AIR QUALITY STUDY

FOR THE PROPOSED

OLOWALU TOWN PROJECT

OLOWALU, MAUI

Prepared for:

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1.0 SUMMARY

Olowalu Town, LLC is proposing a master plan development at Olowalu on the island of Maui. The proposed development includes approximately 1,500 dwelling units, commercial office and retail space, public facilities, the realignment and widening of Honoapiilani Highway and other associated improvements. Full build out of the project is expected by 2020. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities. Mitigative measures are suggested where possible and appropriate to lessen any impacts from the project.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are generally comparable to the national standards although the state standards for carbon monoxide are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its elevation near sea level and by nearby mountains. The West Maui Mountains shelter the project area from the northeast trade winds, and local winds (such as land/sea breezes and upslope/downslope winds) affect the wind flow in the area much of the time. Temperatures in the project area are generally very consistent and warm with average daily temperatures ranging from about 65°F to 84°F. Rainfall in the project area is minimal with an average of only about 11 inches per year.

Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion, the present air quality of the project area is believed to be relatively good. There is very little air quality monitoring data from the Department of Health for the project area, but the limited data that are available suggest that concentrations are generally well within state and national air quality standards.

If the proposed project is given the necessary approvals to proceed, it is inevitable that some short- and long-term impacts on air quality will unavoidably occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment and from the disruption of traffic may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the project boundary. Hence, an effective dust control plan should be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Excess exhaust emissions from traffic disruption can be mitigated by moving construction equipment and workers to and from the project area during off-peak traffic hours and by minimizing road closures during peak traffic periods.

After project construction is completed, motor vehicles coming to and from the proposed development will result in a long-term increase in air pollution emissions in the project area. To assess the potential long-term impact of these emissions, a mesoscale (medium scale) analysis was performed. The mesoscale analysis was designed to provide estimates of air pollution emissions from project-related traffic using Honoapiilani Highway in the Olowalu area. The analysis considered an existing (2011) case and two future scenarios. The future scenarios included 2020 without the project and 2020 with the project.

The mesoscale analysis indicated that in 2011 the totals of emissions from traffic using Honoapiilani Highway within the study area were 1,297 lbs per day of carbon monoxide, 103 lbs per day of volatile organic compounds and 130 lbs per day of nitrogen oxides. These emission amounts are relatively small in comparison to island-wide emissions, amounting to about 1 percent or less. Without the project in the year 2020, it was estimated that carbon monoxide emissions would decrease by 20 percent, volatile organic compounds emissions would decrease by 37 percent and nitrogen oxides emissions would decrease by 54 percent. Although increased traffic volumes are expected, these would be more than offset by the retirement of older, higher-emission vehicles over time. With the project in the year 2020 compared to without it, carbon monoxide emissions and nitrogen oxides emissions would each increase by 20 percent, while volatile organic compounds emissions would increase by about 8 percent. Although emissions in 2020 with the project would be somewhat higher compared to without it, emissions would be lower than the existing emissions.

Although more detailed analyses could be performed using computerized emission and atmospheric dispersion models to estimate worst-case ambient concentrations of carbon monoxide near roadway intersections in the project area, such analyses were not prepared for this project. However, based on the larger-scale analysis that was performed, it appears likely that emissions from project traffic would not have a significant adverse impact on air quality in the project area. Project development will include the realignment and improvement of Honoapiilani Highway in the Olowalu area. Project plans call for the development of "O-turn" intersections. O-turn intersections keep traffic flowing continuously without stoplights or over/underpasses. The O-turn design features long merge lanes which allow for easy turns. Maximum carbon monoxide concentrations typically occur near congested intersections where traffic queuing occurs. The O-turn intersections will serve to eliminate traffic queuing, which will reduce the possibility of carbon monoxide "hot spots".

Depending on the demand levels, long-term impacts on air quality are also possible due to indirect emissions associated with a development's electrical power and solid waste disposal requirements. Quantitative estimates of these potential impacts were not made, but any significant air quality impacts are unlikely.

Based on the results of the analyses of the potential long-term effects of the project, it may be concluded that the proposed project would likely not have a significant impact on the air quality of the area. Although options are available to mitigate long-term traffic-related air quality impacts, requiring these to be implemented is probably unnecessary and unwarranted in this case. Incorporating energy conservation design features and promoting conservation and recycling programs within the proposed development could serve to further reduce any indirect impacts due to electric power usage and to solid waste disposal and would help to conserve the island's resources.

2.0 INTRODUCTION

Olowalu Town, LLC is proposing to develop the Olowalu Town Project on the island of Maui at the village of Olowalu (see Figure 1 for general project location). The proposed project would involve the development of a master-planned community at Olowalu that would include approximately 1,500 residential dwelling units, neighborhood town centers for commercial retail and office space, areas for public facilities, parks, open spaces, and other associated facilities and infrastructure improvements. A major portion of the project would also involve the realignment of Honoapiilani Highway to a more mauka location. The highway would also be widened and intersection improvements would be constructed. The proposed development would be constructed in phases over a 10-year period.

The purpose of this study was to evaluate the potential air quality impacts of the proposed project and recommend mitigative measures, if possible and appropriate, to reduce or eliminate any project-related degradation of air quality in the area. Before examining the potential impacts of the project, a discussion of ambient air quality standards is presented and background information concerning the regional and local climatology and the present air quality of the project area is provided.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit. On the other hand, the current

Hawaii AAQS for sulfur dioxide are probably less stringent than the national standards. During the early part of 2010, the national primary annual and 24-hour standards for sulfur dioxide were revoked in favor of a new national 1-hour standard which is considered to be more stringent than the Hawaii short-term standards. The Hawaii AAQS for sulfur dioxide have not yet been updated to bring them in line with the national standards.

In 1993, the state revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards were challenged in federal court. A Supreme Court ruling was issued during February 2001, and as a result, the new standards for particulate were finally implemented during 2005. To date, the Hawaii Department of Health has not updated the state particulate standards.

In September 2001, the state vacated the state 1-hour standard for ozone and an 8-hour standard was adopted that was the same as the national standard. During 2008, the national standard for ozone was again revised and made more stringent. The Hawaii standard for ozone has not yet been amended to follow the national standard.

During the latter part of 2008, EPA revised the standard for lead making the standard more stringent. So far, the Hawaii Department of Health has not revised the corresponding state standard for lead.

During early 2010, a national 1-hour primary standard for nitrogen dioxide was implemented. To date, Hawaii has not promulgated a 1-hour standard for nitrogen dioxide, but the

Hawaii annual standard for this pollutant is more stringent than the national annual standard.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affect the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

The topography of Maui is dominated by the great volcanic masses of Haleakala (10,023 feet) and the West Maui Mountains (5,788 feet). The island consists entirely of the slopes of these mountains and of a connecting isthmus. Haleakala is still considered to be an active volcano and last erupted about 1790. The project site is located along the lower southwestern slope of the West Maui Mountains at an elevation of about 300 feet or less.

Maui lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. Because the project area is located on the lower southwestern slope of the West Maui Mountains, it is sheltered much of the time from the northeast trade winds. Local winds such as land/sea breezes and/or upslope/downslope winds also influence the wind pattern for the area. During the daytime, winds can typically be expected to move onshore because of seabreeze and/or upslope effects or because of the aerodynamic cavity caused by the trade winds flowing around the mountains. At night, winds are often drainage winds that move downslope and out to sea. During winter, occasional strong winds from the south or southwest occur in association with the passage of winter storm systems.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depends to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. The project site's lower elevation and leeward location results in warmer temperatures compared with many other parts of the island. At Lahaina, which is about 5 miles to the north of the project area and at an elevation of about 50 feet, average daily minimum and maximum temperatures are 65°F and 84°F, respectively [1]. Temperatures at the project site can be expected to be very similar to this.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 is the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Olowalu area, stability classes 5 or 6 typically occur during the nighttime or early morning hours when temperature inversions form due to radiational cooling or to drainage flow from the nearby mountains. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in Hawaii typically are above 3,000 feet (1,000 meters).

Rainfall can have a beneficial affect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The climate of the project area is very dry due to the leeward location. Historical records Olowalu show that this area of Maui averages about only 11 inches of precipitation per year with the summer months being the driest [1].

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from vehicular, industrial, natural and/or agricultural sources. Table 2 presents an air pollutant emission summary for the island of Maui for calendar year 1993. This is the most recent year for which an island-wide emission inventory is available. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, most of the manmade particulate and sulfur oxides emissions on Maui originate from point sources, such as power plants and other fuel-burning industries. Nitrogen oxides emissions are roughly equally divided between point sources and area sources (mostly motor vehicle traffic). The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic and sugar cane burning), while hydrocarbons are emitted mainly from point sources. Emissions today are probably higher than those shown in the table, but the proportional relationships are likely about the same.

The largest sources of air pollution in the immediate project area are most likely agricultural operations, automobile traffic using local roadways and the power plant at Maalaea. Emissions from the agricultural and motor vehicle sources consist primarily of particulate, carbon monoxide and nitrogen oxides. The power plant at Maalaea mostly emits sulfur dioxide, nitrogen oxides and particulate. Emissions from this facility will be carried offshore most of the time by the prevailing winds. Volcanic emissions from distant natural sources on the Big Island also affect the air quality at times during kona wind conditions. By the time the volcanic emissions reach the project area, they consist mostly of fine particulate sulfate.

The State Department of Health operates a network of air quality monitoring stations at various locations around the state, but only very limited data are available for Maui Island. The only air quality data for the project area consists of particulate measurements collected at Kihei (about 10 miles to the east). Although it is doubtful if this data is representative of the Olowalu area, it is the only air quality data available for all of Maui.

Table 3 summarizes the data from the Kihei monitoring station. Annual second-highest 24-hour PM-10 particulate concentrations (which are most relevant to the air quality standards) ranged from 60 to 119 $\mu g/m^3$ between 2005 and 2008. Average annual concentrations ranged from 20 to 26 $\mu g/m^3$. One exceedance of the state standard was recorded during 2005. This was reported to be due to agricultural tilling operations in the area. Another exceedance of the standard was reported during 2007. This was considered an exceptional event due to a brush fire nearby. Monitoring of PM-10 at the Kihei monitoring station was discontinued in 2009.

As indicated in Table 3, PM-2.5 particulate is also monitored at the Kihei monitoring station. Annual 24-hour 98^{th} percentile PM-2.5 particulate concentrations (which are most relevant to the air quality standards) ranged from 8 to 16 $\mu g/m^3$ between 2005 and 2009. Average annual concentrations ranged from 4 to 6 $\mu g/m^3$. One relatively high value was flagged during 2006 due to fireworks. No exceedances of the state standard were recorded during this period.

Given the limited air pollution sources in the area, it is likely that air pollution concentrations are near natural background levels most of the time, except possibly for locations adjacent to agricultural operations or near traffic-congested intersections.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur during project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site and from the disruption of traffic due to road construction.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with land clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [2] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions in the project area would likely be somewhere near this level or possibly lower due to the rocky nature of the soil in the area. In any case, State of Hawaii Air Pollution Control Regulations [3] prohibit visible emissions of fugitive dust from construction activities at the project boundary, and thus an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is oftentimes a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Indirectly, slow-moving construction vehicles on roadways leading to and from the project area could obstruct the normal flow of traffic to such an extent that overall vehicular emissions are increased, but this impact can be mitigated by moving heavy construction equipment during periods of low traffic volume. Likewise, road closures during peak traffic periods should be avoided to the extent possible to minimize air pollution impacts from traffic disruption. Thus, with careful planning and attention to dust control, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

7.1 Roadway Traffic

After construction is completed, use of the proposed facilities will result in increased motor vehicle traffic in the project area, potentially causing long-term impacts on ambient air quality. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments. This legislation required further emission reductions, which have been phased in since 1994. More recently, additional restrictions were signed into law during the Clinton administration, and these began to take effect during the past decade. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles are retired and leave the state's roadways. It is estimated that carbon monoxide emissions, for example, will go down by an average of about 20 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

To evaluate the potential air quality impact of the proposed project, a mesoscale analysis was performed. A mesoscale analysis is a larger scale evaluation of daily and annual emissions from the roadway network in the project area. For this project, the mesoscale analysis was designed to quantify project-related emissions of carbon monoxide, nitrogen oxides and hydrocarbons occurring from motor vehicle traffic using Honoapiilani Highway in the Olowalu area. Emission estimates were prepared for the existing case and for the future (year 2020) with and without project scenarios.

The mesoscale emission estimates for each scenario were made by first obtaining the estimated average daily traffic (ADT) volumes and average travel speeds (ATS) for the section of highway under study from the project traffic impact analysis report [4]. The length of the section of highway included in the project is approximately 2.3 miles. Total vehicle-miles per day were then calculated, and emission estimates were prepared for each scenario based on the estimated vehicle-miles of travel, average travel speeds, and U.S. EPA emission factors obtained using the computer model MOBILE6.2 [5]. MOBILE6.2 is the most recently released version of the EPA mobile emission model. Aside from vehicle speed, several other key inputs are required by the model. One of these is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for the present study. Based on national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 34.2% light-duty gasoline-powered automobiles, 52.8% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.6% heavy-duty diesel-powered trucks and buses, and 0.6% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change somewhat with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans.

Another key input to MOBILE6.2 is ambient temperature. An average ambient temperature 77 degrees F was used for all of the mesoscale emission computations.

The resulting emission factors generated by MOBILE6.2 are given in terms of grams of volatile organic compounds (VOC), carbon monoxide (CO) and nitrogen oxides (NOx) emitted per vehicle mile. Within the speed range of interest, emission factors for carbon monoxide and nitrogen oxides are generally proportional to vehicle speed, while emission factors for VOC are inversely proportional to vehicle speed. It should also be noted that at a given vehicle speed emission factors are generally lower for future years due to the effects of older, more-polluting vehicles being retired.

Table 4 provides the details of the mesoscale analysis. A summary of the results is presented below:

Scenario	Emissions (tons/year)		
	CO	NOx	VOC
2011 Existing	237	24	19
2020 Without Project	189	11	12
2020 With Project	226	13	13

In comparison to the island-wide emissions given in Table 2, emissions in the year 2011 from traffic using Honoapiilani Highway within the project area were relatively small, amounting to about 1 percent or less.

Without the project in the year 2020, carbon monoxide emissions within the project area were estimated to decrease by about 20 percent compared to existing emissions, nitrogen oxides emissions were estimated to decrease by about 54 percent and VOC emissions were estimated to decrease by about 37 percent.

With the project in the year 2020, emissions of carbon monoxide and nitrogen oxides would increase by about 20 percent each while VOC emissions would increase by about 8 percent compared to the without-project case. Although emissions would increase by relatively small amounts with the project compared to without it in the year 2020, emissions would be lower than the existing emission levels. Compared to island-wide emissions, traffic-related emissions in the project area would be relatively small.

7.2 Electrical Demand

The proposed project also will cause indirect air pollution emissions from power generating facilities as a consequence of electrical power usage. Electrical power for the project will most probably be provided mainly by oil-fired generating facilities, but some of the project power may also be derived from photovoltaic systems, wind power or other alternative energy sources. In order to meet the electrical power needs of the proposed project, power generating facilities will likely be required to burn more fuel and hence more air pollution will be emitted at these facilities. Estimates of project electrical demand are not available, but it is probable that any associated indirect air pollution emissions will be small in terms of the island-wide emission estimates given in Table 2.

7.3 Solid Waste Disposal

Solid waste generated by the proposed development may result in indirect offsite emissions of air pollution. Currently, all solid waste on the island of Maui is buried at solid waste landfills. Thus, assuming this continues to be the method for solid waste disposal, the only associated air pollution emissions that will occur will be from trucking the waste to the landfill and burying it. Estimates of the amount of solid waste generated by the proposed project are not yet available, but any associated air pollution emissions should be relatively minor.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Existing Conditions

Although very little ambient air quality data are available to characterize existing conditions, it is likely that state and federal ambient air quality standards are currently being met in the project area, except perhaps for occasional exceedances of the stringent state carbon monoxide standards within small areas near traffic-congested locations.

Short-Term Impacts and Mitigation

The major potential short-term impact of the project on air quality will occur from the emission of fugitive dust during construction. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall and other factors. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall.

Use of wind screens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the project that have been disturbed could be controlled by mulching or chemical stabilization. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Establishment of landscaping early in the construction schedule will also help to control dust.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from the disruption of normal traffic flow. Increased vehicular emissions due to the disruption of traffic can be alleviated by minimizing road closures during peak traffic hours.

Long-Term Impacts

Traffic-related emissions from the project are relatively small compared to island-wide emissions. Without the project by the year 2020, mesoscale analysis indicates that emissions of carbon monoxide, nitrogen oxides and VOC from motor vehicles operating within the project study area would decrease substantially despite the higher traffic volumes from general growth over the next several years. This is because the higher traffic volumes would be more than offset by the retirement and replacement of older vehicles that have less efficient emission control systems.

With the proposed project in the year 2020, emissions of carbon monoxide and nitrogen oxides would increase by about 20 percent each compared to the without-project case and VOC emissions would increase by about 8 percent. Even with these relatively small increases, emissions in the year 2020 would be lower than the existing emissions. Although a more detailed microscale analysis of carbon monoxide concentrations near specific intersections could be performed, it is unlikely that the relatively small increase in carbon monoxide emissions from project-related traffic will result in any significant impacts on air quality in the project area, especially if sufficient roadway capacity is provided. Project plans call for the development of "O-turn" intersections. O-turn intersections keep traffic flowing continuously without stoplights or over/underpasses. The O-turn design features long merge lanes which allow for easy turns. Maximum carbon monoxide concentrations typically occur near congested intersections where traffic queuing occurs. The O-turn intersections will serve to reduce the possibility of carbon monoxide "hot spots".

Any long-term impacts on air quality due to indirect emissions from supplying the project with electricity and from the disposal of solid waste materials generated by the project will likely be small.

Long-Term Mitigation

Options available to mitigate long-term, traffic-related air pollution are generally to further improve roadways, to reduce traffic and/or to reduce individual vehicular emissions. Aside from providing added roadway improvements, air pollution impacts from vehicular emissions could conceivably be additionally mitigated by reducing traffic volumes through the promotion of bus service and car pooling in the project area and/or by adjusting local school and business hours to begin and end during off-peak times. This mitigation measure is generally considered only partially successful. Reduction of emissions from individual vehicles would have to be achieved through the promulgation of local, state or federal air pollution control regulations. For example, Hawaii currently does not require annual inspections of motor vehicle air pollution control equipment. However, at the present time there is no indication that the state is contemplating adopting such rules.

Indirect emissions from project electrical demand could likely be reduced somewhat by incorporating energy-saving features into project design requirements. This might include the use of solar water heaters; designing building space so that window positions maximize indoor light without unduly increasing indoor heat; using landscaping where feasible to provide afternoon shade to cut down on the use of air conditioning; installation of insulation and double-glazed doors to reduce the effects of the sun and heat; providing movable, controlled openings for ventilation at opportune times; and possibly installing automated room occupancy sensors. Promoting conservation and recycling programs within the proposed development could serve to further reduce any indirect impacts due to solid waste disposal and would help to conserve the island's resources.

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Figure 1 - Project Location

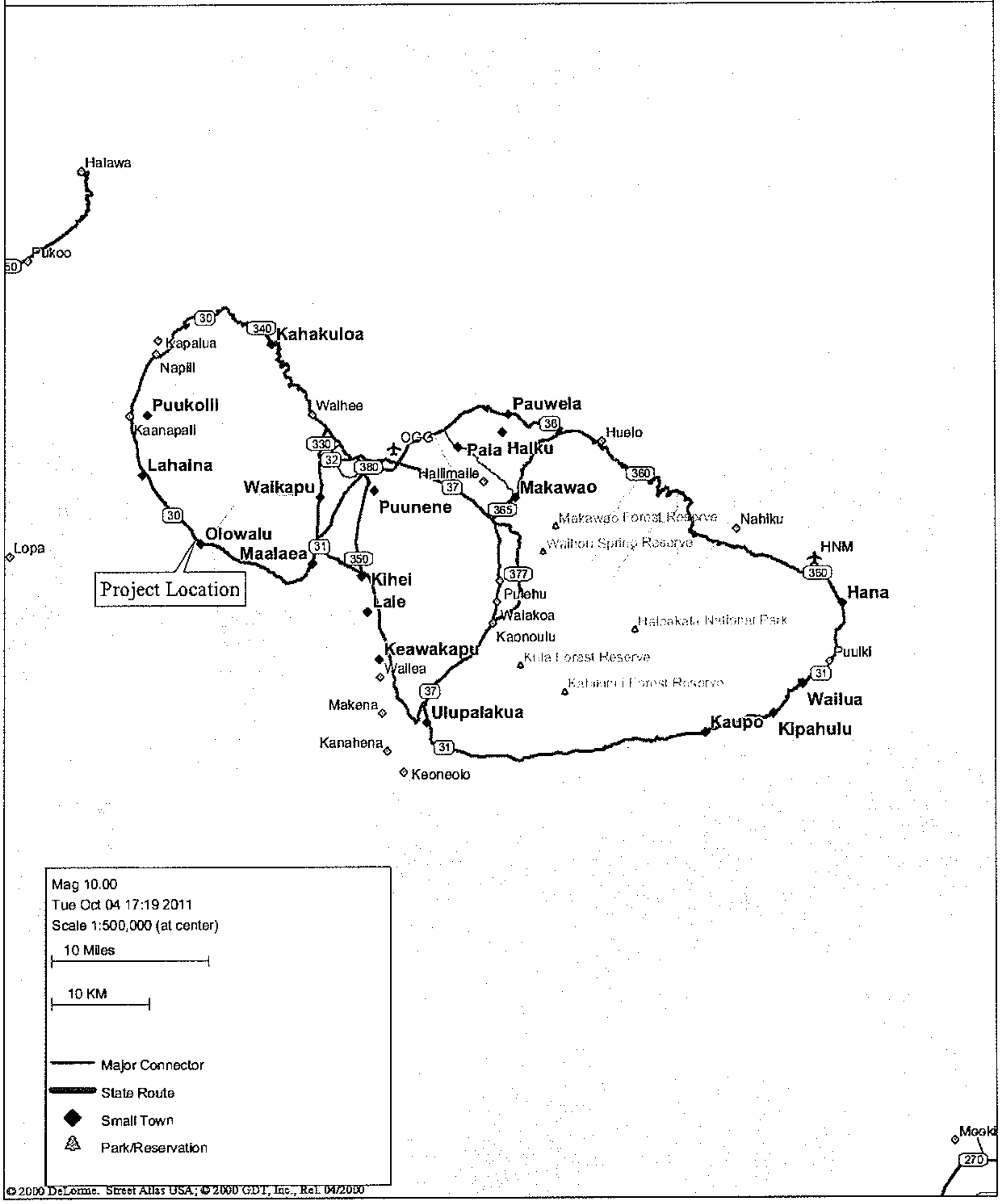

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual	-	-	50
		24 Hours	150[a]	150[a]	150[b]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual	15[c]	15[c]	-
		24 Hours	35[d]	35[d]	-
Sulfur Dioxide	ppm	Annual	-	-	0.03
		24 Hours	-	-	0.14[b]
		3 Hours	-	0.5[b]	0.5[b]
		1 Hour	0.075[e]	-	-
Nitrogen Dioxide	ppm	Annual	0.053	0.053	0.04
		1 Hour	0.100[f]	-	-
Carbon Monoxide	ppm	8 Hours	9[b]	-	4.4[b]
		1 Hour	35[b]	-	9[b]
Ozone	ppm	8 Hours	0.075[g]	0.075[g]	0.08[g]
Lead	$\mu g/m^3$	3 Months	0.15[h]	0.15[h]	-
		Quarter	1.5[i]	1.5[i]	1.5[i]
Hydrogen Sulfide	ppm	1 Hour	-	-	35[b]

[a] Not to be exceeded more than once per year on average over three years.
[b] Not to be exceeded more than once per year.
[c] Three-year average of the weighted annual arithmetic mean.
[d] 98th percentile value of the 24-hour concentrations averaged over three years.
[e] Three-year average of annual fourth-highest daily 1-hour maximum.
[f] 98th percentile value of the daily 1-hour maximum averaged over three years.
[g] Three-year average of annual fourth-highest daily 8-hour maximum.
[h] Rolling 3-month average.
[i] Quarterly average.

Table 2

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF MAUI, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	63,275	7,030	70,305
Sulfur Oxides	6,419	nil	6,419
Nitrogen Oxides	7,312	8,618	15,930
Carbon Monoxide	4,612	20,050	24,662
Hydrocarbons	1,991	234	2,225

Source: Final Report, "Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii", prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 3

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST OLOWALU TOWN PROJECT

Parameter / Location	2005	2006	2007	2008	2009
Particulate (PM-10) / Kihei					
24-Hour Averaging Period:					
No. of Samples	337	337	326	331	-
Highest Concentration (μg/m^3)	155	72	281[a]	78	-
2nd Highest Concentration (μg/m^3)	119	66	93	60	-
No. of State AAQS Exceedances	1	0	1[a]	0	-
Annual Average Concentration (μg/m^3)	25	22	26	20	-
Particulate (PM-2.5) / Kihei					
24-Hour Averaging Period:					
No. of Samples	108	109	78	58	358
Highest Concentration (μg/m^3)	10	30[b]	11	16	26
98th Percentile Concentration (μg/m^3)	8	10	10	15	16
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (μg/m^3)	5	5	5	6	4

[a]Exceptional event (brush fire)

[b]Data flagged due to fireworks

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 2005 - 2009"

Table 4

ESTIMATED EMISSIONS FOR HONOAPIILANI HIGHWAY AT OLOWALU

Scenario	Segment Length (miles)	Average Daily Traffic Volume	Vehicle Miles Per Day	Average Travel Speed (mph)	Emission Factors (grams/veh-mile)			Emissions (lb/day)			Emissions (tons/yr)		
					CO	NOx	VOC	CO	NOx	VOC	CO	NOx	VOC
Existing	2.3	22,840	52,532	43.1	11.2	1.12	0.891	1,297	130	103	237	24	19
2020 Without Project	2.3	24,470	56,281	42.0	8.34	0.478	0.520	1,035	59	64	189	11	12
2020 With Project	2.1	29,850	62,685	50.0	8.95	0.505	0.496	1,237	70	69	226	13	13