APPENDIX D

AIRPORT MODELING STUDIES

Carbon Monoxide Emissions Inventory
And
Dispersion Modeling Study Update 2003

McCarran International, North Las Vegas and Henderson
Executive airports

Prepared for:
Clark County Department of Aviation

Prepared by:
Ricondo & Associates, Inc.

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I. Introduction

The Clark County Department of Air Quality Management is preparing a maintenance plan application for Carbon Monoxide (CO) for the Clark County nonattainment area, Hydrographic Basin 212. This report documents air pollutant emissions inventories conducted for McCarran International Airport, North Las Vegas Airport, and Henderson Executive Airport in support of the CO maintenance plan application. Emissions inventories were conducted for: 2000, 2005, 2010, 2015, and 2020. This report also documents the methodology used to perform atmospheric dispersion of base year (2000) and future-year airport-related CO emissions. The results (CO concentration estimates) of the dispersion analyses are presented in Section VII of this report.

1.1 Regulatory Framework

The federal Clean Air Act,[1] as amended, requires that States identify those areas where the National Ambient Air Quality Standards (NAAQS) are not met for specific air pollutants. The U.S. Environmental Protection Agency (EPA) designates such areas as nonattainment areas. A State with one or more nonattainment areas must prepare a State Implementation Plan (SIP) for each nonattainment area that details the programs and requirements that the state will implement in order to meet the NAAQS by the deadlines specified in the Clean Air Act Amendments of 1990 (CAAA).[2] SIPs must address each pollutant for which the NAAQS are not met.

The Clean Air Act, as amended, further requires that federal actions be found in conformity with approved SIPs. Actions not in conformity with the SIP may not be eligible for federal funding or for federal approvals, such as the FAA's approval of an ALP. The EPA has published a final rule regarding general conformity determinations that applies to the proposed federal action.[3] The final rule includes thresholds of changes in annual emissions for projects within nonattainment areas and maintenance areas that trigger the need for a conformity determination. Generally, to comply with the basic conformity requirements, two criteria must be met: (1) the total direct and indirect pollutant emissions associated with a project must be below *de minimis*[4] emissions levels, and (2) the pollutant emissions from the project must not be regionally significant (i.e., the project does not contribute 10% or more of the region's total emissions for a criteria pollutant).

1.2 Pollutants

The EPA has established national ambient standards for six criteria pollutants. The six criteria pollutants are described in the following paragraphs.

Ozone (O_3), commonly referred to as smog, is formed in the atmosphere rather than being directly emitted from pollutant sources. Ozone forms as a result of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) reacting in the presence of sunlight in the atmosphere. Ozone levels are highest in warm-weather months. VOCs and NO_x are termed "ozone precursors" and their emissions are regulated in order to control the creation of ozone.

[1] U.S. Congress. *Clean Air Act of 1970.* Public Law 91-604, 31 December 1970.
[2] U.S. Congress. *Clean Air Act Amendments of 1990.* Public Law 101-49, 15 November 1990.
[3] U.S. Environmental Protection Agency. *General Conformity Final Rule*. 40 CFR Parts 6, 51, and 93, 30 November, 1993.
[4] The *de minimis* levels are the thresholds of changes in annual emissions associated with a project that determine the need for a conformity determination. If changes in annual emissions are above the *de minimis* levels a conformity determination is required.

Ozone damages lung tissue and reduces lung function. Scientific evidence indicates that ambient levels of ozone not only affect people with impaired respiratory systems (e.g., asthmatics), but also healthy children and adults. Ozone can cause health effects such as chest discomfort, coughing, nausea, respiratory tract and eye irritation, and decreased pulmonary functions.

Carbon monoxide (CO) is an odorless, colorless gas that is highly toxic. It is formed by the incomplete combustion of fuels. The primary sources of this pollutant in Clark County are automobiles and other ground-based vehicles. The health effects associated with exposure to CO are related to its affinity for hemoglobin in the blood. At high concentrations, CO reduces the amount of oxygen in the blood, causing heart difficulties in people with chronic diseases, reduced lung capacity, and impaired mental abilities.

Particulate matter (PM-10) consists of solid and liquid particles of dust, soot, aerosols, and other matter small enough to remain suspended in the air for a long period of time. PM-10 refers to particulate matter less than 10 microns in diameter and represents that portion of particulate matter thought to represent the greatest hazard to public health. Particulate matter can accumulate in the respiratory system and is associated with a variety of negative health effects. Exposure to particulates can aggravate existing respiratory conditions, increase respiratory symptoms and disease, decrease long-term lung function, and possibly cause premature death. The segments of the population which are most sensitive to the negative effects of particulate matter in the air are the elderly, individuals with cardiopulmonary disease, and children. Aside from physical negative effects, particulate matter in the air causes a reduction of visibility and damage to paints and building materials.

A portion of the particulate matter in the air comes from natural sources such as windblown dust and pollen. Manmade sources of particulate matter include combustion of materials, automobiles, field burning, factories, vehicle movement or other manmade disturbances of unpaved areas, and photochemical reactions in the atmosphere. Secondary formation of particulate matter may occur in some cases where gases such as sulfur oxides (SO_x) and nitrogen oxides (NO_x) interact with other compounds in the air to form particulate matter. Fugitive dust generated by construction activities is a major source of suspended particulate matter.

The secondary creators of particulate matter, SO_x and NO_x are also major precursors to acidic deposition (Acid rain). While SO_x is a major precursor to particulate matter formation, NO_x has other environmental effects. NO_x has the potential to change the composition of some species of vegetation in wetland and terrestrial systems, to create the acidification of freshwater bodies, impair the aquatic visibility, create eutrophication of estuarine and coastal waters, and increase the levels of toxins harmful to aquatic life.

Nitrogen dioxide (NO_2) Nitrogen dioxide (NO_2) is a poisonous, reddish-brown to dark brown gas with an irritating odor. NO_2 forms when nitric oxide (NO) reacts with atmospheric oxygen (O_2). Most sources of NO_2 are man-made sources; the primary source of NO_2 is high-temperature combustion. Significant sources of NO_2 at airports are boilers, aircraft operations, and vehicle movements. NO_2 emissions from these sources are highest during high-temperature combustion, such as aircraft takeoff mode.

NO_2 may produce adverse health effects such as nose and throat irritations, coughing, choking, headaches, nausea, stomach or chest pains, and lung inflammations (e.g., bronchitis, pneumonia).

Sulfur dioxide (SO_2) is formed when fuel containing sulfur (typically, coal and oil) is burned, during the metal smelting process, and during other industrial processes. Large SO_2 concentrations are found in the vicinity of large industrial facilities. The physical effects of SO_2 include temporary breathing impairment, respiratory illness, and aggravation of existing cardiovascular disease. Children and the elderly are most susceptible to the negative effects of exposure to SO_2.

Lead (Pb) is a heavy metal solid that is bluish-white to silvery gray in color. Lead occurs in the atmosphere as lead oxide aerosol or lead dust. Historically a significant source of lead in the air at airports was ground access vehicles operating on leaded gasoline. The amount of lead emissions from vehicles has decreased, however, due to the significant federal controls on leaded gasoline and the resultant increase in the use of unleaded gasoline in catalyst-equipped cars. Another source of this pollutant at the Airport is the combustion of leaded aviation gasoline in piston-engine aircraft.
Another group of substances knows as Hazardous Air Pollutants (HAPs) are injurious in small quantities and are regulated despite the absence of criteria documents. The identification, regulation, and monitoring of HAPs are relatively recent compared with such activities for criteria pollutants. The Airport is a minor source of HAPs in the region. HAPs can be generated by the combustion of natural gas for space and water heating, fuel storage and handling, and aircraft maintenance activities, which are sporadic sources of small amounts of benzene, formaldehyde, toluene, and xylene.

1.3 Standards

Federal and Clark County ambient air quality standards are summarized in **Table I-1**. The Clark County Department of Air Quality Management (DAQM) has established ambient air quality standards for the six criteria pollutants that apply to projects in Clark County, Nevada. As shown in Table I-1, Clark County standards are identical to the federal standards for all criteria pollutants except nitrogen dioxide (NO_2) and sulfur dioxide (SO_2). For both NO_2 and SO_2, the Clark County standard is more stringent than the federal standard. Portions of Clark County defined as Hydrographic Basin 212, including the Airport environs area, are currently designated as serious nonattainment areas for both carbon monoxide (CO) and particulate matter (PM-10).

1.4 CO State Implementation Plan

In 1992, the Clark County Board of Commissioners adopted the *Carbon Monoxide Air Quality Implementation Plan* (CO SIP) in response to the area being designated as a serious nonattainment zone for CO by the U.S. EPA. In 1995 the CO SIP was revised and in August 2000 the most recent CO SIP was submitted to the U.S. EPA. The current SIP document demonstrates that the County can attain and maintain air quality standards at budgeted emissions levels with the adoption and implementation of control measures. The control measures are described in detail in the SIP.

The Clark County Department of Aviation, which operates Las Vegas McCarran International, North Las Vegas, and Henderson Executive airports participated in the most recent update to the County's CO SIP. Emissions budgets contained in the EPA-approved CO SIP account for existing Airport-related emissions and address forecast growth in activity at Clark County controlled airports. Annual airport-related CO emissions account for less than 1% of the total CO emissions in the Las Vegas Valley.

Table I-1

Ambient Air Quality Standards in Clark County, Nevada

Pollutant	Averaging Time	Ambient standards (Parts per million unless otherwise noted) Federal standard	Clark County standard
Ozone (O_3)	1-hour	0.12	0.12
Carbon Monoxide (CO)	8-hour	9.0	9.0
	1-hour	35.0	35.0
Nitrogen Dioxide (NO_2)	Annual	0.053	0.050
Sulfur Dioxide (SO_2)	Annual	0.03	0.02
	24-hour	0.14	0.10
	3-hour	0.50	0.50
PM-10	AGM	50 $\mu g/m^3$	50 $\mu g/m^3$
	24-hour	150 $\mu g/m^3$	150 $\mu g/m^3$
Lead	Quarter mean	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

AGM = Annual geometric mean
$\mu g/m^3$ = Micrograms per cubic meter
PM-10 = Suspended particulate matter

Hydrographic Basin 212 is non-attainment for the 8 hour CO standard and the Annual and 24 hour standard for PM-10.

Source: District Board of Health of Clark County, *Air Pollution Control Regulations,* Section 11, Revised May 27, 1993, and U.S. Congress, *Clear Air Act Amendments of 1970* (Public Law 91-604 δ 109 and 110).
Prepared by: Ricondo & Associates, Inc.

II. Modeling Tools

The development of airport CO emissions inventories and the atmospheric dispersion of airport-related CO emissions were conducted using the Emissions and Dispersion Modeling System (EDMS). EDMS is the Environmental Protection Agency's (EPA's) preferred guideline model for air quality analyses at airports. EDMS is a combined emissions and dispersion model developed by the Federal Aviation Administration (FAA) in cooperation with the United States Air Force (USAF). The primary applications of the model are (1) generating an inventory of emissions caused by sources on and around an airport or air base and (2) calculating pollutant concentrations in the surrounding environment. System data tables include emissions factors for civilian and military aircraft, civilian ground support equipment, and civilian motor vehicles. Civilian motor vehicle emissions factors in EDMS are based on MOBILE5b modeling for vehicle fleets between 1997 and the year 2020. Mobile 6A emissions factors developed by the Clark County Department of Air Quality Management were used in lieu of emissions factors incorporated in the EDMS database to model particulate emissions for on-road motor vehicles. These emissions factors more accurately represent conditions in the Las Vegas metropolitan area. Both the emissions inventory and dispersion modeling modules interact with the system database to retrieve and store data.

The EDMS emissions inventory module incorporates EPA-approved methodologies for calculating aircraft emissions, on- and off-road vehicle emissions, and stationary source emissions. Pollutants currently included in EDMS for emissions inventories are carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x), oxides of sulfur (SO_x), and particulate matter less than 10 microns in diameter (PM-10).

In 2001, the FAA re-engineered EDMS to incorporate new data and algorithms and released EDMS Version 4.0.[5] EDMS Version 4.x includes advances in data inputs for aircraft performance and Aircraft Power Units (APUs) and new data for dispersion. EDMS 4.x generates input files for AERMOD - a powerful next-generation dispersion model developed by the EPA. Earlier versions of the EDMS included algorithms from the EPA's PAL2 and CALINE 3 dispersion models. Concentrations estimates produced by the new version of EDMS can be compared with all of the Primary National Ambient Air Quality Standards (NAAQS) and most of the Secondary NAAQS.

[5] The FAA subsequently released Versions 4.1 and 4.11 of the EDMS. EDMS 4.11 is the most current release of the model and was used for the Carbon Monoxide Emissions and Dispersion Modeling Study update.

III. Airport-Related Emissions

The EDMS was used to estimate airport-related CO emissions from the following sources:

- Aircraft
- Ground service equipment (GSE)
- Ground access vehicles (associated with movements on roadways and in parking lots)
- Point sources, such as power plants, incinerators, fuel tanks, and surface coating facilities

The methodologies and assumptions incorporated in the base and future year CO emissions inventories are described in the sections that follow. A detailed discussion of the CO dispersion modeling process is provided in Section V.

3.1 Aircraft Emissions

Annual aircraft emissions are a function of the number of annual aircraft operations expressed as landing and takeoff (LTO) cycles, the aircraft fleet mix (types of aircraft used), and the length of time aircraft spend taxiing and idling on the ground. The EDMS database contains an expansive list of aircraft types (airframes) and engine types for use in air quality analyses. Emissions associated with individual aircraft operations are a function of the aircraft operating mode (i.e. taxi/idle, takeoff, climb-out, etc.), and are estimated using emissions factors associated with particular engine types and operating modes. Key assumptions used for estimating of aircraft-related CO emissions follow.

3.1.1 Aircraft LTO Cycles and Fleet Mix

Tables III-1, III-2, and III-3 summarize 2000 annual LTO cycles by EDMS aircraft type for McCarran International, North Las Vegas, and Henderson Executive airports, respectively. Information contained in the tables is based on data provided by the Clark County Department of Aviation and supplemental sources as noted below.

- For McCarran International Airport, year 2000 aircraft activity (LTO cycles) inputs were based FAA Airport Traffic Control Tower (ATCT) operations summaries. Aircraft engine types modeled for each aircraft type were identified by Ricondo & Associates using information obtained from Brown-Buntin Associates, Inc., Back Information Services and from the Department of Aviation's airline operations summaries.

- For North Las Vegas Airport, year 2000 aircraft activity (LTO cycles) inputs were based on summaries of operations prepared by the Department of Aviation using data provided by the FAA Airport Traffic Control Tower (ATCT). The aircraft fleet mix is based on information contained in the report *Final Environmental Assessment, Runway 12L-30R, North Las Vegas,* prepared by Leigh Fisher Associates. Default EDMS engine types were used for all aircraft types modeled for North Las Vegas Airport.

- For Henderson Executive Airport, year 2000 aircraft activity (LTO cycles) inputs were based on summaries of operations prepared by the Department of Aviation using data provided by the FAA Airport Traffic Control Tower (ATCT). The aircraft fleet mix is based on information contained in the report *Final Environmental Assessment, Master Plan Report Recommendations, Henderson Executive Airport,* prepared by Leigh Fisher Associates. Default EDMS engine types were used for all aircraft types modeled for Henderson Executive Airport.

Table III-1

2000 Aircraft Fleet Mix and Annual LTO Cycles – McCarran International Airport

Aircraft Type	EDMS Type	Engine Type	2000 Annual LTO Cycles (a)(b)
Heavy Air Carrier Jet			
B-747/777	B747-200	JT9D-7Q	520
A300/310/330	A300B	CF6-50C	443
L-1011	L-1011-100	RB211-22B	601
DC-10	DC10-30	CF6-50C2	2,838
B-767	B767-200ER	PW4060	1,907
DC-8-60/70	DC8-70	CFM56-2C5	3
Subtotal			6,309
Air Carrier Jet			
B-727-200	B727-200	JT8D-15	4,462
	B727-200	JT8D-17	203
	B727-200	JT8D-9	138
	B727-200	JT8D-9A	821
B-737-200	B737-200	JT8D-15	5,580
	B737-200	JT8D-17	123
	B737-200	JT8D-9A	5,304
B-737-300	B737-300	CFM56-3-B1	54,400
	B737-300	CFM56-3B-2	1,842
	B737-300	CFM56-3C-1	9,539
B-737-400	B737-400	CFM56-3C-1	1,530
B-737-500	B737-500	CFM56-3-B1	8,313
	B737-500	CFM56-3C-1	3,579
B-737-700	B737-700	CFM56-7B22	11,273
	B737-700	CFM56-7B24	373
B-737-800	B737-800	CFM56-7B26	2,757
B-757	B757-200	PW2037	17,268
	B757-200	PW2040	2,128
	B757-200	RB211-535C	16,556
A-319	A319	CFM56-5B6/P	2,108
	A319	V2524-A5	3,469
A-320	A320	CFM56-5B4	71
	A320	V2500A-1	433
MD-80	MD80	JT8D-217	10,104
	MD80	JT8D-219	6,370
MD-90	MD90-10	V2522-D5	268
DC-9-30	DC9-30	JT8D-17	1,531
Canadair	Reg-100	CF34-3A1	845
Subtotal			170,543
Commuter Propeller			
Dash-6	DHC-6	PT6A-27	399
Dash-8-400	DHC-8-400	PW123	561
F-27	F-27 SERIES	RDa7	1,252
SF-340	SF-340-A	CT7-5	677
EMB-120	EMB-120	PW118	757
Beech-99	BH-C99	PT6A-27	966
Subtotal			3,646
Business Jet			
Large stage 2	Gulfstream II	SPEY MK511-8	1,109
Medium / small stage 2	Learjet 25B	CJ610-6	1,894
Large stage 3	Gulfstream IV	TAY Mk611-8	6,283
Medium / small stage 3	Learjet 35/36	TFE 731-2-2B	10,732
Subtotal			9,285
General Aviation / Military Propeller			
Twin engine turboprop	Kingair 200	PT6A-41	2,826
Twin engine piston prop	Aztec	TIO-540-J2B2	10,411
Single engine piston prop	Cherokee six	TIO-540-J2B2	8,751
Subtotal			13,237
Air Tour / GA Helicopters	Bell 206	250B17B	36,303
Military Fighter / Trainer	F16	F100-PW-100	30
Total Annual LTO Cycles			239,354

(a) LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
(b) LTO subtotals may not equal the sum of individual aircraft LTOs due to rounding.

Source: Ricondo & Associates, Inc. based on operations data provided by the Clark County Department of Aviation, fleet mix data provided by Brown-Buntin Associates, Inc. and data obtained from Back Information Services.
Prepared by: Ricondo & Associates, Inc.

Table III-2

2000 Aircraft Fleet Mix and Annual LTO Cycles – North Las Vegas Airport

Aircraft Type	EDMS Type	Engine Type	2000 Annual LTO Cycles (a)(b)	2000 Annual TG Cycles (c)
Itinerant Operations				
Single engine piston prop	Cherokee 6	TIO-540-J2B2	7,567	0
Single engine piston prop	Cessna 150	O-200	21,107	0
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	6,104	0
Twin engine turboprop	King Air 200	PT6A-41	979	0
Twin engine turboprop	Dash 6	PT6A-27	979	0
Business Jet	Lear 35/36	TFE-731-2-2B	942	0
Subtotal			37,679	0
Local Operation				
Single engine piston prop	Cherokee 6	TIO-540-J2B2	0	10,755
Single engine piston prop	Cessna 150	O-200	0	29,033
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	0	8,275
Twin engine turboprop	King Air 200	PT6A-41	0	1,487
Twin engine turboprop	Dash 6	PT6A-27	0	0
Subtotal			0	49,549
Air taxi Operations				
Single engine piston prop	Cherokee 6	TIO-540-J2B2	877	0
Single engine turboprop	King Air 200 (d)	PT6A-41	1,305	0
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	13,145	0
Twin engine turboprop	Dash 6	PT6A-27	10,194	0
Subtotal			25,521	0
Total Annual Cycles			63,200	49,549

(a) LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
(b) LTO subtotals may not equal the sum of individual aircraft LTOs due to rounding.
(c) TG = Touch and go training operation. One touch and go equals two local operations.
(d) Modeled in EDMS as a King Air 200 with operations divided by 2 to adjust to a single engine.

Source: Ricondo & Associates, Inc. based on operations data provided by the Clark County Department of Aviation, and fleet mix information contained in the report *Final Environmental Assessment, Proposed Runway 12L-30R, North Las Vegas Airport*.
Prepared by: Ricondo & Associates, Inc.

Table III-3

2000 Aircraft Fleet Mix and Annual LTO Cycles – Henderson Executive Airport

Aircraft Type	EDMS Type	Engine Type	2000 Annual LTO Cycles [(a)(b)]	2000 Annual TG Cycles [(c)]
Itinerant Operations				
Single engine piston prop	Cherokee 6	TIO-540-J2B2	3,731	0
Single engine piston prop	Cessna 150	O-200	4,975	0
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	1,617	0
Twin engine turboprop	King Air 200	PT6A-41	871	0
Business Jet	Lear 35/36	TFE-731-2-2B	1,244	0
Subtotal			12,437	0
Local Operation				
Single engine piston prop	Cherokee 6	TIO-540-J2B2	0	5,362
Single engine piston prop	Cessna 150	O-200	0	7,772
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	0	1,466
Subtotal			0	14,600
Air taxi Operations				
Single engine piston prop	Cherokee 6	TIO-540-J2B2	1,861	0
Single engine turboprop	King Air 200 [(d)]	PT6A-41	2,578	0
Twin engine turboprop	Dash 6	PT6A-27	7,303	0
Subtotal			11,742	0
Total Annual Cycles			24,179	14,600

(a) LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
(b) LTO subtotals may not equal the sum of individual aircraft LTOs due to rounding.
(c) TG = Touch and go training operation. One touch and go equals two local operations.
(d) Modeled in EDMS as a KingAir 200 with operations divided by 2 to adjust to a single engine.

Source: Ricondo & Associates, Inc. based on operations data provided by the Clark County Department of Aviation, and fleet mix information contained in the report *Final Environmental Assessment, Master Plan Report Recommendations, Henderson Executive Airport*.
Prepared by: Ricondo & Associates, Inc.

Forecasts of annual LTO cycles were prepared by Ricondo & Associates for each airport for 2005, 2010, 2015, and 2020. These forecasts, summarized in **Tables III-4, III-5, and III-6**, are based on information contained in the *Draft Environmental Assessment for the Construction of Terminal 3* and the *Southern Nevada Regional Airport System Plan*. Key forecast assumptions are discussed below.

- At McCarran International Airport, air carrier and air taxi operations are assumed to increase at an annual rate of 2.6 percent between 2002 and 2020. This growth rate is consistent with the FAA's Terminal Area Forecast for McCarran International Airport, the *FAA Aerospace Forecasts Fiscal Years 2003-2014*, and regional population projections prepared by the Regional Transportation Commission (RTC). It is noted that the capacity of existing airfield at McCarran International Airport is approximately 625,000 annual operations. While forecast operations would exceed the capacity of the airfield by 2015, an unconstrained forecast was deemed appropriate for air quality modeling purposes.
- At McCarran International Airport, the numbers of general aviation and corporate and general aviation operations are projected to initially decrease slightly and then remain constant over the planning period. Similarly, military operations are expected to remain constant.
- The aircraft fleet mix is expected to change somewhat during the forecast period as noisier hushkitted aircraft are phased out of the fleet. It is also expected that older generation passenger aircraft, such as Boeing 737-200s and 727-200s, would be replaced with newer aircraft including Boeing 737-800s and -900s. Future fleet mix assumptions were developed by Ricondo & Associates using Aircraft Flight Tracking and Environment Monitoring System (AFTEMS) data for the period September 2001 through August 2002 and information obtained from Back Information Services.
- Projected aircraft operations for North Las Vegas Airport and Henderson Executive Airport were based on Table V-4, "Existing and Projected Aircraft Operations by Airport," of the *Southern Nevada Regional Airport System Plan*. The two airports are expected to accommodate an increasing share of corporate and general aviation activity in the region.

Table III-4

Forecast Fleet Mix and Annual LTO Cycles – McCarran International Airport

			Forecast LTO Cycles [(a)]			
Aircraft Type	EDMS Type	Engine Type	2005	2010	2015	2020
Heavy Air Carrier Jet						
B-747/777	B747-200	JT9D-7Q	745	1,454	2,291	3,267
A300/310/330	A300B	CF6-50C	1,303	2,308	3,143	4,015
L-1011	L-1011-100	RB211-22B	242	170	0	0
DC-10	DC10-30	CF6-50C2	1,419	1,293	970	0
B-767	B767-200ER	PW4060	5,978	10,109	14,683	19,600
DC-8-60/70	DC8-70	CFM56-2C5	73	96	0	0
Subtotal			9,760	15,430	21,087	26,882
Air Carrier Jet						
B-727-200	B727-200	JT8D-15	590	467	278	33
	B727-200	JT8D-17	99	78	46	6
	B727-200	JT8D-9	3,204	2,537	1,512	178
	B727-200	JT8D-9A	146	115	69	8
B-737-200	B737-200	JT8D-15	66	65	38	0
	B737-200	JT8D-17	2,993	2,935	1,742	0
	B737-200	JT8D-9A	2,845	2,788	1,655	0
B-737-300	B737-300	CFM56-3-B1	7,081	6,175	4,551	2,368
	B737-300	CFM56-3B-2	1,368	1,192	879	457
	B737-300	CFM56-3C-1	40,384	35,217	25,952	13,508
B-737-400	B737-400	CFM56-3C-1	4,046	6,091	9,155	13,066
B-737-500	B737-500	CFM56-3-B1	4,135	6,442	8,954	11,799
	B737-500	CFM56-3C-1	9,604	14,961	20,794	27,401
B-737-700	B737-700	CFM56-7B22	15,150	14,608	18,220	22,135
	B737-700	CFM56-7B24	501	483	603	732
B-737-800	B737-800	CFM56-7B26	5,353	8,936	13,878	19,600
B-737-900	B737-900	CFM56-7B26	2,048	3,705	6,508	9,799
B-757	B757-200	PW2037	16,384	19,070	22,378	25,779
	B757-200	PW2040	2,106	2,452	2,877	3,314
	B757-200	RB211-535C	17,089	19,890	23,340	26,887
A-319	A319	CFM56-5B6/P	5,852	6,631	7,830	10,159
	A319	V2524-A5	3,556	4,030	4,758	6,174
A-320	A320	CFM56-5B4	2,048	2,791	3,760	4,606
	A320	V2500A-1	12,479	17,008	22,911	28,060
MD-80	MD80	JT8D-217	5,193	5,914	6,183	6,316
	MD80	JT8D-219	8,237	9,379	9,807	10,017
MD-90	MD90-10	V2522-D5	3,412	8,794	15,271	22,867
DC-9-30	DC9-30	JT8D-17	344	308	302	277
Canadair	Reg-100	CF34-3A1	1,988	3,517	4,853	6,534
Subtotal			178,301	206,579	239,106	272,080
Commuter Propeller						
Dash-6	DHC-6	PT6A-27	636	907	521	0
Dash-8-400	DHC-8-400	PW123	894	2,372	4,269	6,534
F-27	F-27 SERIES	RDa7	1,995	2,214	1,439	375
SF-340	SF-340-A	CT7-5	1,079	1,111	1,365	1,635
EMB-120	EMB-120	PW118	1,206	2,547	3,643	4,899
Beech-99	BH-C99	PT6A-27	1,540	1,261	1,124	898
Subtotal			7,350	10,412	12,362	14,341
Business Jet						
Large stage 2	Gulfstream II	SPEY MK511-8	1,741	2,032	1,609	1,032
Medium / small stage 2	Learjet 25B	CJ610-6	1,738	1,525	1,112	563
Large stage 3	Gulfstream IV	TAY Mk611-8	6,600	7,920	9,532	11,375
Medium / small stage 3	Learjet 35/36	TFE 731-2-2B	13,845	17,999	21,437	25,104
Subtotal			23,924	29,476	33,690	38,074
General Aviation / Military Propeller						
Twin engine turboprop	Kingair 200	PT6A-41	3,046	3,046	2,899	2,529
Twin engine piston prop	Aztec	TIO-540-J2B2	6,372	3,811	3,492	3,138
Single engine piston prop	Cherokee six	TIO-540-J2B2	5,217	2983	2,715	2,354
Subtotal			14,635	9,840	9,106	8,021
Air Tour / GA Helicopters	Bell 206	250B17B	33,549	32,850	32,850	32,850
Military Fighter / Trainer	F16	F100-PW-100	22	14	7	0
Total Annual LTO Cycles			267,541	304,601	348,208	392,248

(a) LTO subtotals may not equal the sum of individual aircraft LTOs due to rounding.

Source: Ricondo & Associates, Inc. based on the forecasts presented in the *Draft Environmental Assessment for the Construction of Terminal 3*.
Prepared by: Ricondo & Associates, Inc.

Table III-5

Forecast Fleet Mix and Annual LTO Cycles – North Las Vegas Airport

Aircraft Type	EDMS Type	Engine Type	Forecast LTO/TG Cycles (a)(b) 2005	2010	2015	2020
Itinerant Operations						
Single engine piston prop	Cherokee 6	TIO-540-J2B2	9,135	9,226	9,319	9,412
Single engine piston prop	Cessna 150	O-200	25,479	25,734	25,993	26,253
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	7,368	7,442	7,517	7,592
Twin engine turboprop	King Air 200	PT6A-41	1,182	1,194	1,206	1,218
Twin engine turboprop	Dash 6	PT6A-27	1,182	1,194	1,206	1,218
Business Jet	Lear 35/36	TFE-731-2-2B	1,137	1,148	1,160	1,171
Subtotal			45,483	45,939	46,400	46,864
Local Operation (c)						
Single engine piston prop	Cherokee 6	TIO-540-J2B2	13,086	13,217	13,350	13,483
Single engine piston prop	Cessna 150	O-200	35,328	35,681	36,038	36,399
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	10,069	10,170	10,272	10,374
Twin engine turboprop	King Air 200	PT6A-41	1,809	1,827	1,846	1,864
Twin engine turboprop	Dash 6	PT6A-27	0	0	0	0
Subtotal			60,292	60,896	61,505	62,121
Air taxi Operations						
Single engine piston prop	Cherokee 6	TIO-540-J2B2	933	992	1,055	1,121
Single engine turboprop	King Air 200 (d)	PT6A-41	1,388	1,476	1,569	1,668
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	13,981	14,865	15,802	16,799
Twin engine turboprop	Dash 6	PT6A-27	10,842	11,527	12,254	13,027
Subtotal			27,145	28,860	30,680	32,615
Total Annual Cycles			132,920	135,695	138,585	141,600

(a) LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
(b) LTO subtotals may not equal the sum of individual aircraft LTOs due to rounding.
(c) All local operations are assumed to be touch and go operations.
(d) Modeled in EDMS as a King Air 200 with operations divided by 2 to adjust to a single engine.

Source: Ricondo & Associates, Inc. based on information contained in the report *Final Environmental Assessment, Proposed Runway 12L-30R, North Las Vegas Airport*.
Prepared by: Ricondo & Associates, Inc.

Table III-6

Forecast Fleet Mix and Annual LTO Cycles – Henderson Executive Airport

Aircraft Type	EDMS Type	Engine Type	Forecast LTO/TG Cycles (a)(b) 2005	2010	2015	2020
Itinerant Operations						
Single engine piston prop	Cherokee 6	TIO-540-J2B2	4,728	5,992	7,593	9,621
Single engine piston prop	Cessna 150	O-200	6,304	7,989	10,124	12,828
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	2,049	2,597	3,290	4,169
Twin engine turboprop	King Air 200	PT6A-41	1,103	1,398	1,772	2,245
Business Jet	Lear 35/36	TFE-731-2-2B	1,576	1,997	2,531	3,207
Subtotal			15,760	19,973	25,309	32,071
Local Operation (c)						
Single engine piston prop	Cherokee 6	TIO-540-J2B2	6,794	8,611	10,911	13,826
Single engine piston prop	Cessna 150	O-200	9,848	12,481	15,816	20,041
Twin engine piston prop	Piper Navajo	TIO-540-J2B2	1,858	2,355	2,984	3,781
Subtotal			18,500	23,447	29,711	37,649
Air taxi Operations						
Single engine piston prop	Cherokee 6	TIO-540-J2B2	1,974	2,093	2,220	2,355
Single engine turboprop	King Air 200 (d)	PT6A-41	2,734	2,899	3,074	3,261
Twin engine turboprop	Dash 6	PT6A-27	7,747	8,213	8,711	9,239
Subtotal			12,455	13,205	14,005	14,855
Total Annual Cycles			46,715	56,625	69,025	84,575

(a) LTO = Landing and takeoff. One LTO cycle equals two operations: a landing and a takeoff.
(b) LTO subtotals may not equal the sum of individual aircraft LTOs due to rounding.
(c) All local operations are assumed to be touch-and-go operations.
(d) Modeled in EDMS as a King Air 200 with operations divided by 2 to adjust to a single engine.

Source: Ricondo & Associates, Inc. based on information contained in the report *Final Environmental Assessment, Master Plan Report Recommendations, Henderson Executive Airport.*
Prepared by: Ricondo & Associates, Inc.

3.1.2 Aircraft Taxi Time

The EDMS incorporates default operating times for the taxi-in and taxi-out modes of operation for each aircraft type contained in the model database. For commercial aircraft, a default time of 26 minutes is assumed. For general aviation (GA) aircraft, default times of 16 minutes for piston engine aircraft and 12 minutes for turbine engine aircraft are assumed. These taxi times include the time required to taxi to and from the runways as well as any delays encountered while the aircraft is on the ground. To ensure that the emissions inventories appropriately accounted for and, in particular, did not underestimate aircraft taxi-in and taxi-out emissions, taxi times were investigated to determine if actual times were different from default values in the EDMS. Taxi times at each airport were investigated using the following methodologies:

- For McCarran International Airport, data from the Total Airspace and Airport Modeler (TAAM) developed by the Preston Group for the Clark County Department of Aviation was used to determine average taxi-in, taxi-out, and delay times. For the 2000 and 2005 modeling scenarios it was assumed that the taxi-in/taxi-out time would be 18 minutes.

- It was assumed that the taxi-out delay at McCarran International Airport would increase as the volume of aircraft movements nears the capacity of the airfield in its existing configuration. To account for this additional delay, aircraft taxi in/out times were increased to 21 minutes in the 2010 modeling scenario and 25 minutes in 2015 and 2020 modeling scenarios.
- For both North Las Vegas and Henderson Executive airports, average taxi times for air tour operations and general aviation aircraft were estimated by calculating an average taxi distance from the various gate areas to the runways and calculating the time required at typical taxi speeds and typical delays to cover the distance. On the basis of the results of taxi time analyses, default EDMS taxi in/out times (16 minutes for piston engine aircraft and 12 minutes for turbine engine aircraft) were assumed for all aircraft at North Las Vegas Airport and Henderson Executive Airport.

3.2 Ground Service Equipment

Ground service equipment (GSE) includes a wide range of vehicles that are used to service aircraft. Examples of GSE include tugs that haul baggage carts and other equipment, fuel trucks, catering trucks and other service vehicles, and auxiliary power units (APUs) and ground power units (GPUs) that provide electrical power to aircraft when they are parked and the engines are not running. The EDMS database includes default GSE assignments for each aircraft type expressed in terms of total operating times by specific type of GSE per LTO cycle.

For McCarran International Airport, default EDMS assumptions regarding GSE were compared with the results of a GSE inventory conducted by the Clark County Department of Aviation. On the basis of this comparison, EDMS default assignments of equipment type were revised to reflect the proportion of equipment in the 1996 inventory as summarized in **Table III-7**. GSE assignments and assumed GSE operating times by aircraft category are summarized in **Table III-8**.

For North Las Vegas and Henderson Executive airports it was assumed that general aviation aircraft are fueled by trucks. For air tour operators, it was assumed that fuel trucks and auxiliary power units (APUs) are required. GSE equipment types and operating times for North Las Vegas Airport and Henderson Executive Airport are summarized in **Tables III-9 and III-10** respectively.

Table III-7

1996 Ground Service Equipment Inventory – McCarran International Airport

GSE Type [(a)]	Number of Units				
	Diesel	Gasoline	Electric	Propane	Total
Air conditioner	8	1	--	--	9
Aircraft stairs	3	3	--	--	6
Air start	9	4	1	--	14
Belt loader	9	79	--	--	88
Bob tail	--	6	--	--	6
Cabin service truck	1	3	--	--	4
Cherry picker	--	3	1	--	4
Container loader	4	--	--	--	4
Deicer	2	4	--	--	6
Fork lift	--	7	--	5	12
Fuel tanker	2	4	--	--	6
Golf cart	--	4	4	--	8
Ground Power unit	8	2	--	--	10
High lift	1	10	--	--	11
Hoist	--	1	--	--	1
Hydrant	--	28	--	--	28
Hydraulic loader	6	2	--	--	8
Lavatory truck	1	9	--	--	10
Lavatory waste	--	1	--	--	1
Pushback	18	10	--	2	30
Scrubber	--	1	--	--	1
Support vehicle	--	44	--	--	44
Tug	14	89	3	1	107
Water cart	--	--	3	--	3
Total	86	315	12	8	421

(a) GSE = Ground service equipment.

Source: Ricondo & Associates, Inc. based on responses to the 1996 GSE survey for McCarran International Airport conducted by the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc.

Table III-8

Ground Service Equipment Operating Times – McCarran International Airport

GSE Type by Aircraft Category [(a)]	Equipment Operating Time (minutes per LTO cycle) [(b)]			
	Diesel	Gasoline	Electric	Total [(c)]
Wide Body Aircraft				
Aircraft Tractor Wide	8.0	0.0	0.0	8.0
Air Conditioner	0.0	0.0	30.0	30.0
Airstart 300 PPM	3.0	0.0	0.0	3.0
Bag Tug	11.1	70.7	3.2	85.0
Belt Loader	4.9	43.1	0.0	48.0
Cabin Service	3.7	11.3	0.0	15.0
Container Loader	92.0	0.0	0.0	92.0
Hydrant Fuel Truck	11.7	23.3	0.0	35.0
Lavatory Truck	2.0	18.0	0.0	20.0
Catering Truck	0.0	35.0	0.0	35.0
Water Service	0.0	12.0	0.0	12.0
Auxiliary Power Unit (APU)	0.0	26.0	0.0	26.0
Narrow Body				
Aircraft Tractor Narrow	3.6	2.0	0.4	6.0
Air Conditioner	0.0	0.0	30.0	30.0
Airstart 180 PPM	3.0	0.0	0.0	3.0
Bag Tug	11.1	70.7	3.2	85.0
Belt Loader	4.9	43.1	0.0	48.0
Cabin Service	3.8	11.3	0.0	15.0
Hydrant Fuel Truck	11.7	23.3	0.0	35.0
Lavatory Truck	2.0	18.0	0.0	20.0
Catering Truck	0.0	35.0	0.0	35.0
Auxiliary Power Unit (APU)	0.0	26.0	0.0	26.0
Commuter/Business Jet				
Fuel Truck Mid-Size	0.0	6.0	0.0	6.0
Ground Power Unit (28 VDC)	0.0	30.0	0.0	0.0
Aircraft Tractor Narrow	3.6	2.0	0.4	6.0
General Aviation				
Fuel Truck Small	0.0	6.0	0.0	6.0

(a) GSE = Ground Service Equipment.
(b) LTO = Landing and Takeoff.
(c) Some GSE vehicles at McCarran International Airport are powered by propane. Propane is not included in the EDMS database for GSE and hence could not be modeled.

Source: Ricondo & Associates, Inc. based on information provided by the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc.

Table III-9

Ground Service Equipment Operating Times – North Las Vegas Airport

GSE Type by Aircraft Category	Equipment Operating Time (minutes per LTO cycle) [(a)]		
	Diesel	Gasoline	Total
Cessna 150, Cherokee Six, Navajo			
Aircraft Tug Narrow	0.0	0.5	0.5
Fuel Truck	0.0	5.6	5.6
Cart	0.0	1.3	1.3
DHC-6, KingAir 200, Lear 35/36			
Aircraft Tug Narrow	0.0	0.5	0.5
Fuel Truck	12.8	0.0	12.8
Cart	0.0	1.3	1.3
APU GTCP 36 (80 HP) [(b)]	0.0	1.5	1.5

(a) LTO = Landing and Takeoff.
(b) APU = Auxiliary Power Unit.

Source: Clark County Department of Aviation, April 1999.
Prepared by: Ricondo & Associates, Inc.

Table III-10

Ground Service Equipment Operating Times – Henderson Executive Airport

GSE Type by Aircraft Category	Equipment Operating Time (minutes per LTO cycle) [(a)]		
	Diesel	Gasoline	Total
Cessna 150, Cherokee Six, Navajo			
Aircraft Tug Narrow	0.0	3.6	3.6
Fuel Truck	0.0	6.0	6.0
DHC-6, KingAir 200			
Aircraft Tug Narrow	0.0	3.6	3.6
Fuel Truck	0.0	13.5	13.5
APU GTC 85 [(b)]	0.0	3.0	3.0

(a) LTO = Landing and Takeoff.
(b) APU = Auxiliary Power Unit.

Source: Clark County Department of Aviation, April 1999.
Prepared by: Ricondo & Associates, Inc.

3.3 Point Sources

Power generating and heating plants, incinerators, fuel storage tanks, and surface coating facilities are also sources of pollutant emissions at airports. For the Clark County airport emissions inventories, facilities owned and controlled by the Clark County Department of Aviation were modeled in the EDMS. Point sources not operated by the Clark County Department of Aviation but on airport property were not modeled in EDMS. It was assumed that these sources would be accounted for elsewhere in the SIP.

Information regarding emissions from the Central Plant at McCarran International was obtained from the document *Permitting Requirements for Existing Boilers, McCarran International Airport* (October 1998) prepared by Dames and Moore. Information regarding all other point sources was obtained through consultation with Department of Aviation staff. **Table III-11** presents a summary of point sources at McCarran International Airport in 2000 and 2005. **Table III-12** presents additional point sources associated with Terminal 3, which were included in the emissions estimates for the years 2010, 2015, and 2020. **Tables III-13** and **III-14** present a summary of point sources at North Las Vegas, and Henderson Executive airports, respectively. The tables also provide information regarding the volume of fuel consumed by the various point sources at each airport.

Table III-11

Point Source Emissions Data – McCarran International Airport

Source	Category	Type	Annual Consumption (kiloliters)
Fire Department Generator 1	Power/Heat Plant	Diesel	2.80
Fire Department Generator 2	Power/Heat Plant	Diesel	0.70
Bridge Area Generator	Power/Heat Plant	Diesel	1.40
Terminal 2 Generator	Power/Heat Plant	Diesel	0.98
Surface Coating Facility Degreaser	Solvent Degreaser	Open-Top Vapor	7.19
East Airfield Lighting Vault Generator	Power/Heat Plant	Diesel	0.70
Heating and Refrigeration Plant 1	Power/Heat Plant	Diesel	16.82
Heating and Refrigeration Plant 2	Power/Heat Plant	Diesel	16.82
North Finger Generator	Power/Heat Plant	Diesel	0.84
Paint Booth 1	Surface Coating	Enamel, Air Dry	0.09
Paint Booth 2	Surface Coating	Lacquer, Spraying	0.09
Paint Booth 3	Solvent Degreaser	Open-Top Vapor	0.01
Paint Booth 4	Surface Coating	Primer Surfacer	0.05
Rotunda Terminal 1 Generator	Power/Heat Plant	Diesel	1.40
Satellite 1 Generator	Power/Heat Plant	Diesel	2.10
South Finger Generator	Power/Heat Plant	Diesel	8.41

Source: Leigh Fisher Associates, *Air Pollutant Emission Inventory, McCarran International, North Las Vegas, and Henderson Executive Airports.*
Prepared by: Ricondo & Associates, Inc.

Table III-12

Terminal 3 Point Source Emissions Data – McCarran International Airport

Emission Source	Category	Type	Annual Consumption (kiloliters)
T3 Degreaser	Solvent Degreaser	Open-Top Vapor	7.19
T3 Heating and Refrigeration Plant 1	Power/Heat Plant	Diesel	16.82
T3 Heating and Refrigeration Plant 2	Power/Heat Plant	Diesel	16.82
T3 Generator 1	Power/Heat Plant	Diesel	0.84
T3 Generator 2	Power/Heat Plant	Diesel	1.40
T3 Generator 3	Power/Heat Plant	Diesel	8.41
T3 Paint Booth 1	Surface Coating	Enamel, Air Dry	0.09
T3 Paint Booth 2	Surface Coating	Lacquer, Spraying	0.09
T3 Paint Booth 3	Solvent Degreaser	Open-Top Vapor	0.01
T3 Paint Booth 4	Surface Coating	Primer Surfacer	0.05

Source: Ricondo & Associates, Inc. based on information provided by the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc.

Table III-13

Point Source Emissions Data – North Las Vegas Airport

Emission Source	Type	Tank Capacity (gallons)	Annual Gallons Used
Light trailer generator	Diesel fuel	n.a.	100
ATCT emergency backup generator [(a)]	Diesel fuel	n.a.	400
80 Octane fuel truck	Gasoline	2,000	31,232
Jet A tank #1	Jet A fuel	2,000	460,095
Jet A tank #2	Jet A fuel	2,000	87,571
Jet A tank #3	Jet A fuel	2,000	1,038,457
Low lead fuel truck	Avgas	1,200	394,631
Low lead fuel truck #2	Avgas	2,000	100,500
Low lead fuel truck #3	Avgas	2,000	308,196
Low lead fuel truck #4	Avgas	2,000	92,965
Low lead fuel truck #5	Avgas	2,000	81,115
Low lead fuel tank	Avgas	2,000	1,049,122
Low lead fuel tank #2	Avgas	2,000	1,049,122
Unleaded tank	Gasoline	600	11,367

n.a. = Not available

(a) ATCT = Airport traffic control tower.

Source: Leigh Fisher Associates, *Air Pollutant Emissions Inventory, McCarran International, North Las Vegas, and Henderson Executive Airports*.
Prepared by: Ricondo & Associates, Inc.

Table III-14

Point Source Emissions Data – Henderson Executive Airport

Emission Source	Type	Tank Capacity (gallons)	Annual Gallons Used
Jet A tank #1	Jet A fuel	10,000	476,564
Jet A tank #2	Jet A fuel	10,000	476,564
Avgas tank #1	Avgas	10,000	95,141
Avgas tank #2	Avgas	12,000	255,223
Gasoline storage tank	Gasoline	600	5,633

Source: Leigh Fisher Associates, *Air Pollutant Emissions Inventory, McCarran International, North Las Vegas, and Henderson Executive Airports*.
Prepared by: Ricondo & Associates, Inc.

3.4 On-Road Motor Vehicles

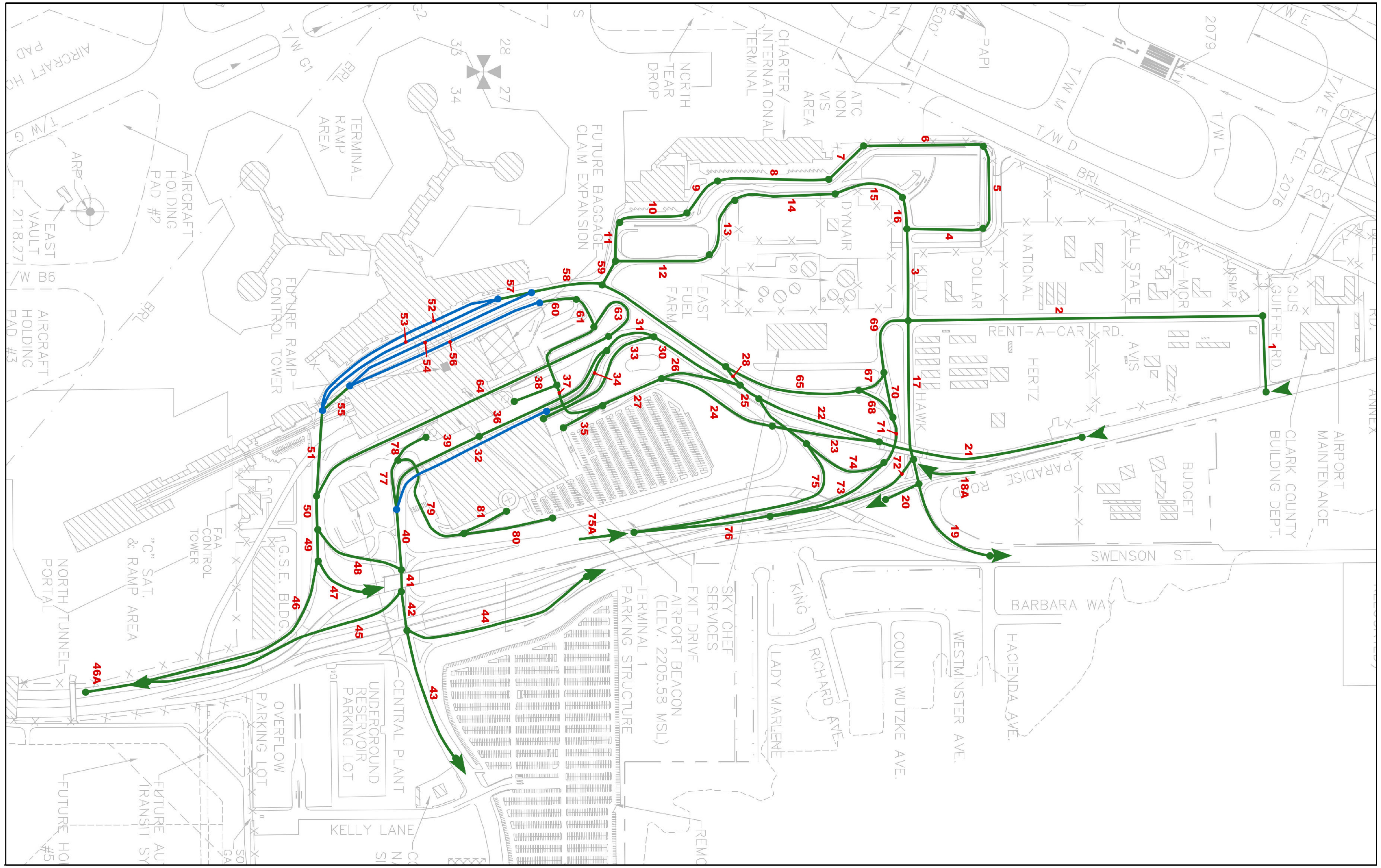
Motor vehicle traffic (on airport roadways and in airport parking lots and garages) can be a significant source of pollutant emissions at an airport. This section summarizes the methodology used to model on-road motor vehicle emissions for the three airports. For the purposes of the emissions inventories only on-Airport vehicle trips were modeled in EDMS. It was assumed that Airport-related traffic offsite is accounted for in the regional travel demand model.

3.4.1 Motor Vehicle Volumes – McCarran International Airport

Exhibit III-1 depicts terminal area roadway segments at McCarran International Airport modeled in the 2000, 2005, 2010, 2015, and 2020 scenarios. **Exhibit III-2** depicts a potential roadway scheme for future Terminal 3. Roadway segments depicted on Exhibit III-2 were modeled only in the 2010, 2015, and 2020 future year scenarios. Vehicle trips on the west side of the Airport by general aviation tenants and customers, and cargo vehicle trips on Spencer Road (not shown on either exhibit) were also modeled in the EDMS.

Table III-15 provides detailed information regarding each roadway segment modeled in the EDMS including: segment length, assumed annual traffic volume, and assumed vehicle speed. As noted on Exhibit 1, roadway segments 32, 52, 53, 54, 56, 84, and 99 were modeled as parking lots in EDMS to account for vehicle dwell time at the terminal curbsides. Annual traffic volumes, and average vehicle idle times associated with the terminal curbsides and airport parking lots are summarized in **Table III-16**.

Annual traffic counts for on-Airport roadways and parking lots at McCarran International Airport for 2000 were based on information contained in existing planning studies including the *Draft Environmental Assessment for the Construction of Terminal 3*. Forecasts of future year traffic volumes were based on forecasted growth in airline passengers and assumptions regarding the future operating capacities of the Airport's terminals including existing terminals (Terminals 1 and 2) and future Terminal 3.



Source: Leigh Fisher Associates, May 1998, based on data provided by the Clark County Department of Aviation
Prepared by: Ricondo & Associates, Inc.

Exhibit III-1

0 600 ft. north

Modeled Terminal Area Roadway Segments

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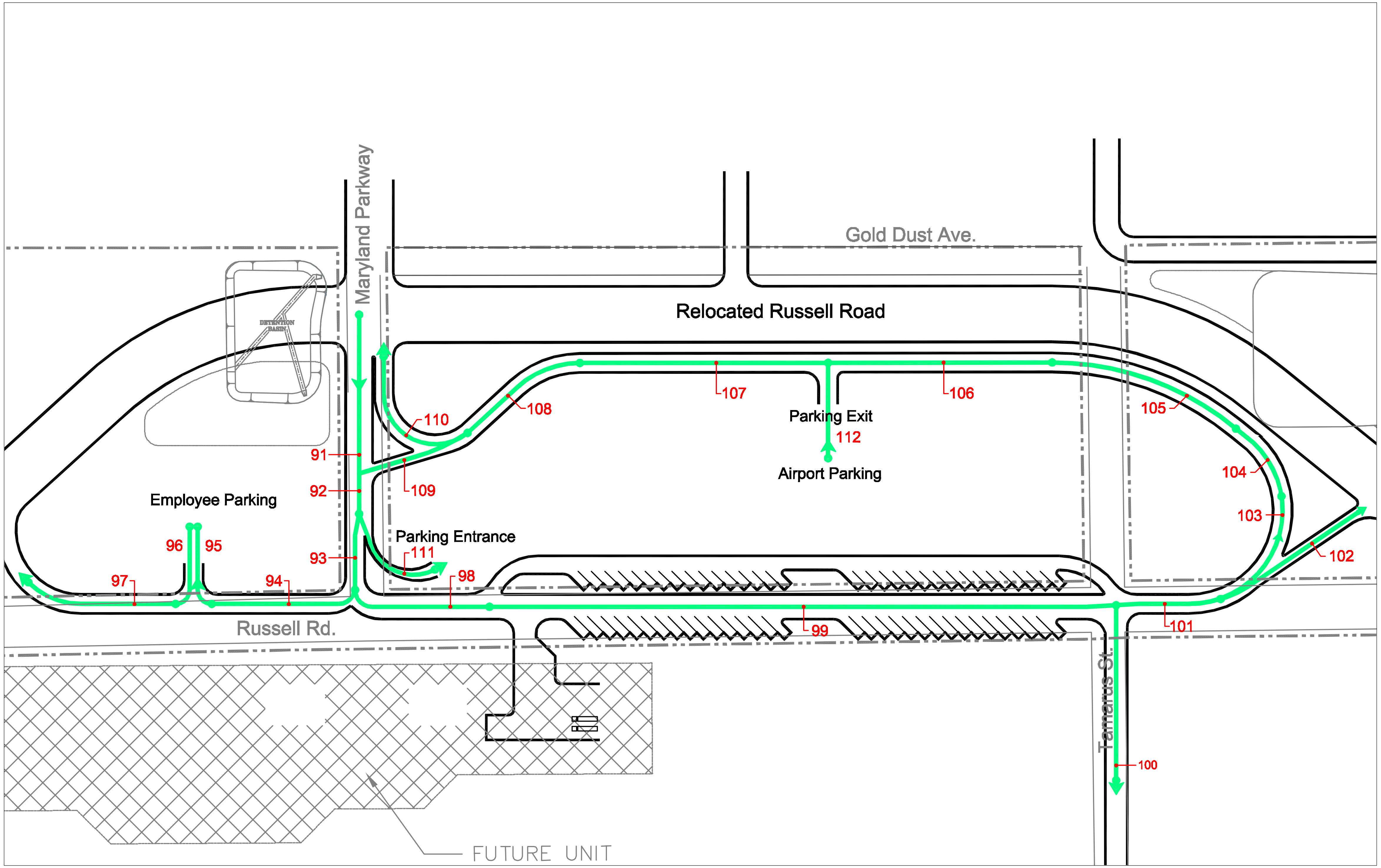

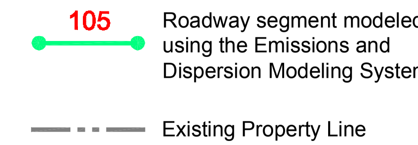

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

Exhibit III-2

Conceptual Future Roadway System
Terminal 3

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Table III-15

Roadway Segments Modeled in EDMS – McCarran International Airport

Segment number [a]		Segment length (miles)	Vehicle Speed	Annual Traffic Volume 2000	2005	2010	2015	2020
1		0.08	20	543,832	572,576	493,243	524,286	610,517
2		0.36	20	543,832	572,576	493,243	524,286	610,517
3		0.08	20	2,856,432	2,466,918	2,726,594	2,856,432	3,375,783
4		0.09	20	1,532,124	1,323,198	1,462,482	1,532,124	1,810,692
5		0.09	20	1,532,124	1,323,198	1,462,482	1,532,124	1,810,692
6		0.13	20	1,532,124	1,323,198	1,462,482	1,532,124	1,810,692
7		0.04	20	1,532,124	1,323,198	1,462,482	1,532,124	1,810,692
8	[b]	--	--	--	--	--	--	--
9		0.04	20	1,532,124	1,323,198	1,462,482	1,532,124	1,810,692
10		0.08	20	1,532,124	1,323,198	1,462,482	1,532,124	1,810,692
11		0.04	20	1,532,124	1,323,198	1,462,482	1,532,124	1,810,692
12		0.10	20	1,581,268	1,365,640	1,509,392	1,581,268	1,868,771
13		0.06	20	1,581,268	1,365,640	1,509,392	1,581,268	1,868,771
13a	[c]	--	--	--	--	--	--	--
14		0.12	20	1,581,268	1,365,640	1,509,392	1,581,268	1,868,771
15		0.06	10	1,581,268	1,365,640	1,509,392	1,581,268	1,868,771
16		0.05	10	1,581,268	1,365,640	1,509,392	1,581,268	1,868,771
17		0.15	20	3,323,376	3,102,128	3,114,005	3,279,321	3,855,064
18		0.02	20	1,452,788	1,254,680	1,386,752	1,452,788	1,716,931
18a		0.01	20	1,745,321	1,713,128	1,614,249	1,706,229	1,998,266
19		0.10	30	842,617	727,715	804,316	842,617	995,820
20		0.12	30	610,171	526,966	582,436	610,171	721,111
21		0.13	30	8,587,483	9,165,807	7,757,363	8,255,205	9,601,562
22		0.05	30	6,097,100	6,495,467	5,510,794	5,863,509	6,820,925
23		0.10	30	2,490,383	2,670,340	2,246,569	2,391,696	2,780,637
24		0.10	30	2,490,383	2,670,340	2,246,569	2,391,696	2,780,637
25		0.09	30	11,042,211	11,797,917	9,971,768	10,612,660	12,342,389
26		0.08	30	3,380,648	3,624,938	3,049,676	3,246,683	3,774,663
27		0.07	30	5,871,031	6,295,278	5,296,245	5,638,379	6,555,300
28		0.02	30	3,727,413	3,954,543	3,373,105	3,587,725	4,175,051
29		0.15	30	7,308,355	7,794,248	6,603,465	7,026,766	8,173,352
30		0.12	30	3,934,150	4,218,436	3,548,988	3,778,251	4,392,675
31		0.03	30	3,934,150	4,218,436	3,548,988	3,778,251	4,392,675
32	[b]	--	--	--	--	--	--	--
33		0.12	15	743,554	797,284	670,759	714,089	830,216
33a	[c]	--	--	--	--	--	--	--
34		0.12	15	1,400,557	1,501,763	1,263,440	1,345,057	1,563,792
35		0.04	20	1,802,406	1,932,650	1,625,947	1,730,982	2,012,477
35a	[c]	--	--	--	--	--	--	--
36		0.15	15	1,790,038	1,919,388	1,614,790	1,719,104	1,998,667
36a	[c]	--	--	--	--	--	--	--
37		0.05	20	4,068,624	4,362,628	3,670,298	3,907,397	4,542,823

Segment number [a]		Segment length (miles)	Vehicle Speed	Annual Traffic Volume 2000	2005	2010	2015	2020
38		0.02	15	943,921	1,012,130	851,509	906,516	1,053,935
38a	(c)	--	--					
39		0.14	15	1,790,038	1,919,388	1,614,790	1,719,104	1,998,667
40		0.03	20	6,680,477	7,163,216	6,026,444	6,415,750	7,459,087
41		0.04	25	7,510,865	8,051,051	6,776,178	7,213,717	8,387,057
42		0.03	30	5,239,503	5,615,558	4,727,187	5,032,362	5,850,967
43		0.05	30	546,695	583,643	493,815	525,517	611,213
44		0.19	30	3,874,677	4,154,665	3,495,338	3,721,135	4,326,271
45		0.25	30	2,271,362	2,435,493	2,048,991	2,181,355	2,536,090
46		0.20	30	3,529,148	3,773,300	3,186,369	3,391,362	3,943,870
46a		0.02	25	5,800,510	6,208,793	5,235,360	5,572,717	6,479,960
47		0.06	30	6,020,311	6,436,806	5,435,571	5,785,265	6,727,779
48		0.09	20	830,388	887,835	749,734	797,968	927,970
49		0.02	30	9,549,459	10,210,106	8,621,940	9,176,628	10,671,649
50		0.04	30	10,379,847	11,097,942	9,371,674	9,974,595	11,599,619
51		0.08	25	9,518,551	10,174,408	8,594,701	9,147,431	10,637,940
52	(b)	--	--	--	--	--	--	--
53	(b)	--	--	--	--	--	--	--
54	(b)	--	--	--	--	--	--	--
55		0.05	15	3,478,452	3,697,845	3,145,940	3,346,683	3,893,866
56	(b)	--	--	--	--	--	--	--
57		0.02	15	6,040,099	6,476,564	5,448,761	5,800,748	6,744,074
58		0.06	20	7,259,212	7,751,806	6,556,555	6,977,622	8,115,274
59		0.03	20	355,568	307,082	339,406	355,568	420,217
60		0.05	20	2,259,340	2,422,602	2,038,146	2,169,809	2,522,666
61		0.03	20	2,259,340	2,422,602	2,038,146	2,169,809	2,522,666
62		0.05	20	3,120,635	3,346,135	2,815,118	2,996,973	3,484,345
63		0.02	20	861,295	923,533	776,973	827,165	961,679
64	(b)	--	--	--	--	--	--	--
65		0.23	30	3,580,942	3,839,705	3,230,361	3,439,040	3,998,302
66		0.07	30	3,580,942	3,839,705	3,230,361	3,439,040	3,998,302
67		0.02	30	674,098	722,810	608,103	647,386	752,665
68		0.03	30	2,906,844	3,116,896	2,622,258	2,791,654	3,245,637
69		0.06	20	1,604,996	1,720,975	1,447,864	1,541,395	1,792,059
70		0.03	20	930,898	998,166	839,761	894,009	1,039,394
71		0.06	20	3,837,742	4,115,061	3,462,019	3,685,663	4,285,031
72		0.09	30	125,268	134,320	113,004	120,304	139,868
73		0.06	30	2,906,844	3,116,896	2,622,258	2,791,654	3,245,637
74		0.08	25	5,876,009	6,300,615	5,300,735	5,643,160	6,560,858
75		0.06	25	4,014,213	4,304,284	3,621,213	3,855,142	4,482,070
75a		0.02	25	5,668,377	6,077,980	5,113,431	5,443,756	6,329,027
76		0.04	30	2,906,844	3,116,896	2,622,258	2,791,654	3,245,637
77		0.08	15	3,489,882	3,742,064	3,148,215	3,351,588	3,896,628
78		0.19	15	943,921	1,012,130	851,509	906,516	1,053,935
79		0.09	20	2,545,961	2,729,935	2,296,706	2,445,072	2,842,693

Segment number [a]		Segment length (miles)	Vehicle Speed	Annual Traffic Volume 2000	2005	2010	2015	2020
80		0.15	20	1,802,406	1,932,650	1,625,947	1,730,982	2,012,477
81		0.08	20	743,554	797,284	670,759	714,089	830,216
82	(d)	0.26	20	173,110	214,183	265,001	327,876	405,669
83	(d)	0.37	20	757,357	937,050	1,159,379	1,434,457	1,774,802
91	(e)	0.04	20	0	0	5,730,500	8,139,500	9,417,000
92	(e)	0.02	20	0	0	6,188,940	8,790,660	10,170,360
93	(e)	0.02	20	0	0	5,673,195	8,058,105	9,322,830
94	(e)	0.05	15	0	0	515,745	732,555	847,530
95	(e)	0.01	15	0	0	515,745	732,555	847,530
95a	(c)	--	--	--	--	--	--	--
96	(e)	0.01	15	0	0	515,745	732,555	847,530
97	(e)	0.05	20	0	0	515,745	732,555	847,530
98	(e)	0.05	15	0	0	5,157,450	7,325,550	8,475,300
99	(b)(e)	--	--	--	--	--	--	--
101	(e)	0.07	20	0	0	5,157,450	7,325,550	8,475,300
102	(e)	0.02	20	0	0	1,320,307	1,875,341	2,169,677
103	(e)	0.06	20	0	0	3,837,143	5,450,209	6,305,623
104	(e)	0.04	20	0	0	3,837,143	5,450,209	6,305,623
105	(e)	0.04	20	0	0	3,837,143	5,450,209	6,305,623
106	(e)	0.10	15	0	0	3,837,143	5,450,209	6,305,623
107	(e)	0.09	20	0	0	4,352,888	6,182,764	7,153,153
108	(e)	0.05	20	0	0	4,352,888	6,182,764	7,153,153
109	(e)	0.02	15	0	0	458,440	651,160	753,360
110	(e)	0.04	20	0	0	3,894,448	5,531,604	6,399,793
111	(e)	0.03	15	0	0	515,745	732,555	847,530
111a	(c)	--	--	--	--	--	--	--
112	(e)	0.01	15	0	0	515,745	732,555	847,530

(a) See Exhibit III-1.
(b) Roadway segments 8, 32, 52, 53, 54, 56, 64, and 99 modeled as parking lots to account for dwell time at the curbside. Traffic volumes are presented in Table III-16.
(c) Placeholder for airport parking areas. Traffic volumes are presented in Table III-16.
(d) Not shown on Exhibit III-1.
(e) Roadway network associated with the future eastside international terminal facility (Exhibit III-2).

Source: Ricondo & Associates, Inc. based on information obtained from the Clark County Department of Aviation
Prepared by: Ricondo & Associates, Inc.

Table III-16

Parking Lot and Curbside Traffic Volumes – McCarran International Airport

Lot Name	Segment Number	Type (a)	Idle time (minutes)	Annual Traffic Volume 2000	2005	2010	2015	2020
Terminal 2	8	Curbside	3.5	1,532,124	1,323,198	1,462,482	1,532,124	1,810,692
Terminal 2	13a	Parking	1.5	284,628	245,815	271,691	284,628	336,379
Arrival	32	Arrival curbside	3.0	1,400,557	1,501,763	1,263,440	1,345,057	1,563,792
Gold Garage	33a	Long term	1.5	743,554	797,284	670,759	714,089	830,216
Oversize Surface	35a	Employee	1.5	1,802,406	1,932,650	1,625,947	1,730,982	2,012,477
Silver Garage	36a	Short term	1.5	1,790,038	1,919,388	1,614,790	1,719,104	1,998,667
Zero Level	38a	Group movements	3.5	943,921	1,012,130	851,509	906,516	1,053,935
West Departure	52	Departure curbside	2.8	4,832,080	5,181,251	4,359,009	4,640,599	5,395,259
East Departure	53	Departure curbside	2.8	1,208,020	1,295,313	1,089,752	1,160,150	1,348,815
Courtesy	54	Courtesy curbside	3.3	1,219,112	1,275,243	1,107,794	1,176,874	1,371,200
Taxi	56	Taxi curbside	3.5	2,259,340	2,422,602	2,038,146	2,169,809	2,522,666
Per Capita	64	Curbside	3.5	861,295	923,533	776,973	827,165	961,679
International (c)	95a	Employee Parking	1.5	0	0	515,745	732,555	847,530
International (c)	99	Curbside	1.7	0	0	5,157,450	7,325,550	8,475,300
International (c)	111a	Public Parking	1.5	0	0	515,745	732,555	847,530
Spencer (b)	--	Air cargo parking	1.5	1,514,714	1,874,101	2,318,757	2,868,914	3,549,603
West Side (b)	--	Westside parking	1.5	346,220	428,366	530,002	655,752	811,338

(a) Terminal curbsides were modeled as parking lots
(b) Not shown on Exhibit III-1.
(c) Future eastside international terminal

Source: Ricondo & Associates, Inc. based on information obtained from the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc.

3.4.2 Motor Vehicle Volumes – North Las Vegas and Henderson Executive Airports

Airport roadway segments and parking lots at North Las Vegas Airport and Henderson Executive Airport were also modeled in the EDMS. Counts of on-road motor vehicle trips in 2000, 2005, 2010, 2015, and 2020 at North Las Vegas Airport and Henderson Executive Airport are summarized in **Tables III-17 and III-18**, respectively. Tables III-17 and III-18 also summarize traffic volumes associated with parking lots at each airport.

As discussed in the table notes, vehicle trips associated with general aviation tenants and commercial (air tour) tenants were estimated separately. Roadway traffic volumes and assumed vehicle operating speeds in 2000 for both facilities are based on information obtained from the Clark County Department of Aviation and information contained in the report *Air Pollutant Emissions Inventory McCarran International, North Las Vegas, and Henderson Executive Airports* by Leigh Fisher Associates. Future year motor vehicle traffic volumes at North Las Vegas Airport and Henderson Executive Airport are based on passenger and aircraft operations forecasts presented in the *Southern Nevada Regional Airport System Plan*.

Table III-17

Motor Vehicle Traffic Volumes – North Las Vegas Airport

	Year				
	2000	2005	2010	2015	2020
Average daily air tour passengers	582 [(a)]	658	743	842	952
Average daily aircraft operations	617 [(b)]	728	743	759	776
Vehicle trip ends per day					
Generated by air tour passengers					
Air tour 1	78	88	99	112	127
Air tour 2	14	16	18	20	23
Total	91	103	117	132	150
Generated by aircraft operations [(c)]	1,598	1,886	1,924	1,966	2,010
Total daily vehicle trips	1,689	1,989	2,041	2,098	2,159
Annual traffic volume	616,663	725,956	745,011	765,815	788,196

(a) Derived from Table V-2 in the *Southern Nevada Regional Airport System Plan*.
(b) Derived from Table V-4 in the Southern *Nevada Regional Airport System Plan*.
(c) Assumes 2.59 vehicle trip ends per aircraft operation. Based on the *Institute of Transportation Engineers, Trip Generation Manual, Fifth Edition*.

Source: Ricondo & Associates, Inc. based on information contained in *Air Pollutant Emissions Inventory, McCarran International, North Las Vegas, and Henderson Executive Airports.*
Prepared by: Ricondo & Associates, Inc.

Table III-18

Motor Vehicle Traffic Volumes – Henderson Executive Airport

	Year				
	2000	2005	2010	2015	2020
Average daily air tour passengers	287 [(a)]	325	368	416	470
Average daily aircraft operations	212 [(b)]	256	310	378	463
Vehicle trip ends per day					
Generated by air tour passengers					
Air tour 1	13	14	16	18	21
Air tour 2	15	17	20	22	25
Total	28	32	36	41	46
Generated by aircraft operations [(c)]	549	663	803	979	1,199
Total daily vehicle trips	577	695	839	1,020	1,245
Annual traffic volume	210,657	253,608	306,192	372,189	454,471

(a) Derived from Table V-2 in the *Southern Nevada Regional Airport System Plan*.
(b) Derived from Table V-4 in the Southern *Nevada Regional Airport System Plan*.
(c) Assumes 2.59 vehicle trip ends per aircraft operation. Based on the *Institute of Transportation Engineers, Trip Generation Manual, Fifth Edition*.

Source: Ricondo & Associates, Inc. based on information contained in *Air Pollutant Emissions Inventory, McCarran International, North Las Vegas, and Henderson Executive Airports.*
Prepared by: Ricondo & Associates, Inc.

3.4.3 On-Road Vehicle Emissions Factors

As discussed on Page 2, Mobile 6A emissions factors developed by the Clark County Department of Air Quality Management were used in lieu of emissions factors incorporated in the EDMS database to model particulate emissions for on-road motor vehicles. These emissions factors more accurately represent conditions in the Las Vegas metropolitan area.

Table III-19 presents CO emissions factors, expressed in grams per vehicle mile, for on-road motor vehicles operating on airport roadways and in airport parking lots.

Table III-19

On-Road Motor Vehicle Emissions Factors

	CO Emissions Factors by Year (Grams per Vehicle Mile)				
Speed	2000	2005	2010	2015	2020
2.5	41.961	33.304	26.971	22.952	20.759
5	26.679	21.026	17.431	15.016	13.67
10	19.726	15.406	12.955	11.253	10.288
15	17.75	13.749	11.584	10.09	9.238
20	16.741	12.908	10.892	9.504	8.709
25	16.186	12.451	10.516	9.183	8.418
30	15.934	12.251	10.358	9.051	8.298
35	15.964	12.298	10.403	9.088	8.329
40	16.401	12.697	10.753	9.386	8.597
45	16.851	13.106	11.108	9.69	8.87

Source: Ricondo & Associates, Inc. based on information provided by the Department of Air Quality Management.
Prepared by: Ricondo & Associates, Inc.

IV. Emissions Inventories

The EDMS was used to calculate airport-related emissions of carbon monoxide (CO) for 2000, 2005, 2010, 2015 and 2020. **Table IV-1** summarizes the annual emissions inventories conducted for McCarran International, North Las Vegas, and Henderson Executive airports.

As shown in the Table IV-1, CO emissions at the three airports are predominantly a result of aircraft and GSE activity. As noted earlier, on-road motor vehicle emissions in these inventories only include on-airport roadways and parking facilities.

Table IV-1

Airport-Related CO Emissions – Tons Per Year

McCarran International Airport

Source	2000	2005	2010	2015	2020
Aircraft	2,462.35	2,210.55	3,115.22	3,464.18	3,819.54
GSE/APU [(a)(b)]	7,895.07	8,277.01	9,755.92	11,395.55	13,067.38
Roadways	342.64	277.29	247.23	241.95	259.15
Parking Lots	444.84	360.55	373.87	378.51	405.36
Stationary Sources [(c)]	7.10	7.10	8.60	9.10	9.10
Total	11,146.21	11,126.71	13,493.55	15,481.50	17,552.74

North Las Vegas Airport

Source	2000	2005	2010	2015	2020
Aircraft	1,529.69	1,789.59	1,832.19	1,876.89	1,923.57
GSE/APU [(a)(b)]	34.65	36.20	36.13	36.82	37.90
Roadways	1.41	1.28	1.11	0.99	0.94
Parking Lots	13.41	12.33	10.64	9.50	8.94
Stationary Sources	0.03	0.03	0.03	0.03	0.03
Total	1,579.19	1,839.42	1,880.09	1,924.22	1,971.27

Henderson Executive Airport

Source	2000	2005	2010	2015	2020
Aircraft	441.71	547.40	680.67	848.61	1,060.63
GSE/APU [(a)(b)]	59.45	66.73	77.84	97.13	155.64
Roadways	3.02	1.24	1.26	1.34	1.50
Parking Lots	2.29	2.15	2.19	2.31	2.58
Stationary Sources	0.00	0.00	0.00	0.00	0.00
Total	506.48	617.51	761.96	949.39	1,220.34

(a) GSE = Ground service equipment.
(b) APU = Auxiliary power unit.
(c) Including Central Plant

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

V. Air Quality Dispersion Analyses

Dispersion modeling using EDMS is significantly more complex in scope and in data input requirements than emissions inventory modeling. Users must (1) specify coordinates for sources of emissions, (2) assign aircraft to runways, runway queues, taxiways, and gate areas, (3) develop appropriate operational profiles for mobile sources, (4) develop weather variables for individual hours, and (5) define other source-specific parameters for each emissions source included in the dispersion analysis. The user is also required to define individual receptors or grids of receptors for pollutant concentration estimation. In preparing for the dispersion analyses, airport operations and physical planning data were assembled and documented for all three airports under consideration.

The methodology followed, and key assumptions used for the dispersion modeling aspect of the study are described in the sections that follow.

5.1 Coordinates for Sources of CO Pollution

Coordinates for major point (e.g., boilers), area (e.g., parking lots, and passenger gates), and line (e.g., roads, taxiways and runways) sources of CO pollutant emissions were derived from Airport Layout Plans (ALPs) provided by the Clark County Department of Aviation. The ALPs provide configurations, lengths, and coordinates of runways and taxiways, commercial aircraft gates, and other airport facilities (boilers, generators, etc.) that are sources of CO emissions. These coordinates were input into the EDMS.

5.2 Airport Operational Profiles

Atmospheric dispersion of pollutants in EDMS is calculated for one hour periods. Because sources of CO emissions at airports vary in their activity or strength depending on the hour of the day, EDMS allows users to develop operational profiles to simulate variations in airport-related traffic volumes that occur over the course of an entire year (8,760 hours). These operational profiles can be used to define hourly, daily, and monthly peaking characteristics for aircraft and ground access vehicles.

Operational profiles were defined for aircraft, ground access vehicles, and ground support equipment on the basis of available data, including airline schedules, and FAA records. To match conditions that were present during the December 8-9, 1996 exceedance episode, operations data from the month of December were selected instead of data from March or October which are typically the busiest months of the year at the Airport in terms of total aircraft operations. Data used to develop aircraft operational profiles included: (1) monthly operations summaries by aircraft type; (2) daily operations summaries for the month of December; and (3) hourly operations summaries for an average day in December.

5.3 Aircraft Runway Assignments

The EDMS dispersion module requires runway, taxiway, and gate assignments for each active aircraft in the study. These assignments directly affect emissions concentrations and therefore are a crucial component of EDMS dispersion modeling. **Table V-1** summarizes assumed baseline (2000) and future year departure runway use percentages by aircraft type for McCarran International Airport. Similar information for North Las Vegas Airport and Henderson Executive Airport is presented in **Tables V-2 and V-3**.

Table V-1

Runway Use — McCarran International Airport

2000 Runway Use - Aircraft Departures

Aircraft Category	Runway 19L	19R	1L	1R	25L	25R	7L	7R
Air Carrier/Cargo	7.86%	7.86%	4.41%	4.41%	36.88%	36.88%	0.85%	0.85%
Commuter/General Aviation	36.95%	36.95%	10.40%	10.40%	1.50%	1.50%	1.15%	1.15%
Helicopter [(a)]	--	--	--	--	--	--	--	--

2005, 2010, 2015, 2020 Runway Use - Aircraft Departures

Aircraft Category	Runway 19L	19R	1L	1R	25L	25R	7L	7R
Air Carrier/Cargo	8.31%	8.31%	2.98%	2.98%	34.33%	34.33%	4.38%	4.38%
Commuter/General Aviation	34.24%	34.24%	4.72%	4.72%	7.01%	7.01%	4.03%	4.03%
Helicopter [(a)]	--	--	--	--	--	--	--	--

(a) Helicopter operations were assigned to two locations on the west side of the airfield.

Source: Ricondo & Associates, Inc. based on information provided by the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc.

Table V-2

Runway Use — North Las Vegas Airport

2000 Runway Use - Aircraft Departures

Aircraft Category	Runway 7	25	12	30
Air Tour	25%	0%	75%	0%
General Aviation - Itinerant	60%	0%	40%	0%
General Aviation - Local	70%	0%	30%	0%

2005, 2010, 2015, 2020 Runway Use - Aircraft Departures

Aircraft Category	Runway 7	25	12R	12L	30L	30R
Air Tour	25%	0%	75%	0%	0%	0%
General Aviation - Itinerant	10%	0%	80%	10%	0%	0%
General Aviation - Local	20%	0%	0%	80%	0%	0%

Note: Runway 12-30 was redesignated 12R-30L when Runway 12L-30R was constructed.

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

Table V-3

Runway Use — Henderson Executive Airport

2000 Runway Use - Aircraft Departures

Aircraft Category	Runway 18	Runway 36
Air Tour	30%	70%
General Aviation - Itinerant	30%	70%
General Aviation - Local	30%	70%
Jet - Itinerant	30%	70%

2005, 2010, 2015, 2020 Runway Use - Aircraft Departures

Aircraft Category	Runway			
	17L	17R	35L	35R
Air Tour	0%	30%	70%	0%
General Aviation - Itinerant	3%	27%	7%	63%
General Aviation - Local	24%	6%	14%	56%
Jet - Itinerant	0%	30%	70%	0%

Source: Ricondo & Associates, Inc. based on information contained in the report *Final Environmental Assessment, Master Plan Report Recommendations, Henderson Executive Airport.*

Prepared by: Ricondo & Associates, Inc.

The assignment of aircraft to airport runways at McCarran International Airport was based on information obtained from the Department of Aviation's AFTEMS system. Runway end assignments at North Las Vegas Airport and Henderson Executive Airport were based on information contained in environmental assessments cited earlier in this report.

5.4 Aircraft Gate Assignments

The following paragraphs summarize the approach used to assign aircraft to gate areas at the three Clark County Airports.

- The assignment of aircraft to passenger gate areas at McCarran International Airport was accomplished through a review of aircraft landings data maintained by the Department of Aviation, existing and historical (2000) airline gate assignments, and information contained in the *Project Definition Manual for the Construction of Terminal 3 (Phase 1)*. A total of nine gate areas were modeled in the 2000 and 2005 modeling scenarios. An additional gate area was defined for the 2010, 2015, and 2020 modeling scenarios to reflect the opening of Terminal 3.

- Gate assignments at North Las Vegas Airport were based on a review of aircraft landings data. Three gate areas were modeled at North Las Vegas for the 2000 and 2005 modeling scenarios. It is assumed that an eastside basing area will be constructed at North Las Vegas after 2005 and prior to 2010 hence an additional gate area is defined in the 2010, 2015, and 2020 modeling scenarios.

- At Henderson Executive Airport one gate area was modeled in the 2000 modeling scenario. Four gate areas were modeled in the 2005, 2010, 2015, and 2020 modeling scenarios.

5.5 Meteorological Data

Meteorological data used in the dispersion modeling included National Weather Service hourly surface data for McCarran International Airport, weather data contained in the County's UAM database, and Upper Air TD-6201 data from the Mercury Desert Rock weather station. Hourly meteorological data taken at McCarran International Airport include winds and temperature. Meteorological observation data were not available for North Las Vegas and Henderson Executive Airports, therefore wind data from the Urban Airshed Model input database were extracted for these locations for use in EDMS.

Weather information for the 20-hour exceedance episode is presented in **Table V-4**.

Table V-4

Meteorological Data –- CO Dispersion Analyses

	McCarran International		North Las Vegas		Henderson Executive		
Hour	Wind (kts)	Direction	Wind (kts)	Direction	Wind (kts)	Direction	Temperature (^{o}C)
15	0	100	2	140	1	70	17
16	0	150	2	180	0	220	17
17	0	190	2	240	2	250	16
18	5	250	2	250	2	230	13
19	7	250	2	310	2	250	11
20	6	260	2	350	2	270	11
21	3	220	1	350	1	210	10
22	4	200	0	310	1	250	9
23	4	240	1	300	1	200	9
0	6	250	2	320	2	200	8
1	4	220	1	320	2	220	7
2	5	270	2	310	3	210	7
3	7	250	2	320	3	210	7
4	4	220	2	320	3	230	7
5	3	230	2	350	2	210	6
6	6	250	1	310	2	220	6
7	4	220	2	320	2	240	7
8	0	230	1	350	1	220	8
9	0	130	1	140	1	150	9
10	0	140	0	170	0	200	11

Note: Wind speeds less than 3 knots are not processed by EDMS therefore it was assumed that during calm conditions the wind speed was 3 knots.

Source: ENVIRON.
Prepared by: Ricondo & Associates, Inc.

5.6 Grid Receptors

In the Urban Airshed Model, the Las Vegas Valley is represented by a grid of 2,500 one-kilometer grids cells (50 x 50 grid) for emissions and dispersion estimation. To accurately measure airport-related CO concentrations in EDMS, a more refined grid of receptors was established for each airport. Each set of grid receptors was designed to subdivide and directly overlay the one-kilometer UAM grid. The EDMS grid resolution and the overall extent of the receptor grid for each airport was determined by running the UAM with and without airport emissions and comparing the resulting UAM CO concentration patterns. A receptor grid spacing of 250 meters was determined to adequately resolve the structure of the resulting dispersion pattern from the various airport sources. Based on the UAM results, it was necessary to define a rather expansive receptor grid for McCarran so that the full extent of the airport's CO concentration "footprint" (to 0.1 ppm) would be modeled with EDMS. The number of EDMS receptors defined for each airport is as follows:

McCarran: 2501 (15x10 km)
North Las Vegas: 825 (8x6 km)
Henderson Executive: 221 (3x4 km)

VI. Airport Construction Activity

Construction activity in Clark County is a major source of pollutant emissions. While construction projects are temporary in duration, they can generate high concentrations of CO.

Several capital improvement projects are planned at airports operated by Clark County. **Table VI-1** summarizes major construction projects planned at each of the three airports and the approximate timing of these developments based on consultation with Department of Aviation staff.

Table VI-1

Future Airport Construction Activity – Clark County Airport System

Airport	Project	Year
McCarran International Airport	NE Arm of "D" gates	Prior to 2005
	Construct Terminal 3 (Phase 1)	2005-2009
	Terminal 3 Roadways and parking	2005-2009
	Construct East Cargo Ramp (Phase 1)	2005-2009
	Terminal 3 (Phase 2)	2010-2014
	Terminal 1 Roadway Re-construct	2010-2014
	Construct NW Arm of "D" gates	2010-2014
North Las Vegas Airport	Carey Avenue hangar project	2010-2014
	East-side basing area	2005-2009
Henderson Executive Airport	New Terminal facilities	2005-2009
	Apron/Ramp improvements	2005-2009
	Apron/Ramp/Hangars	2010-2014

Source: Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc.

Because the final design for many of these improvements has not been completed and the construction schedule has not been finalized it is not possible to develop detailed estimates of CO emissions. The Clark County Department of Aviation recently prepared construction emissions estimates associated with the first phase of Terminal 3. A summary of on-road and non-road construction emissions associated with the Phase I of Terminal 3 is presented in **Table VI-2.**

Table VI-2

Summary of CO Emissions Associated with the Construction of Terminal 3

	CO Emissions (tons/year)		
	2005	2006	2007
Mobile Sources			
Off-site truck	3.9	5.4	0.8
On-site truck	1.1	1.3	0.1
Employee	101.8	100.6	21.3
Employee busing	2.8	2.8	0.7
Total [(a)]	109.6	110.1	22.9
Construction Equipment	71.2	77.8	12.7
Total	180.8	187.9	35.6

(a) Sum may not equal total due to rounding.

Source: Ricondo & Associates, Inc. based on information obtained from the Clark County Department of Aviation.
Prepared by: Ricondo & Associates, Inc.

VII. EDMS Dispersion Modeling Results

The ten highest[6] 8-hour average CO concentrations estimated by the EDMS for each modeling year are presented in **Tables VII-1, VII-2, and VII-3** for McCarran International, North Las Vegas, and Henderson Executive airports respectively. The rank-ordered 8-hour CO concentrations are expressed in parts per million (ppm) and assume no new County mandated emissions reduction controls on on-road motor vehicles beyond those previously adopted and currently in place. The "period" indicates the hour range of maximum CO concentrations expressed in military time. As shown in the tables, EDMS-estimated CO concentrations are below the EPA's National Ambient Air Quality Standards (NAAQS) primary 8-hour standard for CO at North Las Vegas and Henderson Executive Airport in all five modeling years. As shown in Table VII-1, CO concentration estimates developed using the AERMOD dispersion model indicate the possibility for exceedances of the 8-hour CO standard at Receptors 791, 667, 627, and 547 at McCarran International Airport. All four receptors are located on the Airport in areas that are not accessible by the general public. Exceedances of the one hour CO standard are possible at Receptors 667, 627, and 547.

Table VII-1

8-Hour Average CO Concentrations –- McCarran International Airport

2000			2005			2010		
Receptor	Period	CO	Receptor	Period	CO	Receptor	Period	CO
667	17-01	11.43	667	17-01	11.11	547	16-24	12.08
667	16-24	10.91	667	16-24	10.60	547	15-23	12.00
627	15-23	10.22	627	15-23	9.96	667	17-01	10.66
667	18-02	10.16	667	18-02	9.87	667	16-24	10.17
627	16-24	9.86	627	16-24	9.62	547	17-01	9.68
667	15-23	9.74	667	15-23	9.46	627	15-23	9.54
667	19-03	9.02	667	19-03	8.77	791	16-24	9.51
791	16-24	8.47	791	16-24	8.69	667	18-02	9.47
791	15-23	8.32	791	15-23	8.54	791	15-23	9.36
667	20-04	8.27	547	16-24	8.41	627	16-24	9.20

2015			2020		
Receptor	Period	CO	Receptor	Period	CO
547	16-24	13.96	547	16-24	15.87
547	15-23	13.86	547	15-23	15.76
667	17-01	12.27	667	17-01	13.91
667	16-24	11.71	667	16-24	13.27
791	16-24	11.26	791	16-24	13.06
547	17-01	11.19	791	15-23	12.87
791	15-23	11.09	547	17-01	12.71
627	15-23	11.00	627	15-23	12.48
667	18-02	10.91	667	18-02	12.36
627	16-24	10.61	627	16-24	12.04

Source: Ricondo & Associates, Inc., based on output from the Emissions and Dispersion Modeling System (EDMS)
Prepared by: Ricondo & Associates, Inc.

[6] Complete results of the EDMS dispersion modeling were reviewed by Department of Aviation staff and provided to the Clark County Department of Air Quality Management.

Table VII-2

8-Hour Average CO Concentrations –- North Las Vegas Airport

2000			2005			2010		
Receptor	Period	CO	Receptor	Period	CO	Receptor	Period	CO
291	15-23	0.55	291	15-23	0.51	291	15-23	0.44
291	16-24	0.54	291	16-24	0.50	291	16-24	0.44
291	17-01	0.53	291	17-01	0.49	291	17-01	0.43
267	02-10	0.35	267	02-10	0.35	267	02-10	0.32
291	18-02	0.32	291	18-02	0.30	291	18-02	0.26
267	01-09	0.21	267	01-09	0.21	267	01-09	0.19
290	24-08	0.17	290	24-08	0.15	391	02-10	0.18
290	01-09	0.17	290	01-09	0.15	391	01-09	0.18
290	02-10	0.17	290	02-10	0.15	391	24-08	0.18
290	15-23	0.14	267	15-23	0.13	391	15-23	0.14

2015			2020		
Receptor	Period	CO	Receptor	Period	CO
291	15-23	0.40	291	15-23	0.39
291	16-24	0.40	291	16-24	0.38
291	17-01	0.39	291	17-01	0.37
267	02-10	0.33	267	02-10	0.34
291	18-02	0.24	291	18-02	0.23
267	01-09	0.19	267	01-09	0.20
391	02-10	0.18	391	02-10	0.18
391	01-09	0.18	391	01-09	0.18
391	24-08	0.18	391	24-08	0.18
391	15-23	0.14	391	15-23	0.14

Source: Ricondo & Associates, Inc., based on output from the Emissions and Dispersion Modeling System (EDMS)
Prepared by: Ricondo & Associates, Inc.

Table VII-3

8-Hour Average CO Concentrations –- Henderson Executive Airport

2000			2005			2010		
Receptor	Period	CO	Receptor	Period	CO	Receptor	Period	CO
111	15-23	0.76	77	15-23	0.66	77	15-23	0.81
111	16-24	0.76	77	16-24	0.66	77	16-24	0.81
111	17-01	0.76	94	15-23	0.51	94	15-23	0.63
129	15-23	0.26	94	16-24	0.51	94	16-24	0.63
129	16-24	0.26	94	17-01	0.51	94	17-01	0.63
129	17-01	0.26	77	17-01	0.40	77	17-01	0.49
129	18-02	0.23	77	18-02	0.36	77	18-02	0.44
146	15-23	0.20	77	02-10	0.34	77	02-10	0.42
146	16-24	0.20	77	01-09	0.31	77	01-09	0.39
146	17-01	0.20	77	24-08	0.31	77	24-08	0.39

2015			2020		
Receptor	Period	CO	Receptor	Period	CO
77	15-23	1.04	77	15-23	1.94
77	16-24	1.04	77	16-24	1.94
94	15-23	0.83	94	15-23	1.58
94	16-24	0.83	94	16-24	1.58
94	17-01	0.83	94	17-01	1.58
77	17-01	0.62	77	17-01	1.13
77	18-02	0.57	77	18-02	1.06
77	02-10	0.55	77	02-10	1.05
77	01-09	0.51	77	01-09	0.97
77	24-08	0.51	77	24-08	0.97

Source: Ricondo & Associates, Inc., based on output from the Emissions and Dispersion Modeling System (EDMS)
Prepared by: Ricondo & Associates, Inc.

VIII. REFERENCES

1. CSSI, Inc. *Emissions and Dispersion Modeling System (EDMS) Reference Manual*. April 1997.

2. Dames & Moore. *Permitting Requirements for Existing Boilers, McCarran International Airport, Las Vegas, Nevada*. October 13, 1998.

3. Leigh Fisher Associates. *Air Pollutant Emissions Inventory, McCarran International, North Las Vegas, and Henderson Executive Airports*. June 1998.

4. Leigh Fisher Associates. *Final Environmental Assessment, Master Plan Report Recommendations, Henderson Executive Airport.* April 1998

5. Leigh Fisher Associates. *Final Environmental Assessment, Proposed Runway 12L-30R, North Las Vegas Airport.* May 1997.

6. Ricondo & Associates, Inc. *Carbon Monoxide Emissions Inventory and Dispersion Modeling – McCarran International, North Las Vegas, and Henderson Executive airports*. July 27, 1999.

7. Ricondo & Associates, Inc. *Southern Nevada Regional Airport System Plan.* August 2001.

8. Ricondo & Associates, Inc. *Draft Environmental Assessment for the Construction of Terminal 3*. March 2003.

9. Ricondo & Associates, Inc. *Project Definition Manual for the Construction of Terminal 3 (Phase I)*. June 27, 2003

MEMORANDUM **VIA E-MAIL**

Date: May 19, 2005

To: Mr. Dennis Mewshaw
Clark County Department of Aviation

From: Adrian Jones

Subject: ADDENDUM TO THE 2003 CARBON MONOXIDE EMISSIONS INVENTORY AND DISPERSION MODELING STUDY

Introduction

In November 2003, Ricondo & Associates, Inc. (R&A) completed the study entitled *Carbon Monoxide Emissions Inventory and Dispersion Modeling Study Update 2003 – McCarran International, North Las Vegas, and Henderson Executive airports* in support of the maintenance plan application for Carbon Monoxide (CO) for the Clark County nonattainment area, Hydrographic Basin 212. At the request of the Clark County Department of Air Quality and Environmental Management (DAQEM), R&A is issuing this addendum, which includes additional information regarding CO concentrations at McCarran International Airport to clarify information presented in Section VII of the November 2003 report.

EDMS Dispersion Modeling Results – McCarran International Airport

Table 1 presents the highest 8-hour average CO concentrations estimated using the FAA's Emissions and Dispersion Modeling System (EDMS) for each modeling year for receptors located on or around McCarran International Airport[1]. The rank-ordered 8-hour CO concentrations are expressed in parts per million (ppm) and assume no new County-mandated emission reduction controls on on-road motor vehicles beyond those previously adopted and already in place. The "period" indicates the hour range during which the maximum CO concentrations were estimated, expressed in military time. CO concentration estimates developed using the AERMOD dispersion model indicate the possibility for exceedances of the 8-hour CO standard at Receptors 791, 667, 627, 547, and 750 at McCarran International Airport. As shown on **Exhibit 1** (see attachment), all five receptors are located on Airport property in areas that are not accessible by the general public.

[1] Complete results of the EDMS dispersion modeling analysis were reviewed by Department of Aviation staff and provided to the Clark County Department of Air Quality and Environmental Management.

221 MAIN STREET, SUITE 1550, SAN FRANCISCO, CALIFORNIA 94105
Telephone (415) 547-1930 Facsimile (415) 547-1940

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Table 1

Highest 8-Hour Average CO Concentrations –- McCarran International Airport

2000

Receptor	Period	CO
667	17-01	11.43
667	16-24	10.91
627	15-23	10.22
667	18-02	10.16
627	16-24	9.86
667	15-23	9.74
667	19-03	9.02
791	16-24	8.47
791	15-23	8.32
667	20-04	8.27

2005

Receptor	Period	CO
667	17-01	11.11
667	16-24	10.60
627	15-23	9.96
667	18-02	9.87
627	16-24	9.62
667	15-23	9.46
667	19-03	8.77
791	16-24	8.69
791	15-23	8.54
547	16-24	8.41

2010

Receptor	Period	CO
547	16-24	12.08
547	15-23	12.00
667	17-01	10.66
667	16-24	10.17
547	17-01	9.68
627	15-23	9.54
791	16-24	9.51
667	18-02	9.47
791	15-23	9.36
627	16-24	9.20

2015

Receptor	Period	CO
547	16-24	13.96
547	15-23	13.86
667	17-01	12.27
667	16-24	11.71
791	16-24	11.26
547	17-01	11.19
791	15-23	11.09
627	15-23	11.00
667	18-02	10.91
627	16-24	10.61
667	15-23	10.46
791	17-01	9.97
667	19-03	9.68
750	15-23	9.19

2020

Receptor	Period	CO
547	16-24	15.87
547	15-23	15.76
667	17-01	13.91
667	16-24	13.27
791	16-24	13.06
791	15-23	12.87
547	17-01	12.71
627	15-23	12.48
667	18-02	12.36
627	16-24	12.04
667	15-23	11.86
791	17-01	11.57
667	19-03	10.98
750	15-23	10.65
750	16-24	10.41
667	20-04	10.06
667	21-05	9.00

Source: Ricondo & Associates, Inc., based on output from the Emissions and Dispersion Modeling System (EDMS).
Prepared by: Ricondo & Associates, Inc.

Table 2 presents the ten highest 8-hour average CO concentrations for each modeling year, with receptors located in non-public areas excluded. As presented in Table 2, predicted CO concentrations at receptors in the vicinity of McCarran International Airport that are located in publicly accessible areas are below the 8-hour National Ambient Air Quality Standard (NAAQS) for carbon monoxide, which is 9 ppm.

Table 2

Highest 8-Hour Average CO Concentrations (Revised)[1] –- McCarran International Airport

2000 Receptor	2000 Period	2000 CO	2005 Receptor	2005 Period	2005 CO	2010 Receptor	2010 Period	2010 CO
588	16-24	5.36	588	16-24	5.57	588	16-24	5.34
588	15-23	5.36	588	15-23	5.39	588	15-23	5.11
588	17-01	3.52	588	17-01	3.92	834	16-24	5.03
629	16-24	2.63	588	18-02	2.72	834	15-23	4.82
629	15-23	2.59	629	16-24	2.70	834	17-01	4.63
629	17-01	2.43	588	19-03	2.56	588	17-01	4.07
588	18-02	2.39	629	15-23	2.55	793	16-24	3.87
588	19-03	2.24	629	17-01	2.55	793	15-23	3.81
630	16-24	2.18	588	20-04	2.46	834	18-02	3.35
588	20-04	2.15	588	21-05	2.38	793	17-01	3.33

2015 Receptor	2015 Period	2015 CO	2020 Receptor	2020 Period	2020 CO
834	16-24	5.91	834	16-24	6.74
588	16-24	5.79	834	15-23	6.47
834	15-23	5.67	588	16-24	6.47
588	15-23	5.53	834	17-01	6.21
834	17-01	5.49	588	15-23	6.18
793	16-24	4.55	793	16-24	5.20
588	17-01	4.49	793	15-23	5.12
793	15-23	4.48	588	17-01	5.05
834	18-02	3.97	834	18-02	4.48
793	17-01	3.92	793	17-01	4.47

[1] Receptors shown in red on **Exhibit 1** are inside the Airport fence or are otherwise not accessible by the general public and therefore were excluded from the calculation of the highest 8-hour average CO concentrations presented in this table.

Source: Ricondo & Associates, Inc., based on output from the Emissions and Dispersion Modeling System (EDMS).
Prepared by: Ricondo & Associates, Inc.

cc: 02100134 M44
Ms. Teresa Arnold
Mr. John Williams
Mr. Zheng Li

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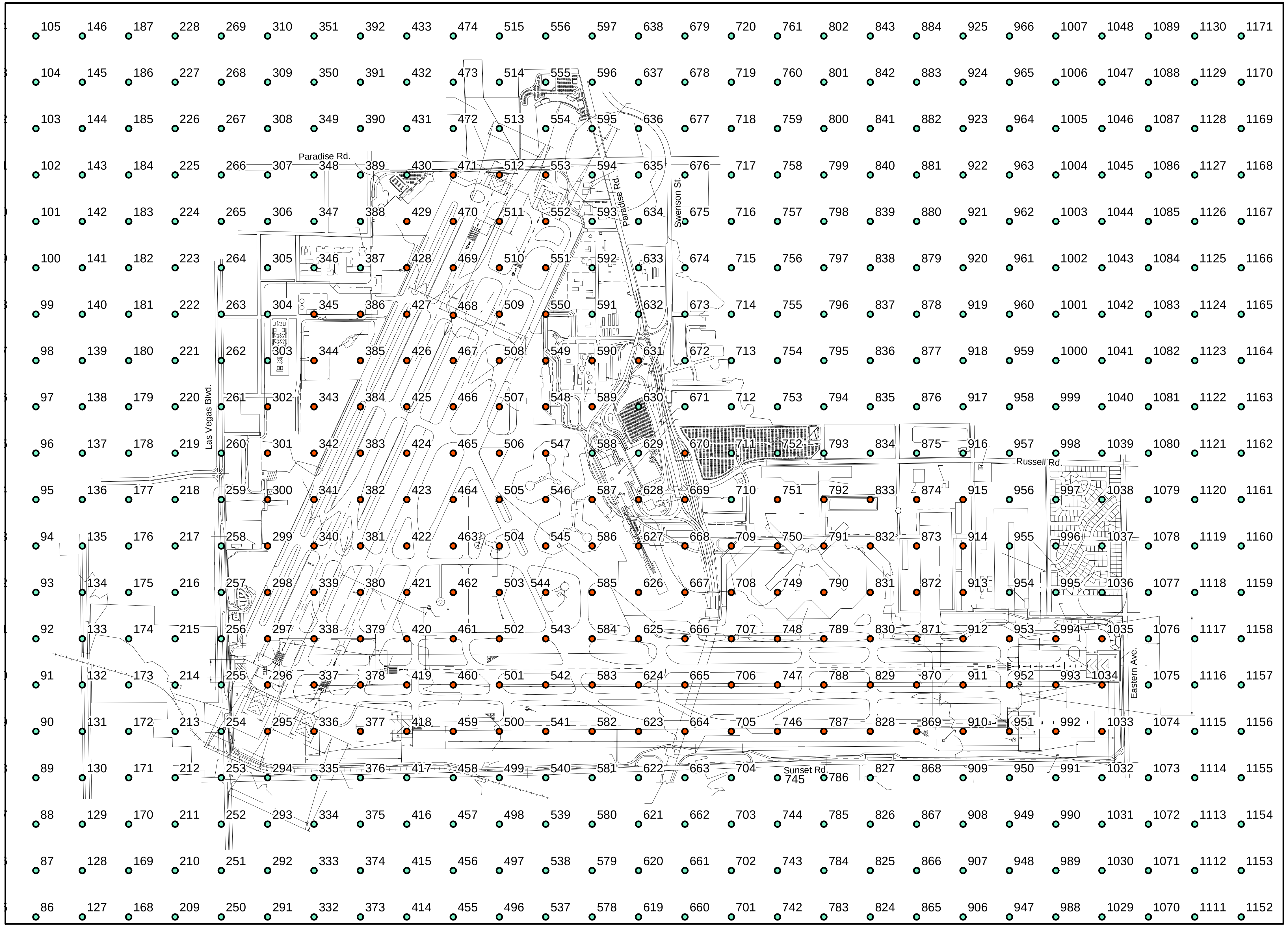

Legend

- Dispersion receptor (location accessible by the general public)
- Dispersion receptor (location not accessible by the general public)

Sources: Ricondo & Associates, Inc. and Clark County Department of Aviation
Prepared by: Ricondo & Associates, Inc.

Exhibit 1

north Not to scale

Dispersion Receptor Locations
McCarran International Airport