestris arenicola*. Journal of Comparative Physiology A **192**:365–372.

Oba, N., K. Kawakami, T. Iwata, T. Uozumi, and S. Kohko. 2005. Sky glow caused by the spill light from office buildings. Journal of Light & Visual Environment **29**:19–24.

Outen, A. R. 1998. The possible ecological implications of artificial lighting. Hertfordshire Biological Records Centre, Hertfordshire.

Overing, R. 1938. High mortality at the Washington Monument. Auk **55**:679.

Pauley, S. M. 2004. Lighting for the human circadian clock: recent research indicates that lighting has become a public health issue. Medical Hypotheses **63**:588–596.

Pawson, S. M., and M. K.-F. Bader. 2014. LED lighting increases the ecological impact of light pollution irrespective of color temperature. Ecological Applications **24**:1561–1568.

Perkin, E. K., F. Hölker, J. S. Richardson, J. P. Sadler, C. Wolter, and K. Tockner. 2011. The influence of artificial light on stream and riparian ecosystems: questions, challenges, and perspectives. Ecosphere **2**:122.

Perry, G., B. W. Buchanan, R. N. Fisher, M. Salmon, and S. E. Wise. 2008. Effects of artificial night lighting on amphibians and reptiles in urban environments. Herpetological Conservation **3**:239–256.

Perry, G., and R. N. Fisher. 2006. Night lights and reptiles: observed and potential effects. Pages 169–191 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Poiani, S., C. Dietrich, A. Barroso, and A. M. Costa-Leonardo. 2015. Effects of residential energy-saving lamps on the attraction of nocturnal insects. Lighting Research & Technology **47**:338–348.

Poot, H., B. J. Ens, H. de Vries, M. A. H. Donners, M. R. Wernand, and J. M. Marquenie. 2008. Green light for nocturnally migrating birds. Ecology and Society **13**:47.

Price, M. V., N. M. Waser, and T. A. Bass. 1984. Effects of moonlight on microhabitat use by desert rodents. Journal of Mammalogy **65**:353–356.

Reed, J. R., J. L. Sincock, and J. P. Hailman. 1985. Light attraction in endangered procellariiform birds: reduction by shielding upward radiation. Auk **102**:377–383.

Rich, C., and T. Longcore, editors. 2006. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Riley, W. D., P. I. Davison, D. L. Maxwell, and B. Bendall. 2013. Street lighting delays and disrupts the dispersal of Atlantic salmon (*Salmo salar*) fry. Biological Conservation **158**:140–146.

Riou, S., and K. C. Hamer. 2008. Predation risk and reproductive effort: impacts of moonlight on food provisioning and chick growth in Manx shearwaters. Animal Behaviour **76**:1743–1748.

Ritz, T., R. Wiltschko, P. J. Hore, C. T. Rodgers, K. Stapput, P. Thalau, C. R. Timmel, and W. Wiltschko. 2009. Magnetic compass of birds is based on a molecule with optimal directional sensitivity. Biophysical Journal **96**:3451–3457.

Robert, M., R. McNeil, and A. Leduc. 1989. Conditions and significance of night feeding in shorebirds and other water birds in a tropical lagoon. Auk **106**:94–101.

Rodrigues, P., C. Aubrecht, A. Gil, T. Longcore, and C. Elvidge. 2012. Remote sensing to map influence of light pollution on Cory's shearwater in São Miguel Island, Azores Archipelago. European Journal of Wildlife Research **58**:147–155.

Rodríguez, A., and B. Rodríguez. 2009. Attraction of petrels to artificial lights in the Canary Islands: effects of the moon phase and age class. Ibis **151**:299–310.

Rohweder, D. A., and P. R. Baverstock. 1996. Preliminary investigation of nocturnal habitat use by migratory waders (Order Charadriiformes) in northern New South Wales. Wildlife Research **23**:169–183.

Salmon, M. 2003. Artificial night lighting and sea turtles. Biologist **50**:163–168.

Salmon, M. 2006. Protecting sea turtles from artificial night lighting at Florida's oceanic beaches. Pages 141–168 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Schlacher, T. A., J. Dugan, D. S. Schoeman, M. Lastra, A. Jones, F. Scapini, A. McLachlan, and O. Defeo. 2007a. Sandy beaches at the brink. Diversity and Distributions **13**:556–560.

Schlacher, T. A., L. Thompson, and S. Price. 2007b. Vehicles *versus* conservation of invertebrates on sandy beaches: mortalities inflicted by off-road vehicles on ghost crabs. Marine Ecology **28**:354–367.

Schmiedel, J. 2001. Auswirkungen künstlicher Beleuchtung auf die Tierwelt – ein Überblick [Effects of artificial lighting on the animal world – an overview]. Schriftenreihe für Landschaftspflege und Naturschutz **67**:19–51.

Schoettle, B., M. Sivak, M. J. Flannagan, and W. J. Kosmatka. 2004. A market-weighted description of low-beam headlighting patterns in the U.S.: 2004. UMTRI-2004-23. University of Michigan Transportation Research Institute, Ann Arbor, Michigan.

Sebens, K. P., and K. DeRiemer. 1977. Diel cycles of expansion and contraction in coral reef anthozoans. Marine Biology **43**:247–256.

Seligmann, H., S. C. Anderson, K. Autumn, A. Bouskila, R. Saf, B. S. Tuniyev, and Y. L. Werner. 2007. Analysis of the locomotor activity of a nocturnal desert lizard (Reptilia: Gekkonidae: *Teratoscincus scincus*) under varying moonlight. Zoology **110**:104–117.

Sherman, L. W., D. Gottfredson, D. MacKenzie, J. Eck, P. Reuter, and S. Bushway. 1997. Preventing crime: what works, what doesn't, what's promising. A report to the United States Congress. University of Maryland at College Park, Department of Criminology and Criminal Justice, College Park, Maryland.

Skutelsky, O. 1996. Predation risk and state-dependent foraging in scorpions: effects of moonlight on foraging in the scorpion *Buthus occitanus*. Animal Behaviour **52**:49–57.

Smallwood, K. S. 2013. Comparing bird and bat fatality-rate estimates among North American wind-energy projects. Wildlife Society Bulletin **37**:19–33.

Squires, W. A., and H. E. Hanson. 1918. The destruction of birds at the lighthouses on the coast of California. Condor **20**:6–10.

Steinbach, R., C. Perkins, L. Tompson, S. Johnson, B. Armstrong, J. Green, C. Grundy, P. Wilkinson, and P. Edwards. 2015. The effect of reduced street lighting on road casualties and crime in England and Wales: controlled interrupted time series analysis. Journal of Epidemiology and Community Health **69**:1118–1124.

Stokkan, K.-A., L. Folkow, J. Dukes, M. Neveu, C. Hogg, S. Siefken, S. C. Dakin, and G. Jeffery. 2013. Shifting mirrors: adaptive changes in retinal reflections to winter darkness in Arctic reindeer. Proceedings of the Royal Society B: Biological Sciences **280**:20132451.

Stone, E. L., S. Harris, and G. Jones. 2015. Impacts of artificial lighting on bats: a review of challenges and solutions. Mammalian Biology-Zeitschrift für Säugetierkunde **80**:213–219.

Stone, E. L., G. Jones, and S. Harris. 2012. Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. Global Change Biology **18**:2458–2465.

Sweeney, A. M., C. A. Boch, S. Johnsen, and D. E. Morse. 2011. Twilight spectral dynamics and the coral reef invertebrate spawning response. Journal of Experimental Biology **214**:770–777.

Telfer, T. C., J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: conservation efforts and effects of moon phase. Wildlife Society Bulletin **15**:406–413.

Thibault, M., and R. McNeil. 1994. Day/night variation in habitat use by Wilson's plovers in northeastern Venezuela. Wilson Bulletin **106**:299–310.

Tien, J. M., V. F. O'Donnell, A. Barnett, and P. B. Mirchandani. 1977. National evaluation program, phase 1 report. Street lighting projects. National Institute of Law Enforcement and Criminal Justice, Washington, D.C.

Tigar, B. J., and P. E. Osborne. 1999. The influence of the lunar cycle on ground-dwelling invertebrates in an Arabian desert. Journal of Arid Environments **43**:171–182.

Upham, N. S., and J. C. Hafner. 2013. Do nocturnal rodents in the Great Basin Desert avoid moonlight? Journal of Mammalogy **94**:59–72.

van de Laar, F. J. T. 2007. Green light to birds: investigation into the effect of bird-friendly lighting. NAM Locatie L15-FA-1, Assen, The Netherlands.

Vásquez, R. A. 1994. Assessment of predation risk via illumination level: facultative central place foraging in the cricetid rodent *Phyllotis darwini*. Behavioral Ecology and Sociobiology **34**:375–381.

Verheijen, F. J. 1985. Photopollution: artificial light optic spatial control systems fail to cope with. Incidents, causations, remedies. Experimental Biology **1985**:1–18.

Wagner, R., C. Moore, and L. Smith. undated. Dark-sky camping: best practices in illumination for the Boy Scouts.

Walmsley, L., L. Hanna, J. Mouland, F. Martial, A. West, A. R. Smedley, D. A. Bechtold, A. R. Webb, R. J. Lucas, and T. M. Brown. 2015. Colour as a signal for entraining the mammalian circadian clock. PLoS Biology **13**:e1002127.

Wiese, F. K., W. A. Montevecchi, G. K. Davoren, F. Huettmann, A. W. Diamond, and J. Linke. 2001. Seabirds at risk around offshore oil platforms in the North-west Atlantic. Marine Pollution Bulletin **42**:1285–1290.

Wilhelm, S. I., J. J. Schau, E. Schau, S. M. Dooley, D. L. Wiseman, and H. A. Hogan. 2013. Atlantic puffins are attracted to coastal communities in Eastern Newfoundland. Northeastern Naturalist **20**:624–630.

Wiltschko, W., U. Munro, H. Ford, and R. Wiltschko. 1993. Red light disrupts magnetic orientation of migratory birds. Nature **364**:525–527.

Wiltschko, W., and R. Wiltschko. 1995. Migratory orientation of European robins is affected by the wavelength of light as well as by a magnetic pulse. Journal of Comparative Physiology A **177**:363–369.

Wise, S. 2007. Studying the ecological impacts of light pollution on wildlife: amphibians as models. Pages 107–116 *in* C. Marín and J. Jafari, editors. StarLight: a common heritage. StarLight Initiative La Palma Biosphere Reserve, Instituto De Astrofísica De Canarias, Government of The Canary Islands, Spanish Ministry of The Environment, UNESCO - MaB., Canary Islands, Spain.

Wise, S. E., and B. W. Buchanan. 2006. The influence of artificial illumination on the nocturnal behavior and physiology of salamanders. Pages 221–251 *in* C. Rich and T. Longcore, editors. Ecological consequences of artificial night lighting. Island Press, Washington, D.C.

Witherington, B. E. 1992. Behavioral responses of nesting sea turtles to artificial lighting. Herpetologica **48**:31–39.

Yahel, R., G. Yahel, T. Berman, J. S. Jaffe, and A. Genin. 2005. Diel pattern with abrupt crepuscular changes of zooplankton over a coral reef. Limnology and Oceanography **50**:930–944.

Yong, E. 2013. Why are reindeer eyes golden in summer but blue in winter? Phenomena. National Geographic (online).

Yurk, H., and A. W. Trites. 2000. Experimental attempts to reduce predation by harbor seals on out-migrating juvenile salmonids. Transactions of the American Fisheries Society **129**:1360–1366.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 999/132629, May 2016

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

2016
National Park Service
CENTENNIAL

EXPERIENCE YOUR AMERICA ™

Attachment B

Supplemental Air Quality Memo

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
1 Willowbrook Court, Suite 120
Petaluma, California 94954
Tel: 707-794-0400 *Fax: 707-794-0405*
www.illingworthrodkin.com *illro@illingworthrodkin.com*

M E M O

Date: November 1, 2016

To: Michael Lisenbee
David J. Powers & Associates

From: Joshua Carman

RE: **Topgolf Entertainment Complex and Hotel Air Quality Assessment**

SUBJECT: **Project Revisions** Job# 16-046

Illingworth & Rodkin, Inc. prepared the AQ assessment for this project in April 2016.[1] This study addressed air quality and community risk impacts that would be attributable to implementation of the proposed project. Since then, the proposed project has been slightly modified to include the following uses: 71,456 square feet (sf) entered as "Racquet Club" for the entertainment complex, 9 acres entered as "Golf Course," and 514 spaces entered as "Parking Lot" (4.5 acres) for the Topgolf entertainment complex project component on a 13.5-acre site; and 200 rooms (100,000 sf) entered as "Hotel," 110,000 sf entered as "Strip Mall," 415 spaces entered as "Enclosed Parking with Elevator" and 254 spaces entered as "Parking Lot" (4 acres) for the hotel/retail project component on a 19.7-acre site. The model defaults for schedule and equipment were used for the entertainment complex, which provides for a conservative assessment of project emissions. The anticipated construction phasing durations and equipment list for the hotel/retail component have not changed. However, the anticipated start date was adjusted to November 2017, since the entertainment complex is planned for construction before the hotel/retail component. Overall project construction is anticipated to be approximately 24 months, and was modeled as beginning in January 2017 and ending in December 2018. Construction was modeled as occurring up to seven days per week, consistent with the project description.

Construction Impacts

The CalEEMod was rerun with the updated project information, as described above. The project schedule assumes that the project would be built out over a period of approximately 24 months, or an estimated 520 construction workdays (based on an average of 260 workdays per year).[2] Average

[1] Illingworth & Rodkin, Inc. 2016. *Topgolf Entertainment Complex and Hotel Draft Air Quality Assessment – San Jose, California*. April 12.
[2] Though construction may occur up to seven days per week, 260 workdays per year was conservatively used to assess average daily construction emissions since it's not known exactly how many weekends may include work.

daily emissions were computed by dividing the total construction emissions by the number of construction days. Table 1 shows revised average daily construction emissions of ROG, NO_X, PM_{10} exhaust, and $PM_{2.5}$ exhaust during construction of the project. As indicated in Table 1, predicted project NO_X emissions would exceed the BAAQMD significance thresholds. However, as shown in Table 1, implementation of Mitigation Measures AQ-1 and AQ-2 would reduce this impact to a level of less than significant and would still be required of the project. Mitigation Measure AQ-2 should be revised to clarify that U.S. EPA Tier 4 engine standards for NO_X are needed in addition to Tier 4 standards for particulate matter. A summary of the suggested revision to the mitigation is given below. *Attachment A* includes the CalEEMod input and output values for construction emissions.

Table 1. Revised Construction Period Emissions

Scenario	ROG	NOx	PM_{10} Exhaust	$PM_{2.5}$ Exhaust
Topgolf Entertainment Complex construction emissions (tons)	3.75 tons	10.27 tons	0.52 tons	0.49 tons
Hotel/Retail construction emissions (tons)	2.75 tons	7.05 tons	0.33 tons	0.31 tons
Total construction emissions (tons)	6.50 tons	17.32 tons	0.85 tons	0.80 tons
Average daily emissions (pounds)[1]	25.0 lbs.	66.6 lbs.	3.3 lbs.	3.1 lbs.
BAAQMD Thresholds (pounds per day)	*54* lbs.	*54* lbs.	*82* lbs.	*54* lbs.
Exceed Threshold?	**No**	**Yes**	**No**	**No**
With Tier 4 Construction Mitigation				
Topgolf Entertainment Complex construction emissions (tons)	3.07 tons	3.02 tons	0.07 tons	0.07 tons
Hotel/Retail construction emissions (tons)	2.30 tons	2.43 tons	0.04 tons	0.04 tons
Total construction emissions (tons)	5.37 tons	5.45 tons	0.11 tons	0.11 tons
Average daily emissions (pounds)[1]	20.7 lbs.	21.0 lbs.	0.4 lbs.	0.4 lbs.
BAAQMD Thresholds (pounds per day)	*54* lbs.	*54* lbs.	*82* lbs.	*54* lbs.
Exceed Threshold?	**No**	**No**	**No**	**No**
Notes: [1]Assumes 520 workdays.				

Construction Risk Impacts

Results of the April 2016 study found the incremental residential infant cancer risk at the MEI to be 47.9 in one million, which exceeds the BAAQMD significance threshold of 10 in one million. The ISCST3 model was rerun using revised CalEEMod construction emissions using the same parameters and methodology as described in the April 2016 study. Results of modeling indicated that the location of the maximally exposed individual (MEI) would not change, however the incremental residential infant cancer risk would increase to 63.4 in one million, which would exceed the BAAQMD significance threshold of 10 in one million. Annual $PM_{2.5}$ concentration at the MEI would remain at 0.4 $\mu g/m^3$, which would exceed the BAAQMD significance threshold of 0.3 $\mu g/m^3$.

The maximum increased cancer risk for a school child exposure at the George Mayne Elementary

School would be 3.6 in one million, which is below the BAAQMD significance threshold. The maximum annual $PM_{2.5}$ concentration at the George Mayne Elementary School would be 0.1 μg/m^3. The project would continue have a significant impact with respect to community risk caused by construction activities at nearby residential receptors. Implementation of Mitigation Measures AQ-1 and AQ-2 would reduce this impact to a level of less than significant. *Attachment A* includes the modeled unmitigated and mitigated cases and ISCST3 output files. With implementation of these recommended mitigation measures, mitigated cancer risk would be 4.7 in one million and annual $PM_{2.5}$ concentration would be reduced to less than 0.1 μg/m^3.

The April 2016 report addressed cumulative TAC impacts from project construction and N. Taylor Street/N. 1st Street. This was identified as the only source of TAC emissions that could adversely affect the project construction MEI. No stationary sources of TACs (e.g., emergency backup generators or gas stations) were identified using BAAQMD screening tools. However, the Midpoint at 237 project has been identified as a planned and approved project that should be included in the cumulative risk assessment. The Midpoint at 237 project would include development of four R&D buildings and two manufacturing buildings at the approved former Cisco Alviso site. A community risk assessment[3] of the Midpoint project found that incremental residential cancer risk from operation of the project would be 1.4 in one million. Incremental cancer risk at the George Mayne Elementary School would 0.6 in one million. Annual $PM_{2.5}$ concentrations for both residential and school receptors were found to be <0.01 μg/m^3. We understand that construction of this project, including equipment-intensive activities such as grading are already underway or complete and that construction of the Midpoint project is not expected to contribute to cumulative risk for project receptors.

Table 2 summarizes cumulative risk computed at the construction MEI. Cumulative risk at the George Mayne Elementary School would be less than at the residential MEI (project construction MEI). As shown in Table 2, cumulative risk would be less than significant.

Table 2. Cumulative Risk at Project Construction MEI

Source	Maximum Cancer Risk (per million)	Maximum Annual $PM_{2.5}$ Concentration (μg/m^3)	Maximum Hazard Index
Unmitigated Project Construction	63.4	0.4	0.04
N. Taylor Street/N. 1st Street	5.0	0.1	<0.03
Midpoint at 237 Project Operation	1.4	<0.01	<0.01
Cumulative Total	69.8	<0.51	<0.08
BAAQMD Threshold – Cumulative Sources	***>100***	***>0.8***	***>10.0***
Significant?	***No***	***No***	***No***

[3] Illingworth & Rodkin, Inc. 2014. *Midpoint at 237 Project – Construction and Operational Health Risk Assessment San Jose, California*. February 6.

Suggested Revision to Mitigation Measure AQ-2

***Mitigation Measure AQ-2*: Use of newer, retrofitted or alternatively powered construction equipment to minimize emissions. Such equipment selection would include the following:**

All diesel-powered construction equipment larger than 50 horsepower and operating on site for more than two days continuously shall meet U.S. EPA NO_X and particulate matter emissions standards for Tier 4 engines or equivalent. *Note that the construction contractor could use other measures to minimize construction period DPM emissions to reduce the predicted cancer risk below the thresholds. Such measures may be the use of alternative powered equipment (e.g., LPG powered forklifts), alternative fuels (e.g., biofuels), added exhaust devices, or a combination of measures, provided that these measures are approved by the lead agency.*

Attachment A

Topgolf - Topgolf Complex Construction

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	514.00	Space	4.50	205,600.00	0
Golf Course	9.00	Acre	9.00	392,040.00	0
Racquet Club	71.46	1000sqft	0.00	71,456.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2014
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - From plan drawings and PD. Structure for hitting bays entered as "Racquet Club"

Construction Phase - Default w/ 7 days/week construction

Off-road Equipment -

Trips and VMT -

Demolition -

Grading -

Architectural Coating -

Construction Off-road Equipment Mitigation - Tier 4 engines for equip > 50hp. BAAQMD BMPs.

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	9.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	20.00	28.00
tblConstructionPhase	NumDays	300.00	420.00
tblConstructionPhase	NumDays	20.00	27.00

tblConstructionPhase	NumDays	30.00	42.00
tblConstructionPhase	NumDays	20.00	28.00
tblConstructionPhase	NumDays	10.00	14.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblLandUse	LandUseSquareFeet	71,460.00	71,456.00
tblLandUse	LotAcreage	4.63	4.50
tblLandUse	LotAcreage	1.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.9499	7.6992	8.0390	0.0138	0.7763	0.3916	1.1680	0.2715	0.3655	0.6370	0.0000	1,173.9316	1,173.9316	0.1597	0.0000	1,177.2849
2018	2.7982	2.5737	3.1601	6.1500e-003	0.2346	0.1288	0.3634	0.0634	0.1208	0.1842	0.0000	505.3772	505.3772	0.0578	0.0000	506.5903
Total	**3.7481**	**10.2729**	**11.1991**	**0.0200**	**1.0109**	**0.5205**	**1.5314**	**0.3349**	**0.4862**	**0.8211**	**0.0000**	**1,679.3088**	**1,679.3088**	**0.2174**	**0.0000**	**1,683.8751**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.4320	2.1051	7.4809	0.0138	0.6066	0.0496	0.6562	0.1591	0.0478	0.2069	0.0000	1,173.9310	1,173.9310	0.1597	0.0000	1,177.2842
2018	2.6416	0.9194	3.2104	6.1500e-003	0.2346	0.0215	0.2561	0.0634	0.0206	0.0840	0.0000	505.3770	505.3770	0.0578	0.0000	506.5900
Total	**3.0736**	**3.0244**	**10.6913**	**0.0200**	**0.8412**	**0.0711**	**0.9123**	**0.2225**	**0.0684**	**0.2909**	**0.0000**	**1,679.3080**	**1,679.3080**	**0.2174**	**0.0000**	**1,683.8743**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**18.00**	**70.56**	**4.53**	**0.00**	**16.79**	**86.34**	**40.43**	**33.56**	**85.93**	**64.57**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2017	1/27/2017	7	27	
2	Site Preparation	Site Preparation	1/28/2017	2/10/2017	7	14	
3	Grading	Grading	2/11/2017	3/24/2017	7	42	
4	Building Construction	Building Construction	3/25/2017	5/18/2018	7	420	
5	Paving	Paving	5/19/2018	6/15/2018	7	28	
6	Architectural Coating	Architectural Coating	6/16/2018	7/13/2018	7	28	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 105

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 704,496; Non-Residential Outdoor: 234,832 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor

Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Scrapers	2	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	281.00	110.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	56.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0547	0.5764	0.4576	5.4000e-004		0.0287	0.0287		0.0267	0.0267	0.0000	49.4346	49.4346	0.0136	0.0000	49.7194
Total	**0.0547**	**0.5764**	**0.4576**	**5.4000e-004**		**0.0287**	**0.0287**		**0.0267**	**0.0267**	**0.0000**	**49.4346**	**49.4346**	**0.0136**	**0.0000**	**49.7194**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.7000e-004	9.5000e-004	9.2000e-003	2.0000e-005	1.8400e-003	1.0000e-005	1.8600e-003	4.9000e-004	1.0000e-005	5.0000e-004	0.0000	1.5624	1.5624	8.0000e-005	0.0000	1.5641

Total	**6.7000e-004**	**9.5000e-004**	**9.2000e-003**	**2.0000e-005**	**1.8400e-003**	**1.0000e-005**	**1.8600e-003**	**4.9000e-004**	**1.0000e-005**	**5.0000e-004**	**0.0000**	**1.5624**	**1.5624**	**8.0000e-005**	**0.0000**	**1.5641**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	6.4000e-003	0.0277	0.3217	5.4000e-004		8.5000e-004	8.5000e-004		8.5000e-004	8.5000e-004	0.0000	49.4345	49.4345	0.0136	0.0000	49.7193
Total	**6.4000e-003**	**0.0277**	**0.3217**	**5.4000e-004**		**8.5000e-004**	**8.5000e-004**		**8.5000e-004**	**8.5000e-004**	**0.0000**	**49.4345**	**49.4345**	**0.0136**	**0.0000**	**49.7193**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.7000e-004	9.5000e-004	9.2000e-003	2.0000e-005	1.8400e-003	1.0000e-005	1.8600e-003	4.9000e-004	1.0000e-005	5.0000e-004	0.0000	1.5624	1.5624	8.0000e-005	0.0000	1.5641
Total	**6.7000e-004**	**9.5000e-004**	**9.2000e-003**	**2.0000e-005**	**1.8400e-003**	**1.0000e-005**	**1.8600e-003**	**4.9000e-004**	**1.0000e-005**	**5.0000e-004**	**0.0000**	**1.5624**	**1.5624**	**8.0000e-005**	**0.0000**	**1.5641**

3.3 Site Preparation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1265	0.0000	0.1265	0.0695	0.0000	0.0695	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0339	0.3623	0.2758	2.7000e-004		0.0193	0.0193		0.0177	0.0177	0.0000	25.4208	25.4208	7.7900e-003	0.0000	25.5843
Total	**0.0339**	**0.3623**	**0.2758**	**2.7000e-004**	**0.1265**	**0.0193**	**0.1457**	**0.0695**	**0.0177**	**0.0873**	**0.0000**	**25.4208**	**25.4208**	**7.7900e-003**	**0.0000**	**25.5843**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2000e-004	5.9000e-004	5.7300e-003	1.0000e-005	1.1500e-003	1.0000e-005	1.1600e-003	3.1000e-004	1.0000e-005	3.1000e-004	0.0000	0.9722	0.9722	5.0000e-005	0.0000	0.9732
Total	**4.2000e-004**	**5.9000e-004**	**5.7300e-003**	**1.0000e-005**	**1.1500e-003**	**1.0000e-005**	**1.1600e-003**	**3.1000e-004**	**1.0000e-005**	**3.1000e-004**	**0.0000**	**0.9722**	**0.9722**	**5.0000e-005**	**0.0000**	**0.9732**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0569	0.0000	0.0569	0.0156	0.0000	0.0156	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.3300e-003	0.0144	0.1487	2.7000e-004		4.4000e-004	4.4000e-004		4.4000e-004	4.4000e-004	0.0000	25.4207	25.4207	7.7900e-003	0.0000	25.5843
Total	**3.3300e-003**	**0.0144**	**0.1487**	**2.7000e-004**	**0.0569**	**4.4000e-004**	**0.0574**	**0.0156**	**4.4000e-004**	**0.0161**	**0.0000**	**25.4207**	**25.4207**	**7.7900e-003**	**0.0000**	**25.5843**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.2000e-004	5.9000e-004	5.7300e-003	1.0000e-005	1.1500e-003	1.0000e-005	1.1600e-003	3.1000e-004	1.0000e-005	3.1000e-004	0.0000	0.9722	0.9722	5.0000e-005	0.0000	0.9732
Total	**4.2000e-004**	**5.9000e-004**	**5.7300e-003**	**1.0000e-005**	**1.1500e-003**	**1.0000e-005**	**1.1600e-003**	**3.1000e-004**	**1.0000e-005**	**3.1000e-004**	**0.0000**	**0.9722**	**0.9722**	**5.0000e-005**	**0.0000**	**0.9732**

3.4 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1821	0.0000	0.1821	0.0755	0.0000	0.0755	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1281	1.4614	0.9829	1.3000e-003		0.0697	0.0697		0.0641	0.0641	0.0000	120.2752	120.2752	0.0369	0.0000	121.0491
Total	**0.1281**	**1.4614**	**0.9829**	**1.3000e-003**	**0.1821**	**0.0697**	**0.2518**	**0.0755**	**0.0641**	**0.1396**	**0.0000**	**120.2752**	**120.2752**	**0.0369**	**0.0000**	**121.0491**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-003	1.9700e-003	0.0191	4.0000e-005	3.8200e-003	3.0000e-005	3.8500e-003	1.0200e-003	3.0000e-005	1.0400e-003	0.0000	3.2406	3.2406	1.6000e-004	0.0000	3.2440
Total	**1.4000e-003**	**1.9700e-003**	**0.0191**	**4.0000e-005**	**3.8200e-003**	**3.0000e-005**	**3.8500e-003**	**1.0200e-003**	**3.0000e-005**	**1.0400e-003**	**0.0000**	**3.2406**	**3.2406**	**1.6000e-004**	**0.0000**	**3.2440**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0820	0.0000	0.0820	0.0170	0.0000	0.0170	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0159	0.0688	0.7304	1.3000e-003		2.1200e-003	2.1200e-003		2.1200e-003	2.1200e-003	0.0000	120.2751	120.2751	0.0369	0.0000	121.0490
Total	**0.0159**	**0.0688**	**0.7304**	**1.3000e-003**	**0.0820**	**2.1200e-003**	**0.0841**	**0.0170**	**2.1200e-003**	**0.0191**	**0.0000**	**120.2751**	**120.2751**	**0.0369**	**0.0000**	**121.0490**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.4000e-003	1.9700e-003	0.0191	4.0000e-005	3.8200e-003	3.0000e-005	3.8500e-003	1.0200e-003	3.0000e-005	1.0400e-003	0.0000	3.2406	3.2406	1.6000e-004	0.0000	3.2440
Total	**1.4000e-003**	**1.9700e-003**	**0.0191**	**4.0000e-005**	**3.8200e-003**	**3.0000e-005**	**3.8500e-003**	**1.0200e-003**	**3.0000e-005**	**1.0400e-003**	**0.0000**	**3.2406**	**3.2406**	**1.6000e-004**	**0.0000**	**3.2440**

3.5 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4374	3.7232	2.5562	3.7800e-003		0.2512	0.2512		0.2359	0.2359	0.0000	337.6656	337.6656	0.0831	0.0000	339.4108
Total	**0.4374**	**3.7232**	**2.5562**	**3.7800e-003**		**0.2512**	**0.2512**		**0.2359**	**0.2359**	**0.0000**	**337.6656**	**337.6656**	**0.0831**	**0.0000**	**339.4108**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1613	1.3866	1.9323	3.6800e-003	0.1002	0.0201	0.1202	0.0287	0.0184	0.0472	0.0000	329.6581	329.6581	2.5600e-003	0.0000	329.7118
Worker	0.1320	0.1859	1.8003	4.1800e-003	0.3607	2.7500e-003	0.3635	0.0959	2.5400e-003	0.0985	0.0000	305.7023	305.7023	0.0155	0.0000	306.0282

Total	**0.2934**	**1.5724**	**3.7326**	**7.8600e-003**	**0.4609**	**0.0228**	**0.4837**	**0.1247**	**0.0210**	**0.1456**	**0.0000**	**635.3603**	**635.3603**	**0.0181**	**0.0000**	**635.7399**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1105	0.4182	2.5136	3.7800e-003		0.0233	0.0233		0.0233	0.0233	0.0000	337.6651	337.6651	0.0831	0.0000	339.4104
Total	**0.1105**	**0.4182**	**2.5136**	**3.7800e-003**		**0.0233**	**0.0233**		**0.0233**	**0.0233**	**0.0000**	**337.6651**	**337.6651**	**0.0831**	**0.0000**	**339.4104**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1613	1.3866	1.9323	3.6800e-003	0.1002	0.0201	0.1202	0.0287	0.0184	0.0472	0.0000	329.6581	329.6581	2.5600e-003	0.0000	329.7118
Worker	0.1320	0.1859	1.8003	4.1800e-003	0.3607	2.7500e-003	0.3635	0.0959	2.5400e-003	0.0985	0.0000	305.7023	305.7023	0.0155	0.0000	306.0282
Total	**0.2934**	**1.5724**	**3.7326**	**7.8600e-003**	**0.4609**	**0.0228**	**0.4837**	**0.1247**	**0.0210**	**0.1456**	**0.0000**	**635.3603**	**635.3603**	**0.0181**	**0.0000**	**635.7399**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1841	1.6050	1.2098	1.8500e-003		0.1031	0.1031		0.0969	0.0969	0.0000	163.3711	163.3711	0.0400	0.0000	164.2107
Total	**0.1841**	**1.6050**	**1.2098**	**1.8500e-003**		**0.1031**	**0.1031**		**0.0969**	**0.0969**	**0.0000**	**163.3711**	**163.3711**	**0.0400**	**0.0000**	**164.2107**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0715	0.6143	0.8906	1.8000e-003	0.0490	9.0900e-003	0.0581	0.0141	8.3600e-003	0.0224	0.0000	158.5027	158.5027	1.2300e-003	0.0000	158.5285
Worker	0.0580	0.0819	0.7903	2.0400e-003	0.1765	1.3000e-003	0.1778	0.0470	1.2100e-003	0.0482	0.0000	144.0289	144.0289	6.9800e-003	0.0000	144.1754
Total	**0.1295**	**0.6961**	**1.6809**	**3.8400e-003**	**0.2255**	**0.0104**	**0.2359**	**0.0610**	**9.5700e-003**	**0.0706**	**0.0000**	**302.5315**	**302.5315**	**8.2100e-003**	**0.0000**	**302.7039**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Off-Road	0.0500	0.2006	1.2264	1.8500e-003		0.0104	0.0104		0.0104	0.0104	0.0000	163.3709	163.3709	0.0400	0.0000	164.2105
Total	**0.0500**	**0.2006**	**1.2264**	**1.8500e-003**		**0.0104**	**0.0104**		**0.0104**	**0.0104**	**0.0000**	**163.3709**	**163.3709**	**0.0400**	**0.0000**	**164.2105**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0715	0.6143	0.8906	1.8000e-003	0.0490	9.0900e-003	0.0581	0.0141	8.3600e-003	0.0224	0.0000	158.5027	158.5027	1.2300e-003	0.0000	158.5285
Worker	0.0580	0.0819	0.7903	2.0400e-003	0.1765	1.3000e-003	0.1778	0.0470	1.2100e-003	0.0482	0.0000	144.0289	144.0289	6.9800e-003	0.0000	144.1754
Total	**0.1295**	**0.6961**	**1.6809**	**3.8400e-003**	**0.2255**	**0.0104**	**0.2359**	**0.0610**	**9.5700e-003**	**0.0706**	**0.0000**	**302.5315**	**302.5315**	**8.2100e-003**	**0.0000**	**302.7039**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0226	0.2403	0.2029	3.1000e-004		0.0131	0.0131		0.0121	0.0121	0.0000	28.5162	28.5162	8.8800e-003	0.0000	28.7027
Paving	5.9000e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0285**	**0.2403**	**0.2029**	**3.1000e-004**		**0.0131**	**0.0131**		**0.0121**	**0.0121**	**0.0000**	**28.5162**	**28.5162**	**8.8800e-003**	**0.0000**	**28.7027**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.3000e-004	8.9000e-004	8.5600e-003	2.0000e-005	1.9100e-003	1.0000e-005	1.9300e-003	5.1000e-004	1.0000e-005	5.2000e-004	0.0000	1.5600	1.5600	8.0000e-005	0.0000	1.5616
Total	**6.3000e-004**	**8.9000e-004**	**8.5600e-003**	**2.0000e-005**	**1.9100e-003**	**1.0000e-005**	**1.9300e-003**	**5.1000e-004**	**1.0000e-005**	**5.2000e-004**	**0.0000**	**1.5600**	**1.5600**	**8.0000e-005**	**0.0000**	**1.5616**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.8400e-003	0.0167	0.2370	3.1000e-004		5.1000e-004	5.1000e-004		5.1000e-004	5.1000e-004	0.0000	28.5162	28.5162	8.8800e-003	0.0000	28.7026
Paving	5.9000e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**9.7400e-003**	**0.0167**	**0.2370**	**3.1000e-004**		**5.1000e-004**	**5.1000e-004**		**5.1000e-004**	**5.1000e-004**	**0.0000**	**28.5162**	**28.5162**	**8.8800e-003**	**0.0000**	**28.7026**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.3000e-004	8.9000e-004	8.5600e-003	2.0000e-005	1.9100e-003	1.0000e-005	1.9300e-003	5.1000e-004	1.0000e-005	5.2000e-004	0.0000	1.5600	1.5600	8.0000e-005	0.0000	1.5616
Total	**6.3000e-004**	**8.9000e-004**	**8.5600e-003**	**2.0000e-005**	**1.9100e-003**	**1.0000e-005**	**1.9300e-003**	**5.1000e-004**	**1.0000e-005**	**5.2000e-004**	**0.0000**	**1.5600**	**1.5600**	**8.0000e-005**	**0.0000**	**1.5616**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	2.4490					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.1800e-003	0.0281	0.0260	4.0000e-005		2.1100e-003	2.1100e-003		2.1100e-003	2.1100e-003	0.0000	3.5746	3.5746	3.4000e-004	0.0000	3.5817
Total	**2.4532**	**0.0281**	**0.0260**	**4.0000e-005**		**2.1100e-003**	**2.1100e-003**		**2.1100e-003**	**2.1100e-003**	**0.0000**	**3.5746**	**3.5746**	**3.4000e-004**	**0.0000**	**3.5817**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3500e-003	3.3100e-003	0.0320	8.0000e-005	7.1400e-003	5.0000e-005	7.1900e-003	1.9000e-003	5.0000e-005	1.9500e-003	0.0000	5.8239	5.8239	2.8000e-004	0.0000	5.8298

Total	**2.3500e-003**	**3.3100e-003**	**0.0320**	**8.0000e-005**	**7.1400e-003**	**5.0000e-005**	**7.1900e-003**	**1.9000e-003**	**5.0000e-005**	**1.9500e-003**	**0.0000**	**5.8239**	**5.8239**	**2.8000e-004**	**0.0000**	**5.8298**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	2.4490					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.2000e-004	1.8000e-003	0.0257	4.0000e-005		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	3.5746	3.5746	3.4000e-004	0.0000	3.5817
Total	**2.4494**	**1.8000e-003**	**0.0257**	**4.0000e-005**		**6.0000e-005**	**6.0000e-005**		**6.0000e-005**	**6.0000e-005**	**0.0000**	**3.5746**	**3.5746**	**3.4000e-004**	**0.0000**	**3.5817**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3500e-003	3.3100e-003	0.0320	8.0000e-005	7.1400e-003	5.0000e-005	7.1900e-003	1.9000e-003	5.0000e-005	1.9500e-003	0.0000	5.8239	5.8239	2.8000e-004	0.0000	5.8298
Total	**2.3500e-003**	**3.3100e-003**	**0.0320**	**8.0000e-005**	**7.1400e-003**	**5.0000e-005**	**7.1900e-003**	**1.9000e-003**	**5.0000e-005**	**1.9500e-003**	**0.0000**	**5.8239**	**5.8239**	**2.8000e-004**	**0.0000**	**5.8298**

Topgolf - Topgolf Complex Construction TAC

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Parking Lot	514.00	Space	0.00	205,600.00	0
Golf Course	13.50	Acre	13.50	588,060.00	0
Racquet Club	71.46	1000sqft	0.00	71,456.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2014
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - From plan drawings and PD. Structure for hitting bays entered as "Racquet Club"

Construction Phase - Default w/ 7 days/week construction

Architectural Coating -

Construction Off-road Equipment Mitigation - Tier 4 engines for equip > 50hp. BAAQMD BMPs.

Off-road Equipment -

Grading -

Demolition -

Trips and VMT - 0.5mi trip length

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	9.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	20.00	28.00
tblConstructionPhase	NumDays	300.00	420.00
tblConstructionPhase	NumDays	20.00	27.00

tblConstructionPhase	NumDays	30.00	42.00
tblConstructionPhase	NumDays	20.00	28.00
tblConstructionPhase	NumDays	10.00	14.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblLandUse	LotAcreage	4.63	0.00
tblLandUse	LotAcreage	1.64	0.00
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.9248	6.6427	6.8323	6.9200e-003	0.3375	0.3722	0.7097	0.1530	0.3476	0.5006	0.0000	616.7603	616.7603	0.1444	0.0000	619.7932
2018	3.8034	2.1113	2.6165	2.7100e-003	0.0145	0.1199	0.1344	3.9900e-003	0.1126	0.1166	0.0000	235.9856	235.9856	0.0507	0.0000	237.0492
Total	**4.7282**	**8.7540**	**9.4488**	**9.6300e-003**	**0.3519**	**0.4921**	**0.8441**	**0.1570**	**0.4602**	**0.6172**	**0.0000**	**852.7459**	**852.7459**	**0.1951**	**0.0000**	**856.8424**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.4068	1.0485	6.2741	6.9200e-003	0.1678	0.0302	0.1979	0.0406	0.0299	0.0705	0.0000	616.7597	616.7597	0.1444	0.0000	619.7926
2018	3.6468	0.4570	2.6669	2.7100e-003	0.0145	0.0126	0.0270	3.9900e-003	0.0125	0.0164	0.0000	235.9853	235.9853	0.0507	0.0000	237.0489
Total	**4.0536**	**1.5055**	**8.9410**	**9.6300e-003**	**0.1822**	**0.0428**	**0.2250**	**0.0446**	**0.0424**	**0.0870**	**0.0000**	**852.7450**	**852.7450**	**0.1951**	**0.0000**	**856.8415**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**14.27**	**82.80**	**5.37**	**0.00**	**48.23**	**91.31**	**73.35**	**71.59**	**90.80**	**85.91**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2017	1/27/2017	7	27	
2	Site Preparation	Site Preparation	1/28/2017	2/10/2017	7	14	
3	Grading	Grading	2/11/2017	3/24/2017	7	42	
4	Building Construction	Building Construction	3/25/2017	5/18/2018	7	420	
5	Paving	Paving	5/19/2018	6/15/2018	7	28	
6	Architectural Coating	Architectural Coating	6/16/2018	7/13/2018	7	28	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 105

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 998,526; Non-Residential Outdoor: 332,842 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Scrapers	2	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37

Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Building Construction	9	363.00	142.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	73.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Off-Road	0.0547	0.5764	0.4576	5.4000e-004		0.0287	0.0287		0.0267	0.0267	0.0000	49.4346	49.4346	0.0136	0.0000	49.7194
Total	**0.0547**	**0.5764**	**0.4576**	**5.4000e-004**		**0.0287**	**0.0287**		**0.0267**	**0.0267**	**0.0000**	**49.4346**	**49.4346**	**0.0136**	**0.0000**	**49.7194**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-004	1.3000e-004	1.7600e-003	0.0000	8.0000e-005	0.0000	8.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.1015	0.1015	1.0000e-005	0.0000	0.1017
Total	**5.0000e-004**	**1.3000e-004**	**1.7600e-003**	**0.0000**	**8.0000e-005**	**0.0000**	**8.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.1015**	**0.1015**	**1.0000e-005**	**0.0000**	**0.1017**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	6.4000e-003	0.0277	0.3217	5.4000e-004		8.5000e-004	8.5000e-004		8.5000e-004	8.5000e-004	0.0000	49.4345	49.4345	0.0136	0.0000	49.7193
Total	**6.4000e-003**	**0.0277**	**0.3217**	**5.4000e-004**		**8.5000e-004**	**8.5000e-004**		**8.5000e-004**	**8.5000e-004**	**0.0000**	**49.4345**	**49.4345**	**0.0136**	**0.0000**	**49.7193**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-004	1.3000e-004	1.7600e-003	0.0000	8.0000e-005	0.0000	8.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.1015	0.1015	1.0000e-005	0.0000	0.1017
Total	**5.0000e-004**	**1.3000e-004**	**1.7600e-003**	**0.0000**	**8.0000e-005**	**0.0000**	**8.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.1015**	**0.1015**	**1.0000e-005**	**0.0000**	**0.1017**

3.3 Site Preparation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1265	0.0000	0.1265	0.0695	0.0000	0.0695	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0339	0.3623	0.2758	2.7000e-004		0.0193	0.0193		0.0177	0.0177	0.0000	25.4208	25.4208	7.7900e-003	0.0000	25.5843
Total	**0.0339**	**0.3623**	**0.2758**	**2.7000e-004**	**0.1265**	**0.0193**	**0.1457**	**0.0695**	**0.0177**	**0.0873**	**0.0000**	**25.4208**	**25.4208**	**7.7900e-003**	**0.0000**	**25.5843**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.1000e-004	8.0000e-005	1.1000e-003	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0632	0.0632	1.0000e-005	0.0000	0.0633
Total	**3.1000e-004**	**8.0000e-005**	**1.1000e-003**	**0.0000**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0632**	**0.0632**	**1.0000e-005**	**0.0000**	**0.0633**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0569	0.0000	0.0569	0.0156	0.0000	0.0156	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.3300e-003	0.0144	0.1487	2.7000e-004		4.4000e-004	4.4000e-004		4.4000e-004	4.4000e-004	0.0000	25.4207	25.4207	7.7900e-003	0.0000	25.5843
Total	**3.3300e-003**	**0.0144**	**0.1487**	**2.7000e-004**	**0.0569**	**4.4000e-004**	**0.0574**	**0.0156**	**4.4000e-004**	**0.0161**	**0.0000**	**25.4207**	**25.4207**	**7.7900e-003**	**0.0000**	**25.5843**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.1000e-004	8.0000e-005	1.1000e-003	0.0000	5.0000e-005	0.0000	5.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0632	0.0632	1.0000e-005	0.0000	0.0633

Total	**3.1000e-004**	**8.0000e-005**	**1.1000e-003**	**0.0000**	**5.0000e-005**	**0.0000**	**5.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0632**	**0.0632**	**1.0000e-005**	**0.0000**	**0.0633**

3.4 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1821	0.0000	0.1821	0.0755	0.0000	0.0755	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1281	1.4614	0.9829	1.3000e-003		0.0697	0.0697		0.0641	0.0641	0.0000	120.2752	120.2752	0.0369	0.0000	121.0491
Total	**0.1281**	**1.4614**	**0.9829**	**1.3000e-003**	**0.1821**	**0.0697**	**0.2518**	**0.0755**	**0.0641**	**0.1396**	**0.0000**	**120.2752**	**120.2752**	**0.0369**	**0.0000**	**121.0491**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0300e-003	2.7000e-004	3.6500e-003	0.0000	1.6000e-004	0.0000	1.6000e-004	4.0000e-005	0.0000	5.0000e-005	0.0000	0.2105	0.2105	2.0000e-005	0.0000	0.2109
Total	**1.0300e-003**	**2.7000e-004**	**3.6500e-003**	**0.0000**	**1.6000e-004**	**0.0000**	**1.6000e-004**	**4.0000e-005**	**0.0000**	**5.0000e-005**	**0.0000**	**0.2105**	**0.2105**	**2.0000e-005**	**0.0000**	**0.2109**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0820	0.0000	0.0820	0.0170	0.0000	0.0170	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0159	0.0688	0.7304	1.3000e-003		2.1200e-003	2.1200e-003		2.1200e-003	2.1200e-003	0.0000	120.2751	120.2751	0.0369	0.0000	121.0490
Total	**0.0159**	**0.0688**	**0.7304**	**1.3000e-003**	**0.0820**	**2.1200e-003**	**0.0841**	**0.0170**	**2.1200e-003**	**0.0191**	**0.0000**	**120.2751**	**120.2751**	**0.0369**	**0.0000**	**121.0490**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0300e-003	2.7000e-004	3.6500e-003	0.0000	1.6000e-004	0.0000	1.6000e-004	4.0000e-005	0.0000	5.0000e-005	0.0000	0.2105	0.2105	2.0000e-005	0.0000	0.2109
Total	**1.0300e-003**	**2.7000e-004**	**3.6500e-003**	**0.0000**	**1.6000e-004**	**0.0000**	**1.6000e-004**	**4.0000e-005**	**0.0000**	**5.0000e-005**	**0.0000**	**0.2105**	**0.2105**	**2.0000e-005**	**0.0000**	**0.2109**

3.5 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Off-Road	0.4374	3.7232	2.5562	3.7800e-003		0.2512	0.2512		0.2359	0.2359	0.0000	337.6656	337.6656	0.0831	0.0000	339.4108
Total	**0.4374**	**3.7232**	**2.5562**	**3.7800e-003**		**0.2512**	**0.2512**		**0.2359**	**0.2359**	**0.0000**	**337.6656**	**337.6656**	**0.0831**	**0.0000**	**339.4108**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1437	0.4857	2.1082	6.8000e-004	9.3200e-003	2.8900e-003	0.0122	2.7200e-003	2.6400e-003	5.3600e-003	0.0000	57.9337	57.9337	8.4000e-004	0.0000	57.9514
Worker	0.1252	0.0331	0.4452	3.5000e-004	0.0193	5.5000e-004	0.0198	5.1900e-003	5.0000e-004	5.6900e-003	0.0000	25.6553	25.6553	2.2400e-003	0.0000	25.7024
Total	**0.2689**	**0.5189**	**2.5534**	**1.0300e-003**	**0.0286**	**3.4400e-003**	**0.0320**	**7.9100e-003**	**3.1400e-003**	**0.0111**	**0.0000**	**83.5890**	**83.5890**	**3.0800e-003**	**0.0000**	**83.6538**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1105	0.4182	2.5136	3.7800e-003		0.0233	0.0233		0.0233	0.0233	0.0000	337.6651	337.6651	0.0831	0.0000	339.4104
Total	**0.1105**	**0.4182**	**2.5136**	**3.7800e-003**		**0.0233**	**0.0233**		**0.0233**	**0.0233**	**0.0000**	**337.6651**	**337.6651**	**0.0831**	**0.0000**	**339.4104**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.1437	0.4857	2.1082	6.8000e-004	9.3200e-003	2.8900e-003	0.0122	2.7200e-003	2.6400e-003	5.3600e-003	0.0000	57.9337	57.9337	8.4000e-004	0.0000	57.9514
Worker	0.1252	0.0331	0.4452	3.5000e-004	0.0193	5.5000e-004	0.0198	5.1900e-003	5.0000e-004	5.6900e-003	0.0000	25.6553	25.6553	2.2400e-003	0.0000	25.7024
Total	**0.2689**	**0.5189**	**2.5534**	**1.0300e-003**	**0.0286**	**3.4400e-003**	**0.0320**	**7.9100e-003**	**3.1400e-003**	**0.0111**	**0.0000**	**83.5890**	**83.5890**	**3.0800e-003**	**0.0000**	**83.6538**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1841	1.6050	1.2098	1.8500e-003		0.1031	0.1031		0.0969	0.0969	0.0000	163.3711	163.3711	0.0400	0.0000	164.2107
Total	**0.1841**	**1.6050**	**1.2098**	**1.8500e-003**		**0.1031**	**0.1031**		**0.0969**	**0.0969**	**0.0000**	**163.3711**	**163.3711**	**0.0400**	**0.0000**	**164.2107**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0619	0.2228	0.9719	3.3000e-004	4.5600e-003	1.2900e-003	5.8500e-003	1.3300e-003	1.1800e-003	2.5100e-003	0.0000	27.8395	27.8395	4.2000e-004	0.0000	27.8482
Worker	0.0567	0.0145	0.1963	1.7000e-004	9.4300e-003	2.7000e-004	9.7000e-003	2.5400e-003	2.5000e-004	2.7900e-003	0.0000	12.0896	12.0896	9.8000e-004	0.0000	12.1103
Total	**0.1186**	**0.2372**	**1.1682**	**5.0000e-004**	**0.0140**	**1.5600e-003**	**0.0156**	**3.8700e-003**	**1.4300e-003**	**5.3000e-003**	**0.0000**	**39.9290**	**39.9290**	**1.4000e-003**	**0.0000**	**39.9585**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0500	0.2006	1.2264	1.8500e-003		0.0104	0.0104		0.0104	0.0104	0.0000	163.3709	163.3709	0.0400	0.0000	164.2105
Total	**0.0500**	**0.2006**	**1.2264**	**1.8500e-003**		**0.0104**	**0.0104**		**0.0104**	**0.0104**	**0.0000**	**163.3709**	**163.3709**	**0.0400**	**0.0000**	**164.2105**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0619	0.2228	0.9719	3.3000e-004	4.5600e-003	1.2900e-003	5.8500e-003	1.3300e-003	1.1800e-003	2.5100e-003	0.0000	27.8395	27.8395	4.2000e-004	0.0000	27.8482
Worker	0.0567	0.0145	0.1963	1.7000e-004	9.4300e-003	2.7000e-004	9.7000e-003	2.5400e-003	2.5000e-004	2.7900e-003	0.0000	12.0896	12.0896	9.8000e-004	0.0000	12.1103

Total	**0.1186**	**0.2372**	**1.1682**	**5.0000e-004**	**0.0140**	**1.5600e-003**	**0.0156**	**3.8700e-003**	**1.4300e-003**	**5.3000e-003**	**0.0000**	**39.9290**	**39.9290**	**1.4000e-003**	**0.0000**	**39.9585**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0226	0.2403	0.2029	3.1000e-004		0.0131	0.0131		0.0121	0.0121	0.0000	28.5162	28.5162	8.8800e-003	0.0000	28.7027
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0226**	**0.2403**	**0.2029**	**3.1000e-004**		**0.0131**	**0.0131**		**0.0121**	**0.0121**	**0.0000**	**28.5162**	**28.5162**	**8.8800e-003**	**0.0000**	**28.7027**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.8000e-004	1.2000e-004	1.6500e-003	0.0000	8.0000e-005	0.0000	8.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.1014	0.1014	1.0000e-005	0.0000	0.1015
Total	**4.8000e-004**	**1.2000e-004**	**1.6500e-003**	**0.0000**	**8.0000e-005**	**0.0000**	**8.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.1014**	**0.1014**	**1.0000e-005**	**0.0000**	**0.1015**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.8400e-003	0.0167	0.2370	3.1000e-004		5.1000e-004	5.1000e-004		5.1000e-004	5.1000e-004	0.0000	28.5162	28.5162	8.8800e-003	0.0000	28.7026
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**3.8400e-003**	**0.0167**	**0.2370**	**3.1000e-004**		**5.1000e-004**	**5.1000e-004**		**5.1000e-004**	**5.1000e-004**	**0.0000**	**28.5162**	**28.5162**	**8.8800e-003**	**0.0000**	**28.7026**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.8000e-004	1.2000e-004	1.6500e-003	0.0000	8.0000e-005	0.0000	8.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.1014	0.1014	1.0000e-005	0.0000	0.1015
Total	**4.8000e-004**	**1.2000e-004**	**1.6500e-003**	**0.0000**	**8.0000e-005**	**0.0000**	**8.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.1014**	**0.1014**	**1.0000e-005**	**0.0000**	**0.1015**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Archit. Coating	3.4711					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.1800e-003	0.0281	0.0260	4.0000e-005		2.1100e-003	2.1100e-003		2.1100e-003	2.1100e-003	0.0000	3.5746	3.5746	3.4000e-004	0.0000	3.5817
Total	**3.4753**	**0.0281**	**0.0260**	**4.0000e-005**		**2.1100e-003**	**2.1100e-003**		**2.1100e-003**	**2.1100e-003**	**0.0000**	**3.5746**	**3.5746**	**3.4000e-004**	**0.0000**	**3.5817**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3100e-003	5.9000e-004	8.0100e-003	1.0000e-005	3.8000e-004	1.0000e-005	4.0000e-004	1.0000e-004	1.0000e-005	1.1000e-004	0.0000	0.4933	0.4933	4.0000e-005	0.0000	0.4941
Total	**2.3100e-003**	**5.9000e-004**	**8.0100e-003**	**1.0000e-005**	**3.8000e-004**	**1.0000e-005**	**4.0000e-004**	**1.0000e-004**	**1.0000e-005**	**1.1000e-004**	**0.0000**	**0.4933**	**0.4933**	**4.0000e-005**	**0.0000**	**0.4941**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	3.4711					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.2000e-004	1.8000e-003	0.0257	4.0000e-005		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	3.5746	3.5746	3.4000e-004	0.0000	3.5817
Total	**3.4716**	**1.8000e-003**	**0.0257**	**4.0000e-005**		**6.0000e-005**	**6.0000e-005**		**6.0000e-005**	**6.0000e-005**	**0.0000**	**3.5746**	**3.5746**	**3.4000e-004**	**0.0000**	**3.5817**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3100e-003	5.9000e-004	8.0100e-003	1.0000e-005	3.8000e-004	1.0000e-005	4.0000e-004	1.0000e-004	1.0000e-005	1.1000e-004	0.0000	0.4933	0.4933	4.0000e-005	0.0000	0.4941
Total	**2.3100e-003**	**5.9000e-004**	**8.0100e-003**	**1.0000e-005**	**3.8000e-004**	**1.0000e-005**	**4.0000e-004**	**1.0000e-004**	**1.0000e-005**	**1.1000e-004**	**0.0000**	**0.4933**	**0.4933**	**4.0000e-005**	**0.0000**	**0.4941**

Topgolf - Retail/Hotel Construction

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Enclosed Parking with Elevator	415.00	Space	0.00	166,000.00	0
Parking Lot	254.00	Space	4.00	101,600.00	0
Hotel	200.00	Room	15.70	100,000.00	0
Strip Mall	110.00	1000sqft	0.00	110,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2014
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - From plan drawings and PD

Construction Phase - Anticipated phasing schedule provided by applicant. 7 day/week construction

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Trips and VMT - Paving: 25,000cy asphalt @ 16cy/truck = 3,126 trips. Vendor trip length for aspahlt.

Demolition - 20,000 tons demo

Grading - 50,000cy import

Architectural Coating -

Construction Off-road Equipment Mitigation - Tier 4 engines for equip > 50hp. BAAQMD BMPs.

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final

tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	20.00	69.00
tblConstructionPhase	NumDays	300.00	224.00
tblConstructionPhase	NumDays	20.00	16.00
tblConstructionPhase	NumDays	30.00	35.00
tblConstructionPhase	NumDays	20.00	70.00
tblConstructionPhase	NumDays	10.00	16.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	PhaseEndDate	7/23/2018	12/28/2018
tblConstructionPhase	PhaseEndDate	9/21/2018	9/18/2018
tblConstructionPhase	PhaseEndDate	11/27/2018	5/15/2018

tblConstructionPhase	PhaseEndDate	12/8/2017	12/6/2017
tblConstructionPhase	PhaseEndDate	2/13/2018	2/9/2018
tblConstructionPhase	PhaseStartDate	5/16/2018	10/21/2018
tblConstructionPhase	PhaseStartDate	2/10/2018	2/7/2018
tblConstructionPhase	PhaseStartDate	9/19/2018	3/7/2018
tblConstructionPhase	PhaseStartDate	11/23/2017	11/21/2017
tblConstructionPhase	PhaseStartDate	1/11/2018	1/7/2018
tblGrading	MaterialImported	0.00	50,000.00
tblLandUse	LandUseSquareFeet	290,400.00	100,000.00
tblLandUse	LotAcreage	3.73	0.00
tblLandUse	LotAcreage	2.29	4.00
tblLandUse	LotAcreage	6.67	15.70
tblLandUse	LotAcreage	2.53	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	UsageHours	6.00	5.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	5.00

tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	2.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	5.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	7.00	5.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblTripsAndVMT	HaulingTripLength	20.00	7.30
tblTripsAndVMT	HaulingTripNumber	0.00	3,126.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.1422	1.7108	1.3111	3.1500e-003	0.4514	0.0547	0.5061	0.1308	0.0504	0.1813	0.0000	284.9349	284.9349	0.0210	0.0000	285.3755
2018	2.6094	5.3427	5.8673	0.0108	0.4257	0.2775	0.7033	0.1328	0.2607	0.3935	0.0000	916.2471	916.2471	0.1225	0.0000	918.8190
Total	**2.7516**	**7.0535**	**7.1784**	**0.0140**	**0.8771**	**0.3322**	**1.2093**	**0.2637**	**0.3111**	**0.5748**	**0.0000**	**1,201.1820**	**1,201.1820**	**0.1435**	**0.0000**	**1,204.1945**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.0728	0.9122	1.1097	3.1500e-003	0.2412	0.0122	0.2534	0.0439	0.0113	0.0552	0.0000	284.9349	284.9349	0.0210	0.0000	285.3754
2018	2.2315	1.5175	6.0849	0.0108	0.3692	0.0255	0.3947	0.0971	0.0241	0.1212	0.0000	916.2465	916.2465	0.1225	0.0000	918.8184
Total	**2.3043**	**2.4297**	**7.1945**	**0.0140**	**0.6104**	**0.0377**	**0.6480**	**0.1410**	**0.0354**	**0.1764**	**0.0000**	**1,201.1814**	**1,201.1814**	**0.1435**	**0.0000**	**1,204.1939**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**16.25**	**65.55**	**-0.23**	**0.00**	**30.41**	**88.65**	**46.41**	**46.54**	**88.61**	**69.31**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	11/7/2017	11/22/2017	7	16	
2	Site Preparation	Site Preparation	11/21/2017	12/6/2017	7	16	
3	Grading	Grading	12/7/2017	1/10/2018	7	35	
4	Trenching	Trenching	1/7/2018	2/9/2018	7	34	
5	Building Construction	Building Construction	2/7/2018	9/18/2018	7	224	
6	Paving	Paving	3/7/2018	5/15/2018	7	70	
7	Architectural Coating	Architectural Coating	10/21/2018	12/28/2018	7	69	

Acres of Grading (Site Preparation Phase): 10

Acres of Grading (Grading Phase): 39.38

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 568,572; Non-Residential Outdoor: 189,524 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	6.00	81	0.73
Demolition	Excavators	0	8.00	162	0.38
Demolition	Rubber Tired Dozers	1	6.00	255	0.40
Demolition	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Site Preparation	Rubber Tired Dozers	2	5.00	255	0.40
Site Preparation	Scrapers	1	5.00	361	0.48
Site Preparation	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Grading	Excavators	1	5.00	162	0.38
Grading	Graders	1	6.00	174	0.41
Grading	Rubber Tired Dozers	1	6.00	255	0.40
Grading	Scrapers	1	6.00	361	0.48
Grading	Sweepers/Scrubbers	1	6.00	64	0.46
Grading	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Trenching	Rollers	1	6.00	80	0.38
Trenching	Skid Steer Loaders	1	6.00	64	0.37
Trenching	Sweepers/Scrubbers	2	6.00	64	0.46
Trenching	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Building Construction	Cranes	0	7.00	226	0.29
Building Construction	Forklifts	2	4.00	89	0.20
Building Construction	Generator Sets	0	2.00	84	0.74
Building Construction	Other Construction Equipment	2	6.00	171	0.42
Building Construction	Other General Industrial Equipment	2	6.00	87	0.34
Building Construction	Other Material Handling Equipment	1	6.00	167	0.40
Building Construction	Pumps	2	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	2	5.00	97	0.37
Building Construction	Welders	0	8.00	46	0.45
Paving	Cement and Mortar Mixers	1	8.00	9	0.56
Paving	Pavers	1	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	1	8.00	80	0.38

Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Architectural Coating	Aerial Lifts	1	4.00	62	0.31
Architectural Coating	Air Compressors	1	5.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	1,978.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	5	13.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	0.00	6,250.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Trenching	6	15.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	11	190.00	78.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	3,126.00	12.40	7.30	7.30	LD_Mix	HDT_Mix	HHDT
Architectural Coating	2	38.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2140	0.0000	0.2140	0.0324	0.0000	0.0324	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	0.0144	0.1413	0.1109	1.3000e-004		8.2600e-003	8.2600e-003		7.7500e-003	7.7500e-003	0.0000	11.6439	11.6439	2.8600e-003	0.0000	11.7040
Total	**0.0144**	**0.1413**	**0.1109**	**1.3000e-004**	**0.2140**	**8.2600e-003**	**0.2223**	**0.0324**	**7.7500e-003**	**0.0402**	**0.0000**	**11.6439**	**11.6439**	**2.8600e-003**	**0.0000**	**11.7040**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0193	0.2645	0.2153	7.4000e-004	0.0167	3.3900e-003	0.0201	4.5900e-003	3.1200e-003	7.7100e-003	0.0000	66.6029	66.6029	4.8000e-004	0.0000	66.6131
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.7000e-004	3.8000e-004	3.6300e-003	1.0000e-005	7.3000e-004	1.0000e-005	7.3000e-004	1.9000e-004	1.0000e-005	2.0000e-004	0.0000	0.6173	0.6173	3.0000e-005	0.0000	0.6179
Total	**0.0195**	**0.2649**	**0.2190**	**7.5000e-004**	**0.0174**	**3.4000e-003**	**0.0208**	**4.7800e-003**	**3.1300e-003**	**7.9100e-003**	**0.0000**	**67.2202**	**67.2202**	**5.1000e-004**	**0.0000**	**67.2310**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0963	0.0000	0.0963	7.2900e-003	0.0000	7.2900e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.4800e-003	6.4100e-003	0.0750	1.3000e-004		2.0000e-004	2.0000e-004		2.0000e-004	2.0000e-004	0.0000	11.6439	11.6439	2.8600e-003	0.0000	11.7040
Total	**1.4800e-003**	**6.4100e-003**	**0.0750**	**1.3000e-004**	**0.0963**	**2.0000e-004**	**0.0965**	**7.2900e-003**	**2.0000e-004**	**7.4900e-003**	**0.0000**	**11.6439**	**11.6439**	**2.8600e-003**	**0.0000**	**11.7040**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0193	0.2645	0.2153	7.4000e-004	0.0167	3.3900e-003	0.0201	4.5900e-003	3.1200e-003	7.7100e-003	0.0000	66.6029	66.6029	4.8000e-004	0.0000	66.6131
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.7000e-004	3.8000e-004	3.6300e-003	1.0000e-005	7.3000e-004	1.0000e-005	7.3000e-004	1.9000e-004	1.0000e-005	2.0000e-004	0.0000	0.6173	0.6173	3.0000e-005	0.0000	0.6179
Total	**0.0195**	**0.2649**	**0.2190**	**7.5000e-004**	**0.0174**	**3.4000e-003**	**0.0208**	**4.7800e-003**	**3.1300e-003**	**7.9100e-003**	**0.0000**	**67.2202**	**67.2202**	**5.1000e-004**	**0.0000**	**67.2310**

3.3 Site Preparation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0655	0.0000	0.0655	0.0337	0.0000	0.0337	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0222	0.2500	0.1791	2.0000e-004		0.0122	0.0122		0.0112	0.0112	0.0000	18.6300	18.6300	5.7100e-003	0.0000	18.7499
Total	**0.0222**	**0.2500**	**0.1791**	**2.0000e-004**	**0.0655**	**0.0122**	**0.0777**	**0.0337**	**0.0112**	**0.0449**	**0.0000**	**18.6300**	**18.6300**	**5.7100e-003**	**0.0000**	**18.7499**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.5000e-004	4.9000e-004	4.7300e-003	1.0000e-005	9.5000e-004	1.0000e-005	9.5000e-004	2.5000e-004	1.0000e-005	2.6000e-004	0.0000	0.8024	0.8024	4.0000e-005	0.0000	0.8033
Total	**3.5000e-004**	**4.9000e-004**	**4.7300e-003**	**1.0000e-005**	**9.5000e-004**	**1.0000e-005**	**9.5000e-004**	**2.5000e-004**	**1.0000e-005**	**2.6000e-004**	**0.0000**	**0.8024**	**0.8024**	**4.0000e-005**	**0.0000**	**0.8033**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0295	0.0000	0.0295	7.5800e-003	0.0000	7.5800e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.4500e-003	0.0106	0.1013	2.0000e-004		3.3000e-004	3.3000e-004		3.3000e-004	3.3000e-004	0.0000	18.6300	18.6300	5.7100e-003	0.0000	18.7498
Total	**2.4500e-003**	**0.0106**	**0.1013**	**2.0000e-004**	**0.0295**	**3.3000e-004**	**0.0298**	**7.5800e-003**	**3.3000e-004**	**7.9100e-003**	**0.0000**	**18.6300**	**18.6300**	**5.7100e-003**	**0.0000**	**18.7498**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.5000e-004	4.9000e-004	4.7300e-003	1.0000e-005	9.5000e-004	1.0000e-005	9.5000e-004	2.5000e-004	1.0000e-005	2.6000e-004	0.0000	0.8024	0.8024	4.0000e-005	0.0000	0.8033
Total	**3.5000e-004**	**4.9000e-004**	**4.7300e-003**	**1.0000e-005**	**9.5000e-004**	**1.0000e-005**	**9.5000e-004**	**2.5000e-004**	**1.0000e-005**	**2.6000e-004**	**0.0000**	**0.8024**	**0.8024**	**4.0000e-005**	**0.0000**	**0.8033**

3.4 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1028	0.0000	0.1028	0.0461	0.0000	0.0461	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0416	0.4563	0.3029	3.8000e-004		0.0232	0.0232		0.0213	0.0213	0.0000	34.8710	34.8710	0.0107	0.0000	35.0954
Total	**0.0416**	**0.4563**	**0.3029**	**3.8000e-004**	**0.1028**	**0.0232**	**0.1259**	**0.0461**	**0.0213**	**0.0675**	**0.0000**	**34.8710**	**34.8710**	**0.0107**	**0.0000**	**35.0954**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0435	0.5970	0.4860	1.6700e-003	0.0491	7.6500e-003	0.0567	0.0131	7.0300e-003	0.0202	0.0000	150.3207	150.3207	1.0900e-003	0.0000	150.3437
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.2000e-004	8.8000e-004	8.5200e-003	2.0000e-005	1.7100e-003	1.0000e-005	1.7200e-003	4.5000e-004	1.0000e-005	4.7000e-004	0.0000	1.4467	1.4467	7.0000e-005	0.0000	1.4482
Total	**0.0441**	**0.5978**	**0.4945**	**1.6900e-003**	**0.0508**	**7.6600e-003**	**0.0584**	**0.0136**	**7.0400e-003**	**0.0207**	**0.0000**	**151.7674**	**151.7674**	**1.1600e-003**	**0.0000**	**151.7919**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0462	0.0000	0.0462	0.0104	0.0000	0.0104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.8900e-003	0.0320	0.2151	3.8000e-004		6.1000e-004	6.1000e-004		6.1000e-004	6.1000e-004	0.0000	34.8710	34.8710	0.0107	0.0000	35.0954
Total	**4.8900e-003**	**0.0320**	**0.2151**	**3.8000e-004**	**0.0462**	**6.1000e-004**	**0.0469**	**0.0104**	**6.1000e-004**	**0.0110**	**0.0000**	**34.8710**	**34.8710**	**0.0107**	**0.0000**	**35.0954**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0435	0.5970	0.4860	1.6700e-003	0.0491	7.6500e-003	0.0567	0.0131	7.0300e-003	0.0202	0.0000	150.3207	150.3207	1.0900e-003	0.0000	150.3437
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.2000e-004	8.8000e-004	8.5200e-003	2.0000e-005	1.7100e-003	1.0000e-005	1.7200e-003	4.5000e-004	1.0000e-005	4.7000e-004	0.0000	1.4467	1.4467	7.0000e-005	0.0000	1.4482
Total	**0.0441**	**0.5978**	**0.4945**	**1.6900e-003**	**0.0508**	**7.6600e-003**	**0.0584**	**0.0136**	**7.0400e-003**	**0.0207**	**0.0000**	**151.7674**	**151.7674**	**1.1600e-003**	**0.0000**	**151.7919**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1028	0.0000	0.1028	0.0461	0.0000	0.0461	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	0.0145	0.1572	0.1103	1.5000e-004		7.8500e-003	7.8500e-003		7.2300e-003	7.2300e-003	0.0000	13.7247	13.7247	4.2700e-003	0.0000	13.8145
Total	**0.0145**	**0.1572**	**0.1103**	**1.5000e-004**	**0.1028**	**7.8500e-003**	**0.1106**	**0.0461**	**7.2300e-003**	**0.0534**	**0.0000**	**13.7247**	**13.7247**	**4.2700e-003**	**0.0000**	**13.8145**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0164	0.2170	0.1867	6.7000e-004	0.0434	3.0300e-003	0.0465	0.0111	2.7800e-003	0.0139	0.0000	59.0950	59.0950	4.4000e-004	0.0000	59.1042
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.2000e-004	3.2000e-004	3.0600e-003	1.0000e-005	6.8000e-004	1.0000e-005	6.9000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5571	0.5571	3.0000e-005	0.0000	0.5577
Total	**0.0166**	**0.2173**	**0.1898**	**6.8000e-004**	**0.0441**	**3.0400e-003**	**0.0471**	**0.0113**	**2.7800e-003**	**0.0141**	**0.0000**	**59.6521**	**59.6521**	**4.7000e-004**	**0.0000**	**59.6619**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0462	0.0000	0.0462	0.0104	0.0000	0.0104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.9600e-003	0.0128	0.0861	1.5000e-004		2.5000e-004	2.5000e-004		2.5000e-004	2.5000e-004	0.0000	13.7247	13.7247	4.2700e-003	0.0000	13.8144
Total	**1.9600e-003**	**0.0128**	**0.0861**	**1.5000e-004**	**0.0462**	**2.5000e-004**	**0.0465**	**0.0104**	**2.5000e-004**	**0.0106**	**0.0000**	**13.7247**	**13.7247**	**4.2700e-003**	**0.0000**	**13.8144**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0164	0.2170	0.1867	6.7000e-004	0.0434	3.0300e-003	0.0465	0.0111	2.7800e-003	0.0139	0.0000	59.0950	59.0950	4.4000e-004	0.0000	59.1042
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.2000e-004	3.2000e-004	3.0600e-003	1.0000e-005	6.8000e-004	1.0000e-005	6.9000e-004	1.8000e-004	0.0000	1.9000e-004	0.0000	0.5571	0.5571	3.0000e-005	0.0000	0.5577
Total	**0.0166**	**0.2173**	**0.1898**	**6.8000e-004**	**0.0441**	**3.0400e-003**	**0.0471**	**0.0113**	**2.7800e-003**	**0.0141**	**0.0000**	**59.6521**	**59.6521**	**4.7000e-004**	**0.0000**	**59.6619**

3.5 Trenching - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0192	0.1821	0.1531	2.0000e-004		0.0134	0.0134		0.0123	0.0123	0.0000	18.5718	18.5718	5.7800e-003	0.0000	18.6933
Total	**0.0192**	**0.1821**	**0.1531**	**2.0000e-004**		**0.0134**	**0.0134**		**0.0123**	**0.0123**	**0.0000**	**18.5718**	**18.5718**	**5.7800e-003**	**0.0000**	**18.6933**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.6000e-004	1.0800e-003	0.0104	3.0000e-005	2.3200e-003	2.0000e-005	2.3400e-003	6.2000e-004	2.0000e-005	6.3000e-004	0.0000	1.8942	1.8942	9.0000e-005	0.0000	1.8962
Total	**7.6000e-004**	**1.0800e-003**	**0.0104**	**3.0000e-005**	**2.3200e-003**	**2.0000e-005**	**2.3400e-003**	**6.2000e-004**	**2.0000e-005**	**6.3000e-004**	**0.0000**	**1.8942**	**1.8942**	**9.0000e-005**	**0.0000**	**1.8962**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.6100e-003	0.0568	0.1537	2.0000e-004		3.3000e-004	3.3000e-004		3.3000e-004	3.3000e-004	0.0000	18.5718	18.5718	5.7800e-003	0.0000	18.6932
Total	**3.6100e-003**	**0.0568**	**0.1537**	**2.0000e-004**		**3.3000e-004**	**3.3000e-004**		**3.3000e-004**	**3.3000e-004**	**0.0000**	**18.5718**	**18.5718**	**5.7800e-003**	**0.0000**	**18.6932**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.6000e-004	1.0800e-003	0.0104	3.0000e-005	2.3200e-003	2.0000e-005	2.3400e-003	6.2000e-004	2.0000e-005	6.3000e-004	0.0000	1.8942	1.8942	9.0000e-005	0.0000	1.8962
Total	**7.6000e-004**	**1.0800e-003**	**0.0104**	**3.0000e-005**	**2.3200e-003**	**2.0000e-005**	**2.3400e-003**	**6.2000e-004**	**2.0000e-005**	**6.3000e-004**	**0.0000**	**1.8942**	**1.8942**	**9.0000e-005**	**0.0000**	**1.8962**

3.6 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3503	3.2556	2.6679	4.0200e-003		0.2067	0.2067		0.1951	0.1951	0.0000	359.0308	359.0308	0.0819	0.0000	360.7514
Total	**0.3503**	**3.2556**	**2.6679**	**4.0200e-003**		**0.2067**	**0.2067**		**0.1951**	**0.1951**	**0.0000**	**359.0308**	**359.0308**	**0.0819**	**0.0000**	**360.7514**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0823	0.7070	1.0251	2.0700e-003	0.0564	0.0105	0.0669	0.0162	9.6200e-003	0.0258	0.0000	182.4347	182.4347	1.4100e-003	0.0000	182.4644
Worker	0.0637	0.0899	0.8674	2.2400e-003	0.1938	1.4300e-003	0.1952	0.0515	1.3200e-003	0.0529	0.0000	158.0759	158.0759	7.6600e-003	0.0000	158.2368
Total	**0.1459**	**0.7969**	**1.8925**	**4.3100e-003**	**0.2502**	**0.0119**	**0.2621**	**0.0677**	**0.0109**	**0.0786**	**0.0000**	**340.5106**	**340.5106**	**9.0700e-003**	**0.0000**	**340.7012**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0461	0.1999	2.8444	4.0200e-003		6.1500e-003	6.1500e-003		6.1500e-003	6.1500e-003	0.0000	359.0303	359.0303	0.0819	0.0000	360.7510
Total	**0.0461**	**0.1999**	**2.8444**	**4.0200e-003**		**6.1500e-003**	**6.1500e-003**		**6.1500e-003**	**6.1500e-003**	**0.0000**	**359.0303**	**359.0303**	**0.0819**	**0.0000**	**360.7510**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0823	0.7070	1.0251	2.0700e-003	0.0564	0.0105	0.0669	0.0162	9.6200e-003	0.0258	0.0000	182.4347	182.4347	1.4100e-003	0.0000	182.4644
Worker	0.0637	0.0899	0.8674	2.2400e-003	0.1938	1.4300e-003	0.1952	0.0515	1.3200e-003	0.0529	0.0000	158.0759	158.0759	7.6600e-003	0.0000	158.2368
Total	**0.1459**	**0.7969**	**1.8925**	**4.3100e-003**	**0.2502**	**0.0119**	**0.2621**	**0.0677**	**0.0109**	**0.0786**	**0.0000**	**340.5106**	**340.5106**	**9.0700e-003**	**0.0000**	**340.7012**

3.7 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0478	0.4969	0.4337	6.6000e-004		0.0279	0.0279		0.0258	0.0258	0.0000	60.0014	60.0014	0.0184	0.0000	60.3867

Paving	5.2400e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0530**	**0.4969**	**0.4337**	**6.6000e-004**		**0.0279**	**0.0279**		**0.0258**	**0.0258**	**0.0000**	**60.0014**	**60.0014**	**0.0184**	**0.0000**	**60.3867**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0178	0.1583	0.2630	4.5000e-004	9.6600e-003	1.9800e-003	0.0116	2.6600e-003	1.8200e-003	4.4800e-003	0.0000	39.2805	39.2805	3.3000e-004	0.0000	39.2874
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.5700e-003	2.2200e-003	0.0214	6.0000e-005	4.7800e-003	4.0000e-005	4.8200e-003	1.2700e-003	3.0000e-005	1.3000e-003	0.0000	3.8999	3.8999	1.9000e-004	0.0000	3.9039
Total	**0.0194**	**0.1605**	**0.2844**	**5.1000e-004**	**0.0144**	**2.0200e-003**	**0.0165**	**3.9300e-003**	**1.8500e-003**	**5.7800e-003**	**0.0000**	**43.1804**	**43.1804**	**5.2000e-004**	**0.0000**	**43.1913**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.9200e-003	0.0470	0.4959	6.6000e-004		1.5600e-003	1.5600e-003		1.5600e-003	1.5600e-003	0.0000	60.0013	60.0013	0.0184	0.0000	60.3866
Paving	5.2400e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0152**	**0.0470**	**0.4959**	**6.6000e-004**		**1.5600e-003**	**1.5600e-003**		**1.5600e-003**	**1.5600e-003**	**0.0000**	**60.0013**	**60.0013**	**0.0184**	**0.0000**	**60.3866**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0178	0.1583	0.2630	4.5000e-004	9.6600e-003	1.9800e-003	0.0116	2.6600e-003	1.8200e-003	4.4800e-003	0.0000	39.2805	39.2805	3.3000e-004	0.0000	39.2874
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.5700e-003	2.2200e-003	0.0214	6.0000e-005	4.7800e-003	4.0000e-005	4.8200e-003	1.2700e-003	3.0000e-005	1.3000e-003	0.0000	3.8999	3.8999	1.9000e-004	0.0000	3.9039
Total	**0.0194**	**0.1605**	**0.2844**	**5.1000e-004**	**0.0144**	**2.0200e-003**	**0.0165**	**3.9300e-003**	**1.8500e-003**	**5.7800e-003**	**0.0000**	**43.1804**	**43.1804**	**5.2000e-004**	**0.0000**	**43.1913**

3.8 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.9765					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.3000e-003	0.0697	0.0718	1.1000e-004		4.6600e-003	4.6600e-003		4.6400e-003	4.6400e-003	0.0000	9.9425	9.9425	1.5100e-003	0.0000	9.9741
Total	**1.9858**	**0.0697**	**0.0718**	**1.1000e-004**		**4.6600e-003**	**4.6600e-003**		**4.6400e-003**	**4.6400e-003**	**0.0000**	**9.9425**	**9.9425**	**1.5100e-003**	**0.0000**	**9.9741**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.9200e-003	5.5400e-003	0.0534	1.4000e-004	0.0119	9.0000e-005	0.0120	3.1700e-003	8.0000e-005	3.2600e-003	0.0000	9.7386	9.7386	4.7000e-004	0.0000	9.7485
Total	**3.9200e-003**	**5.5400e-003**	**0.0534**	**1.4000e-004**	**0.0119**	**9.0000e-005**	**0.0120**	**3.1700e-003**	**8.0000e-005**	**3.2600e-003**	**0.0000**	**9.7386**	**9.7386**	**4.7000e-004**	**0.0000**	**9.7485**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.9765					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.5600e-003	0.0197	0.0743	1.1000e-004		1.6000e-004	1.6000e-004		1.6000e-004	1.6000e-004	0.0000	9.9424	9.9424	1.5100e-003	0.0000	9.9741
Total	**1.9781**	**0.0197**	**0.0743**	**1.1000e-004**		**1.6000e-004**	**1.6000e-004**		**1.6000e-004**	**1.6000e-004**	**0.0000**	**9.9424**	**9.9424**	**1.5100e-003**	**0.0000**	**9.9741**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.9200e-003	5.5400e-003	0.0534	1.4000e-004	0.0119	9.0000e-005	0.0120	3.1700e-003	8.0000e-005	3.2600e-003	0.0000	9.7386	9.7386	4.7000e-004	0.0000	9.7485
Total	**3.9200e-003**	**5.5400e-003**	**0.0534**	**1.4000e-004**	**0.0119**	**9.0000e-005**	**0.0120**	**3.1700e-003**	**8.0000e-005**	**3.2600e-003**	**0.0000**	**9.7386**	**9.7386**	**4.7000e-004**	**0.0000**	**9.7485**

Topgolf - Retail/Hotel Construction

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Enclosed Parking with Elevator	415.00	Space	0.00	166,000.00	0
Hotel	200.00	Room	19.70	100,000.00	0
Strip Mall	110.00	1000sqft	0.00	110,000.00	0
Parking Lot	254.00	Space	0.00	101,600.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2014
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - From plan drawings and PD

Construction Phase - Anticipated phasing schedule provided by applicant. 7 day/week construction

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Off-road Equipment - Proposed equipment list provided by applicant

Trips and VMT - Paving: 25,000cy asphalt @ 16cy/truck = 3,126 trips. 0.5mi trip lengths

Demolition - 20,000 tons demo

Grading - 50,000cy import

Architectural Coating -

Construction Off-road Equipment Mitigation - Tier 4 engines for equip > 50hp. BAAQMD BMPs.

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final

tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	20.00	69.00
tblConstructionPhase	NumDays	300.00	224.00
tblConstructionPhase	NumDays	20.00	16.00
tblConstructionPhase	NumDays	30.00	35.00
tblConstructionPhase	NumDays	20.00	70.00
tblConstructionPhase	NumDays	10.00	16.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	NumDaysWeek	5.00	7.00
tblConstructionPhase	PhaseEndDate	7/23/2018	12/28/2018
tblConstructionPhase	PhaseEndDate	9/21/2018	9/18/2018
tblConstructionPhase	PhaseEndDate	11/27/2018	5/15/2018

tblConstructionPhase	PhaseEndDate	12/8/2017	12/6/2017
tblConstructionPhase	PhaseEndDate	2/13/2018	2/9/2018
tblConstructionPhase	PhaseStartDate	5/16/2018	10/21/2018
tblConstructionPhase	PhaseStartDate	2/10/2018	2/7/2018
tblConstructionPhase	PhaseStartDate	9/19/2018	3/7/2018
tblConstructionPhase	PhaseStartDate	11/23/2017	11/21/2017
tblConstructionPhase	PhaseStartDate	1/11/2018	1/7/2018
tblGrading	MaterialImported	0.00	50,000.00
tblLandUse	LandUseSquareFeet	290,400.00	100,000.00
tblLandUse	LotAcreage	3.73	0.00
tblLandUse	LotAcreage	6.67	19.70
tblLandUse	LotAcreage	2.53	0.00
tblLandUse	LotAcreage	2.29	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	UsageHours	6.00	5.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	5.00

tblOffRoadEquipment	UsageHours	8.00	4.00
tblOffRoadEquipment	UsageHours	8.00	2.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	5.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	7.00	5.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblOffRoadEquipment	UsageHours	8.00	6.00
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripLength	20.00	0.50
tblTripsAndVMT	HaulingTripNumber	0.00	3,126.00
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	VendorTripLength	7.30	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50

tblTripsAndVMT	WorkerTripLength	12.40	0.50
tblTripsAndVMT	WorkerTripLength	12.40	0.50

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.1076	0.9342	1.0927	8.3000e-004	0.3841	0.0440	0.4282	0.1127	0.0407	0.1534	0.0000	75.6711	75.6711	0.0195	0.0000	76.0799
2018	2.5448	4.4358	4.8466	5.7000e-003	0.1174	0.2622	0.3797	0.0502	0.2466	0.2967	0.0000	505.1441	505.1441	0.1133	0.0000	507.5232
Total	**2.6524**	**5.3700**	**5.9393**	**6.5300e-003**	**0.5016**	**0.3063**	**0.8078**	**0.1629**	**0.2872**	**0.4501**	**0.0000**	**580.8151**	**580.8151**	**0.1328**	**0.0000**	**583.6030**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.0382	0.1357	0.8913	8.3000e-004	0.1739	1.5700e-003	0.1754	0.0258	1.5400e-003	0.0273	0.0000	75.6710	75.6710	0.0195	0.0000	76.0798
2018	2.1669	0.6106	5.0641	5.7000e-003	0.0609	0.0102	0.0711	0.0144	0.0100	0.0244	0.0000	505.1435	505.1435	0.1133	0.0000	507.5226
Total	**2.2051**	**0.7463**	**5.9554**	**6.5300e-003**	**0.2348**	**0.0117**	**0.2465**	**0.0402**	**0.0116**	**0.0517**	**0.0000**	**580.8145**	**580.8145**	**0.1328**	**0.0000**	**583.6024**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**

Percent Reduction	**16.86**	**86.10**	**-0.27**	**0.00**	**53.19**	**96.17**	**69.48**	**75.34**	**95.98**	**88.51**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	11/7/2017	11/22/2017	7	16	
2	Site Preparation	Site Preparation	11/21/2017	12/6/2017	7	16	
3	Grading	Grading	12/7/2017	1/10/2018	7	35	
4	Trenching	Trenching	1/7/2018	2/9/2018	7	34	
5	Building Construction	Building Construction	2/7/2018	9/18/2018	7	224	
6	Paving	Paving	3/7/2018	5/15/2018	7	70	
7	Architectural Coating	Architectural Coating	10/21/2018	12/28/2018	7	69	

Acres of Grading (Site Preparation Phase): 10

Acres of Grading (Grading Phase): 39.38

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 568,572; Non-Residential Outdoor: 189,524 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	6.00	81	0.73
Demolition	Excavators	0	8.00	162	0.38
Demolition	Rubber Tired Dozers	1	6.00	255	0.40
Demolition	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Site Preparation	Rubber Tired Dozers	2	5.00	255	0.40
Site Preparation	Scrapers	1	5.00	361	0.48
Site Preparation	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Grading	Excavators	1	5.00	162	0.38

Grading	Graders	1	6.00	174	0.41
Grading	Rubber Tired Dozers	1	6.00	255	0.40
Grading	Scrapers	1	6.00	361	0.48
Grading	Sweepers/Scrubbers	1	6.00	64	0.46
Grading	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Trenching	Rollers	1	6.00	80	0.38
Trenching	Skid Steer Loaders	1	6.00	64	0.37
Trenching	Sweepers/Scrubbers	2	6.00	64	0.46
Trenching	Tractors/Loaders/Backhoes	2	6.00	97	0.37
Building Construction	Cranes	0	7.00	226	0.29
Building Construction	Forklifts	2	4.00	89	0.20
Building Construction	Generator Sets	0	2.00	84	0.74
Building Construction	Other Construction Equipment	2	6.00	171	0.42
Building Construction	Other General Industrial Equipment	2	6.00	87	0.34
Building Construction	Other Material Handling Equipment	1	6.00	167	0.40
Building Construction	Pumps	2	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	2	5.00	97	0.37
Building Construction	Welders	0	8.00	46	0.45
Paving	Cement and Mortar Mixers	1	8.00	9	0.56
Paving	Pavers	1	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	1	8.00	80	0.38
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Architectural Coating	Aerial Lifts	1	4.00	62	0.31
Architectural Coating	Air Compressors	1	5.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	1,978.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT

Site Preparation	5	13.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	0.00	6,250.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Trenching	6	15.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Building Construction	11	190.00	78.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	3,126.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT
Architectural Coating	2	38.00	0.00	0.00	0.50	0.50	0.50	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Replace Ground Cover

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

Clean Paved Roads

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2140	0.0000	0.2140	0.0324	0.0000	0.0324	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0144	0.1413	0.1109	1.3000e-004		8.2600e-003	8.2600e-003		7.7500e-003	7.7500e-003	0.0000	11.6439	11.6439	2.8600e-003	0.0000	11.7040
Total	**0.0144**	**0.1413**	**0.1109**	**1.3000e-004**	**0.2140**	**8.2600e-003**	**0.2223**	**0.0324**	**7.7500e-003**	**0.0402**	**0.0000**	**11.6439**	**11.6439**	**2.8600e-003**	**0.0000**	**11.7040**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	8.7500e-003	0.0265	0.1525	4.0000e-005	4.4000e-004	1.3000e-004	5.7000e-004	1.2000e-004	1.2000e-004	2.4000e-004	0.0000	3.1747	3.1747	6.0000e-005	0.0000	3.1760
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-004	5.0000e-005	7.0000e-004	0.0000	3.0000e-005	0.0000	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0401	0.0401	0.0000	0.0000	0.0402
Total	**8.9500e-003**	**0.0266**	**0.1532**	**4.0000e-005**	**4.7000e-004**	**1.3000e-004**	**6.0000e-004**	**1.3000e-004**	**1.2000e-004**	**2.5000e-004**	**0.0000**	**3.2148**	**3.2148**	**6.0000e-005**	**0.0000**	**3.2161**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0963	0.0000	0.0963	7.2900e-003	0.0000	7.2900e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.4800e-003	6.4100e-003	0.0750	1.3000e-004		2.0000e-004	2.0000e-004		2.0000e-004	2.0000e-004	0.0000	11.6439	11.6439	2.8600e-003	0.0000	11.7040
Total	**1.4800e-003**	**6.4100e-003**	**0.0750**	**1.3000e-004**	**0.0963**	**2.0000e-004**	**0.0965**	**7.2900e-003**	**2.0000e-004**	**7.4900e-003**	**0.0000**	**11.6439**	**11.6439**	**2.8600e-003**	**0.0000**	**11.7040**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	8.7500e-003	0.0265	0.1525	4.0000e-005	4.4000e-004	1.3000e-004	5.7000e-004	1.2000e-004	1.2000e-004	2.4000e-004	0.0000	3.1747	3.1747	6.0000e-005	0.0000	3.1760

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-004	5.0000e-005	7.0000e-004	0.0000	3.0000e-005	0.0000	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0401	0.0401	0.0000	0.0000	0.0402
Total	**8.9500e-003**	**0.0266**	**0.1532**	**4.0000e-005**	**4.7000e-004**	**1.3000e-004**	**6.0000e-004**	**1.3000e-004**	**1.2000e-004**	**2.5000e-004**	**0.0000**	**3.2148**	**3.2148**	**6.0000e-005**	**0.0000**	**3.2161**

3.3 Site Preparation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0655	0.0000	0.0655	0.0337	0.0000	0.0337	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0222	0.2500	0.1791	2.0000e-004		0.0122	0.0122		0.0112	0.0112	0.0000	18.6300	18.6300	5.7100e-003	0.0000	18.7499
Total	**0.0222**	**0.2500**	**0.1791**	**2.0000e-004**	**0.0655**	**0.0122**	**0.0777**	**0.0337**	**0.0112**	**0.0449**	**0.0000**	**18.6300**	**18.6300**	**5.7100e-003**	**0.0000**	**18.7499**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.5000e-004	7.0000e-005	9.0000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0521	0.0521	0.0000	0.0000	0.0522
Total	**2.5000e-004**	**7.0000e-005**	**9.0000e-004**	**0.0000**	**4.0000e-005**	**0.0000**	**4.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0521**	**0.0521**	**0.0000**	**0.0000**	**0.0522**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0295	0.0000	0.0295	7.5800e-003	0.0000	7.5800e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.4500e-003	0.0106	0.1013	2.0000e-004		3.3000e-004	3.3000e-004		3.3000e-004	3.3000e-004	0.0000	18.6300	18.6300	5.7100e-003	0.0000	18.7498
Total	**2.4500e-003**	**0.0106**	**0.1013**	**2.0000e-004**	**0.0295**	**3.3000e-004**	**0.0298**	**7.5800e-003**	**3.3000e-004**	**7.9100e-003**	**0.0000**	**18.6300**	**18.6300**	**5.7100e-003**	**0.0000**	**18.7498**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.5000e-004	7.0000e-005	9.0000e-004	0.0000	4.0000e-005	0.0000	4.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0521	0.0521	0.0000	0.0000	0.0522
Total	**2.5000e-004**	**7.0000e-005**	**9.0000e-004**	**0.0000**	**4.0000e-005**	**0.0000**	**4.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**0.0000**	**0.0521**	**0.0521**	**0.0000**	**0.0000**	**0.0522**

3.4 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Fugitive Dust					0.1028	0.0000	0.1028	0.0461	0.0000	0.0461	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0416	0.4563	0.3029	3.8000e-004		0.0232	0.0232		0.0213	0.0213	0.0000	34.8710	34.8710	0.0107	0.0000	35.0954
Total	**0.0416**	**0.4563**	**0.3029**	**3.8000e-004**	**0.1028**	**0.0232**	**0.1259**	**0.0461**	**0.0213**	**0.0675**	**0.0000**	**34.8710**	**34.8710**	**0.0107**	**0.0000**	**35.0954**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0197	0.0599	0.3442	9.0000e-005	1.2700e-003	3.0000e-004	1.5700e-003	3.5000e-004	2.7000e-004	6.2000e-004	0.0000	7.1652	7.1652	1.4000e-004	0.0000	7.1681
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.6000e-004	1.2000e-004	1.6300e-003	0.0000	7.0000e-005	0.0000	7.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0940	0.0940	1.0000e-005	0.0000	0.0942
Total	**0.0202**	**0.0600**	**0.3458**	**9.0000e-005**	**1.3400e-003**	**3.0000e-004**	**1.6400e-003**	**3.7000e-004**	**2.7000e-004**	**6.4000e-004**	**0.0000**	**7.2592**	**7.2592**	**1.5000e-004**	**0.0000**	**7.2622**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0462	0.0000	0.0462	0.0104	0.0000	0.0104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.8900e-003	0.0320	0.2151	3.8000e-004		6.1000e-004	6.1000e-004		6.1000e-004	6.1000e-004	0.0000	34.8710	34.8710	0.0107	0.0000	35.0954

Total	**4.8900e-003**	**0.0320**	**0.2151**	**3.8000e-004**	**0.0462**	**6.1000e-004**	**0.0469**	**0.0104**	**6.1000e-004**	**0.0110**	**0.0000**	**34.8710**	**34.8710**	**0.0107**	**0.0000**	**35.0954**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0197	0.0599	0.3442	9.0000e-005	1.2700e-003	3.0000e-004	1.5700e-003	3.5000e-004	2.7000e-004	6.2000e-004	0.0000	7.1652	7.1652	1.4000e-004	0.0000	7.1681
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.6000e-004	1.2000e-004	1.6300e-003	0.0000	7.0000e-005	0.0000	7.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0940	0.0940	1.0000e-005	0.0000	0.0942
Total	**0.0202**	**0.0600**	**0.3458**	**9.0000e-005**	**1.3400e-003**	**3.0000e-004**	**1.6400e-003**	**3.7000e-004**	**2.7000e-004**	**6.4000e-004**	**0.0000**	**7.2592**	**7.2592**	**1.5000e-004**	**0.0000**	**7.2622**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1028	0.0000	0.1028	0.0461	0.0000	0.0461	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0145	0.1572	0.1103	1.5000e-004		7.8500e-003	7.8500e-003		7.2300e-003	7.2300e-003	0.0000	13.7247	13.7247	4.2700e-003	0.0000	13.8145
Total	**0.0145**	**0.1572**	**0.1103**	**1.5000e-004**	**0.1028**	**7.8500e-003**	**0.1106**	**0.0461**	**7.2300e-003**	**0.0534**	**0.0000**	**13.7247**	**13.7247**	**4.2700e-003**	**0.0000**	**13.8145**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	6.8800e-003	0.0226	0.1307	3.0000e-005	1.1000e-003	1.2000e-004	1.2200e-003	2.8000e-004	1.1000e-004	3.9000e-004	0.0000	2.8119	2.8119	6.0000e-005	0.0000	2.8130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	4.0000e-005	5.9000e-004	0.0000	3.0000e-005	0.0000	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0362	0.0362	0.0000	0.0000	0.0363
Total	**7.0500e-003**	**0.0227**	**0.1313**	**3.0000e-005**	**1.1300e-003**	**1.2000e-004**	**1.2500e-003**	**2.9000e-004**	**1.1000e-004**	**4.0000e-004**	**0.0000**	**2.8481**	**2.8481**	**6.0000e-005**	**0.0000**	**2.8493**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0462	0.0000	0.0462	0.0104	0.0000	0.0104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.9600e-003	0.0128	0.0861	1.5000e-004		2.5000e-004	2.5000e-004		2.5000e-004	2.5000e-004	0.0000	13.7247	13.7247	4.2700e-003	0.0000	13.8144
Total	**1.9600e-003**	**0.0128**	**0.0861**	**1.5000e-004**	**0.0462**	**2.5000e-004**	**0.0465**	**0.0104**	**2.5000e-004**	**0.0106**	**0.0000**	**13.7247**	**13.7247**	**4.2700e-003**	**0.0000**	**13.8144**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	6.8800e-003	0.0226	0.1307	3.0000e-005	1.1000e-003	1.2000e-004	1.2200e-003	2.8000e-004	1.1000e-004	3.9000e-004	0.0000	2.8119	2.8119	6.0000e-005	0.0000	2.8130
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	4.0000e-005	5.9000e-004	0.0000	3.0000e-005	0.0000	3.0000e-005	1.0000e-005	0.0000	1.0000e-005	0.0000	0.0362	0.0362	0.0000	0.0000	0.0363
Total	**7.0500e-003**	**0.0227**	**0.1313**	**3.0000e-005**	**1.1300e-003**	**1.2000e-004**	**1.2500e-003**	**2.9000e-004**	**1.1000e-004**	**4.0000e-004**	**0.0000**	**2.8481**	**2.8481**	**6.0000e-005**	**0.0000**	**2.8493**

3.5 Trenching - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0192	0.1821	0.1531	2.0000e-004		0.0134	0.0134		0.0123	0.0123	0.0000	18.5718	18.5718	5.7800e-003	0.0000	18.6933
Total	**0.0192**	**0.1821**	**0.1531**	**2.0000e-004**		**0.0134**	**0.0134**		**0.0123**	**0.0123**	**0.0000**	**18.5718**	**18.5718**	**5.7800e-003**	**0.0000**	**18.6933**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.8000e-004	1.5000e-004	2.0000e-003	0.0000	1.0000e-004	0.0000	1.0000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1231	0.1231	1.0000e-005	0.0000	0.1233
Total	**5.8000e-004**	**1.5000e-004**	**2.0000e-003**	**0.0000**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.1231**	**0.1231**	**1.0000e-005**	**0.0000**	**0.1233**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.6100e-003	0.0568	0.1537	2.0000e-004		3.3000e-004	3.3000e-004		3.3000e-004	3.3000e-004	0.0000	18.5718	18.5718	5.7800e-003	0.0000	18.6932
Total	**3.6100e-003**	**0.0568**	**0.1537**	**2.0000e-004**		**3.3000e-004**	**3.3000e-004**		**3.3000e-004**	**3.3000e-004**	**0.0000**	**18.5718**	**18.5718**	**5.7800e-003**	**0.0000**	**18.6932**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.8000e-004	1.5000e-004	2.0000e-003	0.0000	1.0000e-004	0.0000	1.0000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1231	0.1231	1.0000e-005	0.0000	0.1233
Total	**5.8000e-004**	**1.5000e-004**	**2.0000e-003**	**0.0000**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.1231**	**0.1231**	**1.0000e-005**	**0.0000**	**0.1233**

3.6 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3503	3.2556	2.6679	4.0200e-003		0.2067	0.2067		0.1951	0.1951	0.0000	359.0308	359.0308	0.0819	0.0000	360.7514
Total	**0.3503**	**3.2556**	**2.6679**	**4.0200e-003**		**0.2067**	**0.2067**		**0.1951**	**0.1951**	**0.0000**	**359.0308**	**359.0308**	**0.0819**	**0.0000**	**360.7514**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0552	0.1986	0.8666	2.9000e-004	4.0600e-003	1.1500e-003	5.2100e-003	1.1900e-003	1.0500e-003	2.2400e-003	0.0000	24.8220	24.8220	3.7000e-004	0.0000	24.8298
Worker	0.0482	0.0123	0.1668	1.5000e-004	8.0100e-003	2.3000e-004	8.2400e-003	2.1600e-003	2.1000e-004	2.3700e-003	0.0000	10.2714	10.2714	8.4000e-004	0.0000	10.2889
Total	**0.1034**	**0.2109**	**1.0334**	**4.4000e-004**	**0.0121**	**1.3800e-003**	**0.0135**	**3.3500e-003**	**1.2600e-003**	**4.6100e-003**	**0.0000**	**35.0933**	**35.0933**	**1.2100e-003**	**0.0000**	**35.1187**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0461	0.1999	2.8444	4.0200e-003		6.1500e-003	6.1500e-003		6.1500e-003	6.1500e-003	0.0000	359.0303	359.0303	0.0819	0.0000	360.7510

Total	**0.0461**	**0.1999**	**2.8444**	**4.0200e-003**		**6.1500e-003**	**6.1500e-003**		**6.1500e-003**	**6.1500e-003**	**0.0000**	**359.0303**	**359.0303**	**0.0819**	**0.0000**	**360.7510**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0552	0.1986	0.8666	2.9000e-004	4.0600e-003	1.1500e-003	5.2100e-003	1.1900e-003	1.0500e-003	2.2400e-003	0.0000	24.8220	24.8220	3.7000e-004	0.0000	24.8298
Worker	0.0482	0.0123	0.1668	1.5000e-004	8.0100e-003	2.3000e-004	8.2400e-003	2.1600e-003	2.1000e-004	2.3700e-003	0.0000	10.2714	10.2714	8.4000e-004	0.0000	10.2889
Total	**0.1034**	**0.2109**	**1.0334**	**4.4000e-004**	**0.0121**	**1.3800e-003**	**0.0135**	**3.3500e-003**	**1.2600e-003**	**4.6100e-003**	**0.0000**	**35.0933**	**35.0933**	**1.2100e-003**	**0.0000**	**35.1187**

3.7 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0478	0.4969	0.4337	6.6000e-004		0.0279	0.0279		0.0258	0.0258	0.0000	60.0014	60.0014	0.0184	0.0000	60.3867
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0478**	**0.4969**	**0.4337**	**6.6000e-004**		**0.0279**	**0.0279**		**0.0258**	**0.0258**	**0.0000**	**60.0014**	**60.0014**	**0.0184**	**0.0000**	**60.3867**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0121	0.0396	0.2287	6.0000e-005	6.9000e-004	2.0000e-004	9.0000e-004	1.9000e-004	1.9000e-004	3.8000e-004	0.0000	4.9223	4.9223	1.0000e-004	0.0000	4.9244
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1900e-003	3.0000e-004	4.1200e-003	0.0000	2.0000e-004	1.0000e-005	2.0000e-004	5.0000e-005	1.0000e-005	6.0000e-005	0.0000	0.2534	0.2534	2.0000e-005	0.0000	0.2538
Total	**0.0132**	**0.0399**	**0.2329**	**6.0000e-005**	**8.9000e-004**	**2.1000e-004**	**1.1000e-003**	**2.4000e-004**	**2.0000e-004**	**4.4000e-004**	**0.0000**	**5.1757**	**5.1757**	**1.2000e-004**	**0.0000**	**5.1782**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.9200e-003	0.0470	0.4959	6.6000e-004		1.5600e-003	1.5600e-003		1.5600e-003	1.5600e-003	0.0000	60.0013	60.0013	0.0184	0.0000	60.3866
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**9.9200e-003**	**0.0470**	**0.4959**	**6.6000e-004**		**1.5600e-003**	**1.5600e-003**		**1.5600e-003**	**1.5600e-003**	**0.0000**	**60.0013**	**60.0013**	**0.0184**	**0.0000**	**60.3866**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0121	0.0396	0.2287	6.0000e-005	6.9000e-004	2.0000e-004	9.0000e-004	1.9000e-004	1.9000e-004	3.8000e-004	0.0000	4.9223	4.9223	1.0000e-004	0.0000	4.9244
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1900e-003	3.0000e-004	4.1200e-003	0.0000	2.0000e-004	1.0000e-005	2.0000e-004	5.0000e-005	1.0000e-005	6.0000e-005	0.0000	0.2534	0.2534	2.0000e-005	0.0000	0.2538
Total	**0.0132**	**0.0399**	**0.2329**	**6.0000e-005**	**8.9000e-004**	**2.1000e-004**	**1.1000e-003**	**2.4000e-004**	**2.0000e-004**	**4.4000e-004**	**0.0000**	**5.1757**	**5.1757**	**1.2000e-004**	**0.0000**	**5.1782**

3.8 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.9765					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.3000e-003	0.0697	0.0718	1.1000e-004		4.6600e-003	4.6600e-003		4.6400e-003	4.6400e-003	0.0000	9.9425	9.9425	1.5100e-003	0.0000	9.9741
Total	**1.9858**	**0.0697**	**0.0718**	**1.1000e-004**		**4.6600e-003**	**4.6600e-003**		**4.6400e-003**	**4.6400e-003**	**0.0000**	**9.9425**	**9.9425**	**1.5100e-003**	**0.0000**	**9.9741**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.9700e-003	7.6000e-004	0.0103	1.0000e-005	4.9000e-004	1.0000e-005	5.1000e-004	1.3000e-004	1.0000e-005	1.5000e-004	0.0000	0.6328	0.6328	5.0000e-005	0.0000	0.6339
Total	**2.9700e-003**	**7.6000e-004**	**0.0103**	**1.0000e-005**	**4.9000e-004**	**1.0000e-005**	**5.1000e-004**	**1.3000e-004**	**1.0000e-005**	**1.5000e-004**	**0.0000**	**0.6328**	**0.6328**	**5.0000e-005**	**0.0000**	**0.6339**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.9765					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.5600e-003	0.0197	0.0743	1.1000e-004		1.6000e-004	1.6000e-004		1.6000e-004	1.6000e-004	0.0000	9.9424	9.9424	1.5100e-003	0.0000	9.9741
Total	**1.9781**	**0.0197**	**0.0743**	**1.1000e-004**		**1.6000e-004**	**1.6000e-004**		**1.6000e-004**	**1.6000e-004**	**0.0000**	**9.9424**	**9.9424**	**1.5100e-003**	**0.0000**	**9.9741**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.9700e-003	7.6000e-004	0.0103	1.0000e-005	4.9000e-004	1.0000e-005	5.1000e-004	1.3000e-004	1.0000e-005	1.5000e-004	0.0000	0.6328	0.6328	5.0000e-005	0.0000	0.6339
Total	**2.9700e-003**	**7.6000e-004**	**0.0103**	**1.0000e-005**	**4.9000e-004**	**1.0000e-005**	**5.1000e-004**	**1.3000e-004**	**1.0000e-005**	**1.5000e-004**	**0.0000**	**0.6328**	**0.6328**	**5.0000e-005**	**0.0000**	**0.6339**

Construction Modeling and Health Risk Calculations Information

Topgolf, Alviso, CA

DPM Construction Emissions and Modeling Emission Rates - Unmitigated

Construction Year	Construction Area	DPM (ton/year)	Area Source	DPM Emissions (lb/yr)	DPM Emissions (lb/hr)	DPM Emissions (g/s)	Modeled Area (m^2)	DPM Emission Rate ($g/s/m^2$)
2017	Area 1 - A	0.0209	A1A_DPM	41.9	0.01274	1.61E-03	31,667	5.07E-08
	Area 1 - B	0.0198	A1B_DPM	39.5	0.01204	1.52E-03	29,907	5.07E-08
		0.0407		81.4	0.02478	3.12E-03	61,574	
2017	Topgolf	0.3476	TG_DPM	695.2	0.21163	2.67E-02	32,229	8.27E-07
2018	Area 1 - A	0.1268	A1A_DPM	253.6	0.07721	9.73E-03	31,667	3.07E-07
	Area 1 - B	0.1198	A1B_DPM	239.6	0.07292	9.19E-03	29,907	3.07E-07
		0.2466		493.2	0.15014	1.89E-02	61,574	
2018	Topgolf	0.1126	TG_DPM	225.2	0.06855	8.64E-03	32,229	2.68E-07
Total	All	0.7475	-	1495	0.4551	0.0573	93,803	-
		hr/day =	9	(7am - 4pm)				
		days/yr =	365					
		hours/year =	3285					

PM2.5 Fugitive Dust Construction Emissions for Modeling - Unmitigated

Construction Year	Construction Area	Area Source	PM2.5 Emissions (ton/year)	PM2.5 Emissions (lb/yr)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (g/s)	Modeled Area (m^2)	PM2.5 Emission Rate $g/s/m^2$
2017	Area 1 - A	A1A_FUG	0.05796	115.9	0.03529	4.45E-03	31,667	1.40E-07
	Area 1 - B	A1B_FUG	0.0547	109.5	0.03333	4.20E-03	29,907	1.40E-07
			0.1127	225.4	0.06861	8.65E-03	61,574	
2017	Topgolf	TG_FUG	0.1530	306.0	0.09315	1.17E-02	32,229	3.64E-07
2018	Area 1 - A	A1A_FUG	0.02582	51.6	0.01572	1.98E-03	31,667	6.25E-08
	Area 1 - B	A1B_FUG	0.0244	48.8	0.01484	1.87E-03	29,907	6.25E-08
			0.0502	100.4	0.03056	3.85E-03	61,574	
2018	Topgolf	TG_FUG	0.0040	8.0	0.00243	3.06E-04	32,229	9.50E-09
Total			0.3199	639.8	0.1948	0.0245	93,803	
		hr/day =	9	(7am - 4pm)				
		days/yr =	365					
		hours/year =	3285					

DPM Construction Emissions and Modeling Emission Rates - With Mitigation

Construction Year	Construction Area	DPM (ton/year)	Area Source	DPM Emissions (lb/yr)	(lb/hr)	(g/s)	Modeled Area (m^2)	DPM Emission Rate ($g/s/m^2$)
2017	Area 1 - A	0.0008	A1A_DPM	1.6	0.00048	6.08E-05	31,667	1.92E-09
	Area 1 - B	0.0007	A1B_DPM	1.5	0.00046	5.74E-05	29,907	1.92E-09
		0.0015		3.1	0.00094	1.18E-04	61,574	
2017	Topgolf	0.0299	TG_DPM	59.8	0.01820	2.29E-03	32,229	7.12E-08
2018	Area 1 - A	0.0051	A1A_DPM	10.3	0.00313	3.95E-04	31,667	1.25E-08
	Area 1 - B	0.0049	A1B_DPM	9.7	0.00296	3.73E-04	29,907	1.25E-08
		0.0100		20.0	0.00609	7.67E-04	61,574	
2018	Topgolf	0.0125	TG_DPM	25.0	0.00761	9.59E-04	32,229	2.98E-08
Total	All	0.0539	-	108	0.0328	0.0041	93,803	-
		hr/day =	9	(7am - 4pm)				
		days/yr =	365					
		hours/year =	3285					

PM2.5 Fugitive Dust Construction Emissions for Modeling - With Mitigation

Construction Year	Construction Area	Area Source	PM2.5 Emissions (ton/year)	(lb/yr)	(lb/hr)	(g/s)	Modeled Area (m^2)	PM2.5 Emission Rate $g/s/m^2$
2017	Area 1 - A	A1A_FUG	0.01327	26.5	0.00808	1.02E-03	31,667	3.21E-08
	Area 1 - B	A1B_FUG	0.0125	25.1	0.00763	9.61E-04	29,907	3.21E-08
			0.0258	51.6	0.01571	1.98E-03	61,574	
2017	Topgolf	TG_FUG	0.0406	81.2	0.02472	3.11E-03	32,229	9.66E-08
2018	Area 1 - A	A1A_FUG	0.00741	14.8	0.00451	5.68E-04	31,667	1.79E-08
	Area 1 - B	A1B_FUG	0.0070	14.0	0.00426	5.37E-04	29,907	1.79E-08
			0.0144	28.8	0.00877	1.10E-03	61,574	
2018	Topgolf	TG_FUG	0.0040	8.0	0.00243	3.06E-04	32,229	9.50E-09
Total			0.0848	169.6	0.0516	0.0065	93,803	
		hr/day =	9	(7am - 4pm)				
		days/yr =	365					
		hours/year =	3285					

Topgolf, Alviso, CA - Health Impacts Summary

Construction Health Impact Summary - Residential Receptors Without Mitigation

Construction Year	Maximum Concentrations Exhaust PM2.5/DPM ($\mu g/m^3$)	Maximum Concentrations Fugitive PM2.5 ($\mu g/m^3$)	Cancer Risk (per million) Infant/Child	Cancer Risk (per million) Adult	Hazard Index (-)	Maximum Annual PM2.5 Concentration ($\mu g/m^3$)
2017	0.2077	0.1802	34.1	0.6	0.042	0.388
2018	0.1780	0.0385	29.24	0.5	0.036	0.217
Total	-	-	**63.4**	**1.1**	-	-
Maximum Annual	0.2077	0.1802	-	-	**0.04**	**0.39**

Construction Health Impact Summary - Residential Receptors With Mitigation

Construction Year	Maximum Concentrations Exhaust PM2.5/DPM ($\mu g/m^3$)	Maximum Concentrations Fugitive PM2.5 ($\mu g/m^3$)	Cancer Risk (per million) Infant/Child	Cancer Risk (per million) Adult	Hazard Index (-)	Maximum Annual PM2.5 Concentration ($\mu g/m^3$)
2017	0.0170	0.0449	2.8	0.05	0.003	0.062
2018	0.0116	0.0129	1.9	0.03	0.002	0.024
Total	-	-	**4.7**	**0.08**	-	-
Maximum Annual	0.0170	0.0449	-	-	**0.003**	**0.06**

Maximum Impacts at George Mayne Elementary School - Without Mitigation

Construction Year	Maximum Concentrations Exhaust PM2.5/DPM ($\mu g/m^3$)	Maximum Concentrations Fugitive PM2.5 ($\mu g/m^3$)	Cancer Risk (per million) Child	Cancer Risk (per million) Adult	Hazard Index (-)	Maximum Annual PM2.5 Concentration ($\mu g/m^3$)
2017	0.0564	0.0731	1.5	-	0.011	0.130
2018	0.0823	0.0222	2.1	-	0.016	0.104
Total	-	-	**3.6**	-	-	-
Maximum Annual	0.0823	0.0731			**0.016**	**0.13**

Topgolf, Alviso, CA - Construction Impacts - Unmitigated Emissions
Maximum DPM Cancer Risk Calculations From Construction
Off-Site Residential Receptor Locations - 1.5 meters receptor height

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Values

	Infant/Child			Adult
Age -->	**3rd Trimester**	**0 - 2**	**2 - 16**	**16 - 30**
Parameter				
ASF =	10	10	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00	1.10E+00
DBR* =	361	1090	572	261
A =	1	1	1	1
EF =	350	350	350	350
AT =	70	70	70	70
FAH =	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Receptor Location

			Infant/Child - Exposure Information			Infant/Child	Adult - Exposure Information			Adult		
							Modeled					
Exposure Year	**Exposure Duration (years)**	**Age**	**DPM Conc (ug/m3) Year**	**DPM Conc (ug/m3) Annual**	**Age Sensitivity Factor**	**Cancer Risk (per million)**	**DPM Conc (ug/m3) Year**	**DPM Conc (ug/m3) Annual**	**Age Sensitivity Factor**	**Cancer Risk (per million)**	**Fugitive PM2.5**	**Total PM2.5**
0	0.25	-0.25 - 0*	-	-	10	-		-	-	-	-	-
1	1	0 - 1	2017	0.2077	10	34.12	2017	0.20771	1	0.60	0.1802	0.388
2	1	1 - 2	2018	0.1780	10	29.24	2018	0.17801	1	0.51	0.0385	0.217
3	1	2 - 3		0.0000	3	0.00		0.0000	1	0.00		
4	1	3 - 4		0.0000	3	0.00		0.0000	1	0.00		
5	1	4 - 5		0.0000	3	0.00		0.0000	1	0.00		
6	1	5 - 6		0.0000	3	0.00		0.0000	1	0.00		
7	1	6 - 7		0.0000	3	0.00		0.0000	1	0.00		
8	1	7 - 8		0.0000	3	0.00		0.0000	1	0.00		
9	1	8 - 9		0.0000	3	0.00		0.0000	1	0.00		
10	1	9 - 10		0.0000	3	0.00		0.0000	1	0.00		
11	1	10 - 11		0.0000	3	0.00		0.0000	1	0.00		
12	1	11 - 12		0.0000	3	0.00		0.0000	1	0.00		
13	1	12 - 13		0.0000	3	0.00		0.0000	1	0.00		
14	1	13 - 14		0.0000	3	0.00		0.0000	1	0.00		
15	1	14 - 15		0.0000	3	0.00		0.0000	1	0.00		
16	1	15 - 16		0.0000	3	0.00		0.0000	1	0.00		
17	1	16-17		0.0000	1	0.00		0.0000	1	0.00		
18	1	17-18		0.0000	1	0.00		0.0000	1	0.00		
19	1	18-19		0.0000	1	0.00		0.0000	1	0.00		
20	1	19-20		0.0000	1	0.00		0.0000	1	0.00		
21	1	20-21		0.0000	1	0.00		0.0000	1	0.00		
22	1	21-22		0.0000	1	0.00		0.0000	1	0.00		
23	1	22-23		0.0000	1	0.00		0.0000	1	0.00		
24	1	23-24		0.0000	1	0.00		0.0000	1	0.00		
25	1	24-25		0.0000	1	0.00		0.0000	1	0.00		
26	1	25-26		0.0000	1	0.00		0.0000	1	0.00		
27	1	26-27		0.0000	1	0.00		0.0000	1	0.00		
28	1	27-28		0.0000	1	0.00		0.0000	1	0.00		
29	1	28-29		0.0000	1	0.00		0.0000	1	0.00		
30	1	29-30		0.0000	1	0.00		0.0000	1	0.00		
Total Increased Cancer Risk						**63.4**				**1.1**		

* Third trimester of pregnancy

Topgolf, Alviso, CA - Construction Impacts - Mitigated Emissions
Maximum DPM Cancer Risk Calculations From Construction
Off-Site Residential Receptor Locations - 1.5 meter Receptor Height

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Values

	Infant/Child			Adult
Age -->	**3rd Trimester**	**0 - 2**	**2 - 16**	**16 - 30**
Parameter				
ASF =	10	10	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00	1.10E+00
DBR* =	361	1090	572	261
A =	1	1	1	1
EF =	350	350	350	350
AT =	70	70	70	70
FAH =	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Receptor Location

			Infant/Child - Exposure Information			Infant/Child	Adult - Exposure Information			Adult		
			DPM Conc (ug/m3)		Age	Cancer	Modeled DPM Conc (ug/m3)		Age	Cancer		
Exposure Year	**Exposure Duration (years)**	**Age**	**Year**	**Annual**	**Sensitivity Factor**	**Risk (per million)**	**Year**	**Annual**	**Sensitivity Factor**	**Risk (per million)**	**Fugitive PM2.5**	**Total PM2.5**
0	0.25	-0.25 - 0*	-	-	10	-		-	-	-	-	-
1	1	0 - 1	2017	0.0170	10	2.78	2017	0.0170	1	0.05	0.0449	0.062
2	1	1 - 2	2018	0.0116	10	1.90	2018	0.0116	1	0.03	0.0129	0.024
3	1	2 - 3		0.0000	3	0.00		0.0000	1	0.00		
4	1	3 - 4		0.0000	3	0.00		0.0000	1	0.00		
5	1	4 - 5		0.0000	3	0.00		0.0000	1	0.00		
6	1	5 - 6		0.0000	3	0.00		0.0000	1	0.00		
7	1	6 - 7		0.0000	3	0.00		0.0000	1	0.00		
8	1	7 - 8		0.0000	3	0.00		0.0000	1	0.00		
9	1	8 - 9		0.0000	3	0.00		0.0000	1	0.00		
10	1	9 - 10		0.0000	3	0.00		0.0000	1	0.00		
11	1	10 - 11		0.0000	3	0.00		0.0000	1	0.00		
12	1	11 - 12		0.0000	3	0.00		0.0000	1	0.00		
13	1	12 - 13		0.0000	3	0.00		0.0000	1	0.00		
14	1	13 - 14		0.0000	3	0.00		0.0000	1	0.00		
15	1	14 - 15		0.0000	3	0.00		0.0000	1	0.00		
16	1	15 - 16		0.0000	3	0.00		0.0000	1	0.00		
17	1	16-17		0.0000	1	0.00		0.0000	1	0.00		
18	1	17-18		0.0000	1	0.00		0.0000	1	0.00		
19	1	18-19		0.0000	1	0.00		0.0000	1	0.00		
20	1	19-20		0.0000	1	0.00		0.0000	1	0.00		
21	1	20-21		0.0000	1	0.00		0.0000	1	0.00		
22	1	21-22		0.0000	1	0.00		0.0000	1	0.00		
23	1	22-23		0.0000	1	0.00		0.0000	1	0.00		
24	1	23-24		0.0000	1	0.00		0.0000	1	0.00		
25	1	24-25		0.0000	1	0.00		0.0000	1	0.00		
26	1	25-26		0.0000	1	0.00		0.0000	1	0.00		
27	1	26-27		0.0000	1	0.00		0.0000	1	0.00		
28	1	27-28		0.0000	1	0.00		0.0000	1	0.00		
29	1	28-29		0.0000	1	0.00		0.0000	1	0.00		
30	1	29-30		0.0000	1	0.00		0.0000	1	0.00		
Total Increased Cancer Risk						**4.7**				**0.08**		

* Third trimester of pregnancy

Topgolf, Alviso, CA - Construction Impacts - Unmitigated Emissions
Maximum DPM Cancer Risk Calculations From Construction
George Mayne Elementary School Receptors - 1.0 meters - Child Exposures

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Values

	Infant/Child			Adult
Age -->	**3rd Trimester**	**0 - 2**	**2 - 16**	**16 - 30**
Parameter				
ASF =	10	10	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00	1.10E+00
DBR* =	361	1090	572	261
A =	1	1	1	1
EF =	350	350	350	350
AT =	70	70	70	70
FAH =	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Exposure Year	Exposure Duration (years)	Student - Exposure Information			Student Cancer Risk (per million)	Fugitive PM2.5	Total PM2.5
		DPM Conc (ug/m3)		Age* Sensitivity Factor			
		Year	Annual				
1	1	2017	0.0564	3	1.46	0.0731	0.130
2	1	2018	0.0823	3	2.13	0.0222	0.104
Total Increased Cancer Risk					**3.6**		

* Students assumed to be less than 16 years of age

2017 DPM & Fugitive PM2.5 Model Input/Output- Residential Receptors

```
**
****************************************
**
** ISCST3 Input Produced by:
** AERMOD View Ver. 9.1.0
** Lakes Environmental Software Inc.
** Date: 10/27/2016
** File: G:\Projects\I&R\Topgolf\Model\Topgolf-Const-2017.INP
**
****************************************
**
**
****************************************
** ISCST3 Control Pathway
****************************************
**
**
CO STARTING
   TITLEONE TopGolf-2017 Construction DPM/PM2.5, 1996-2000 Alviso Met Data
   TITLETWO Residential Receptors
   MODELOPT DFAULT CONC  RURAL
   AVERTIME PERIOD
   POLLUTID OTHER
   TERRHGTS FLAT
   FLAGPOLE 1.50
   RUNORNOT RUN
   ERRORFIL TOPGOL~1.ERR
CO FINISHED
**
****************************************
** ISCST3 Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION A1A_DPM      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A -2017 DPM
   LOCATION A1A_FUG      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A - 2017 Fugitive PM2.5
   LOCATION A1B_DPM      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B -2017 DPM
   LOCATION A1B_FUG      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B - 2017 Fugitive PM2.5
   LOCATION TG_DPM       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2017 DPM
   LOCATION TG_FUG       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2017 Fugitive PM2.5
** Source Parameters **
   SRCPARAM A1A_DPM       5.07E-08     6.000        10
   AREAVERT A1A_DPM      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_DPM      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_DPM      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_DPM      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_DPM      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1A_FUG        1.4E-07     2.000        10     0.000
   AREAVERT A1A_FUG      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_FUG      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_FUG      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_FUG      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_FUG      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1B_DPM       5.07E-08     6.000         6
   AREAVERT A1B_DPM      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_DPM      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_DPM      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM A1B_FUG        1.4E-07     2.000         6     0.000
   AREAVERT A1B_FUG      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_FUG      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_FUG      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM TG_DPM        8.27E-07     6.000        10
   AREAVERT TG_DPM       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_DPM       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_DPM       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_DPM       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_DPM       591226.892 4142337.693 591256.845 4142288.678
   SRCPARAM TG_FUG        3.64E-07     2.000        10     0.000
   AREAVERT TG_FUG       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_FUG       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_FUG       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_FUG       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_FUG       591226.892 4142337.693 591256.845 4142288.678

** Variable Emissions Type: "By Hour-of-Day (HROFDY)"
** Variable Emission Scenario: "7am-4pm"
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
```

```
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_DPM       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_FUG       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   SRCGROUP DPM      A1A_DPM A1B_DPM TG_DPM
   SRCGROUP FugPM    A1A_FUG A1B_FUG TG_FUG
   SRCGROUP ALL
SO FINISHED
**
****************************************
** ISCST3 Receptor Pathway
****************************************
**
**
RE STARTING
** DESCRREC "" ""
   DISCCART    591115.96   4142496.03    1.50
   DISCCART    591096.17   4142502.50    1.50
   DISCCART    591077.52   4142507.82    1.50
   DISCCART    591058.50   4142513.53    1.50
   DISCCART    591040.23   4142518.86    1.50
   DISCCART    591020.07   4142524.57    1.50
   DISCCART    591001.42   4142531.04    1.50
   DISCCART    590982.77   4142537.12    1.50
   DISCCART    591138.41   4142481.19    1.50
   DISCCART    591142.97   4142499.45    1.50
   DISCCART    591148.30   4142518.48    1.50
   DISCCART    591123.19   4142520.00    1.50
   DISCCART    591104.16   4142525.71    1.50
   DISCCART    591084.75   4142531.42    1.50
   DISCCART    591065.73   4142537.12    1.50
   DISCCART    591046.70   4142542.07    1.50
   DISCCART    591027.30   4142548.54    1.50
   DISCCART    591009.03   4142554.63    1.50
   DISCCART    591152.11   4142551.58    1.50
   DISCCART    591156.29   4142570.61    1.50
   DISCCART    591127.37   4142566.42    1.50
   DISCCART    591109.11   4142572.51    1.50
   DISCCART    591090.08   4142577.08    1.50
   DISCCART    591070.68   4142583.55    1.50
   DISCCART    591052.79   4142588.50    1.50
   DISCCART    591032.24   4142594.96    1.50
   DISCCART    591145.26   4142586.97    1.50
   DISCCART    591126.23   4142592.30    1.50
   DISCCART    591107.21   4142597.63    1.50
   DISCCART    591088.94   4142602.95    1.50
   DISCCART    591068.39   4142609.42    1.50
   DISCCART    590876.61   4142572.13    1.50
   DISCCART    590899.06   4142588.50    1.50
   DISCCART    590920.75   4142605.24    1.50
   DISCCART    590939.78   4142624.26    1.50
   DISCCART    590960.32   4142642.15    1.50
   DISCCART    590980.49   4142658.51    1.50
   DISCCART    591001.42   4142676.40    1.50
   DISCCART    591031.10   4142698.09    1.50
   DISCCART    590848.07   4142584.31    1.50
   DISCCART    590851.87   4142600.67    1.50
   DISCCART    590874.33   4142614.75    1.50
   DISCCART    590893.73   4142634.92    1.50
   DISCCART    590912.76   4142653.94    1.50
   DISCCART    590932.55   4142671.83    1.50
   DISCCART    590952.71   4142690.09    1.50
   DISCCART    590971.36   4142709.50    1.50
   DISCCART    590850.35   4142666.12    1.50
   DISCCART    590870.52   4142683.63    1.50
   DISCCART    590892.59   4142700.37    1.50
   DISCCART    590912.38   4142714.07    1.50
   DISCCART    590827.52   4142693.14    1.50
   DISCCART    590854.54   4142720.16    1.50
   DISCCART    590878.13   4142740.32    1.50
   DISCCART    590900.20   4142759.35    1.50
   DISCCART    590773.11   4142712.93    1.50
   DISCCART    590789.47   4142723.96    1.50
   DISCCART    590823.72   4142755.54    1.50
   DISCCART    590844.26   4142774.57    1.50
   DISCCART    590738.48   4142741.85    1.50
   DISCCART    590751.04   4142755.16    1.50
   DISCCART    590765.50   4142767.34    1.50
   DISCCART    590773.49   4142678.30    1.50
   DISCCART    590755.22   4142677.92    1.50
   DISCCART    590742.28   4142679.44    1.50
   DISCCART    590726.68   4142679.06    1.50
   DISCCART    590689.39   4142171.44    1.50
   DISCCART    590682.92   4142156.98    1.50
   DISCCART    590678.74   4142139.86    1.50
   DISCCART    590724.78   4142165.35    1.50
   DISCCART    590754.84   4142160.41    1.50
```

```
   DISCCART    590784.14   4142156.22    1.50
   DISCCART    590816.49   4142153.56    1.50
   DISCCART    590841.60   4142151.66    1.50
   DISCCART    590836.27   4142126.54    1.50
   DISCCART    590805.07   4142129.20    1.50
   DISCCART    590776.91   4142134.15    1.50
   DISCCART    590743.43   4142139.10    1.50
   DISCCART    590714.51   4142141.00    1.50
   DISCCART    590899.44   4142140.24    1.50
   DISCCART    590929.12   4142137.96    1.50
   DISCCART    590959.94   4142126.92    1.50
   DISCCART    590986.96   4142116.27    1.50
   DISCCART    590896.78   4142118.93    1.50
   DISCCART    590927.60   4142112.84    1.50
   DISCCART    590955.00   4142103.33    1.50
   DISCCART    590970.22   4142092.29    1.50
   DISCCART    590983.92   4142082.40    1.50
   DISCCART    590987.72   4142065.28    1.50
   DISCCART    591000.66   4142098.00    1.50
   DISCCART    591014.36   4142069.84    1.50
   DISCCART    590780.72   4142100.67    1.50
   DISCCART    590806.59   4142102.19    1.50
   DISCCART    590843.12   4142099.52    1.50
   DISCCART    590875.47   4142093.82    1.50
   DISCCART    590907.43   4142090.77    1.50
   DISCCART    590943.20   4142081.26    1.50
   DISCCART    591503.99   4142382.16    1.50
   DISCCART    591537.80   4142385.06    1.50
   DISCCART    591459.55   4141782.24    1.50
   DISCCART    591491.43   4141786.59    1.50
   DISCCART    591523.31   4141787.07    1.50
   DISCCART    591550.84   4141786.59    1.50
   DISCCART    591580.31   4141787.07    1.50
   DISCCART    591608.81   4141787.56    1.50
   DISCCART    591638.27   4141792.87    1.50
   DISCCART    591668.70   4141802.53    1.50
   DISCCART    591009.59   4142041.64    1.50
   DISCCART    590998.13   4142018.71    1.50
   DISCCART    590991.25   4141992.10    1.50
   DISCCART    590982.07   4141965.50    1.50
   DISCCART    590979.78   4142038.43    1.50
   DISCCART    590972.90   4142015.49    1.50
   DISCCART    590964.64   4141989.35    1.50
   DISCCART    590965.56   4141951.73    1.50
   DISCCART    590947.21   4141956.32    1.50
   DISCCART    590944.46   4141980.63    1.50
   DISCCART    590864.92   4142387.88    1.50
   DISCCART    590854.14   4142373.71    1.50
   DISCCART    590804.24   4142384.03    1.50
   DISCCART    590789.77   4142384.95    1.50
   DISCCART    590776.99   4142386.80    1.50
   DISCCART    590761.90   4142387.26    1.50
   DISCCART    590747.89   4142390.50    1.50
   DISCCART    590736.95   4142389.88    1.50
   DISCCART    590724.94   4142389.73    1.50
   DISCCART    590688.75   4142442.54    1.50
   DISCCART    590683.83   4142430.07    1.50
   DISCCART    590687.83   4142456.25    1.50
   DISCCART    590687.83   4142473.34    1.50
   DISCCART    590690.91   4142486.74    1.50
   DISCCART    590690.76   4142504.76    1.50
   DISCCART    590730.33   4142593.61    1.50
   DISCCART    590618.38   4142553.42    1.50
   DISCCART    590613.45   4142595.30    1.50
   DISCCART    590570.95   4142579.59    1.50
   DISCCART    590686.14   4142609.00    1.50
   DISCCART    590657.03   4142612.85    1.50
   DISCCART    590623.93   4142620.09    1.50
   DISCCART    590638.40   4142620.25    1.50
   DISCCART    590661.34   4142594.53    1.50
   DISCCART    590646.25   4142597.15    1.50
   DISCCART    590630.09   4142595.61    1.50
   DISCCART    590660.27   4142665.21    1.50
   DISCCART    590639.79   4142681.38    1.50
   DISCCART    590628.55   4142681.07    1.50
   DISCCART    590617.77   4142685.23    1.50
   DISCCART    590608.37   4142686.15    1.50
   DISCCART    590675.67   4142678.45    1.50
   DISCCART    590689.83   4142688.31    1.50
   DISCCART    590686.14   4142721.88    1.50
   DISCCART    590663.81   4142736.51    1.50
   DISCCART    590645.79   4142735.12    1.50
   DISCCART    590632.24   4142737.89    1.50
   DISCCART    590612.38   4142734.66    1.50
   DISCCART    590612.84   4142725.73    1.50
   DISCCART    590627.62   4142716.95    1.50
   DISCCART    590655.65   4142716.03    1.50
RE FINISHED
**
****************************************
** ISCST3 Meteorology Pathway
****************************************
**
**
ME STARTING
   INPUTFIL C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
```

```
   ANEMHGHT 10 METERS
   SURFDATA 7905 1996
   UAIRDATA 7905 1996
ME FINISHED
**
****************************************
** ISCST3 Output Pathway
****************************************
**
**
OU STARTING
** Auto-Generated Plotfiles
   PLOTFILE PERIOD ALL TOPGOL~1.IS\PE00GALL.PLT 31
   PLOTFILE PERIOD DPM TOPGOL~1.IS\PE00G001.PLT 32
   PLOTFILE PERIOD FugPM TOPGOL~1.IS\PE00G002.PLT 33
OU FINISHED

***********************************
*** SETUP Finishes Successfully ***
***********************************
```

```
**MODELOPTs:
CONC                    RURAL FLAT  FLGPOL DFAULT

                                   ***     MODEL SETUP OPTIONS SUMMARY       ***
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

**Intermediate Terrain Processing is Selected

**Model Is Setup For Calculation of Average CONCentration Values.

  --  SCAVENGING/DEPOSITION LOGIC --
**Model Uses NO DRY DEPLETION.  DDPLETE =  F
**Model Uses NO WET DEPLETION.  WDPLETE =  F
**NO WET SCAVENGING Data Provided.
**NO GAS DRY DEPOSITION Data Provided.
**Model Does NOT Use GRIDDED TERRAIN Data for Depletion Calculations

**Model Uses RURAL Dispersion.

**Model Uses Regulatory DEFAULT Options:
           1. Final Plume Rise.
           2. Stack-tip Downwash.
           3. Buoyancy-induced Dispersion.
           4. Use Calms Processing Routine.
           5. Not Use Missing Data Processing Routine.
           6. Default Wind Profile Exponents.
           7. Default Vertical Potential Temperature Gradients.
           8. "Upper Bound" Values for Supersquat Buildings.
           9. No Exponential Decay for RURAL Mode

**Model Assumes Receptors on FLAT Terrain.

**Model Accepts FLAGPOLE Receptor Heights.

**Model Calculates PERIOD Averages Only

**This Run Includes:     6 Source(s);      3 Source Group(s); and     158 Receptor(s)

**The Model Assumes A Pollutant Type of:  OTHER

**Model Set To Continue RUNning After the Setup Testing.

**Output Options Selected:
         Model Outputs Tables of PERIOD Averages by Receptor
         Model Outputs External File(s) of High Values for Plotting (PLOTFILE Keyword)

**NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                m for Missing Hours
                                                                b for Both Calm and Missing Hours

**Misc. Inputs:  Anem. Hgt. (m) =    10.00 ;    Decay Coef. =    0.000     ;    Rot. Angle =     0.0
                 Emission Units = GRAMS/SEC                                ;  Emission Rate Unit Factor =   0.10000E+07
                 Output Units   = MICROGRAMS/M**3

**Approximate Storage Requirements of Model =     1.2 MB of RAM.

**Input Runstream File:          Topgolf-Const-2017.INP
**Output Print File:             Topgolf-Const-2017.OUT
**Detailed Error/Message File:   TOPGOL~1.ERR
```

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** AREAPOLY SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (GRAMS/SEC /METER**2)	LOCATION OF AREA X (METERS)	Y (METERS)	BASE ELEV. (METERS)	RELEASE HEIGHT (METERS)	NUMBER OF VERTS.	INIT. SZ (METERS)	EMISSION RATE SCALAR VARY BY
A1A_DPM	0	0.50700E-07	590982.4	4142485.5	0.0	6.00	10	0.00	HROFDY
A1A_FUG	0	0.14000E-06	590982.4	4142485.5	0.0	2.00	10	0.00	HROFDY
A1B_DPM	0	0.50700E-07	591301.5	4142218.8	0.0	6.00	6	0.00	HROFDY
A1B_FUG	0	0.14000E-06	591301.5	4142218.8	0.0	2.00	6	0.00	HROFDY
TG_DPM	0	0.82700E-06	591150.6	4142203.2	0.0	6.00	10	0.00	HROFDY
TG_FUG	0	0.36400E-06	591150.6	4142203.2	0.0	2.00	10	0.00	HROFDY

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
DPM	A1A_DPM , A1B_DPM , TG_DPM ,
FUGPM	A1A_FUG , A1B_FUG , TG_FUG ,
ALL	A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = A1A_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1A_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = TG_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = TG_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591115.9,	4142496.0,	0.0,	1.5);	(591096.2,	4142502.5,	0.0,	1.5);
(591077.5,	4142507.8,	0.0,	1.5);	(591058.5,	4142513.5,	0.0,	1.5);
(591040.3,	4142518.8,	0.0,	1.5);	(591020.1,	4142524.5,	0.0,	1.5);
(591001.4,	4142531.0,	0.0,	1.5);	(590982.8,	4142537.0,	0.0,	1.5);
(591138.4,	4142481.3,	0.0,	1.5);	(591143.0,	4142499.5,	0.0,	1.5);
(591148.3,	4142518.5,	0.0,	1.5);	(591123.2,	4142520.0,	0.0,	1.5);
(591104.2,	4142525.8,	0.0,	1.5);	(591084.8,	4142531.5,	0.0,	1.5);
(591065.8,	4142537.0,	0.0,	1.5);	(591046.7,	4142542.0,	0.0,	1.5);
(591027.3,	4142548.5,	0.0,	1.5);	(591009.0,	4142554.8,	0.0,	1.5);
(591152.1,	4142551.5,	0.0,	1.5);	(591156.3,	4142570.5,	0.0,	1.5);
(591127.4,	4142566.5,	0.0,	1.5);	(591109.1,	4142572.5,	0.0,	1.5);
(591090.1,	4142577.0,	0.0,	1.5);	(591070.7,	4142583.5,	0.0,	1.5);
(591052.8,	4142588.5,	0.0,	1.5);	(591032.2,	4142595.0,	0.0,	1.5);
(591145.3,	4142587.0,	0.0,	1.5);	(591126.3,	4142592.2,	0.0,	1.5);
(591107.2,	4142597.8,	0.0,	1.5);	(591088.9,	4142603.0,	0.0,	1.5);
(591068.4,	4142609.5,	0.0,	1.5);	(590876.6,	4142572.2,	0.0,	1.5);
(590899.1,	4142588.5,	0.0,	1.5);	(590920.8,	4142605.2,	0.0,	1.5);
(590939.8,	4142624.2,	0.0,	1.5);	(590960.3,	4142642.2,	0.0,	1.5);
(590980.5,	4142658.5,	0.0,	1.5);	(591001.4,	4142676.5,	0.0,	1.5);
(591031.1,	4142698.0,	0.0,	1.5);	(590848.1,	4142584.2,	0.0,	1.5);
(590851.9,	4142600.8,	0.0,	1.5);	(590874.3,	4142614.8,	0.0,	1.5);
(590893.8,	4142635.0,	0.0,	1.5);	(590912.8,	4142654.0,	0.0,	1.5);
(590932.6,	4142671.8,	0.0,	1.5);	(590952.7,	4142690.0,	0.0,	1.5);
(590971.4,	4142709.5,	0.0,	1.5);	(590850.4,	4142666.0,	0.0,	1.5);
(590870.5,	4142683.8,	0.0,	1.5);	(590892.6,	4142700.2,	0.0,	1.5);
(590912.4,	4142714.0,	0.0,	1.5);	(590827.5,	4142693.2,	0.0,	1.5);
(590854.6,	4142720.2,	0.0,	1.5);	(590878.1,	4142740.2,	0.0,	1.5);
(590900.2,	4142759.2,	0.0,	1.5);	(590773.1,	4142713.0,	0.0,	1.5);
(590789.5,	4142724.0,	0.0,	1.5);	(590823.8,	4142755.5,	0.0,	1.5);
(590844.2,	4142774.5,	0.0,	1.5);	(590738.5,	4142741.8,	0.0,	1.5);
(590751.1,	4142755.2,	0.0,	1.5);	(590765.5,	4142767.3,	0.0,	1.5);
(590773.5,	4142678.3,	0.0,	1.5);	(590755.2,	4142678.0,	0.0,	1.5);
(590742.2,	4142679.5,	0.0,	1.5);	(590726.7,	4142679.0,	0.0,	1.5);
(590689.4,	4142171.5,	0.0,	1.5);	(590682.9,	4142157.0,	0.0,	1.5);
(590678.8,	4142139.8,	0.0,	1.5);	(590724.8,	4142165.2,	0.0,	1.5);
(590754.8,	4142160.5,	0.0,	1.5);	(590784.1,	4142156.2,	0.0,	1.5);
(590816.5,	4142153.5,	0.0,	1.5);	(590841.6,	4142151.8,	0.0,	1.5);
(590836.2,	4142126.5,	0.0,	1.5);	(590805.1,	4142129.2,	0.0,	1.5);
(590776.9,	4142134.2,	0.0,	1.5);	(590743.4,	4142139.0,	0.0,	1.5);
(590714.5,	4142141.0,	0.0,	1.5);	(590899.4,	4142140.2,	0.0,	1.5);
(590929.1,	4142138.0,	0.0,	1.5);	(590959.9,	4142127.0,	0.0,	1.5);
(590986.9,	4142116.2,	0.0,	1.5);	(590896.8,	4142119.0,	0.0,	1.5);
(590927.6,	4142112.8,	0.0,	1.5);	(590955.0,	4142103.2,	0.0,	1.5);
(590970.3,	4142092.2,	0.0,	1.5);	(590983.9,	4142082.5,	0.0,	1.5);
(590987.8,	4142065.2,	0.0,	1.5);	(591000.7,	4142098.0,	0.0,	1.5);

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591014.4,	4142069.8,	0.0,	1.5);	(590780.8,	4142100.8,	0.0,	1.5);
(590806.6,	4142102.2,	0.0,	1.5);	(590843.1,	4142099.5,	0.0,	1.5);
(590875.5,	4142093.8,	0.0,	1.5);	(590907.4,	4142090.8,	0.0,	1.5);
(590943.2,	4142081.3,	0.0,	1.5);	(591504.0,	4142382.2,	0.0,	1.5);
(591537.8,	4142385.0,	0.0,	1.5);	(591459.6,	4141782.3,	0.0,	1.5);
(591491.4,	4141786.5,	0.0,	1.5);	(591523.3,	4141787.0,	0.0,	1.5);
(591550.8,	4141786.5,	0.0,	1.5);	(591580.3,	4141787.0,	0.0,	1.5);
(591608.8,	4141787.5,	0.0,	1.5);	(591638.2,	4141792.8,	0.0,	1.5);
(591668.7,	4141802.5,	0.0,	1.5);	(591009.6,	4142041.8,	0.0,	1.5);
(590998.1,	4142018.8,	0.0,	1.5);	(590991.2,	4141992.0,	0.0,	1.5);
(590982.1,	4141965.5,	0.0,	1.5);	(590979.8,	4142038.5,	0.0,	1.5);
(590972.9,	4142015.5,	0.0,	1.5);	(590964.6,	4141989.2,	0.0,	1.5);
(590965.6,	4141951.8,	0.0,	1.5);	(590947.2,	4141956.2,	0.0,	1.5);
(590944.4,	4141980.8,	0.0,	1.5);	(590864.9,	4142388.0,	0.0,	1.5);
(590854.1,	4142373.8,	0.0,	1.5);	(590804.2,	4142384.0,	0.0,	1.5);
(590789.8,	4142385.0,	0.0,	1.5);	(590777.0,	4142386.8,	0.0,	1.5);
(590761.9,	4142387.2,	0.0,	1.5);	(590747.9,	4142390.5,	0.0,	1.5);
(590736.9,	4142390.0,	0.0,	1.5);	(590724.9,	4142389.8,	0.0,	1.5);
(590688.8,	4142442.5,	0.0,	1.5);	(590683.8,	4142430.0,	0.0,	1.5);
(590687.8,	4142456.3,	0.0,	1.5);	(590687.8,	4142473.2,	0.0,	1.5);
(590690.9,	4142486.8,	0.0,	1.5);	(590690.8,	4142504.8,	0.0,	1.5);
(590730.3,	4142593.5,	0.0,	1.5);	(590618.4,	4142553.5,	0.0,	1.5);
(590613.4,	4142595.3,	0.0,	1.5);	(590570.9,	4142579.5,	0.0,	1.5);
(590686.1,	4142609.0,	0.0,	1.5);	(590657.0,	4142612.8,	0.0,	1.5);
(590623.9,	4142620.0,	0.0,	1.5);	(590638.4,	4142620.2,	0.0,	1.5);
(590661.3,	4142594.5,	0.0,	1.5);	(590646.3,	4142597.2,	0.0,	1.5);
(590630.1,	4142595.5,	0.0,	1.5);	(590660.2,	4142665.3,	0.0,	1.5);
(590639.8,	4142681.5,	0.0,	1.5);	(590628.6,	4142681.0,	0.0,	1.5);
(590617.8,	4142685.2,	0.0,	1.5);	(590608.4,	4142686.2,	0.0,	1.5);
(590675.7,	4142678.5,	0.0,	1.5);	(590689.8,	4142688.2,	0.0,	1.5);
(590686.1,	4142722.0,	0.0,	1.5);	(590663.8,	4142736.5,	0.0,	1.5);
(590645.8,	4142735.0,	0.0,	1.5);	(590632.2,	4142738.0,	0.0,	1.5);
(590612.4,	4142734.8,	0.0,	1.5);	(590612.8,	4142725.8,	0.0,	1.5);
(590627.6,	4142717.0,	0.0,	1.5);	(590655.6,	4142716.0,	0.0,	1.5);

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

```
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1
```

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

*** WIND PROFILE EXPONENTS ***

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
B	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
C	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00
D	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00
E	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00
F	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00

*** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
(DEGREES KELVIN PER METER)

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
B	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
C	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
D	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
E	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01
F	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

FILE: C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
FORMAT: (4I2,2F9.4,F6.1,I2,2F7.1,f9.4,f10.1,f8.4,i4,f7.2)
SURFACE STATION NO.: 7905 UPPER AIR STATION NO.: 7905
NAME: UNKNOWN NAME: UNKNOWN
YEAR: 1996 YEAR: 1996

YR	MN	DY	HR	FLOW VECTOR	SPEED (M/S)	TEMP (K)	STAB CLASS	MIXING HEIGHT (M) RURAL	MIXING HEIGHT (M) URBAN	USTAR (M/S)	M-O LENGTH (M)	Z-0 (M)	IPCODE	PRATE (mm/HR)
96	01	01	01	212.7	1.56	283.5	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	02	186.7	1.03	284.0	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	03	162.3	1.79	284.0	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	04	185.1	1.97	283.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	05	132.3	2.46	283.0	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	06	97.9	4.16	283.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	07	95.8	1.61	284.4	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	08	152.8	3.58	285.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	09	157.8	5.54	288.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	10	158.3	5.01	289.9	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	11	162.5	5.54	291.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	12	161.7	5.72	292.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	13	168.0	6.84	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	14	182.2	6.12	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	15	153.1	5.68	292.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	16	112.6	4.34	291.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	17	134.5	3.84	290.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	18	143.4	4.38	290.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	19	145.1	3.62	290.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	20	161.2	4.83	289.3	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	21	155.0	4.83	289.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	22	105.9	4.25	286.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	23	48.0	2.68	285.6	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	24	89.0	2.46	285.8	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00

*** NOTES: STABILITY CLASS 1=A, 2=B, 3=C, 4=D, 5=E AND 6=F.
FLOW VECTOR IS DIRECTION TOWARD WHICH WIND IS BLOWING.

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.15969	591096.19	4142502.50	0.17186
591077.50	4142507.75	0.18306	591058.50	4142513.50	0.19235
591040.25	4142518.75	0.20024	591020.06	4142524.50	0.20663
591001.44	4142531.00	0.20771	590982.75	4142537.00	0.20666
591138.44	4142481.25	0.15261	591143.00	4142499.50	0.12721
591148.31	4142518.50	0.10602	591123.19	4142520.00	0.12554
591104.19	4142525.75	0.13618	591084.75	4142531.50	0.14637
591065.75	4142537.00	0.15569	591046.69	4142542.00	0.16473
591027.31	4142548.50	0.17047	591009.00	4142554.75	0.17355
591152.13	4142551.50	0.08255	591156.31	4142570.50	0.07148
591127.38	4142566.50	0.08765	591109.12	4142572.50	0.09424
591090.06	4142577.00	0.10243	591070.69	4142583.50	0.10944
591052.81	4142588.50	0.11610	591032.25	4142595.00	0.12208
591145.25	4142587.00	0.06923	591126.25	4142592.25	0.07494
591107.19	4142597.75	0.08107	591088.94	4142603.00	0.08722
591068.38	4142609.50	0.09375	590876.62	4142572.25	0.15558
590899.06	4142588.50	0.15537	590920.75	4142605.25	0.14596
590939.75	4142624.25	0.13081	590960.31	4142642.25	0.11469
590980.50	4142658.50	0.09921	591001.44	4142676.50	0.08405
591031.13	4142698.00	0.06704	590848.06	4142584.25	0.13490
590851.88	4142600.75	0.13176	590874.31	4142614.75	0.13406
590893.75	4142635.00	0.12634	590912.75	4142654.00	0.11526
590932.56	4142671.75	0.10311	590952.69	4142690.00	0.09023
590971.38	4142709.50	0.07748	590850.38	4142666.00	0.10735
590870.50	4142683.75	0.10214	590892.56	4142700.25	0.09439
590912.38	4142714.00	0.08646	590827.50	4142693.25	0.09481
590854.56	4142720.25	0.08821	590878.12	4142740.25	0.08023
590900.19	4142759.25	0.07159	590773.12	4142713.00	0.08002
590789.50	4142724.00	0.08114	590823.75	4142755.50	0.07710
590844.25	4142774.50	0.07174	590738.50	4142741.75	0.06893
590751.06	4142755.25	0.06943	590765.50	4142767.25	0.06973
590773.50	4142678.25	0.08569	590755.25	4142678.00	0.08062
590742.25	4142679.50	0.07680	590726.69	4142679.00	0.07251
590689.38	4142171.50	0.01153	590682.94	4142157.00	0.01088
590678.75	4142139.75	0.01042	590724.75	4142165.25	0.01312
590754.81	4142160.50	0.01482	590784.12	4142156.25	0.01685
590816.50	4142153.50	0.01956	590841.62	4142151.75	0.02187
590836.25	4142126.50	0.01977	590805.06	4142129.25	0.01752
590776.94	4142134.25	0.01560	590743.44	4142139.00	0.01353
590714.50	4142141.00	0.01204	590899.44	4142140.25	0.02714

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.03177	590959.94	4142127.00	0.03747
590986.94	4142116.25	0.04346	590896.75	4142119.00	0.02473
590927.62	4142112.75	0.02853	590955.00	4142103.25	0.03259
590970.25	4142092.25	0.03444	590983.94	4142082.50	0.03611
590987.75	4142065.25	0.03407	591000.69	4142098.00	0.04397
591014.38	4142069.75	0.04190	590780.75	4142100.75	0.01479
590806.56	4142102.25	0.01639	590843.12	4142099.50	0.01853
590875.50	4142093.75	0.02056	590907.44	4142090.75	0.02357
590943.19	4142081.25	0.02760	591504.00	4142382.25	0.02292
591537.81	4142385.00	0.01971	591459.56	4141782.25	0.05478
591491.44	4141786.50	0.05795	591523.31	4141787.00	0.05995
591550.81	4141786.50	0.06121	591580.31	4141787.00	0.06261
591608.81	4141787.50	0.06372	591638.25	4141792.75	0.06570
591668.69	4141802.50	0.06820	591009.56	4142041.75	0.03484
590998.12	4142018.75	0.02896	590991.25	4141992.00	0.02470
590982.06	4141965.50	0.02111	590979.75	4142038.50	0.02863
590972.88	4142015.50	0.02490	590964.63	4141989.25	0.02140
590965.56	4141951.75	0.01850	590947.19	4141956.25	0.01735
590944.44	4141980.75	0.01881	590864.94	4142388.00	0.10876
590854.12	4142373.75	0.08822	590804.25	4142384.00	0.06352
590789.75	4142385.00	0.05613	590777.00	4142386.75	0.05042
590761.88	4142387.25	0.04384	590747.88	4142390.50	0.03919
590736.94	4142390.00	0.03557	590724.94	4142389.75	0.03243
590688.75	4142442.50	0.03177	590683.81	4142430.00	0.02920
590687.81	4142456.25	0.03378	590687.81	4142473.25	0.03710
590690.94	4142486.75	0.04119	590690.75	4142504.75	0.04564
590730.31	4142593.50	0.07817	590618.38	4142553.50	0.03445
590613.44	4142595.25	0.03806	590570.94	4142579.50	0.02873
590686.12	4142609.00	0.06211	590657.00	4142612.75	0.05203
590623.94	4142620.00	0.04306	590638.38	4142620.25	0.04699
590661.31	4142594.50	0.05159	590646.25	4142597.25	0.04703
590630.06	4142595.50	0.04219	590660.25	4142665.25	0.05507
590639.81	4142681.50	0.04982	590628.56	4142681.00	0.04716
590617.75	4142685.25	0.04480	590608.38	4142686.25	0.04284
590675.69	4142678.50	0.05894	590689.81	4142688.25	0.06215
590686.12	4142722.00	0.05952	590663.81	4142736.50	0.05408
590645.81	4142735.00	0.05046	590632.25	4142738.00	0.04772
590612.38	4142734.75	0.04397	590612.81	4142725.75	0.04408
590627.63	4142717.00	0.04704	590655.62	4142716.00	0.05301

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.15709	591096.19	4142502.50	0.16284
591077.50	4142507.75	0.16890	591058.50	4142513.50	0.17351
591040.25	4142518.75	0.17763	591020.06	4142524.50	0.18090
591001.44	4142531.00	0.18022	590982.75	4142537.00	0.17937
591138.44	4142481.25	0.16178	591143.00	4142499.50	0.12938
591148.31	4142518.50	0.10448	591123.19	4142520.00	0.11892
591104.19	4142525.75	0.12460	591084.75	4142531.50	0.12992
591065.75	4142537.00	0.13475	591046.69	4142542.00	0.13963
591027.31	4142548.50	0.14187	591009.00	4142554.75	0.14279
591152.13	4142551.50	0.07733	591156.31	4142570.50	0.06534
591127.38	4142566.50	0.07871	591109.12	4142572.50	0.08250
591090.06	4142577.00	0.08739	591070.69	4142583.50	0.09087
591052.81	4142588.50	0.09436	591032.25	4142595.00	0.09728
591145.25	4142587.00	0.06166	591126.25	4142592.25	0.06561
591107.19	4142597.75	0.06943	591088.94	4142603.00	0.07299
591068.38	4142609.50	0.07645	590876.62	4142572.25	0.15558
590899.06	4142588.50	0.13546	590920.75	4142605.25	0.11829
590939.75	4142624.25	0.10189	590960.31	4142642.25	0.08774
590980.50	4142658.50	0.07571	591001.44	4142676.50	0.06436
591031.13	4142698.00	0.05187	590848.06	4142584.25	0.14503
590851.88	4142600.75	0.12826	590874.31	4142614.75	0.11613
590893.75	4142635.00	0.10160	590912.75	4142654.00	0.08918
590932.56	4142671.75	0.07823	590952.69	4142690.00	0.06802
590971.38	4142709.50	0.05852	590850.38	4142666.00	0.08821
590870.50	4142683.75	0.07975	590892.56	4142700.25	0.07170
590912.38	4142714.00	0.06495	590827.50	4142693.25	0.07759
590854.56	4142720.25	0.06767	590878.12	4142740.25	0.06015
590900.19	4142759.25	0.05328	590773.12	4142713.00	0.07054
590789.50	4142724.00	0.06777	590823.75	4142755.50	0.05918
590844.25	4142774.50	0.05373	590738.50	4142741.75	0.06125
590751.06	4142755.25	0.05887	590765.50	4142767.25	0.05683
590773.50	4142678.25	0.08249	590755.25	4142678.00	0.08190
590742.25	4142679.50	0.08044	590726.69	4142679.00	0.07919
590689.38	4142171.50	0.00969	590682.94	4142157.00	0.00904
590678.75	4142139.75	0.00853	590724.75	4142165.25	0.01126
590754.81	4142160.50	0.01293	590784.12	4142156.25	0.01500
590816.50	4142153.50	0.01776	590841.62	4142151.75	0.02019
590836.25	4142126.50	0.01764	590805.06	4142129.25	0.01531
590776.94	4142134.25	0.01343	590743.44	4142139.00	0.01145
590714.50	4142141.00	0.01007	590899.44	4142140.25	0.02567

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.02985	590959.94	4142127.00	0.03387
590986.94	4142116.25	0.03755	590896.75	4142119.00	0.02273
590927.62	4142112.75	0.02594	590955.00	4142103.25	0.02880
590970.25	4142092.25	0.02965	590983.94	4142082.50	0.03038
590987.75	4142065.25	0.02819	591000.69	4142098.00	0.03665
591014.38	4142069.75	0.03356	590780.75	4142100.75	0.01233
590806.56	4142102.25	0.01397	590843.12	4142099.50	0.01622
590875.50	4142093.75	0.01826	590907.44	4142090.75	0.02101
590943.19	4142081.25	0.02409	591504.00	4142382.25	0.01983
591537.81	4142385.00	0.01658	591459.56	4141782.25	0.03403
591491.44	4141786.50	0.03596	591523.31	4141787.00	0.03718
591550.81	4141786.50	0.03796	591580.31	4141787.00	0.03882
591608.81	4141787.50	0.03952	591638.25	4141792.75	0.04075
591668.69	4141802.50	0.04233	591009.56	4142041.75	0.02775
590998.12	4142018.75	0.02315	590991.25	4141992.00	0.01965
590982.06	4141965.50	0.01673	590979.75	4142038.50	0.02348
590972.88	4142015.50	0.02028	590964.63	4141989.25	0.01732
590965.56	4141951.75	0.01475	590947.19	4141956.25	0.01400
590944.44	4141980.75	0.01535	590864.94	4142388.00	0.19233
590854.12	4142373.75	0.14551	590804.25	4142384.00	0.11337
590789.75	4142385.00	0.09755	590777.00	4142386.75	0.08462
590761.88	4142387.25	0.06701	590747.88	4142390.50	0.05510
590736.94	4142390.00	0.04487	590724.94	4142389.75	0.03710
590688.75	4142442.50	0.03744	590683.81	4142430.00	0.03204
590687.81	4142456.25	0.04232	590687.81	4142473.25	0.05078
590690.94	4142486.75	0.06193	590690.75	4142504.75	0.07233
590730.31	4142593.50	0.15755	590618.38	4142553.50	0.03749
590613.44	4142595.25	0.04243	590570.94	4142579.50	0.02790
590686.12	4142609.00	0.09414	590657.00	4142612.75	0.06893
590623.94	4142620.00	0.05041	590638.38	4142620.25	0.05775
590661.31	4142594.50	0.07027	590646.25	4142597.25	0.05969
590630.06	4142595.50	0.05002	590660.25	4142665.25	0.06710
590639.81	4142681.50	0.05726	590628.56	4142681.00	0.05337
590617.75	4142685.25	0.04959	590608.38	4142686.25	0.04665
590675.69	4142678.50	0.06973	590689.81	4142688.25	0.07034
590686.12	4142722.00	0.06102	590663.81	4142736.50	0.05501
590645.81	4142735.00	0.05229	590632.25	4142738.00	0.04939
590612.38	4142734.75	0.04559	590612.81	4142725.75	0.04626
590627.63	4142717.00	0.05044	590655.62	4142716.00	0.05703

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.31678	591096.19	4142502.50	0.33470
591077.50	4142507.75	0.35196	591058.50	4142513.50	0.36585
591040.25	4142518.75	0.37787	591020.06	4142524.50	0.38752
591001.44	4142531.00	0.38793	590982.75	4142537.00	0.38602
591138.44	4142481.25	0.31439	591143.00	4142499.50	0.25659
591148.31	4142518.50	0.21050	591123.19	4142520.00	0.24446
591104.19	4142525.75	0.26078	591084.75	4142531.50	0.27630
591065.75	4142537.00	0.29044	591046.69	4142542.00	0.30436
591027.31	4142548.50	0.31234	591009.00	4142554.75	0.31634
591152.13	4142551.50	0.15988	591156.31	4142570.50	0.13682
591127.38	4142566.50	0.16636	591109.12	4142572.50	0.17674
591090.06	4142577.00	0.18983	591070.69	4142583.50	0.20031
591052.81	4142588.50	0.21045	591032.25	4142595.00	0.21936
591145.25	4142587.00	0.13088	591126.25	4142592.25	0.14055
591107.19	4142597.75	0.15050	591088.94	4142603.00	0.16021
591068.38	4142609.50	0.17020	590876.62	4142572.25	0.31116
590899.06	4142588.50	0.29082	590920.75	4142605.25	0.26425
590939.75	4142624.25	0.23270	590960.31	4142642.25	0.20243
590980.50	4142658.50	0.17491	591001.44	4142676.50	0.14841
591031.13	4142698.00	0.11890	590848.06	4142584.25	0.27993
590851.88	4142600.75	0.26002	590874.31	4142614.75	0.25019
590893.75	4142635.00	0.22795	590912.75	4142654.00	0.20443
590932.56	4142671.75	0.18134	590952.69	4142690.00	0.15826
590971.38	4142709.50	0.13600	590850.38	4142666.00	0.19556
590870.50	4142683.75	0.18189	590892.56	4142700.25	0.16609
590912.38	4142714.00	0.15141	590827.50	4142693.25	0.17241
590854.56	4142720.25	0.15588	590878.12	4142740.25	0.14038
590900.19	4142759.25	0.12487	590773.12	4142713.00	0.15056
590789.50	4142724.00	0.14891	590823.75	4142755.50	0.13629
590844.25	4142774.50	0.12547	590738.50	4142741.75	0.13018
590751.06	4142755.25	0.12830	590765.50	4142767.25	0.12656
590773.50	4142678.25	0.16818	590755.25	4142678.00	0.16251
590742.25	4142679.50	0.15723	590726.69	4142679.00	0.15171
590689.38	4142171.50	0.02122	590682.94	4142157.00	0.01992
590678.75	4142139.75	0.01895	590724.75	4142165.25	0.02438
590754.81	4142160.50	0.02775	590784.12	4142156.25	0.03185
590816.50	4142153.50	0.03731	590841.62	4142151.75	0.04206
590836.25	4142126.50	0.03741	590805.06	4142129.25	0.03284
590776.94	4142134.25	0.02903	590743.44	4142139.00	0.02499
590714.50	4142141.00	0.02211	590899.44	4142140.25	0.05281

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.06162	590959.94	4142127.00	0.07134
590986.94	4142116.25	0.08101	590896.75	4142119.00	0.04746
590927.62	4142112.75	0.05448	590955.00	4142103.25	0.06139
590970.25	4142092.25	0.06408	590983.94	4142082.50	0.06649
590987.75	4142065.25	0.06226	591000.69	4142098.00	0.08062
591014.38	4142069.75	0.07546	590780.75	4142100.75	0.02712
590806.56	4142102.25	0.03035	590843.12	4142099.50	0.03475
590875.50	4142093.75	0.03881	590907.44	4142090.75	0.04458
590943.19	4142081.25	0.05169	591504.00	4142382.25	0.04275
591537.81	4142385.00	0.03629	591459.56	4141782.25	0.08881
591491.44	4141786.50	0.09391	591523.31	4141787.00	0.09713
591550.81	4141786.50	0.09917	591580.31	4141787.00	0.10143
591608.81	4141787.50	0.10323	591638.25	4141792.75	0.10645
591668.69	4141802.50	0.11052	591009.56	4142041.75	0.06259
590998.12	4142018.75	0.05211	590991.25	4141992.00	0.04435
590982.06	4141965.50	0.03784	590979.75	4142038.50	0.05211
590972.88	4142015.50	0.04518	590964.63	4141989.25	0.03872
590965.56	4141951.75	0.03325	590947.19	4141956.25	0.03135
590944.44	4141980.75	0.03415	590864.94	4142388.00	0.30108
590854.12	4142373.75	0.23373	590804.25	4142384.00	0.17688
590789.75	4142385.00	0.15367	590777.00	4142386.75	0.13504
590761.88	4142387.25	0.11084	590747.88	4142390.50	0.09430
590736.94	4142390.00	0.08044	590724.94	4142389.75	0.06953
590688.75	4142442.50	0.06921	590683.81	4142430.00	0.06124
590687.81	4142456.25	0.07610	590687.81	4142473.25	0.08789
590690.94	4142486.75	0.10313	590690.75	4142504.75	0.11797
590730.31	4142593.50	0.23572	590618.38	4142553.50	0.07193
590613.44	4142595.25	0.08049	590570.94	4142579.50	0.05662
590686.12	4142609.00	0.15625	590657.00	4142612.75	0.12097
590623.94	4142620.00	0.09348	590638.38	4142620.25	0.10474
590661.31	4142594.50	0.12186	590646.25	4142597.25	0.10671
590630.06	4142595.50	0.09221	590660.25	4142665.25	0.12217
590639.81	4142681.50	0.10709	590628.56	4142681.00	0.10053
590617.75	4142685.25	0.09440	590608.38	4142686.25	0.08948
590675.69	4142678.50	0.12867	590689.81	4142688.25	0.13248
590686.12	4142722.00	0.12054	590663.81	4142736.50	0.10909
590645.81	4142735.00	0.10275	590632.25	4142738.00	0.09710
590612.38	4142734.75	0.08956	590612.81	4142725.75	0.09034
590627.63	4142717.00	0.09748	590655.62	4142716.00	0.11004

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (43848 HRS) RESULTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
DPM	1ST HIGHEST VALUE IS	0.20771 AT	(591001.44, 4142531.00, 0.00, 1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.20666 AT	(590982.75, 4142537.00, 0.00, 1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.20663 AT	(591020.06, 4142524.50, 0.00, 1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.20024 AT	(591040.25, 4142518.75, 0.00, 1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.19235 AT	(591058.50, 4142513.50, 0.00, 1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.18306 AT	(591077.50, 4142507.75, 0.00, 1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.17355 AT	(591009.00, 4142554.75, 0.00, 1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.17186 AT	(591096.19, 4142502.50, 0.00, 1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.17047 AT	(591027.31, 4142548.50, 0.00, 1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.16473 AT	(591046.69, 4142542.00, 0.00, 1.50)	DC	NA
FUGPM	1ST HIGHEST VALUE IS	0.19233 AT	(590864.94, 4142388.00, 0.00, 1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.18090 AT	(591020.06, 4142524.50, 0.00, 1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.18022 AT	(591001.44, 4142531.00, 0.00, 1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.17937 AT	(590982.75, 4142537.00, 0.00, 1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.17763 AT	(591040.25, 4142518.75, 0.00, 1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.17351 AT	(591058.50, 4142513.50, 0.00, 1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.16890 AT	(591077.50, 4142507.75, 0.00, 1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.16284 AT	(591096.19, 4142502.50, 0.00, 1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.16178 AT	(591138.44, 4142481.25, 0.00, 1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.15755 AT	(590730.31, 4142593.50, 0.00, 1.50)	DC	NA
ALL	1ST HIGHEST VALUE IS	0.38793 AT	(591001.44, 4142531.00, 0.00, 1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.38752 AT	(591020.06, 4142524.50, 0.00, 1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.38602 AT	(590982.75, 4142537.00, 0.00, 1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.37787 AT	(591040.25, 4142518.75, 0.00, 1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.36585 AT	(591058.50, 4142513.50, 0.00, 1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.35196 AT	(591077.50, 4142507.75, 0.00, 1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.33470 AT	(591096.19, 4142502.50, 0.00, 1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.31678 AT	(591115.94, 4142496.00, 0.00, 1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.31634 AT	(591009.00, 4142554.75, 0.00, 1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.31439 AT	(591138.44, 4142481.25, 0.00, 1.50)	DC	NA

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

CONC RURAL FLAT FLGPOL DFAULT

*** Message Summary : ISCST3 Model Execution ***

--------- Summary of Total Messages --------

A Total of 0 Fatal Error Message(s)
A Total of 0 Warning Message(s)
A Total of 121 Informational Message(s)

A Total of 121 Calm Hours Identified

******** FATAL ERROR MESSAGES ********
*** NONE ***

******** WARNING MESSAGES ********
*** NONE ***

****
*** ISCST3 Finishes Successfully ***
****

2018 DPM & Fugitive PM2.5 Model Input/Output- Residential Receptors

```
**
****************************************
**
** ISCST3 Input Produced by:
** AERMOD View Ver. 9.1.0
** Lakes Environmental Software Inc.
** Date: 10/27/2016
** File: G:\Projects\I&R\Topgolf\Model\Topgolf-Const-2018.INP
**
****************************************
**
**
****************************************
** ISCST3 Control Pathway
****************************************
**
**
CO STARTING
   TITLEONE TopGolf-2018 Construction DPM/PM2.5, 1996-2000 Alviso Met Data
   TITLETWO Residential Receptors
   MODELOPT DFAULT CONC  RURAL
   AVERTIME PERIOD
   POLLUTID OTHER
   TERRHGTS FLAT
   FLAGPOLE 1.50
   RUNORNOT RUN
   ERRORFIL TOPGOL~2.ERR
CO FINISHED
**
****************************************
** ISCST3 Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION A1A_DPM      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A -2018 DPM
   LOCATION A1A_FUG      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A - 2018 Fugitive PM2.5
   LOCATION A1B_DPM      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B -2018 DPM
   LOCATION A1B_FUG      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B - 2018 Fugitive PM2.5
   LOCATION TG_DPM       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2018 DPM
   LOCATION TG_FUG       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2018 Fugitive PM2.5
** Source Parameters **
   SRCPARAM A1A_DPM       3.07E-07     6.000        10
   AREAVERT A1A_DPM      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_DPM      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_DPM      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_DPM      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_DPM      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1A_FUG       6.25E-08     2.000        10     0.000
   AREAVERT A1A_FUG      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_FUG      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_FUG      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_FUG      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_FUG      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1B_DPM       3.07E-07     6.000         6
   AREAVERT A1B_DPM      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_DPM      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_DPM      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM A1B_FUG       6.25E-08     2.000         6     0.000
   AREAVERT A1B_FUG      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_FUG      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_FUG      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM TG_DPM        2.68E-07     6.000        10
   AREAVERT TG_DPM       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_DPM       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_DPM       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_DPM       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_DPM       591226.892 4142337.693 591256.845 4142288.678
   SRCPARAM TG_FUG         9.5E-09     2.000        10     0.000
   AREAVERT TG_FUG       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_FUG       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_FUG       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_FUG       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_FUG       591226.892 4142337.693 591256.845 4142288.678

** Variable Emissions Type: "By Hour-of-Day (HROFDY)"
** Variable Emission Scenario: "7am-4pm"
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
```

```
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_DPM       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_FUG       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   SRCGROUP DPM      A1A_DPM A1B_DPM TG_DPM
   SRCGROUP FugPM    A1A_FUG A1B_FUG TG_FUG
   SRCGROUP ALL
SO FINISHED
**
****************************************
** ISCST3 Receptor Pathway
****************************************
**
**
RE STARTING
** DESCRREC "" ""
   DISCCART    591115.96   4142496.03    1.50
   DISCCART    591096.17   4142502.50    1.50
   DISCCART    591077.52   4142507.82    1.50
   DISCCART    591058.50   4142513.53    1.50
   DISCCART    591040.23   4142518.86    1.50
   DISCCART    591020.07   4142524.57    1.50
   DISCCART    591001.42   4142531.04    1.50
   DISCCART    590982.77   4142537.12    1.50
   DISCCART    591138.41   4142481.19    1.50
   DISCCART    591142.97   4142499.45    1.50
   DISCCART    591148.30   4142518.48    1.50
   DISCCART    591123.19   4142520.00    1.50
   DISCCART    591104.16   4142525.71    1.50
   DISCCART    591084.75   4142531.42    1.50
   DISCCART    591065.73   4142537.12    1.50
   DISCCART    591046.70   4142542.07    1.50
   DISCCART    591027.30   4142548.54    1.50
   DISCCART    591009.03   4142554.63    1.50
   DISCCART    591152.11   4142551.58    1.50
   DISCCART    591156.29   4142570.61    1.50
   DISCCART    591127.37   4142566.42    1.50
   DISCCART    591109.11   4142572.51    1.50
   DISCCART    591090.08   4142577.08    1.50
   DISCCART    591070.68   4142583.55    1.50
   DISCCART    591052.79   4142588.50    1.50
   DISCCART    591032.24   4142594.96    1.50
   DISCCART    591145.26   4142586.97    1.50
   DISCCART    591126.23   4142592.30    1.50
   DISCCART    591107.21   4142597.63    1.50
   DISCCART    591088.94   4142602.95    1.50
   DISCCART    591068.39   4142609.42    1.50
   DISCCART    590876.61   4142572.13    1.50
   DISCCART    590899.06   4142588.50    1.50
   DISCCART    590920.75   4142605.24    1.50
   DISCCART    590939.78   4142624.26    1.50
   DISCCART    590960.32   4142642.15    1.50
   DISCCART    590980.49   4142658.51    1.50
   DISCCART    591001.42   4142676.40    1.50
   DISCCART    591031.10   4142698.09    1.50
   DISCCART    590848.07   4142584.31    1.50
   DISCCART    590851.87   4142600.67    1.50
   DISCCART    590874.33   4142614.75    1.50
   DISCCART    590893.73   4142634.92    1.50
   DISCCART    590912.76   4142653.94    1.50
   DISCCART    590932.55   4142671.83    1.50
   DISCCART    590952.71   4142690.09    1.50
   DISCCART    590971.36   4142709.50    1.50
   DISCCART    590850.35   4142666.12    1.50
   DISCCART    590870.52   4142683.63    1.50
   DISCCART    590892.59   4142700.37    1.50
   DISCCART    590912.38   4142714.07    1.50
   DISCCART    590827.52   4142693.14    1.50
   DISCCART    590854.54   4142720.16    1.50
   DISCCART    590878.13   4142740.32    1.50
   DISCCART    590900.20   4142759.35    1.50
   DISCCART    590773.11   4142712.93    1.50
   DISCCART    590789.47   4142723.96    1.50
   DISCCART    590823.72   4142755.54    1.50
   DISCCART    590844.26   4142774.57    1.50
   DISCCART    590738.48   4142741.85    1.50
   DISCCART    590751.04   4142755.16    1.50
   DISCCART    590765.50   4142767.34    1.50
   DISCCART    590773.49   4142678.30    1.50
   DISCCART    590755.22   4142677.92    1.50
   DISCCART    590742.28   4142679.44    1.50
   DISCCART    590726.68   4142679.06    1.50
   DISCCART    590689.39   4142171.44    1.50
   DISCCART    590682.92   4142156.98    1.50
   DISCCART    590678.74   4142139.86    1.50
   DISCCART    590724.78   4142165.35    1.50
   DISCCART    590754.84   4142160.41    1.50
```

```
   DISCCART    590784.14   4142156.22    1.50
   DISCCART    590816.49   4142153.56    1.50
   DISCCART    590841.60   4142151.66    1.50
   DISCCART    590836.27   4142126.54    1.50
   DISCCART    590805.07   4142129.20    1.50
   DISCCART    590776.91   4142134.15    1.50
   DISCCART    590743.43   4142139.10    1.50
   DISCCART    590714.51   4142141.00    1.50
   DISCCART    590899.44   4142140.24    1.50
   DISCCART    590929.12   4142137.96    1.50
   DISCCART    590959.94   4142126.92    1.50
   DISCCART    590986.96   4142116.27    1.50
   DISCCART    590896.78   4142118.93    1.50
   DISCCART    590927.60   4142112.84    1.50
   DISCCART    590955.00   4142103.33    1.50
   DISCCART    590970.22   4142092.29    1.50
   DISCCART    590983.92   4142082.40    1.50
   DISCCART    590987.72   4142065.28    1.50
   DISCCART    591000.66   4142098.00    1.50
   DISCCART    591014.36   4142069.84    1.50
   DISCCART    590780.72   4142100.67    1.50
   DISCCART    590806.59   4142102.19    1.50
   DISCCART    590843.12   4142099.52    1.50
   DISCCART    590875.47   4142093.82    1.50
   DISCCART    590907.43   4142090.77    1.50
   DISCCART    590943.20   4142081.26    1.50
   DISCCART    591503.99   4142382.16    1.50
   DISCCART    591537.80   4142385.06    1.50
   DISCCART    591459.55   4141782.24    1.50
   DISCCART    591491.43   4141786.59    1.50
   DISCCART    591523.31   4141787.07    1.50
   DISCCART    591550.84   4141786.59    1.50
   DISCCART    591580.31   4141787.07    1.50
   DISCCART    591608.81   4141787.56    1.50
   DISCCART    591638.27   4141792.87    1.50
   DISCCART    591668.70   4141802.53    1.50
   DISCCART    591009.59   4142041.64    1.50
   DISCCART    590998.13   4142018.71    1.50
   DISCCART    590991.25   4141992.10    1.50
   DISCCART    590982.07   4141965.50    1.50
   DISCCART    590979.78   4142038.43    1.50
   DISCCART    590972.90   4142015.49    1.50
   DISCCART    590964.64   4141989.35    1.50
   DISCCART    590965.56   4141951.73    1.50
   DISCCART    590947.21   4141956.32    1.50
   DISCCART    590944.46   4141980.63    1.50
   DISCCART    590864.92   4142387.88    1.50
   DISCCART    590854.14   4142373.71    1.50
   DISCCART    590804.24   4142384.03    1.50
   DISCCART    590789.77   4142384.95    1.50
   DISCCART    590776.99   4142386.80    1.50
   DISCCART    590761.90   4142387.26    1.50
   DISCCART    590747.89   4142390.50    1.50
   DISCCART    590736.95   4142389.88    1.50
   DISCCART    590724.94   4142389.73    1.50
   DISCCART    590688.75   4142442.54    1.50
   DISCCART    590683.83   4142430.07    1.50
   DISCCART    590687.83   4142456.25    1.50
   DISCCART    590687.83   4142473.34    1.50
   DISCCART    590690.91   4142486.74    1.50
   DISCCART    590690.76   4142504.76    1.50
   DISCCART    590730.33   4142593.61    1.50
   DISCCART    590618.38   4142553.42    1.50
   DISCCART    590613.45   4142595.30    1.50
   DISCCART    590570.95   4142579.59    1.50
   DISCCART    590686.14   4142609.00    1.50
   DISCCART    590657.03   4142612.85    1.50
   DISCCART    590623.93   4142620.09    1.50
   DISCCART    590638.40   4142620.25    1.50
   DISCCART    590661.34   4142594.53    1.50
   DISCCART    590646.25   4142597.15    1.50
   DISCCART    590630.09   4142595.61    1.50
   DISCCART    590660.27   4142665.21    1.50
   DISCCART    590639.79   4142681.38    1.50
   DISCCART    590628.55   4142681.07    1.50
   DISCCART    590617.77   4142685.23    1.50
   DISCCART    590608.37   4142686.15    1.50
   DISCCART    590675.67   4142678.45    1.50
   DISCCART    590689.83   4142688.31    1.50
   DISCCART    590686.14   4142721.88    1.50
   DISCCART    590663.81   4142736.51    1.50
   DISCCART    590645.79   4142735.12    1.50
   DISCCART    590632.24   4142737.89    1.50
   DISCCART    590612.38   4142734.66    1.50
   DISCCART    590612.84   4142725.73    1.50
   DISCCART    590627.62   4142716.95    1.50
   DISCCART    590655.65   4142716.03    1.50
RE FINISHED
**
****************************************
** ISCST3 Meteorology Pathway
****************************************
**
**
ME STARTING
   INPUTFIL C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
```

```
   ANEMHGHT 10 METERS
   SURFDATA 7905 1996
   UAIRDATA 7905 1996
ME FINISHED
**
****************************************
** ISCST3 Output Pathway
****************************************
**
**
OU STARTING
** Auto-Generated Plotfiles
   PLOTFILE PERIOD ALL TOPGOL~2.IS\PE00GALL.PLT 31
   PLOTFILE PERIOD DPM TOPGOL~2.IS\PE00G001.PLT 32
   PLOTFILE PERIOD FugPM TOPGOL~2.IS\PE00G002.PLT 33
OU FINISHED

***********************************
*** SETUP Finishes Successfully ***
***********************************
```

```
**MODELOPTs:
CONC                    RURAL FLAT  FLGPOL DFAULT

                                      ***     MODEL SETUP OPTIONS SUMMARY       ***
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

**Intermediate Terrain Processing is Selected

**Model Is Setup For Calculation of Average CONCentration Values.

  --  SCAVENGING/DEPOSITION LOGIC --
**Model Uses NO DRY DEPLETION.  DDPLETE =  F
**Model Uses NO WET DEPLETION.  WDPLETE =  F
**NO WET SCAVENGING Data Provided.
**NO GAS DRY DEPOSITION Data Provided.
**Model Does NOT Use GRIDDED TERRAIN Data for Depletion Calculations

**Model Uses RURAL Dispersion.

**Model Uses Regulatory DEFAULT Options:
           1. Final Plume Rise.
           2. Stack-tip Downwash.
           3. Buoyancy-induced Dispersion.
           4. Use Calms Processing Routine.
           5. Not Use Missing Data Processing Routine.
           6. Default Wind Profile Exponents.
           7. Default Vertical Potential Temperature Gradients.
           8. "Upper Bound" Values for Supersquat Buildings.
           9. No Exponential Decay for RURAL Mode

**Model Assumes Receptors on FLAT Terrain.

**Model Accepts FLAGPOLE Receptor Heights.

**Model Calculates PERIOD Averages Only

**This Run Includes:     6 Source(s);      3 Source Group(s); and     158 Receptor(s)

**The Model Assumes A Pollutant Type of:  OTHER

**Model Set To Continue RUNning After the Setup Testing.

**Output Options Selected:
         Model Outputs Tables of PERIOD Averages by Receptor
         Model Outputs External File(s) of High Values for Plotting (PLOTFILE Keyword)

**NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                m for Missing Hours
                                                                b for Both Calm and Missing Hours

**Misc. Inputs:  Anem. Hgt. (m) =    10.00 ;    Decay Coef. =    0.000     ;    Rot. Angle =     0.0
                 Emission Units = GRAMS/SEC                                ;  Emission Rate Unit Factor =   0.10000E+07
                 Output Units   = MICROGRAMS/M**3

**Approximate Storage Requirements of Model =     1.2 MB of RAM.

**Input Runstream File:          Topgolf-Const-2018.INP
**Output Print File:             Topgolf-Const-2018.OUT
**Detailed Error/Message File:   TOPGOL~2.ERR
```

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** AREAPOLY SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (GRAMS/SEC /METER**2)	LOCATION OF AREA X (METERS)	Y (METERS)	BASE ELEV. (METERS)	RELEASE HEIGHT (METERS)	NUMBER OF VERTS.	INIT. SZ (METERS)	EMISSION RATE SCALAR VARY BY
A1A_DPM	0	0.30700E-06	590982.4	4142485.5	0.0	6.00	10	0.00	HROFDY
A1A_FUG	0	0.62500E-07	590982.4	4142485.5	0.0	2.00	10	0.00	HROFDY
A1B_DPM	0	0.30700E-06	591301.5	4142218.8	0.0	6.00	6	0.00	HROFDY
A1B_FUG	0	0.62500E-07	591301.5	4142218.8	0.0	2.00	6	0.00	HROFDY
TG_DPM	0	0.26800E-06	591150.6	4142203.2	0.0	6.00	10	0.00	HROFDY
TG_FUG	0	0.95000E-08	591150.6	4142203.2	0.0	2.00	10	0.00	HROFDY

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
DPM	A1A_DPM , A1B_DPM , TG_DPM ,
FUGPM	A1A_FUG , A1B_FUG , TG_FUG ,
ALL	A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = A1A_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1A_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = TG_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = TG_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591115.9,	4142496.0,	0.0,	1.5);	(591096.2,	4142502.5,	0.0,	1.5);
(591077.5,	4142507.8,	0.0,	1.5);	(591058.5,	4142513.5,	0.0,	1.5);
(591040.3,	4142518.8,	0.0,	1.5);	(591020.1,	4142524.5,	0.0,	1.5);
(591001.4,	4142531.0,	0.0,	1.5);	(590982.8,	4142537.0,	0.0,	1.5);
(591138.4,	4142481.3,	0.0,	1.5);	(591143.0,	4142499.5,	0.0,	1.5);
(591148.3,	4142518.5,	0.0,	1.5);	(591123.2,	4142520.0,	0.0,	1.5);
(591104.2,	4142525.8,	0.0,	1.5);	(591084.8,	4142531.5,	0.0,	1.5);
(591065.8,	4142537.0,	0.0,	1.5);	(591046.7,	4142542.0,	0.0,	1.5);
(591027.3,	4142548.5,	0.0,	1.5);	(591009.0,	4142554.8,	0.0,	1.5);
(591152.1,	4142551.5,	0.0,	1.5);	(591156.3,	4142570.5,	0.0,	1.5);
(591127.4,	4142566.5,	0.0,	1.5);	(591109.1,	4142572.5,	0.0,	1.5);
(591090.1,	4142577.0,	0.0,	1.5);	(591070.7,	4142583.5,	0.0,	1.5);
(591052.8,	4142588.5,	0.0,	1.5);	(591032.2,	4142595.0,	0.0,	1.5);
(591145.3,	4142587.0,	0.0,	1.5);	(591126.3,	4142592.2,	0.0,	1.5);
(591107.2,	4142597.8,	0.0,	1.5);	(591088.9,	4142603.0,	0.0,	1.5);
(591068.4,	4142609.5,	0.0,	1.5);	(590876.6,	4142572.2,	0.0,	1.5);
(590899.1,	4142588.5,	0.0,	1.5);	(590920.8,	4142605.2,	0.0,	1.5);
(590939.8,	4142624.2,	0.0,	1.5);	(590960.3,	4142642.2,	0.0,	1.5);
(590980.5,	4142658.5,	0.0,	1.5);	(591001.4,	4142676.5,	0.0,	1.5);
(591031.1,	4142698.0,	0.0,	1.5);	(590848.1,	4142584.2,	0.0,	1.5);
(590851.9,	4142600.8,	0.0,	1.5);	(590874.3,	4142614.8,	0.0,	1.5);
(590893.8,	4142635.0,	0.0,	1.5);	(590912.8,	4142654.0,	0.0,	1.5);
(590932.6,	4142671.8,	0.0,	1.5);	(590952.7,	4142690.0,	0.0,	1.5);
(590971.4,	4142709.5,	0.0,	1.5);	(590850.4,	4142666.0,	0.0,	1.5);
(590870.5,	4142683.8,	0.0,	1.5);	(590892.6,	4142700.2,	0.0,	1.5);
(590912.4,	4142714.0,	0.0,	1.5);	(590827.5,	4142693.2,	0.0,	1.5);
(590854.6,	4142720.2,	0.0,	1.5);	(590878.1,	4142740.2,	0.0,	1.5);
(590900.2,	4142759.2,	0.0,	1.5);	(590773.1,	4142713.0,	0.0,	1.5);
(590789.5,	4142724.0,	0.0,	1.5);	(590823.8,	4142755.5,	0.0,	1.5);
(590844.2,	4142774.5,	0.0,	1.5);	(590738.5,	4142741.8,	0.0,	1.5);
(590751.1,	4142755.2,	0.0,	1.5);	(590765.5,	4142767.3,	0.0,	1.5);
(590773.5,	4142678.3,	0.0,	1.5);	(590755.2,	4142678.0,	0.0,	1.5);
(590742.2,	4142679.5,	0.0,	1.5);	(590726.7,	4142679.0,	0.0,	1.5);
(590689.4,	4142171.5,	0.0,	1.5);	(590682.9,	4142157.0,	0.0,	1.5);
(590678.8,	4142139.8,	0.0,	1.5);	(590724.8,	4142165.2,	0.0,	1.5);
(590754.8,	4142160.5,	0.0,	1.5);	(590784.1,	4142156.2,	0.0,	1.5);
(590816.5,	4142153.5,	0.0,	1.5);	(590841.6,	4142151.8,	0.0,	1.5);
(590836.2,	4142126.5,	0.0,	1.5);	(590805.1,	4142129.2,	0.0,	1.5);
(590776.9,	4142134.2,	0.0,	1.5);	(590743.4,	4142139.0,	0.0,	1.5);
(590714.5,	4142141.0,	0.0,	1.5);	(590899.4,	4142140.2,	0.0,	1.5);
(590929.1,	4142138.0,	0.0,	1.5);	(590959.9,	4142127.0,	0.0,	1.5);
(590986.9,	4142116.2,	0.0,	1.5);	(590896.8,	4142119.0,	0.0,	1.5);
(590927.6,	4142112.8,	0.0,	1.5);	(590955.0,	4142103.2,	0.0,	1.5);
(590970.3,	4142092.2,	0.0,	1.5);	(590983.9,	4142082.5,	0.0,	1.5);
(590987.8,	4142065.2,	0.0,	1.5);	(591000.7,	4142098.0,	0.0,	1.5);

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591014.4,	4142069.8,	0.0,	1.5);	(590780.8,	4142100.8,	0.0,	1.5);
(590806.6,	4142102.2,	0.0,	1.5);	(590843.1,	4142099.5,	0.0,	1.5);
(590875.5,	4142093.8,	0.0,	1.5);	(590907.4,	4142090.8,	0.0,	1.5);
(590943.2,	4142081.3,	0.0,	1.5);	(591504.0,	4142382.2,	0.0,	1.5);
(591537.8,	4142385.0,	0.0,	1.5);	(591459.6,	4141782.3,	0.0,	1.5);
(591491.4,	4141786.5,	0.0,	1.5);	(591523.3,	4141787.0,	0.0,	1.5);
(591550.8,	4141786.5,	0.0,	1.5);	(591580.3,	4141787.0,	0.0,	1.5);
(591608.8,	4141787.5,	0.0,	1.5);	(591638.2,	4141792.8,	0.0,	1.5);
(591668.7,	4141802.5,	0.0,	1.5);	(591009.6,	4142041.8,	0.0,	1.5);
(590998.1,	4142018.8,	0.0,	1.5);	(590991.2,	4141992.0,	0.0,	1.5);
(590982.1,	4141965.5,	0.0,	1.5);	(590979.8,	4142038.5,	0.0,	1.5);
(590972.9,	4142015.5,	0.0,	1.5);	(590964.6,	4141989.2,	0.0,	1.5);
(590965.6,	4141951.8,	0.0,	1.5);	(590947.2,	4141956.2,	0.0,	1.5);
(590944.4,	4141980.8,	0.0,	1.5);	(590864.9,	4142388.0,	0.0,	1.5);
(590854.1,	4142373.8,	0.0,	1.5);	(590804.2,	4142384.0,	0.0,	1.5);
(590789.8,	4142385.0,	0.0,	1.5);	(590777.0,	4142386.8,	0.0,	1.5);
(590761.9,	4142387.2,	0.0,	1.5);	(590747.9,	4142390.5,	0.0,	1.5);
(590736.9,	4142390.0,	0.0,	1.5);	(590724.9,	4142389.8,	0.0,	1.5);
(590688.8,	4142442.5,	0.0,	1.5);	(590683.8,	4142430.0,	0.0,	1.5);
(590687.8,	4142456.3,	0.0,	1.5);	(590687.8,	4142473.2,	0.0,	1.5);
(590690.9,	4142486.8,	0.0,	1.5);	(590690.8,	4142504.8,	0.0,	1.5);
(590730.3,	4142593.5,	0.0,	1.5);	(590618.4,	4142553.5,	0.0,	1.5);
(590613.4,	4142595.3,	0.0,	1.5);	(590570.9,	4142579.5,	0.0,	1.5);
(590686.1,	4142609.0,	0.0,	1.5);	(590657.0,	4142612.8,	0.0,	1.5);
(590623.9,	4142620.0,	0.0,	1.5);	(590638.4,	4142620.2,	0.0,	1.5);
(590661.3,	4142594.5,	0.0,	1.5);	(590646.3,	4142597.2,	0.0,	1.5);
(590630.1,	4142595.5,	0.0,	1.5);	(590660.2,	4142665.3,	0.0,	1.5);
(590639.8,	4142681.5,	0.0,	1.5);	(590628.6,	4142681.0,	0.0,	1.5);
(590617.8,	4142685.2,	0.0,	1.5);	(590608.4,	4142686.2,	0.0,	1.5);
(590675.7,	4142678.5,	0.0,	1.5);	(590689.8,	4142688.2,	0.0,	1.5);
(590686.1,	4142722.0,	0.0,	1.5);	(590663.8,	4142736.5,	0.0,	1.5);
(590645.8,	4142735.0,	0.0,	1.5);	(590632.2,	4142738.0,	0.0,	1.5);
(590612.4,	4142734.8,	0.0,	1.5);	(590612.8,	4142725.8,	0.0,	1.5);
(590627.6,	4142717.0,	0.0,	1.5);	(590655.6,	4142716.0,	0.0,	1.5);

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

```
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1
```

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

*** WIND PROFILE EXPONENTS ***

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
B	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
C	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00
D	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00
E	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00
F	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00

*** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
(DEGREES KELVIN PER METER)

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
B	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
C	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
D	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
E	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01
F	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

FILE: C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
FORMAT: (4I2,2F9.4,F6.1,I2,2F7.1,f9.4,f10.1,f8.4,i4,f7.2)
SURFACE STATION NO.: 7905 UPPER AIR STATION NO.: 7905
NAME: UNKNOWN NAME: UNKNOWN
YEAR: 1996 YEAR: 1996

YR	MN	DY	HR	FLOW VECTOR	SPEED (M/S)	TEMP (K)	STAB CLASS	MIXING HEIGHT (M) RURAL	MIXING HEIGHT (M) URBAN	USTAR (M/S)	M-O LENGTH (M)	Z-0 (M)	IPCODE	PRATE (mm/HR)
96	01	01	01	212.7	1.56	283.5	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	02	186.7	1.03	284.0	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	03	162.3	1.79	284.0	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	04	185.1	1.97	283.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	05	132.3	2.46	283.0	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	06	97.9	4.16	283.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	07	95.8	1.61	284.4	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	08	152.8	3.58	285.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	09	157.8	5.54	288.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	10	158.3	5.01	289.9	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	11	162.5	5.54	291.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	12	161.7	5.72	292.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	13	168.0	6.84	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	14	182.2	6.12	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	15	153.1	5.68	292.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	16	112.6	4.34	291.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	17	134.5	3.84	290.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	18	143.4	4.38	290.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	19	145.1	3.62	290.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	20	161.2	4.83	289.3	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	21	155.0	4.83	289.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	22	105.9	4.25	286.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	23	48.0	2.68	285.6	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	24	89.0	2.46	285.8	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00

*** NOTES: STABILITY CLASS 1=A, 2=B, 3=C, 4=D, 5=E AND 6=F.
FLOW VECTOR IS DIRECTION TOWARD WHICH WIND IS BLOWING.

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.16067	591096.19	4142502.50	0.16440
591077.50	4142507.75	0.16850	591058.50	4142513.50	0.17185
591040.25	4142518.75	0.17484	591020.06	4142524.50	0.17746
591001.44	4142531.00	0.17801	590982.75	4142537.00	0.17877
591138.44	4142481.25	0.16371	591143.00	4142499.50	0.14155
591148.31	4142518.50	0.12072	591123.19	4142520.00	0.13257
591104.19	4142525.75	0.13676	591084.75	4142531.50	0.14078
591065.75	4142537.00	0.14443	591046.69	4142542.00	0.14802
591027.31	4142548.50	0.14978	591009.00	4142554.75	0.15101
591152.13	4142551.50	0.09402	591156.31	4142570.50	0.08093
591127.38	4142566.50	0.09523	591109.12	4142572.50	0.09886
591090.06	4142577.00	0.10334	591070.69	4142583.50	0.10617
591052.81	4142588.50	0.10906	591032.25	4142595.00	0.11162
591145.25	4142587.00	0.07682	591126.25	4142592.25	0.08127
591107.19	4142597.75	0.08524	591088.94	4142603.00	0.08865
591068.38	4142609.50	0.09173	590876.62	4142572.25	0.17090
590899.06	4142588.50	0.15273	590920.75	4142605.25	0.13518
590939.75	4142624.25	0.11824	590960.31	4142642.25	0.10342
590980.50	4142658.50	0.09095	591001.44	4142676.50	0.07883
591031.13	4142698.00	0.06503	590848.06	4142584.25	0.16509
590851.88	4142600.75	0.15154	590874.31	4142614.75	0.13745
590893.75	4142635.00	0.12073	590912.75	4142654.00	0.10662
590932.56	4142671.75	0.09436	590952.69	4142690.00	0.08307
590971.38	4142709.50	0.07262	590850.38	4142666.00	0.10965
590870.50	4142683.75	0.09834	590892.56	4142700.25	0.08834
590912.38	4142714.00	0.08036	590827.50	4142693.25	0.09901
590854.56	4142720.25	0.08503	590878.12	4142740.25	0.07548
590900.19	4142759.25	0.06723	590773.12	4142713.00	0.09535
590789.50	4142724.00	0.08988	590823.75	4142755.50	0.07614
590844.25	4142774.50	0.06867	590738.50	4142741.75	0.08541
590751.06	4142755.25	0.08074	590765.50	4142767.25	0.07661
590773.50	4142678.25	0.11144	590755.25	4142678.00	0.11282
590742.25	4142679.50	0.11239	590726.69	4142679.00	0.11234
590689.38	4142171.50	0.01269	590682.94	4142157.00	0.01183
590678.75	4142139.75	0.01114	590724.75	4142165.25	0.01490
590754.81	4142160.50	0.01717	590784.12	4142156.25	0.01999
590816.50	4142153.50	0.02368	590841.62	4142151.75	0.02694
590836.25	4142126.50	0.02341	590805.06	4142129.25	0.02020
590776.94	4142134.25	0.01769	590743.44	4142139.00	0.01508
590714.50	4142141.00	0.01323	590899.44	4142140.25	0.03449

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.03973	590959.94	4142127.00	0.04389
590986.94	4142116.25	0.04763	590896.75	4142119.00	0.03059
590927.62	4142112.75	0.03459	590955.00	4142103.25	0.03768
590970.25	4142092.25	0.03843	590983.94	4142082.50	0.03911
590987.75	4142065.25	0.03646	591000.69	4142098.00	0.04619
591014.38	4142069.75	0.04238	590780.75	4142100.75	0.01607
590806.56	4142102.25	0.01836	590843.12	4142099.50	0.02160
590875.50	4142093.75	0.02454	590907.44	4142090.75	0.02822
590943.19	4142081.25	0.03190	591504.00	4142382.25	0.02744
591537.81	4142385.00	0.02300	591459.56	4141782.25	0.04041
591491.44	4141786.50	0.04270	591523.31	4141787.00	0.04419
591550.81	4141786.50	0.04518	591580.31	4141787.00	0.04626
591608.81	4141787.50	0.04716	591638.25	4141792.75	0.04869
591668.69	4141802.50	0.05065	591009.56	4142041.75	0.03581
590998.12	4142018.75	0.03043	590991.25	4141992.00	0.02616
590982.06	4141965.50	0.02250	590979.75	4142038.50	0.03083
590972.88	4142015.50	0.02691	590964.63	4141989.25	0.02320
590965.56	4141951.75	0.01996	590947.19	4141956.25	0.01896
590944.44	4141980.75	0.02068	590864.94	4142388.00	0.23267
590854.12	4142373.75	0.18637	590804.25	4142384.00	0.13517
590789.75	4142385.00	0.11338	590777.00	4142386.75	0.09567
590761.88	4142387.25	0.07458	590747.88	4142390.50	0.05982
590736.94	4142390.00	0.04911	590724.94	4142389.75	0.04094
590688.75	4142442.50	0.03831	590683.81	4142430.00	0.03435
590687.81	4142456.25	0.04218	590687.81	4142473.25	0.04958
590690.94	4142486.75	0.05936	590690.75	4142504.75	0.07158
590730.31	4142593.50	0.15601	590618.38	4142553.50	0.04797
590613.44	4142595.25	0.05790	590570.94	4142579.50	0.03724
590686.12	4142609.00	0.12215	590657.00	4142612.75	0.09466
590623.94	4142620.00	0.07090	590638.38	4142620.25	0.08106
590661.31	4142594.50	0.09324	590646.25	4142597.25	0.08081
590630.06	4142595.50	0.06809	590660.25	4142665.25	0.09854
590639.81	4142681.50	0.08543	590628.56	4142681.00	0.07961
590617.75	4142685.25	0.07407	590608.38	4142686.25	0.06957
590675.69	4142678.50	0.10270	590689.81	4142688.25	0.10321
590686.12	4142722.00	0.08988	590663.81	4142736.50	0.08205
590645.81	4142735.00	0.07877	590632.25	4142738.00	0.07473
590612.38	4142734.75	0.06917	590612.81	4142725.75	0.07011
590627.63	4142717.00	0.07632	590655.62	4142716.00	0.08564

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.03687	591096.19	4142502.50	0.03694
591077.50	4142507.75	0.03739	591058.50	4142513.50	0.03771
591040.25	4142518.75	0.03810	591020.06	4142524.50	0.03851
591001.44	4142531.00	0.03849	590982.75	4142537.00	0.03884
591138.44	4142481.25	0.04009	591143.00	4142499.50	0.03198
591148.31	4142518.50	0.02582	591123.19	4142520.00	0.02805
591104.19	4142525.75	0.02842	591084.75	4142531.50	0.02881
591065.75	4142537.00	0.02918	591046.69	4142542.00	0.02960
591027.31	4142548.50	0.02961	591009.00	4142554.75	0.02969
591152.13	4142551.50	0.01886	591156.31	4142570.50	0.01579
591127.38	4142566.50	0.01855	591109.12	4142572.50	0.01899
591090.06	4142577.00	0.01960	591070.69	4142583.50	0.01981
591052.81	4142588.50	0.02010	591032.25	4142595.00	0.02033
591145.25	4142587.00	0.01467	591126.25	4142592.25	0.01538
591107.19	4142597.75	0.01594	591088.94	4142603.00	0.01636
591068.38	4142609.50	0.01666	590876.62	4142572.25	0.04139
590899.06	4142588.50	0.03198	590920.75	4142605.25	0.02593
590939.75	4142624.25	0.02147	590960.31	4142642.25	0.01819
590980.50	4142658.50	0.01577	591001.44	4142676.50	0.01356
591031.13	4142698.00	0.01115	590848.06	4142584.25	0.04131
590851.88	4142600.75	0.03421	590874.31	4142614.75	0.02789
590893.75	4142635.00	0.02261	590912.75	4142654.00	0.01905
590932.56	4142671.75	0.01639	590952.69	4142690.00	0.01420
590971.38	4142709.50	0.01232	590850.38	4142666.00	0.02058
590870.50	4142683.75	0.01757	590892.56	4142700.25	0.01530
590912.38	4142714.00	0.01370	590827.50	4142693.25	0.01826
590854.56	4142720.25	0.01479	590878.12	4142740.25	0.01280
590900.19	4142759.25	0.01126	590773.12	4142713.00	0.01817
590789.50	4142724.00	0.01654	590823.75	4142755.50	0.01311
590844.25	4142774.50	0.01155	590738.50	4142741.75	0.01605
590751.06	4142755.25	0.01475	590765.50	4142767.25	0.01366
590773.50	4142678.25	0.02276	590755.25	4142678.00	0.02361
590742.25	4142679.50	0.02375	590726.69	4142679.00	0.02409
590689.38	4142171.50	0.00227	590682.94	4142157.00	0.00210
590678.75	4142139.75	0.00196	590724.75	4142165.25	0.00268
590754.81	4142160.50	0.00310	590784.12	4142156.25	0.00363
590816.50	4142153.50	0.00430	590841.62	4142151.75	0.00490
590836.25	4142126.50	0.00418	590805.06	4142129.25	0.00360
590776.94	4142134.25	0.00314	590743.44	4142139.00	0.00267
590714.50	4142141.00	0.00234	590899.44	4142140.25	0.00630

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.00720	590959.94	4142127.00	0.00777
590986.94	4142116.25	0.00824	590896.75	4142119.00	0.00551
590927.62	4142112.75	0.00617	590955.00	4142103.25	0.00661
590970.25	4142092.25	0.00665	590983.94	4142082.50	0.00669
590987.75	4142065.25	0.00619	591000.69	4142098.00	0.00784
591014.38	4142069.75	0.00705	590780.75	4142100.75	0.00279
590806.56	4142102.25	0.00321	590843.12	4142099.50	0.00381
590875.50	4142093.75	0.00435	590907.44	4142090.75	0.00500
590943.19	4142081.25	0.00557	591504.00	4142382.25	0.00496
591537.81	4142385.00	0.00407	591459.56	4141782.25	0.00556
591491.44	4141786.50	0.00587	591523.31	4141787.00	0.00608
591550.81	4141786.50	0.00621	591580.31	4141787.00	0.00636
591608.81	4141787.50	0.00649	591638.25	4141792.75	0.00670
591668.69	4141802.50	0.00698	591009.56	4142041.75	0.00596
590998.12	4142018.75	0.00509	590991.25	4141992.00	0.00437
590982.06	4141965.50	0.00375	590979.75	4142038.50	0.00522
590972.88	4142015.50	0.00454	590964.63	4141989.25	0.00391
590965.56	4141951.75	0.00334	590947.19	4141956.25	0.00319
590944.44	4141980.75	0.00350	590864.94	4142388.00	0.06721
590854.12	4142373.75	0.04988	590804.25	4142384.00	0.04055
590789.75	4142385.00	0.03455	590777.00	4142386.75	0.02955
590761.88	4142387.25	0.02252	590747.88	4142390.50	0.01780
590736.94	4142390.00	0.01371	590724.94	4142389.75	0.01070
590688.75	4142442.50	0.01109	590683.81	4142430.00	0.00909
590687.81	4142456.25	0.01299	590687.81	4142473.25	0.01633
590690.94	4142486.75	0.02077	590690.75	4142504.75	0.02491
590730.31	4142593.50	0.05913	590618.38	4142553.50	0.01110
590613.44	4142595.25	0.01294	590570.94	4142579.50	0.00771
590686.12	4142609.00	0.03314	590657.00	4142612.75	0.02309
590623.94	4142620.00	0.01592	590638.38	4142620.25	0.01872
590661.31	4142594.50	0.02370	590646.25	4142597.25	0.01953
590630.06	4142595.50	0.01580	590660.25	4142665.25	0.02187
590639.81	4142681.50	0.01815	590628.56	4142681.00	0.01677
590617.75	4142685.25	0.01539	590608.38	4142686.25	0.01433
590675.69	4142678.50	0.02239	590689.81	4142688.25	0.02203
590686.12	4142722.00	0.01801	590663.81	4142736.50	0.01621
590645.81	4142735.00	0.01564	590632.25	4142738.00	0.01478
590612.38	4142734.75	0.01366	590612.81	4142725.75	0.01396
590627.63	4142717.00	0.01542	590655.62	4142716.00	0.01743

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.19753	591096.19	4142502.50	0.20134
591077.50	4142507.75	0.20588	591058.50	4142513.50	0.20956
591040.25	4142518.75	0.21294	591020.06	4142524.50	0.21597
591001.44	4142531.00	0.21650	590982.75	4142537.00	0.21761
591138.44	4142481.25	0.20379	591143.00	4142499.50	0.17353
591148.31	4142518.50	0.14654	591123.19	4142520.00	0.16062
591104.19	4142525.75	0.16518	591084.75	4142531.50	0.16959
591065.75	4142537.00	0.17361	591046.69	4142542.00	0.17762
591027.31	4142548.50	0.17939	591009.00	4142554.75	0.18070
591152.13	4142551.50	0.11287	591156.31	4142570.50	0.09672
591127.38	4142566.50	0.11379	591109.12	4142572.50	0.11785
591090.06	4142577.00	0.12294	591070.69	4142583.50	0.12598
591052.81	4142588.50	0.12916	591032.25	4142595.00	0.13196
591145.25	4142587.00	0.09149	591126.25	4142592.25	0.09665
591107.19	4142597.75	0.10118	591088.94	4142603.00	0.10501
591068.38	4142609.50	0.10839	590876.62	4142572.25	0.21229
590899.06	4142588.50	0.18471	590920.75	4142605.25	0.16111
590939.75	4142624.25	0.13970	590960.31	4142642.25	0.12161
590980.50	4142658.50	0.10672	591001.44	4142676.50	0.09239
591031.13	4142698.00	0.07618	590848.06	4142584.25	0.20639
590851.88	4142600.75	0.18575	590874.31	4142614.75	0.16534
590893.75	4142635.00	0.14335	590912.75	4142654.00	0.12567
590932.56	4142671.75	0.11075	590952.69	4142690.00	0.09727
590971.38	4142709.50	0.08494	590850.38	4142666.00	0.13023
590870.50	4142683.75	0.11590	590892.56	4142700.25	0.10363
590912.38	4142714.00	0.09406	590827.50	4142693.25	0.11727
590854.56	4142720.25	0.09982	590878.12	4142740.25	0.08828
590900.19	4142759.25	0.07849	590773.12	4142713.00	0.11352
590789.50	4142724.00	0.10641	590823.75	4142755.50	0.08925
590844.25	4142774.50	0.08022	590738.50	4142741.75	0.10146
590751.06	4142755.25	0.09549	590765.50	4142767.25	0.09026
590773.50	4142678.25	0.13420	590755.25	4142678.00	0.13642
590742.25	4142679.50	0.13614	590726.69	4142679.00	0.13643
590689.38	4142171.50	0.01496	590682.94	4142157.00	0.01393
590678.75	4142139.75	0.01310	590724.75	4142165.25	0.01758
590754.81	4142160.50	0.02027	590784.12	4142156.25	0.02362
590816.50	4142153.50	0.02798	590841.62	4142151.75	0.03184
590836.25	4142126.50	0.02759	590805.06	4142129.25	0.02380
590776.94	4142134.25	0.02083	590743.44	4142139.00	0.01775
590714.50	4142141.00	0.01557	590899.44	4142140.25	0.04079

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.04693	590959.94	4142127.00	0.05166
590986.94	4142116.25	0.05587	590896.75	4142119.00	0.03611
590927.62	4142112.75	0.04076	590955.00	4142103.25	0.04429
590970.25	4142092.25	0.04507	590983.94	4142082.50	0.04579
590987.75	4142065.25	0.04265	591000.69	4142098.00	0.05403
591014.38	4142069.75	0.04943	590780.75	4142100.75	0.01885
590806.56	4142102.25	0.02158	590843.12	4142099.50	0.02541
590875.50	4142093.75	0.02889	590907.44	4142090.75	0.03322
590943.19	4142081.25	0.03746	591504.00	4142382.25	0.03240
591537.81	4142385.00	0.02706	591459.56	4141782.25	0.04597
591491.44	4141786.50	0.04857	591523.31	4141787.00	0.05027
591550.81	4141786.50	0.05139	591580.31	4141787.00	0.05262
591608.81	4141787.50	0.05365	591638.25	4141792.75	0.05539
591668.69	4141802.50	0.05762	591009.56	4142041.75	0.04177
590998.12	4142018.75	0.03551	590991.25	4141992.00	0.03052
590982.06	4141965.50	0.02625	590979.75	4142038.50	0.03604
590972.88	4142015.50	0.03145	590964.63	4141989.25	0.02711
590965.56	4141951.75	0.02329	590947.19	4141956.25	0.02215
590944.44	4141980.75	0.02418	590864.94	4142388.00	0.29987
590854.12	4142373.75	0.23625	590804.25	4142384.00	0.17572
590789.75	4142385.00	0.14792	590777.00	4142386.75	0.12522
590761.88	4142387.25	0.09710	590747.88	4142390.50	0.07762
590736.94	4142390.00	0.06282	590724.94	4142389.75	0.05164
590688.75	4142442.50	0.04939	590683.81	4142430.00	0.04344
590687.81	4142456.25	0.05517	590687.81	4142473.25	0.06591
590690.94	4142486.75	0.08013	590690.75	4142504.75	0.09648
590730.31	4142593.50	0.21513	590618.38	4142553.50	0.05907
590613.44	4142595.25	0.07084	590570.94	4142579.50	0.04495
590686.12	4142609.00	0.15529	590657.00	4142612.75	0.11775
590623.94	4142620.00	0.08682	590638.38	4142620.25	0.09978
590661.31	4142594.50	0.11694	590646.25	4142597.25	0.10034
590630.06	4142595.50	0.08390	590660.25	4142665.25	0.12041
590639.81	4142681.50	0.10358	590628.56	4142681.00	0.09637
590617.75	4142685.25	0.08945	590608.38	4142686.25	0.08389
590675.69	4142678.50	0.12510	590689.81	4142688.25	0.12524
590686.12	4142722.00	0.10789	590663.81	4142736.50	0.09826
590645.81	4142735.00	0.09441	590632.25	4142738.00	0.08951
590612.38	4142734.75	0.08284	590612.81	4142725.75	0.08407
590627.63	4142717.00	0.09173	590655.62	4142716.00	0.10308

*** THE SUMMARY OF MAXIMUM PERIOD (43848 HRS) RESULTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)				OF TYPE	NETWORK GRID-ID
DPM	1ST HIGHEST VALUE IS	0.23267 AT (	590864.94,	4142388.00,	0.00,	1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.18637 AT (	590854.12,	4142373.75,	0.00,	1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.17877 AT (	590982.75,	4142537.00,	0.00,	1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.17801 AT (	591001.44,	4142531.00,	0.00,	1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.17746 AT (	591020.06,	4142524.50,	0.00,	1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.17484 AT (	591040.25,	4142518.75,	0.00,	1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.17185 AT (	591058.50,	4142513.50,	0.00,	1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.17090 AT (	590876.62,	4142572.25,	0.00,	1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.16850 AT (	591077.50,	4142507.75,	0.00,	1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.16509 AT (	590848.06,	4142584.25,	0.00,	1.50)	DC	NA
FUGPM	1ST HIGHEST VALUE IS	0.06721 AT (	590864.94,	4142388.00,	0.00,	1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.05913 AT (	590730.31,	4142593.50,	0.00,	1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.04988 AT (	590854.12,	4142373.75,	0.00,	1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.04139 AT (	590876.62,	4142572.25,	0.00,	1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.04131 AT (	590848.06,	4142584.25,	0.00,	1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.04055 AT (	590804.25,	4142384.00,	0.00,	1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.04009 AT (	591138.44,	4142481.25,	0.00,	1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.03884 AT (	590982.75,	4142537.00,	0.00,	1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.03851 AT (	591020.06,	4142524.50,	0.00,	1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.03849 AT (	591001.44,	4142531.00,	0.00,	1.50)	DC	NA
ALL	1ST HIGHEST VALUE IS	0.29987 AT (	590864.94,	4142388.00,	0.00,	1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.23625 AT (	590854.12,	4142373.75,	0.00,	1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.21761 AT (	590982.75,	4142537.00,	0.00,	1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.21650 AT (	591001.44,	4142531.00,	0.00,	1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.21597 AT (	591020.06,	4142524.50,	0.00,	1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.21513 AT (	590730.31,	4142593.50,	0.00,	1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.21294 AT (	591040.25,	4142518.75,	0.00,	1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.21229 AT (	590876.62,	4142572.25,	0.00,	1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.20956 AT (	591058.50,	4142513.50,	0.00,	1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.20639 AT (	590848.06,	4142584.25,	0.00,	1.50)	DC	NA

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

```
**MODELOPTs:
CONC                    RURAL FLAT  FLGPOL DFAULT


*** Message Summary : ISCST3 Model Execution ***

 --------- Summary of Total Messages --------

A Total of            0 Fatal Error Message(s)
A Total of            0 Warning Message(s)
A Total of          121 Informational Message(s)

A Total of          121 Calm Hours Identified


   ******** FATAL ERROR MESSAGES ********
              ***  NONE  ***


   ********   WARNING MESSAGES   ********
              ***  NONE  ***


   ************************************
   *** ISCST3 Finishes Successfully ***
   ************************************
```

2017 DPM & Fugitive PM2.5 Model Input/Output- Residential Receptors - Mitigated Emissions

```
**
****************************************
**
** ISCST3 Input Produced by:
** AERMOD View Ver. 9.1.0
** Lakes Environmental Software Inc.
** Date: 10/27/2016
** File: G:\Projects\I&R\Topgolf\Model\Topgolf-Const-2017-Mitigated.INP
**
****************************************
**
**
****************************************
** ISCST3 Control Pathway
****************************************
**
**
CO STARTING
   TITLEONE TopGolf-2017 Construction DPM/PM2.5, 1996-2000 Alviso Met Data
   TITLETWO Mitigated Emissions - Residential Receptors
   MODELOPT DFAULT CONC  RURAL
   AVERTIME PERIOD
   POLLUTID OTHER
   TERRHGTS FLAT
   FLAGPOLE 1.50
   RUNORNOT RUN
   ERRORFIL TO8F37~1.ERR
CO FINISHED
**
****************************************
** ISCST3 Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION A1A_DPM      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A -2017 Mitigated DPM
   LOCATION A1A_FUG      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A - 2017 Mitigated Fugitive PM2.5
   LOCATION A1B_DPM      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B -2017 Mitigated DPM
   LOCATION A1B_FUG      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B - 2017 Mitigated Fugitive PM2.5
   LOCATION TG_DPM       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2017 Mitigated DPM
   LOCATION TG_FUG       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2017 Mitigated Fugitive PM2.5
** Source Parameters **
   SRCPARAM A1A_DPM       1.92E-09     6.000        10
   AREAVERT A1A_DPM      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_DPM      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_DPM      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_DPM      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_DPM      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1A_FUG       3.21E-08     2.000        10     0.000
   AREAVERT A1A_FUG      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_FUG      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_FUG      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_FUG      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_FUG      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1B_DPM       1.92E-09     6.000         6
   AREAVERT A1B_DPM      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_DPM      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_DPM      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM A1B_FUG       3.21E-08     2.000         6     0.000
   AREAVERT A1B_FUG      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_FUG      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_FUG      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM TG_DPM        7.12E-08     6.000        10
   AREAVERT TG_DPM       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_DPM       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_DPM       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_DPM       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_DPM       591226.892 4142337.693 591256.845 4142288.678
   SRCPARAM TG_FUG        9.66E-08     2.000        10     0.000
   AREAVERT TG_FUG       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_FUG       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_FUG       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_FUG       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_FUG       591226.892 4142337.693 591256.845 4142288.678

** Variable Emissions Type: "By Hour-of-Day (HROFDY)"
** Variable Emission Scenario: "7am-4pm"
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
```

```
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_DPM       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_FUG       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   SRCGROUP DPM      A1A_DPM A1B_DPM TG_DPM
   SRCGROUP FugPM    A1A_FUG A1B_FUG TG_FUG
   SRCGROUP ALL
SO FINISHED
**
****************************************
** ISCST3 Receptor Pathway
****************************************
**
**
RE STARTING
** DESCRREC "" ""
   DISCCART    591115.96   4142496.03    1.50
   DISCCART    591096.17   4142502.50    1.50
   DISCCART    591077.52   4142507.82    1.50
   DISCCART    591058.50   4142513.53    1.50
   DISCCART    591040.23   4142518.86    1.50
   DISCCART    591020.07   4142524.57    1.50
   DISCCART    591001.42   4142531.04    1.50
   DISCCART    590982.77   4142537.12    1.50
   DISCCART    591138.41   4142481.19    1.50
   DISCCART    591142.97   4142499.45    1.50
   DISCCART    591148.30   4142518.48    1.50
   DISCCART    591123.19   4142520.00    1.50
   DISCCART    591104.16   4142525.71    1.50
   DISCCART    591084.75   4142531.42    1.50
   DISCCART    591065.73   4142537.12    1.50
   DISCCART    591046.70   4142542.07    1.50
   DISCCART    591027.30   4142548.54    1.50
   DISCCART    591009.03   4142554.63    1.50
   DISCCART    591152.11   4142551.58    1.50
   DISCCART    591156.29   4142570.61    1.50
   DISCCART    591127.37   4142566.42    1.50
   DISCCART    591109.11   4142572.51    1.50
   DISCCART    591090.08   4142577.08    1.50
   DISCCART    591070.68   4142583.55    1.50
   DISCCART    591052.79   4142588.50    1.50
   DISCCART    591032.24   4142594.96    1.50
   DISCCART    591145.26   4142586.97    1.50
   DISCCART    591126.23   4142592.30    1.50
   DISCCART    591107.21   4142597.63    1.50
   DISCCART    591088.94   4142602.95    1.50
   DISCCART    591068.39   4142609.42    1.50
   DISCCART    590876.61   4142572.13    1.50
   DISCCART    590899.06   4142588.50    1.50
   DISCCART    590920.75   4142605.24    1.50
   DISCCART    590939.78   4142624.26    1.50
   DISCCART    590960.32   4142642.15    1.50
   DISCCART    590980.49   4142658.51    1.50
   DISCCART    591001.42   4142676.40    1.50
   DISCCART    591031.10   4142698.09    1.50
   DISCCART    590848.07   4142584.31    1.50
   DISCCART    590851.87   4142600.67    1.50
   DISCCART    590874.33   4142614.75    1.50
   DISCCART    590893.73   4142634.92    1.50
   DISCCART    590912.76   4142653.94    1.50
   DISCCART    590932.55   4142671.83    1.50
   DISCCART    590952.71   4142690.09    1.50
   DISCCART    590971.36   4142709.50    1.50
   DISCCART    590850.35   4142666.12    1.50
   DISCCART    590870.52   4142683.63    1.50
   DISCCART    590892.59   4142700.37    1.50
   DISCCART    590912.38   4142714.07    1.50
   DISCCART    590827.52   4142693.14    1.50
   DISCCART    590854.54   4142720.16    1.50
   DISCCART    590878.13   4142740.32    1.50
   DISCCART    590900.20   4142759.35    1.50
   DISCCART    590773.11   4142712.93    1.50
   DISCCART    590789.47   4142723.96    1.50
   DISCCART    590823.72   4142755.54    1.50
   DISCCART    590844.26   4142774.57    1.50
   DISCCART    590738.48   4142741.85    1.50
   DISCCART    590751.04   4142755.16    1.50
   DISCCART    590765.50   4142767.34    1.50
   DISCCART    590773.49   4142678.30    1.50
   DISCCART    590755.22   4142677.92    1.50
   DISCCART    590742.28   4142679.44    1.50
   DISCCART    590726.68   4142679.06    1.50
   DISCCART    590689.39   4142171.44    1.50
   DISCCART    590682.92   4142156.98    1.50
   DISCCART    590678.74   4142139.86    1.50
   DISCCART    590724.78   4142165.35    1.50
   DISCCART    590754.84   4142160.41    1.50
```

```
   DISCCART    590784.14   4142156.22    1.50
   DISCCART    590816.49   4142153.56    1.50
   DISCCART    590841.60   4142151.66    1.50
   DISCCART    590836.27   4142126.54    1.50
   DISCCART    590805.07   4142129.20    1.50
   DISCCART    590776.91   4142134.15    1.50
   DISCCART    590743.43   4142139.10    1.50
   DISCCART    590714.51   4142141.00    1.50
   DISCCART    590899.44   4142140.24    1.50
   DISCCART    590929.12   4142137.96    1.50
   DISCCART    590959.94   4142126.92    1.50
   DISCCART    590986.96   4142116.27    1.50
   DISCCART    590896.78   4142118.93    1.50
   DISCCART    590927.60   4142112.84    1.50
   DISCCART    590955.00   4142103.33    1.50
   DISCCART    590970.22   4142092.29    1.50
   DISCCART    590983.92   4142082.40    1.50
   DISCCART    590987.72   4142065.28    1.50
   DISCCART    591000.66   4142098.00    1.50
   DISCCART    591014.36   4142069.84    1.50
   DISCCART    590780.72   4142100.67    1.50
   DISCCART    590806.59   4142102.19    1.50
   DISCCART    590843.12   4142099.52    1.50
   DISCCART    590875.47   4142093.82    1.50
   DISCCART    590907.43   4142090.77    1.50
   DISCCART    590943.20   4142081.26    1.50
   DISCCART    591503.99   4142382.16    1.50
   DISCCART    591537.80   4142385.06    1.50
   DISCCART    591459.55   4141782.24    1.50
   DISCCART    591491.43   4141786.59    1.50
   DISCCART    591523.31   4141787.07    1.50
   DISCCART    591550.84   4141786.59    1.50
   DISCCART    591580.31   4141787.07    1.50
   DISCCART    591608.81   4141787.56    1.50
   DISCCART    591638.27   4141792.87    1.50
   DISCCART    591668.70   4141802.53    1.50
   DISCCART    591009.59   4142041.64    1.50
   DISCCART    590998.13   4142018.71    1.50
   DISCCART    590991.25   4141992.10    1.50
   DISCCART    590982.07   4141965.50    1.50
   DISCCART    590979.78   4142038.43    1.50
   DISCCART    590972.90   4142015.49    1.50
   DISCCART    590964.64   4141989.35    1.50
   DISCCART    590965.56   4141951.73    1.50
   DISCCART    590947.21   4141956.32    1.50
   DISCCART    590944.46   4141980.63    1.50
   DISCCART    590864.92   4142387.88    1.50
   DISCCART    590854.14   4142373.71    1.50
   DISCCART    590804.24   4142384.03    1.50
   DISCCART    590789.77   4142384.95    1.50
   DISCCART    590776.99   4142386.80    1.50
   DISCCART    590761.90   4142387.26    1.50
   DISCCART    590747.89   4142390.50    1.50
   DISCCART    590736.95   4142389.88    1.50
   DISCCART    590724.94   4142389.73    1.50
   DISCCART    590688.75   4142442.54    1.50
   DISCCART    590683.83   4142430.07    1.50
   DISCCART    590687.83   4142456.25    1.50
   DISCCART    590687.83   4142473.34    1.50
   DISCCART    590690.91   4142486.74    1.50
   DISCCART    590690.76   4142504.76    1.50
   DISCCART    590730.33   4142593.61    1.50
   DISCCART    590618.38   4142553.42    1.50
   DISCCART    590613.45   4142595.30    1.50
   DISCCART    590570.95   4142579.59    1.50
   DISCCART    590686.14   4142609.00    1.50
   DISCCART    590657.03   4142612.85    1.50
   DISCCART    590623.93   4142620.09    1.50
   DISCCART    590638.40   4142620.25    1.50
   DISCCART    590661.34   4142594.53    1.50
   DISCCART    590646.25   4142597.15    1.50
   DISCCART    590630.09   4142595.61    1.50
   DISCCART    590660.27   4142665.21    1.50
   DISCCART    590639.79   4142681.38    1.50
   DISCCART    590628.55   4142681.07    1.50
   DISCCART    590617.77   4142685.23    1.50
   DISCCART    590608.37   4142686.15    1.50
   DISCCART    590675.67   4142678.45    1.50
   DISCCART    590689.83   4142688.31    1.50
   DISCCART    590686.14   4142721.88    1.50
   DISCCART    590663.81   4142736.51    1.50
   DISCCART    590645.79   4142735.12    1.50
   DISCCART    590632.24   4142737.89    1.50
   DISCCART    590612.38   4142734.66    1.50
   DISCCART    590612.84   4142725.73    1.50
   DISCCART    590627.62   4142716.95    1.50
   DISCCART    590655.65   4142716.03    1.50
RE FINISHED
**
****************************************
** ISCST3 Meteorology Pathway
****************************************
**
**
ME STARTING
   INPUTFIL C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
```

```
   ANEMHGHT 10 METERS
   SURFDATA 7905 1996
   UAIRDATA 7905 1996
ME FINISHED
**
****************************************
** ISCST3 Output Pathway
****************************************
**
**
OU STARTING
** Auto-Generated Plotfiles
   PLOTFILE PERIOD ALL TO8745~1.IS\PE00GALL.PLT 31
   PLOTFILE PERIOD DPM TO8745~1.IS\PE00G001.PLT 32
   PLOTFILE PERIOD FugPM TO8745~1.IS\PE00G002.PLT 33
OU FINISHED

***********************************
*** SETUP Finishes Successfully ***
***********************************
```

```
                                         ***     MODEL SETUP OPTIONS SUMMARY       ***
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

**Intermediate Terrain Processing is Selected

**Model Is Setup For Calculation of Average CONCentration Values.

  --  SCAVENGING/DEPOSITION LOGIC --
**Model Uses NO DRY DEPLETION.  DDPLETE =  F
**Model Uses NO WET DEPLETION.  WDPLETE =  F
**NO WET SCAVENGING Data Provided.
**NO GAS DRY DEPOSITION Data Provided.
**Model Does NOT Use GRIDDED TERRAIN Data for Depletion Calculations

**Model Uses RURAL Dispersion.

**Model Uses Regulatory DEFAULT Options:
           1. Final Plume Rise.
           2. Stack-tip Downwash.
           3. Buoyancy-induced Dispersion.
           4. Use Calms Processing Routine.
           5. Not Use Missing Data Processing Routine.
           6. Default Wind Profile Exponents.
           7. Default Vertical Potential Temperature Gradients.
           8. "Upper Bound" Values for Supersquat Buildings.
           9. No Exponential Decay for RURAL Mode

**Model Assumes Receptors on FLAT Terrain.

**Model Accepts FLAGPOLE Receptor Heights.

**Model Calculates PERIOD Averages Only

**This Run Includes:     6 Source(s);      3 Source Group(s); and     158 Receptor(s)

**The Model Assumes A Pollutant Type of:  OTHER

**Model Set To Continue RUNning After the Setup Testing.

**Output Options Selected:
         Model Outputs Tables of PERIOD Averages by Receptor
         Model Outputs External File(s) of High Values for Plotting (PLOTFILE Keyword)

**NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                m for Missing Hours
                                                                b for Both Calm and Missing Hours

**Misc. Inputs:  Anem. Hgt. (m) =    10.00 ;    Decay Coef. =    0.000     ;    Rot. Angle =     0.0
                 Emission Units = GRAMS/SEC                                ;  Emission Rate Unit Factor =   0.10000E+07
                 Output Units   = MICROGRAMS/M**3

**Approximate Storage Requirements of Model =     1.2 MB of RAM.

**Input Runstream File:          Topgolf-Const-2017-Mitigated.INP
**Output Print File:             Topgolf-Const-2017-Mitigated.OUT
**Detailed Error/Message File:   TO8F37~1.ERR
```

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** AREAPOLY SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (GRAMS/SEC /METER**2)	LOCATION OF AREA X (METERS)	Y (METERS)	BASE ELEV. (METERS)	RELEASE HEIGHT (METERS)	NUMBER OF VERTS.	INIT. SZ (METERS)	EMISSION RATE SCALAR VARY BY
A1A_DPM	0	0.19200E-08	590982.4	4142485.5	0.0	6.00	10	0.00	HROFDY
A1A_FUG	0	0.32100E-07	590982.4	4142485.5	0.0	2.00	10	0.00	HROFDY
A1B_DPM	0	0.19200E-08	591301.5	4142218.8	0.0	6.00	6	0.00	HROFDY
A1B_FUG	0	0.32100E-07	591301.5	4142218.8	0.0	2.00	6	0.00	HROFDY
TG_DPM	0	0.71200E-07	591150.6	4142203.2	0.0	6.00	10	0.00	HROFDY
TG_FUG	0	0.96600E-07	591150.6	4142203.2	0.0	2.00	10	0.00	HROFDY

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
DPM	A1A_DPM , A1B_DPM , TG_DPM ,
FUGPM	A1A_FUG , A1B_FUG , TG_FUG ,
ALL	A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = A1A_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1A_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = TG_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = TG_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591115.9,	4142496.0,	0.0,	1.5);	(591096.2,	4142502.5,	0.0,	1.5);
(591077.5,	4142507.8,	0.0,	1.5);	(591058.5,	4142513.5,	0.0,	1.5);
(591040.3,	4142518.8,	0.0,	1.5);	(591020.1,	4142524.5,	0.0,	1.5);
(591001.4,	4142531.0,	0.0,	1.5);	(590982.8,	4142537.0,	0.0,	1.5);
(591138.4,	4142481.3,	0.0,	1.5);	(591143.0,	4142499.5,	0.0,	1.5);
(591148.3,	4142518.5,	0.0,	1.5);	(591123.2,	4142520.0,	0.0,	1.5);
(591104.2,	4142525.8,	0.0,	1.5);	(591084.8,	4142531.5,	0.0,	1.5);
(591065.8,	4142537.0,	0.0,	1.5);	(591046.7,	4142542.0,	0.0,	1.5);
(591027.3,	4142548.5,	0.0,	1.5);	(591009.0,	4142554.8,	0.0,	1.5);
(591152.1,	4142551.5,	0.0,	1.5);	(591156.3,	4142570.5,	0.0,	1.5);
(591127.4,	4142566.5,	0.0,	1.5);	(591109.1,	4142572.5,	0.0,	1.5);
(591090.1,	4142577.0,	0.0,	1.5);	(591070.7,	4142583.5,	0.0,	1.5);
(591052.8,	4142588.5,	0.0,	1.5);	(591032.2,	4142595.0,	0.0,	1.5);
(591145.3,	4142587.0,	0.0,	1.5);	(591126.3,	4142592.2,	0.0,	1.5);
(591107.2,	4142597.8,	0.0,	1.5);	(591088.9,	4142603.0,	0.0,	1.5);
(591068.4,	4142609.5,	0.0,	1.5);	(590876.6,	4142572.2,	0.0,	1.5);
(590899.1,	4142588.5,	0.0,	1.5);	(590920.8,	4142605.2,	0.0,	1.5);
(590939.8,	4142624.2,	0.0,	1.5);	(590960.3,	4142642.2,	0.0,	1.5);
(590980.5,	4142658.5,	0.0,	1.5);	(591001.4,	4142676.5,	0.0,	1.5);
(591031.1,	4142698.0,	0.0,	1.5);	(590848.1,	4142584.2,	0.0,	1.5);
(590851.9,	4142600.8,	0.0,	1.5);	(590874.3,	4142614.8,	0.0,	1.5);
(590893.8,	4142635.0,	0.0,	1.5);	(590912.8,	4142654.0,	0.0,	1.5);
(590932.6,	4142671.8,	0.0,	1.5);	(590952.7,	4142690.0,	0.0,	1.5);
(590971.4,	4142709.5,	0.0,	1.5);	(590850.4,	4142666.0,	0.0,	1.5);
(590870.5,	4142683.8,	0.0,	1.5);	(590892.6,	4142700.2,	0.0,	1.5);
(590912.4,	4142714.0,	0.0,	1.5);	(590827.5,	4142693.2,	0.0,	1.5);
(590854.6,	4142720.2,	0.0,	1.5);	(590878.1,	4142740.2,	0.0,	1.5);
(590900.2,	4142759.2,	0.0,	1.5);	(590773.1,	4142713.0,	0.0,	1.5);
(590789.5,	4142724.0,	0.0,	1.5);	(590823.8,	4142755.5,	0.0,	1.5);
(590844.2,	4142774.5,	0.0,	1.5);	(590738.5,	4142741.8,	0.0,	1.5);
(590751.1,	4142755.2,	0.0,	1.5);	(590765.5,	4142767.3,	0.0,	1.5);
(590773.5,	4142678.3,	0.0,	1.5);	(590755.2,	4142678.0,	0.0,	1.5);
(590742.2,	4142679.5,	0.0,	1.5);	(590726.7,	4142679.0,	0.0,	1.5);
(590689.4,	4142171.5,	0.0,	1.5);	(590682.9,	4142157.0,	0.0,	1.5);
(590678.8,	4142139.8,	0.0,	1.5);	(590724.8,	4142165.2,	0.0,	1.5);
(590754.8,	4142160.5,	0.0,	1.5);	(590784.1,	4142156.2,	0.0,	1.5);
(590816.5,	4142153.5,	0.0,	1.5);	(590841.6,	4142151.8,	0.0,	1.5);
(590836.2,	4142126.5,	0.0,	1.5);	(590805.1,	4142129.2,	0.0,	1.5);
(590776.9,	4142134.2,	0.0,	1.5);	(590743.4,	4142139.0,	0.0,	1.5);
(590714.5,	4142141.0,	0.0,	1.5);	(590899.4,	4142140.2,	0.0,	1.5);
(590929.1,	4142138.0,	0.0,	1.5);	(590959.9,	4142127.0,	0.0,	1.5);
(590986.9,	4142116.2,	0.0,	1.5);	(590896.8,	4142119.0,	0.0,	1.5);
(590927.6,	4142112.8,	0.0,	1.5);	(590955.0,	4142103.2,	0.0,	1.5);
(590970.3,	4142092.2,	0.0,	1.5);	(590983.9,	4142082.5,	0.0,	1.5);
(590987.8,	4142065.2,	0.0,	1.5);	(591000.7,	4142098.0,	0.0,	1.5);

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591014.4,	4142069.8,	0.0,	1.5);	(590780.8,	4142100.8,	0.0,	1.5);
(590806.6,	4142102.2,	0.0,	1.5);	(590843.1,	4142099.5,	0.0,	1.5);
(590875.5,	4142093.8,	0.0,	1.5);	(590907.4,	4142090.8,	0.0,	1.5);
(590943.2,	4142081.3,	0.0,	1.5);	(591504.0,	4142382.2,	0.0,	1.5);
(591537.8,	4142385.0,	0.0,	1.5);	(591459.6,	4141782.3,	0.0,	1.5);
(591491.4,	4141786.5,	0.0,	1.5);	(591523.3,	4141787.0,	0.0,	1.5);
(591550.8,	4141786.5,	0.0,	1.5);	(591580.3,	4141787.0,	0.0,	1.5);
(591608.8,	4141787.5,	0.0,	1.5);	(591638.2,	4141792.8,	0.0,	1.5);
(591668.7,	4141802.5,	0.0,	1.5);	(591009.6,	4142041.8,	0.0,	1.5);
(590998.1,	4142018.8,	0.0,	1.5);	(590991.2,	4141992.0,	0.0,	1.5);
(590982.1,	4141965.5,	0.0,	1.5);	(590979.8,	4142038.5,	0.0,	1.5);
(590972.9,	4142015.5,	0.0,	1.5);	(590964.6,	4141989.2,	0.0,	1.5);
(590965.6,	4141951.8,	0.0,	1.5);	(590947.2,	4141956.2,	0.0,	1.5);
(590944.4,	4141980.8,	0.0,	1.5);	(590864.9,	4142388.0,	0.0,	1.5);
(590854.1,	4142373.8,	0.0,	1.5);	(590804.2,	4142384.0,	0.0,	1.5);
(590789.8,	4142385.0,	0.0,	1.5);	(590777.0,	4142386.8,	0.0,	1.5);
(590761.9,	4142387.2,	0.0,	1.5);	(590747.9,	4142390.5,	0.0,	1.5);
(590736.9,	4142390.0,	0.0,	1.5);	(590724.9,	4142389.8,	0.0,	1.5);
(590688.8,	4142442.5,	0.0,	1.5);	(590683.8,	4142430.0,	0.0,	1.5);
(590687.8,	4142456.3,	0.0,	1.5);	(590687.8,	4142473.2,	0.0,	1.5);
(590690.9,	4142486.8,	0.0,	1.5);	(590690.8,	4142504.8,	0.0,	1.5);
(590730.3,	4142593.5,	0.0,	1.5);	(590618.4,	4142553.5,	0.0,	1.5);
(590613.4,	4142595.3,	0.0,	1.5);	(590570.9,	4142579.5,	0.0,	1.5);
(590686.1,	4142609.0,	0.0,	1.5);	(590657.0,	4142612.8,	0.0,	1.5);
(590623.9,	4142620.0,	0.0,	1.5);	(590638.4,	4142620.2,	0.0,	1.5);
(590661.3,	4142594.5,	0.0,	1.5);	(590646.3,	4142597.2,	0.0,	1.5);
(590630.1,	4142595.5,	0.0,	1.5);	(590660.2,	4142665.3,	0.0,	1.5);
(590639.8,	4142681.5,	0.0,	1.5);	(590628.6,	4142681.0,	0.0,	1.5);
(590617.8,	4142685.2,	0.0,	1.5);	(590608.4,	4142686.2,	0.0,	1.5);
(590675.7,	4142678.5,	0.0,	1.5);	(590689.8,	4142688.2,	0.0,	1.5);
(590686.1,	4142722.0,	0.0,	1.5);	(590663.8,	4142736.5,	0.0,	1.5);
(590645.8,	4142735.0,	0.0,	1.5);	(590632.2,	4142738.0,	0.0,	1.5);
(590612.4,	4142734.8,	0.0,	1.5);	(590612.8,	4142725.8,	0.0,	1.5);
(590627.6,	4142717.0,	0.0,	1.5);	(590655.6,	4142716.0,	0.0,	1.5);

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

```
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1
```

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

*** WIND PROFILE EXPONENTS ***

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
B	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
C	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00
D	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00
E	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00
F	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00

*** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
(DEGREES KELVIN PER METER)

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
B	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
C	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
D	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
E	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01
F	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

FILE: C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
FORMAT: (4I2,2F9.4,F6.1,I2,2F7.1,f9.4,f10.1,f8.4,i4,f7.2)
SURFACE STATION NO.: 7905 UPPER AIR STATION NO.: 7905
NAME: UNKNOWN NAME: UNKNOWN
YEAR: 1996 YEAR: 1996

YR	MN	DY	HR	FLOW VECTOR	SPEED (M/S)	TEMP (K)	STAB CLASS	MIXING HEIGHT (M) RURAL	MIXING HEIGHT (M) URBAN	USTAR (M/S)	M-O LENGTH (M)	Z-0 (M)	IPCODE	PRATE (mm/HR)
96	01	01	01	212.7	1.56	283.5	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	02	186.7	1.03	284.0	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	03	162.3	1.79	284.0	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	04	185.1	1.97	283.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	05	132.3	2.46	283.0	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	06	97.9	4.16	283.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	07	95.8	1.61	284.4	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	08	152.8	3.58	285.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	09	157.8	5.54	288.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	10	158.3	5.01	289.9	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	11	162.5	5.54	291.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	12	161.7	5.72	292.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	13	168.0	6.84	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	14	182.2	6.12	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	15	153.1	5.68	292.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	16	112.6	4.34	291.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	17	134.5	3.84	290.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	18	143.4	4.38	290.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	19	145.1	3.62	290.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	20	161.2	4.83	289.3	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	21	155.0	4.83	289.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	22	105.9	4.25	286.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	23	48.0	2.68	285.6	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	24	89.0	2.46	285.8	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00

*** NOTES: STABILITY CLASS 1=A, 2=B, 3=C, 4=D, 5=E AND 6=F.
FLOW VECTOR IS DIRECTION TOWARD WHICH WIND IS BLOWING.

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.01283	591096.19	4142502.50	0.01388
591077.50	4142507.75	0.01484	591058.50	4142513.50	0.01564
591040.25	4142518.75	0.01631	591020.06	4142524.50	0.01686
591001.44	4142531.00	0.01695	590982.75	4142537.00	0.01685
591138.44	4142481.25	0.01218	591143.00	4142499.50	0.01011
591148.31	4142518.50	0.00840	591123.19	4142520.00	0.01004
591104.19	4142525.75	0.01095	591084.75	4142531.50	0.01182
591065.75	4142537.00	0.01261	591046.69	4142542.00	0.01339
591027.31	4142548.50	0.01388	591009.00	4142554.75	0.01414
591152.13	4142551.50	0.00654	591156.31	4142570.50	0.00567
591127.38	4142566.50	0.00698	591109.12	4142572.50	0.00754
591090.06	4142577.00	0.00823	591070.69	4142583.50	0.00883
591052.81	4142588.50	0.00939	591032.25	4142595.00	0.00990
591145.25	4142587.00	0.00550	591126.25	4142592.25	0.00597
591107.19	4142597.75	0.00648	591088.94	4142603.00	0.00700
591068.38	4142609.50	0.00756	590876.62	4142572.25	0.01238
590899.06	4142588.50	0.01251	590920.75	4142605.25	0.01183
590939.75	4142624.25	0.01062	590960.31	4142642.25	0.00932
590980.50	4142658.50	0.00805	591001.44	4142676.50	0.00680
591031.13	4142698.00	0.00541	590848.06	4142584.25	0.01059
590851.88	4142600.75	0.01043	590874.31	4142614.75	0.01075
590893.75	4142635.00	0.01021	590912.75	4142654.00	0.00934
590932.56	4142671.75	0.00836	590952.69	4142690.00	0.00732
590971.38	4142709.50	0.00627	590850.38	4142666.00	0.00861
590870.50	4142683.75	0.00824	590892.56	4142700.25	0.00764
590912.38	4142714.00	0.00700	590827.50	4142693.25	0.00759
590854.56	4142720.25	0.00712	590878.12	4142740.25	0.00649
590900.19	4142759.25	0.00579	590773.12	4142713.00	0.00631
590789.50	4142724.00	0.00645	590823.75	4142755.50	0.00621
590844.25	4142774.50	0.00579	590738.50	4142741.75	0.00540
590751.06	4142755.25	0.00549	590765.50	4142767.25	0.00555
590773.50	4142678.25	0.00667	590755.25	4142678.00	0.00621
590742.25	4142679.50	0.00588	590726.69	4142679.00	0.00550
590689.38	4142171.50	0.00092	590682.94	4142157.00	0.00087
590678.75	4142139.75	0.00083	590724.75	4142165.25	0.00104
590754.81	4142160.50	0.00117	590784.12	4142156.25	0.00133
590816.50	4142153.50	0.00154	590841.62	4142151.75	0.00172
590836.25	4142126.50	0.00156	590805.06	4142129.25	0.00139
590776.94	4142134.25	0.00124	590743.44	4142139.00	0.00108
590714.50	4142141.00	0.00096	590899.44	4142140.25	0.00212

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.00249	590959.94	4142127.00	0.00296
590986.94	4142116.25	0.00346	590896.75	4142119.00	0.00194
590927.62	4142112.75	0.00224	590955.00	4142103.25	0.00258
590970.25	4142092.25	0.00274	590983.94	4142082.50	0.00288
590987.75	4142065.25	0.00272	591000.69	4142098.00	0.00352
591014.38	4142069.75	0.00336	590780.75	4142100.75	0.00118
590806.56	4142102.25	0.00130	590843.12	4142099.50	0.00146
590875.50	4142093.75	0.00162	590907.44	4142090.75	0.00186
590943.19	4142081.25	0.00218	591504.00	4142382.25	0.00180
591537.81	4142385.00	0.00156	591459.56	4141782.25	0.00453
591491.44	4141786.50	0.00479	591523.31	4141787.00	0.00495
591550.81	4141786.50	0.00506	591580.31	4141787.00	0.00517
591608.81	4141787.50	0.00526	591638.25	4141792.75	0.00543
591668.69	4141802.50	0.00563	591009.56	4142041.75	0.00279
590998.12	4142018.75	0.00232	590991.25	4141992.00	0.00197
590982.06	4141965.50	0.00169	590979.75	4142038.50	0.00228
590972.88	4142015.50	0.00198	590964.63	4141989.25	0.00171
590965.56	4141951.75	0.00148	590947.19	4141956.25	0.00138
590944.44	4141980.75	0.00150	590864.94	4142388.00	0.00770
590854.12	4142373.75	0.00627	590804.25	4142384.00	0.00450
590789.75	4142385.00	0.00403	590777.00	4142386.75	0.00367
590761.88	4142387.25	0.00327	590747.88	4142390.50	0.00298
590736.94	4142390.00	0.00275	590724.94	4142389.75	0.00254
590688.75	4142442.50	0.00250	590683.81	4142430.00	0.00230
590687.81	4142456.25	0.00265	590687.81	4142473.25	0.00288
590690.94	4142486.75	0.00316	590690.75	4142504.75	0.00345
590730.31	4142593.50	0.00563	590618.38	4142553.50	0.00266
590613.44	4142595.25	0.00289	590570.94	4142579.50	0.00224
590686.12	4142609.00	0.00449	590657.00	4142612.75	0.00383
590623.94	4142620.00	0.00323	590638.38	4142620.25	0.00349
590661.31	4142594.50	0.00380	590646.25	4142597.25	0.00350
590630.06	4142595.50	0.00317	590660.25	4142665.25	0.00406
590639.81	4142681.50	0.00371	590628.56	4142681.00	0.00352
590617.75	4142685.25	0.00336	590608.38	4142686.25	0.00322
590675.69	4142678.50	0.00437	590689.81	4142688.25	0.00465
590686.12	4142722.00	0.00453	590663.81	4142736.50	0.00411
590645.81	4142735.00	0.00382	590632.25	4142738.00	0.00361
590612.38	4142734.75	0.00332	590612.81	4142725.75	0.00333
590627.63	4142717.00	0.00354	590655.62	4142716.00	0.00399

CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.03887	591096.19	4142502.50	0.04041
591077.50	4142507.75	0.04199	591058.50	4142513.50	0.04320
591040.25	4142518.75	0.04427	591020.06	4142524.50	0.04511
591001.44	4142531.00	0.04493	590982.75	4142537.00	0.04467
591138.44	4142481.25	0.03985	591143.00	4142499.50	0.03188
591148.31	4142518.50	0.02574	591123.19	4142520.00	0.02942
591104.19	4142525.75	0.03091	591084.75	4142531.50	0.03230
591065.75	4142537.00	0.03356	591046.69	4142542.00	0.03483
591027.31	4142548.50	0.03543	591009.00	4142554.75	0.03566
591152.13	4142551.50	0.01908	591156.31	4142570.50	0.01613
591127.38	4142566.50	0.01947	591109.12	4142572.50	0.02045
591090.06	4142577.00	0.02171	591070.69	4142583.50	0.02262
591052.81	4142588.50	0.02353	591032.25	4142595.00	0.02429
591145.25	4142587.00	0.01524	591126.25	4142592.25	0.01624
591107.19	4142597.75	0.01721	591088.94	4142603.00	0.01813
591068.38	4142609.50	0.01903	590876.62	4142572.25	0.03808
590899.06	4142588.50	0.03350	590920.75	4142605.25	0.02943
590939.75	4142624.25	0.02543	590960.31	4142642.25	0.02192
590980.50	4142658.50	0.01891	591001.44	4142676.50	0.01606
591031.13	4142698.00	0.01292	590848.06	4142584.25	0.03527
590851.88	4142600.75	0.03139	590874.31	4142614.75	0.02868
590893.75	4142635.00	0.02525	590912.75	4142654.00	0.02223
590932.56	4142671.75	0.01953	590952.69	4142690.00	0.01699
590971.38	4142709.50	0.01460	590850.38	4142666.00	0.02184
590870.50	4142683.75	0.01983	590892.56	4142700.25	0.01787
590912.38	4142714.00	0.01621	590827.50	4142693.25	0.01920
590854.56	4142720.25	0.01684	590878.12	4142740.25	0.01500
590900.19	4142759.25	0.01329	590773.12	4142713.00	0.01732
590789.50	4142724.00	0.01672	590823.75	4142755.50	0.01471
590844.25	4142774.50	0.01339	590738.50	4142741.75	0.01501
590751.06	4142755.25	0.01449	590765.50	4142767.25	0.01404
590773.50	4142678.25	0.02012	590755.25	4142678.00	0.01989
590742.25	4142679.50	0.01949	590726.69	4142679.00	0.01913
590689.38	4142171.50	0.00240	590682.94	4142157.00	0.00224
590678.75	4142139.75	0.00211	590724.75	4142165.25	0.00278
590754.81	4142160.50	0.00319	590784.12	4142156.25	0.00370
590816.50	4142153.50	0.00438	590841.62	4142151.75	0.00498
590836.25	4142126.50	0.00436	590805.06	4142129.25	0.00379
590776.94	4142134.25	0.00332	590743.44	4142139.00	0.00284
590714.50	4142141.00	0.00249	590899.44	4142140.25	0.00633

CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.00737	590959.94	4142127.00	0.00840
590986.94	4142116.25	0.00934	590896.75	4142119.00	0.00561
590927.62	4142112.75	0.00641	590955.00	4142103.25	0.00714
590970.25	4142092.25	0.00736	590983.94	4142082.50	0.00756
590987.75	4142065.25	0.00701	591000.69	4142098.00	0.00914
591014.38	4142069.75	0.00838	590780.75	4142100.75	0.00306
590806.56	4142102.25	0.00346	590843.12	4142099.50	0.00401
590875.50	4142093.75	0.00451	590907.44	4142090.75	0.00519
590943.19	4142081.25	0.00597	591504.00	4142382.25	0.00488
591537.81	4142385.00	0.00409	591459.56	4141782.25	0.00863
591491.44	4141786.50	0.00912	591523.31	4141787.00	0.00943
591550.81	4141786.50	0.00963	591580.31	4141787.00	0.00984
591608.81	4141787.50	0.01002	591638.25	4141792.75	0.01033
591668.69	4141802.50	0.01073	591009.56	4142041.75	0.00691
590998.12	4142018.75	0.00576	590991.25	4141992.00	0.00488
590982.06	4141965.50	0.00416	590979.75	4142038.50	0.00584
590972.88	4142015.50	0.00504	590964.63	4141989.25	0.00430
590965.56	4141951.75	0.00366	590947.19	4141956.25	0.00347
590944.44	4141980.75	0.00381	590864.94	4142388.00	0.04570
590854.12	4142373.75	0.03466	590804.25	4142384.00	0.02686
590789.75	4142385.00	0.02314	590777.00	4142386.75	0.02011
590761.88	4142387.25	0.01600	590747.88	4142390.50	0.01322
590736.94	4142390.00	0.01083	590724.94	4142389.75	0.00901
590688.75	4142442.50	0.00907	590683.81	4142430.00	0.00779
590687.81	4142456.25	0.01021	590687.81	4142473.25	0.01219
590690.94	4142486.75	0.01479	590690.75	4142504.75	0.01722
590730.31	4142593.50	0.03709	590618.38	4142553.50	0.00908
590613.44	4142595.25	0.01024	590570.94	4142579.50	0.00680
590686.12	4142609.00	0.02235	590657.00	4142612.75	0.01646
590623.94	4142620.00	0.01212	590638.38	4142620.25	0.01385
590661.31	4142594.50	0.01677	590646.25	4142597.25	0.01430
590630.06	4142595.50	0.01203	590660.25	4142665.25	0.01608
590639.81	4142681.50	0.01377	590628.56	4142681.00	0.01284
590617.75	4142685.25	0.01195	590608.38	4142686.25	0.01125
590675.69	4142678.50	0.01674	590689.81	4142688.25	0.01693
590686.12	4142722.00	0.01478	590663.81	4142736.50	0.01333
590645.81	4142735.00	0.01265	590632.25	4142738.00	0.01195
590612.38	4142734.75	0.01103	590612.81	4142725.75	0.01118
590627.63	4142717.00	0.01218	590655.62	4142716.00	0.01376

CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.05171	591096.19	4142502.50	0.05429
591077.50	4142507.75	0.05683	591058.50	4142513.50	0.05883
591040.25	4142518.75	0.06058	591020.06	4142524.50	0.06197
591001.44	4142531.00	0.06188	590982.75	4142537.00	0.06152
591138.44	4142481.25	0.05203	591143.00	4142499.50	0.04199
591148.31	4142518.50	0.03414	591123.19	4142520.00	0.03945
591104.19	4142525.75	0.04185	591084.75	4142531.50	0.04411
591065.75	4142537.00	0.04617	591046.69	4142542.00	0.04821
591027.31	4142548.50	0.04931	591009.00	4142554.75	0.04981
591152.13	4142551.50	0.02562	591156.31	4142570.50	0.02180
591127.38	4142566.50	0.02645	591109.12	4142572.50	0.02799
591090.06	4142577.00	0.02993	591070.69	4142583.50	0.03144
591052.81	4142588.50	0.03292	591032.25	4142595.00	0.03419
591145.25	4142587.00	0.02074	591126.25	4142592.25	0.02221
591107.19	4142597.75	0.02370	591088.94	4142603.00	0.02513
591068.38	4142609.50	0.02658	590876.62	4142572.25	0.05046
590899.06	4142588.50	0.04602	590920.75	4142605.25	0.04126
590939.75	4142624.25	0.03605	590960.31	4142642.25	0.03124
590980.50	4142658.50	0.02695	591001.44	4142676.50	0.02286
591031.13	4142698.00	0.01833	590848.06	4142584.25	0.04586
590851.88	4142600.75	0.04182	590874.31	4142614.75	0.03944
590893.75	4142635.00	0.03546	590912.75	4142654.00	0.03157
590932.56	4142671.75	0.02789	590952.69	4142690.00	0.02430
590971.38	4142709.50	0.02087	590850.38	4142666.00	0.03045
590870.50	4142683.75	0.02808	590892.56	4142700.25	0.02552
590912.38	4142714.00	0.02321	590827.50	4142693.25	0.02679
590854.56	4142720.25	0.02396	590878.12	4142740.25	0.02149
590900.19	4142759.25	0.01908	590773.12	4142713.00	0.02362
590789.50	4142724.00	0.02317	590823.75	4142755.50	0.02092
590844.25	4142774.50	0.01918	590738.50	4142741.75	0.02042
590751.06	4142755.25	0.01998	590765.50	4142767.25	0.01959
590773.50	4142678.25	0.02679	590755.25	4142678.00	0.02610
590742.25	4142679.50	0.02536	590726.69	4142679.00	0.02462
590689.38	4142171.50	0.00332	590682.94	4142157.00	0.00311
590678.75	4142139.75	0.00295	590724.75	4142165.25	0.00382
590754.81	4142160.50	0.00437	590784.12	4142156.25	0.00503
590816.50	4142153.50	0.00592	590841.62	4142151.75	0.00670
590836.25	4142126.50	0.00592	590805.06	4142129.25	0.00518
590776.94	4142134.25	0.00456	590743.44	4142139.00	0.00391
590714.50	4142141.00	0.00345	590899.44	4142140.25	0.00845

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.00986	590959.94	4142127.00	0.01136
590986.94	4142116.25	0.01280	590896.75	4142119.00	0.00755
590927.62	4142112.75	0.00866	590955.00	4142103.25	0.00972
590970.25	4142092.25	0.01010	590983.94	4142082.50	0.01044
590987.75	4142065.25	0.00973	591000.69	4142098.00	0.01265
591014.38	4142069.75	0.01174	590780.75	4142100.75	0.00424
590806.56	4142102.25	0.00476	590843.12	4142099.50	0.00548
590875.50	4142093.75	0.00613	590907.44	4142090.75	0.00705
590943.19	4142081.25	0.00815	591504.00	4142382.25	0.00669
591537.81	4142385.00	0.00565	591459.56	4141782.25	0.01316
591491.44	4141786.50	0.01391	591523.31	4141787.00	0.01438
591550.81	4141786.50	0.01468	591580.31	4141787.00	0.01502
591608.81	4141787.50	0.01528	591638.25	4141792.75	0.01576
591668.69	4141802.50	0.01636	591009.56	4142041.75	0.00971
590998.12	4142018.75	0.00808	590991.25	4141992.00	0.00686
590982.06	4141965.50	0.00584	590979.75	4142038.50	0.00812
590972.88	4142015.50	0.00702	590964.63	4141989.25	0.00601
590965.56	4141951.75	0.00514	590947.19	4141956.25	0.00485
590944.44	4141980.75	0.00530	590864.94	4142388.00	0.05340
590854.12	4142373.75	0.04093	590804.25	4142384.00	0.03136
590789.75	4142385.00	0.02717	590777.00	4142386.75	0.02378
590761.88	4142387.25	0.01926	590747.88	4142390.50	0.01620
590736.94	4142390.00	0.01358	590724.94	4142389.75	0.01155
590688.75	4142442.50	0.01157	590683.81	4142430.00	0.01010
590687.81	4142456.25	0.01286	590687.81	4142473.25	0.01507
590690.94	4142486.75	0.01795	590690.75	4142504.75	0.02067
590730.31	4142593.50	0.04272	590618.38	4142553.50	0.01174
590613.44	4142595.25	0.01314	590570.94	4142579.50	0.00904
590686.12	4142609.00	0.02684	590657.00	4142612.75	0.02029
590623.94	4142620.00	0.01535	590638.38	4142620.25	0.01734
590661.31	4142594.50	0.02057	590646.25	4142597.25	0.01779
590630.06	4142595.50	0.01520	590660.25	4142665.25	0.02014
590639.81	4142681.50	0.01747	590628.56	4142681.00	0.01636
590617.75	4142685.25	0.01531	590608.38	4142686.25	0.01447
590675.69	4142678.50	0.02111	590689.81	4142688.25	0.02158
590686.12	4142722.00	0.01931	590663.81	4142736.50	0.01744
590645.81	4142735.00	0.01647	590632.25	4142738.00	0.01556
590612.38	4142734.75	0.01435	590612.81	4142725.75	0.01451
590627.63	4142717.00	0.01571	590655.62	4142716.00	0.01775

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (43848 HRS) RESULTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
DPM	1ST HIGHEST VALUE IS	0.01695 AT	(591001.44, 4142531.00, 0.00, 1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.01686 AT	(591020.06, 4142524.50, 0.00, 1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.01685 AT	(590982.75, 4142537.00, 0.00, 1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.01631 AT	(591040.25, 4142518.75, 0.00, 1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.01564 AT	(591058.50, 4142513.50, 0.00, 1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.01484 AT	(591077.50, 4142507.75, 0.00, 1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.01414 AT	(591009.00, 4142554.75, 0.00, 1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.01388 AT	(591096.19, 4142502.50, 0.00, 1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.01388 AT	(591027.31, 4142548.50, 0.00, 1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.01339 AT	(591046.69, 4142542.00, 0.00, 1.50)	DC	NA
FUGPM	1ST HIGHEST VALUE IS	0.04570 AT	(590864.94, 4142388.00, 0.00, 1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.04511 AT	(591020.06, 4142524.50, 0.00, 1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.04493 AT	(591001.44, 4142531.00, 0.00, 1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.04467 AT	(590982.75, 4142537.00, 0.00, 1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.04427 AT	(591040.25, 4142518.75, 0.00, 1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.04320 AT	(591058.50, 4142513.50, 0.00, 1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.04199 AT	(591077.50, 4142507.75, 0.00, 1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.04041 AT	(591096.19, 4142502.50, 0.00, 1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.03985 AT	(591138.44, 4142481.25, 0.00, 1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.03887 AT	(591115.94, 4142496.00, 0.00, 1.50)	DC	NA
ALL	1ST HIGHEST VALUE IS	0.06197 AT	(591020.06, 4142524.50, 0.00, 1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.06188 AT	(591001.44, 4142531.00, 0.00, 1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.06152 AT	(590982.75, 4142537.00, 0.00, 1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.06058 AT	(591040.25, 4142518.75, 0.00, 1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.05883 AT	(591058.50, 4142513.50, 0.00, 1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.05683 AT	(591077.50, 4142507.75, 0.00, 1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.05429 AT	(591096.19, 4142502.50, 0.00, 1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.05340 AT	(590864.94, 4142388.00, 0.00, 1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.05203 AT	(591138.44, 4142481.25, 0.00, 1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.05171 AT	(591115.94, 4142496.00, 0.00, 1.50)	DC	NA

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

```
**MODELOPTs:
CONC                    RURAL FLAT  FLGPOL DFAULT


*** Message Summary : ISCST3 Model Execution ***

 --------- Summary of Total Messages --------

A Total of            0 Fatal Error Message(s)
A Total of            0 Warning Message(s)
A Total of          121 Informational Message(s)

A Total of          121 Calm Hours Identified


   ******** FATAL ERROR MESSAGES ********
              ***  NONE  ***


   ********   WARNING MESSAGES   ********
              ***  NONE  ***


   ************************************
   *** ISCST3 Finishes Successfully ***
   ************************************
```

2018 DPM & Fugitive PM2.5 Model Input/Output- Residential Receptors - Mitigated Emissions

```
**
****************************************
**
** ISCST3 Input Produced by:
** AERMOD View Ver. 9.1.0
** Lakes Environmental Software Inc.
** Date: 10/27/2016
** File: G:\Projects\I&R\Topgolf\Model\Topgolf-Const-2018-Mitigated.INP
**
****************************************
**
**
****************************************
** ISCST3 Control Pathway
****************************************
**
**
CO STARTING
   TITLEONE TopGolf-2018 Construction DPM/PM2.5, 1996-2000 Alviso Met Data
   TITLETWO Mitigated Emissions - Residential Receptors
   MODELOPT DFAULT CONC  RURAL
   AVERTIME PERIOD
   POLLUTID OTHER
   TERRHGTS FLAT
   FLAGPOLE 1.50
   RUNORNOT RUN
   ERRORFIL TO8FD7~1.ERR
CO FINISHED
**
****************************************
** ISCST3 Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION A1A_DPM      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A -2018 Mitigated DPM
   LOCATION A1A_FUG      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A - 2018 Mitigated Fugitive PM2.5
   LOCATION A1B_DPM      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B -2018 Mitigated DPM
   LOCATION A1B_FUG      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B - 2018 Mitigated Fugitive PM2.5
   LOCATION TG_DPM       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2018 Mitigated DPM
   LOCATION TG_FUG       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2018 Mitigated Fugitive PM2.5
** Source Parameters **
   SRCPARAM A1A_DPM       1.25E-08     6.000        10
   AREAVERT A1A_DPM      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_DPM      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_DPM      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_DPM      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_DPM      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1A_FUG       1.79E-08     2.000        10     0.000
   AREAVERT A1A_FUG      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_FUG      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_FUG      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_FUG      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_FUG      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1B_DPM       1.25E-08     6.000         6
   AREAVERT A1B_DPM      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_DPM      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_DPM      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM A1B_FUG       1.79E-08     2.000         6     0.000
   AREAVERT A1B_FUG      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_FUG      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_FUG      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM TG_DPM        2.98E-08     6.000        10
   AREAVERT TG_DPM       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_DPM       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_DPM       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_DPM       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_DPM       591226.892 4142337.693 591256.845 4142288.678
   SRCPARAM TG_FUG         9.5E-09     2.000        10     0.000
   AREAVERT TG_FUG       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_FUG       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_FUG       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_FUG       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_FUG       591226.892 4142337.693 591256.845 4142288.678

** Variable Emissions Type: "By Hour-of-Day (HROFDY)"
** Variable Emission Scenario: "7am-4pm"
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
```

```
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_DPM       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_FUG       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   SRCGROUP DPM      A1A_DPM A1B_DPM TG_DPM
   SRCGROUP FugPM    A1A_FUG A1B_FUG TG_FUG
   SRCGROUP ALL
SO FINISHED
**
****************************************
** ISCST3 Receptor Pathway
****************************************
**
**
RE STARTING
** DESCRREC "" ""
   DISCCART    591115.96   4142496.03    1.50
   DISCCART    591096.17   4142502.50    1.50
   DISCCART    591077.52   4142507.82    1.50
   DISCCART    591058.50   4142513.53    1.50
   DISCCART    591040.23   4142518.86    1.50
   DISCCART    591020.07   4142524.57    1.50
   DISCCART    591001.42   4142531.04    1.50
   DISCCART    590982.77   4142537.12    1.50
   DISCCART    591138.41   4142481.19    1.50
   DISCCART    591142.97   4142499.45    1.50
   DISCCART    591148.30   4142518.48    1.50
   DISCCART    591123.19   4142520.00    1.50
   DISCCART    591104.16   4142525.71    1.50
   DISCCART    591084.75   4142531.42    1.50
   DISCCART    591065.73   4142537.12    1.50
   DISCCART    591046.70   4142542.07    1.50
   DISCCART    591027.30   4142548.54    1.50
   DISCCART    591009.03   4142554.63    1.50
   DISCCART    591152.11   4142551.58    1.50
   DISCCART    591156.29   4142570.61    1.50
   DISCCART    591127.37   4142566.42    1.50
   DISCCART    591109.11   4142572.51    1.50
   DISCCART    591090.08   4142577.08    1.50
   DISCCART    591070.68   4142583.55    1.50
   DISCCART    591052.79   4142588.50    1.50
   DISCCART    591032.24   4142594.96    1.50
   DISCCART    591145.26   4142586.97    1.50
   DISCCART    591126.23   4142592.30    1.50
   DISCCART    591107.21   4142597.63    1.50
   DISCCART    591088.94   4142602.95    1.50
   DISCCART    591068.39   4142609.42    1.50
   DISCCART    590876.61   4142572.13    1.50
   DISCCART    590899.06   4142588.50    1.50
   DISCCART    590920.75   4142605.24    1.50
   DISCCART    590939.78   4142624.26    1.50
   DISCCART    590960.32   4142642.15    1.50
   DISCCART    590980.49   4142658.51    1.50
   DISCCART    591001.42   4142676.40    1.50
   DISCCART    591031.10   4142698.09    1.50
   DISCCART    590848.07   4142584.31    1.50
   DISCCART    590851.87   4142600.67    1.50
   DISCCART    590874.33   4142614.75    1.50
   DISCCART    590893.73   4142634.92    1.50
   DISCCART    590912.76   4142653.94    1.50
   DISCCART    590932.55   4142671.83    1.50
   DISCCART    590952.71   4142690.09    1.50
   DISCCART    590971.36   4142709.50    1.50
   DISCCART    590850.35   4142666.12    1.50
   DISCCART    590870.52   4142683.63    1.50
   DISCCART    590892.59   4142700.37    1.50
   DISCCART    590912.38   4142714.07    1.50
   DISCCART    590827.52   4142693.14    1.50
   DISCCART    590854.54   4142720.16    1.50
   DISCCART    590878.13   4142740.32    1.50
   DISCCART    590900.20   4142759.35    1.50
   DISCCART    590773.11   4142712.93    1.50
   DISCCART    590789.47   4142723.96    1.50
   DISCCART    590823.72   4142755.54    1.50
   DISCCART    590844.26   4142774.57    1.50
   DISCCART    590738.48   4142741.85    1.50
   DISCCART    590751.04   4142755.16    1.50
   DISCCART    590765.50   4142767.34    1.50
   DISCCART    590773.49   4142678.30    1.50
   DISCCART    590755.22   4142677.92    1.50
   DISCCART    590742.28   4142679.44    1.50
   DISCCART    590726.68   4142679.06    1.50
   DISCCART    590689.39   4142171.44    1.50
   DISCCART    590682.92   4142156.98    1.50
   DISCCART    590678.74   4142139.86    1.50
   DISCCART    590724.78   4142165.35    1.50
   DISCCART    590754.84   4142160.41    1.50
```

```
   DISCCART    590784.14   4142156.22    1.50
   DISCCART    590816.49   4142153.56    1.50
   DISCCART    590841.60   4142151.66    1.50
   DISCCART    590836.27   4142126.54    1.50
   DISCCART    590805.07   4142129.20    1.50
   DISCCART    590776.91   4142134.15    1.50
   DISCCART    590743.43   4142139.10    1.50
   DISCCART    590714.51   4142141.00    1.50
   DISCCART    590899.44   4142140.24    1.50
   DISCCART    590929.12   4142137.96    1.50
   DISCCART    590959.94   4142126.92    1.50
   DISCCART    590986.96   4142116.27    1.50
   DISCCART    590896.78   4142118.93    1.50
   DISCCART    590927.60   4142112.84    1.50
   DISCCART    590955.00   4142103.33    1.50
   DISCCART    590970.22   4142092.29    1.50
   DISCCART    590983.92   4142082.40    1.50
   DISCCART    590987.72   4142065.28    1.50
   DISCCART    591000.66   4142098.00    1.50
   DISCCART    591014.36   4142069.84    1.50
   DISCCART    590780.72   4142100.67    1.50
   DISCCART    590806.59   4142102.19    1.50
   DISCCART    590843.12   4142099.52    1.50
   DISCCART    590875.47   4142093.82    1.50
   DISCCART    590907.43   4142090.77    1.50
   DISCCART    590943.20   4142081.26    1.50
   DISCCART    591503.99   4142382.16    1.50
   DISCCART    591537.80   4142385.06    1.50
   DISCCART    591459.55   4141782.24    1.50
   DISCCART    591491.43   4141786.59    1.50
   DISCCART    591523.31   4141787.07    1.50
   DISCCART    591550.84   4141786.59    1.50
   DISCCART    591580.31   4141787.07    1.50
   DISCCART    591608.81   4141787.56    1.50
   DISCCART    591638.27   4141792.87    1.50
   DISCCART    591668.70   4141802.53    1.50
   DISCCART    591009.59   4142041.64    1.50
   DISCCART    590998.13   4142018.71    1.50
   DISCCART    590991.25   4141992.10    1.50
   DISCCART    590982.07   4141965.50    1.50
   DISCCART    590979.78   4142038.43    1.50
   DISCCART    590972.90   4142015.49    1.50
   DISCCART    590964.64   4141989.35    1.50
   DISCCART    590965.56   4141951.73    1.50
   DISCCART    590947.21   4141956.32    1.50
   DISCCART    590944.46   4141980.63    1.50
   DISCCART    590864.92   4142387.88    1.50
   DISCCART    590854.14   4142373.71    1.50
   DISCCART    590804.24   4142384.03    1.50
   DISCCART    590789.77   4142384.95    1.50
   DISCCART    590776.99   4142386.80    1.50
   DISCCART    590761.90   4142387.26    1.50
   DISCCART    590747.89   4142390.50    1.50
   DISCCART    590736.95   4142389.88    1.50
   DISCCART    590724.94   4142389.73    1.50
   DISCCART    590688.75   4142442.54    1.50
   DISCCART    590683.83   4142430.07    1.50
   DISCCART    590687.83   4142456.25    1.50
   DISCCART    590687.83   4142473.34    1.50
   DISCCART    590690.91   4142486.74    1.50
   DISCCART    590690.76   4142504.76    1.50
   DISCCART    590730.33   4142593.61    1.50
   DISCCART    590618.38   4142553.42    1.50
   DISCCART    590613.45   4142595.30    1.50
   DISCCART    590570.95   4142579.59    1.50
   DISCCART    590686.14   4142609.00    1.50
   DISCCART    590657.03   4142612.85    1.50
   DISCCART    590623.93   4142620.09    1.50
   DISCCART    590638.40   4142620.25    1.50
   DISCCART    590661.34   4142594.53    1.50
   DISCCART    590646.25   4142597.15    1.50
   DISCCART    590630.09   4142595.61    1.50
   DISCCART    590660.27   4142665.21    1.50
   DISCCART    590639.79   4142681.38    1.50
   DISCCART    590628.55   4142681.07    1.50
   DISCCART    590617.77   4142685.23    1.50
   DISCCART    590608.37   4142686.15    1.50
   DISCCART    590675.67   4142678.45    1.50
   DISCCART    590689.83   4142688.31    1.50
   DISCCART    590686.14   4142721.88    1.50
   DISCCART    590663.81   4142736.51    1.50
   DISCCART    590645.79   4142735.12    1.50
   DISCCART    590632.24   4142737.89    1.50
   DISCCART    590612.38   4142734.66    1.50
   DISCCART    590612.84   4142725.73    1.50
   DISCCART    590627.62   4142716.95    1.50
   DISCCART    590655.65   4142716.03    1.50
RE FINISHED
**
****************************************
** ISCST3 Meteorology Pathway
****************************************
**
**
ME STARTING
   INPUTFIL C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
```

```
   ANEMHGHT 10 METERS
   SURFDATA 7905 1996
   UAIRDATA 7905 1996
ME FINISHED
**
****************************************
** ISCST3 Output Pathway
****************************************
**
**
OU STARTING
** Auto-Generated Plotfiles
   PLOTFILE PERIOD ALL TO87E5~1.IS\PE00GALL.PLT 31
   PLOTFILE PERIOD DPM TO87E5~1.IS\PE00G001.PLT 32
   PLOTFILE PERIOD FugPM TO87E5~1.IS\PE00G002.PLT 33
OU FINISHED

***********************************
*** SETUP Finishes Successfully ***
***********************************
```

```
**MODELOPTs:
CONC                    RURAL FLAT  FLGPOL DFAULT

                                        ***     MODEL SETUP OPTIONS SUMMARY       ***
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

**Intermediate Terrain Processing is Selected

**Model Is Setup For Calculation of Average CONCentration Values.

  --  SCAVENGING/DEPOSITION LOGIC --
**Model Uses NO DRY DEPLETION.  DDPLETE =  F
**Model Uses NO WET DEPLETION.  WDPLETE =  F
**NO WET SCAVENGING Data Provided.
**NO GAS DRY DEPOSITION Data Provided.
**Model Does NOT Use GRIDDED TERRAIN Data for Depletion Calculations

**Model Uses RURAL Dispersion.

**Model Uses Regulatory DEFAULT Options:
           1. Final Plume Rise.
           2. Stack-tip Downwash.
           3. Buoyancy-induced Dispersion.
           4. Use Calms Processing Routine.
           5. Not Use Missing Data Processing Routine.
           6. Default Wind Profile Exponents.
           7. Default Vertical Potential Temperature Gradients.
           8. "Upper Bound" Values for Supersquat Buildings.
           9. No Exponential Decay for RURAL Mode

**Model Assumes Receptors on FLAT Terrain.

**Model Accepts FLAGPOLE Receptor Heights.

**Model Calculates PERIOD Averages Only

**This Run Includes:     6 Source(s);      3 Source Group(s); and     158 Receptor(s)

**The Model Assumes A Pollutant Type of:  OTHER

**Model Set To Continue RUNning After the Setup Testing.

**Output Options Selected:
         Model Outputs Tables of PERIOD Averages by Receptor
         Model Outputs External File(s) of High Values for Plotting (PLOTFILE Keyword)

**NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                m for Missing Hours
                                                                b for Both Calm and Missing Hours

**Misc. Inputs:  Anem. Hgt. (m) =    10.00 ;    Decay Coef. =    0.000     ;    Rot. Angle =     0.0
                 Emission Units = GRAMS/SEC                                  ;  Emission Rate Unit Factor =   0.10000E+07
                 Output Units   = MICROGRAMS/M**3

**Approximate Storage Requirements of Model =     1.2 MB of RAM.

**Input Runstream File:          Topgolf-Const-2018-Mitigated.INP
**Output Print File:             Topgolf-Const-2018-Mitigated.OUT
**Detailed Error/Message File:   TO8FD7~1.ERR
```

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** AREAPOLY SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (GRAMS/SEC /METER**2)	LOCATION OF AREA X (METERS)	Y (METERS)	BASE ELEV. (METERS)	RELEASE HEIGHT (METERS)	NUMBER OF VERTS.	INIT. SZ (METERS)	EMISSION RATE SCALAR VARY BY
A1A_DPM	0	0.12500E-07	590982.4	4142485.5	0.0	6.00	10	0.00	HROFDY
A1A_FUG	0	0.17900E-07	590982.4	4142485.5	0.0	2.00	10	0.00	HROFDY
A1B_DPM	0	0.12500E-07	591301.5	4142218.8	0.0	6.00	6	0.00	HROFDY
A1B_FUG	0	0.17900E-07	591301.5	4142218.8	0.0	2.00	6	0.00	HROFDY
TG_DPM	0	0.29800E-07	591150.6	4142203.2	0.0	6.00	10	0.00	HROFDY
TG_FUG	0	0.95000E-08	591150.6	4142203.2	0.0	2.00	10	0.00	HROFDY

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
DPM	A1A_DPM , A1B_DPM , TG_DPM ,
FUGPM	A1A_FUG , A1B_FUG , TG_FUG ,
ALL	A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = A1A_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1A_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = TG_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = TG_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591115.9,	4142496.0,	0.0,	1.5);	(591096.2,	4142502.5,	0.0,	1.5);
(591077.5,	4142507.8,	0.0,	1.5);	(591058.5,	4142513.5,	0.0,	1.5);
(591040.3,	4142518.8,	0.0,	1.5);	(591020.1,	4142524.5,	0.0,	1.5);
(591001.4,	4142531.0,	0.0,	1.5);	(590982.8,	4142537.0,	0.0,	1.5);
(591138.4,	4142481.3,	0.0,	1.5);	(591143.0,	4142499.5,	0.0,	1.5);
(591148.3,	4142518.5,	0.0,	1.5);	(591123.2,	4142520.0,	0.0,	1.5);
(591104.2,	4142525.8,	0.0,	1.5);	(591084.8,	4142531.5,	0.0,	1.5);
(591065.8,	4142537.0,	0.0,	1.5);	(591046.7,	4142542.0,	0.0,	1.5);
(591027.3,	4142548.5,	0.0,	1.5);	(591009.0,	4142554.8,	0.0,	1.5);
(591152.1,	4142551.5,	0.0,	1.5);	(591156.3,	4142570.5,	0.0,	1.5);
(591127.4,	4142566.5,	0.0,	1.5);	(591109.1,	4142572.5,	0.0,	1.5);
(591090.1,	4142577.0,	0.0,	1.5);	(591070.7,	4142583.5,	0.0,	1.5);
(591052.8,	4142588.5,	0.0,	1.5);	(591032.2,	4142595.0,	0.0,	1.5);
(591145.3,	4142587.0,	0.0,	1.5);	(591126.3,	4142592.2,	0.0,	1.5);
(591107.2,	4142597.8,	0.0,	1.5);	(591088.9,	4142603.0,	0.0,	1.5);
(591068.4,	4142609.5,	0.0,	1.5);	(590876.6,	4142572.2,	0.0,	1.5);
(590899.1,	4142588.5,	0.0,	1.5);	(590920.8,	4142605.2,	0.0,	1.5);
(590939.8,	4142624.2,	0.0,	1.5);	(590960.3,	4142642.2,	0.0,	1.5);
(590980.5,	4142658.5,	0.0,	1.5);	(591001.4,	4142676.5,	0.0,	1.5);
(591031.1,	4142698.0,	0.0,	1.5);	(590848.1,	4142584.2,	0.0,	1.5);
(590851.9,	4142600.8,	0.0,	1.5);	(590874.3,	4142614.8,	0.0,	1.5);
(590893.8,	4142635.0,	0.0,	1.5);	(590912.8,	4142654.0,	0.0,	1.5);
(590932.6,	4142671.8,	0.0,	1.5);	(590952.7,	4142690.0,	0.0,	1.5);
(590971.4,	4142709.5,	0.0,	1.5);	(590850.4,	4142666.0,	0.0,	1.5);
(590870.5,	4142683.8,	0.0,	1.5);	(590892.6,	4142700.2,	0.0,	1.5);
(590912.4,	4142714.0,	0.0,	1.5);	(590827.5,	4142693.2,	0.0,	1.5);
(590854.6,	4142720.2,	0.0,	1.5);	(590878.1,	4142740.2,	0.0,	1.5);
(590900.2,	4142759.2,	0.0,	1.5);	(590773.1,	4142713.0,	0.0,	1.5);
(590789.5,	4142724.0,	0.0,	1.5);	(590823.8,	4142755.5,	0.0,	1.5);
(590844.2,	4142774.5,	0.0,	1.5);	(590738.5,	4142741.8,	0.0,	1.5);
(590751.1,	4142755.2,	0.0,	1.5);	(590765.5,	4142767.3,	0.0,	1.5);
(590773.5,	4142678.3,	0.0,	1.5);	(590755.2,	4142678.0,	0.0,	1.5);
(590742.2,	4142679.5,	0.0,	1.5);	(590726.7,	4142679.0,	0.0,	1.5);
(590689.4,	4142171.5,	0.0,	1.5);	(590682.9,	4142157.0,	0.0,	1.5);
(590678.8,	4142139.8,	0.0,	1.5);	(590724.8,	4142165.2,	0.0,	1.5);
(590754.8,	4142160.5,	0.0,	1.5);	(590784.1,	4142156.2,	0.0,	1.5);
(590816.5,	4142153.5,	0.0,	1.5);	(590841.6,	4142151.8,	0.0,	1.5);
(590836.2,	4142126.5,	0.0,	1.5);	(590805.1,	4142129.2,	0.0,	1.5);
(590776.9,	4142134.2,	0.0,	1.5);	(590743.4,	4142139.0,	0.0,	1.5);
(590714.5,	4142141.0,	0.0,	1.5);	(590899.4,	4142140.2,	0.0,	1.5);
(590929.1,	4142138.0,	0.0,	1.5);	(590959.9,	4142127.0,	0.0,	1.5);
(590986.9,	4142116.2,	0.0,	1.5);	(590896.8,	4142119.0,	0.0,	1.5);
(590927.6,	4142112.8,	0.0,	1.5);	(590955.0,	4142103.2,	0.0,	1.5);
(590970.3,	4142092.2,	0.0,	1.5);	(590983.9,	4142082.5,	0.0,	1.5);
(590987.8,	4142065.2,	0.0,	1.5);	(591000.7,	4142098.0,	0.0,	1.5);

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591014.4,	4142069.8,	0.0,	1.5);	(590780.8,	4142100.8,	0.0,	1.5);
(590806.6,	4142102.2,	0.0,	1.5);	(590843.1,	4142099.5,	0.0,	1.5);
(590875.5,	4142093.8,	0.0,	1.5);	(590907.4,	4142090.8,	0.0,	1.5);
(590943.2,	4142081.3,	0.0,	1.5);	(591504.0,	4142382.2,	0.0,	1.5);
(591537.8,	4142385.0,	0.0,	1.5);	(591459.6,	4141782.3,	0.0,	1.5);
(591491.4,	4141786.5,	0.0,	1.5);	(591523.3,	4141787.0,	0.0,	1.5);
(591550.8,	4141786.5,	0.0,	1.5);	(591580.3,	4141787.0,	0.0,	1.5);
(591608.8,	4141787.5,	0.0,	1.5);	(591638.2,	4141792.8,	0.0,	1.5);
(591668.7,	4141802.5,	0.0,	1.5);	(591009.6,	4142041.8,	0.0,	1.5);
(590998.1,	4142018.8,	0.0,	1.5);	(590991.2,	4141992.0,	0.0,	1.5);
(590982.1,	4141965.5,	0.0,	1.5);	(590979.8,	4142038.5,	0.0,	1.5);
(590972.9,	4142015.5,	0.0,	1.5);	(590964.6,	4141989.2,	0.0,	1.5);
(590965.6,	4141951.8,	0.0,	1.5);	(590947.2,	4141956.2,	0.0,	1.5);
(590944.4,	4141980.8,	0.0,	1.5);	(590864.9,	4142388.0,	0.0,	1.5);
(590854.1,	4142373.8,	0.0,	1.5);	(590804.2,	4142384.0,	0.0,	1.5);
(590789.8,	4142385.0,	0.0,	1.5);	(590777.0,	4142386.8,	0.0,	1.5);
(590761.9,	4142387.2,	0.0,	1.5);	(590747.9,	4142390.5,	0.0,	1.5);
(590736.9,	4142390.0,	0.0,	1.5);	(590724.9,	4142389.8,	0.0,	1.5);
(590688.8,	4142442.5,	0.0,	1.5);	(590683.8,	4142430.0,	0.0,	1.5);
(590687.8,	4142456.3,	0.0,	1.5);	(590687.8,	4142473.2,	0.0,	1.5);
(590690.9,	4142486.8,	0.0,	1.5);	(590690.8,	4142504.8,	0.0,	1.5);
(590730.3,	4142593.5,	0.0,	1.5);	(590618.4,	4142553.5,	0.0,	1.5);
(590613.4,	4142595.3,	0.0,	1.5);	(590570.9,	4142579.5,	0.0,	1.5);
(590686.1,	4142609.0,	0.0,	1.5);	(590657.0,	4142612.8,	0.0,	1.5);
(590623.9,	4142620.0,	0.0,	1.5);	(590638.4,	4142620.2,	0.0,	1.5);
(590661.3,	4142594.5,	0.0,	1.5);	(590646.3,	4142597.2,	0.0,	1.5);
(590630.1,	4142595.5,	0.0,	1.5);	(590660.2,	4142665.3,	0.0,	1.5);
(590639.8,	4142681.5,	0.0,	1.5);	(590628.6,	4142681.0,	0.0,	1.5);
(590617.8,	4142685.2,	0.0,	1.5);	(590608.4,	4142686.2,	0.0,	1.5);
(590675.7,	4142678.5,	0.0,	1.5);	(590689.8,	4142688.2,	0.0,	1.5);
(590686.1,	4142722.0,	0.0,	1.5);	(590663.8,	4142736.5,	0.0,	1.5);
(590645.8,	4142735.0,	0.0,	1.5);	(590632.2,	4142738.0,	0.0,	1.5);
(590612.4,	4142734.8,	0.0,	1.5);	(590612.8,	4142725.8,	0.0,	1.5);
(590627.6,	4142717.0,	0.0,	1.5);	(590655.6,	4142716.0,	0.0,	1.5);

CONC RURAL FLAT FLGPOL DFAULT

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

```
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1
```

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

*** WIND PROFILE EXPONENTS ***

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
B	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
C	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00
D	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00
E	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00
F	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00

*** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
(DEGREES KELVIN PER METER)

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
B	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
C	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
D	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
E	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01
F	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

FILE: C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
FORMAT: (4I2,2F9.4,F6.1,I2,2F7.1,f9.4,f10.1,f8.4,i4,f7.2)
SURFACE STATION NO.: 7905 UPPER AIR STATION NO.: 7905
NAME: UNKNOWN NAME: UNKNOWN
YEAR: 1996 YEAR: 1996

YR	MN	DY	HR	FLOW VECTOR	SPEED (M/S)	TEMP (K)	STAB CLASS	MIXING HEIGHT (M) RURAL	MIXING HEIGHT (M) URBAN	USTAR (M/S)	M-O LENGTH (M)	Z-0 (M)	IPCODE	PRATE (mm/HR)
96	01	01	01	212.7	1.56	283.5	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	02	186.7	1.03	284.0	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	03	162.3	1.79	284.0	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	04	185.1	1.97	283.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	05	132.3	2.46	283.0	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	06	97.9	4.16	283.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	07	95.8	1.61	284.4	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	08	152.8	3.58	285.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	09	157.8	5.54	288.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	10	158.3	5.01	289.9	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	11	162.5	5.54	291.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	12	161.7	5.72	292.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	13	168.0	6.84	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	14	182.2	6.12	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	15	153.1	5.68	292.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	16	112.6	4.34	291.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	17	134.5	3.84	290.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	18	143.4	4.38	290.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	19	145.1	3.62	290.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	20	161.2	4.83	289.3	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	21	155.0	4.83	289.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	22	105.9	4.25	286.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	23	48.0	2.68	285.6	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	24	89.0	2.46	285.8	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00

*** NOTES: STABILITY CLASS 1=A, 2=B, 3=C, 4=D, 5=E AND 6=F.
FLOW VECTOR IS DIRECTION TOWARD WHICH WIND IS BLOWING.

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.00976	591096.19	4142502.50	0.01019
591077.50	4142507.75	0.01061	591058.50	4142513.50	0.01095
591040.25	4142518.75	0.01125	591020.06	4142524.50	0.01150
591001.44	4142531.00	0.01155	590982.75	4142537.00	0.01155
591138.44	4142481.25	0.00970	591143.00	4142499.50	0.00827
591148.31	4142518.50	0.00699	591123.19	4142520.00	0.00790
591104.19	4142525.75	0.00831	591084.75	4142531.50	0.00870
591065.75	4142537.00	0.00906	591046.69	4142542.00	0.00941
591027.31	4142548.50	0.00962	591009.00	4142554.75	0.00973
591152.13	4142551.50	0.00545	591156.31	4142570.50	0.00470
591127.38	4142566.50	0.00561	591109.12	4142572.50	0.00591
591090.06	4142577.00	0.00627	591070.69	4142583.50	0.00654
591052.81	4142588.50	0.00681	591032.25	4142595.00	0.00705
591145.25	4142587.00	0.00449	591126.25	4142592.25	0.00479
591107.19	4142597.75	0.00509	591088.94	4142603.00	0.00536
591068.38	4142609.50	0.00563	590876.62	4142572.25	0.01003
590899.06	4142588.50	0.00936	590920.75	4142605.25	0.00849
590939.75	4142624.25	0.00750	590960.31	4142642.25	0.00657
590980.50	4142658.50	0.00573	591001.44	4142676.50	0.00492
591031.13	4142698.00	0.00401	590848.06	4142584.25	0.00932
590851.88	4142600.75	0.00875	590874.31	4142614.75	0.00828
590893.75	4142635.00	0.00748	590912.75	4142654.00	0.00670
590932.56	4142671.75	0.00595	590952.69	4142690.00	0.00523
590971.38	4142709.50	0.00454	590850.38	4142666.00	0.00662
590870.50	4142683.75	0.00608	590892.56	4142700.25	0.00552
590912.38	4142714.00	0.00504	590827.50	4142693.25	0.00592
590854.56	4142720.25	0.00525	590878.12	4142740.25	0.00471
590900.19	4142759.25	0.00420	590773.12	4142713.00	0.00543
590789.50	4142724.00	0.00526	590823.75	4142755.50	0.00466
590844.25	4142774.50	0.00425	590738.50	4142741.75	0.00480
590751.06	4142755.25	0.00464	590765.50	4142767.25	0.00450
590773.50	4142678.25	0.00616	590755.25	4142678.00	0.00609
590742.25	4142679.50	0.00598	590726.69	4142679.00	0.00588
590689.38	4142171.50	0.00074	590682.94	4142157.00	0.00070
590678.75	4142139.75	0.00066	590724.75	4142165.25	0.00086
590754.81	4142160.50	0.00099	590784.12	4142156.25	0.00114
590816.50	4142153.50	0.00134	590841.62	4142151.75	0.00152
590836.25	4142126.50	0.00134	590805.06	4142129.25	0.00116
590776.94	4142134.25	0.00103	590743.44	4142139.00	0.00088
590714.50	4142141.00	0.00078	590899.44	4142140.25	0.00192

CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.00223	590959.94	4142127.00	0.00252
590986.94	4142116.25	0.00280	590896.75	4142119.00	0.00172
590927.62	4142112.75	0.00196	590955.00	4142103.25	0.00217
590970.25	4142092.25	0.00224	590983.94	4142082.50	0.00231
590987.75	4142065.25	0.00216	591000.69	4142098.00	0.00276
591014.38	4142069.75	0.00257	590780.75	4142100.75	0.00095
590806.56	4142102.25	0.00107	590843.12	4142099.50	0.00124
590875.50	4142093.75	0.00140	590907.44	4142090.75	0.00161
590943.19	4142081.25	0.00184	591504.00	4142382.25	0.00156
591537.81	4142385.00	0.00132	591459.56	4141782.25	0.00281
591491.44	4141786.50	0.00297	591523.31	4141787.00	0.00307
591550.81	4141786.50	0.00314	591580.31	4141787.00	0.00321
591608.81	4141787.50	0.00327	591638.25	4141792.75	0.00337
591668.69	4141802.50	0.00351	591009.56	4142041.75	0.00216
590998.12	4142018.75	0.00182	590991.25	4141992.00	0.00156
590982.06	4141965.50	0.00134	590979.75	4142038.50	0.00182
590972.88	4142015.50	0.00159	590964.63	4141989.25	0.00137
590965.56	4141951.75	0.00118	590947.19	4141956.25	0.00112
590944.44	4141980.75	0.00121	590864.94	4142388.00	0.01117
590854.12	4142373.75	0.00897	590804.25	4142384.00	0.00650
590789.75	4142385.00	0.00552	590777.00	4142386.75	0.00473
590761.88	4142387.25	0.00380	590747.88	4142390.50	0.00314
590736.94	4142390.00	0.00266	590724.94	4142389.75	0.00229
590688.75	4142442.50	0.00217	590683.81	4142430.00	0.00197
590687.81	4142456.25	0.00236	590687.81	4142473.25	0.00272
590690.94	4142486.75	0.00317	590690.75	4142504.75	0.00373
590730.31	4142593.50	0.00762	590618.38	4142553.50	0.00259
590613.44	4142595.25	0.00305	590570.94	4142579.50	0.00206
590686.12	4142609.00	0.00599	590657.00	4142612.75	0.00473
590623.94	4142620.00	0.00364	590638.38	4142620.25	0.00411
590661.31	4142594.50	0.00467	590646.25	4142597.25	0.00410
590630.06	4142595.50	0.00352	590660.25	4142665.25	0.00495
590639.81	4142681.50	0.00434	590628.56	4142681.00	0.00406
590617.75	4142685.25	0.00380	590608.38	4142686.25	0.00359
590675.69	4142678.50	0.00519	590689.81	4142688.25	0.00529
590686.12	4142722.00	0.00474	590663.81	4142736.50	0.00432
590645.81	4142735.00	0.00411	590632.25	4142738.00	0.00390
590612.38	4142734.75	0.00360	590612.81	4142725.75	0.00364
590627.63	4142717.00	0.00394	590655.62	4142716.00	0.00443

CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.01203	591096.19	4142502.50	0.01216
591077.50	4142507.75	0.01239	591058.50	4142513.50	0.01256
591040.25	4142518.75	0.01274	591020.06	4142524.50	0.01290
591001.44	4142531.00	0.01288	590982.75	4142537.00	0.01295
591138.44	4142481.25	0.01291	591143.00	4142499.50	0.01030
591148.31	4142518.50	0.00832	591123.19	4142520.00	0.00914
591104.19	4142525.75	0.00934	591084.75	4142531.50	0.00954
591065.75	4142537.00	0.00973	591046.69	4142542.00	0.00993
591027.31	4142548.50	0.00998	591009.00	4142554.75	0.01001
591152.13	4142551.50	0.00609	591156.31	4142570.50	0.00512
591127.38	4142566.50	0.00605	591109.12	4142572.50	0.00623
591090.06	4142577.00	0.00647	591070.69	4142583.50	0.00659
591052.81	4142588.50	0.00673	591032.25	4142595.00	0.00685
591145.25	4142587.00	0.00477	591126.25	4142592.25	0.00502
591107.19	4142597.75	0.00523	591088.94	4142603.00	0.00540
591068.38	4142609.50	0.00555	590876.62	4142572.25	0.01310
590899.06	4142588.50	0.01042	590920.75	4142605.25	0.00862
590939.75	4142624.25	0.00721	590960.31	4142642.25	0.00614
590980.50	4142658.50	0.00532	591001.44	4142676.50	0.00456
591031.13	4142698.00	0.00373	590848.06	4142584.25	0.01287
590851.88	4142600.75	0.01082	590874.31	4142614.75	0.00905
590893.75	4142635.00	0.00748	590912.75	4142654.00	0.00638
590932.56	4142671.75	0.00551	590952.69	4142690.00	0.00478
590971.38	4142709.50	0.00414	590850.38	4142666.00	0.00673
590870.50	4142683.75	0.00583	590892.56	4142700.25	0.00512
590912.38	4142714.00	0.00460	590827.50	4142693.25	0.00596
590854.56	4142720.25	0.00492	590878.12	4142740.25	0.00429
590900.19	4142759.25	0.00378	590773.12	4142713.00	0.00579
590789.50	4142724.00	0.00534	590823.75	4142755.50	0.00434
590844.25	4142774.50	0.00386	590738.50	4142741.75	0.00510
590751.06	4142755.25	0.00474	590765.50	4142767.25	0.00443
590773.50	4142678.25	0.00714	590755.25	4142678.00	0.00734
590742.25	4142679.50	0.00734	590726.69	4142679.00	0.00740
590689.38	4142171.50	0.00074	590682.94	4142157.00	0.00069
590678.75	4142139.75	0.00064	590724.75	4142165.25	0.00087
590754.81	4142160.50	0.00101	590784.12	4142156.25	0.00118
590816.50	4142153.50	0.00139	590841.62	4142151.75	0.00159
590836.25	4142126.50	0.00136	590805.06	4142129.25	0.00117
590776.94	4142134.25	0.00103	590743.44	4142139.00	0.00087
590714.50	4142141.00	0.00077	590899.44	4142140.25	0.00203

CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.00233	590959.94	4142127.00	0.00255
590986.94	4142116.25	0.00274	590896.75	4142119.00	0.00178
590927.62	4142112.75	0.00201	590955.00	4142103.25	0.00217
590970.25	4142092.25	0.00220	590983.94	4142082.50	0.00222
590987.75	4142065.25	0.00206	591000.69	4142098.00	0.00262
591014.38	4142069.75	0.00237	590780.75	4142100.75	0.00092
590806.56	4142102.25	0.00105	590843.12	4142099.50	0.00124
590875.50	4142093.75	0.00141	590907.44	4142090.75	0.00163
590943.19	4142081.25	0.00182	591504.00	4142382.25	0.00159
591537.81	4142385.00	0.00131	591459.56	4141782.25	0.00202
591491.44	4141786.50	0.00213	591523.31	4141787.00	0.00221
591550.81	4141786.50	0.00225	591580.31	4141787.00	0.00231
591608.81	4141787.50	0.00235	591638.25	4141792.75	0.00243
591668.69	4141802.50	0.00253	591009.56	4142041.75	0.00199
590998.12	4142018.75	0.00169	590991.25	4141992.00	0.00145
590982.06	4141965.50	0.00124	590979.75	4142038.50	0.00173
590972.88	4142015.50	0.00150	590964.63	4141989.25	0.00129
590965.56	4141951.75	0.00110	590947.19	4141956.25	0.00105
590944.44	4141980.75	0.00115	590864.94	4142388.00	0.02007
590854.12	4142373.75	0.01495	590804.25	4142384.00	0.01206
590789.75	4142385.00	0.01029	590777.00	4142386.75	0.00883
590761.88	4142387.25	0.00678	590747.88	4142390.50	0.00540
590736.94	4142390.00	0.00421	590724.94	4142389.75	0.00332
590688.75	4142442.50	0.00342	590683.81	4142430.00	0.00284
590687.81	4142456.25	0.00398	590687.81	4142473.25	0.00496
590690.94	4142486.75	0.00625	590690.75	4142504.75	0.00746
590730.31	4142593.50	0.01743	590618.38	4142553.50	0.00343
590613.44	4142595.25	0.00397	590570.94	4142579.50	0.00242
590686.12	4142609.00	0.00989	590657.00	4142612.75	0.00695
590623.94	4142620.00	0.00485	590638.38	4142620.25	0.00567
590661.31	4142594.50	0.00713	590646.25	4142597.25	0.00591
590630.06	4142595.50	0.00482	590660.25	4142665.25	0.00662
590639.81	4142681.50	0.00553	590628.56	4142681.00	0.00511
590617.75	4142685.25	0.00471	590608.38	4142686.25	0.00439
590675.69	4142678.50	0.00680	590689.81	4142688.25	0.00672
590686.12	4142722.00	0.00557	590663.81	4142736.50	0.00501
590645.81	4142735.00	0.00482	590632.25	4142738.00	0.00455
590612.38	4142734.75	0.00421	590612.81	4142725.75	0.00430
590627.63	4142717.00	0.00473	590655.62	4142716.00	0.00535

CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591115.94	4142496.00	0.02179	591096.19	4142502.50	0.02235
591077.50	4142507.75	0.02300	591058.50	4142513.50	0.02352
591040.25	4142518.75	0.02399	591020.06	4142524.50	0.02441
591001.44	4142531.00	0.02443	590982.75	4142537.00	0.02450
591138.44	4142481.25	0.02260	591143.00	4142499.50	0.01857
591148.31	4142518.50	0.01531	591123.19	4142520.00	0.01704
591104.19	4142525.75	0.01765	591084.75	4142531.50	0.01825
591065.75	4142537.00	0.01879	591046.69	4142542.00	0.01934
591027.31	4142548.50	0.01959	591009.00	4142554.75	0.01975
591152.13	4142551.50	0.01154	591156.31	4142570.50	0.00981
591127.38	4142566.50	0.01166	591109.12	4142572.50	0.01214
591090.06	4142577.00	0.01274	591070.69	4142583.50	0.01313
591052.81	4142588.50	0.01354	591032.25	4142595.00	0.01389
591145.25	4142587.00	0.00926	591126.25	4142592.25	0.00981
591107.19	4142597.75	0.01032	591088.94	4142603.00	0.01077
591068.38	4142609.50	0.01118	590876.62	4142572.25	0.02313
590899.06	4142588.50	0.01978	590920.75	4142605.25	0.01710
590939.75	4142624.25	0.01471	590960.31	4142642.25	0.01270
590980.50	4142658.50	0.01105	591001.44	4142676.50	0.00948
591031.13	4142698.00	0.00773	590848.06	4142584.25	0.02219
590851.88	4142600.75	0.01957	590874.31	4142614.75	0.01733
590893.75	4142635.00	0.01497	590912.75	4142654.00	0.01307
590932.56	4142671.75	0.01147	590952.69	4142690.00	0.01001
590971.38	4142709.50	0.00868	590850.38	4142666.00	0.01335
590870.50	4142683.75	0.01191	590892.56	4142700.25	0.01064
590912.38	4142714.00	0.00964	590827.50	4142693.25	0.01188
590854.56	4142720.25	0.01017	590878.12	4142740.25	0.00900
590900.19	4142759.25	0.00798	590773.12	4142713.00	0.01123
590789.50	4142724.00	0.01060	590823.75	4142755.50	0.00900
590844.25	4142774.50	0.00811	590738.50	4142741.75	0.00990
590751.06	4142755.25	0.00938	590765.50	4142767.25	0.00893
590773.50	4142678.25	0.01330	590755.25	4142678.00	0.01342
590742.25	4142679.50	0.01332	590726.69	4142679.00	0.01328
590689.38	4142171.50	0.00149	590682.94	4142157.00	0.00138
590678.75	4142139.75	0.00130	590724.75	4142165.25	0.00174
590754.81	4142160.50	0.00199	590784.12	4142156.25	0.00232
590816.50	4142153.50	0.00273	590841.62	4142151.75	0.00310
590836.25	4142126.50	0.00270	590805.06	4142129.25	0.00234
590776.94	4142134.25	0.00205	590743.44	4142139.00	0.00175
590714.50	4142141.00	0.00154	590899.44	4142140.25	0.00395

CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
590929.12	4142138.00	0.00456	590959.94	4142127.00	0.00507
590986.94	4142116.25	0.00554	590896.75	4142119.00	0.00350
590927.62	4142112.75	0.00397	590955.00	4142103.25	0.00434
590970.25	4142092.25	0.00444	590983.94	4142082.50	0.00453
590987.75	4142065.25	0.00422	591000.69	4142098.00	0.00538
591014.38	4142069.75	0.00494	590780.75	4142100.75	0.00187
590806.56	4142102.25	0.00212	590843.12	4142099.50	0.00248
590875.50	4142093.75	0.00281	590907.44	4142090.75	0.00323
590943.19	4142081.25	0.00366	591504.00	4142382.25	0.00315
591537.81	4142385.00	0.00263	591459.56	4141782.25	0.00483
591491.44	4141786.50	0.00510	591523.31	4141787.00	0.00528
591550.81	4141786.50	0.00539	591580.31	4141787.00	0.00552
591608.81	4141787.50	0.00562	591638.25	4141792.75	0.00580
591668.69	4141802.50	0.00603	591009.56	4142041.75	0.00415
590998.12	4142018.75	0.00351	590991.25	4141992.00	0.00300
590982.06	4141965.50	0.00257	590979.75	4142038.50	0.00355
590972.88	4142015.50	0.00309	590964.63	4141989.25	0.00266
590965.56	4141951.75	0.00228	590947.19	4141956.25	0.00216
590944.44	4141980.75	0.00236	590864.94	4142388.00	0.03124
590854.12	4142373.75	0.02393	590804.25	4142384.00	0.01856
590789.75	4142385.00	0.01581	590777.00	4142386.75	0.01356
590761.88	4142387.25	0.01057	590747.88	4142390.50	0.00854
590736.94	4142390.00	0.00687	590724.94	4142389.75	0.00561
590688.75	4142442.50	0.00560	590683.81	4142430.00	0.00480
590687.81	4142456.25	0.00635	590687.81	4142473.25	0.00767
590690.94	4142486.75	0.00943	590690.75	4142504.75	0.01119
590730.31	4142593.50	0.02505	590618.38	4142553.50	0.00602
590613.44	4142595.25	0.00702	590570.94	4142579.50	0.00448
590686.12	4142609.00	0.01587	590657.00	4142612.75	0.01169
590623.94	4142620.00	0.00850	590638.38	4142620.25	0.00979
590661.31	4142594.50	0.01180	590646.25	4142597.25	0.01001
590630.06	4142595.50	0.00833	590660.25	4142665.25	0.01157
590639.81	4142681.50	0.00987	590628.56	4142681.00	0.00918
590617.75	4142685.25	0.00851	590608.38	4142686.25	0.00798
590675.69	4142678.50	0.01199	590689.81	4142688.25	0.01201
590686.12	4142722.00	0.01031	590663.81	4142736.50	0.00933
590645.81	4142735.00	0.00893	590632.25	4142738.00	0.00845
590612.38	4142734.75	0.00781	590612.81	4142725.75	0.00793
590627.63	4142717.00	0.00867	590655.62	4142716.00	0.00977

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (43848 HRS) RESULTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
DPM	1ST HIGHEST VALUE IS	0.01155 AT	(590982.75, 4142537.00, 0.00, 1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.01155 AT	(591001.44, 4142531.00, 0.00, 1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.01150 AT	(591020.06, 4142524.50, 0.00, 1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.01125 AT	(591040.25, 4142518.75, 0.00, 1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.01117 AT	(590864.94, 4142388.00, 0.00, 1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.01095 AT	(591058.50, 4142513.50, 0.00, 1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.01061 AT	(591077.50, 4142507.75, 0.00, 1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.01019 AT	(591096.19, 4142502.50, 0.00, 1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.01003 AT	(590876.62, 4142572.25, 0.00, 1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.00976 AT	(591115.94, 4142496.00, 0.00, 1.50)	DC	NA
FUGPM	1ST HIGHEST VALUE IS	0.02007 AT	(590864.94, 4142388.00, 0.00, 1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.01743 AT	(590730.31, 4142593.50, 0.00, 1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.01495 AT	(590854.12, 4142373.75, 0.00, 1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.01310 AT	(590876.62, 4142572.25, 0.00, 1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.01295 AT	(590982.75, 4142537.00, 0.00, 1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.01291 AT	(591138.44, 4142481.25, 0.00, 1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.01290 AT	(591020.06, 4142524.50, 0.00, 1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.01288 AT	(591001.44, 4142531.00, 0.00, 1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.01287 AT	(590848.06, 4142584.25, 0.00, 1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.01274 AT	(591040.25, 4142518.75, 0.00, 1.50)	DC	NA
ALL	1ST HIGHEST VALUE IS	0.03124 AT	(590864.94, 4142388.00, 0.00, 1.50)	DC	NA
	2ND HIGHEST VALUE IS	0.02505 AT	(590730.31, 4142593.50, 0.00, 1.50)	DC	NA
	3RD HIGHEST VALUE IS	0.02450 AT	(590982.75, 4142537.00, 0.00, 1.50)	DC	NA
	4TH HIGHEST VALUE IS	0.02443 AT	(591001.44, 4142531.00, 0.00, 1.50)	DC	NA
	5TH HIGHEST VALUE IS	0.02441 AT	(591020.06, 4142524.50, 0.00, 1.50)	DC	NA
	6TH HIGHEST VALUE IS	0.02399 AT	(591040.25, 4142518.75, 0.00, 1.50)	DC	NA
	7TH HIGHEST VALUE IS	0.02393 AT	(590854.12, 4142373.75, 0.00, 1.50)	DC	NA
	8TH HIGHEST VALUE IS	0.02352 AT	(591058.50, 4142513.50, 0.00, 1.50)	DC	NA
	9TH HIGHEST VALUE IS	0.02313 AT	(590876.62, 4142572.25, 0.00, 1.50)	DC	NA
	10TH HIGHEST VALUE IS	0.02300 AT	(591077.50, 4142507.75, 0.00, 1.50)	DC	NA

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

```
**MODELOPTs:
CONC                    RURAL FLAT  FLGPOL DFAULT


*** Message Summary : ISCST3 Model Execution ***

 --------- Summary of Total Messages --------

A Total of            0 Fatal Error Message(s)
A Total of            0 Warning Message(s)
A Total of          121 Informational Message(s)

A Total of          121 Calm Hours Identified


   ******** FATAL ERROR MESSAGES ********
              ***  NONE  ***


   ********   WARNING MESSAGES   ********
              ***  NONE  ***


   ************************************
   *** ISCST3 Finishes Successfully ***
   ************************************
```

2017 DPM & Fugitive PM2.5 Model Input/Output- School Receptors

```
**
****************************************
**
** ISCST3 Input Produced by:
** AERMOD View Ver. 9.1.0
** Lakes Environmental Software Inc.
** Date: 10/27/2016
** File: G:\Projects\I&R\Topgolf\Model\Topgolf-Const-2017-School.INP
**
****************************************
**
**
****************************************
** ISCST3 Control Pathway
****************************************
**
**
CO STARTING
   TITLEONE TopGolf-2017 Construction DPM/PM2.5, 1996-2000 Alviso Met Data
   TITLETWO School Receptors - 1.0 meter receptor heights
   MODELOPT DFAULT CONC  RURAL
   AVERTIME PERIOD
   POLLUTID OTHER
   TERRHGTS FLAT
   FLAGPOLE 1.00
   RUNORNOT RUN
   ERRORFIL TOPGOL~3.ERR
CO FINISHED
**
****************************************
** ISCST3 Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION A1A_DPM      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A -2017 DPM
   LOCATION A1A_FUG      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A - 2017 Fugitive PM2.5
   LOCATION A1B_DPM      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B -2017 DPM
   LOCATION A1B_FUG      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B - 2017 Fugitive PM2.5
   LOCATION TG_DPM       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2017 DPM
   LOCATION TG_FUG       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2017 Fugitive PM2.5
** Source Parameters **
   SRCPARAM A1A_DPM       5.07E-08     6.000        10
   AREAVERT A1A_DPM      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_DPM      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_DPM      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_DPM      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_DPM      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1A_FUG        1.4E-07     2.000        10     0.000
   AREAVERT A1A_FUG      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_FUG      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_FUG      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_FUG      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_FUG      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1B_DPM       5.07E-08     6.000         6
   AREAVERT A1B_DPM      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_DPM      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_DPM      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM A1B_FUG        1.4E-07     2.000         6     0.000
   AREAVERT A1B_FUG      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_FUG      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_FUG      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM TG_DPM        8.27E-07     6.000        10
   AREAVERT TG_DPM       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_DPM       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_DPM       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_DPM       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_DPM       591226.892 4142337.693 591256.845 4142288.678
   SRCPARAM TG_FUG        3.64E-07     2.000        10     0.000
   AREAVERT TG_FUG       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_FUG       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_FUG       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_FUG       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_FUG       591226.892 4142337.693 591256.845 4142288.678

** Variable Emissions Type: "By Hour-of-Day (HROFDY)"
** Variable Emission Scenario: "7am-4pm"
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
```

```
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_DPM       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_FUG       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   SRCGROUP DPM      A1A_DPM A1B_DPM TG_DPM
   SRCGROUP FugPM    A1A_FUG A1B_FUG TG_FUG
   SRCGROUP ALL
SO FINISHED
**
****************************************
** ISCST3 Receptor Pathway
****************************************
**
**
RE STARTING
** DESCRREC "" ""
   DISCCART    591457.75   4142446.89    1.00
   DISCCART    591436.31   4142442.91    1.00
   DISCCART    591414.88   4142439.24    1.00
   DISCCART    591453.46   4142467.71    1.00
   DISCCART    591432.33   4142463.12    1.00
   DISCCART    591411.51   4142460.37    1.00
   DISCCART    591449.48   4142488.23    1.00
   DISCCART    591428.04   4142484.86    1.00
   DISCCART    591407.53   4142480.88    1.00
   DISCCART    591446.11   4142509.36    1.00
   DISCCART    591424.68   4142505.07    1.00
   DISCCART    591403.85   4142501.70    1.00
   DISCCART    591464.18   4142543.96    1.00
   DISCCART    591435.09   4142539.37    1.00
   DISCCART    591378.75   4142521.61    1.00
   DISCCART    591375.68   4142536.30    1.00
   DISCCART    591353.02   4142517.32    1.00
   DISCCART    591350.88   4142532.02    1.00
   DISCCART    591393.44   4142589.28    1.00
   DISCCART    591379.66   4142593.26    1.00
   DISCCART    591303.32   4142461.21    1.00
   DISCCART    591281.72   4142464.06    1.00
   DISCCART    591284.57   4142448.16    1.00
   DISCCART    591441.51   4142406.99    1.00
   DISCCART    591439.88   4142419.22    1.00
   DISCCART    591395.86   4142427.37    1.00
   DISCCART    591382.00   4142424.11    1.00
RE FINISHED
**
****************************************
** ISCST3 Meteorology Pathway
****************************************
**
**
ME STARTING
   INPUTFIL C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
   ANEMHGHT 10 METERS
   SURFDATA 7905 1996
   UAIRDATA 7905 1996
ME FINISHED
**
****************************************
** ISCST3 Output Pathway
****************************************
**
**
OU STARTING
** Auto-Generated Plotfiles
   PLOTFILE PERIOD ALL TOPGOL~3.IS\PE00GALL.PLT 31
   PLOTFILE PERIOD DPM TOPGOL~3.IS\PE00G001.PLT 32
   PLOTFILE PERIOD FugPM TOPGOL~3.IS\PE00G002.PLT 33
OU FINISHED

***********************************
*** SETUP Finishes Successfully ***
***********************************
```

```
                                          ***     MODEL SETUP OPTIONS SUMMARY       ***
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

**Intermediate Terrain Processing is Selected

**Model Is Setup For Calculation of Average CONCentration Values.

  --  SCAVENGING/DEPOSITION LOGIC --
**Model Uses NO DRY DEPLETION.  DDPLETE =  F
**Model Uses NO WET DEPLETION.  WDPLETE =  F
**NO WET SCAVENGING Data Provided.
**NO GAS DRY DEPOSITION Data Provided.
**Model Does NOT Use GRIDDED TERRAIN Data for Depletion Calculations

**Model Uses RURAL Dispersion.

**Model Uses Regulatory DEFAULT Options:
           1. Final Plume Rise.
           2. Stack-tip Downwash.
           3. Buoyancy-induced Dispersion.
           4. Use Calms Processing Routine.
           5. Not Use Missing Data Processing Routine.
           6. Default Wind Profile Exponents.
           7. Default Vertical Potential Temperature Gradients.
           8. "Upper Bound" Values for Supersquat Buildings.
           9. No Exponential Decay for RURAL Mode

**Model Assumes Receptors on FLAT Terrain.

**Model Accepts FLAGPOLE Receptor Heights.

**Model Calculates PERIOD Averages Only

**This Run Includes:     6 Source(s);      3 Source Group(s); and      27 Receptor(s)

**The Model Assumes A Pollutant Type of:  OTHER

**Model Set To Continue RUNning After the Setup Testing.

**Output Options Selected:
         Model Outputs Tables of PERIOD Averages by Receptor
         Model Outputs External File(s) of High Values for Plotting (PLOTFILE Keyword)

**NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                m for Missing Hours
                                                                b for Both Calm and Missing Hours

**Misc. Inputs:  Anem. Hgt. (m) =    10.00 ;    Decay Coef. =    0.000     ;    Rot. Angle =     0.0
                 Emission Units = GRAMS/SEC                                ;  Emission Rate Unit Factor =   0.10000E+07
                 Output Units   = MICROGRAMS/M**3

**Approximate Storage Requirements of Model =     1.2 MB of RAM.

**Input Runstream File:          Topgolf-Const-2017-School.INP
**Output Print File:             Topgolf-Const-2017-School.OUT
**Detailed Error/Message File:   TOPGOL~3.ERR
```

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** AREAPOLY SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (GRAMS/SEC /METER**2)	LOCATION OF AREA X (METERS)	Y (METERS)	BASE ELEV. (METERS)	RELEASE HEIGHT (METERS)	NUMBER OF VERTS.	INIT. SZ (METERS)	EMISSION RATE SCALAR VARY BY
A1A_DPM	0	0.50700E-07	590982.4	4142485.5	0.0	6.00	10	0.00	HROFDY
A1A_FUG	0	0.14000E-06	590982.4	4142485.5	0.0	2.00	10	0.00	HROFDY
A1B_DPM	0	0.50700E-07	591301.5	4142218.8	0.0	6.00	6	0.00	HROFDY
A1B_FUG	0	0.14000E-06	591301.5	4142218.8	0.0	2.00	6	0.00	HROFDY
TG_DPM	0	0.82700E-06	591150.6	4142203.2	0.0	6.00	10	0.00	HROFDY
TG_FUG	0	0.36400E-06	591150.6	4142203.2	0.0	2.00	10	0.00	HROFDY

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
DPM	A1A_DPM , A1B_DPM , TG_DPM ,
FUGPM	A1A_FUG , A1B_FUG , TG_FUG ,
ALL	A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = A1A_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1A_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = TG_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = TG_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591457.8,	4142447.0,	0.0,	1.0);	(591436.3,	4142443.0,	0.0,	1.0);
(591414.9,	4142439.2,	0.0,	1.0);	(591453.4,	4142467.8,	0.0,	1.0);
(591432.3,	4142463.0,	0.0,	1.0);	(591411.5,	4142460.2,	0.0,	1.0);
(591449.5,	4142488.2,	0.0,	1.0);	(591428.1,	4142484.8,	0.0,	1.0);
(591407.5,	4142481.0,	0.0,	1.0);	(591446.1,	4142509.2,	0.0,	1.0);
(591424.7,	4142505.0,	0.0,	1.0);	(591403.9,	4142501.8,	0.0,	1.0);
(591464.2,	4142544.0,	0.0,	1.0);	(591435.1,	4142539.2,	0.0,	1.0);
(591378.8,	4142521.5,	0.0,	1.0);	(591375.7,	4142536.2,	0.0,	1.0);
(591353.0,	4142517.2,	0.0,	1.0);	(591350.9,	4142532.0,	0.0,	1.0);
(591393.4,	4142589.3,	0.0,	1.0);	(591379.7,	4142593.2,	0.0,	1.0);
(591303.3,	4142461.2,	0.0,	1.0);	(591281.8,	4142464.0,	0.0,	1.0);
(591284.6,	4142448.2,	0.0,	1.0);	(591441.5,	4142407.0,	0.0,	1.0);
(591439.9,	4142419.2,	0.0,	1.0);	(591395.9,	4142427.2,	0.0,	1.0);
(591382.0,	4142424.0,	0.0,	1.0);				

CONC RURAL FLAT FLGPOL DFAULT

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

```
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1
```

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

*** WIND PROFILE EXPONENTS ***

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
B	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
C	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00
D	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00
E	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00
F	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00

*** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
(DEGREES KELVIN PER METER)

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
B	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
C	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
D	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
E	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01
F	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01

*** THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

FILE: C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
FORMAT: (4I2,2F9.4,F6.1,I2,2F7.1,f9.4,f10.1,f8.4,i4,f7.2)
SURFACE STATION NO.: 7905 UPPER AIR STATION NO.: 7905
NAME: UNKNOWN NAME: UNKNOWN
YEAR: 1996 YEAR: 1996

YR	MN	DY	HR	FLOW VECTOR	SPEED (M/S)	TEMP (K)	STAB CLASS	MIXING HEIGHT (M) RURAL	MIXING HEIGHT (M) URBAN	USTAR (M/S)	M-O LENGTH (M)	Z-0 (M)	IPCODE	PRATE (mm/HR)
96	01	01	01	212.7	1.56	283.5	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	02	186.7	1.03	284.0	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	03	162.3	1.79	284.0	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	04	185.1	1.97	283.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	05	132.3	2.46	283.0	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	06	97.9	4.16	283.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	07	95.8	1.61	284.4	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	08	152.8	3.58	285.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	09	157.8	5.54	288.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	10	158.3	5.01	289.9	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	11	162.5	5.54	291.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	12	161.7	5.72	292.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	13	168.0	6.84	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	14	182.2	6.12	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	15	153.1	5.68	292.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	16	112.6	4.34	291.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	17	134.5	3.84	290.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	18	143.4	4.38	290.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	19	145.1	3.62	290.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	20	161.2	4.83	289.3	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	21	155.0	4.83	289.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	22	105.9	4.25	286.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	23	48.0	2.68	285.6	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	24	89.0	2.46	285.8	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00

*** NOTES: STABILITY CLASS 1=A, 2=B, 3=C, 4=D, 5=E AND 6=F.
FLOW VECTOR IS DIRECTION TOWARD WHICH WIND IS BLOWING.

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591457.75	4142447.00	0.02062	591436.31	4142443.00	0.02307
591414.88	4142439.25	0.02597	591453.44	4142467.75	0.01955
591432.31	4142463.00	0.02185	591411.50	4142460.25	0.02435
591449.50	4142488.25	0.01871	591428.06	4142484.75	0.02080
591407.50	4142481.00	0.02325	591446.12	4142509.25	0.01796
591424.69	4142505.00	0.02004	591403.88	4142501.75	0.02251
591464.19	4142544.00	0.01534	591435.06	4142539.25	0.01772
591378.75	4142521.50	0.02466	591375.69	4142536.25	0.02406
591353.00	4142517.25	0.02835	591350.88	4142532.00	0.02724
591393.44	4142589.25	0.01941	591379.69	4142593.25	0.02018
591303.31	4142461.25	0.04636	591281.75	4142464.00	0.05270
591284.56	4142448.25	0.05643	591441.50	4142407.00	0.02643
591439.88	4142419.25	0.02510	591395.88	4142427.25	0.03013
591382.00	4142424.00	0.03294			

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591457.75	4142447.00	0.01751	591436.31	4142443.00	0.02016
591414.88	4142439.25	0.02352	591453.44	4142467.75	0.01641
591432.31	4142463.00	0.01887	591411.50	4142460.25	0.02164
591449.50	4142488.25	0.01557	591428.06	4142484.75	0.01772
591407.50	4142481.00	0.02014	591446.12	4142509.25	0.01479
591424.69	4142505.00	0.01672	591403.88	4142501.75	0.01893
591464.19	4142544.00	0.01222	591435.06	4142539.25	0.01420
591378.75	4142521.50	0.02045	591375.69	4142536.25	0.01970
591353.00	4142517.25	0.02453	591350.88	4142532.00	0.02323
591393.44	4142589.25	0.01497	591379.69	4142593.25	0.01574
591303.31	4142461.25	0.05202	591281.75	4142464.00	0.06308
591284.56	4142448.25	0.07309	591441.50	4142407.00	0.02384
591439.88	4142419.25	0.02235	591395.88	4142427.25	0.02873
591382.00	4142424.00	0.03251			

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591457.75	4142447.00	0.03813	591436.31	4142443.00	0.04323
591414.88	4142439.25	0.04949	591453.44	4142467.75	0.03596
591432.31	4142463.00	0.04072	591411.50	4142460.25	0.04599
591449.50	4142488.25	0.03428	591428.06	4142484.75	0.03852
591407.50	4142481.00	0.04338	591446.12	4142509.25	0.03275
591424.69	4142505.00	0.03677	591403.88	4142501.75	0.04144
591464.19	4142544.00	0.02756	591435.06	4142539.25	0.03192
591378.75	4142521.50	0.04511	591375.69	4142536.25	0.04376
591353.00	4142517.25	0.05287	591350.88	4142532.00	0.05047
591393.44	4142589.25	0.03437	591379.69	4142593.25	0.03593
591303.31	4142461.25	0.09838	591281.75	4142464.00	0.11577
591284.56	4142448.25	0.12953	591441.50	4142407.00	0.05027
591439.88	4142419.25	0.04745	591395.88	4142427.25	0.05886
591382.00	4142424.00	0.06545			

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (43848 HRS) RESULTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
DPM	1ST HIGHEST VALUE IS	0.05643 AT	(591284.56, 4142448.25, 0.00, 1.00)	DC	NA
	2ND HIGHEST VALUE IS	0.05270 AT	(591281.75, 4142464.00, 0.00, 1.00)	DC	NA
	3RD HIGHEST VALUE IS	0.04636 AT	(591303.31, 4142461.25, 0.00, 1.00)	DC	NA
	4TH HIGHEST VALUE IS	0.03294 AT	(591382.00, 4142424.00, 0.00, 1.00)	DC	NA
	5TH HIGHEST VALUE IS	0.03013 AT	(591395.88, 4142427.25, 0.00, 1.00)	DC	NA
	6TH HIGHEST VALUE IS	0.02835 AT	(591353.00, 4142517.25, 0.00, 1.00)	DC	NA
	7TH HIGHEST VALUE IS	0.02724 AT	(591350.88, 4142532.00, 0.00, 1.00)	DC	NA
	8TH HIGHEST VALUE IS	0.02643 AT	(591441.50, 4142407.00, 0.00, 1.00)	DC	NA
	9TH HIGHEST VALUE IS	0.02597 AT	(591414.88, 4142439.25, 0.00, 1.00)	DC	NA
	10TH HIGHEST VALUE IS	0.02510 AT	(591439.88, 4142419.25, 0.00, 1.00)	DC	NA
FUGPM	1ST HIGHEST VALUE IS	0.07309 AT	(591284.56, 4142448.25, 0.00, 1.00)	DC	NA
	2ND HIGHEST VALUE IS	0.06308 AT	(591281.75, 4142464.00, 0.00, 1.00)	DC	NA
	3RD HIGHEST VALUE IS	0.05202 AT	(591303.31, 4142461.25, 0.00, 1.00)	DC	NA
	4TH HIGHEST VALUE IS	0.03251 AT	(591382.00, 4142424.00, 0.00, 1.00)	DC	NA
	5TH HIGHEST VALUE IS	0.02873 AT	(591395.88, 4142427.25, 0.00, 1.00)	DC	NA
	6TH HIGHEST VALUE IS	0.02453 AT	(591353.00, 4142517.25, 0.00, 1.00)	DC	NA
	7TH HIGHEST VALUE IS	0.02384 AT	(591441.50, 4142407.00, 0.00, 1.00)	DC	NA
	8TH HIGHEST VALUE IS	0.02352 AT	(591414.88, 4142439.25, 0.00, 1.00)	DC	NA
	9TH HIGHEST VALUE IS	0.02323 AT	(591350.88, 4142532.00, 0.00, 1.00)	DC	NA
	10TH HIGHEST VALUE IS	0.02235 AT	(591439.88, 4142419.25, 0.00, 1.00)	DC	NA
ALL	1ST HIGHEST VALUE IS	0.12953 AT	(591284.56, 4142448.25, 0.00, 1.00)	DC	NA
	2ND HIGHEST VALUE IS	0.11577 AT	(591281.75, 4142464.00, 0.00, 1.00)	DC	NA
	3RD HIGHEST VALUE IS	0.09838 AT	(591303.31, 4142461.25, 0.00, 1.00)	DC	NA
	4TH HIGHEST VALUE IS	0.06545 AT	(591382.00, 4142424.00, 0.00, 1.00)	DC	NA
	5TH HIGHEST VALUE IS	0.05886 AT	(591395.88, 4142427.25, 0.00, 1.00)	DC	NA
	6TH HIGHEST VALUE IS	0.05287 AT	(591353.00, 4142517.25, 0.00, 1.00)	DC	NA
	7TH HIGHEST VALUE IS	0.05047 AT	(591350.88, 4142532.00, 0.00, 1.00)	DC	NA
	8TH HIGHEST VALUE IS	0.05027 AT	(591441.50, 4142407.00, 0.00, 1.00)	DC	NA
	9TH HIGHEST VALUE IS	0.04949 AT	(591414.88, 4142439.25, 0.00, 1.00)	DC	NA
	10TH HIGHEST VALUE IS	0.04745 AT	(591439.88, 4142419.25, 0.00, 1.00)	DC	NA

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** Message Summary : ISCST3 Model Execution ***

--------- Summary of Total Messages --------

A Total of 0 Fatal Error Message(s)
A Total of 0 Warning Message(s)
A Total of 121 Informational Message(s)

A Total of 121 Calm Hours Identified

******** FATAL ERROR MESSAGES ********
*** NONE ***

******** WARNING MESSAGES ********
*** NONE ***

****
*** ISCST3 Finishes Successfully ***
****

2018 DPM & Fugitive PM2.5 Model Input/Output- School Receptors

```
**
****************************************
**
** ISCST3 Input Produced by:
** AERMOD View Ver. 9.1.0
** Lakes Environmental Software Inc.
** Date: 10/27/2016
** File: G:\Projects\I&R\Topgolf\Model\Topgolf-Const-2018-School.INP
**
****************************************
**
**
****************************************
** ISCST3 Control Pathway
****************************************
**
**
CO STARTING
   TITLEONE TopGolf-2018 Construction DPM/PM2.5, 1996-2000 Alviso Met Data
   TITLETWO School Receptors - 1.0 meter receptor heights
   MODELOPT DFAULT CONC  RURAL
   AVERTIME PERIOD
   POLLUTID OTHER
   TERRHGTS FLAT
   FLAGPOLE 1.00
   RUNORNOT RUN
   ERRORFIL TOPGOL~4.ERR
CO FINISHED
**
****************************************
** ISCST3 Source Pathway
****************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION A1A_DPM      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A -2018 DPM
   LOCATION A1A_FUG      AREAPOLY   590982.382  4142485.552
** DESCRSRC Hotel-Retail Construction Area 1A - 2018 Fugitive PM2.5
   LOCATION A1B_DPM      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B -2018 DPM
   LOCATION A1B_FUG      AREAPOLY   591301.474  4142218.829
** DESCRSRC Hotel-Retail Construction Area 1B - 2018 Fugitive PM2.5
   LOCATION TG_DPM       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2018 DPM
   LOCATION TG_FUG       AREAPOLY   591150.648  4142203.130
** DESCRSRC TopGolf Construction Area - 2018 Fugitive PM2.5
** Source Parameters **
   SRCPARAM A1A_DPM       3.07E-07     6.000        10
   AREAVERT A1A_DPM      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_DPM      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_DPM      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_DPM      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_DPM      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1A_FUG       6.25E-08     2.000        10     0.000
   AREAVERT A1A_FUG      590982.382 4142485.552 590982.973 4142360.599
   AREAVERT A1A_FUG      590932.165 4142360.304 590931.869 4142424.996
   AREAVERT A1A_FUG      590725.978 4142425.291 590724.501 4142578.306
   AREAVERT A1A_FUG      590750.791 4142579.193 590817.551 4142552.016
   AREAVERT A1A_FUG      590897.308 4142516.273 590944.276 4142497.663
   SRCPARAM A1B_DPM       3.07E-07     6.000         6
   AREAVERT A1B_DPM      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_DPM      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_DPM      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM A1B_FUG       6.25E-08     2.000         6     0.000
   AREAVERT A1B_FUG      591301.474 4142218.829 591227.737 4142338.088
   AREAVERT A1B_FUG      590982.822 4142414.835 590982.446 4142485.563
   AREAVERT A1B_FUG      591162.276 4142428.755 591349.629 4142369.313
   SRCPARAM TG_DPM        2.68E-07     6.000        10
   AREAVERT TG_DPM       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_DPM       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_DPM       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_DPM       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_DPM       591226.892 4142337.693 591256.845 4142288.678
   SRCPARAM TG_FUG         9.5E-09     2.000        10     0.000
   AREAVERT TG_FUG       591150.648 4142203.130 591119.106 4142224.461
   AREAVERT TG_FUG       591099.137 4142234.899 591081.211 4142244.883
   AREAVERT TG_FUG       591057.158 4142256.229 591031.743 4142290.267
   AREAVERT TG_FUG       590984.090 4142283.459 590983.636 4142413.710
   AREAVERT TG_FUG       591226.892 4142337.693 591256.845 4142288.678

** Variable Emissions Type: "By Hour-of-Day (HROFDY)"
** Variable Emission Scenario: "7am-4pm"
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1A_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1A_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_DPM      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_DPM      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
```

```
   EMISFACT A1B_DPM      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT A1B_FUG      HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT A1B_FUG      HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_DPM       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_DPM       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 1.0 1.0 1.0 1.0 1.0
   EMISFACT TG_FUG       HROFDY 1.0 1.0 1.0 1.0 0.0 0.0
   EMISFACT TG_FUG       HROFDY 0.0 0.0 0.0 0.0 0.0 0.0
   SRCGROUP DPM      A1A_DPM A1B_DPM TG_DPM
   SRCGROUP FugPM    A1A_FUG A1B_FUG TG_FUG
   SRCGROUP ALL
SO FINISHED
**
****************************************
** ISCST3 Receptor Pathway
****************************************
**
**
RE STARTING
** DESCRREC "" ""
   DISCCART    591457.75   4142446.89    1.00
   DISCCART    591436.31   4142442.91    1.00
   DISCCART    591414.88   4142439.24    1.00
   DISCCART    591453.46   4142467.71    1.00
   DISCCART    591432.33   4142463.12    1.00
   DISCCART    591411.51   4142460.37    1.00
   DISCCART    591449.48   4142488.23    1.00
   DISCCART    591428.04   4142484.86    1.00
   DISCCART    591407.53   4142480.88    1.00
   DISCCART    591446.11   4142509.36    1.00
   DISCCART    591424.68   4142505.07    1.00
   DISCCART    591403.85   4142501.70    1.00
   DISCCART    591464.18   4142543.96    1.00
   DISCCART    591435.09   4142539.37    1.00
   DISCCART    591378.75   4142521.61    1.00
   DISCCART    591375.68   4142536.30    1.00
   DISCCART    591353.02   4142517.32    1.00
   DISCCART    591350.88   4142532.02    1.00
   DISCCART    591393.44   4142589.28    1.00
   DISCCART    591379.66   4142593.26    1.00
   DISCCART    591303.32   4142461.21    1.00
   DISCCART    591281.72   4142464.06    1.00
   DISCCART    591284.57   4142448.16    1.00
   DISCCART    591441.51   4142406.99    1.00
   DISCCART    591439.88   4142419.22    1.00
   DISCCART    591395.86   4142427.37    1.00
   DISCCART    591382.00   4142424.11    1.00
RE FINISHED
**
****************************************
** ISCST3 Meteorology Pathway
****************************************
**
**
ME STARTING
   INPUTFIL C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
   ANEMHGHT 10 METERS
   SURFDATA 7905 1996
   UAIRDATA 7905 1996
ME FINISHED
**
****************************************
** ISCST3 Output Pathway
****************************************
**
**
OU STARTING
** Auto-Generated Plotfiles
   PLOTFILE PERIOD ALL TOPGOL~4.IS\PE00GALL.PLT 31
   PLOTFILE PERIOD DPM TOPGOL~4.IS\PE00G001.PLT 32
   PLOTFILE PERIOD FugPM TOPGOL~4.IS\PE00G002.PLT 33
OU FINISHED

***********************************
*** SETUP Finishes Successfully ***
***********************************
```

```
                                             ***     MODEL SETUP OPTIONS SUMMARY       ***
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

**Intermediate Terrain Processing is Selected

**Model Is Setup For Calculation of Average CONCentration Values.

  --  SCAVENGING/DEPOSITION LOGIC --
**Model Uses NO DRY DEPLETION.  DDPLETE =  F
**Model Uses NO WET DEPLETION.  WDPLETE =  F
**NO WET SCAVENGING Data Provided.
**NO GAS DRY DEPOSITION Data Provided.
**Model Does NOT Use GRIDDED TERRAIN Data for Depletion Calculations

**Model Uses RURAL Dispersion.

**Model Uses Regulatory DEFAULT Options:
           1. Final Plume Rise.
           2. Stack-tip Downwash.
           3. Buoyancy-induced Dispersion.
           4. Use Calms Processing Routine.
           5. Not Use Missing Data Processing Routine.
           6. Default Wind Profile Exponents.
           7. Default Vertical Potential Temperature Gradients.
           8. "Upper Bound" Values for Supersquat Buildings.
           9. No Exponential Decay for RURAL Mode

**Model Assumes Receptors on FLAT Terrain.

**Model Accepts FLAGPOLE Receptor Heights.

**Model Calculates PERIOD Averages Only

**This Run Includes:     6 Source(s);      3 Source Group(s); and      27 Receptor(s)

**The Model Assumes A Pollutant Type of:  OTHER

**Model Set To Continue RUNning After the Setup Testing.

**Output Options Selected:
         Model Outputs Tables of PERIOD Averages by Receptor
         Model Outputs External File(s) of High Values for Plotting (PLOTFILE Keyword)

**NOTE:  The Following Flags May Appear Following CONC Values:  c for Calm Hours
                                                                m for Missing Hours
                                                                b for Both Calm and Missing Hours

**Misc. Inputs:  Anem. Hgt. (m) =    10.00 ;    Decay Coef. =    0.000     ;    Rot. Angle =     0.0
                 Emission Units = GRAMS/SEC                                ;  Emission Rate Unit Factor =   0.10000E+07
                 Output Units   = MICROGRAMS/M**3

**Approximate Storage Requirements of Model =     1.2 MB of RAM.

**Input Runstream File:          Topgolf-Const-2018-School.INP
**Output Print File:             Topgolf-Const-2018-School.OUT
**Detailed Error/Message File:   TOPGOL~4.ERR
```

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** AREAPOLY SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (GRAMS/SEC /METER**2)	LOCATION OF AREA X (METERS)	Y (METERS)	BASE ELEV. (METERS)	RELEASE HEIGHT (METERS)	NUMBER OF VERTS.	INIT. SZ (METERS)	EMISSION RATE SCALAR VARY BY
A1A_DPM	0	0.30700E-06	590982.4	4142485.5	0.0	6.00	10	0.00	HROFDY
A1A_FUG	0	0.62500E-07	590982.4	4142485.5	0.0	2.00	10	0.00	HROFDY
A1B_DPM	0	0.30700E-06	591301.5	4142218.8	0.0	6.00	6	0.00	HROFDY
A1B_FUG	0	0.62500E-07	591301.5	4142218.8	0.0	2.00	6	0.00	HROFDY
TG_DPM	0	0.26800E-06	591150.6	4142203.2	0.0	6.00	10	0.00	HROFDY
TG_FUG	0	0.95000E-08	591150.6	4142203.2	0.0	2.00	10	0.00	HROFDY

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
DPM	A1A_DPM , A1B_DPM , TG_DPM ,
FUGPM	A1A_FUG , A1B_FUG , TG_FUG ,
ALL	A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = A1A_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1A_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = A1B_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

SOURCE ID = TG_DPM ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

* SOURCE EMISSION RATE SCALARS WHICH VARY FOR EACH HOUR OF THE DAY *

SOURCE ID = TG_FUG ; SOURCE TYPE = AREAPOLY :

HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR	HOUR	SCALAR
1	.00000E+00	2	.00000E+00	3	.00000E+00	4	.00000E+00	5	.00000E+00	6	.00000E+00
7	.00000E+00	8	.10000E+01	9	.10000E+01	10	.10000E+01	11	.10000E+01	12	.10000E+01
13	.10000E+01	14	.10000E+01	15	.10000E+01	16	.10000E+01	17	.00000E+00	18	.00000E+00
19	.00000E+00	20	.00000E+00	21	.00000E+00	22	.00000E+00	23	.00000E+00	24	.00000E+00

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** DISCRETE CARTESIAN RECEPTORS ***
(X-COORD, Y-COORD, ZELEV, ZFLAG)
(METERS)

(591457.8,	4142447.0,	0.0,	1.0);	(591436.3,	4142443.0,	0.0,	1.0);
(591414.9,	4142439.2,	0.0,	1.0);	(591453.4,	4142467.8,	0.0,	1.0);
(591432.3,	4142463.0,	0.0,	1.0);	(591411.5,	4142460.2,	0.0,	1.0);
(591449.5,	4142488.2,	0.0,	1.0);	(591428.1,	4142484.8,	0.0,	1.0);
(591407.5,	4142481.0,	0.0,	1.0);	(591446.1,	4142509.2,	0.0,	1.0);
(591424.7,	4142505.0,	0.0,	1.0);	(591403.9,	4142501.8,	0.0,	1.0);
(591464.2,	4142544.0,	0.0,	1.0);	(591435.1,	4142539.2,	0.0,	1.0);
(591378.8,	4142521.5,	0.0,	1.0);	(591375.7,	4142536.2,	0.0,	1.0);
(591353.0,	4142517.2,	0.0,	1.0);	(591350.9,	4142532.0,	0.0,	1.0);
(591393.4,	4142589.3,	0.0,	1.0);	(591379.7,	4142593.2,	0.0,	1.0);
(591303.3,	4142461.2,	0.0,	1.0);	(591281.8,	4142464.0,	0.0,	1.0);
(591284.6,	4142448.2,	0.0,	1.0);	(591441.5,	4142407.0,	0.0,	1.0);
(591439.9,	4142419.2,	0.0,	1.0);	(591395.9,	4142427.2,	0.0,	1.0);
(591382.0,	4142424.0,	0.0,	1.0);				

*** METEOROLOGICAL DAYS SELECTED FOR PROCESSING ***
(1=YES; 0=NO)

```
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1   1 1 1 1 1 1
```

NOTE: METEOROLOGICAL DATA ACTUALLY PROCESSED WILL ALSO DEPEND ON WHAT IS INCLUDED IN THE DATA FILE.

*** UPPER BOUND OF FIRST THROUGH FIFTH WIND SPEED CATEGORIES ***
(METERS/SEC)

1.54, 3.09, 5.14, 8.23, 10.80,

*** WIND PROFILE EXPONENTS ***

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
B	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01	.70000E-01
C	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00	.10000E+00
D	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00	.15000E+00
E	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00	.35000E+00
F	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00	.55000E+00

*** VERTICAL POTENTIAL TEMPERATURE GRADIENTS ***
(DEGREES KELVIN PER METER)

STABILITY CATEGORY	WIND SPEED CATEGORY 1	2	3	4	5	6
A	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
B	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
C	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
D	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
E	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01	.20000E-01
F	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01	.35000E-01

*** THE FIRST 24 HOURS OF METEOROLOGICAL DATA ***

FILE: C:\PROJEC~1\I&R\METDAT~1\Alviso\alv96-00.asc
FORMAT: (4I2,2F9.4,F6.1,I2,2F7.1,f9.4,f10.1,f8.4,i4,f7.2)
SURFACE STATION NO.: 7905 UPPER AIR STATION NO.: 7905
NAME: UNKNOWN NAME: UNKNOWN
YEAR: 1996 YEAR: 1996

YR	MN	DY	HR	FLOW VECTOR	SPEED (M/S)	TEMP (K)	STAB CLASS	MIXING HEIGHT (M) RURAL	MIXING HEIGHT (M) URBAN	USTAR (M/S)	M-O LENGTH (M)	Z-0 (M)	IPCODE	PRATE (mm/HR)
96	01	01	01	212.7	1.56	283.5	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	02	186.7	1.03	284.0	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	03	162.3	1.79	284.0	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	04	185.1	1.97	283.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	05	132.3	2.46	283.0	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	06	97.9	4.16	283.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	07	95.8	1.61	284.4	6	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	08	152.8	3.58	285.9	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	09	157.8	5.54	288.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	10	158.3	5.01	289.9	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	11	162.5	5.54	291.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	12	161.7	5.72	292.4	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	13	168.0	6.84	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	14	182.2	6.12	292.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	15	153.1	5.68	292.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	16	112.6	4.34	291.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	17	134.5	3.84	290.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	18	143.4	4.38	290.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	19	145.1	3.62	290.6	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	20	161.2	4.83	289.3	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	21	155.0	4.83	289.3	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	22	105.9	4.25	286.5	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	23	48.0	2.68	285.6	5	300.0	300.0	0.0000	0.0	0.0000	0	0.00
96	01	01	24	89.0	2.46	285.8	4	300.0	300.0	0.0000	0.0	0.0000	0	0.00

*** NOTES: STABILITY CLASS 1=A, 2=B, 3=C, 4=D, 5=E AND 6=F.
FLOW VECTOR IS DIRECTION TOWARD WHICH WIND IS BLOWING.

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: DPM ***
INCLUDING SOURCE(S): A1A_DPM , A1B_DPM , TG_DPM ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591457.75	4142447.00	0.02346	591436.31	4142443.00	0.02681
591414.88	4142439.25	0.03084	591453.44	4142467.75	0.02188
591432.31	4142463.00	0.02494	591411.50	4142460.25	0.02817
591449.50	4142488.25	0.02065	591428.06	4142484.75	0.02324
591407.50	4142481.00	0.02600	591446.12	4142509.25	0.01951
591424.69	4142505.00	0.02177	591403.88	4142501.75	0.02422
591464.19	4142544.00	0.01614	591435.06	4142539.25	0.01840
591378.75	4142521.50	0.02549	591375.69	4142536.25	0.02447
591353.00	4142517.25	0.03022	591350.88	4142532.00	0.02872
591393.44	4142589.25	0.01864	591379.69	4142593.25	0.01960
591303.31	4142461.25	0.06089	591281.75	4142464.00	0.07375
591284.56	4142448.25	0.08228	591441.50	4142407.00	0.03204
591439.88	4142419.25	0.02992	591395.88	4142427.25	0.03691
591382.00	4142424.00	0.04088			

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: FUGPM ***
INCLUDING SOURCE(S): A1A_FUG , A1B_FUG , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591457.75	4142447.00	0.00426	591436.31	4142443.00	0.00501
591414.88	4142439.25	0.00600	591453.44	4142467.75	0.00396
591432.31	4142463.00	0.00465	591411.50	4142460.25	0.00544
591449.50	4142488.25	0.00373	591428.06	4142484.75	0.00431
591407.50	4142481.00	0.00493	591446.12	4142509.25	0.00351
591424.69	4142505.00	0.00398	591403.88	4142501.75	0.00449
591464.19	4142544.00	0.00282	591435.06	4142539.25	0.00325
591378.75	4142521.50	0.00469	591375.69	4142536.25	0.00445
591353.00	4142517.25	0.00579	591350.88	4142532.00	0.00542
591393.44	4142589.25	0.00319	591379.69	4142593.25	0.00339
591303.31	4142461.25	0.01466	591281.75	4142464.00	0.01841
591284.56	4142448.25	0.02218	591441.50	4142407.00	0.00609
591439.88	4142419.25	0.00565	591395.88	4142427.25	0.00758
591382.00	4142424.00	0.00874			

*** THE PERIOD (43848 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: ALL ***
INCLUDING SOURCE(S): A1A_DPM , A1A_FUG , A1B_DPM , A1B_FUG , TG_DPM , TG_FUG ,

*** DISCRETE CARTESIAN RECEPTOR POINTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
591457.75	4142447.00	0.02772	591436.31	4142443.00	0.03182
591414.88	4142439.25	0.03684	591453.44	4142467.75	0.02584
591432.31	4142463.00	0.02959	591411.50	4142460.25	0.03361
591449.50	4142488.25	0.02438	591428.06	4142484.75	0.02755
591407.50	4142481.00	0.03094	591446.12	4142509.25	0.02302
591424.69	4142505.00	0.02575	591403.88	4142501.75	0.02871
591464.19	4142544.00	0.01896	591435.06	4142539.25	0.02165
591378.75	4142521.50	0.03018	591375.69	4142536.25	0.02892
591353.00	4142517.25	0.03601	591350.88	4142532.00	0.03414
591393.44	4142589.25	0.02183	591379.69	4142593.25	0.02300
591303.31	4142461.25	0.07554	591281.75	4142464.00	0.09216
591284.56	4142448.25	0.10445	591441.50	4142407.00	0.03812
591439.88	4142419.25	0.03556	591395.88	4142427.25	0.04449
591382.00	4142424.00	0.04961			

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** THE SUMMARY OF MAXIMUM PERIOD (43848 HRS) RESULTS ***

** CONC OF OTHER IN MICROGRAMS/M**3 **

GROUP ID		AVERAGE CONC	RECEPTOR (XR, YR, ZELEV, ZFLAG)	OF TYPE	NETWORK GRID-ID
DPM	1ST HIGHEST VALUE IS	0.08228 AT	(591284.56, 4142448.25, 0.00, 1.00)	DC	NA
	2ND HIGHEST VALUE IS	0.07375 AT	(591281.75, 4142464.00, 0.00, 1.00)	DC	NA
	3RD HIGHEST VALUE IS	0.06089 AT	(591303.31, 4142461.25, 0.00, 1.00)	DC	NA
	4TH HIGHEST VALUE IS	0.04088 AT	(591382.00, 4142424.00, 0.00, 1.00)	DC	NA
	5TH HIGHEST VALUE IS	0.03691 AT	(591395.88, 4142427.25, 0.00, 1.00)	DC	NA
	6TH HIGHEST VALUE IS	0.03204 AT	(591441.50, 4142407.00, 0.00, 1.00)	DC	NA
	7TH HIGHEST VALUE IS	0.03084 AT	(591414.88, 4142439.25, 0.00, 1.00)	DC	NA
	8TH HIGHEST VALUE IS	0.03022 AT	(591353.00, 4142517.25, 0.00, 1.00)	DC	NA
	9TH HIGHEST VALUE IS	0.02992 AT	(591439.88, 4142419.25, 0.00, 1.00)	DC	NA
	10TH HIGHEST VALUE IS	0.02872 AT	(591350.88, 4142532.00, 0.00, 1.00)	DC	NA
FUGPM	1ST HIGHEST VALUE IS	0.02218 AT	(591284.56, 4142448.25, 0.00, 1.00)	DC	NA
	2ND HIGHEST VALUE IS	0.01841 AT	(591281.75, 4142464.00, 0.00, 1.00)	DC	NA
	3RD HIGHEST VALUE IS	0.01466 AT	(591303.31, 4142461.25, 0.00, 1.00)	DC	NA
	4TH HIGHEST VALUE IS	0.00874 AT	(591382.00, 4142424.00, 0.00, 1.00)	DC	NA
	5TH HIGHEST VALUE IS	0.00758 AT	(591395.88, 4142427.25, 0.00, 1.00)	DC	NA
	6TH HIGHEST VALUE IS	0.00609 AT	(591441.50, 4142407.00, 0.00, 1.00)	DC	NA
	7TH HIGHEST VALUE IS	0.00600 AT	(591414.88, 4142439.25, 0.00, 1.00)	DC	NA
	8TH HIGHEST VALUE IS	0.00579 AT	(591353.00, 4142517.25, 0.00, 1.00)	DC	NA
	9TH HIGHEST VALUE IS	0.00565 AT	(591439.88, 4142419.25, 0.00, 1.00)	DC	NA
	10TH HIGHEST VALUE IS	0.00544 AT	(591411.50, 4142460.25, 0.00, 1.00)	DC	NA
ALL	1ST HIGHEST VALUE IS	0.10445 AT	(591284.56, 4142448.25, 0.00, 1.00)	DC	NA
	2ND HIGHEST VALUE IS	0.09216 AT	(591281.75, 4142464.00, 0.00, 1.00)	DC	NA
	3RD HIGHEST VALUE IS	0.07554 AT	(591303.31, 4142461.25, 0.00, 1.00)	DC	NA
	4TH HIGHEST VALUE IS	0.04961 AT	(591382.00, 4142424.00, 0.00, 1.00)	DC	NA
	5TH HIGHEST VALUE IS	0.04449 AT	(591395.88, 4142427.25, 0.00, 1.00)	DC	NA
	6TH HIGHEST VALUE IS	0.03812 AT	(591441.50, 4142407.00, 0.00, 1.00)	DC	NA
	7TH HIGHEST VALUE IS	0.03684 AT	(591414.88, 4142439.25, 0.00, 1.00)	DC	NA
	8TH HIGHEST VALUE IS	0.03601 AT	(591353.00, 4142517.25, 0.00, 1.00)	DC	NA
	9TH HIGHEST VALUE IS	0.03556 AT	(591439.88, 4142419.25, 0.00, 1.00)	DC	NA
	10TH HIGHEST VALUE IS	0.03414 AT	(591350.88, 4142532.00, 0.00, 1.00)	DC	NA

*** RECEPTOR TYPES: GC = GRIDCART
GP = GRIDPOLR
DC = DISCCART
DP = DISCPOLR
BD = BOUNDARY

**MODELOPTs:
CONC RURAL FLAT FLGPOL DFAULT

*** Message Summary : ISCST3 Model Execution ***

--------- Summary of Total Messages --------

A Total of 0 Fatal Error Message(s)
A Total of 0 Warning Message(s)
A Total of 121 Informational Message(s)

A Total of 121 Calm Hours Identified

******** FATAL ERROR MESSAGES ********
*** NONE ***

******** WARNING MESSAGES ********
*** NONE ***

****
*** ISCST3 Finishes Successfully ***
****

Attachment C

Revised Noise Analysis

Environmental Noise Assessment

Terra-Topgolf Development Project

San Jose, California

BAC Job # 2015-275

Prepared For:

David J. Powers & Associates, Inc.

1871 The Alameda, Suite 200
San Jose, CA 95126

Prepared By:

Bollard Acoustical Consultants, Inc.

Paul Bollard, President

October 28, 2016

BOLLARD
Acoustical Consultants

3551 Bankhead Road • Loomis, CA 95650 • Phone: (916) 663-0500 • Fax: (916) 663-0501 • BACNOISE.COM

Table of Contents

Table of Contents i

Introduction 1

Environmental Setting 5

Acoustical Terminology 5

Identification of Sensitive Receptors 7

Existing Overall Ambient Noise Environment at Sensitive Receptors 7

Existing Traffic Noise Environment 15

Traffic Noise Prediction Methodology 15

Predicted Existing Traffic Noise Levels 16

Regulatory Setting - Criteria for Acceptable Noise Exposure 16

City of San Jose General Plan 16

City of San Jose Zoning Code 19

Impacts and Mitigation Measures 19

Standards of Significance Applied to this Project 19

Major Noise Sources Evaluated in this Study 20

Traffic Noise Impacts Due to the Project 20

Impact 1: Increases in Existing Traffic Noise Levels due to the Project 21

Impact 2: Increases in Background Traffic Noise Levels due to the Project 22

Noise Impacts Resulting from On-Site Activities within the Project Site 24

Impact 3: Parking Lot Activity Noise 24

Impact 4: Mechanical Equipment Noise 26

Impact 5: Topgolf Outdoor Entertainment Facility Noise 26

Topgolf Facility Overview 26

Topgolf Music and Patron Activity Noise Generation 27

Predicted Topgolf Noise Levels at the Nearest Residences to the San Jose Facility..... 28

Impact 6: Project Construction Noise Generation..... 32

Cumulative Setting, Impacts and Mitigation Measure 34

Cumulative Traffic Noise Impacts..... 34

Impact 7: Increase in Cumulative Traffic Noise Levels 34

Impact 8: Cumulative (Future) Traffic Noise Levels within Proposed Hotel..... 36

Impact 9: Combined Noise from all On-Site Project Noise Sources 36

Conclusions and Recommendations 38

Introduction

The Terra-Topgolf project (project) is located on the south side of North 1st Street, east of Liberty Street and north of the Guadalupe River, in the City of San Jose, California. The project site vicinity is shown on Figure 1. The project proposes the following specific uses:

- Ten commercial/retail buildings
- One hotel building
- One outdoor recreation facility (Top Golf)

In addition to these uses, the project includes 1,344 total parking spaces (709 in underground parking garages, 635 paved surface parking). Figures 2 and 3 show the project ground and surface level site plans, respectively.

Existing land uses in the project vicinity include a mix of residential, commercial, library/community center, park, open space, school, and light industrial uses. Due to the potential noise generation of the project relative to nearby noise-sensitive land uses, Bollard Acoustical Consultants, Inc. (BAC) was retained by David J. Powers & Associates, Inc. to prepare a noise analysis for the project.

The purposes of this analysis are to quantify existing ambient noise levels in the vicinity of the nearest sensitive receptors to the project site, to predict the noise generation of the various aspects of the project, and to compare project-generated noise levels against both the City of San Jose noise standards as well as against the measured ambient noise environment.

It should be noted that, during BAC field inspections of the project site, no sources of local vibration were identified and ambient vibration levels were observed to be imperceptible. Because the project does not propose any appreciable sources of vibration, vibration impacts associated with this project are not anticipated and no further analysis of vibration impacts was considered to be warranted.

Figure 1

Project Site Vicinity and Noise Measurement Locations
Terra-Topgolf Development Project - San Jose, California

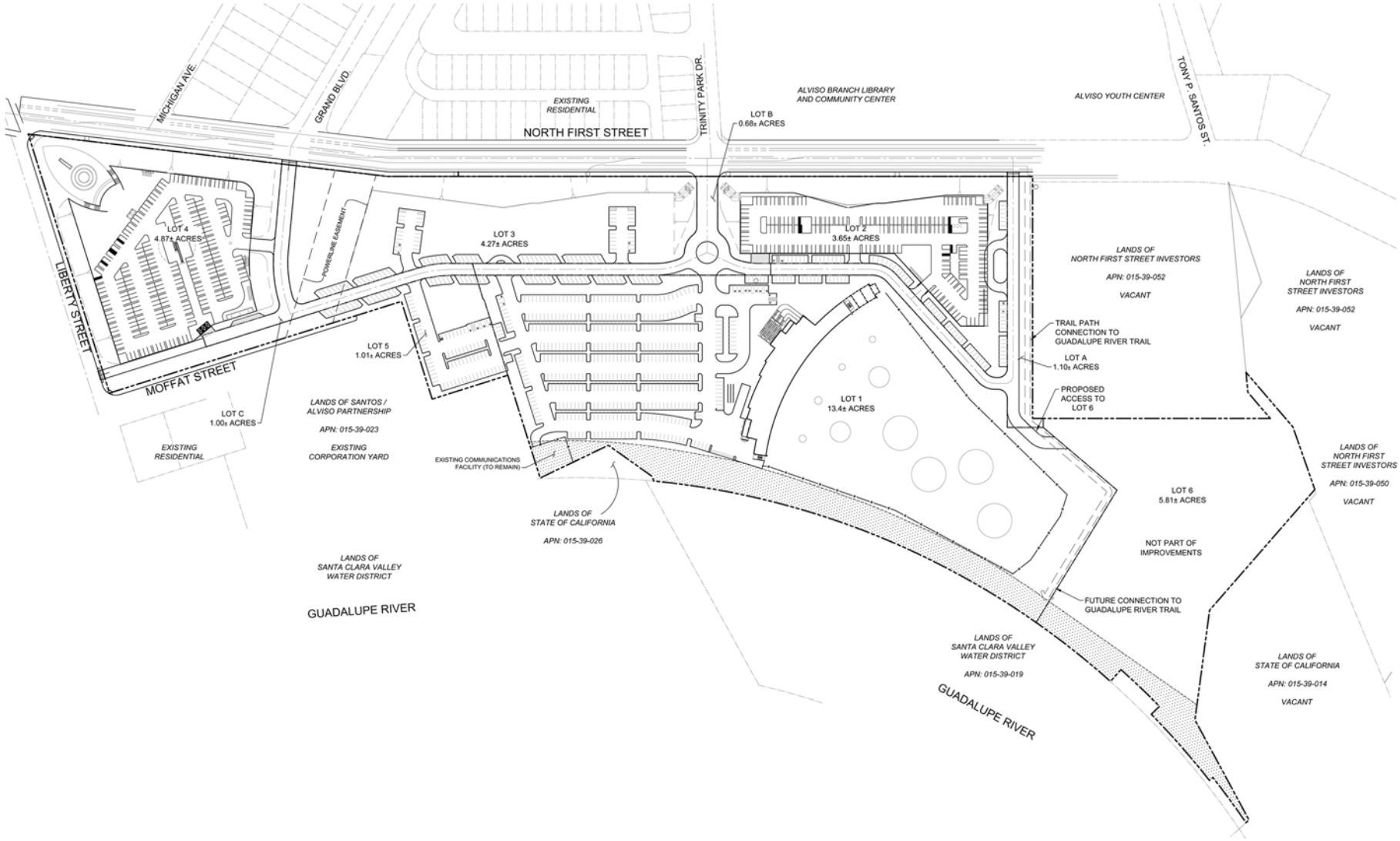
BOLLARD
Acoustical Consultants

Scale (feet)
0 250 500

Figure 2

Site Plan - Lower Level

Terra-Topgolf Development Project - San Jose, California



BOLLARD
Acoustical Consultants

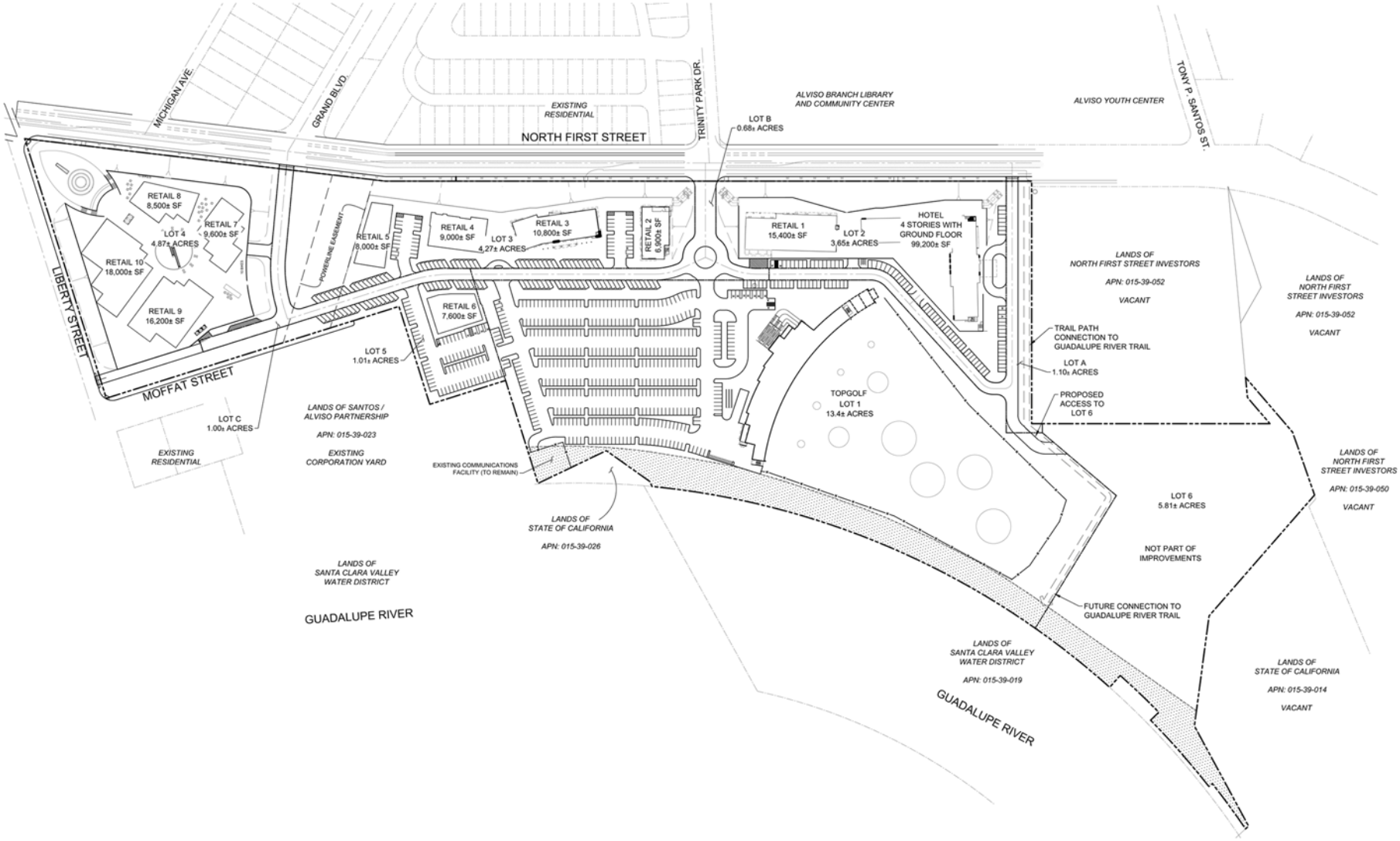
Scale (feet)

0 200 400

Figure 3

Site Plan - Surface Level

Terra-Topgolf Development Project - San Jose, California



BOLLARD Acoustical Consultants

Scale (feet)

0 200 400

Environmental Setting

Acoustical Terminology

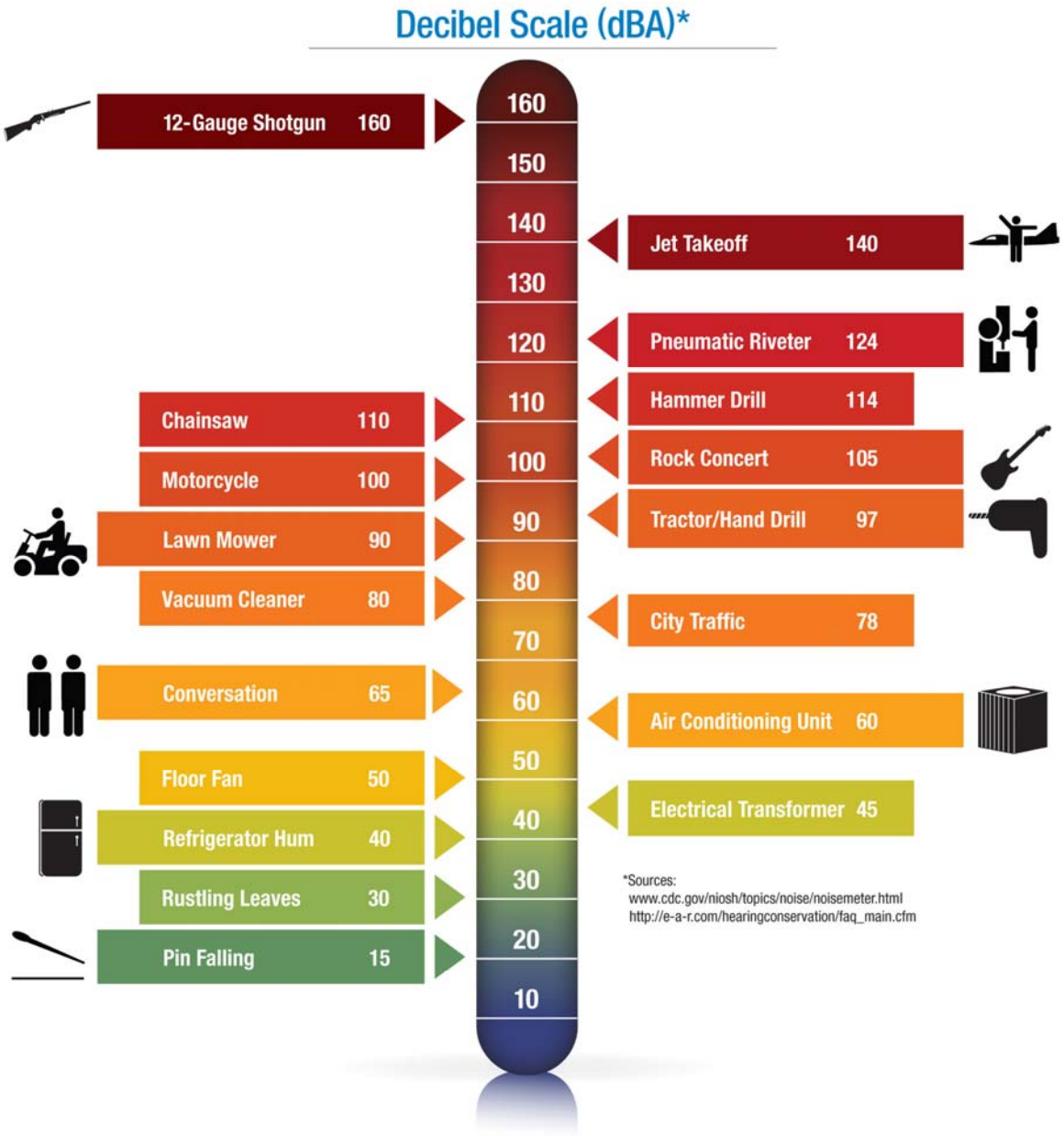
Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and are designated as sound. The number of pressure variations per second is called the frequency of sound and is expressed as cycles per second, or Hertz (Hz). Definitions of acoustical terminology are provided in Appendix A. Figure 4 shows common noise levels associated with various sources.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals of pressure) as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB. Another useful aspect of the decibel scale is that changes in decibel levels correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable and can be approximated by filtering the frequency response of a sound level meter by means of the standardized A-weighting network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (L_{eq}). The L_{eq} is the foundation of the day/night average noise descriptor, L_{dn}, and shows very good correlation with community response to noise. The day/night average sound level (L_{dn} or DNL) is based on the average noise level over a 24-hour day, with a +10 decibel weighting applied to noise occurring during nighttime (10:00 PM to 7:00 AM) hours. The nighttime penalty is based on the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment. For this reason, the City of San Jose utilizes performance standards for non-transportation noise sources. Specifically, performance standards in terms of instantaneous maximum levels (L_{max}) and hourly average levels (L_{eq}), are used to assess noise generated on the project site.

Figure 4
Noise Levels Associated with Common Noise Sources



Identification of Sensitive Receptors

As noted previously, existing land uses in the project vicinity include a mix of residential, commercial, library/community center, park, open space, school, and light industrial uses. Of these uses, the greatest degree of sensitivity exists at the nearby residential uses (exterior and interior areas), and within the interior spaces of the library/community center and elementary school classrooms. The school playing fields and outdoor play areas of the library are considered noise-generating spaces, not noise-sensitive spaces. As a result, the focus of this analysis is the identification of potential noise impacts at the noise-sensitive interior and exterior spaces described above. Those sensitive areas are identified on Figure 1.

Existing Overall Ambient Noise Environment at Sensitive Receptors

The ambient noise environment in the immediate project vicinity varies depending on proximity to project-area roadways. To generally quantify existing overall ambient noise levels from all sources at the nearest noise-sensitive receptors to the project site, continuous (48-hour) ambient noise surveys were conducted at 3 locations on December 16-17, 2015. The monitoring locations are shown on Figure 1. It is recognized that there are more than three noise-sensitive receptors in the project vicinity. Due to the similar setback from North First Street of receptors represented by Areas 1, 4 and 5, noise measurement Site A represents ambient conditions at all sensitive receptors located along North First Street, including the residences directly opposite the project site (Area 1 on Figure 1), school and library (Area 4), and single residence identified as Area 5.

The ambient noise level monitoring results are summarized in Table 1, with graphs of the detailed hourly average (L_{eq}) and maximum (L_{max}) values shown in Figures 5-10. The ambient noise monitoring results are also tabulated Appendix B.

Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used for the noise level measurement survey. The meters were calibrated before use with an LDL Model CA200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all specifications of the American National Standards Institute requirements for Type 1 sound level meters (ANSI S1.4).

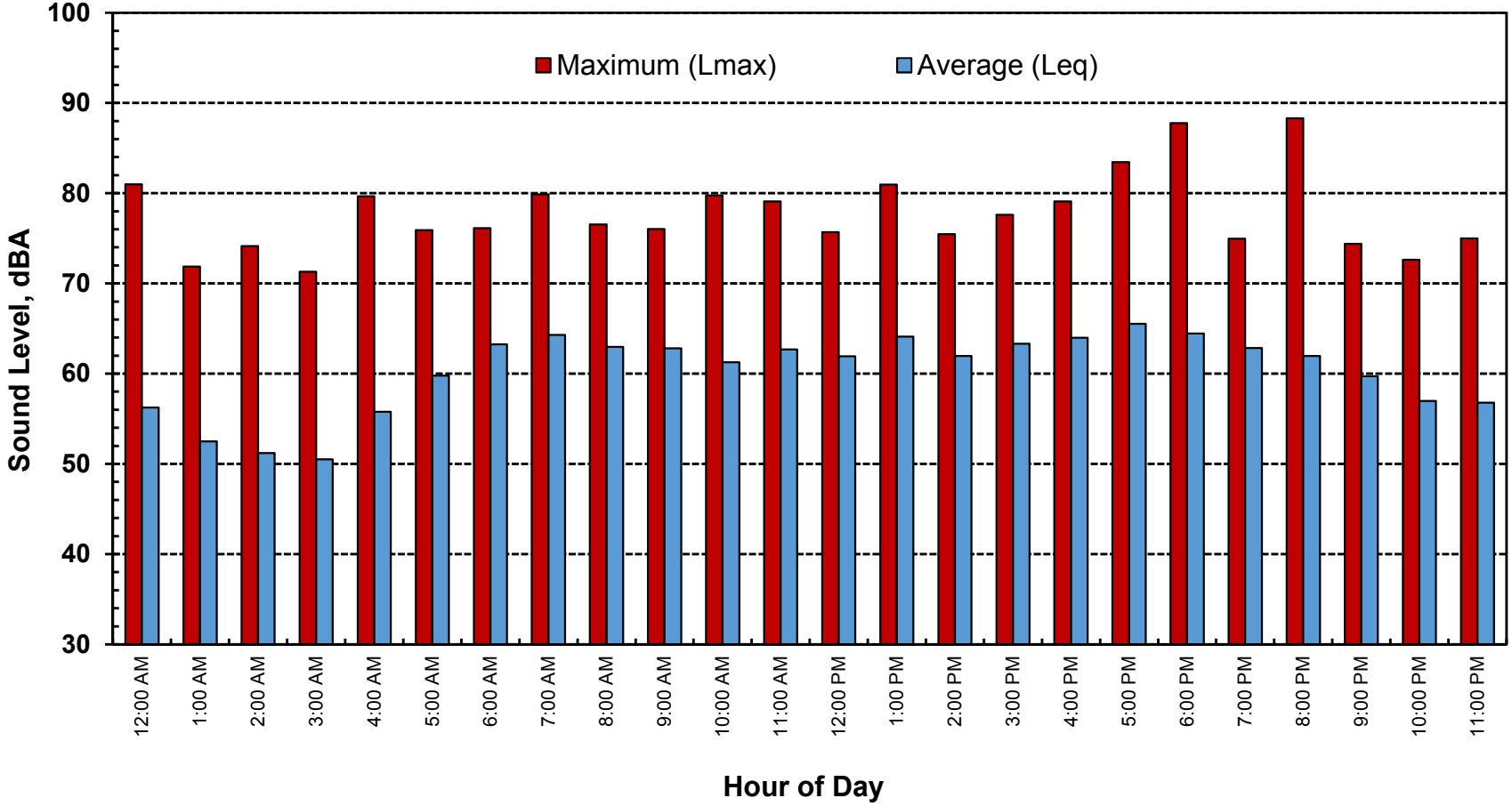
Table 1
Ambient Noise Monitoring Results[1]
Terra-Topgolf Development Project – San Jose, CA

			Measured Hourly Noise Levels (dB)			
			Daytime (7 AM – 10 PM)		Nighttime (10 PM – 7 AM)	
Site	**Date**	L_{dn}	L_{eq}	L_{max}	L_{eq}	L_{max}
A	Wednesday, December 16	65	63	74-88	56	71-81
	Thursday, December 17	66	63	75-82	56	71-81
B	Wednesday, December 16	62	58	72-82	52	59-76
	Thursday, December 17	64	60	75-86	53	55-76
C	Wednesday, December 16	62	60	71-80	52	61-78
	Thursday, December 17	62	60	71-80	52	61-75

Notes:
1. Detailed results provided in Appendix B.

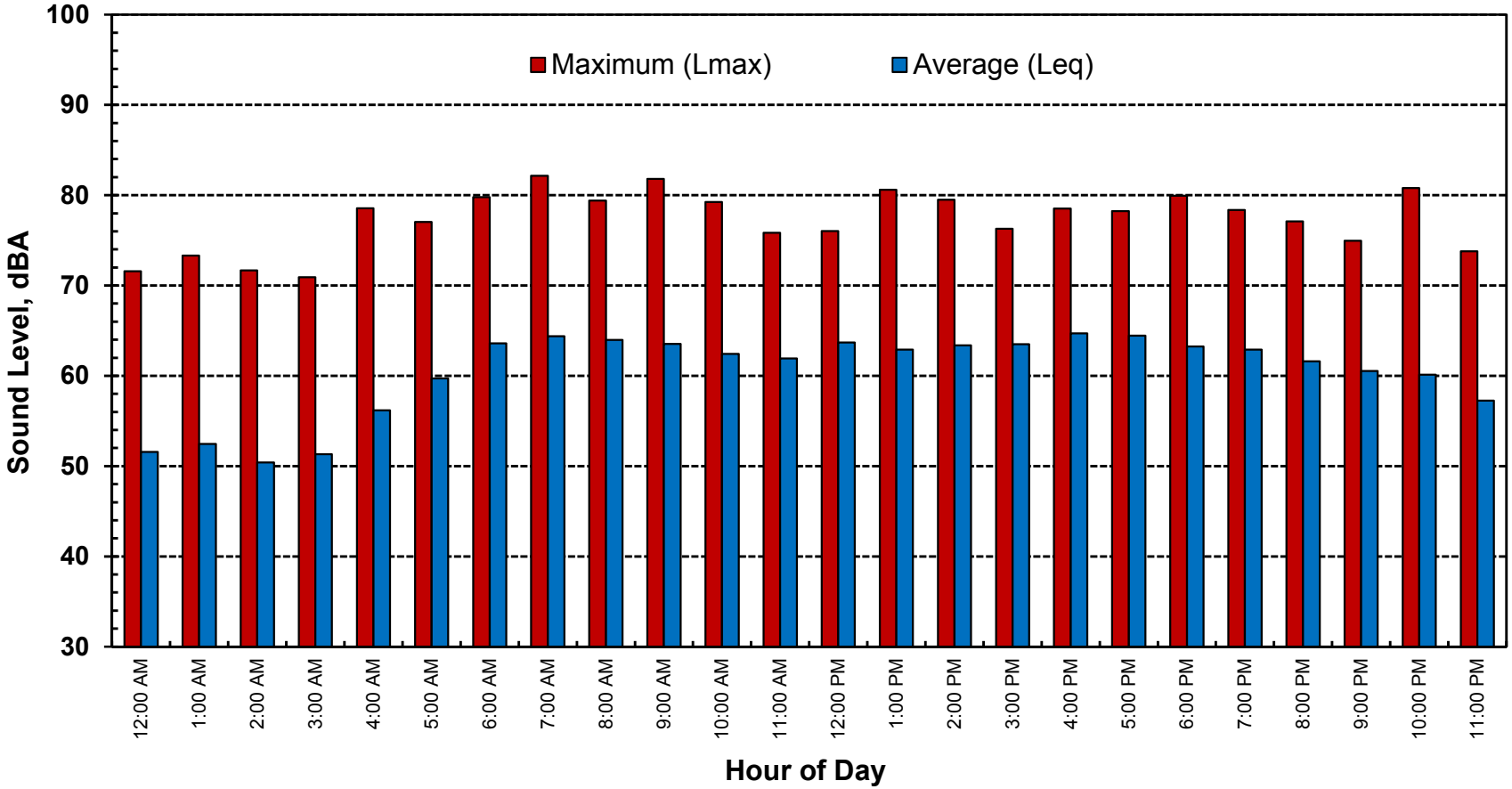
Source: Bollard Acoustical Consultants, Inc. (2016)

Figure 5
Hourly Noise Survey Results - Site A
Terra-Topgolf Development Project - San Jose, California
Wednesday, December 16, 2015



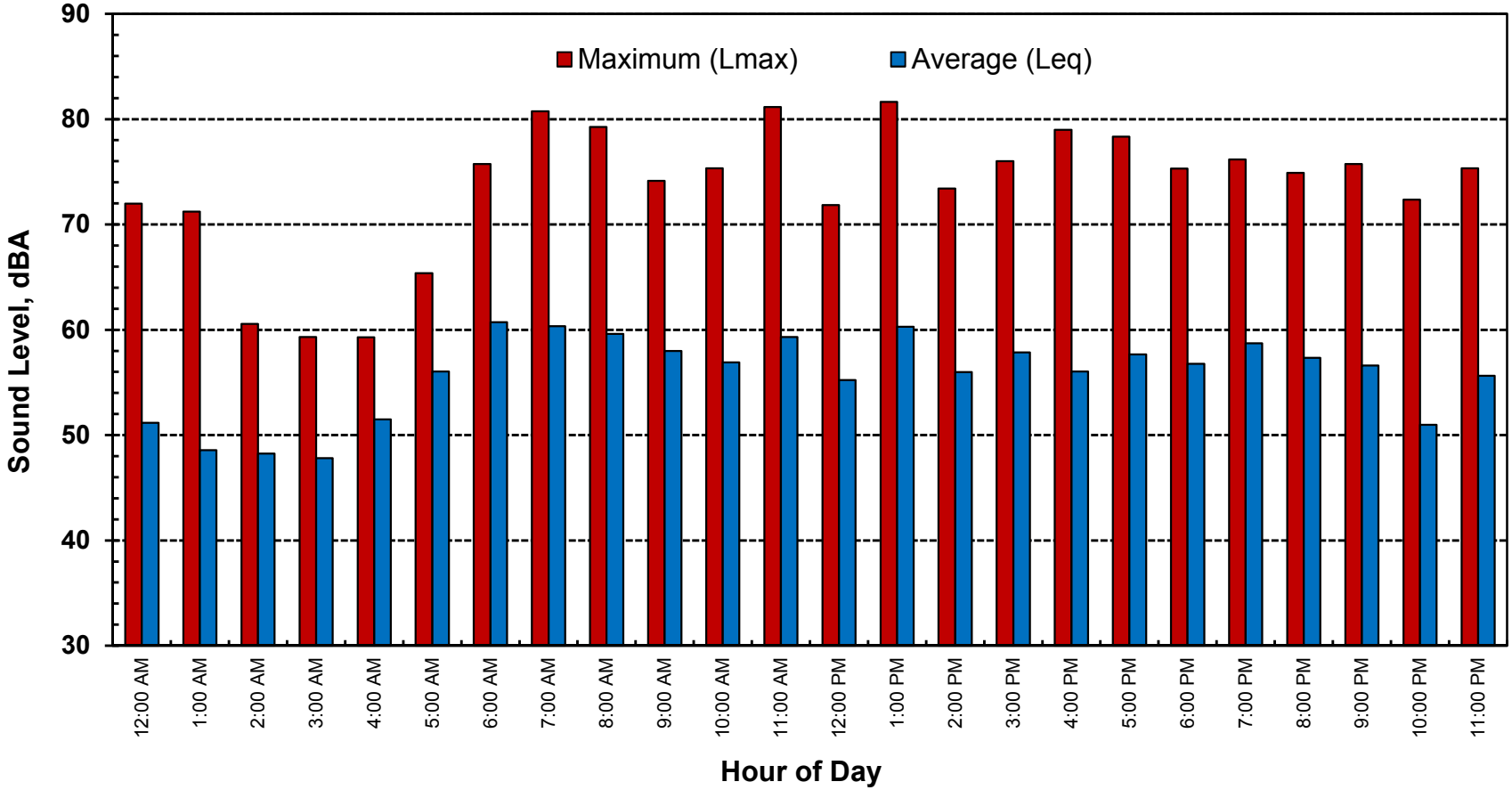
BOLLARD
Acoustical Consultants

Figure 6
Hourly Noise Survey Results - Site A
Terra-Topgolf Development Project - San Jose, California
Thursday, December 17, 2015



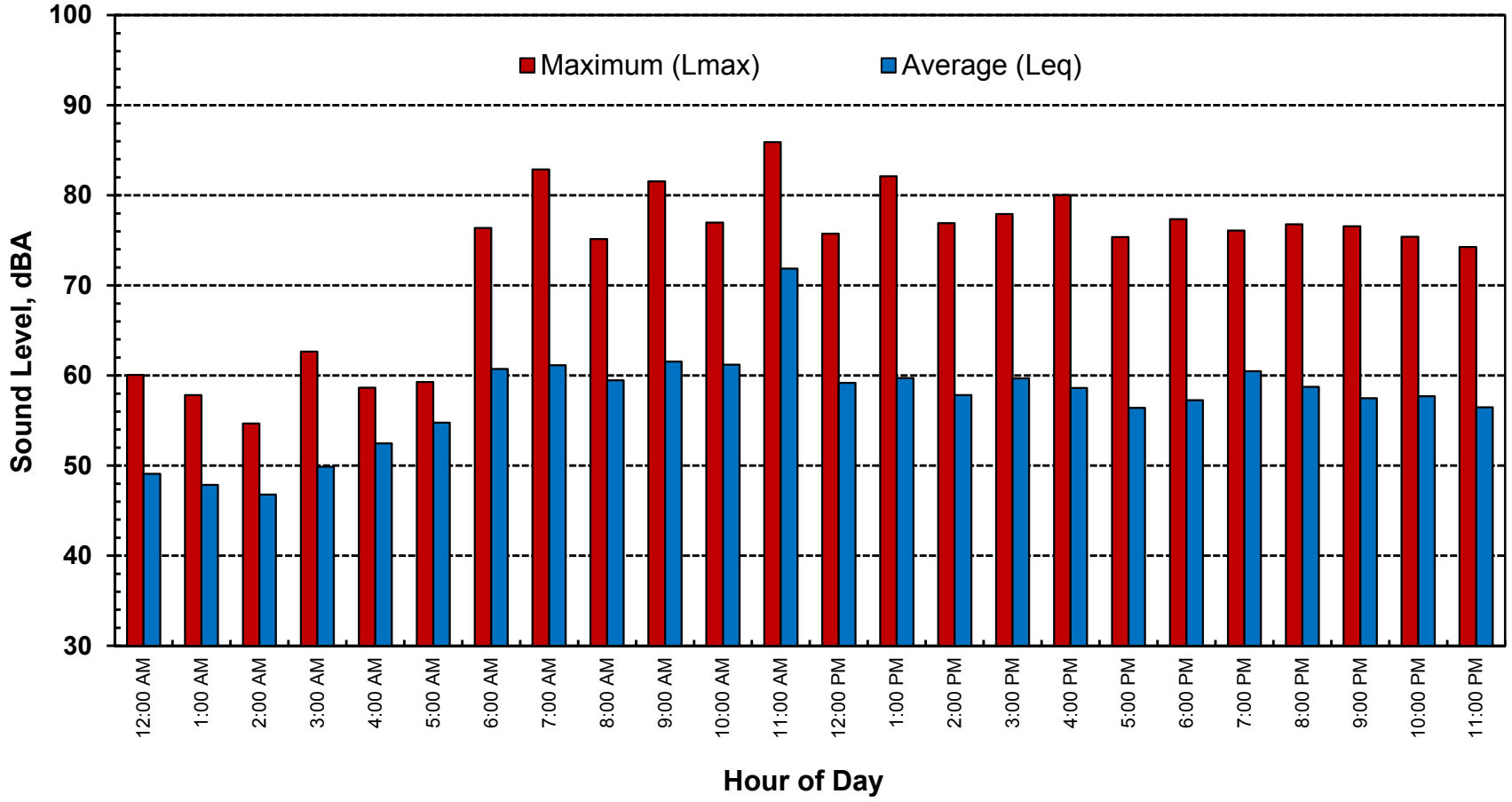
BOLLARD
Acoustical Consultants

Figure 7
Hourly Noise Survey Results - Site B
Terra-Topgolf Development Project - San Jose, California
Wednesday, December 16, 2015



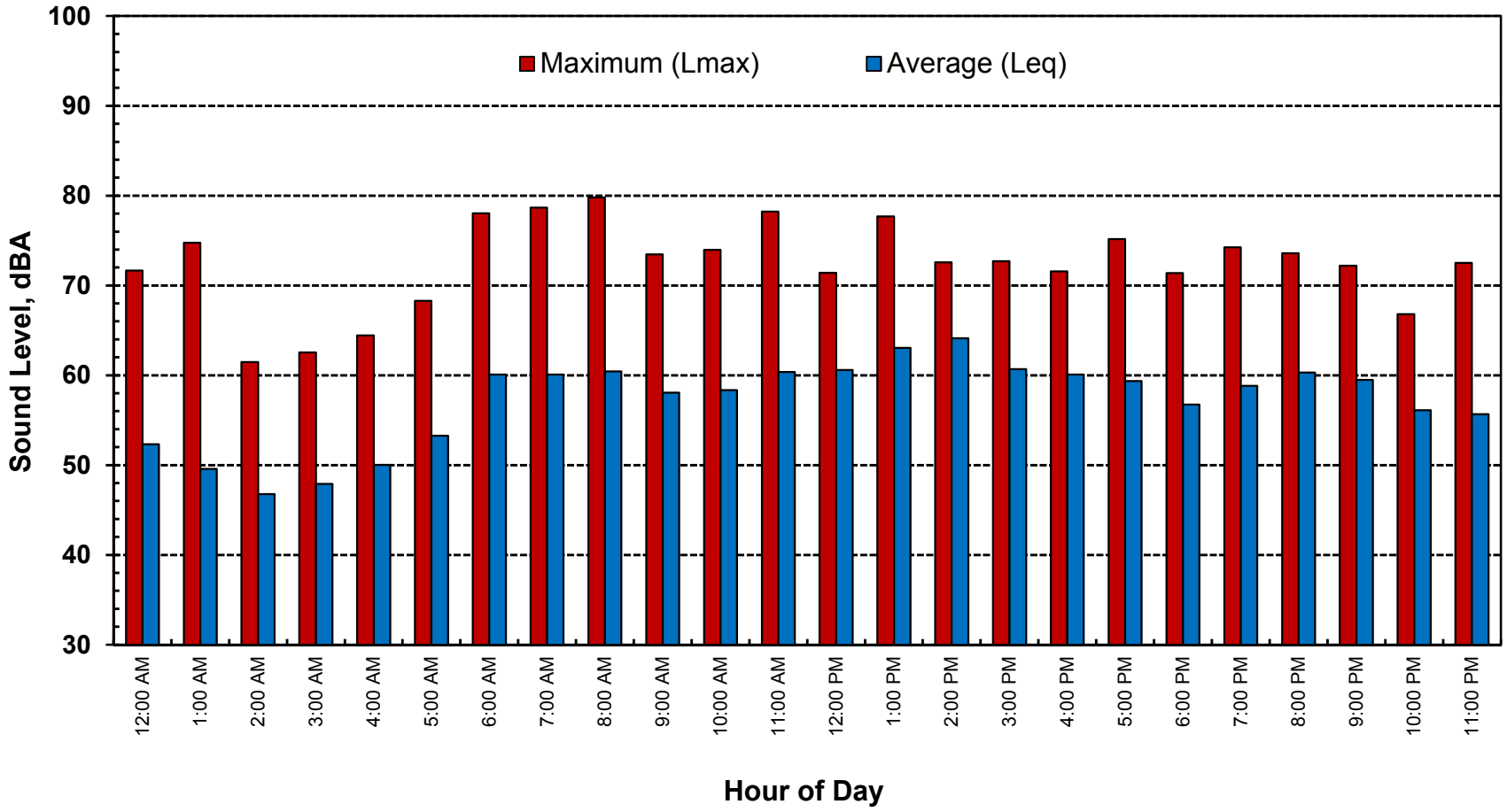
BOLLARD
Acoustical Consultants

Figure 8
Hourly Noise Survey Results - Site B
Terra-Topgolf Development Project - San Jose, California
Thursday, December 17, 2015



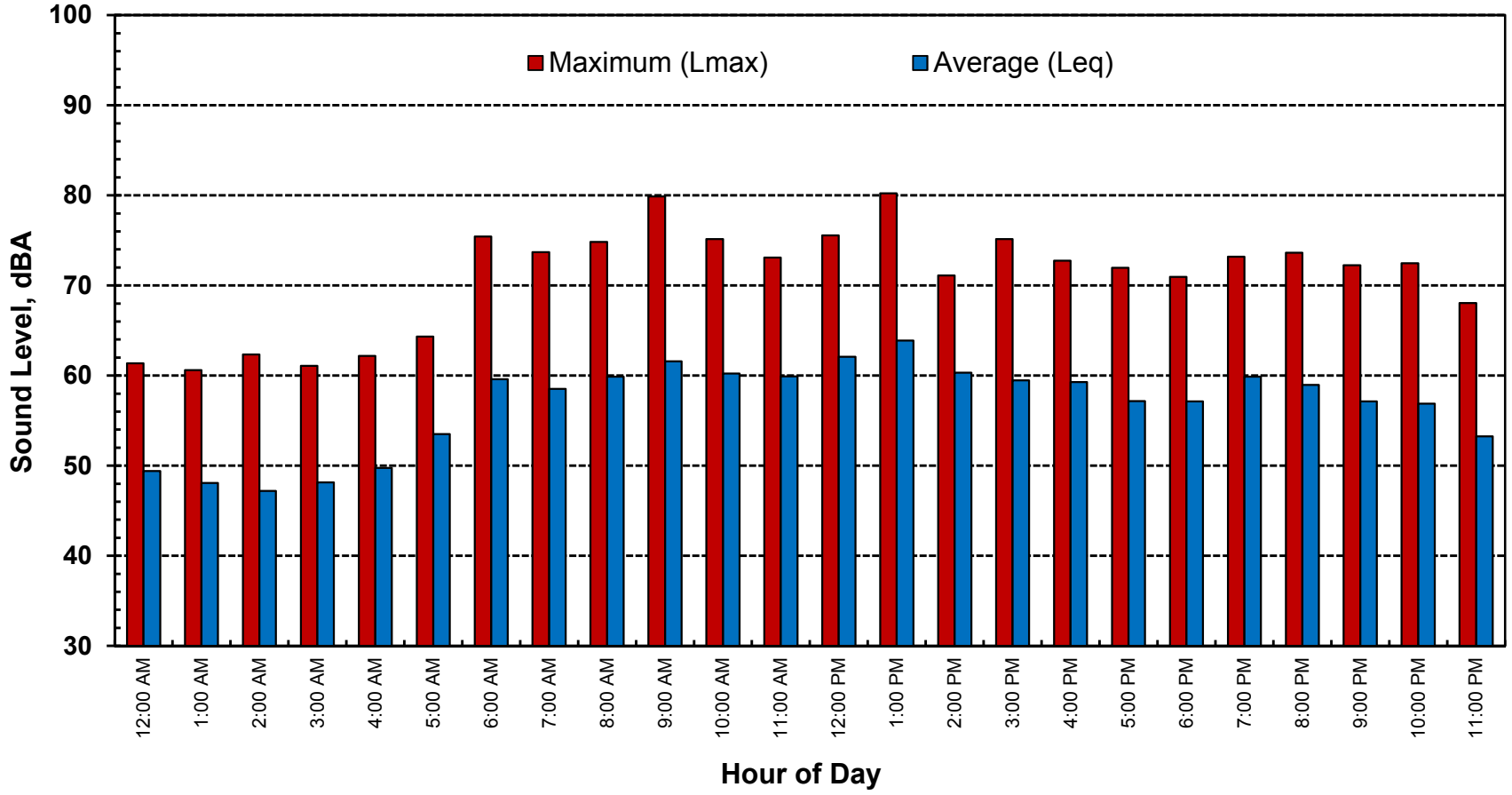
BOLLARD
Acoustical Consultants

Figure 9
Hourly Noise Survey Results - Site C
Terra-Topgolf Development Project - San Jose, California
Wednesday, December 16, 2015



BOLLARD
Acoustical Consultants

Figure 10
Hourly Noise Survey Results - Site C
Terra-Topgolf Development Project - San Jose, California
Thursday, December 17, 2015



BOLLARD
Acoustical Consultants

The hourly noise measurement results presented in Figures 5-10 are important in that they establish baseline conditions at the nearest residential areas against which noise generated by the project can be evaluated. The hour-by-hour data is presented because certain noise-generating aspects of the proposed project would occur during late night and/or early morning periods. For example, the Topgolf project is proposed to operate until 2 a.m. on weekends. Because ambient conditions decrease during these periods due to less traffic on local roadways, and because nighttime hours are more sensitive to noise in general, the identification of specific ambient conditions during these periods is essential to the subsequent evaluation of potential noise impacts due to the project.

Measurement Site A represents noise-sensitive Areas 1 and 5 (see Figure 1), which includes the existing residences located on the opposite side of North First Street from the project site and the lone residence at the corner of Liberty Street and North First Street, respectively. Due to their proximity to North First Street, ambient conditions at both locations are expected to be similar. It should be noted that the residence represented by noise-sensitive Area 5 will be acquired by the applicant prior to the development of the commercial uses in the northern portion of the project site. According to Figures 5 and 6, the lowest measured hourly average (L_{eq}) noise level during the hours of proposed activities at the project site was 52 dB L_{eq} measured during the midnight to 1 a.m. hour. The lowest measured maximum (L_{max}) noise level during the hours of proposed activities at the project site was 74 dB L_{max} measured during the 10-11 p.m. hour.

Measurement Site B represents noise-sensitive Area 2 (see Figure 1), which includes the existing mobile home community of residences located on the opposite side of the Guadalupe River, west of the Project site. According to Figures 7 and 8, the lowest measured hourly average (L_{eq}) noise level during the hours of proposed activities at the project site was 49 dB L_{eq} measured during the midnight to 1 a.m. hour. The lowest measured maximum (L_{max}) noise level during the hours of proposed activities at the project site was 60 dB L_{max} measured during the same midnight to 1 a.m. hour.

Measurement Site C represents noise-sensitive Area 3 (see Figure 1), which includes the existing residences located on the south side of Highway 237. Those residences a screened from view of Highway 237 and the project site by a substantial grade differential and existing sound wall. According to Figures 9 and 10, the lowest measured hourly average (L_{eq}) noise level during the hours of proposed activities at the project site was 50 dB L_{eq} measured during the midnight to 1 a.m. hour. The lowest measured maximum (L_{max}) noise level during the hours of proposed activities at the project site was 62 dB L_{max} measured during the same Midnight to 1 a.m. hour.

Existing Traffic Noise Environment

Traffic Noise Prediction Methodology

The Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA-RD-77-108) was used with the Calveno vehicle noise emission curves to predict existing traffic noise levels along project-area roadways.

Predicted Existing Traffic Noise Levels

The FHWA Model was used with existing traffic data prepared by Fehr & Peers Associates to predict existing traffic noise levels in the immediate project vicinity. Table 2 shows the predicted existing traffic noise levels at a reference distance of 50 feet from the roadway centerlines, as well as the distances to the unshielded L_{dn} contours. The FHWA Model Inputs for baseline conditions are provided in Appendix C-1.

Table 2
Existing (Baseline) Traffic Noise Levels and Distances to Traffic Noise Contours
Terra-Topgolf Development Project – San Jose, CA

Roadway	Segment	L_{dn}[1]	L_{dn} Contour (feet) 75	70	65
N Taylor Street	Gold Street to Liberty Street	64	9	20	43
N Taylor Street	Liberty Street to Trinity Park Drive	65	11	23	49
N First Street	Trinity Park Drive to Nortech Pkwy	64	9	20	43
N First Street	Nortech Parkway to SR 237 WB Ramps	66	13	28	59
Gold Street	North of Taylor Street	59	4	9	19
Gold Street	South of Taylor Street	65	11	23	49
Gold Street	North of Gold Street Connector	66	13	28	60
Liberty Street	North of Taylor Street	55	2	5	11
Liberty Street	South of Taylor Street	59	4	10	21
Trinity Park Drive	North of N First Street	52	1	3	7
Nortech Parkway	North of N First Street	64	10	21	46

Notes:
1. L_{dn} is computed at a distance of 50 feet from the roadway centerline.

Source: FHWA-RD-77-108 with inputs prepared by Kimley-Horn

Regulatory Setting - Criteria for Acceptable Noise Exposure

City of San Jose General Plan

Chapter 3 of the City of San Jose General Plan pertains to Environmental Leadership, and contains the City's noise-related policies. The specific policies which are applicable to this project are reproduced below.

EC-1.1 Locate new development in areas where noise levels are appropriate for the proposed uses. Consider federal, state and City noise standards and guidelines as a part of new development review. Applicable standards and guidelines for land uses in San José include:

<u>Interior Noise Levels</u>

- The City's standard for interior noise levels in residences, hotels, motels, residential care facilities, and hospitals is 45 dBA DNL. Include appropriate site and building design, building construction and noise attenuation techniques in new development to meet this standard. For sites with exterior noise levels of 60 dBA DNL or more, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that development projects

can meet this standard. The acoustical analysis shall base required noise attenuation techniques on expected *Envision General Plan* traffic volumes to ensure land use compatibility and General Plan consistency over the life of this plan.

Exterior Noise Levels

- The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses (Table EC-1). The acceptable exterior noise level objective is established for the City, except in the environs of the San José International Airport and the Downtown, as described below:

    - For new multi-family residential projects and for the residential component of mixed-use development, use a standard of 60 dBA DNL in usable outdoor activity areas, excluding balconies and residential stoops and porches facing existing roadways. Some common use areas that meet the 60 dBA DNL exterior standard will be available to all residents. Use noise attenuation techniques such as shielding by buildings and structures for outdoor common use areas. On sites subject to aircraft overflights or adjacent to elevated roadways, use noise attenuation techniques to achieve the 60 dBA DNL standard for noise from sources other than aircraft and elevated roadway segments.

    - For single family residential uses, use a standard of 60 dBA DNL for exterior noise in private usable outdoor activity areas, such as backyards.

EC-1.2 Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3 and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers, where feasible. The City considers significant noise impacts to occur if a project would:

- Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain "Normally Acceptable"; or

- Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where noise levels would equal or exceed the "Normally Acceptable" level.

Table EC-1: Land Use Compatibility Guidelines for Community Noise in San José

LAND USE CATEGORY	EXTERIOR NOISE EXPOSURE (DNL IN DECIBELS (DBA)) 55	60	65	70	75	80
1. Residential, Hotels and Motels, Hospitals and Residential Care[1]						
2. Outdoor Sports and Recreation, Neighborhood Parks and Playgrounds						
3. Schools, Libraries, Museums, Meeting Halls, Churches						
4. Office Buildings, Business Commercial, and Professional Offices						
5. Sports Arena, Outdoor Spectator Sports						
6. Public and Quasi-Public Auditoriums, Concert Halls, Amphitheaters						

[1]Noise mitigation to reduce interior noise levels pursuant to Policy EC-1.1 is required.

Normally Acceptable:

- Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable:

- Specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

Unacceptable:

- New construction or development should generally not be undertaken because mitigation is usually not feasible to comply with noise element policies.

EC-1.3 Mitigate noise generation of new nonresidential land uses to 55 dBA DNL at the property line when located adjacent to existing or planned noise sensitive residential and public/quasi-public land uses.

EC-1.6 Regulate the effects of operational noise from existing and new industrial and commercial development on adjacent uses through noise standards in the City's Municipal Code.

EC-1.7 Require construction operations within San José to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

EC-1.9 Require noise studies for land use proposals where known or suspected loud intermittent noise sources occur which may impact adjacent existing or planned land uses. For new residential

development affected by noise from heavy rail, light rail, BART or other single-event noise sources, implement mitigation so that recurring maximum instantaneous noise levels do not exceed 50 dBA L_{max} in bedrooms and 55 dBA L_{max} in other rooms.

City of San Jose Zoning Code

In addition, the City of San Jose Zoning Code establishes performance standards for commercial uses adjacent to residentially zoned properties. These standards have been reproduced and are shown in Table 3.

20.40.600 Performance standards.

Table 3
City of San Jose Zoning Code Performance Standards
Residential Properties Affected by Commercial Uses

Noise Level Descriptor	Maximum Noise Level in Decibels at Property Line, dB (L_{max})
Commercial or PQP use adjacent to property used for residential purposes	55
Commercial or PQP use adjacent to property used for commercial or other non-residential purposes	60
Source: City of San Jose Code of Ordinances, Code Section 20.40.060, Table 20-105	

Impacts and Mitigation Measures

Standards of Significance Applied to this Project

The following City of San Jose General Plan standards of significance are applied to this project. It should be noted that the City of San Jose relies on the noise policies identified in the General Plan as CEQA thresholds.

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan, or applicable standards of other agencies.

For on-site noise sources affecting nearby noise-sensitive areas, the following standards are applied:

- General Plan (EC-1.1): 45 dB L_{dn} daytime/nighttime interior noise level for noise-sensitive land uses.
- General Plan (EC-1.2): Significant impacts would occur if a project would:
    - Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain “Normally Acceptable”; or

- Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where the noise levels would equal or exceed the "Normally Acceptable" level.

- General Plan (EC-1.3): 55 dB L_{dn} daytime/nighttime exterior noise level measured at the property lines of residences (applicable to new non-residential land uses when located adjacent to existing or planned noise-sensitive land uses).
- Zoning Code: 55 dB L_{max} exterior noise level measured at the property lines of residences (Planning Consideration, not a CEQA threshold).

b) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

A significant impact would occur if a project would exceed the noise criteria identified above in General Plan EC-1.2.

c) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above level existing without the project.

A significant impact would occur if project construction would exceed the noise criteria identified above in General Plan EC-1.7.

Major Noise Sources Evaluated in this Study

As noted previously, the project proposes a combination of commercial/retail, hotel and outdoor entertainment uses. The major noise-producing components and associated impacts of the proposed Terra-Topgolf project are as follows:

1. Traffic noise impacts at existing residences located in the general project vicinity caused by increased traffic noise resulting from increased project-generated traffic on the local roadway network.

2. Noise impacts at the existing residences located immediately adjacent or near the project site resulting from noise generated by on-site activities associated with the project. Specific on-site noise sources evaluated in this assessment include parking lot movements (vehicles arriving and departing, doors opening and closing, etc.), mechanical equipment (HVAC) operation, operation of the proposed Topgolf entertainment facility (amplified music and patron/crowd noises), and project construction and operations.

Traffic Noise Impacts Due to the Project

With development of the project site, traffic volumes on the local roadway network will increase. Those increases in daily traffic volumes will result in a corresponding increase in traffic noise levels at existing uses located along those roadways. The FHWA Model was used with traffic data provided by the client to predict existing and existing plus, background and background plus, and project traffic noise level increases.

Impact 1: Increases in Existing Traffic Noise Levels due to the Project

Existing versus existing-plus-project traffic noise levels on the local roadway network are shown in Table 4. The following section includes an assessment predicted noise levels relative to the noise criteria identified in City General Plan sections EC-1.1, 1.2 & 1.3.

Table 4
Existing vs. Existing Plus Project Traffic Noise Levels[1]
Terra-Topgolf Development Project – San Jose, CA

Roadway	Segment Description	E	E+ P	Change	Substantial Increase?
N Taylor Street	Gold Street to Liberty Street	63.9	64.9	1.0	No
N Taylor Street	Liberty Street to Trinity Park Drive	64.9	65.7	0.8	No
N First Street	Trinity Park Drive to Nortech Pkwy	64.0	66.8	2.9	No
N First Street	Nortech Parkway to SR 237 WB Ramps	66.1	66.4	0.2	No
Gold Street	North of Taylor Street	58.7	58.7	--	No
Gold Street	South of Taylor Street	64.9	65.7	0.8	No
Gold Street	North of Gold Street Connector	66.2	66.8	0.6	No
Liberty Street	North of Taylor Street	54.9	55.3	0.4	No
Liberty Street	South of Taylor Street	59.2	59.2	--	No
Trinity Park Drive	North of N First Street	51.7	51.7	--	No
Nortech Parkway	North of N First Street	64.4	67.0	2.6	No

Notes:
1. dB Ldn @ 50 feet from roadway centerline

Source: FHWA-RD-77-108 with inputs prepared by Fehr & Peers

Assessment Relative to General Plan Policy EC-1.1

As indicated in Table 4, existing traffic noise levels on 7 of the 11 analyzed roadway segments currently exceed the City's 60 dB L_{dn} standard for residential land uses. However, at the remaining 4 roadway segments, existing traffic volumes satisfy the City's 60 dB L_{dn} standard. In the analysis of existing plus project noise level conditions at these 4 roadway segments, the increase in noise levels as a result of the project has a range of 0 to 0.4 dB, with no exceedances of the City's 60 dB L_{dn} exterior noise level standard resulting from the project. Because these existing plus project traffic noise levels satisfy the City of San Jose General Plan exterior noise level standard of 60 dB L_{dn} for residential land uses, this noise impact is considered ***less than significant***.

As indicated in Table 4, existing plus project exterior noise levels at the analyzed roadway segments range from 52-67 dB L_{dn}. Given this exterior noise level, a building facade noise reduction of at least 22 dB would be required to satisfy the City's 45 dB L_{dn} interior noise level standard for residential land uses. Standard construction (wood or stucco siding, STC-27 windows, door weather-stripping, exterior wall insulation, composition plywood roof), results in an exterior to interior noise reduction of at least 25 dB with windows closed and approximately

15 dB with windows open. After taking into consideration the noise reduction achieved from standard construction, the range of existing plus project traffic noise levels within interior spaces would be 27-42 dB L_{dn}. Because existing plus project traffic noise levels satisfy the City of San Jose General Plan interior noise level standard of 45 dB L_{dn} for residential land uses, this noise impact is considered ***less than significant***.

Assessment Relative to General Plan Policy EC-1.2

Given a baseline exposure between 51.7 and 67.2 dB L_{dn}, the applicable General Plan significance threshold criteria would range from 3 to 5 dB. According to Table 4, the proposed project would not result in any substantial increases in off-site traffic noise impacts relative to existing traffic conditions present without the project. Because the predicted increases in traffic noise levels are below the significance criteria for each roadway segment, this noise impact is considered ***less than significant.***

Assessment Relative to General Plan Policy EC-1.3

As indicated in Table 4, existing traffic noise levels on 9 of the 11 analyzed roadway segments currently exceed the City's 55 dB L_{dn} property line standard. However, traffic noise generated by the project is not predicted to exceed the City's 55 dB L_{dn} standard. Because project traffic noise levels would not exceed the City of San Jose General Plan property line 55 dB L_{dn} noise level standard, this noise impact is considered ***less than significant****.*

Impact 2: Increases in Background Traffic Noise Levels due to the Project

Using the same methodology described above, traffic noise levels were predicted for background and background-plus-project conditions. Table 5 shows the results of the background traffic analysis.

Table 5
Background vs. Background Plus Project Traffic Noise Levels[1]
Terra-Topgolf Development Project – San Jose, CA

Roadway	Segment Description	B	B+P	Change	Substantial Increase?
N Taylor Street	Gold Street to Liberty Street	63.9	64.9	1.0	No
N Taylor Street	Liberty Street to Trinity Park Drive	64.9	65.7	0.8	No
N First Street	Trinity Park Drive to Nortech Pkwy	64.0	66.8	2.9	No
N First Street	Nortech Parkway to SR 237 WB Ramps	67.2	67.4	0.2	No
Gold Street	North of Taylor Street	58.7	58.7	--	No
Gold Street	South of Taylor Street	64.9	65.7	0.8	No
Gold Street	North of Gold Street Connector	67.0	67.5	0.5	No
Liberty Street	North of Taylor Street	54.9	55.3	0.4	No
Liberty Street	South of Taylor Street	59.2	59.2	--	No
Trinity Park Drive	North of N First Street	51.7	51.7	--	No
Nortech Parkway	North of N First Street	64.4	67.0	2.6	No

Notes:
1. dB L_{dn} @ 50 feet from roadway centerline

Source: FHWA-RD-77-108 with inputs prepared by Fehr & Peers

Assessment Relative to General Plan Policy EC-1.1

As indicated in Table 5, background traffic noise levels on 7 of the 11 analyzed roadway segments currently exceed the City's 60 dB L_{dn} standard for residential land uses. However, at the remaining 4 roadway segments, background traffic volumes satisfy the City's 60 dB L_{dn} standard. In the analysis of background plus project noise level conditions at these 4 roadway segments, the increase in noise levels as a result of the project has a range of 0 to 0.4 dB, with no exceedances of the City's 60 dB L_{dn} exterior noise level standard resulting from the project. Because these background plus project traffic noise levels satisfy the City of San Jose General Plan exterior noise level standard of 60 dB L_{dn} for residential land uses, this noise impact is considered ***less than significant***.

As indicated in Table 5, background plus project noise levels at the analyzed roadway segments range from 52-67 dB L_{dn}. Given this exterior noise level, a building facade noise reduction of at least 22 dB would be required to satisfy the City's 45 dB L_{dn} interior noise level standard for residential land uses. After taking into consideration the noise reduction achieved from the aforementioned standard construction practices, the range of background plus project traffic noise levels within interior spaces would be 27-42 dB L_{dn}. Because background plus project traffic noise levels satisfy the City of San Jose General Plan interior noise level standard of 45 dB L_{dn} for residential land uses, this noise impact is considered ***less than significant***.

Assessment Relative to General Plan Policy EC-1.2

Given a baseline exposure between 51.7 and 67.2 dB L_{dn}, the applicable General Plan significance threshold criteria would range from 3 to 5 dB. According to Table 5, the proposed project would not result in any substantial increases in off-site traffic noise impacts relative to background traffic conditions present without the project. Because the predicted increases in traffic noise levels are below the significance criteria for each roadway segment, this noise impact is considered ***less than significant.***

Assessment Relative to General Plan Policy EC-1.3

As indicated in Table 5, existing traffic noise levels on 9 of the 11 analyzed roadway segments currently exceed the City's 55 dB L_{dn} property line standard. However, traffic noise generated by the project is not predicted to exceed the City's 55 dB L_{dn} standard. Because project traffic noise levels would not exceed the City of San Jose General Plan property line 55 dB L_{dn} noise level standard, this noise impact is considered ***less than significant****.*

Noise Impacts Resulting from On-Site Activities within the Project Site

Impact 3: Parking Lot Activity Noise

The project proposes both ground level and lower level parking as indicated in Figures 2 and 3. Lower level parking areas will be depressed relative to the project site and the nearest noise-sensitive receptors located opposite the project site on North First Street. As a result, noise generated by lower-level parking lot activities would be reduced due to shielding provided by intervening topography and structures. As indicated in Figure 3, ground level parking is primarily located northwest of the proposed Topgolf facility.

As a means of predicting the noise generation due to parking lot activities, BAC utilized noise level data collected at various parking lots over the years. That data indicate that a typical maximum noise level associated with parking lot activity did not exceed 65 dB L_{max} at a reference distance of 50 feet. Average (L_{eq}) noise levels were predicted to be 5 dB lower than maximum noise levels. Given the proposed hours of operation, parking lot L_{dn} values computed to 3 dB higher than L_{eq} values, assuming equal level of activity for 12 daytime and 4 nighttime hours. Because it is known that parking lot activity will be lighter during non-peak hours, this assumption is conservative.

Because individual cars entering and leaving the proposed parking areas will result in brief periods of noise generation, impacts associated with parking lot movements are assessed relative to the City's Zoning Code maximum noise level standards (L_{max}) shown in Table 3.

The distance between the nearest proposed lower level parking spaces and the closest existing residences to the north (Area 1 on Figure 1), is approximately 150 feet. At that distance, maximum noise levels generated by the nearest parking lot activities are predicted to be approximately 55 dB L_{max} prior to consideration of shielding provided by the recessed parking area. That shielding is predicted to result in a reduction of approximately 10 dB at the nearest residences, resulting in lower level parking lot noise emissions of 45 dB L_{max} at the nearest

residences in Area 1. Please see Appendix D-1 for computations of parking lot noise levels at the nearest sensitive receptors. This level is considered satisfactory relative to the City's Zoning Code 55 L_{max} exterior noise level standard.

The distance between the nearest proposed ground level parking spaces and the closest existing residence to the north is approximately 250 feet. The residences to the north will be partially screened from view of the ground level parking spaces by intervening commercial buildings. That screening is predicted to result in a minimum 5 dB reduction in parking lot noise levels at those northern residences (Area 1 on Figure 1). Resulting maximum ground level parking lot noise levels at the residences identified within Area 1 would be approximately 46 dB L_{max}. This level is considered satisfactory relative to the City's Zoning Code 55 L_{max} exterior noise level standard.

The residences to the south, on the opposite side of the Guadalupe River (Area 2 on Figure 1), are located approximately 500+ feet from the nearest ground level parking space at the project site. These residences would not be shielded from view of the proposed ground-level parking areas. Maximum ground-level parking lot noise levels at the Area 2 residences are predicted to be approximately 45 dB L_{max}. This level would satisfy the City's Zoning Code 55 L_{max} exterior noise level standard.

The residences represented by Area 3 (see Figure 1) are approximately 1,700 feet from the nearest proposed ground level parking area associated with the project site. Those residences are substantially shielded from view of the project site by a grade differential as well as the masonry sound wall along the southern side of SR-237. Resulting maximum ground level parking lot noise levels at the residences identified within Area 3 would be approximately 19 dB L_{max}. This level is considered satisfactory relative to the City's Zoning Code 55 L_{max} exterior noise level standard.

At sensitive areas 4 and 5, parking lot noise would be substantially screened by intervening structures and attenuated due to the considerable setbacks from these sensitive locations and the nearest parking areas. As a result, maximum ground-level parking lot noise levels at the Area 4 and 5 receptors are predicted to be 34 and 25 dB L_{max}, respectively These levels would satisfy the City's Zoning Code 55 L_{max} exterior noise level standard. Parking lot noise levels within the school classrooms and library within Area 4 would be 20 dB lower due to noise attenuation provided by the building façade.

In addition to lower level and ground level parking lot noise levels satisfying the City's 55 dB L_{max} noise standard at all of the nearest residential areas to the project site, Figures 5-10 indicated the predicted maximum noise levels level are well below the measured existing maximum noise levels at the nearest residences and other nearby noise-sensitive areas. As a result, this impact is considered ***less than significant.***

Impact 4: Mechanical Equipment Noise

The heating, ventilation, and air conditioning (HVAC) systems for maintaining comfortable temperatures within the proposed hotel, commercial/retail, and Topgolf facility office uses will vary. For the commercial buildings, HVAC systems would likely consist of packaged rooftop air conditioning systems. For the proposed hotel use, mechanical equipment could either be located internally within a mechanical equipment room or on the rooftop. The mechanical equipment for the Topgolf facility is located within a mechanical equipment enclosure.

Because mechanical equipment operation typically generates sustained, steady-state, noise levels, impacts of HVAC system usage are assessed in this study relative to the City's General Plan daytime/nighttime 55 L_{dn} exterior and 45 L_{dn} interior noise level standards.

Noise from rooftop HVAC units has been measured by BAC to be approximately 50 dB at a reference distance of 100 feet from the building façades of similar uses. HVAC systems located within dedicated mechanical equipment rooms typically result in even lower noise levels.

At the nearest residence to the site (Area 1), would be located a minimum of 150+ feet from any project-related HVAC equipment, average HVAC exterior noise levels are predicted to be approximately 46 dB L_{eq}/L_{max} and 50 dB L_{dn}, conservatively assuming the mechanical equipment were to operate 12 daytime and 4 nighttime hours per day. Based on more typical operating conditions, predicted HVAC system levels are predicted to be even lower at the nearest residences to the project site (Area 1). Please see Appendix D-2 for computations of parking lot noise levels at the nearest sensitive receptors.

Within the nearest residences, noise levels would be approximately 15 dB lower with windows open, and 25 dB lower with windows closed. Resulting interior noise levels would range from approximately 25-35 dB L_{dn} within the nearest residences.

Predicted HVAC system noise levels at the nearest existing residences would be satisfactory relative to the City's exterior noise level standards of 55 dB L_{max} and 55 L_{dn} , and 45 dB L_{dn} interior noise level standard. In addition, predicted HVAC system noise levels would be well below measured ambient conditions at all of the nearest residences to the project site. As a result, noise impacts resulting from daytime and/or nighttime HVAC system usage within the project area is considered ***less than significant.***

Impact 5: Topgolf Outdoor Entertainment Facility Noise

Topgolf Facility Overview

Topgolf is a proposed golf entertainment complex planned on the 13.5-acre portion of the project site identified on Figures 1 - 3. Topgolf is a three-story driving range facility with 125 climate-controlled hitting bays, with an outdoor outfield enclosed by netting. The Topgolf facility includes a full-service restaurant, bar, lounges and corporate/event meeting spaces, and family entertainment area with games. Players play in individual hitting bays. Each hitting bay can accommodate up to six players at a time but it's not unusual to have one or two players in some bays. Hitting bays include seating, television screens to monitor sporting events and track

Topgolf scoring, and include overhead speakers providing amplified music. Topgolf facilities include the following specific activities:

- **Lower Level**. The lower level features approximately 40 hitting bays including bays designated for golf instruction and team practice. The lower level features a family lounge area. This level is at grade on the tee line.

- **Main Level.** The entrance to the building is on the main level. The main level features approximately 40 hitting bays, a full-service bar/restaurant, a 2,900-square foot corporate and event meeting space and lobby area.

- **Upper Level.** The upper level features approximately 40 hitting bays and an open-air rooftop terrace. The rooftop terrace will be furnished with tables, couches and fire pits. Restaurant food service is available on the roof top terrace. The terrace can accommodate live music for events.

- **Operations.** Proposed operating hours are 9 a.m. to 2 a.m., seven days a week. The project proposes live and DJ-generated music on the outdoor terrace on the third level. On weekdays, the music would start at 6 p.m. and end at midnight. On weekends, the music would start at noon and end at 1 a.m. Security will be provided with on-site indoor and outdoor cameras and on-site staff security during operating hours.

Topgolf Music and Patron Activity Noise Generation

The design of the Topgolf facilities is such that music is played above the individual drive bays, as well as on the third level terrace. In addition to this music, sound is also generated at the Topgolf facilities by patrons conversing, sometimes in raised voices.

To evaluate the noise generation of the proposed facility, BAC staff utilized data from an extensive sound level survey at the Topgolf facility in Gilbert, Arizona. BAC staff conducted surveys from 5 p.m. Friday September 25 to Noon on Sunday, September 27, 2015. The surveys consisted of both short and long-term sound level measurements at 17 locations in and around the Topgolf facility. An aerial image with noise measurement locations at the Gilbert facility is shown in Figure 11. Long-term sound level measurements were conducted at sites A and B shown on Figure 11. Measured sound levels resulting from typical weekend Topgolf activities at the Gilbert facility were plotted and are displayed on Figure 12. The Figure 12 “heat map” highlights the range of noise levels which can be expected throughout the site. According to Topgolf representatives, the noise generation of the proposed Topgolf San Jose facility would be comparable to that of the Gilbert facility where the sound level surveys were conducted.

Predicted Topgolf Noise Levels at the Nearest Residences to the San Jose Facility

The noise exposure data shown in Figure 12 were projected from the proposed facility to the nearest residences assuming a six (6) dB decrease per doubling of distance from the noise source, consistent with accepted sound propagation algorithms.

The Gilbert Topgolf facility measurement sites shown in Figure 11 which are most pertinent to this analysis of potential impacts at the proposed San Jose facility are Sites I, M, and A, as they represent noise exposure in the direction of residential receptor locations 1, 2 and 3, respectively. See Figure 1 for locations of nearest potentially affected residential receptor locations. The noise level data collected at those locations were projected to the nearest residences assuming standard spherical spreading of sound (-6 dB per doubling of distance from the source). The results of the noise assessment at those locations are shown in Table 6.

Table 6
Predicted Topgolf Facility Noise Levels at Nearest Sensitive Uses
Terra-Topgolf Development Project – San Jose, California

Site	Description	Distance from Topgolf Facility (ft)	Predicted Topgolf Noise Levels, dB[1]			Baseline Ldn, dB[4]	Baseline + Project Ldn, dB	Project Related Increase in Ldn, dB
			L_{eq}	L_{max}	L_{dn}[2]			
Area 1	Nearest Residences to North	700	45	53	48	65	65	0
Area 2	Nearest Residences to West	580	47	55	50	63	63	0
Area 3	Nearest Residences to South[3]	1,900	37	44	40	62	62	0
Area 4	Interior of Library and School Classrooms[4]	400	27	40	30	65	65	0
Area 5	Single Residence to Northwest	1,700	37	45	40	65	65	0

Notes:

1. Predicted levels are based on reference levels from BAC file data, and 6 dB per doubling of distance attenuation rate.
2. L_{dn} calculations conservatively assume continuous Topgolf noise generation between 9 am and 2 am.
3. A -10 dB offset was conservatively applied to the residences represented by Area 3 due to shielding provided by the existing grade differential and SR-237 noise barrier.

Interior spaces of library and school classrooms were conservatively estimated to be 20 dB lower than exterior noise levels due to noise reduction provided by the library and school buildings.

4. Baseline noise levels are identified in Table 1.
5. Please see Appendix D-3 for computations of parking lot noise levels at the nearest sensitive receptors.

Source: Bollard Acoustical Consultants, Inc. (2015, 2016)

Table 6 indicates the predicted average (L_{eq}), maximum (L_{max}), and day-night average level (L_{dn}), at each of the nearest noise-sensitive areas to the project site would be satisfactory relative to the project standards of significance. In addition, predicted exterior noise levels are at, or below, measured existing ambient conditions at those nearest sensitive areas. As a result, the project-related increase in Ldn at the nearest sensitive receptors is 0 dB, which is also below the City's thresholds for significance. As a result, noise impacts associated with on-site Topgolf activities, including amplified music and sound generated by facility patrons, is considered ***less than significant.***

Figure 11

Project Area and Noise Measurement Locations

Topgolf Gilbert - Gilbert, Arizona

BOLLARD
Acoustical Consultants

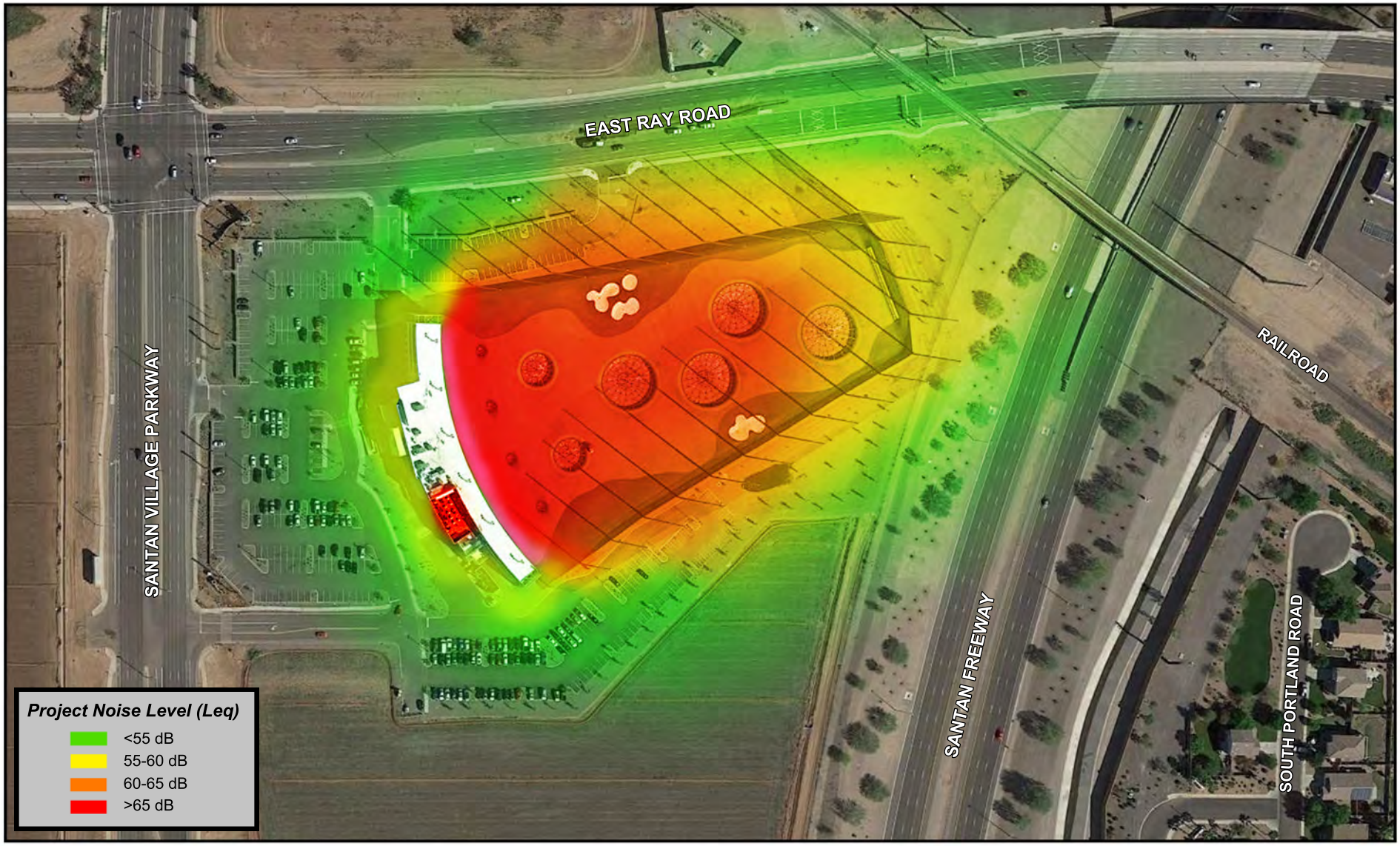
Scale (feet)

0 120 240

Figure 12

Project Noise Generation Heat Map

Topgolf Gilbert - Gilbert, Arizona



BOLLARD
Acoustical Consultants

Scale (feet)
0 120 240

Impact 6: Project Construction Noise Generation

During the construction phases of the proposed project, noise from construction activities would add to the noise environment in the immediate project vicinity. Activities involved in typical construction would generate maximum noise levels, as indicated in Table 7, ranging from 70 to 90 dB at a distance of 50 feet.

Because project construction activities would not include pile driving or other substantial sources of vibration, and because vibration levels dissipate rapidly from earthmoving equipment uses for site grading, no vibration-related impacts are identified at any of the nearest sensitive receptors to the project site.

Table 7
Typical Construction Equipment Noise

Equipment Description	Maximum Noise Level at 50 feet, dBA
Auger drill rig	85
Backhoe	80
Bar bender	80
Boring jack power unit	80
Chain saw	85
Compactor (ground)	80
Compressor (air)	80
Concrete batch plant	83
Concrete mixer truck	85
Concrete pump truck	82
Concrete saw	90
Crane (mobile or stationary)	85
Dozer	85
Dump truck	84
Excavator	85
Flatbed truck	84
Front end loader	80
Generator (25 kilovolt-amperes [kVA] or less)	70
Generator (more than 25 kVA)	82
Grader	85
Jackhammer	85
Paver	85
Pickup truck	55
Pneumatic tools	85
Pumps	77
Rock drill	85
Scraper	85
Soil mix drill rig	80
Tractor	84
Vacuum street sweeper	80
Vibratory concrete mixer	80

Source: Federal Highway Administration 2006.

The nearest existing residences are located between 100 and over 1,000 feet to the required construction areas within the project site. At this range of distances, maximum noise levels would range from approximately 50 to 85 dB L_{max} at the nearest sensitive receptors. Figures 5-10 indicate that daytime maximum noise levels frequently exceeded 80 dB L_{max} at the nearest sensitive receptor location (Areas 1 & 5). Therefore, the predicted range of construction-related noise levels would not likely represent a substantial short-term increase over ambient maximum noise levels, provided construction activities were limited to daytime hours. However, due to the potential for substantial short-term exceedances of ambient noise levels at nearby sensitive areas during project construction, this impact is considered ***potentially significant***.

Mitigation for Impact 6:

MM 6: Implement measures to prevent exposure of sensitive receptors to excessive construction noise

To reduce impacts associated with noise generated during project-related construction activities, the project applicant(s) and their primary contractors for engineering design and construction of all project phases shall ensure that the following requirements are implemented at each work site in any year of project construction to avoid and minimize construction noise effects on sensitive receptors. The project applicant(s) and primary construction contractor(s) shall employ noise-reducing construction practices. Measures that shall be used to limit noise shall include the measures listed below:

- Noise-generating construction operations shall be limited to the hours between 7 a.m. and 7 p.m. Monday through Friday, and between 8 a.m. and 6 p.m. on Saturdays and Sundays.

- All construction equipment and equipment staging areas shall be located as far as possible from nearby noise-sensitive land uses.

- All construction equipment shall be properly maintained and equipped with noise-reduction intake and exhaust mufflers and engine shrouds, in accordance with manufacturers' recommendations. Equipment engine shrouds shall be closed during equipment operation.

- All motorized construction equipment shall be shut down when not in use to prevent idling.

- The primary contractor shall prepare and implement a construction noise management plan. This plan shall identify specific measures to ensure compliance with the noise control measures specified above. The noise control plan shall be submitted to the City of San Jose before any noise-generating construction activity begins.

Significance after mitigation: ***Less than Significant***

Cumulative Setting, Impacts and Mitigation Measure

The future (cumulative) noise environment at the project site will continue to be dominated by traffic on the local roadway network. A detailed analysis of cumulative traffic noise levels, both with and without the project, is provided in Table 8. The FHWA Model input data used to derive the cumulative data contained in Table 8 is provided in Appendix C.

Cumulative Traffic Noise Impacts

Impact 7: Increase in Cumulative Traffic Noise Levels

Cumulative versus cumulative plus project traffic noise levels on the local roadway network are shown in Table 8. The following section includes an assessment of predicted noise levels relative to the noise criteria identified in City General Plan sections EC-1.1, 1.2 & 1.3.

Table 8
Cumulative vs. Cumulative Plus Project Traffic Noise Levels[1]
Terra-Topgolf Development Project – San Jose, CA

Roadway	Segment Description	C	C+P	Change	Substantial Increase?
N Taylor Street	Gold Street to Liberty Street	66.4	67.0	0.6	No
N Taylor Street	Liberty Street to Trinity Park Drive	67.0	67.5	0.5	No
N First Street	Trinity Park Drive to Nortech Pkwy	66.1	68.1	1.9	No
N First Street	Nortech Parkway to SR 237 WB Ramps	67.4	67.5	0.2	No
Gold Street	North of Taylor Street	58.7	58.7	--	No
Gold Street	South of Taylor Street	67.0	67.5	0.5	No
Gold Street	North of Gold Street Connector	68.7	69.1	0.3	No
Liberty Street	North of Taylor Street	54.9	55.3	0.4	No
Liberty Street	South of Taylor Street	59.2	59.2	--	No
Trinity Park Drive	North of N First Street	53.8	53.8	--	No
Nortech Parkway	North of N First Street	66.4	68.2	1.8	No

Notes:
1. dB L_{dn} @ 50 feet from roadway centerline

Source: FHWA-RD-77-108 with inputs prepared by Fehr & Peers

A significant cumulative traffic noise impact would be identified if existing sensitive receptors would be exposed to substantial cumulative traffic noise levels and if the project would make a "cumulatively considerable" contribution to the overall traffic noise level increase. A substantial increase would occur if: a) the noise level increase is five dBA L_{dn} or greater, where the resulting future noise level is below what is considered "normally acceptable" for the affected land use in the General Plan, or b) the noise level increase is three dBA L_{dn} or greater, where the resulting future noise level is higher than what is considered "normally acceptable" in the General Plan. Sensitive receptors in the project vicinity include residential uses, a school, a library, and a community center. The City considers "normally acceptable" exterior noise levels to be 60 dBA

L_{dn} for residential and institutional uses (such as schools, libraries, and community centers), and 65 dBA L_{dn} for outdoor sports and recreation, neighborhood parks, and playgrounds. The City's General Plan states that for sites with exterior noise levels of 60 dBA L_{dn} or more, such as the sensitive receptors in the project vicinity, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that the 45 dBA L_{dn} interior noise standard would be met.

As indicated in Table 8, cumulative traffic noise levels at the analyzed roadway segments would range from 53.8-68.7 dB L_{dn}. It should be noted that these estimates are at a distance of 50 feet from the center of the roadway. Compared to existing traffic noise levels shown in Table 4, all roadway segments would experience traffic noise increases of less than three dB L_{dn} under cumulative conditions without the project, resulting in a less than significant cumulative impact. Under cumulative plus project conditions, three roadway segments would experience traffic noise increases of more than three dB L_{dn}, and therefore warrant further discussion: 1) N. Taylor Street between Gold Street and Liberty Street, 2) N. First Street between Trinity Park Drive and Nortech Parkway, and 3) Nortech Parkway north of N. First Street. Since no sensitive receptors are located along the frontage of Nortech Parkway, no further discussion of cumulative traffic noise along this segment is warranted.

On N. Taylor Street between Gold Street and Liberty Street, sensitive receptors along the roadway frontage consist of single-family residences. The cumulative plus project traffic noise level on this roadway segment is estimated to be 67 dB L_{dn} at a distance of 50 feet from the center of the roadway. As discussed previously, standard construction practices reduce residential interior noise levels by 25 dB L_{dn} compared to exterior noise levels. As a result, interior spaces in residences along this roadway segment would not experience noise levels in excess of the City's 45 dB L_{dn} standard. Sensitive receptors along this roadway segment, therefore, would not be exposed to a significant cumulative traffic noise impact.

On N. First Street between Trinity Park Drive and Nortech Parkway, the existing sensitive receptors along the roadway segment consist of a school, a library, and a community center. Cumulative plus project traffic noise levels along this roadway segment are estimated to be 68.1 dB L_{dn} at a distance of 50 feet from the center of the roadway. It should be noted that the building facades of these uses are located at distances of at least 85 feet from the center of the roadway and, therefore, actual noise levels at these receptors would be lower than 68.1 dB L_{dn}. Utilizing the same calculation methodology, traffic noise levels were estimated at distances further than 50 feet from the center of the roadway to more accurately determine noise levels at the sensitive uses. At a distance of 85 feet, existing traffic noise levels are estimated to be 60.5 dB L_{dn}, and cumulative plus project traffic noise levels are estimated to be 64.6 dB L_{dn}. Using a conservative assumption of 20 dB L_{dn} in noise attenuation achieved by standard construction practices for institutional uses such as libraries, community centers, and schools, interior noise levels in these uses would be reduced to at least 44.6 dB L_{dn} in the areas closest to the roadway, resulting in a less than significant cumulative traffic noise impact to the interior spaces of these land uses. To analyze the cumulative traffic noise levels experienced by sensitive receptors utilizing outdoor common recreation areas associated with these land uses, cumulative plus project traffic noise levels were calculated at the closest common outdoor use areas to the roadway. A communal gardening area is located roughly 85 feet from the center of

the roadway, and a children's playground is located roughly 100 feet from the center of the roadway. As mentioned previously, at a distance of 85 feet, existing traffic noise levels are estimated to be 60.5 dB L_{dn}, and cumulative plus project traffic noise levels are estimated to be 64.6 dB L_{dn}, which is below the City's "normally acceptable" noise level of 65 dB L_{dn} for outdoor sports and recreation, neighborhood parks, and playgrounds. Similarly, existing traffic noise levels are estimated to be 59.5 dB L_{dn} at a distance of 100 feet, and cumulative plus project traffic noise levels are estimated to be 63.6. Both locations would experience an increase of 4.1 dB L_{dn} under cumulative plus project conditions, which is below the five dB L_{dn} threshold and would be considered a less than significant cumulative impact.

Because no significant noise level increases relative to the City of San Jose standards are predicted, this noise impact is considered ***less than significant.***

Impact 8: Cumulative (Future) Traffic Noise Levels within Proposed Hotel

As noted in Table 8, the predicted future (cumulative plus project) traffic noise level at a distance of 50 feet from the centerline of North First Street at the location of the proposed hotel is 68.1 dB L_{dn}. Because the nearest proposed hotel building façade will be 100 feet from that roadway, the future traffic noise exposure at that façade would be 63.6 dB L_{dn} (based on 4.5 dB decrease per doubling of distance from source).

Based on an exterior noise exposure of 63.6 dB L_{dn}, the building façade of the proposed hotel would need to provide at least 19 dB of traffic noise attenuation to achieve compliance with the City of San Jose interior noise exposure standard of 45 dB L_{dn}. Because standard hotel building design provides approximately 30 dB of exterior to interior traffic noise reduction, interior noise levels within the hotel rooms are predicted to be approximately 34 dB L_{dn} or less. Because the predicted interior noise level within the hotel rooms would be satisfactory relative to the City of San Jose noise standard, this noise impact is considered ***less than significant.***

Impact 9: Combined Noise from all On-Site Project Noise Sources

Combined noise levels for each on-site noise source operating concurrently are shown below in Table 9. It should be noted that project construction noise would not occur simultaneously with operational noise. Because the cumulative noise generation of all on-site sources would satisfy the City of San Jose exterior noise criteria applied at the nearest noise-sensitive land uses, and because the increase in Ldn values at those nearest sensitive receptors would be 0 dB as a result of the project, this impact is considered **less than significant.**

Table 9
Predicted Noise Levels at Nearest Receptors from All On-Site Noise Sources Combined
Terra-Topgolf Development Project – San Jose, California

Site	Description	Predicted Project Noise Levels, dB[1]			Baseline Ldn, dB[4]	Baseline + Project Ldn, dB	Project Related Increase in Ldn, dB
		L_{eq}	L_{max}	L_{dn}[2]			
Area 1	Nearest Residences to North	49	54	53	65	65	0
Area 2	Nearest Residences to West	48	55	51	63	63	0
Area 3	Nearest Residences to South[3]	37	44	40	62	62	0
Area 4	Interior of Library and School Classrooms[4]	29	40	32	65	65	0
Area 5	Single Residence to Northwest	45	48	48	65	65	0

Notes:

1. Predicted levels are based on the decibel addition of data reported in previous sections of this report.
2. L_{dn} calculations conservatively assume continuous Topgolf noise generation between 9 am and 2 am.
3. A -10 dB offset was conservatively applied to the residences represented by Area 3 due to shielding provided by the existing grade differential and SR-237 noise barrier.
   Interior spaces of library and school classrooms were conservatively estimated to be 20 dB lower than exterior noise levels due to noise reduction provided by the library and school buildings.
4. Baseline noise levels are identified in Table 1.

Source: Bollard Acoustical Consultants, Inc. (2015, 2016)

Conclusions and Recommendations

There are considerable setbacks between the existing residences in the area and proposed buildings within the Terra-Topgolf development. In addition, existing Highway 237 and local roadway network traffic noise levels will provide masking of project noise generation at those nearest residences. As a result, with the exception of potential impacts during project construction, noise impacts are not identified for this project.

These conclusions are based on the project site plans shown on Figures 2 and 3, and on the data and assumptions cited herein. Any substantive revisions to the project site plans or proposed operations could cause actual noise levels to vary relative to those predicted herein. BAC is not responsible for such revisions.

This concludes BAC's environmental noise analysis for the proposed Terra-Topgolf Development Project. Please contact Paul Bollard at (916) 663-0500 or paulb@bacnoise.com with any questions regarding this assessment.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
Loudness	A subjective term for the sensation of the magnitude of sound.
Masking	The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
SEL	A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.

Appendix B-1
Ambient Noise Monitoring Results - Site A
Terra-Topgolf Development Project - San Jose, California
Wednesday, December 16, 2015

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	56	81	42	66	58	49	47	44
1:00 AM	53	72	41	63	54	48	46	43
2:00 AM	51	74	42	58	52	50	48	45
3:00 AM	51	71	41	56	52	49	48	45
4:00 AM	56	80	43	64	56	54	52	46
5:00 AM	60	76	52	68	63	59	57	55
6:00 AM	63	76	55	71	68	63	59	57
7:00 AM	64	80	54	72	69	65	60	56
8:00 AM	63	77	50	71	68	64	58	52
9:00 AM	63	76	50	70	68	64	58	52
10:00 AM	61	80	44	70	66	61	54	47
11:00 AM	63	79	41	71	67	63	56	45
12:00 PM	62	76	39	69	67	63	57	44
1:00 PM	64	81	41	72	68	65	60	48
2:00 PM	62	75	41	70	67	63	56	45
3:00 PM	63	78	42	71	68	65	58	46
4:00 PM	64	79	43	71	69	65	60	48
5:00 PM	66	83	46	72	69	67	64	53
6:00 PM	64	88	42	70	68	66	62	49
7:00 PM	63	75	43	70	68	64	58	46
8:00 PM	62	88	44	69	66	60	51	46
9:00 PM	60	74	39	69	65	59	49	43
10:00 PM	57	73	38	67	63	53	46	41
11:00 PM	57	75	38	68	62	49	45	41

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	63	79	44	71	68	64	57	48
High	66	88	55	72	69	67	64	56
Low	60	74	38	69	65	59	49	43

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	56	75	44	65	59	53	50	46
High	63	81	55	71	68	63	59	57
Low	51	71	38	56	52	48	45	41

Ldn:	65

BOLLARD
Acoustical Consultants

Appendix B-2
Ambient Noise Monitoring Results - Site A
Terra-Topgolf Development Project - San Jose, California
Thursday, December 17, 2015

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	52	72	42	61	52	49	47	44
1:00 AM	52	73	41	62	52	49	47	44
2:00 AM	50	72	40	59	51	48	46	43
3:00 AM	51	71	40	58	53	50	48	44
4:00 AM	56	79	45	65	57	55	53	49
5:00 AM	60	77	50	68	62	59	57	54
6:00 AM	64	80	55	72	68	63	59	57
7:00 AM	64	82	56	71	68	64	60	57
8:00 AM	64	79	52	71	69	65	60	55
9:00 AM	64	82	50	72	68	64	56	52
10:00 AM	62	79	42	71	68	62	54	47
11:00 AM	62	76	40	70	67	63	55	44
12:00 PM	64	76	41	71	68	65	59	45
1:00 PM	63	81	39	71	67	64	57	43
2:00 PM	63	80	38	71	68	65	59	43
3:00 PM	64	76	38	71	69	65	58	45
4:00 PM	65	79	41	72	69	66	61	48
5:00 PM	64	78	43	71	69	66	63	51
6:00 PM	63	80	47	70	68	65	60	50
7:00 PM	63	78	47	71	68	64	56	49
8:00 PM	62	77	48	70	67	61	54	51
9:00 PM	61	75	48	69	66	58	55	53
10:00 PM	60	81	46	69	65	57	53	49
11:00 PM	57	74	47	67	61	54	52	49

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	63	79	45	71	68	64	58	49
High	65	82	56	72	69	66	63	57
Low	61	75	38	69	66	58	54	43

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	56	75	45	65	58	54	51	48
High	64	81	55	72	68	63	59	57
Low	50	71	40	58	51	48	46	43

Ldn:	66

BOLLARD
Acoustical Consultants

Appendix B-3
Ambient Noise Monitoring Results - Site B
Terra-Topgolf Development Project - San Jose, California
Wednesday, December 16, 2015

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	51	72	39	58	54	51	49	44
1:00 AM	49	71	38	54	51	48	46	42
2:00 AM	48	61	38	54	52	49	47	44
3:00 AM	48	59	39	54	51	49	46	43
4:00 AM	51	59	42	56	54	53	51	47
5:00 AM	56	65	49	59	58	57	56	53
6:00 AM	61	76	55	70	64	59	58	56
7:00 AM	60	81	52	69	62	57	55	53
8:00 AM	60	79	47	70	62	54	52	51
9:00 AM	58	74	50	68	60	55	53	52
10:00 AM	57	75	45	67	60	53	51	48
11:00 AM	59	81	41	70	59	50	48	44
12:00 PM	55	72	39	68	57	46	43	41
1:00 PM	60	82	41	70	63	50	45	42
2:00 PM	56	73	43	68	58	50	47	44
3:00 PM	58	76	42	70	61	49	45	43
4:00 PM	56	79	43	66	56	49	47	45
5:00 PM	58	78	44	69	58	50	49	46
6:00 PM	57	75	42	67	60	51	48	45
7:00 PM	59	76	42	70	63	50	47	45
8:00 PM	57	75	43	69	59	49	48	45
9:00 PM	57	76	41	67	58	49	46	43
10:00 PM	51	72	40	60	50	47	45	42
11:00 PM	56	75	41	65	56	52	49	44

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	58	77	44	68	60	51	48	46
High	60	82	55	70	63	57	55	53
Low	55	72	38	66	56	46	43	41

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	52	68	42	59	54	52	50	46
High	61	76	55	70	64	59	58	56
Low	48	59	38	54	50	47	45	42

Ldn:	62

BOLLARD
Acoustical Consultants

Appendix B-4
Ambient Noise Monitoring Results - Site B
Terra-Topgolf Development Project - San Jose, California
Thursday, December 17, 2015

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	49	60	40	55	52	50	48	44
1:00 AM	48	58	39	54	51	49	46	43
2:00 AM	47	55	40	52	50	48	46	43
3:00 AM	50	63	40	56	53	51	49	44
4:00 AM	52	59	44	56	55	54	52	49
5:00 AM	55	59	50	57	56	56	55	53
6:00 AM	61	76	53	70	64	58	57	55
7:00 AM	61	83	54	69	62	57	56	55
8:00 AM	59	75	51	70	62	56	55	53
9:00 AM	62	82	51	72	63	55	54	52
10:00 AM	61	77	44	72	66	54	52	48
11:00 AM	72	86	40	80	77	73	68	42
12:00 PM	59	76	39	71	63	52	45	41
1:00 PM	60	82	40	70	56	46	44	42
2:00 PM	58	77	39	69	61	51	44	41
3:00 PM	60	78	39	71	63	51	44	41
4:00 PM	59	80	42	71	61	49	47	45
5:00 PM	56	75	44	68	58	49	48	46
6:00 PM	57	77	46	68	60	52	50	48
7:00 PM	60	76	47	71	65	55	53	51
8:00 PM	59	77	48	70	59	54	52	50
9:00 PM	57	77	47	68	57	54	53	51
10:00 PM	58	75	45	69	57	54	52	49
11:00 PM	56	74	46	63	57	55	54	51

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	60	78	45	71	62	54	51	47
High	72	86	54	80	77	73	68	55
Low	56	75	39	68	56	46	44	41

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	53	64	44	59	55	53	51	48
High	61	76	53	70	64	58	57	55
Low	47	55	39	52	50	48	46	43

Ldn:	64

BOLLARD
Acoustical Consultants

Appendix B-5
Ambient Noise Monitoring Results - Site C
Terra-Topgolf Development Project - San Jose, California
Wednesday, December 16, 2015

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	52	72	39	60	55	52	49	43
1:00 AM	50	75	38	56	52	48	44	41
2:00 AM	47	61	39	54	50	47	44	41
3:00 AM	48	63	40	55	52	48	45	42
4:00 AM	50	64	42	57	53	50	48	44
5:00 AM	53	68	46	58	56	54	52	49
6:00 AM	60	78	49	69	64	58	55	52
7:00 AM	60	79	51	68	62	58	56	54
8:00 AM	60	80	51	69	63	58	56	54
9:00 AM	58	73	48	67	61	56	55	52
10:00 AM	58	74	48	68	62	57	55	52
11:00 AM	60	78	48	70	61	59	57	53
12:00 PM	61	71	49	67	63	61	60	56
1:00 PM	63	78	52	70	66	63	61	58
2:00 PM	64	73	55	69	67	65	63	59
3:00 PM	61	73	53	67	63	61	59	57
4:00 PM	60	72	53	65	63	61	59	56
5:00 PM	59	75	49	67	62	59	57	54
6:00 PM	57	71	48	65	60	56	54	51
7:00 PM	59	74	47	69	63	56	54	51
8:00 PM	60	74	48	69	63	60	58	55
9:00 PM	59	72	47	66	62	60	58	54
10:00 PM	56	67	45	61	59	57	55	50
11:00 PM	56	73	42	63	58	55	53	48

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	60	74	50	68	63	59	57	54
High	64	80	55	70	67	65	63	59
Low	57	71	38	65	60	56	54	51

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	52	69	42	59	56	52	50	46
High	60	78	49	69	64	58	55	52
Low	47	61	38	54	50	47	44	41

Ldn:	62

BOLLARD
Acoustical Consultants

Appendix B-6
Ambient Noise Monitoring Results - Site C
Terra-Topgolf Development Project - San Jose, California
Thursday, December 17, 2015

Hour	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
12:00 AM	49	61	40	56	53	51	47	42
1:00 AM	48	61	39	55	52	49	45	41
2:00 AM	47	62	38	54	51	47	44	41
3:00 AM	48	61	39	56	52	48	45	41
4:00 AM	50	62	42	56	53	50	48	45
5:00 AM	54	64	45	59	57	55	52	49
6:00 AM	60	75	49	69	63	58	55	52
7:00 AM	59	74	50	66	62	58	56	54
8:00 AM	60	75	51	69	63	58	56	54
9:00 AM	62	80	50	71	65	57	56	53
10:00 AM	60	75	49	70	64	59	56	53
11:00 AM	60	73	49	65	62	60	59	55
12:00 PM	62	76	51	70	65	62	60	57
1:00 PM	64	80	53	70	66	64	62	59
2:00 PM	60	71	50	66	64	62	58	55
3:00 PM	59	75	49	70	63	57	55	53
4:00 PM	59	73	51	68	62	59	57	55
5:00 PM	57	72	51	65	60	57	55	53
6:00 PM	57	71	50	66	59	55	54	52
7:00 PM	60	73	50	69	65	58	56	53
8:00 PM	59	74	47	68	61	58	57	53
9:00 PM	57	72	46	67	59	56	54	50
10:00 PM	57	72	44	65	59	56	54	50
11:00 PM	53	68	43	62	56	53	51	47

Daytime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	60	74	50	68	63	59	57	54
High	64	80	53	71	66	64	62	59
Low	57	71	38	65	59	55	54	50

Nighttime	Leq	Lmax	Lmin	L02	L08	L25	L50	L90
Average	52	65	42	59	55	52	49	45
High	60	75	49	69	63	58	55	52
Low	47	61	38	54	51	47	44	41

Ldn:	62

BOLLARD
Acoustical Consultants

Appendix C-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2015-275 Terra-Topgolf Development Project
Description: Existing
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	N Taylor Street	Gold Street to Liberty Street	5,340	85		15	2	2	40	50	
2	N Taylor Street	Liberty Street to Trinity Park Drive	6,670	85		15	2	2	40	50	
3	N First Street	Trinity Park Drive to Nortech Pkwy	5,370	85		15	2	2	40	50	
4	N First Street	Nortech Pkwy to SR 237 WB Ramps	8,800	85		15	2	2	40	50	
5	Gold Street	North of Taylor Street	1,590	85		15	2	2	40	50	
6	Gold Street	South of Taylor Street	6,600	85		15	2	2	40	50	
7	Gold Street	North of Gold Street Connector	9,000	85		15	2	2	40	50	
8	Liberty Street	North of Taylor Street	670	85		15	2	2	40	50	
9	Liberty Street	South of Taylor Street	1,810	85		15	2	2	40	50	
10	Trinity Park Drive	North of N First Street	320	85		15	2	2	40	50	
11	Nortech Pkwy	North of N First Street	5,980	85		15	2	2	40	50	

BOLLARD
Acoustical Consultants

Appendix C-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2015-275 Terra-Topgolf Development Project
Description: Existing+Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	N Taylor Street	Gold Street to Liberty Street	6,700	85		15	2	2	40	50	
2	N Taylor Street	Liberty Street to Trinity Park Drive	8,090	85		15	2	2	40	50	
3	N First Street	Trinity Park Drive to Nortech Pkwy	10,380	85		15	2	2	40	50	
4	N First Street	Nortech Pkwy to SR 237 WB Ramps	9,310	85		15	2	2	40	50	
5	Gold Street	North of Taylor Street	1,590	85		15	2	2	40	50	
6	Gold Street	South of Taylor Street	7,960	85		15	2	2	40	50	
7	Gold Street	North of Gold Street Connector	10,300	85		15	2	2	40	50	
8	Liberty Street	North of Taylor Street	730	85		15	2	2	40	50	
9	Liberty Street	South of Taylor Street	1,810	85		15	2	2	40	50	
10	Trinity Park Drive	North of N First Street	320	85		15	2	2	40	50	
11	Nortech Pkwy	North of N First Street	10,820	85		15	2	2	40	50	

BOLLARD
Acoustical Consultants

Appendix C-3

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2015-275 Terra-Topgolf Development Project
Description: Background
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	N Taylor Street	Gold Street to Liberty Street	5,340	85		15	2	2	40	50	
2	N Taylor Street	Liberty Street to Trinity Park Drive	6,670	85		15	2	2	40	50	
3	N First Street	Trinity Park Drive to Nortech Pkwy	5,370	85		15	2	2	40	50	
4	N First Street	Nortech Pkwy to SR 237 WB Ramps	11,420	85		15	2	2	40	50	
5	Gold Street	North of Taylor Street	1,590	85		15	2	2	40	50	
6	Gold Street	South of Taylor Street	6,600	85		15	2	2	40	50	
7	Gold Street	North of Gold Street Connector	10,860	85		15	2	2	40	50	
8	Liberty Street	North of Taylor Street	670	85		15	2	2	40	50	
9	Liberty Street	South of Taylor Street	1,810	85		15	2	2	40	50	
10	Trinity Park Drive	North of N First Street	320	85		15	2	2	40	50	
11	Nortech Pkwy	North of N First Street	5,980	85		15	2	2	40	50	

BOLLARD
Acoustical Consultants

Appendix C-4

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2015-275 Terra-Topgolf Development Project
Description: Background+Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	N Taylor Street	Gold Street to Liberty Street	6,700	85		15	2	2	40	50	
2	N Taylor Street	Liberty Street to Trinity Park Drive	8,090	85		15	2	2	40	50	
3	N First Street	Trinity Park Drive to Nortech Pkwy	10,380	85		15	2	2	40	50	
4	N First Street	Nortech Pkwy to SR 237 WB Ramps	11,930	85		15	2	2	40	50	
5	Gold Street	North of Taylor Street	1,590	85		15	2	2	40	50	
6	Gold Street	South of Taylor Street	7,960	85		15	2	2	40	50	
7	Gold Street	North of Gold Street Connector	12,160	85		15	2	2	40	50	
8	Liberty Street	North of Taylor Street	730	85		15	2	2	40	50	
9	Liberty Street	South of Taylor Street	1,810	85		15	2	2	40	50	
10	Trinity Park Drive	North of N First Street	320	85		15	2	2	40	50	
11	Nortech Pkwy	North of N First Street	10,820	85		15	2	2	40	50	

BOLLARD
Acoustical Consultants

Appendix C-5

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2015-275 Terra-Topgolf Development Project
Description: Cumulative
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	N Taylor Street	Gold Street to Liberty Street	9,440	85		15	2	2	40	50	
2	N Taylor Street	Liberty Street to Trinity Park Drive	10,770	85		15	2	2	40	50	
3	N First Street	Trinity Park Drive to Nortech Pkwy	8,870	85		15	2	2	40	50	
4	N First Street	Nortech Pkwy to SR 237 WB Ramps	11,710	85		15	2	2	40	50	
5	Gold Street	North of Taylor Street	1,590	85		15	2	2	40	50	
6	Gold Street	South of Taylor Street	10,700	85		15	2	2	40	50	
7	Gold Street	North of Gold Street Connector	16,060	85		15	2	2	40	50	
8	Liberty Street	North of Taylor Street	670	85		15	2	2	40	50	
9	Liberty Street	South of Taylor Street	1,810	85		15	2	2	40	50	
10	Trinity Park Drive	North of N First Street	520	85		15	2	2	40	50	
11	Nortech Pkwy	North of N First Street	9,480	85		15	2	2	40	50	

BOLLARD
Acoustical Consultants

Appendix C-6

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2015-275 Terra-Topgolf Development Project
Description: Cumulative+Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	N Taylor Street	Gold Street to Liberty Street	10,800	85		15	2	2	40	50	
2	N Taylor Street	Liberty Street to Trinity Park Drive	12,190	85		15	2	2	40	50	
3	N First Street	Trinity Park Drive to Nortech Pkwy	13,880	85		15	2	2	40	50	
4	N First Street	Nortech Pkwy to SR 237 WB Ramps	12,220	85		15	2	2	40	50	
5	Gold Street	North of Taylor Street	1,590	85		15	2	2	40	50	
6	Gold Street	South of Taylor Street	12,060	85		15	2	2	40	50	
7	Gold Street	North of Gold Street Connector	17,360	85		15	2	2	40	50	
8	Liberty Street	North of Taylor Street	730	85		15	2	2	40	50	
9	Liberty Street	South of Taylor Street	1,810	85		15	2	2	40	50	
10	Trinity Park Drive	North of N First Street	520	85		15	2	2	40	50	
11	Nortech Pkwy	North of N First Street	14,320	85		15	2	2	40	50	

BOLLARD
Acoustical Consultants

Appendix D-1
Noise Level Calculations - Impact 3: Parking Lot Noise
Terra-Topgolf Development Project

Reference Noise Level Data for Parking Lots		
Source Reference	**Reference Noise Level (dBA Lmax)**	**Reference Distance (feet)**
Parking Lot	65	50

Predicted Noise Levels at the Nearest Noise-Sensitive Receivers				
Nearest Parking Lot to Receiver	**Distance to Source (feet)**	**Distance Attenuation (dBA)**	**Shielding Offset (dBA)**	**Resulting Noise Level (dBA Lmax)**
Lower Level to Area 1	150	-10	-10	45
Ground Level to Area 1	250	-14	-5	46
Ground Level to Area 2	500	-20	0	45
Ground Level to Area 3	1700	-31	-15	19
Ground Level to Area 4*	325	-16	-15	14
Ground Level to Area 5	850	-25	-15	25
Sample Calculation (Lower Level to Area 1)	150	-20*LOG(150/50)=-10	-10	65+(-10)+(-10)=45

Notes

* Interior spaces of library and school classrooms were conservatively estimated to be 20 dB lower than exterior noise levels due to noise reduction provided by the library and school buildings (additional -20 dB offset applied).

BOLLARD
Acoustical Consultants

Appendix D-2
Noise Level Calculations - Impact 4: Mechanical Equipment Noise (HVAC)
Terra-Topgolf Development Project

Reference Noise Level Data for HVAC		
Source Reference	Reference Noise Level (dBA Leq/Lmax)	Reference Distance (feet)
HVAC	50	100

Predicted Noise Levels at the Nearest Noise-Sensitive Receiver					
Nearest Receiver	Distance to Lease Area (feet)	Distance Attenuation (dBA)	Resulting Noise Level (dBA Leq/Lmax)	Hours of Operation	Resulting Noise Level (dBA Ldn)
Area 1	150	-4	46	16	50
Area 2	600	-16	34	16	38
Area 3*	1800	-25	25	16	28
Area 4**	200	-6	24	16	27
Area 5	200	-6	44	16	47
Sample Calc (Area 1)	150	-20*LOG(150/100)=-4	45+(-4)=41	16	10*LOG((15*(10^(41/10)) +9*(10^((41+10)/10)))/24) =48

Notes
* Offset due to shielding from the existing wall was not applied to provide a conservative estimate
** Interior spaces of library and school classrooms were conservatively estimated to be 20 dB lower than exterior noise levels due to noise reduction provided by the library and school buildings (additional -20 dB offset applied).

BOLLARD
Acoustical Consultants

Appendix D-3
Noise Level Calculations - Impact 5: Topgolf Outdoor Entertainment Facility Noise
Terra-Topgolf Development Project

Reference Noise Level Data for a Topgolf Facility				
Nearest Receiver	Reference Topgolf Gilbert Monitoring Location	Topgolf Gilbert Noise Level (dBA Leq)	Topgolf Gilbert Noise Level (dBA Lmax)	Reference Distance (feet)
Area 1	I	56	64	190
Area 2	K	56	64	200
Area 3	A	61	68	370
Area 4	L	54	67	180
Area 5	I	56	64	190

Predicted Noise Levels at the Nearest Noise-Sensitive Receiver							
Nearest Area	Distance to proposed Topgolf (feet)	Distance Attentuation (dBA)	Offset due to Barrier/Interior (dBA)	Resulting Noise Level (dBA Leq)	Resulting Noise Level (dBA Lmax)	Hours of Operation (9AM - 2AM)	Resulting Noise Level (dBA Ldn)
1	700	-11		45	53	16	48
2	580	-9		47	55	16	50
3	1900	-14	-10	37	44	16	40
4*	400	-7	-20	27	40	16	30
5	1700	-19		37	45	16	40
Sample Calculation (Area 3)		-20*LOG(1900/370) =-14	-10	61+(-14)+(-10) =37	68+(-14)+(-10) =44		10*LOG((12*(10^(37/10)) +4*(10^((37+10)/10)))/24) =40

Notes

* Interior spaces of library and school classrooms were conservatively estimated to be 20 dB lower than exterior noise levels due to noise reduction provided by the library and school buildings (additional -20 dB offset applied).

BOLLARD
Acoustical Consultants

Appendix D-4
Noise Level Calculations - Combined Noise Sources
Terra-Topgolf Development Project

Predicted Noise Levels at the Nearest Noise-Sensitive Receivers												
Nearest Receiver	**Parking Lot Activities**			**HVAC Equipment[1]**			**Topgolf Facility**			**Combined**		
	Leq	**Lmax**	**Ldn**	**Leq**	**Lmax**	**Ldn**	**Leq**	**Lmax**	**Ldn**	**Leq**	**Lmax**	**Ldn**
Area 1	41	46	44	46	46	50	45	53	48	49	54	53
Area 2	40	45	43	34	34	38	47	55	50	48	55	51
Area 3	14	19	17	25	25	28	37	44	40	37	44	40
Area 4	9	14	12	24	24	27	27	40	30	29	40	32
Area 5	20	25	23	44	44	47	37	45	40	45	48	48

		Combined	
	Leq	**Lmax**	**Ldn**
Sample Calculation (Area 1)	10*LOG(10^(41/10) +10^(46/10)+10^(45/10)) =49	10*LOG(10^(46/10) +10^(46/10)+10^(53/10)) =54	10*LOG(10^(44/10) +10^(50/10)+10^(48/10)) =53

Notes

1 Because the vacuums were assumed to be in continuous operation for a full hour, hourly average (Leq) and maximum (Lmax) noise levels would be equivalent.

BOLLARD
Acoustical Consultants

Attachment D

Example of Successful Congdon's Tarplant Mitigation

H. T. HARVEY & ASSOCIATES

Ecological Consultants

Wrigley Creek Improvement Project
Milpitas, California
Year 5 (2015) Monitoring Report

Project #2995-04

Prepared for:

Ann Calnan, Manager
Environmental Programs and Resources Management
Santa Clara Valley Transportation Authority
3331 North First St., Bldg. B-2
San Jose, CA 95134

Prepared by:

H. T. Harvey & Associates

September 2015

983 University Avenue, Building D • Los Gatos, CA 95032 • Ph: 408.458.3200 • F: 408.458.3210

Executive Summary

Permit Numbers

The following permits apply to the Wrigley Creek Improvement Project:

- U. S. Army Corps of Engineers Section 404 Permit File No. 26644S
- California Department of Fish & Game Streambed Alteration Notification No.1600-2008-0266-3
- Regional Water Quality Control Board Site No. 02-43-C0589

Background

The Santa Clara Valley Transportation Authority's (VTA) Freight Railroad Relocation/Lower Berryessa Creek (FRR/LBC) project is located within the Union Pacific Railroad (UPRR) corridor from the UPRR Milpitas yard, just south of Calaveras Boulevard in Milpitas, to an unnamed creek in Fremont (designated as Line B by the Alameda County Flood Control and Water Conservation District). The project includes track relocation and construction, modifications to roadway crossings, drainage improvements, and culvert replacement and/or extension where the rail line crosses Line B, Scott Creek, Calera Creek, Berryessa Creek, and Wrigley Creek. The project's Mitigation and Monitoring Plan (MMP) describes FRR/LBC project related impacts, which include 0.48 acre (ac) of permanent impacts to wetlands, 288 linear feet (ln ft) of permanent impacts to other State and Federal waters, and permanent removal of approximately 100 Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*) individuals (ICF Jones & Stokes 2009). All FRR/LBC impacts are mitigated within the Wrigley Creek Improvement Project site, which was completed in February 2011 and included the installation of a total of 1.04 ac of seasonal floodplain wetlands, 1.96 ac of riparian woodland habitat, 1985 ln ft of channel (including channel meanders and backwater alcoves) and seeding of 0.23 ac with Congdon's tarplant (H. T. Harvey & Associates 2011).

The MMP includes native grassland percent cover performance criteria and a final success criterion, although the project did not impact native grassland habitat. Following Year 1 (2011) monitoring, a memorandum was produced that describes changes to the original native grassland percent cover success criterion (H. T. Harvey & Associates 2012a). Specifically, it broadens the interpretation of native grasses to include all native grasses and forbs both naturally recruiting as well as those species included in the original native seed mix installed at the site. Prior to Year 5 monitoring, H. T. Harvey & Associates and VTA met with representatives from CDFW at the site on 29 April 2015 to further discuss the native grassland percent cover success criterion. Following this meeting, the locations of some of the grassland monitoring transects were modified to better represent the current distribution of herbaceous vegetation cover at the site because of the maturation of planted and naturally recruited native woody vegetation (H. T. Harvey & Associates 2015).

Results

The table below presents the Year 5 (2015) monitoring results relative to the project's Year 5 final success criteria. The survival rate of woody plants in good or fair condition was 73%, exceeding the 70% criterion. The site had 44.6% cover of native grassland species, which is above the Year 5 cover criterion of 35% cover. The percent cover of native grassland species on the site is substantially higher than is typically found in local grassland habitats.

The final success criterion for Congdon's tarplant was met in Year 3. Nonetheless, Congdon's tarplant monitoring was conducted in Years 4 and 5 to provide additional information on population dynamics at the site. Two Hundred and Fifty Five (255) Congdon's tarplant individuals were tallied in Year 5, exceeding the minimum 100 individuals. Greater than 100 Congdon's tarplant individuals have been observed in 4 of the 5 monitoring years meeting the MMP's final success criterion of a minimum of 100 individuals in at least 2 of the 5 monitoring years. Hydrologic and geomorphic observations indicate the constructed channel and floodplain are stable. These results indicate that the site has met all of its long-term success criteria.

The project hydrologist estimated that floodplain surface soils were continuously inundated or saturated for at least 40 days between 29 November 2014 and 3 January 2015. This exceeds the minimum requirement of 31 days of continuous inundation or saturation. Due to drought conditions and the flashy hydrology of the drainage, the project hydrologist had few opportunities to observe flow on the floodplain and was not able to make flow measurements in Year 5. However, water level/depth observations from Year 5 continue to support prior observations of backwatering of the channel. It appears that the source of this backwatering is flow modification caused by normal operations of the City of Milpitas Wrigley-Ford Creek pump station located approximately 4500 feet downstream of the project site. During storm events, water likely accumulates within the channel until the station pumps flows into Berryessa Creek. Regardless of this backwatering, the mitigation project is establishing well and sedimentation rates on the floodplain are minimal.

Wrigley Creek Improvement Project Habitat Mitigation Performance and Success Criteria Summary

Indicator	Year 5 Success Criteria	Year 1 Success Criteria Met?	Year 2 Success Criteria Met?	Year 3 Success Criteria Met?	Year 4 Success Criteria Met?	Year 5 Success Criteria Met?	Management Recommendations
Woody Plant Percent Survival	70% in good or fair condition	Yes (97% survival in good or fair condition)	Yes (92% survival in good or fair condition)	Yes (84% survival in good or fair condition)	Yes (81% survival in good or fair condition)	Yes (73% survival in good or fair condition)	None-Final Success Criterion met
Native Grass Average Percent Cover	35% cover of native herbaceous species	No (35% cover of native herbaceous species)	No (21.5% cover of native herbaceous species)	No (16.1% cover of native herbaceous species)	No (23.2% cover of native herbaceous species)	Yes (44.6% cover of native herbaceous species)	None-Final Success Criterion met
Congdon's Tarplant Survival	Final Success Criterion ≥ 100 individuals in ≥2 monitoring years	Yes (5600 individuals)	No (6 individuals)	Yes (150-250 individuals)	Yes (105 individuals)	Yes (255 individuals)	None-Final Success Criterion met
Hydrology and Geomorphology	Stable channel; continuous floodplain soil saturation for 12.5% of growing season (31 days)	Yes (stable channel; at least 31 days continuous saturation)	Yes (stable channel; 39 days continuous saturation)	Yes (stable channel; 81 days continuous saturation)	Yes (stable channel; 68 days continuous saturation)	Yes (stable channel, 40 days continuous saturation)	None-Final Success Criterion met

Management Recommendations

The site has met all of its final success criteria. Upon agency approval that the success criteria have been met and that maintenance may cease, we recommend that the above ground elements of the irrigation system be removed and any below ground elements be cut and capped. We have no further vegetation maintenance recommendations for the Wrigley Creek Improvement Project.

Agency Actions

The VTA requests sign-off from the U. S. Army Corps of Engineers, California Department of Fish and Wildlife, and Regional Water Quality Control Board that the project's final success criteria have been met and that maintenance, monitoring, and reporting may cease.

Table of Contents

Section 1.0 Introduction 1
1.1 Permit Numbers 1
1.2 Overview 1

Section 2.0 Methods 3
2.1 Vegetation Maintenance Monitoring 3
2.2 Woody Plant Survival 3
2.3 Percent Cover of Native Grassland Species 3
2.4 Congdon's Tarplant Survival 4
2.5 Woody Plant Health and Vigor 4
2.6 Natural Recruitment 8
2.7 Hydrology and Geomorphology 8
2.8 Photo-documentation 8

Section 3.0 Results and Discussion 9
3.1 Vegetation Maintenance Monitoring 9
3.2 Woody Plant Survival 9
3.3 Percent Cover of Native Grassland Species 10
3.4 Congdon's Tarplant Survival 15
3.5 Woody Plant Health and Vigor 15
3.6 Natural Recruitment 16
3.7 Hydrology and Geomorphology 16
3.8 Photo-documentation 17
3.9 Trail Construction Effects on the Mitigation Site 17
Conclusion 18
Management Recommendations 18
Agency Actions 18

Section 4.0 References 19
4.1 Literature Cited 19
4.2 Personal Communications 20

Figures

Figure 1. Site Vicinity Map 2
Figure 2-1. Site Map 6
Figure 2-2. Site Map 7
Figure 3. Mean Percent Cover of Native Grassland Species Compared to Success Criterion 14

Tables

Table 1. Plant Health and Vigor Categories 5
Table 2. Percent Survival of Planted Woody Species in Good or Fair Condition 9
Table 3. Comparison of Woody Plant Survival to the Success Criteria 10
Table 4. Average Percent Cover of Herbaceous Vegetation 10
Table 5. Comparison of Percent Cover of Native Grassland Species to the Success Criterion 14
Table 6. Comparison of Congdon's Tarplant Survival to the Success Criteria 15
Table 7. Mean Woody Plant Health and Vigor Ratings 15
Table 8. Percentage of Planted Tree and Shrub Individuals within Each Health and Vigor Category 16
Table 9. Trail Construction Replanting Palette 17

Appendices

Appendix A. Hydrology and Geomorphology Monitoring Memorandum A-1
Appendix B. Photo-documentation.....B-**Error! Bookmark not defined.**

List of Preparers

Daniel Stephens, B.S., Principal Restoration Ecologist

Max Busnardo, M.S., Senior Restoration Ecologist

Matt Quinn, M.S., Associate Restoration Ecologist

Will Spangler, B.A., Restoration Ecologist

Kaitlin Schott, M.S., Restoration Ecologist

Patrick Furtado, M.S., Restoration Ecologist

Section 1.0 Introduction

1.1 Permit Numbers

The following permits apply to the Wrigley Creek Improvement Project:

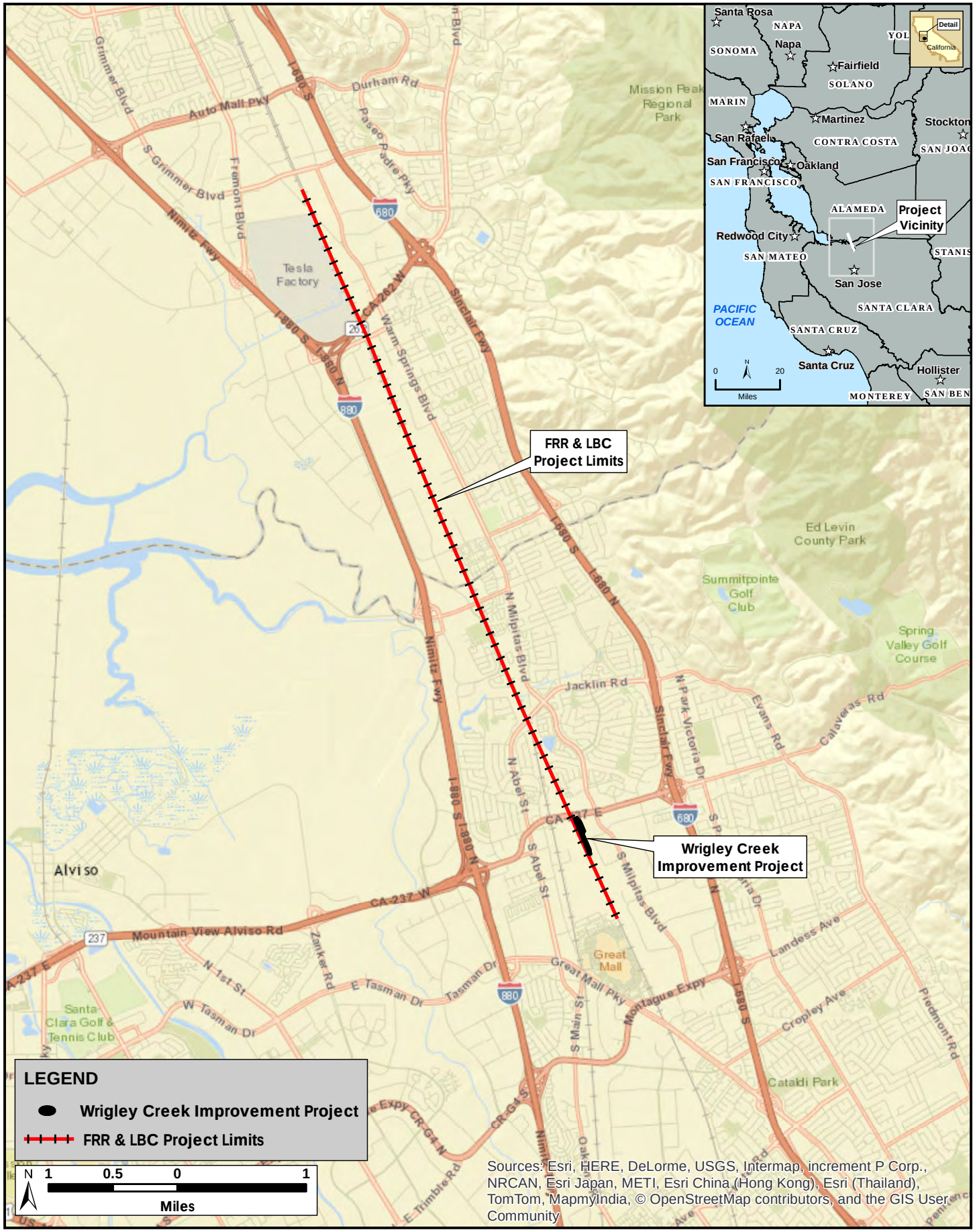
- U. S. Army Corps of Engineers Section 404 Permit File No. 26644S
- California Department of Fish & Game Streambed Alteration Notification No.1600-2008-0266-3
- Regional Water Quality Control Board Site No. 02-43-C0589

1.2 Overview

The Santa Clara Valley Transportation Authority's (VTA) Freight Railroad Relocation/Lower Berryessa Creek Project (FRR/LBC) is located within the Union Pacific Railroad (UPRR) corridor from the UPRR Milpitas yard, just south of Calaveras Boulevard in Milpitas, to an unnamed creek in Fremont (designated as Line B by the Alameda County Flood Control and Water Conservation District) (Figure 1). The project includes track relocation and construction, modifications to roadway crossings, drainage improvements, and culvert replacement and/or extension where the rail line crosses Line B, Scott Creek, Calera Creek, Berryessa Creek, and Wrigley Creek. The FRR/LBC project resulted in 0.48 acre (ac) of permanent impacts to wetlands, 288 linear feet (ln ft) of permanent impacts to other State and Federal waters, and permanent removal of approximately 100 Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*) individuals (ICF Jones & Stokes 2009).

All FRR/LBC impacts are mitigated within the Wrigley Creek Improvement Project (mitigation project) in accordance with the project's regulatory agency permits and associated Mitigation and Monitoring Plan (MMP) (ICF Jones & Stokes 2009). The Wrigley Creek Improvement Project site is located within the larger FRR/LBC project area, on a reach of Wrigley Creek between Yosemite Drive and Calaveras Boulevard in Milpitas, California (Figure 1). Construction of the Wrigley Creek Improvement Project began in August 2010 and was completed in February 2011. The mitigation project included the construction of 1.04 ac of seasonal floodplain wetlands, 1.96 ac of riparian woodland habitat, 1985 ln ft of channel (including channel meanders and backwater alcoves), and seeding of 0.23 ac with Congdon's tarplant. The project meets the habitat mitigation requirements in the regulatory agency permits and includes an additional 60 ln ft of channel restoration and 0.04 ac of floodplain wetland habitat (H. T. Harvey & Associates 2011).

The MMP includes quantifiable performance and final success criteria and calls for a minimum 5-year monitoring period (Years 1-5). Results of quantitative annual monitoring of the mitigation site are used to determine if the project has met the MMP's performance and final success criteria. This report presents the results of Year 5 monitoring. These results are compared to the MMP's final success criteria to determine whether the restored riparian ecosystem is likely to eventually achieve the long-term habitat mitigation goals with little chance of failure.



N:\Projects\2995-02\04

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 1: Vicinity Map

Wrigley Creek Improvement Project (2995-04)
September 2015

Section 2.0 Methods

H. T. Harvey & Associates' restoration ecologists Will Spangler, B.A., Kaitlin Schott, M.S., and Patrick Furtado, M.S., conducted vegetation surveys at the Wrigley Creek mitigation site on 6 May 2015 and 2 July 2015. Vegetation surveys were conducted in accordance with the methods outlined in the MMP (ICF Jones & Stokes 2009). Vegetation characteristics measured in the field included woody plant survival, percent cover of native grassland species, Congdon's tarplant abundance, woody plant health and vigor, and woody plant natural recruitment. In addition, vegetation maintenance observations were noted and photographs were taken from fixed locations to document habitat establishment. The following is a description of the methods employed during these field surveys and the methods used to analyze the data. The methods employed by Balance Hydrologics, Inc. to assess on-site hydrology and geomorphology and detailed results of their assessment are provided in Appendix A. The VTA's landscape contractor, Confluence, performed vegetation maintenance activities in 2015.

2.1 Vegetation Maintenance Monitoring

The VTA's landscape contractor (Confluence Restoration) performed vegetation maintenance activities in 2015. H. T. Harvey & Associates restoration ecologists conducted two site visits in 2015 to inspect vegetation maintenance work and also reviewed Confluence Restoration's maintenance logs. A summary of vegetation maintenance work is provided in the below results section.

2.2 Woody Plant Survival

Plant survivorship was determined on 2 July 2015 by counting 100% of the installed woody plants. The total number of living and dead individuals of each planted species was counted in the field. The percent survival of individuals in good or fair condition was calculated and the percent survival for each species was calculated as follows:

Percent Survival Species A = (Total Number Alive in Good or Fair Condition in 2014/Total Number Required per the MMP) * 100

The success criterion for woody plant survival in Year 5 is 70% in good or fair condition. The methods for assessing the condition of the woody plantings are described in the Plant Health and Vigor section below.

2.3 Percent Cover of Native Grassland Species

Native grassland species percent cover was estimated on 6 May 2015 by conducting a survey along nine transects (ICF Jones & Stokes 2009; H. T. Harvey & Associates 2012a). During the course of the 5 year monitoring period, the increasing shade cast by maturing native woody vegetation altered the distribution of

herbaceous vegetation. Therefore, prior to Year 5 monitoring, the locations of eight of the grassland monitoring transects were modified to better represent the current distribution of herbaceous vegetation cover at the site (H. T. Harvey & Associates 2015). One transect was located in the Congdon's Tarplant Mitigation Area and eight transects were located throughout the Floodplain Planting Zone, Streamside Planting Zone, and the Upland Planting Zone (Figures 2-1 & 2-2). Each transect is 100 feet in length and endpoints of each transect were mapped using GPS. Percent cover of herbaceous species was estimated using the quadrat method (Bonham 1989). Cover data were collected in five randomly located 1 m^2 quadrats along each of the nine transects. Within each quadrat, all species were identified and percent cover was estimated to the nearest 1 percent. Plant species were identified in accordance with the Jepson Manual (Baldwin et al. 2012). Average percent cover was calculated for each species, native species, nonnative species, and total average cover of all species. Sample size was determined adequate (H. T. Harvey & Associates 2012b) by graphing the cumulative average percent native grass cover as a function of sample size to determine whether the variability in average cover declined to an acceptable level (Elzinga et al. 1998).

The average percent cover of native grasses and forbs in 2015 was compared to results from previous years and the Year 5 performance criterion of 35% cover (ICF Jones & Stokes 2009).

2.4 Congdon's Tarplant Survival

The abundance of Congdon's tarplant was determined by surveying the entire site and counting each live individual encountered. The survey was conducted on 2 July 2015 during the flowering period for this species. The performance criterion for survival of Congdon's tarplant is a minimum of 100 individuals in 2 of 5 years (ICF Jones & Stokes 2009).

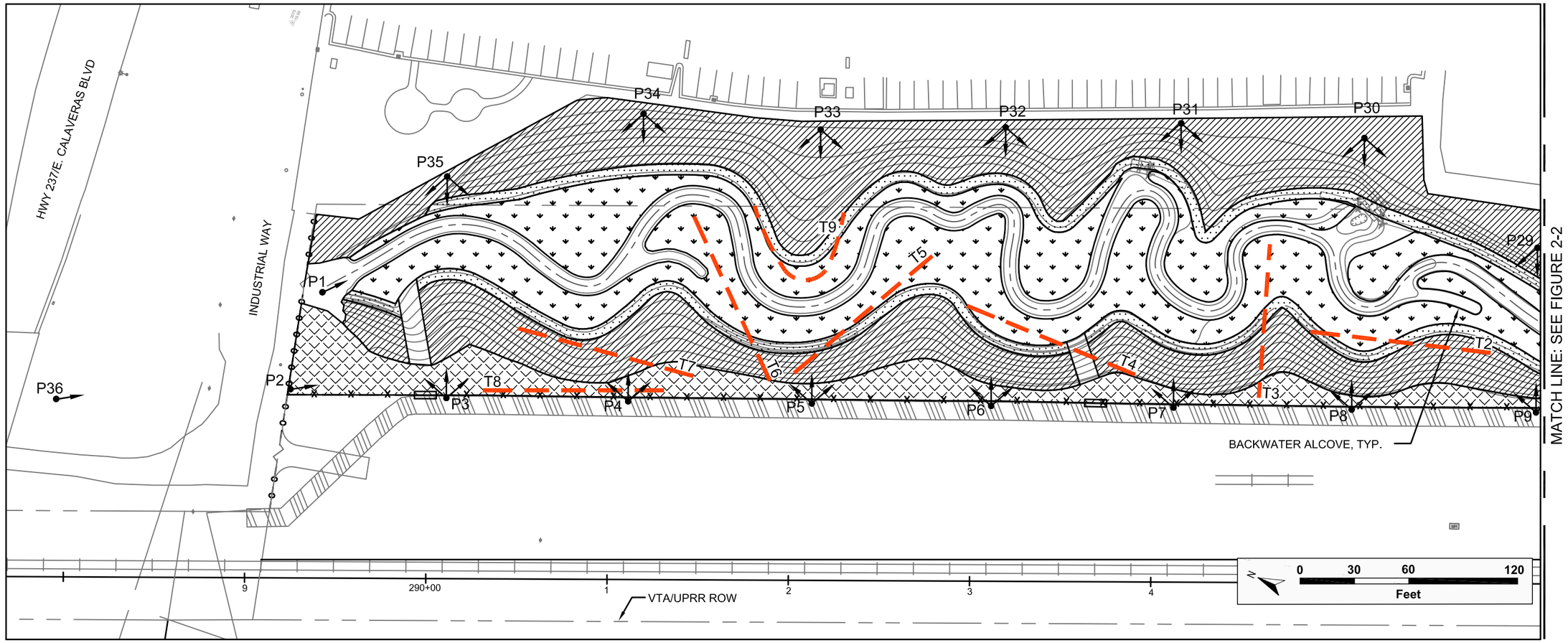
2.5 Woody Plant Health and Vigor

The health and vigor of all of the woody plantings was assessed on 2 July 2015 by considering such factors as internode length, leaf color, leaf size, presence of browse damage, disease symptoms, and insect infestation. Numerical health and vigor ratings were assigned to each woody planting as described in Table 1.

Mean health and vigor ratings were calculated for each planted woody species by dividing the total health and vigor points by the number of living individuals of that species sampled. The percentage of individuals who fall into the three general health and vigor categories was calculated by dividing the number of individuals within each category by the total number of living individuals.

Table 1. Plant Health and Vigor Categories

Categories	Numerical Values	Observations
Good Condition	1	Plant has relatively long internode lengths and most or all leaves show healthy color and size, and/or <25% of plant's aboveground growth is affected by browse damage, disease, or insect infestation.
Fair Condition	2	Plant has medium to long internode lengths and most leaves show healthy color and size, and/or 25-50% of plant's aboveground growth is affected by browse damage, disease, or insect infestation.
Poor Condition	3	Plant has short internode lengths and few or some leaves show healthy color and size, and/or >75% of plant's aboveground growth is affected by browse damage, disease, or insect infestation.



Legend

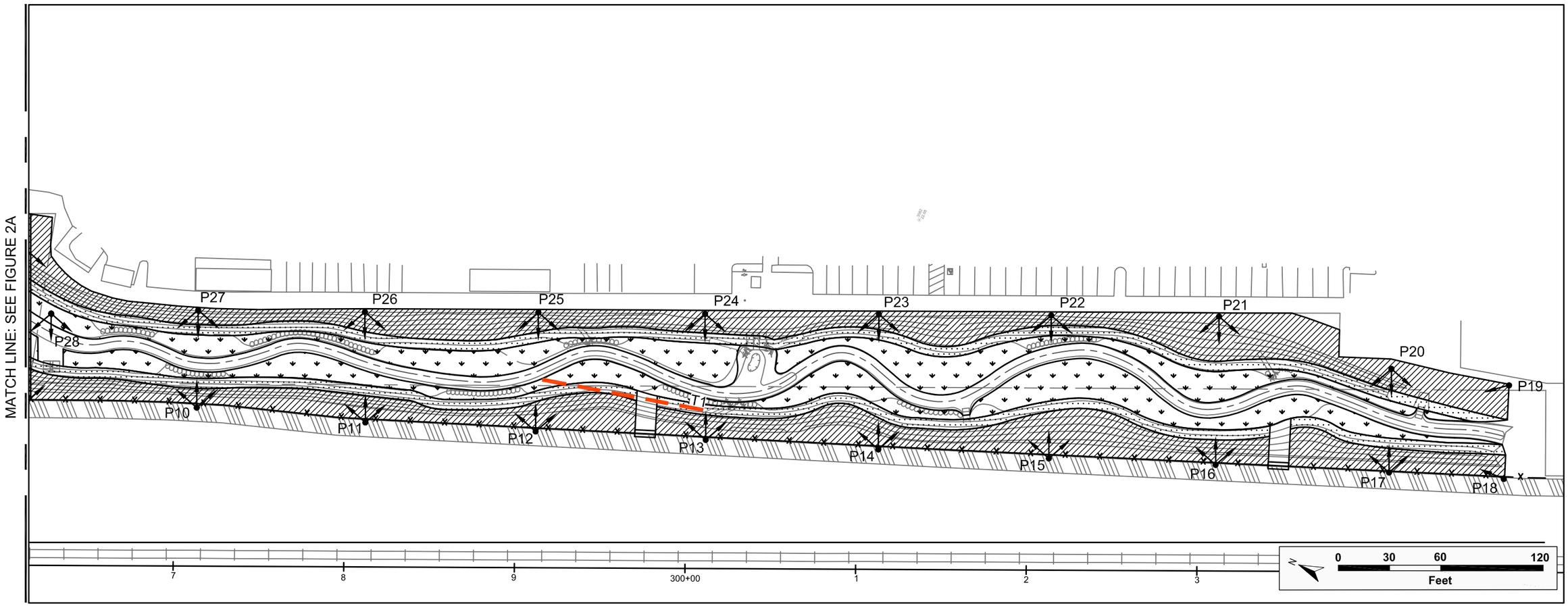
- FLOODPLAIN PLANTING ZONE
- STREAMSIDE PLANTING ZONE
- UPLAND PLANTING ZONE
- CONGDON'S TARPLANT MITIGATION AREA
- CHEVRON PIPELINE PROTECTION ZONE (NO PLANTING)
- BIOENGINEERED OUTFALL STRUCTURE
- P1 PHOTO DOCUMENTATION POINT
- SPLIT RAIL FENCE
- SPLIT RAIL GATE
- CHAIN LINK FENCE
- CHANNEL CENTERLINE
- T1 TRANSECT LOCATION

G:\Active Projects\2995, VTA on call\04, Wrigley Crk As-built & L-t Mon\Graphics\Report Figures\Year-5\CAD Files

H.T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 2-1: Site Map

Wrigley Creek Improvement Project (2995-04)
September 2015



Legend

- FLOODPLAIN PLANTING ZONE
- STREAMSIDE PLANTING ZONE
- UPLAND PLANTING ZONE
- CONGDON'S TARPLANT MITIGATION AREA
- CHEVRON PIPELINE PROTECTION ZONE (NO PLANTING)
- BIOENGINEERED OUTFALL STRUCTURE
- P1 PHOTO DOCUMENTATION POINT
- SPLIT RAIL FENCE
- SPLIT RAIL GATE
- CHAIN LINK FENCE
- CHANNEL CENTERLINE
- T1 TRANSECT LOCATION

G:\Active Projects\2995, VTA on call\04, Wrigley Crk As-built & L-t Mon\Graphics\Report Figures\Year-5\CAD Files

H.T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 2-2: Site Map

Wrigley Creek Improvement Project (2995-04)
September 2015

2.6 Natural Recruitment

The number of stems of naturally recruiting native and nonnative woody plant species within 5 feet on each side of the nine native grassland cover monitoring transects was recorded on 6 May 2015. Recruitment densities were compared between each monitoring year.

2.7 Hydrology and Geomorphology

The project hydrologist (Balance Hydrologics Inc.) conducted hydrology and geomorphology monitoring. Monitoring included visual observations of stormflows and geomorphic stability, floodplain sedimentation using sedimentation plates, floodplain soil moisture monitoring using water level data loggers and graduated staff plates, and photo-documentation. A more detailed description of monitoring methods is presented in the Year 5 (water year 2015) Hydrologic and Geomorphic Monitoring Letter Report by Balance Hydrologics, Inc. (Appendix A).

2.8 Photo-documentation

Photographs of the mitigation site were taken at 36 fixed photo-documentation points on 2 July 2015. These photo-documentation point locations are indicated on Figures 2-1 and 2-2. Photographs from additional locations were also taken to document general site conditions.

Section 3.0 Results and Discussion

3.1 Vegetation Maintenance Monitoring

Confluence Restoration conducted regular weed control activities throughout 2015 including targeted mowing and hand weeding of planting basins. Woody plantings, with the exception of willows, were irrigated starting in July 2015.

3.2 Woody Plant Survival

The overall survival rate of woody riparian plantings in good or fair condition decreased from 81% in Year 4 to 73% in Year 5 (Table 2). Percent survival ranged from 47% for blue elderberry (*Sambucus nigra* ssp. *caerulea*) to 109% for coyote brush (*Baccharis pilularis*).

Table 2. Percent Survival of Planted Woody Species in Good or Fair Condition

Scientific Name	Common Name	No. of Plants Specified in MMP Planting Plan	% Survival				
			Year 1	Year 2	Year 3	Year 4	Year 5
Acer negundo	box elder	176	101%	97%	92%	88%	55%
Baccharis pilularis	coyote brush	129	97%	105%	104%	102%	109%
Quercus agrifolia	coast live oak	89	89%	83%	82%	76%	81%
Rosa californica	California rose	343	96%	91%	85%	80%	79%
Salix laevigata	red willow	154	104%	95%	90%	94%	79%
Salix lasiolepis	arroyo willow	254	101%	98%	87%	86%	74%
Sambucus nigra ssp. *caerulea*	blue elderberry	206	88%	78%	54%	50%	47%
	Total[1]	**1351**	**97%**	**92%**	**84%**	**81%**	**73%**

[1] The total average cover values vary slightly from the sum of average cover values across species due to rounding assumptions.
Note: Percent survival is occasionally greater than 100% or increases between years because either additional plants were installed in excess of the number required by the MMP, or individuals that were dead aboveground resprouted in subsequent years.

The 73% survival rate in Year 5 exceeds the success criterion of 70% (Table 3).

Table 3. Comparison of Woody Plant Survival to the Success Criteria

Year	MMP Success Criterion	Results
1	90% survival in good or fair condition	97% in good or fair condition
2	80% survival in good or fair condition	92% in good or fair condition
3	75% survival in good or fair condition	84% in good or fair condition
4	70% survival in good or fair condition	81% in good or fair condition
5	70% survival in good or fair condition	73% in good or fair condition

3.3 Percent Cover of Native Grassland Species

Following Year 1 (2011) monitoring, a memorandum was produced that describes changes to the MMP's native grassland percent cover success criterion based upon guidance from the California Department of Fish and Wildlife (CDFW) and Regional Water Quality Control Board (RWQCB) staff (H. T. Harvey & Associates 2012a). It broadens the interpretation of native grasses to include all native grasses and forbs both naturally recruiting, as well as those species included in the original native seed mix installed at the site. Therefore, we calculated the average percent cover of native grassland species, including all native grasses and forbs, and compared this metric to the MMP final success criterion of 35% cover.

The average percent cover of native grassland species increased from 23.2 % in 2014 to 44.6% in 2015 (Table 4). The increased percent cover from 2014 to 2015 was due primarily to substantial increases in the percent cover of meadow barley (*Hordeum brachyantherum*) and purple needlegrass (*Stipa pulchra*). The most abundant native species were meadow barley (25.1%), purple needlegrass (11.5%), and blue eyed grass (*Sisyrinchium bellum*) (1.9%). All three species were included in the original native seed mix installed at the mitigation site (H. T. Harvey & Associates 2011).

Table 4. Average Percent Cover of Herbaceous Vegetation

Native/Nonnative Status	Scientific Name	Common Name	Average % Cover				
			Year 1	Year 2	Year 3	Year 4	Year 5
Native	*Achillea millefolium*[1]	yarrow	1.6	8.3	5.9	3.8	<0.1
	*Artemisia douglasiana**	mugwort	0.2	1.5	1.6	2.7	1.1
	Bolboschoenus robustus	sturdy bulrush	0.0	0.1	1.1	0.5	0.3

Native/Nonnative Status	Scientific Name	Common Name	Average % Cover				
			Year 1	Year 2	Year 3	Year 4	Year 5
	Centromadia parryi ssp. *congdonii*[1]	Congdon's tarplant	17.0	<0.1	1.1	0.0	0.2
	Cressa truxillensis	spreading alkaliweed	0.3	0.1	0.0	0.2	0.3
	Cyperus eragrostis	tall flatsedge	0.2	0.1	0.1	<0.1	0.5
	Distichlis spicata	saltgrass	0.0	0.5	<0.1	0.1	0.0
	Eleocharis macrostachya	common spikerush	0.0	0.0	0.8	0.0	1.6
	Elymus triticoides[1]	beardless wildrye	0.0	0.3	0.0	0.0	0.5
	Eschscholzia californica[1]	California poppy	0.1	<0.1	0.1	0.2	0.0
	Festuca microstachys[1]	small fescue	0.5	1.4	0.0	<0.1	0.0
	Hordeum brachyantherum[1]	meadow barley	14.8	7.0	0.4	10.9	25.1
	Lythrum californicum	California loosestrife	0.4	0.3	0.4	<0.1	0.1
	Malvella leprosa	alkali mallow	0.0	0.0	0.0	0.0	0.5
	Persicaria amphibia	water smartweed	0.0	0.0	0.4	0.2	0.4
	Sisyrinchium bellum[1]	blue eyed grass	0.0	0.0	0.0	0.0	1.9
	Stipa pulchra[1]	purple needle grass	0.0	0.4	0.2	0.8	11.5
	Typha latifolia	broadleaf cattail	0.0	<0.1	0.7	1.5	0.3
	Symphyotrichum subulatum	eastern annual saltmarsh aster	0.0	1.4	3.3	1.5	0.2
Nonnative	*Anagallis arvensis*	scarlet pimpernel	0.0	0.0	0.0	0.0	0.2
	Atriplex prostrata	fat-hen	11.6	2.9	1.1	0.8	0.1

Native/Nonnative Status	Scientific Name	Common Name	Average % Cover				
			Year 1	Year 2	Year 3	Year 4	Year 5
	Avena fatua	common wild oats	0.3	1.0	3.1	5.5	4.1
	Beta vulgaris	common beet	4.1	<0.1	0.2	0.3	1.2
	Bromus diandrus	ripgut brome	0.0	0.0	0.0	0.1	0.1
	Crypsis schoenoides	swamp grass	0.1	0.0	0.0	0.0	0.0
	Dittrichia graveolens	stinkwort	0.6	0.0	0.0	0.0	0.0
	Echinochloa crus-galli	barnyard grass	0.8	0.2	0.0	0.1	0.0
	Festuca myuros	six weeks grass	0.0	0.0	0.0	0.0	<0.1
	Festuca perennis	Italian rye grass	14.3	22.9	26.4	8.5	16.9
	Foeniculum vulgare	sweet fennel	0.0	<0.1	0.1	0.0	0.3
	Geranium dissectum	cutleaf geranium	0.0	0.0	0.0	0.0	2.8
	Helminthotheca echioides	bristly ox-tongue	2.1	1.6	2.7	3.5	0.3
	Hordeum sp.[3]	barley	0.0	0.0	12.3	<0.1	0.0
	Hordeum marinum	seaside barley	0.0	0.0	0.0	0.0	<0.1
	Hordeum murinum	foxtail barley	0.0	0.0	0.0	0.0	0.6
	Lactuca serriola	prickly lettuce	0.2	0.9	0.8	8.2	2.3
	Ludwigia peploides ssp. *peploides*	floating water primrose	0.0	7.8	6.9	7.4	0.8
	Malva parviflora	cheeseweed	0.0	<0.1	<0.1	0.1	0.0
	Medicago polymorpha	bur clover	0.0	<0.1	0.3	0.0	1.9
	Melilotus indicus	annual yellow sweetclover	0.0	<0.1	0.0	0.0	0.8

Native/Nonnative Status	Scientific Name	Common Name	Average % Cover				
			Year 1	Year 2	Year 3	Year 4	Year 5
	Paspalum dilatatum	dallis grass	0.0	0.0	1.9	0.0	0.0
	Plantago coronopus	cut leaf plantain	0.0	0.0	<0.1	0.1	0.0
	Polypogon monspeliensis	rabbitsfoot grass	0.1	0.1	0.0	2.2	0.0
	Raphanus sativus	wild radish	0.0	<0.1	<0.1	0.0	0.6
	Rumex crispus	curly leaved dock	0.1	0.7	0.2	1.0	0.3
	Salsola tragus	Russian thistle	0.0	1.0	0.0	0.0	0.0
	Sonchus asper ssp. *asper*	prickly sow thistle	0.0	<0.1	0.0	0.0	0.5
	Stipa miliacea var. *miliacea*	smilo grass	0.0	<0.1	0.2	<0.1	0.0
	Taraxacum officinale	common dandelion	0.0	0.0	0.0	<0.1	0.0
	Tragopogon porrifolius	salsify	0.0	0.0	0.0	0.0	<0.1
	Trifolium repens	white clover	0.0	0.0	0.0	0.2	0.0
	Vicia sativa ssp. *nigra*	common vetch	0.0	0.0	<0.1	<0.1	1.2
	Total Average Percent Native Species Cover[2]		**35.0**	**21.5**	**16.1**	**23.2**	**44.6**
Total Average Percent Nonnative Species Cover[2]			**34.7**	**40.2**	**56.3**	**38.2**	**35.0**
	Total Average Percent Cover		**69.7**	**61.7**	**72.4**	**61.4**	**79.6**

[1] Indicates species that were included in the original native grassland seed mix.
[2] The total average cover values vary slightly from the sum of average cover values across species due to rounding assumptions.
[3] Plant was not positively identified to species level due to a lack of flowering parts in all years.
Note: Table 4 only includes native species found along monitoring transects. Congdon's tarplant was encountered elsewhere on the site and was not exclusively found along the transects.

The average percent cover of native grassland species in Year 5 is 44.6% (Table 5, Figure 3). The percent cover of native grassland species on the site is substantially higher than is typically found in local grassland habitats. In addition to the populations encountered along the sampling transects, dense stands of native purple needlegrass (*Stipa pulchra*) were observed on the upper slopes of the west creek bank and dense stands of native meadow barley (*Hordeum brachyantherum*) were observed throughout the floodplain (Photos 21 and 22). The Year 5 percent cover of native grassland species exceeds the Year 5 success criterion of 35%.

Nonnative, invasive weeds have been controlled throughout the five year monitoring period, which has likely contributed to the increase in native grassland cover over time.

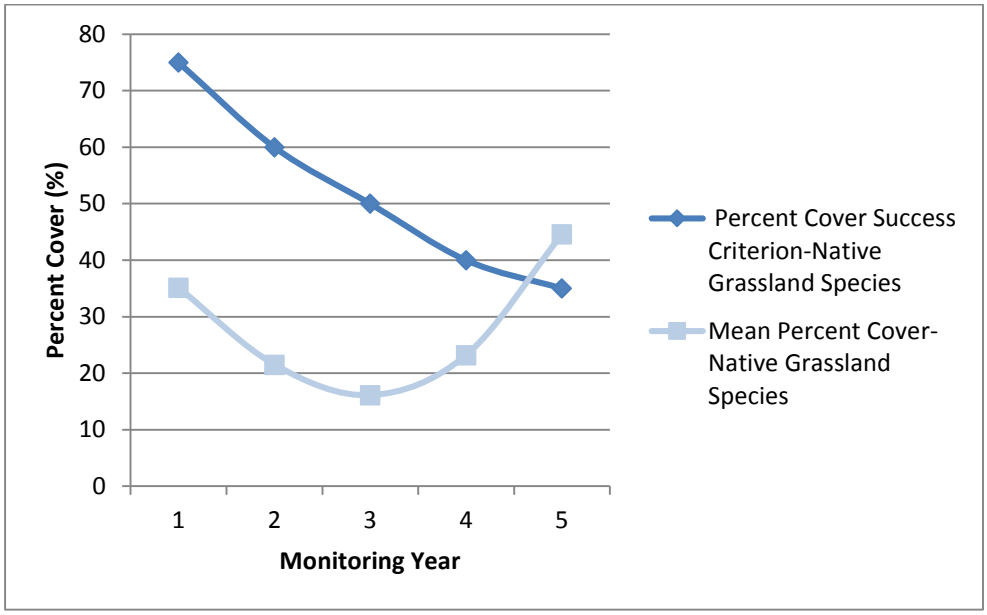


Figure 3. Mean Percent Cover of Native Grassland Species Compared to Success Criterion.

Table 5. Comparison of Percent Cover of Native Grassland Species to the Success Criterion

Year	Success Criterion[1]	Results
1	75% cover of native grassland species	35.0% cover of native grassland species[2]
2	60% cover of native grassland species	21.5% cover of native grassland species
3	50% cover of native grassland species	16.1% cover of native grassland species
4	40% cover of native grassland species	23.2% cover of native grassland species
5	35% cover of native grassland species	44.6% cover of native grassland species

[1] The interpretation of "native grassland species" was broadened, with CDFW and RWQCB approval, to include all native grassland species (grasses and forbs), not just those native grasses that were included in the seed mix.
[2] The Year 1 percent cover result was re-calculated to account for the broadened interpretation of the success criterion.

3.4 Congdon's Tarplant Survival

The MMP performance criterion requires a minimum of 100 Congdon's tarplant individuals in 2 of 5 monitoring years. Two hundred and fifty-five (255) Congdon's tarplant individuals were counted throughout the mitigation area in Year 5 (Table 6) (Photo 23). Congdon's tarplant individuals were observed in the seeding area as well as the in the adjacent upland planting area and the floodplain area. The population size of Congdon's tarplant has exceeded 100 individuals in 4 of the 5 years of monitoring and has therefore met the final success criterion.

Table 6. Comparison of Congdon's Tarplant Survival to the Success Criteria

Year	Success Criterion	Results
1	not applicable	5600 individuals
2	Minimum 100 individuals in 2 of 5 years	6 individuals
3	Minimum 100 individuals in 2 of 5 years	150-250
4	Minimum 100 individuals in 2 of 5 years	105
5	Minimum 100 individuals in 2 of 5 years	255

3.5 Woody Plant Health and Vigor

Despite ongoing drought conditions in the region, nearly every planted tree and shrub displayed good health and vigor (Photo 24; Tables 7 and 8). Moreover, a greater percentage of individuals were in good condition in Year 5 relative to previous years (Table 8). The overall average health and vigor of the woody plantings was 1.0 (good) in Year 5 (Table 7). The average health and vigor rating for each species was 1.0 (good). Table 8 lists the percentage of individuals that fall into the three general health and vigor categories by monitoring year. The percentage of individuals in good condition increased from 72.6% in Year 4 to 98.5% in Year 5. The percentage of individuals in fair condition decreased from 23.9% in Year 4 to 1.2% in Year 5. The percentage of individuals in poor condition decreased from 3.5% in Year 4 to 0.3% in Year 5.

Table 7. Mean Woody Plant Health and Vigor Ratings

Scientific Name	Common Name	Average Health and Vigor Rating[1]				
		Year 1	Year 2	Year 3	Year 4	Year 5
Acer negundo	box elder	1.2	1.1	1.2	1.3	1.0
Baccharis pilularis	coyote brush	1.0	1.0	1.0	1.1	1.0
Quercus agrifolia	coast live oak	1.2	1.2	1.1	1.3	1.0

Scientific Name	Common Name	Average Health and Vigor Rating[1]				
		Year 1	Year 2	Year 3	Year 4	Year 5
Rosa californica	California rose	1.3	1.2	1.2	1.4	1.0
Salix laevigata	red willow	1.1	1.3	1.2	1.3	1.0
Salix lasiolepis	arroyo willow	1.1	1.1	1.1	1.2	1.0
Sambucus nigra ssp. *caerulea*	blue elderberry	1.6	1.4	1.7	1.6	1.0
	Average	**1.2**	**1.2**	**1.2**	**1.3**	**1.0**

[1] Good Condition = 1.0; Fair Condition = 2.0; Poor Condition = 3.0

Table 8. Percentage of Planted Tree and Shrub Individuals within Each Health and Vigor Category

Plant Health and Vigor Categories	Year 1 % of Individuals	Year 2 % of Individuals	Year 3 % of Individuals	Year 4 % of Individuals	Year 5 % of individuals
Good Condition	80.7%	80.2%	81.5%	72.6%	98.5%
Fair Condition	16.7%	12.1%	15.8%	23.9%	1.2%
Poor Condition	2.6%	2.0%	2.7%	3.5%	0.3%

3.6 Natural Recruitment

Natural recruitment of native woody plant species was observed, with 9 California rose (*Rosa californica*) individuals and 1 coyote brush encountered along the monitoring transects. Additional individuals were qualitatively observed to be recruiting in large numbers throughout the mitigation area outside of the transects.

3.7 Hydrology and Geomorphology

Observations made by Balance Hydrologics indicate that the constructed channel and floodplain are stable. No major or minor erosion was observed.

The MMP's quantitative hydrologic success criterion requires continuous inundation or saturation of floodplain soils for at least 12.5% (31 days) of the annual growing season. The project hydrologist estimated that floodplain soils were continuously inundated or saturated for at least 40 days between 29 November 2014 and 8 January 2015. This exceeds the minimum requirement of 31 days of continuous inundation or saturation.

Due to drought conditions and the flashy hydrology of the drainage, the project hydrologist had few opportunities to observe flow on the floodplain and was not able to make flow measurements in Year 5. However, water level/depth observations from Year 5 continue to support prior observations of backwatering of the channel. It appears that the source of this backwatering is flow modification caused by the City of Milpitas' Wrigley-Ford Creek Pump Station located approximately 4500 feet downstream of the project site. During storm events, water likely accumulates within the channel until the station pumps flows into Berryessa Creek. Regardless of this backwatering, the mitigation project is establishing well and sedimentation rates on the floodplain are minimal. Minor sediment deposition (<0.2 inches) was observed on the floodplain, which was anticipated and poses no threat to the geomorphic functioning of the site.

Balance Hydrologics visited the site on 11 December 2014 during the one of the largest storms to pass through the region over the 5 year monitoring period. They observed that the site was inundated under several feet of water because of backwatering effects and a high volume of runoff. However, no damage was observed following this inundation, which suggests that the site is capable of withstanding extreme hydrologic events (Balance Hydrologics 2015).

Appendix A provides Balance Hydrologics' detailed results.

3.8 Photo-documentation

Photos were taken from the 36 photo-documentation points. A representative selection of these photos is presented in Appendix B.

3.9 Trail Construction Effects on the Mitigation Site

Construction of an adjacent redevelopment project (by others) began in 2013 and affected the VTA's mitigation project. Redevelopment included construction of a trail bordering the eastern side of the mitigation site that resulted in the removal of approximately 20 trees and shrubs including some mitigation plantings within the upland planting zone of the mitigation site (Calnan 2015, pers. comm.). The 20 removed trees and shrubs accounted for no more than 1.4% of the total quantity of installed plants. VTA replaced the plants in December 2014 with 20 native riparian trees and shrubs of the same species as the original planting palette (Table 9). Plantings were installed in gaps in the riparian woodland canopy within the upland planting zone.

Table 9. Trail Construction Replanting Palette

Scientific Name	Common Name	Source County	Container Size	Quantity
Acer negundo	Box elder	Santa Clara	TP4	2
Baccharis pilularis	Coyote brush	Santa Clara	1-Gal	5
Quercus agrifolia	Coast live oak	Santa Clara	5-Gal	4
Rosa californica	California rose	Santa Clara	1-Gal	8
Sambucus nigra ssp. *caerulea*	Blue elderberry	Santa Clara	TP4	1
			Total	**20**

Conclusion

The Year 5 monitoring results indicate that the site is performing well and is on a trajectory to achieve the long-term habitat mitigation goals. The site met or exceeded the final success criteria for woody plant survival, native grassland species cover, Congdon's tarplant survival, continuous floodplain surface soil inundation or saturation, and hydrologic and geomorphic stability. The site has been well maintained and nonnative, invasive weeds do not pose a threat to the continued establishment of riparian habitat at the site. Willow plantings had a high survival rate, displayed significant growth, and retained their leaves long into the summer dry season despite not being irrigated during 2015, indicating that they have reached groundwater and are self-sufficient without supplemental irrigation. The VTA's landscape contractor applied irrigation to woody plantings, with the exception of willow plantings, starting in July 2015 in response to plant stress associated with the ongoing regional drought. It is important to note that the Year 5 vegetation data collection was completed one day after the first irrigation event in 2015. Therefore, these data reflect site conditions in the absence of supplemental irrigation, and thus it is valid to state that the site met or exceeded the final success criteria without supplemental irrigation.

Management Recommendations

The site has met all of its final success criteria. Upon agency approval that the success criteria have been met and that maintenance may cease, we recommend that the above ground elements of the irrigation system be removed and any below ground elements be cut and capped. We have no further vegetation maintenance recommendations for the Wrigley Creek Improvement Project.

Agency Actions

The VTA requests sign-off from the U. S. Army Corps of Engineers, California Department of Fish and Wildlife, and Regional Water Quality Control Board that the project's final success criteria have been met and that maintenance, monitoring, and reporting may cease.

Section 4.0 References

4.1 Literature Cited

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken, editors. 2012. The Jepson Manual: Vascular Plants of California, Second Edition. University of California Press, Berkeley.

Balance Hydrologics, Inc. 2015. Year 5 (water year 2015) Hydrologic and Geomorphic Monitoring Letter Report, Wrigley Creek, Santa Clara County, California.

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley and Sons. New York.

Elzinga, C. L., W. Salzer, and J. W. Willoughby. 1998. Measuring and Monitoring Plant Populations. U.S. Department of the Interior, Bureau of Land Management, Technical Reference 1730-1, Denver, Colorado, USA.

H. T. Harvey & Associates. 2011. Wrigley Creek Improvement Project Biological As-built Report. Milpitas, California. Dated 21 October 2011.

H. T. Harvey & Associates. 2012a. Wrigley Creek Improvement Project – Meeting Summary Regarding Native Grassland Success Criterion. Dated 30 March 2012.

H. T. Harvey & Associates. 2012b. Wrigley Creek Improvement Project – Year 2 Native Grassland Spring Monitoring. Dated 17 May 2012.

H. T. Harvey & Associates. 2013. Wrigley Creek Improvement Project Milpitas, California Year 2 (2012) Monitoring Report. Dated 11 January 2013.

H. T. Harvey & Associates. 2014. Wrigley Creek Improvement Project Milpitas, California Year 3 (2013) Monitoring Report. Dated 4 March 2014.

H. T. Harvey & Associates. 2015. Wrigley Creek Agency Meeting to Discuss Native Grassland Success Criterion. Dated 21 May 2015.

ICF Jones & Stokes. 2009. Wrigley Creek Improvement Project Mitigation and Monitoring Plan. June 2009. (ICF/JS 00099.09) San Jose, CA.

4.2 Personal Communications

Calnan, A. 2015. Phone communications between Max Busnardo (H. T. Harvey & Associates) and Ann Calnan (VTA) regarding trail construction impacts and replacement planting.

Appendix A. Hydrology and Geomorphology Monitoring Memorandum

Balance Hydrologics, Inc.®

800 Bancroft Way • Suite 101 • Berkeley, CA 94710 • (510) 704-1000
224 Walnut Avenue • Suite E • Santa Cruz, CA 95060 • (831) 457-9900
PO Box 1077 • Truckee, CA 96160 • (530) 550-9776
www.balancehydro.com • email: office@balancehydro.com

September 29, 2015

Mr. Will Spangler
H. T. Harvey and Associates
983 University Avenue, Building D
Los Gatos, California 95032

Submitted Via Email

Year-5 (Water Year 2015) Hydrologic and Geomorphic Monitoring Letter Report, Wrigley Creek, Santa Clara County, California

Dear Mr. Spangler:

We are pleased to furnish you with this letter report for abbreviated Year 5 (Water Year[1] 2015, or WY15, hereafter) post-construction monitoring of the Wrigley Creek Mitigation Project ('project', hereafter). Construction of the mitigation site was completed in the summer and fall of 2010. The geomorphic and hydrologic monitoring program is designed to assess whether the numeric success criterion for soil saturation is met and identify whether the site is functioning as intended hydrologically and geomorphically. We visited the site numerous times during WY15 including storm responses, at other times during the winter months, dry season visits, and most recently during the dry summer season, on July 30, 2015 to perform the geomorphic site walk. The July 30, 2015 site visit concludes 5-year period for physical monitoring of the project. This letter report summarizes the findings of those visits. It should be noted that we have slightly shortened the monitoring duration for WY15 by 2 months in accordance with a request from the Santa Clara Valley Transportation Authority (VTA) (i.e., hydrology monitoring occurred from October 1, 2014 – July 30, 2015, rather than terminating on September 30, 2015). The VTA shortened the monitoring duration in order to submit the last monitoring report for regulatory review prior to the retirement of Dave Johnston, who has been the California Department of Fish and Wildlife contact since the project's inception. We wish him well in his future endeavors.

Per the project Mitigation and Monitoring Plan (MMP), the project has one numeric performance criterion, whereas other measures of success are related to visual assessment of post-construction conditions. The success criterion for inundation/saturation in the MMP mandates that floodplain soils should be inundated or saturated within the uppermost 6 inches of the soil profile continually for 12.5% of the growing season. Utilizing a growing season of 250 days for neighboring Santa Clara County based on data from the NRCS Soil Survey of Santa Clara County (M. Parsons, H. T. Harvey and Associates, pers. comm.), we conclude that to meet the

[1] A water year (WY) is defined as that period from October 1st of a preceding year through September 30th of the following year, and is named according to the following year. For example, WY15 occurred from October 1, 2014 through September 30, 2015.

success criterion outlined in the MMP, the site must be continually inundated or saturated for at least 31.25 days.

Figure 1 illustrates the general design features of the site and the location of hydrologic monitoring and photo-documentation points that serve as the basis for our monitoring work. The schedule for monitoring during years 2 through 5 is presented in **Table 1**.

Table 1. Schedule of Hydrologic and Geomorphic Monitoring Activities

		Year 1 (WY2011)	Year 2 (WY2012)	Year 3 (WY2013)	Year 4 (WY2014)	Year 5 (WY2015)
Task 1	Stormflow Observation	n/a	Oct. 2011-June 2012	Oct. 2012-June 2013	Oct. 2013-June 2014	Oct. 2014-June 2015
Task 2	Floodplain Soil Moisture Monitoring	n/a	Oct. 2011-June 2012	Oct. 2012-June 2013	Oct. 2013-June 2014	Oct. 2014-June 2015
Task 3	End of Water Year Geomorphic Monitoring	Oct. 2011	Oct. 2012	Oct. 2013	Oct. 2014	July 2015
Task 4	Photo-documentation Points	Oct. 2011	Oct. 2012	Oct. 2013	Oct. 2014	July 2015

Monitoring Methods

Winter Storm Observations

To assess the fundamental assumptions and basis for channel design, Balance Hydrologics (Balance, hereafter) observed conditions during or immediately after winter storm events and looked for marked headcutting, marked channel incision or downcutting, substantial bank erosion or lateral channel migration, and excessive sedimentation or aggradation, and whether sediment is sourced from within the site or upstream. In addition, we documented floodplain inundation during storm observations to assess project hydraulic performance. We documented floodplain inundation levels via the staff plates and recording water level loggers, which we periodically downloaded.

Floodplain Soil Moisture Monitoring

Our approach provided for the monitoring of surficial hydrologic conditions at two different locations along the project reach (**Figure 1**); monitoring instrumentation included graduated staff plates and water level loggers. At each monitoring location, a staff plate was installed next to a

water level logger housing. The water level logger housing consist of a fence post driven into the ground 3 to 4 feet, with a perforated pipe secured to the fence post above ground. The perforated pipe houses the water level logger and is installed in a position with the water level logger slightly beneath the surrounding floodplain in order to document the depth and duration of ponding on the floodplain. Manual monitoring consisted of observations of stage (water depth as measured against the staff plate), soil moisture conditions, and downloading of the water level loggers. We utilized the record of inundation in tandem with visual observations of soil moisture to determine whether or not the soils were saturated for the required 12.5% of the growing season (i.e., at least 31 days, assuming an 8 month growing season.), as outlined in the MMP.

End of Water Year Geomorphic Monitoring

On July 30, 2015 Balance conducted a geomorphic assessment of the channel and floodplain to identify areas of erosion or aggradation within the site over the past year, as specified in the MMP. During the end of water year monitoring visit, Balance supplemented photo-documentation points collected by H. T. Harvey and Associates with five photo-documentation points at places of hydrologic and geomorphic significance (**Figure 1**). On November 30, 2012 Balance staff installed four sedimentation plates (~square-foot plates mounted at the ground surface on a shaft driven into the floodplain) at the site on the floodplain (**Figure 1**). On July 30, 2015, Balance staff measured the depth of accumulated sediment (not including organic litter) at four locations on each plate, one at each of the four cardinal directions. The average depth of accumulated sediment for each sedimentation plate location is presented in the results.

Hydrologic Monitoring Results

To provide context for data collected at Wrigley Creek, we present precipitation data from two nearby stations: the California Irrigation Management Information System (CIMIS) station in Union City (Station 171), and Weather Underground Station KCANSANJO17 (Berryessa, hereafter), which we have used since WY12. The Berryessa rainfall station is located approximately 3 miles southeast of the Wrigley Creek mitigation site and the Union City CIMIS station is approximately 14.5 miles northwest of the mitigation site. For all intents and purposes, mean annual rainfall at these sites is similar to that of the project site. Note that the San Jose Airport station (KSJC) has a longer-term record that is more proximal to the project, however we found to have missing values in WY12 and WY13, so only long-term averages are used from this station.

WY15 was characterized by very wet conditions in December 2014 followed by very dry conditions for the rest of the year in the Wrigley Creek area. In the vicinity of the project, approximately 80% of the rain recorded for the entire season fell before January 1st, 2015. The Berryessa station received 16.19 inches of rainfall for the season, (**Figure 2**), 1.10 inches more than the long-term average of 15.09 inches for the San Jose Airport (KSJC), the closest long-term station. Of that total, 12.03 inches of rain fell before January 1st, 2015. The Union City CIMIS station received 15.49 inches of rainfall (**Figure 3**) or 0.40 inches more than the long-term average for that location. Of that total, 11.87 inches of rain fell before January 1st.

By far, the largest daily rainfall totals for nearby stations were recorded on December 11, 2014, during an atmospheric river event. On this day, 3.74 inches fell at the Berryessa station, with another 0.44 inches the following day, bringing the 2-day storm total to 4.18 inches. At the Union City station, 4.21 inches fell on December 11, followed by 0.36 inches on December 12, for a 2-day total of 4.57 inches. An analysis of the hourly rainfall data for the Union City indicates that the 12- and 24-hour rainfall duration intensities correlate to approximately a 50-year recurrence interval, while shorter 1-4 hour duration intensities correlate to approximately a 10- to 25- year recurrence[2]. Another large multi –day storm event had preceded this, occurring from November 29 to December 6, with rainfall totals of 4.25 inches recorded at Berryessa, and 2.46 inches recorded at Union City. Watershed conditions were therefore already very wet at the time of the atmospheric river event.

Balance made a total of five site visits during WY15 to take staff plate readings, measure the depth to soil moisture, and download water-level recording instruments. In the discussion that follows, records of water level (stage) and soil moisture (shown in **Figure 4**) are used to deduce the period of inundation/saturation on the floodplain. Precipitation over time is also shown in **Figure 4.**

Criteria for the site are met when the floodplain is either inundated or saturated for a required amount of time. Inundation is defined here as having standing or flowing water on top of the floodplain, and is represented in **Figure 4** as spikes in stage that extend above the ground surface. Floodplain saturation is defined as the presence of moisture a minimum of 2 inches beneath the ground surface, and is represented by points shown in **Figure 4**. Saturation is considered to be achieved whenever these observations confirm it, or when inundation is observed on the floodplain.

As in previous years, at both the north and south gages, we observed that inundation tracked closely to rainfall events. At the beginning of the water year (October 1, 2014), the soils were not saturated within the upper 6 inches of the soil profile, as is reflected in the September 23, 2014 soil moisture observations **(Figure 4).** Continually inundated/saturated conditions begin with the onset of significant precipitation on November 29; inundation was first observed by field staff on December 11, 2014. A series of clustered rainy days, from late November to mid-January, correlate with the longest periods of saturation and inundation. The storms with the highest intensity rainfall yielded the highest stage levels; for example, the season peak in one-day rainfall (December 11, 2014, 4.21 inches) correlates with the highest stage of the year at both the north and south gages, 5.20 and 5.67 feet above the ground surface, respectively. The high water levels rise quickly with the onset of rain, and recede quickly as precipitation ceases, due to the flashy nature of the site. Following the recession of high water, water levels remain elevated a few inches above the floodplain for several days.

Smaller late-season storms produce only brief spikes in stage. For the larger events (February 6 April 7, and May 15, when 1.08, 0.68, and 0.73 inches of rain fell, respectively) the gages show a strong response, recording water levels of around 2 to 3 feet deep on the floodplain. On March 2,

[2] Based on intensity-duration-frequency curves in the Santa Clara County Drainage Manual, 2007.

when only 0.11 inches of precipitation was recorded, a similarly high water level was recorded on the floodplain. This may be due to saturated conditions persisting through the watershed, or perhaps rainfall was locally higher at the site than at nearby precipitation gages. Other small events (e.g. March 11, 2015, when 0.15 inches of rain fell), produce much lower water levels at the site. The small January 27 spike is not associated with rainfall recorded at either gage.

As discussed in our WY2013 and WY2014 reports, the modeling performed for the site as the basis for design by the Balance design team predicted near bankfull conditions to occur with a discharge of approximately 20 cubic feet per second (cfs), and a 100-year flow of 325 cfs would be required to inundate the floodplain to a depth of 4 feet. This year's multiple stage measurements indicate that the floodplain is inundated more frequently than anticipated, an indication that the site is backwatered, which likely results from flow modifications caused by a pump station located approximately 4500 feet downstream of the project site. Again, pump operations are not understood, but we presume that during storm events, stream flow accumulates within the channel until the station pumps flows up and over the levee into Berryessa Creek.

Throughout the wet season, there were approximately 59 days (discontinuous) during which the north gage site was inundated (**Figure 4**). The longest continuous period of inundation was about 24 days, from December 11, 2014 to January 3, 2015. The stage record and field observations show that between November 29, 2014, when storms inundated the site, and January 8, 2015, when moist soils were observed in the field, soils near the gage were either inundated or saturated at a depth of approximately 2 inches, a period of continuous inundation/saturation lasting 40 days. **Figure 5** shows site photos from the January 8 field visit.

The south gage is located on a section of floodplain that ponds during and after storm events, therefore this site is inundated for a longer duration. According to the stage record **(Figure 4)** there were approximately 78 (discontinuous) during which the south gage site was inundated. The longest period of continuous ponding/inundation lasted 32 days, from November 29, 2014 to January 3, 2015. As at the north gage site, the stage record and field observations show that between November 29, 2014, when storms inundated the site, and January 8, 2015, on which moist soils were observed in the field, soils near the gage were either inundated or saturated at a depth of approximately 2 inches, a period of continuous inundation/saturation lasting 40 days. **Figure 6** shows site photos from the January 8 field visit.

The 40 day period of inundation and soil saturation at the north and south gage sites exceeds the minimum duration of 12.5% of the growing season (i.e., 31 days), stated success criterion outlined in the MMP. Therefore, the site has met the numeric success criterion for inundation/saturation in the MMP, which is particularly notable because rainfall during WY15 was consolidated largely between November 28, and December 27, 2014.

The December 11-12, 2014 atmospheric river event was exceptional in that it was one of the largest storms to pass through the area over the five-year monitoring period. Balance visited the site on December 11, 2014. Due to the backwatering effect of the pump station downstream and the high volume of runoff entering the project site, the channel, staff plates and most of the

vegetation was inundated under several feet of water at the time of the visit **(Figure 7**). Discharge measurements were impossible to take with a wading instrument, and difficult to estimate due to turbulent backwater effects. It is encouraging that after an event of this magnitude, no damage was observed following recession of the floodwaters. Due to the dry year and the flashy nature of the site, Balance had few other opportunities to observe flow on the floodplain, and therefore we were not able to measure flow during WY15.

Geomorphic Observations

On July 30, 2015, Balance conducted an end-of-water-year geomorphic walk at the site to make observations. There had been no measurable rain in the area since June 11, 2015. Overall, the site was observed to be in good condition and functioning geomorphically (**Figure 8**).

Table 2 shows the accumulation of sediment on the four sediment plates. Plate 1, located in the upstream portion of the site, showed an accumulation of sediment. We attribute the sediment accumulation to the natural levee that is forming adjacent to the channel. This process does not threaten the long term sustainability of the site, as rates are still quite low, and are expected to slow further with time. At Plate 2, no change was detected. At the downstream sites, Plate 3 saw a slight accumulation when compared to WY14. However, the site experienced scour between WY13 and WY14, so long term trends at this location are difficult to assess. No change was detected at Plate 4. Overall, the transport of sediment on the floodplain is in very small amounts and is not expected to affect the geomorphic or biologic functionality of the site for some time.

Table 2. Summary of Cumulative Annual Sediment Accumulation on Sedimentation Plates 1-4.

	Sedimentation Plate 1 *mm of accumulation*	**Sedimentation Plate 2** *mm of accumulation*	**Sedimentation Plate 3** *mm of accumulation*	**Sedimentation Plate 4** *mm of accumulation*
Year 1 - WY11	n/a	n/a	n/a	n/a
Year 2 - WY12	n/a	n/a	n/a	n/a
Year 3 - WY13*	1	1	5	<1
Year 4 - WY14	3	3	3	3
Year 5 - WY14	15	3	7	3

*Sediment plates installed on November 30, 2012, and therefore the WY13 sediment accumulations do not reflect the complete water year.

During the July 30 site walk, 1.5 feet-deep desiccation cracks were observed on the floodplain adjacent to the downstream (north) gage with moisture at the bottom of these cracks. At the upstream site, flow was estimated at 0.05-0.07 cfs. Soils at the very upstream extent of the site were visibly saturated. Vigorous willow growth was observed here as well.

As noted in our WY14 report, substantial cattail growth continues to expand, and now covers approximately 95% of the low-flow channel length, a condition that remains unchanged in recent visits. It should be noted that successful willows are beginning to shade-out cattail along short portions of that channel. We expect the succession from cattail to willow to continue, and view this succession positively with respect to the hydrologic and geomorphic functions of the site, though it is unlikely that the frequency and duration of inundation will change dramatically. Our observations of water levels (**Figure 4**) and physical bank features suggest these stands of cattail do not currently hinder the ability of the low-flow channel to convey low flows; however they very likely reduce velocities within the channel during high flows. Our observations suggest that elevated water levels are most likely caused by flow modifications from the downstream pump station in combination with the downstream channel conditions, and do not currently threaten the success of the mitigation project.

Recommendations for Adaptive Management

We observed no major or minor erosion along the project reach, at the inlet structures, within the backwater channels, the floodplains, or the upland slopes. WY15 was drier than average during the second half of the wet season, however there were major regional runoff events, and the soil moisture criterion from the MMP was met. Therefore, no adaptive management strategies are needed.

It should be noted that the majority of years in which monitoring took place were drier than usual. If downstream conditions that currently cause the backwatering of the site persist in the future, which we expect, it is likely that the site will continue to meet the quantitative soil moisture success criteria, even during severe drought conditions. Additionally, the significant storms of December 11, 2014 caused no detrimental sedimentation or erosion, which suggests the site is geomorphically stable, and capable of withstanding extreme hydrologic events.

Closing

We greatly appreciate the opportunity to assist you with this 5-year geomorphic and hydrologic monitoring effort. If issues arise in the future with regard to the Wrigley Creek Habitat Enhancement Project, or you would like to request any of the archived documentation, we will be happy to assist.

Respectfully submitted,

BALANCE HYDROLOGICS, Inc.

Eric Donaldson, M.S., P.G.
Project Manager

Krysia Skorko, M.S.
Geomorphologist

Shawn Chartrand, M.S., P.G., CEG
Principal-in-charge

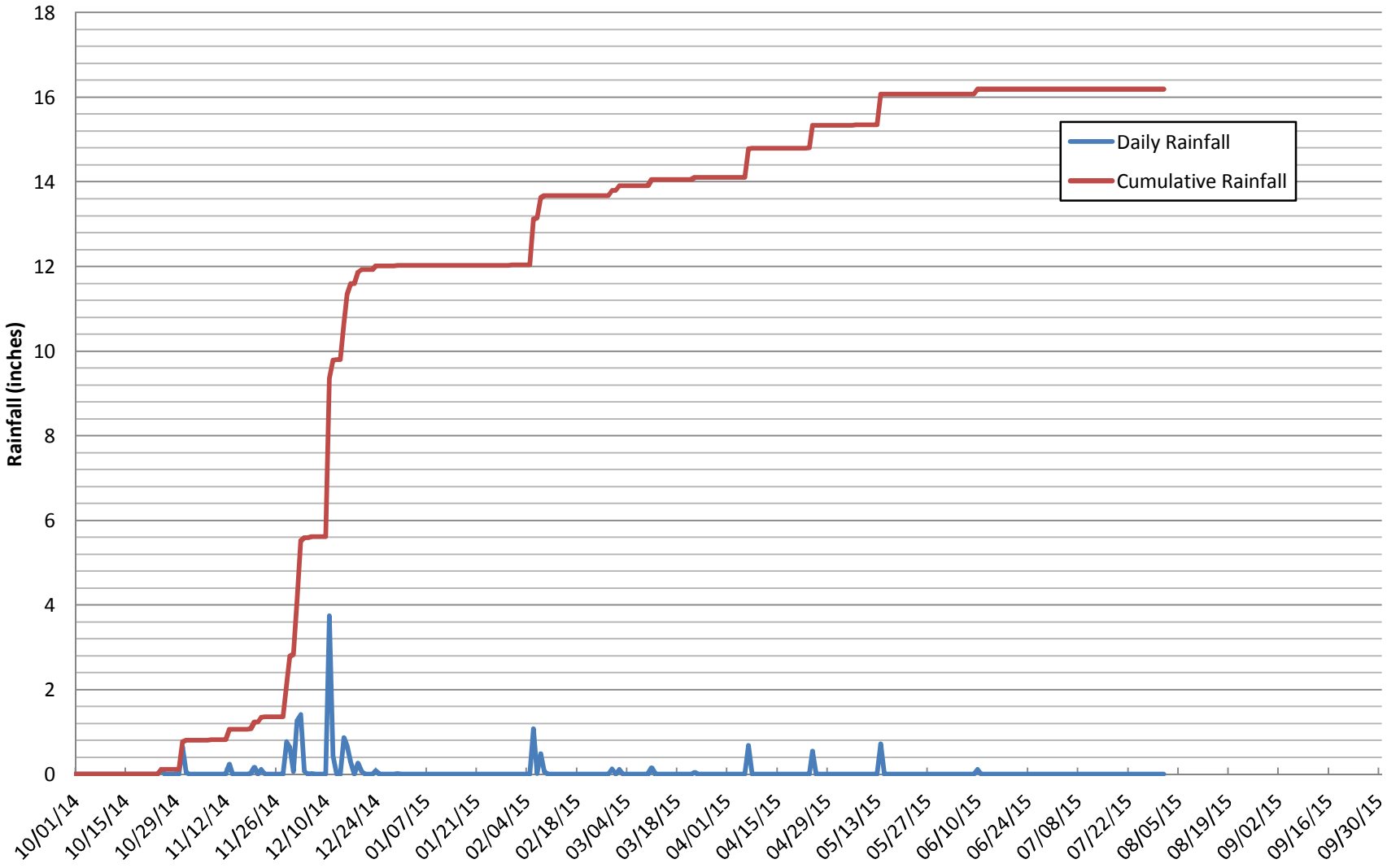
Encl. Figures 1 through 8

Balance Hydrologics, Inc.

Figure 1. Monitoring map.
Basemap Source, H.T. Harvey and Associates, 2011.

211138 Wrigley Monitoring 12/9/2011

©2011 Balance Hydrologics, Inc.



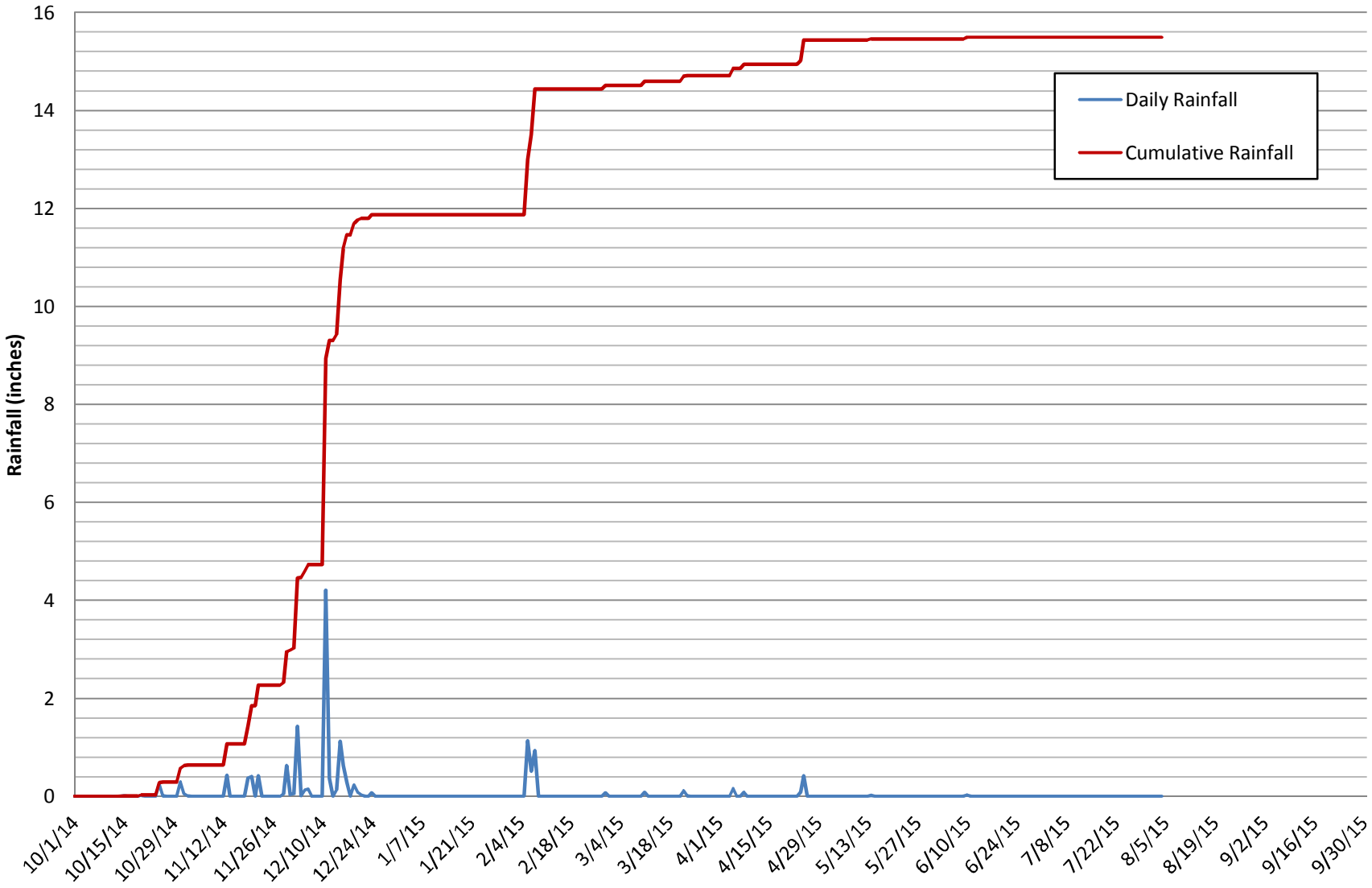
Source: Weather Underground

Figure 2. Daily Rainfall and Cumulative Rainfall, Berryessa, California (Weather Underground Station KCANSANJO17). Wrigley Creek Mitigation Performance Monitoring, Water Year 2015, Milpitas, California.

Balance Hydrologics, Inc.

Rainfall_WY2015.xls

© 2015 Balance Hydrologics, Inc.



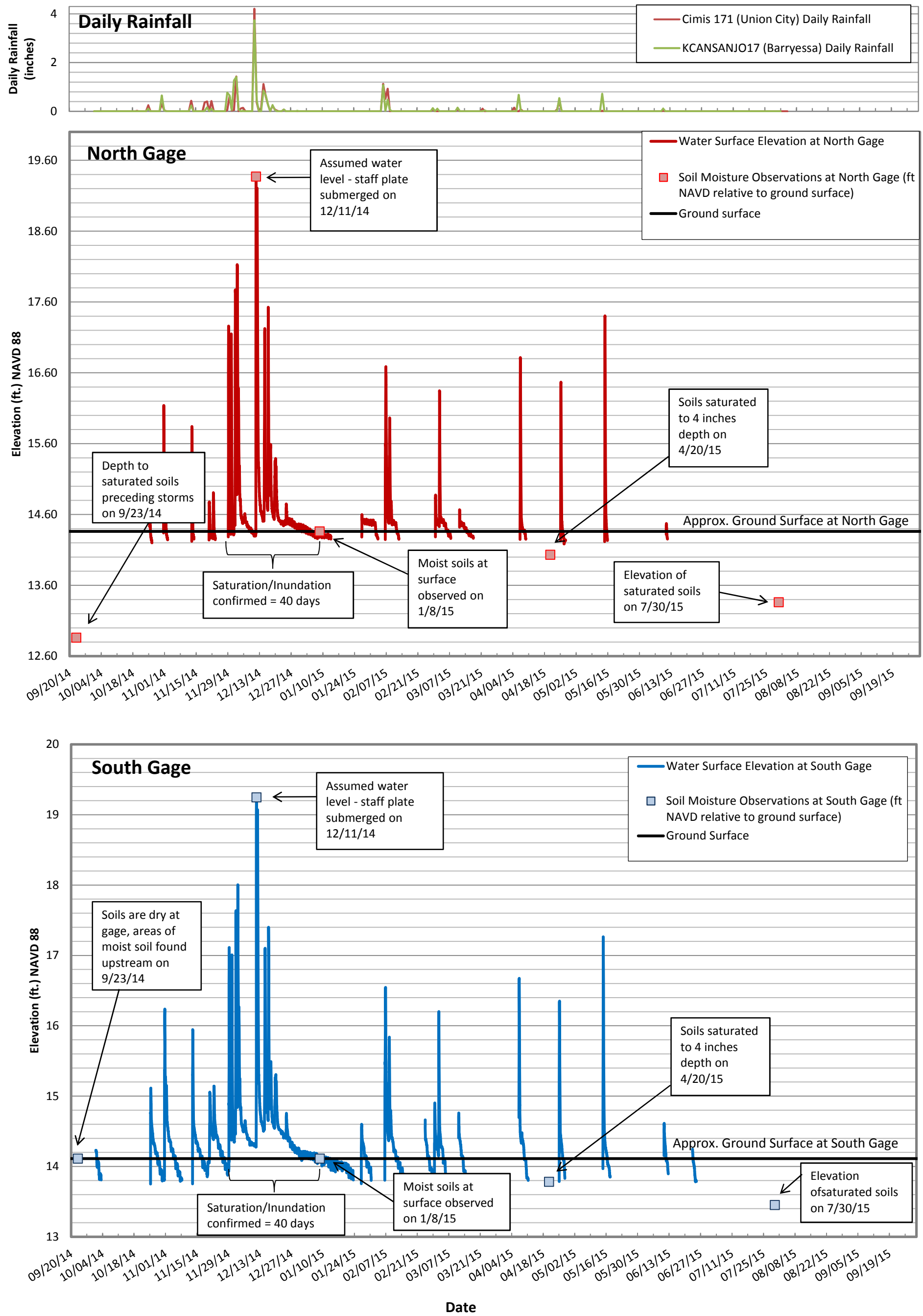
Source: CIMIS

Balance Hydrologics, Inc.

Figure 3. Daily Rainfall and Cumulative Rainfall, Union City (CIMIS 171), Water Year 2015. Wrigley Creek Mitigation Performance Monitoring, Water Year 2015, Milpitas, California.

Rainfall_WY2015

© 2015 Balance Hydrologics, Inc.



Source: Balance Hydrologics, Inc.

Balance Hydrologics, Inc.

WY15 Water Level Data

Figure 4. Annotated stage record - Wrigley Creek Mitigation Performance Monitoring, Water Year 2015, Milpitas, California Stage record for the north and south stations with storms shown by the steep spikes in stage followed by a gradual decline as the monitoring locations drain. Note that the pressure transducers are installed below the ground surface. Soil moisture observations are elevations in NAVD and should be compared to the adjacent ground surface.

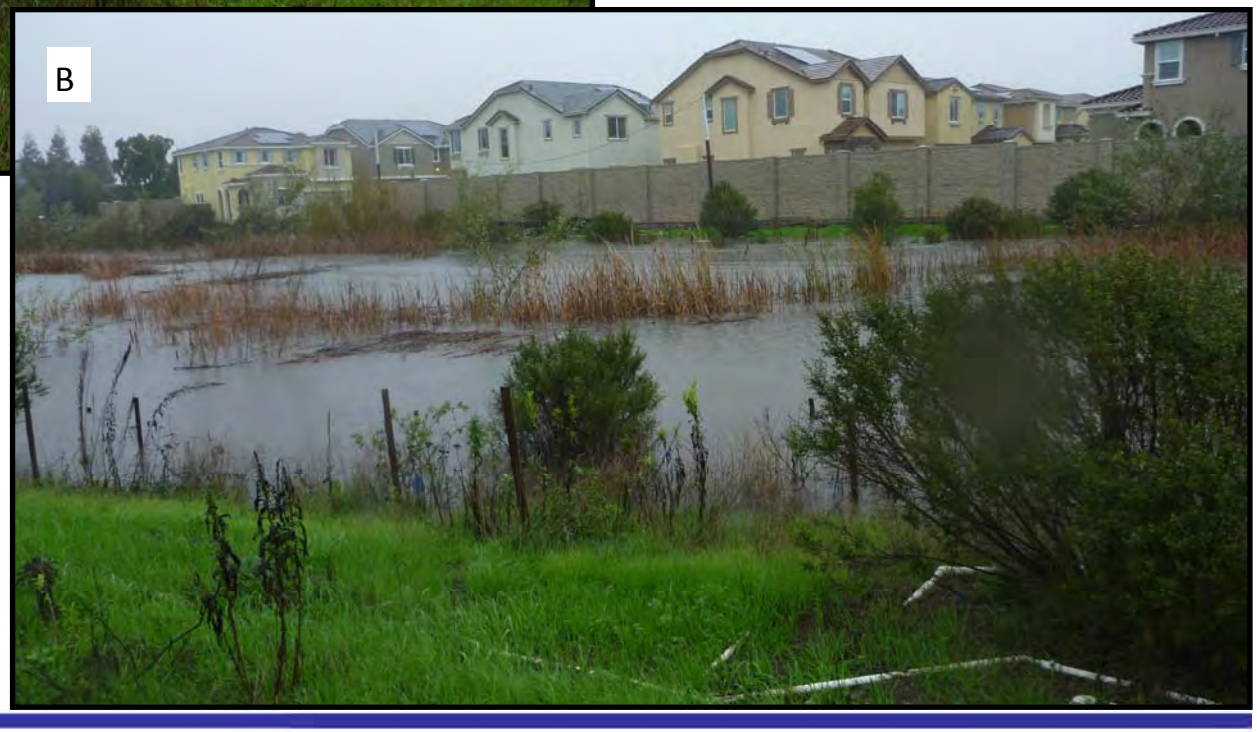
© 2015 Balance Hydrologics, Inc.

Balance Hydrologics, Inc.

Figure 5. **January 8, 2015 north gage field photographs. Wrigley Creek Mitigation Performance Monitoring, Santa Clara County, California .** On the day these photos were taken, saturated soils were confirmed at the surface at both the north and south gages. A) North gage on January 8, 2015. B) Soils at the north gage on January 8, 2015.

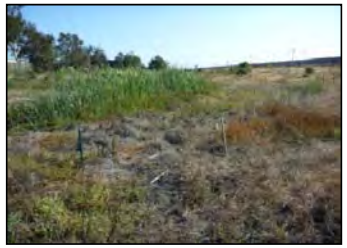
Balance Hydrologics, Inc.

Figure 6. **January 8, 2015 south gage field photographs. Wrigley Creek Mitigation Performance Monitoring, Santa Clara County, California .** On the day these photos were taken, saturated soils were confirmed at the surface at both the north and south gages. A) South gage on January 8, 2015. B) The channel about 50 feet upstream of the south gage, January 8, 2015.



Balance Hydrologics, Inc.

Figure 7. **December 11, 2014 storm flow field photographs. Wrigley Creek Mitigation Performance Monitoring, Santa Clara County, California .** On the day these photos were taken, high flows inundated both staff plates and most vegetation. The tops of the cattail indicate the location of the channel. A) Looking upstream. B) Looking downstream.

Photo Point 1 Looking downstream, approx. 0˚ azimuth.	Photo Point 2 Looking downstream, approx. 8˚ azimuth.	Photo Point 3 Looking downstream, approx. 0˚ azimuth.	Photo Point 4 Looking downstream, approximately 8˚ azimuth.	Photo Point 5 Looking upstream, approximately 164˚ azimuth.	
					November 18, 2011
					October 3, 2012
	Note: Photo Point 2 relocated in 2013 				November 5, 2013
					September 23, 2014
					July 30, 2015

Balance Hydrologics, Inc.

Year 5 Photodoc

Figure 8. **Photo points 1-5, Years 1-5. Wrigley Creek Mitigation Performance Monitoring, Santa Clara County, California .** Note that vegetation growth at Photo Point 2 obscured the view of the culvert outlet and channel, and in 2013, the photo point was relocated to a location higher on the left bank.

© 2015 Balance Hydrologics, Inc.

Appendix B. Photo-documentation

Photo 1. Photo-point 1, looking upstream from the culvert at the downstream end of the project site (October 2011)

Photo 2. Photo-point 1, looking upstream from the culvert at the downstream end of the project site (July 2015)

Photo 3. Photo-point 2, looking at Congdon's tarplant Mitigation Area (October 2011)

Photo 4. Photo-point 2, looking at Congdon's tarplant Mitigation Area (July 2015)

Photo 5. Photo-point 7, looking downstream from the west bank. (October 2011)

Photo 6. Photo-point 7, looking downstream from the west bank. (July 2015)

Photo 7. Photo-point 7, looking across the channel from the west bank to the east bank (October 2011)

Photo 8. Photo-point 7, looking across the channel from the west bank to the east bank (July 2015)

Photo 9. Photo-point 7, looking upstream from the west bank (October 2011)

Photo 10. Photo-point 7, looking upstream from the west bank (July 2015)

Photo 11. Photo-point 18, looking downstream from the upstream end of the project site (October 2011)

Photo 12. Photo-point 18, looking downstream from the upstream end of the project site (July 2015)

Photo 13. Photo-point 23, looking upstream from the east bank (October 2011)

Photo 14. Photo-point 23, looking upstream from the east bank (July 2015)

Photo 15. Photo-point 23, looking across the channel from the east bank to the west bank (October 2011)

Photo 16. Photo-point 23, looking across the channel from the east bank to the west bank (July 2015)

Photo 17. Photo-point 23, looking downstream from the east bank (October 2011)

Photo 18. Photo-point 23, looking downstream from the east bank (July 2015)

Photo 19. Photo-point 36, looking over the site from the Hwy 237 embankment located north of the site (October 2011)

Photo 20. Photo-point 36, looking over the site from the Hwy 237 embankment located north of the site (July 2015)

Photo 21. Dense patch of purple needlegrass on the western creek bank slope (May 2015)

Photo 22. Dense patch of meadow barley on the floodplain (May 2015)

Photo 23. Flowering Congdon's tarplant in the Congdon's Tarplant Mitigation Area (July 2015)

Photo 24. Vigorous elderberry planting on the eastern creek bank slope (July 2015)

Photo 25. Mugwort natural recruitment on the western creek bank slope (July 2015)