APPENDIX H
TECHNICAL ANALYSES

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APPENDIX H LIST OF TECHNICAL ANALYSES IN ORDER OF OCCURRENCE

For Alignment and Stations

- Air Quality
- Noise
- Geotechnical
- Hazardous Substances
- Hydrology

For Maintenance Facility Site

- Traffic
- Air Quality
- Noise
- Geotechnical/Hazardous

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AIR QUALITY APPENDIX

Appendix A

Construction Emissions

Crenshaw LRT Construction Emission Factors

2013 EMFAC2007 RATES (grams per mile)							
Vehicle Type	**CO**	**ROG**	**NO_2**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**
Haul Truck @ 20 MPH	6.482	1.114	8.7	0.017	0.455	0.4186	1784.35
Worker Vehicle @30 MPH	1.752	0.063	0.137	0.003	0.031	0.02852	343.84

Assumptions:

Construction Year	2013
Season	Winter
Temperature	70^{o}F

EQUIPMENT EMISSION FACTORS (pounds per hour)							
	CO	**ROG**	**NO_X**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**	**CO_2**
Equipment	0.3765	0.0872	0.7938	0.0013	0.0330	0.0304	123.00
Source: CARB Off-Road Emission Factors							

Title   : Construction Haul Truck and Worker Commute Emission Factors
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2011/01/20 18:44:49
Scen Year: 2013 -- All model years in the range 1969 to 2013 selected
Season   : Annual
Area   : Los Angeles

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Year: 2013 -- Model Years 1969 to 2013 Inclusive -- Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

County Average   Los Angeles   County Average

Table 1: Running Exhaust Emissions (grams/mile)

Pollutant Name: Total Organic Gases   Temperature: 70F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
20	0.099	0.153	0.280	1.114	1.527	2.715	0.199
30	0.063	0.099	0.175	0.729	0.950	2.256	0.130

Pollutant Name: Carbon Monoxide   Temperature: 70F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
20	2.107	3.221	4.047	6.482	9.122	18.266	2.968
30	1.752	2.660	3.166	4.493	5.749	17.222	2.403

Pollutant Name: Oxides of Nitrogen   Temperature: 70F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
20	0.158	0.316	0.624	8.700	16.134	1.035	0.690
30	0.137	0.273	0.568	7.880	13.589	1.062	0.616

Pollutant Name: Carbon Dioxide   Temperature: 70F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
20	463.740	580.884	794.547	1784.348	2272.959	161.843	601.977
30	343.842	430.977	582.936	1602.683	2190.965	136.602	459.539

Pollutant Name: Sulfur Dioxide   Temperature: 70F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
20	0.004	0.006	0.008	0.017	0.022	0.002	0.006
30	0.003	0.004	0.006	0.015	0.021	0.002	0.004

Pollutant Name: PM10   Temperature: 70F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
20	0.017	0.036	0.038	0.409	0.318	0.024	0.043
30	0.010	0.022	0.023	0.299	0.213	0.020	0.029

Pollutant Name: PM10 - Tire Wear   Temperature: 70F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
20	0.008	0.008	0.009	0.025	0.009	0.004	0.009
30	0.008	0.008	0.009	0.025	0.009	0.004	0.009

Pollutant Name: PM10 - Brake Wear   Temperature: 70F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
20	0.013	0.013	0.013	0.021	0.013	0.006	0.013
30	0.013	0.013	0.013	0.021	0.013	0.006	0.013

EQUIPMENT				Equipment Emissions (ppd)						
Construction Phase	Hours in Work Day	# Equipment	Total Equipments	CO	ROG	NOX	SOX	PM10	PM 2.5	CO2
General Construction Activity	12	20	20	90.36	20.93	190.51	0.31	7.92	7.29	29,520.00

WORKER VEHICLES					Worker Vehicle Emissions (ppd)						
Construction Phase	# of Workers	Round Trip Length	# Worker Vehicle @ 1.1 AVR	Total VMT/Day	CO	ROG	NOX	SOX	PM10	PM 2.5	CO2
General Construction Activity	150	13.3	136.36	1,813.64	7.00	0.25	0.55	0.012	0.124	0.11	1,373.578

HAUL TRUCKS						Haul Truck Emissions (ppd)						
Construction Phase	Debris / Pavement / Concrete per Day (cy/day)	# of Haul Loads per Day (20 cy/load)	# of Haul Loads per Hour	Haul Truck Round Trip Length	Haul Truck VMT/day	CO	ROG	NOX	SOX	PM10	PM2.5	CO2
General Construction Activity	4,000.00	200	16.7	20	4,000	57.11	9.81	76.65	0.15	4.01	3.69	15,721.13

Dirt Piling/Material Handling							
Construction Phase		Tons of Dirt/Day	Pounds of Dirt/day	(G/5)^1.3, G=Wind Speed	(H/2)^1.4, H=Moisture Content	PM10 Emissions	PM 2.5 Emissions
General Construction Activity	4,000	4,860	9,720,000	0.54	6.36	0.46	0.05

Dragline			
Construction Phase	Daily Volume (cy Debris/day)	PM10 Emissions	PM2.5 Emissions
General Construction Activity	4,000.00	16.80	6.80

NOTES:	
Average Wind Speed (mph)	3.10
Moisture Content	7.5%
Dirt Weight	2,000
Silt Content	10%

TOTAL EMISSIONS						
Construction Phase	CO	ROG	NOX	SOX	PM10	PM2.5
ON SITE	90	21	191	0.3	25	14
OFF SITE	57	10	77	0	4	4
TOTAL	147	31	267	0	29	18

GHG Emissions Calcs	
pounds/day	metric tons/year
46,615	7,827

Appendix B

Operational Emissions

Title   : Crenshaw - Operational Emissions
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2008/09/03 10:45:48
Scen Year: 2030 -- All model years in the range 1986 to 2030 selected
Season   : Annual
Area   : Los Angeles (SC)

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Year: 2030 -- Model Years 1986 to 2030 Inclusive -- Annual
Emfac2007 Emission Factors: V2.3 Nov 1 2006

Los Angeles (SC)   Los Angeles (SC)   Los Angeles (SC)

Table 1: Running Exhaust Emissions (grams/mile)

Pollutant Name: Total Organic Gases   Temperature: 63F   Relative Humidity: 66%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
23	0.021	0.040	0.058	0.314	0.553	2.387	0.060

Pollutant Name: Carbon Monoxide   Temperature: 63F   Relative Humidity: 66%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
23	0.670	1.228	1.397	1.552	4.086	15.388	1.059

Pollutant Name: Oxides of Nitrogen   Temperature: 63F   Relative Humidity: 66%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
23	0.046	0.099	0.185	2.425	7.416	1.039	0.230

Pollutant Name: Sulfur Dioxide   Temperature: 63F   Relative Humidity: 66%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
23	0.004	0.005	0.007	0.017	0.017	0.002	0.005

Pollutant Name: PM10   Temperature: 63F   Relative Humidity: 66%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
23	0.015	0.035	0.035	0.103	0.158	0.016	0.029

Pollutant Name: PM10 - Tire Wear   Temperature: 63F   Relative Humidity: 66%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
23	0.008	0.008	0.009	0.025	0.010	0.004	0.009

Pollutant Name: PM10 - Brake Wear   Temperature: 63F   Relative Humidity: 66%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
23	0.013	0.013	0.013	0.021	0.013	0.006	0.013

Pollutant Name: Methane Temperature: 63F Relative Humidity: 66%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
23	0.009	0.016	0.018	0.015	0.030	0.192	0.013

Pollutant Name: Carbon Dioxide Temperature: 63F Relative Humidity: 66%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
23	401.212	514.282	701.026	1740.724	1797.938	158.982	548.358

Crenshaw LRT Operational Criteria Pollutant Emissions

Crenshaw Vehicle Miles Traveled (VMT) Summary[1]				
Scenario	Auto Regional VMT	Bus VMT	LRT VMT	Total Miles Traveled
NB	454,428,833	686,607	0	455,115,440
LRT	454,261,449	686,662	3,632	454,951,743

Crenshaw VMT Alternative Comparison				
Scenario	Auto Regional VMT	Bus VMT	LRT VMT	Total VMT
NB v. LRT	-167,384	54	3,632	-163,698

Automobile Emission Factors (grams/mile)						
Vehcile	VOC	CO	NO_X	SO_X	$PM_{2.5}$	PM_{10}
Auto[2]	0.031	0.949	0.073	0.005	0.010	0.015
Bus[3]	0.820	8.20	4.92	-	0.040	0.041

Light Rail Transit Emission Factors (pounds/megawatt-hour)						
Vehcile	VOC	CO	NO_X	SO_X	$PM_{2.5}$	PM_{10}
Light Rail	0.010	0.200	1.150	0.120	0.040	0.040

Regional Operational Emissions (pounds/day)						
Scenario	VOC	CO	NO_X	SO_X	$PM_{2.5}$	PM_{10}
NB v. LRT[3]	-11	-337	45	5.7	-1.2	-3.2

Regional Operational Emissions (tons/yr)						
Scenario	VOC	CO	NO_X	SO_X	$PM_{2.5}$	PM_{10}
NB v. LRT	-2.0	-61	8	1.0	-0.2	-0.6

1 Vehicle miles traveled obtained from traffic analysis. Does not include Metrolink miles.
2 Auto emission factors obtained from EMFAC2007.
3 Assumes 17 kilowatt-hours per train mile.

Crensahaw LRT Operational Greenhouse Gas Emissions

Crenshaw Vehicle Miles Traveled (VMT) Summary[1]				
Scenario	**Auto Regional VMT**	**Bus VMT**	**LRT VMT**	**Total Miles Traveled**
NB	454,428,833	686,607	0	455,115,440
LRT	454,261,449	686,662	3,632	454,951,743

Crenshaw VMT Alternative Comparison				
Scenario	**Auto Regional VMT**	**Bus VMT**	**LRT VMT**	**Total VMT**
NB v. LRT	-167,384	54	3,632	-163,698

Emission Factors (grams/mile)			Emission Factors (pounds/kilowatt-hour)		
Auto[2]		**Bus[3]**	**Light Rail[3]**		
CO_2	CH_4	CO_2 eq.	CO_2	CH_4	N_2O
548.358	0.013	3,275	0.805	0.0000067	0.0000037

GHG Emissions (metric tons/year)	
Scenario	**GHG**
NB v. LRT[4]	-25,568

1 Vehicle miles traveled obtained from traffic analysis. Urban rail miles are identical (18,156) for each alternative.
2 Auto emission factors obtained from EMFAC2007.
3 California Climate Action Registry, General Reporting Protocol, March 2007.
4 Assumes 17 kilowatt-hours per train mile.

NOISE APPENDIX

Appendix A

LRT Noise and Vibration

Crenshaw LRT Operational Noise Summary Sheet

:ategory 1&3 = Le
Category 2 = Ldn

Rec. #	Street That Alignment Follows	SITE #	LRT Alignment	Receptor Description		# Bldgs	Noise Sensitive Category (1,2,3)	Speed (mph)	Distance from Alignment to Receptor (ft)	Distance from Centerline to Receptor (ft)	Measurement Location Being Used	Measurement Raw Reading	Project Induced Noise (dBA)	Level of Impact	Vibration Criteria (Vdb)	Vibration Level (adjusted to speed) (Vdb)
	Crenshaw Blvd	B	Crenshaw Blvd	Sweet Hour of Prayer Faith Church			3	35	80	100	B	71	56	No Impact	75	66
	Crenshaw Blvd	B	Crenshaw Blvd	Muhammad Mosque No. 27			3	35	80	100	B	71	56	No Impact	75	66
	Crenshaw Blvd	B	Crenshaw Blvd	Iglesia De Dios Pentecostal			3	35	80	100	B	71	56	No Impact	75	66
	Crenshaw Blvd	C	Crenshaw Blvd	Bethel Chapel Community Church			3	35	75	95	C	75	57	No Impact	75	67
	Crenshaw Blvd	B	Crenshaw Blvd	Masjid Balal Ibn Rabah (Church)			3	35	80	100	B	75	56	No Impact	75	66
	Crenshaw Blvd	C	Crenshaw Blvd	View Park Prepatory Accelerated Schools			3	35	72	92	C	75	57	No Impact	75	68
	Crenshaw Blvd	B	Crenshaw Blvd	Frederick Douglas Middle School			3	35	88	108	B	71	56	No Impact	75	66
	Crenshaw Blvd	B	Crenshaw Blvd	Crenshaw Montessori Academy			3	35	75	95	B	71	54	No Impact	75	67
	Crenshaw Blvd	B	Crenshaw Blvd	Bethesda Temple Apostolic Church			3	35	80	100	B	71	56	No Impact	75	66
	Crenshaw Blvd	B	Crenshaw Blvd	Escuela Elementary Center			3	35	80	100	B	71	56	No Impact	75	66
	Crenshaw Blvd	B	Crenshaw Blvd	4802, 4808, 4812 Crenshaw			2	35	110	130	B	72	60	No Impact	72	64
	Crenshaw Blvd	B	Crenshaw Blvd	4816 Crenshaw			2	35	82	102	B	72	61	No Impact	72	66
	Crenshaw Blvd	B	Crenshaw Blvd	4822, 4826, 4830 Crenshaw			2	35	106	126	B	72	60	No Impact	72	65
	Crenshaw Blvd	B	Crenshaw Blvd	4900 Crenshaw			2	35	77	97	B	72	62	No Impact	72	67
	Crenshaw Blvd	B	Crenshaw Blvd	4904 Crenshaw			2	35	115	135	B	72	59	No Impact	72	64
	Crenshaw Blvd	B	Crenshaw Blvd	4908 Crenshaw			2	35	144	164	B	72	58	No Impact	72	61
	Crenshaw Blvd	B	Crenshaw Blvd	4916 Crenshaw			2	35	88	108	B	72	61	No Impact	72	66
	Crenshaw Blvd	B	Crenshaw Blvd	4924, 4928 Crenshaw			2	35	112	132	B	72	59	No Impact	72	64
	Crenshaw Blvd	B	Crenshaw Blvd	3315 W 50th St.			2	35	72	92	B	72	62	No Impact	72	68
	Crenshaw Blvd	B	Crenshaw Blvd	4835 Crenshaw			2	35	80	100	B	72	62	No Impact	72	66
	Crenshaw Blvd	B	Crenshaw Blvd	5001 Crenshaw			2	35	120	140	B	72	59	No Impact	72	63
	Crenshaw Blvd	B	Crenshaw Blvd	5009, 5017 Crenshaw			2	35	128	148	B	72	59	No Impact	72	63
	Crenshaw Blvd	B	Crenshaw Blvd	5025, 5031 Crenshaw			2	35	135	155	B	72	58	No Impact	72	62
	Crenshaw Blvd	B	Crenshaw Blvd	5101, 5107 Crenshaw			2	35	136	156	B	72	58	No Impact	72	62
	Crenshaw Blvd	B	Crenshaw Blvd	5117 Crenshaw			2	35	88	108	B	72	61	No Impact	72	66
	Crenshaw Blvd	C	Crenshaw Blvd	5903 Crenshaw			2	35	64	84	C	77	63	No Impact	72	69
	Crenshaw Blvd	C	Crenshaw Blvd	5909 Crenshaw			2	35	72	92	C	77	62	No Impact	72	68
	Crenshaw Blvd	C	Crenshaw Blvd	5919, 5925 Crenshaw			2	35	64	84	C	77	63	No Impact	72	69
	Florence Ave	2	Florence Ave	Inglewood Park Cemetery			3	55	160	180	2	60	51	No Impact	75	64
	Florence Ave	D	Florence Ave	Briercrest Inglewood Healthcare Center			2	55	72	92	D	68	63	**Moderate**	65	**71**
	Florence Ave	D	Florence Ave	Edward Vincent Park			1	55	520	540	D	60	48	No Impact	75	61
	Florence Ave	E	Florence Ave	Faithful Central Bible Church			3	35	72	92	E	71	57	No Impact	75	68
	Florence Ave	D	Florence Ave	St. John's Chrystostom Church and School			3	55	200	220	D	68	54	No Impact	75	61
	Florence Ave	1	Florence Ave	7107 Brynhurst			2	55	120	140	1	73	54	No Impact	72	67
	Florence Ave	1	Florence Ave	7112 West Blvd			2	55	120	140	1	73	60	No Impact	72	67
	Florence Ave	1	Florence Ave	7124 West Blvd			2	55	192	112	1	73	57	No Impact	72	62
	Florence Ave	D	Florence Ave	714 E Florence			2	55	200	220	D	69	57	No Impact	72	61
	Florence Ave	D	Florence Ave	700, 708 E Florence			2	55	184	204	D	69	57	No Impact	72	63
	Florence Ave	D	Florence Ave	444 N Osage Ave			2	55	260	280	D	69	49	No Impact	72	61
	Florence Ave	D	Florence Ave	608, 618 E Florence			2	55	200	220	D	69	57	No Impact	72	61
	Florence Ave	D	Florence Ave	612 E Florence			2	55	220	240	D	69	56	No Impact	72	61
	Florence Ave	D	Florence Ave	600 E Florence			2	55	192	212	D	69	57	No Impact	72	62
	Florence Ave	D	Florence Ave	333 - 423 La Colina, 338 Beach			2	55	64	84	D	69	64	**Moderate**	72	**73**
	Florence Ave	9	Florence Ave	7862 Midfield Ave			2	35	150	170	9	68	54	No Impact	72	60
	Florence Ave	E	Florence Ave	619 Regent			2	35	120	140	E	68	56	No Impact	72	63
	Aviation Blvd	F	Aviation Blvd	9706, 9712, 9720 Aviation Blvd			2	35	240	260	F	74	52	No Impact	72	57
	Aviation Blvd	F	Aviation Blvd	5524 W 98th St			2	35	123	143	F	75	60	No Impact	72	63
	Aviation Blvd	F	Aviation Blvd	5447 W Century Blvd			2	35	123	143	F	75	60	No Impact	72	63
	Florence Ave	D	Florence Ave	Courthouse			3	55	83	103	D	68	60	No Impact	72	70
	Crenshaw Blvd	C	Crenshaw Blvd	5716, 5720, 5728 Crenshaw			2	55	74	94	C	77	63	No Impact	72	71
	Aviation Blvd	F	Aviation Blvd	Crimson Technical College			3	35	60	80	F	75	58	No Impact	75	69
	Florence Ave	9	Florence Ave	Westchester Playhouse			3	35	335	355	9	70	47	No Impact	72	57
	Florence Ave	9	Florence Ave	Stilleto Entertainment			1	35	52	72	9	70	59	No Impact	65	60
	Florence Ave	E	Florence Ave	129 Ash			2	35	136	156	E	68	55	No Impact	72	62
	Aviation Blvd	F	Aviation Blvd	Merle Norman			3	35	88	108	F	75	56	No Impact	72	66
	Crenshaw Blvd	C	Crenshaw Blvd	G Life Records			1	55	290	310	C	75	52	No Impact	72	61

Crenshaw LRT Operational Noise Variables

Rec. #	Street That Alignment Follows	Receptor Description	Noise Sensitive Category (1,2,3)	Technology LRT = 4	Distance from Alignment to Receptor (ft)	Daytime Average, 7a.m.-10.p.m. (Cat 2) Noisiest Hour of Activity (Cat 1&3) Speed (mph)	Trains/Hour	Cars/Train	Nighttime Average, 10 p.m.-7a.m. (Category 2 Only) Speed (mph)	Trains/Hour	Cars/Train	Wheel Flat %	LRT Only Jointed Track? (Y/N)	Embedded Track? (Y/N)	Aerial Structure? (Y/N)	Barrier Present?	Shielding # of Intervening Building Rows	Category 1&3=Peak Leq Category 2=Ldn (dBA) Per Source
B	Crenshaw Blvd	Sweet Hour of Prayer Faith Church	3	4	80	35	20	2	55	6	2	0	n	n	n	n	0	56
B	Crenshaw Blvd	Muhammad Mosque No. 27	3	4	80	35	20	2	55	6	2	0	n	n	n	n	0	56
B	Crenshaw Blvd	Iglesia De Dios Pentecostal	3	4	80	35	20	2	55	6	2	0	n	n	n	n	0	56
C	Crenshaw Blvd	Bethel Chapel Community Church	3	4	75	35	20	2	55	6	2	0	n	n	n	n	0	57
B	Crenshaw Blvd	Masjid Balal Ibn Rabah (Church)	3	4	80	35	20	2	55	6	2	0	n	n	n	n	0	56
C	Crenshaw Blvd	View Park Prepatory Accelerated Schools	3	4	72	35	20	2	55	6	2	0	n	n	n	n	0	57
B	Crenshaw Blvd	Frederick Douglas Middle School	3	4	88	35	20	2	55	6	2	0	n	n	n	n	0	56
B	Crenshaw Blvd	Crenshaw Montessori Academy	3	4	120	35	20	2	55	6	2	0	n	n	n	n	0	54
B	Crenshaw Blvd	Bethesda Temple Apostolic Church	3	4	80	35	20	2	55	6	2	0	n	n	n	n	0	56
B	Crenshaw Blvd	Escuela Elementary Center	3	4	80	35	20	2	55	6	2	0	n	n	n	n	0	56
B	Crenshaw Blvd	4802, 4808, 4812 Crenshaw	2	4	110	35	20	2	55	6	2	0	n	n	n	n	0	60
B	Crenshaw Blvd	4816 Crenshaw	2	4	82	35	20	2	55	6	2	0	n	n	n	n	0	61
B	Crenshaw Blvd	4822, 4826, 4830 Crenshaw	2	4	106	35	20	2	55	6	2	0	n	n	n	n	0	60
B	Crenshaw Blvd	4900 Crenshaw	2	4	77	35	20	2	55	6	2	0	n	n	n	n	0	62
B	Crenshaw Blvd	4904 Crenshaw	2	4	115	35	20	2	55	6	2	0	n	n	n	n	0	59
B	Crenshaw Blvd	4908 Crenshaw	2	4	144	35	20	2	55	6	2	0	n	n	n	n	0	58
B	Crenshaw Blvd	4916 Crenshaw	2	4	88	35	20	2	55	6	2	0	n	n	n	n	0	61
B	Crenshaw Blvd	4924, 4928 Crenshaw	2	4	112	35	20	2	55	6	2	0	n	n	n	n	0	59
B	Crenshaw Blvd	3315 W 50th St.	2	4	72	35	20	2	55	6	2	0	n	n	n	n	0	62
B	Crenshaw Blvd	4835 Crenshaw	2	4	80	35	20	2	55	6	2	0	n	n	n	n	0	62
B	Crenshaw Blvd	5001 Crenshaw	2	4	120	35	20	2	55	6	2	0	n	n	n	n	0	59
B	Crenshaw Blvd	5009, 5017 Crenshaw	2	4	128	35	20	2	55	6	2	0	n	n	n	n	0	59
B	Crenshaw Blvd	5025, 5031 Crenshaw	2	4	135	35	20	2	55	6	2	0	n	n	n	n	0	58
B	Crenshaw Blvd	5101, 5107 Crenshaw	2	4	136	35	20	2	55	6	2	0	n	n	n	n	0	58
B	Crenshaw Blvd	5117 Crenshaw	2	4	88	35	20	2	55	6	2	0	n	n	n	n	0	61
C	Crenshaw Blvd	5903 Crenshaw	2	4	64	35	20	2	55	6	2	0	n	n	n	n	0	63
C	Crenshaw Blvd	5909 Crenshaw	2	4	72	35	20	2	55	6	2	0	n	n	n	n	0	62
C	Crenshaw Blvd	5919, 5925 Crenshaw	2	4	64	35	20	2	55	6	2	0	n	n	n	n	0	63
2	Florence Ave	Inglewood Park Cemetery	3	4	160	55	20	2	55	6	2	0	n	n	n	y	0	51
D	Florence Ave	Briercrest Inglewood Healthcare Center	2	4	72	55	20	2	55	6	2	0	n	n	n	n	0	63
D	Florence Ave	Edward Vincent Park	1	4	520	55	20	2	55	6	2	0	n	n	n	n	0	48
E	Florence Ave	Faithful Central Bible Church	3	4	72	35	20	2	35	6	2	0	n	n	n	n	0	57
D	Florence Ave	St. John's Chrystostom Church and School	3	4	200	55	20	2	55	6	2	0	n	n	n	n	0	54
1	Florence Ave	7107 Brynhurst	2	4	120	55	20	2	55	6	2	0	n	n	n	n	2	54
1	Florence Ave	7112 West Blvd	2	4	120	55	20	2	55	6	2	0	n	n	n	n	0	60
1	Florence Ave	7124 West Blvd	2	4	192	55	20	2	55	6	2	0	n	n	n	n	0	57
D	Florence Ave	714 E Florence	2	4	200	55	20	2	55	6	2	0	n	n	n	n	0	57
D	Florence Ave	700, 708 E Florence	2	4	184	55	20	2	55	6	2	0	n	n	n	n	0	57
D	Florence Ave	444 N Osage Ave	2	4	260	55	20	2	55	6	2	0	n	n	n	n	2	49
D	Florence Ave	608, 618 E Florence	2	4	200	55	20	2	55	6	2	0	n	n	n	n	0	57
D	Florence Ave	612 E Florence	2	4	220	55	20	2	55	6	2	0	n	n	n	n	0	56
D	Florence Ave	600 E Florence	2	4	192	55	20	2	55	6	2	0	n	n	n	n	0	57
D	Florence Ave	333 - 423 La Colina, 338 Beach	2	4	64	55	20	2	55	6	2	0	n	n	n	n	0	64
9	Florence Ave	7862 Midfield Ave	2	4	150	35	20	2	35	6	2	0	n	n	y	n	1	54
E	Florence Ave	619 Regent	2	4	120	35	20	2	35	6	2	0	n	n	n	n	0	56
F	Aviation Blvd	9706, 9712, 9720 Aviation Blvd	2	4	240	35	20	2	35	6	2	0	n	n	n	n	0	52
F	Aviation Blvd	5524 W 98th St	2	4	123	35	20	2	35	6	2	0	n	n	y	n	0	60
F	Aviation Blvd	5447 W Century Blvd	2	4	123	35	20	2	35	6	2	0	n	n	y	n	0	60
D	Florence Ave	Courthouse	3	4	83	55	20	2	55	6	2	0	n	n	n	n	0	60
C	Crenshaw Blvd	5716, 5720, 5728 Crenshaw	2	4	74	55	20	2	55	6	2	0	n	n	n	n	0	63
F	Aviation Blvd	Crimson Technical College	3	4	60	35	20	2	35	6	2	0	n	n	n	n	0	58
9	Florence Ave	Westchester Playhouse	3	4	335	35	20	2	35	6	2	0	n	n	n	n	0	47
9	Florence Ave	Stilleto Entertainment	1	4	52	35	20	2	35	6	2	0	n	n	n	n	0	59
E	Florence Ave	129 Ash	2	4	136	35	20	2	35	6	2	0	n	n	n	n	0	55
F	Aviation Blvd	Merle Norman	3	4	88	35	20	2	35	6	2	0	n	n	n	n	0	56
56	Crenshaw Blvd	G Life Records	1	4	290	55	20	2	55	6	2	0	n	n	n	n	0	52

Crenshaw LRT Below-Grade Vibration and Noise Analysis

Address	Receptor Description	Noise Sensitive Category (1,2,3)	Speed (mph)	Distance from Alignment to Receptor (ft)	Vibration Criteria (Vdb)	Vibration Level (adjusted to speed) (Vdb)	GB Noise (Vdb)
6627 Crenshaw	Residential	2	25	43	72	68	33
6621 Crenshaw	Residential	2	30	50	72	69	34
6613 Crenshaw	Residential	2	35	43	72	71	36
6607 Crenshaw	Residential	2	35	58	72	69	34
6601 Crenshaw	Residential	2	35	43	72	71	**36**
6531 Crenshaw	Residential	2	35	43	72	71	**36**
6501 Crenshaw	Hyde Park Congressional Church	3	35	43	75	71	36
6419 Crenshaw	Residential	2	35	50	72	70	**35**
6416 Crenshaw	Mision Cristiana El Amor (Church)	3	35	43	75	71	36
6412 Crenshaw	Residential	2	35	74	72	68	33
6345 Crenshaw	Cornett Motel	2	35	43	72	71	**36**
6340 Crenshaw	Hyde Park Motel	2	35	43	72	71	**36**
6332 Crenshaw	Residential	2	35	43	72	71	**36**
6326 Crenshaw	Residential	2	35	50	72	70	**35**
6315 Crenshaw	Revival Center Church of God	3	35	43	75	71	36
6303 Crenshaw	Crenshaw Inn Motel	2	35	43	72	71	**36**
6215 Crenshaw	Residential	2	35	50	72	70	**35**
6207 Crenshaw	Residential	2	35	47	72	71	**36**
6203 Crenshaw	Residential	2	35	47	72	71	**36**
6121 Crenshaw	Residential	2	35	43	72	71	**36**
6131 Crenshaw	Residential	2	35	50	72	70	**35**
6103 Crenshaw	St. John the Evangelist School and Church	3	35	54	75	70	35
6028 Crenshaw	Senior Living Center	2	35	90	72	65	30
5969 Crenshaw	St. Mark's Baptist Church	3	55	58	75	73	38
4601 Crenshaw	Harrison-Ross Mortuary	3	35	64	75	69	34
4514 Crenshaw	Today's Fresh Start School	3	35	261	75	57	22
4508 Crenshaw	Golden Day & University	3	35	231	75	57	22
4434 Crenshaw	Tavis Smiley Foundation	1	35	16	65	**>78**	**>43**
4309 Crenshaw	2 Down Front Entertainment	1	35	60	65	**69**	**34**
4309 Crenshaw	Laq Records	1	35	120	65	63	**28**
4225 Crenshaw	Maverick's Flat	1	35	45	65	**71**	**36**
4101 Crenshaw	Broadway Department Store	3	35	84	75	66	31
4030 Crenshaw	DWP Building	3	35	41	75	71	36
4005 Crenshaw	May Company Building	3	55	92	75	69	34
3964 Crenshaw	Residential	2	55	88	72	70	**35**
3875 Crenshaw	Angelus Funeral Home	1	35	92	65	65	**30**
3773 Crenshaw	Lulu Washington Dance Theater	1	55	80	72	70	**35**
3683 Crenshaw	One United Bank	3	25	28	75	72	37
3677 Crenshaw	Jim Eve Records	1	35	50	65	**70**	**35**
3600 Crenshaw	West Los Angeles Church of God	3	35	201	75	57	22
3321 50th	Residential	2	55	95	72	69	34
3319 50th	Residential	2	55	140	72	65	30
3413 63rd	Residential	2	55	89	72	70	35
3331 59th	Residential	2	55	66	72	72	37

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Sweet Hour of Prayer Faith Church

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	56		
Source 1	56		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	80				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Muhammad Mosque No. 27

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	56		
Source 1	56		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	80				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Iglesia De Dios Pentecostal

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	56		
Source 1	56		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	80				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Bethel Chapel Community Church

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	57		
Source 1	57		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	75				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Masjid Balal Ibn Rabah (Church)

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	56		
Source 1	56		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	80				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: View Park Prepatory Accelerated Schools

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	57		
Source 1	57		
Source 2	48		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4	Crossover	13		
Distance (source to receiver)	distance (ft)	72	distance (ft)	72		
Noisiest Hour of	speed (mph)	35	trains/hour	20		
Activity During	trains/hour	20	duration of one train (sec)	10		
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n	Y/N			
Aerial Structure?	Y/N	n	Y/N			
Barrier Present?	Y/N	n	Y/N			
Intervening Rows of of Buildings	number of rows	0	number of rows			

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Frederick Douglas Middle School

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	56		
Source 1	56		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	88				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Crenshaw Montessori Academy

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	54		
Source 1	54		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	120				
Noisiest Hour of Activity During Sensitive Hours	speed (mph)	35				
	trains/hour	20				
	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Bethesda Temple Apostolic Church

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	56		
Source 1	56		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	80				
Noisiest Hour of Activity During Sensitive Hours	speed (mph)	35				
	trains/hour	20				
	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Escuela Elementary Center

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	56		
Source 1	56		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	80				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 4802, 4808, 4812 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	60	54	53
Source 1	60	54	53
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	110				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 4816 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	61	56	55
Source 1	61	56	55
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	82				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 4822, 4826, 4830 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	60	54	53
Source 1	60	54	53
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	106				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 4900 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	62	57	55
Source 1	62	57	55
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	77				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 4904 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	59	54	53
Source 1	59	54	53
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	115				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 4908 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	58	52	51
Source 1	58	52	51
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	144				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 4916 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	61	56	54
Source 1	61	56	54
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	88				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 4924, 4928 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	59	54	53
Source 1	59	54	53
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	112				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 3315 W 50th St.

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	62	57	56
Source 1	62	57	56
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	72				
Daytime Hours (7 AM - 10 PM)	speed (mph)	35				
	trains/hour	20				
	cars/train	2				
Nighttime Hours (10 PM - 7 AM)	speed (mph)	55				
	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 4835 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	62	56	55
Source 1	62	56	55
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	80				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 5001 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	59	54	52
Source 1	59	54	52
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	120				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 5009, 5017 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	59	53	52
Source 1	59	53	52
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	128				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: 5025, 5031 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	58	53	52
Source 1	58	53	52
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	135				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 5101, 5107 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	58	53	52
Source 1	58	53	52
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	136				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: 5117 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	61	56	54
Source 1	61	56	54
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	88				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 5903 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	63	58	56
Source 1	63	58	56
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	64				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: 5909 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	62	57	56
Source 1	62	57	56
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	72				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: 5919, 5925 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	63	58	56
Source 1	63	58	56
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	64				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: Inglewood Park Cemetery

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	51		
Source 1	51		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	160				
Noisiest Hour of	speed (mph)	55				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	y				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessment
Developed for Chicago Create Project
Copyright 2006, HMMH Inc.
Case: Briercrest Inglewood Healthcare Center

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	63	61	56
Source 1	63	61	56
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	72				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: Edward Vincent Park

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	48		
Source 1	48		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	1

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	520				
Noisiest Hour of Activity During Sensitive Hours	speed (mph)	55				
	trains/hour	20				
	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: Faithful Central Bible Church

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	57		
Source 1	57		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	72				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		35				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: St. John's Chrystostom Church and School

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	54		
Source 1	54		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	200				
Noisiest Hour of	speed (mph)	55				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: 7107 Brynhurst

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	54	52	46
Source 1	54	52	46
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	120				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	2				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 7112 West Blvd

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	60	58	52
Source 1	60	58	52
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	120				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 7124 West Blvd

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	57	54	49
Source 1	57	54	49
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	192				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 714 E Florence

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	57	54	49
Source 1	57	54	49
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	200				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 700, 708 E Florence

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	57	55	50
Source 1	57	55	50
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	184				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 444 N Osage Ave

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	49	47	41
Source 1	49	47	41
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	260				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	2				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 608, 618 E Florence

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	57	54	49
Source 1	57	54	49
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	200				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 612 E Florence

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	56	54	48
Source 1	56	54	48
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	220				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 600 E Florence

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	57	54	49
Source 1	57	54	49
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	192				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 333 - 423 La Colina, 338 Beach

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	64	62	56
Source 1	64	62	56
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	64				
Daytime Hours (7 AM - 10 PM)	speed (mph)	55				
	trains/hour	20				
	cars/train	2				
Nighttime Hours (10 PM - 7 AM)	speed (mph)	55				
	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 7862 Midfield Ave

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	54	52	46
Source 1	54	52	46
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	150				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	35				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	y				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	1				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 619 Regent

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	56	54	48
Source 1	56	54	48
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	120				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	35				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 9706, 9712, 9720 Aviation Blvd

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	52	49	44
Source 1	52	49	44
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	240				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	35				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 5524 W 98th St

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	60	57	52
Source 1	60	57	52
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	123				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	35				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	y				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: 5447 W Century Blvd

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	60	57	52
Source 1	60	57	52
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	123				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	35				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	y				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Courthouse

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	60		
Source 1	60		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	83				
Noisiest Hour of	speed (mph)	55				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: 5716, 5720, 5728 Crenshaw

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	63	61	55
Source 1	63	61	55
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	74				
Daytime Hours	speed (mph)	55				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	55				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Crimson Technical College

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	58		
Source 1	58		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	60				
Noisiest Hour of Activity During Sensitive Hours	speed (mph)	35				
	trains/hour	20				
	cars/train	2				
		35				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Westchester Playhouse

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	47		
Source 1	47		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	335				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		35				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Stilleto Entertainment

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	59		
Source 1	59		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	1

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	52				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		35				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: 129 Ash

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	55	53	48
Source 1	55	53	48
Source 2	0	0	0
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	136				
Daytime Hours	speed (mph)	35				
(7 AM - 10 PM)	trains/hour	20				
	cars/train	2				
Nighttime Hours	speed (mph)	35				
(10 PM - 7 AM)	trains/hour	6				
	cars/train	2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Merle Norman

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	56		
Source 1	56		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	88				
Noisiest Hour of	speed (mph)	35				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		35				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: G Life Records

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	52		
Source 1	52		
Source 2	0		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	1

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	RRT/LRT	4				
Distance (source to receiver)	distance (ft)	290				
Noisiest Hour of	speed (mph)	55				
Activity During	trains/hour	20				
Sensitive Hours	cars/train	2				
		55				
		6				
		2				
Wheel Flats?	% of cars w/ wheel flats	0.00%				
Jointed Track?	Y/N	n				
Embedded Track?	Y/N	n				
Aerial Structure?	Y/N	n				
Barrier Present?	Y/N	n				
Intervening Rows of of Buildings	number of rows	0				

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Appendix B

Stationary Sources

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmer
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Parking - Exposition

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	52.3	50	45
Source 1	0	0	0
Source 2	52.3	50	45
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	0		Park & Ride Lot	23		
Distance (source to receiver)			distance (ft)	200		
Daytime Hours (7 AM - 10 PM)			autos/hour	200		
			buses/hour	18		
Nighttime Hours (10 PM - 7 AM)			autos/hour	50		
			buses/hour	6		
Wheel Flats?						
Jointed Track?						
Embedded Track?						
Aerial Structure?						
Barrier Present?			Y/N	N		
Intervening Rows of of Buildings			number of rows	0		

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
Copyright 2006, HMMH Inc.
Case: Parking - La Brea Residential

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	53.7	51	46
Source 1	0	0	0
Source 2	53.7	51	46
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	0		Park & Ride Lot	23		
Distance (source to receiver)			distance (ft)	175		
Daytime Hours (7 AM - 10 PM)			autos/hour buses/hour	187 18		
Nighttime Hours (10 PM - 7 AM)			autos/hour buses/hour	47 6		
Wheel Flats?						
Jointed Track?						
Embedded Track?						
Aerial Structure?						
Barrier Present?			Y/N	N		
Intervening Rows of of Buildings			number of rows	0		

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessmen
Developed for Chicago Create Projec
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Case: Parking - La Brea Church

RESULTS			
Noise Source	**Leq - 1-hr (dB)**		
All Sources	51.1		
Source 1	0		
Source 2	51.1		
Source 3	0		
Source 4	0		
Source 5	0		
Source 6	0		
Source 7	0		
Source 8	0		

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	3

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	0		Park & Ride Lot	23		
Distance (source to receiver)			distance (ft)	175		
Noisiest Hour of Activity During Sensitive Hours			autos/hour buses/hour	187 18		
Wheel Flats?						
Jointed Track?						
Embedded Track?						
Aerial Structure?						
Barrier Present?			Y/N	N		
Intervening Rows of of Buildings			number of rows	0		

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Noise Model Based on Federal Transit Adminstration General Transit Noise Assessment
Developed for Chicago Create Project
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Case: Parking - La Brea Church

RESULTS			
Noise Source	**Ldn (dB)**	**Leq - daytime (dB)**	**Leq - nighttime (dB)**
All Sources	55.6	53	48
Source 1	0	0	0
Source 2	55.6	53	48
Source 3	0	0	0
Source 4	0	0	0
Source 5	0	0	0
Source 6	0	0	0
Source 7	0	0	0
Source 8	0	0	0

Enter noise receiver land use category below.

LAND USE CATEGORY	
Noise receiver land use category (1, 2 or 3)	2

Enter data for up to 8 noise sources below - see reference list for source numbers.

NOISE SOURCE PARAMETERS						
Parameter	**Source 1**		**Source 2**		**Source 3**	
Source Num.	0		Park & Ride Lot	23		
Distance (source to receiver)			distance (ft)	125		
Daytime Hours (7 AM - 10 PM)			autos/hour	128		
			buses/hour	12		
Nighttime Hours (10 PM - 7 AM)			autos/hour	32		
			buses/hour	4		
Wheel Flats?						
Jointed Track?						
Embedded Track?						
Aerial Structure?						
Barrier Present?			Y/N	N		
Intervening Rows of of Buildings			number of rows	0		

SOURCE REFERENCE LIST	
Source	**Number**
Commuter Electric Locomotive	1
Commuter Diesel Locomotive	2
Commuter Rail Cars	3
RRT/LRT	4
AGT, Steel Wheel	5
AGT, Rubber Tire	6
Monorail	7
Maglev	8
Freight Locomotive	9
Freight Cars	10
Hopper Cars (empty)	11
Hopper Cars (full)	12
Crossover	13
Automobiles	14
City Buses	15
Commuter Buses	16
Rail Yard or Shop	17
Layover Tracks	18
Bus Storage Yard	19
Bus Op. Facility	20
Bus Transit Center	21
Parking Garage	22
Park & Ride Lot	23

Source 4		Source 5		Source 6		Source 7		Source 8	

CALCULATIONS

Term	Sou 1	Sou 2	Sou 3	Sou 4	Sou 5	Sou 6	Sou 7	Sou 8
SELref	0.0	101.0	0.0	0.0	0.0	0.0	0.0	0.0
C1 - Coef	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
C1 - Denom	0.0	2000.0	0.0	0.0	0.0	0.0	0.0	0.0
C1 - Day Num	0.00	128.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - Night Num	0.00	32.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - Day	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C1 - Night	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C2 - Coef	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
C2 - Denom	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0
C2 - Day Num	0.00	12.00	0.00	0.00	0.00	0.00	0.00	0.00
C2 - Night Num	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00
C2 - Day	0.0	-2.5	0.0	0.0	0.0	0.0	0.0	0.0
C2 - Night	0.0	-7.4	0.0	0.0	0.0	0.0	0.0	0.0
C3 - Coef	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C3 - Denom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C3 - Day Num	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3 - Night Num	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3 - Day	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C3 - Night	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leq50ft - Day	0.0	62.9	0.0	0.0	0.0	0.0	0.0	0.0
Leq50ft - Night	0.0	58.0	0.0	0.0	0.0	0.0	0.0	0.0
Ldn50ft	6.4	65.6	6.4	6.4	6.4	6.4	6.4	6.4
Dist Coef	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0
Adj. Dist	0.0	-9.9	0.0	0.0	0.0	0.0	0.0	0.0
Adj. Wheel Flats	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Adj. Jointed	0	0	0	0	0	0	0	0
Adj. Embed	0	0	0	0	0	0	0	0
Adj. Aerial	0	0	0	0	0	0	0	0
Adj. Shield	0	0	0	0	0	0	0	0
Leq - Day	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0
Leq - Night	0.0	48.1	0.0	0.0	0.0	0.0	0.0	0.0
Ldn	0.0	55.6	0.0	0.0	0.0	0.0	0.0	0.0
Need Land Use	0							
Calc Leq	0							

Rec Leq-Day #NAME?
Rec Leq-Night
Rec LDN

Adj. Dist

REFERENCE DATA

				Term 1				Term 2				Term 3								Combine
Num	Desc	Ref SEL	Dist Term	Desc	Denom	Min	Coef	Desc	Denom	Min	Coef	Desc	Denom	Min	Coef	Jointed	Embedded	Aerial	Barrier	1&2?
0		0	0		0	0	0													
1	Commuter Electric Locomotive	90	15	speed (mph)	50	20	10.0	trains/hour	1	0.01	10.0	locos/train	1	1	10	5.0	3.0	4.0	-5.0	0.0
2	Commuter Diesel Locomotive	92	15	speed (mph)	50	20	-10.0	trains/hour	1	0.01	10.0	locos/train	1	1	10	5.0	3.0	4.0	-5.0	0.0
3	Commuter Rail Cars	82	15	speed (mph)	50	20	20.0	trains/hour	1	0.01	10.0	cars/train	1	1	10	5.0	3.0	4.0	-5.0	0.0
4	RRT/LRT	82	15	speed (mph)	50	20	20.0	trains/hour	1	0.01	10.0	cars/train	1	1	10	5.0	3.0	4.0	-5.0	0.0
5	AGT, Steel Wheel	80	15	speed (mph)	50	20	20.0	trains/hour	1	0.01	10.0	cars/train	1	1	10				-5.0	0.0
6	AGT, Rubber Tire	78	15	speed (mph)	50	20	20.0	trains/hour	1	0.01	10.0	cars/train	1	1	10				-5.0	0.0
7	Monorail	82	15	speed (mph)	50	20	20.0	trains/hour	1	0.01	10.0	cars/train	1	1	10				-5.0	0.0
8	Maglev	72	15	speed (mph)	50	20	20.0	trains/hour	1	0.01	10.0	cars/train	1	1	10			4.0	-5.0	0.0
9	Freight Locomotive	97	15	speed (mph)	40	20	10.0	trains/hour	1	0.01	10.0	locos/train	1	1	10	5.0	3.0	4.0	-5.0	0.0
10	Freight Cars	100	15	speed (mph)	40	20	20.0	trains/hour	1	0.01	10.0	h of cars (ft)	2000	40	10	5.0	3.0	4.0	-5.0	0.0
11	Hopper Cars (empty)	104	15	speed (mph)	40	20	20.0	trains/hour	1	0.01	10.0	h of cars (ft)	2000	40	10	5.0	3.0	4.0	-5.0	0.0
12	Hopper Cars (full)	100	15	speed (mph)	40	20	20.0	trains/hour	1	0.01	10.0	h of cars (ft)	2000	40	10	5.0	3.0	4.0	-5.0	0.0
13	Crossover	100	25	trains/hour	1	0.01	10.0	on of one trai	3600	0.01	10.0						3.0	4.0	-5.0	0.0
14	Automobiles	73	15	speed (mph)	50	30	28.1	vehicles/hou	1	0.01	10.0								-5.0	0.0
15	City Buses	84	15	speed (mph)	50	30	23.9	vehicles/hou	1	0.01	10.0								-5.0	0.0
16	Orange Line Bus	83	15	speed (mph)	40	30	14.6	vehicles/hou	1	0.01	10.0								-5.0	0.0
17	Rail Yard or Shop	118	25	trains/hour	20	0.01	10.0												-5.0	0.0
18	Layover Tracks	109	25	trains/hour	1	0.01	10.0												-5.0	0.0
19	Bus Storage Yard	111	25	buses/hour	100	0.01	10.0												-5.0	0.0
20	Bus Op. Facility	114	25	buses/hour	200	0.01	10.0	es serviced/l	60	0.01	10.0								-5.0	1.0
21	Bus Transit Center	101	25	buses/hour	20	0.01	10.0												-5.0	0.0
22	Parking Garage	92	25	autos/hour	1000	0.01	10.0												-5.0	0.0
23	Park & Ride Lot	101	25	autos/hour	2000	0.01	10.0	buses/hour	24	0.01	10.0								-5.0	1.0

LAND USE DATA

Category	Ldn/Leq
0	
1	Leq
2	Ldn
3	Leq

Warning Signal Noise

Location	Distance to Receptor	Receptor	Existing Noise Level	Metric	Impact Threshold	Unmitigated Warning Signal Noise	Mitigated Warning Signal Noise
48th	56	Residence	72	Ldn	66	64.3	58.3
52nd	180	Residence	72	Ldn	66	54.2	48.2
54th	96	Mosque	64	Leq	61	59.6	53.6
57th	36	View Park	68	Leq	63	**68.1**	62.1
Slauson	128	View Park	68	Leq	63	57.1	51.1
Brynhurst	120	Residence	69	Ldn	64	57.7	51.7
West	36	Residence	69	Ldn	64	**68.1**	62.1
Centinela	72	Healthcare	69	Ldn	64	62.1	56.1
Ivy	350	Church	68	Leq	63	48.4	42.4
Eucalyptus	408	Residence	68	Ldn	63	47.1	41.1
Cedar	430	Residence	68	Ldn	63	46.6	40.6
Oak	120	Residence	68	Ldn	63	57.7	51.7
Hindry							
Arbor Vitae	682	School	66	Leq	62	42.6	36.6

Reference Noise Level	109	85	103
Reference Distance	50	100	50

Leq day = SELref + 10log(Ed/3600) - 36.6
Leq night = SELref + 10log(En/3600) - 36.6

Ed = average daytime hourly duration
En = average nighttime hourly duration

Ldn = 10log((15)10^Leq(day)/10 + (9)10^(Leq(night)+10)/10) - 13.8

	Unmit	Mit	
Reference Noise Level	109	85	dBA
Reference Distance	50	100	feet
Bell duration	20	20	seconds
Day Trains	20	20	hour
Night Trains	6	6	hour

Leq Day	62.9	56.9
Leq Night	57.6	51.6

TPPS Noise

Location	Distance to Receptor	Receptor	Existing Noise Level	Metric	Impact Threshold	Unmitigated Noise
Florence and Redondo	200	Residence	69	Ldn	64	44.4
Crenshaw and 60th	Adjacent	Residence	77	Ldn	66	56.4
Crenshaw and 48th	Adjacent	Residence	72	Ldn	66	56.4

Reference Noise Level	50	85	44
Reference Distance	50	100	50

Ldn = 10log((15)10^Leq(day)/10 + (9)10^(Leq(night)+10)/10) - 13.8

Leq Day	50.0
Leq Night	50.0

Ventilation Shaft Noise

Location	Distance to Receptor	Receptor	Existing Noise Level	Metric	Impact Threshold	Unmitigated Noise
Crenshaw and 67th	75	Residence	77	Ldn	66	51.5
Crenshaw and 60th	Adjacent	Residence	77	Ldn	66	59.2
Crenshaw and Vernon	175	Mortuary	71	Leq	66	49.1

	Leq	Ldn
Reference Noise Level	60	55
Reference Distance	50	50

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Preliminary Geotechnical Report (Subtask 6.2.3)

Crenshaw/LAX Transit Corridor Project
Advanced Conceptual Engineering
Contract E0117

Prepared for:
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Los Angeles, CA 90012-2952

Prepared by:
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October 2010

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- Base Architecture
- DCA Civil Engineering Group
- Earth Mechanics, Inc.
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- IBI Group
- Jacobs Engineering Group, Inc.
- J. L. Patterson & Associates
- McKissack & McKissack
- PQM, Inc.
- The Solis Group
- Ultrasystems
- Wagner Engineering & Survey
- Wilson Ihrig & Associates

ISSUE AND REVISION RECORD

Rev	Date	Originator	Checker	Approver	Description
0	6/21/10	P. Espinosa	A. Lee, G. Ueblacker, R. Quraishi	H. Law, F. Nourbakhsh	Draft to Metro
1	10/04/10	P. Espinosa	A. Lee, M.Kapuskar	H. Law, F. Nourbakhsh	ACE final

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1 EXECUTIVE SUMMARY

The Los Angeles County Metropolitan Transportation Authority (Metro) is planning transit improvements in the Crenshaw/LAX Transit Corridor to accommodate demand for travel in north-south and east-west directions. These improvements will provide more direct service between downtown Los Angeles and Los Angeles International Airport (LAX), and important connections between the Crenshaw corridor and downtown Los Angeles, the Westside, and the South Bay.

As part of the advanced conceptual engineering design, Metro has requested that Hatch Mott MacDonald prepare a preliminary geotechnical report. As a subconsultant to Hatch Mott MacDonald, Earth Mechanics, Inc. (EMI) assists the design team in geotechnical engineering related aspects in this advanced conceptual engineering design phase.

Based on our knowledge of the geotechnical conditions along the project alignment and our understanding of the project requirements, it was originally planned to conduct field exploration program consisting of drilling thirty three (33) borings along the proposed structure alignments, including one boring at each elevated station, to a depth of about 100 feet and eleven (11) borings to a depth of 30 feet for at-grade tracks and stations. Four (4) of the borings to a depth of 30 feet were originally planned at the potential maintenance facility sites. One of the potential sites (Site 11) was no longer considered by the project team, which resulted in the elimination of two (2) 30-foot borings. Four (4) downhole P-S loggings to measure shear wave velocities of the upper 100 feet of soil, four (4) Packer testing to estimate groundwater extraction rates, and ten (10) pressuremeter tests to determine stress-strain relationship of subsurface soils were performed during our field exploration. Where groundwater was encountered, up to four (4) borings were converted to monitoring wells. In addition, thirteen (13) Cone Penetration Tests (CPTs) were to be performed to obtain continuous profile of subsurface soils. Besides geotechnical sampling, environmental sampling of soil and water were performed within fifteen (15) of the 100 feet deep borings and five (5) of the 30 feet deep borings, including one at each maintenance facility site. Results of the analytical testing were included in a separate Preliminary Hazardous Substance Identification Technical Memo to be submitted to Metro.

Based on the findings of the field exploration and data review, two active strands of the Newport-Inglewood Structure Zone cross the project alignment. One of the strands traverses the proposed site of an aerial structure near the intersection of La Brea Avenue and Florence Avenue. The southern and central portions of the alignment are underlain by Lakewood formation, while the northern portion of the alignment is underlain by younger age alluvium. Groundwater along the Aviation Boulevard/ Harbor Subdivision (Harbor S/D) segment is between approximately 40 to 63 feet below existing grade, between 95 to 135 feet along Florence Avenue. Although groundwater was observed at 51 to 97 feet below existing grade along Crenshaw Boulevard, a perched water condition occurs at much shallow depths between 38th Street and Exposition Boulevard. With a combination of high groundwater and weaker strength of some sandy soils within the younger alluvium, liquefaction is likely within the upper 15 to 25 feet of soil north of W. Vernon Avenue. The impact of these subsurface conditions on the tunnel design must be evaluated by the tunnel designers.

This report presents results of the subsurface explorations and laboratory testing conducted to date, our interpretation of the geologic and geotechnical conditions encountered, and preliminary recommendations for the design and construction of the project. Design response spectra for aerial structure and time history analysis for underground structures were developed for the dual levels of ground motion outlined in the Metro Rail Design Criteria. Due to the seismicity along the project alignment, deep foundations are recommended for the aerial structures. Shallow foundations are feasible for lightly loaded surface structures and above grade retaining walls up to ten (10) feet in height in the southern and central portion of the project alignment. For below-grade U-sections, retaining walls up to thirty (30) feet in height can be supported by shallow foundations. Soil along the project alignment is non-corrosive to concrete and metal, except near the northern project limit near Exposition Boulevard where corrosive protection is necessary for metal in direct contact with the on-site soil. Surface soil is considered moderately expansive due to the presence of clayey materials. For shallow foundations founded within the upper four (4) feet of any on-site clayey soils, remedial grading is necessary.

2 PROJECT BACKGROUND

The Los Angeles County Metropolitan Transportation Authority (Metro) is planning light rail transit (LRT) improvements in the Crenshaw/LAX Transit Corridor. Metro requires advanced conceptual engineering design services to determine the scope of the design, the extent of infrastructure required, appropriate construction methods, and probable project costs. The extent of environmental impacts and appropriate mitigation needed in this corridor in support of the final environmental documents will also be defined. Metro is serving as the lead agency for the California Environmental Quality Act (CEQA) environmental clearance, and the Federal Transit Administration (FTA) is serving as lead agency for the National Environmental Protection Act (NEPA) environmental clearance. The project will be conducted in accordance with the most recent FTA guidelines for project development and all environmental documentation prepared will satisfy the requirements of NEPA and CEQA.

This effort is a continuation of previous planning studies, including the Crenshaw-Prairie Corridor Major Investment Study, which was completed in 2003. Since then Metro has implemented several new Metro Rapid Bus routes within the corridor and now provides new options for travel in both north-south and east-west directions. With construction of the Exposition Phase I Line underway, the Crenshaw/LAX Corridor Transit project will provide important connections between the Crenshaw corridor and downtown Los Angeles, the Westside, and the South Bay. The corridor will also provide an important connection to Los Angeles International Airport (LAX) through an automated people mover (planned to be constructed by Los Angeles World Airports). Local transit service needs between and within the corridor cities of Los Angeles, Inglewood, Hawthorne, and El Segundo are also part of the developing transit alternatives.

Metro plans to fund LRT improvements in the corridor with Measure R Los Angeles County Sale Tax Funds and with other local and state sources.

2.1 Project Description

The proposed Crenshaw/LAX Transit Corridor Project is shown in *Figure 2-1 – Crenshaw/LAX Transit Corridor Alignment*. The proposed alignment extends approximately 8.5 miles from the Exposition LRT line at the intersection of Crenshaw and Exposition Boulevards to the Metro Green Line Aviation/LAX Station. The alignment comprises a double-tracked right-of-way consisting of sections of at-grade LRT, aerial structures and below-grade guideway.

The proposed LRT alignment's northern terminus is located at the proposed Crenshaw/Exposition Station, where the Crenshaw/LAX Corridor will provide a pedestrian at-grade link to the Exposition Line, currently under construction. From the Crenshaw/Exposition Station, the proposed LRT alignment extends south along Crenshaw Boulevard for 3.25 miles to the Harbor Subdivision (Harbor S/D) tracks. At this point, the alignment turns to the southwest and continues along the Harbor S/D for a distance of approximately 3.15 miles, to Aviation Boulevard. Thereafter, the alignment proceeds south along the west side of Aviation Boulevard for a distance of 2.15 miles to a connection to the Metro Green Line near the Green Line Aviation/LAX Station.

New stations are under consideration at the following locations: Crenshaw/Exposition, Crenshaw/Martin Luther King Jr., Crenshaw/Vernon (optional), Crenshaw/Slauson, Florence/West, Florence/La Brea, Aviation/Manchester (optional), and Aviation/Century.

The LRT alignment features crossings at a number of heavily trafficked roadways and highways, and is in proximity to the south runways of LAX. To avoid traffic delays, grade separations are being considered at some roadway crossings and locations: across Century Boulevard adjacent to the LAX south runways, across Manchester Avenue, across La Cienega Boulevard/I-405, across La Brea Avenue, between Victoria Avenue and 60th Street and between 48th and 39th Streets.

The Crenshaw/LAX Transit Corridor Project, as described above and shown in Figure 3-1, was adopted as the Locally Preferred Alternative (LPA) at the meeting of the Metro Board of Directors on December 10, 2009. At the same time, a number of design options have been incorporated into the LPA scheme. These include the following:

- An elevated station at the interface of Aviation Boulevard and Century Boulevard.
- Grade separation of Manchester Avenue by means of an aerial LRT guideway.
- Below-grade guideway between Victoria and 60th Street.

Other design options are still being studied. The LPA configuration may be further refined when the outcomes of these design studies are known.

For the purpose of presentation, the project corridor was divided into three segments: along Aviation Boulevard/Harbor S/D, along Florence Avenue/Harbor S/D, and on Crenshaw Boulevard.

2.1.1 Aviation Boulevard/Harbor S/D Segment

The Aviation Boulevard/Harbor S/D segment commences at the connection with the Metro Green Line. The alignment crosses under I-105 and over the Imperial Highway landing on the existing Metro Harbor Subdivision, adjacent to the Harbor S/D track. The alignment drops into a trench before 111th Street and remains in a trench until north of 104th Street, at which point the grade rises to an aerial configuration, crossing at Century Boulevard. North of the Century/Aviation Station the tracks drop to an at-grade alignment and follow the Harbor S/D until the proposed aerial grade separation at Manchester, where the alignment veers northeast, parallel to Florence Avenue.

2.1.2 Florence Avenue/Harbor S/D Segment

North of the aerial structure at Manchester, the alignment parallels Florence Avenue, running at-grade along the Harbor S/D. This alignment continues until it rises to an aerial configuration over La Cienega Boulevard and the I-405. North of the I-405 the alignment drops back down to grade to a point south of La Brea Avenue, where the alignment declines into a trench to pass below La Brea Avenue. Northward the alignment rises to grade and continues to a point near Brynhurst Avenue, where the alignment transitions into a cut-and-cover underground structure that curves northward into the Crenshaw Boulevard Segment.

2.1.3 Crenshaw Boulevard Segment

The Crenshaw Boulevard segment begins at the point where the alignment leaves the Harbor S/D corridor. The alignment begins in an underground configuration that continues north surfacing at approximately 60th Street. The alignment then runs at-grade, down the middle of Crenshaw Boulevard to just south of the Leimert Park area, where the transition to an underground tunnel begins. The tunnel extends through to approximately 39th Street. North to Exposition Boulevard the alignment in the base configuration is at-grade running in the middle of Crenshaw Boulevard. Two alignment options are being considered including an optional station at Leimert Park, and an underground alignment between Martin Luther King Boulevard and Exposition Boulevard.

2.2 Scope of Work

The geotechnical services provided for this project, as detailed in the Revised Geotechnical Engineering Work Plan dated February 15, 2010, included the following tasks:

- Review of existing geotechnical, geological, and seismological data,
- Field investigation, which included drilling, sampling, and logging exploratory borings; supervising CPT soundings; and installing groundwater monitoring wells,
- Geotechnical in-situ testing and laboratory testing of soil samples,
- Chemical analyses of soil and water samples for presence of hazardous materials,
- Geotechnical engineering analyses to develop preliminary design and construction recommendations, and
- Preparation of preliminary geotechnical reports to present EMI’s current findings, preliminary conclusions, and recommendations.

3 FIELD INVESTIGATION AND LABORATORY TESTING

All elevations in this report are with respect to mean sea level (msl).

3.1 Field Investigation

The purpose of this investigation was to obtain and analyze soil samples to determine the engineering properties to support the advanced conceptual engineering phase of this project. In addition, environmental soil samples were obtained and analyzed to evaluate the potential for chemical contamination at the proposed construction areas of the project site. Our exploratory program was generally planned to follow the project alignment closely at an average spacing of approximately 800 feet wherever there is a structure; and at 1,200 feet to 1,600 feet where the alignment is proposed to be at-grade. Placement of some exploratory locations was constrained by access, underground utility lines and traffic control. The locations of the exploratory borings and CPT soundings are shown in Appendix B.

3.1.1 Aviation Boulevard/Harbor S/D Segment

The field investigation for the Aviation Boulevard/Harbor S/D segment was originally planned to include fourteen (14) geotechnical borings and CPT soundings. An initial field investigation program was completed between April 1st and May 20th, 2010 by EMI, which only included drilling and sampling six (6) exploratory borings. The remaining eight (8) locations were explored between June 10 and June 14, 2010.

Field investigation information for the explored locations for the Aviation Boulevard/Harbor S/D segment is presented in Table 3-1. The existing ground surface elevations (GSE) at the subsurface exploratory locations within this segment vary from approximately 98.0 feet to 104.8 feet.

Table 3-1 – Field Investigation Information – Aviation Boulevard/Harbor S/D Segment

Boring No.	Approx. Station	Approx. Offset (ft)	Station Line Along Centerline	Approx GSE (ft)	Boring Depth (ft)	Approx. GWE (ft)
CPT-10-001*	12+85	15 Lt	Harbor S/D Railroad Track	98.0	50.3	N/E
R-10-002*	18+20	15 Lt		96.0	101.0	31.5
A-10-003*	27+35	15 Lt		94.4	101.5	3.4
CPT-10-004*	34+60	10 Lt		94.0	65.9	N/E
CPT-10-005*	41+70	10 Lt		94.0	64.0	N/E
CPT-10-006*	49+00	15 Lt		94.0	66.4	N/E
A-10-007*	56+28	15 Lt		95.3	101.5	27.3
R-10-008*	65+00	10 Lt		94.5	101.0	31.5
A-10-009*	74+36	10 Lt		98.0	101.5	11.4
A-10-010*	84+80	10 Lt		100.0	86.5	N/E
A-10-011	94+37	20 Lt		103.4	31	N/E
A-10-012	107+48	10 Lt		103.5	31	N/E
R-10-013	117+00	10 Lt		104.0	101.5	N/E
A-10-014	122+60	8 Lt		104.8	100	7.8

Notes:

N/E = Not Encountered, GWE = Groundwater Elevation, GSE = Ground Surface Elevation, *Location estimated from plans

3.1.2 Florence Avenue/Harbor S/D Segment

The field investigation program for the Florence Avenue/Harbor S/D segment was performed between March 29 and April 6, 2010 by EMI. The field investigation included drilling and sampling fourteen (14) exploratory borings and performing three (3) Cone Penetration Test (CPT) soundings.

Field investigation information for the Florence Avenue/Harbor S/D segment is presented in Table 3-2. The existing ground surface elevations at the subsurface exploratory locations within this segment vary from 105.3 feet to 175.8 feet.

Table 3-2 – Field Investigation Information – Florence Avenue/Harbor S/D Segment

Boring No.	Approx. Station	Approx. Offset (ft)	Station Line Along Centerline	Approx GSE (ft)	Boring Depth (ft)	Approx. GWE (ft)
A-10-015	132+80	10 Lt	Harbor S/D Railroad Track	105.3	31	N/E
A-10-016	144+40	10 Lt		106.6	101	N/E
CPT-10-017	144+45	10 Lt		106.5	75.3	N/E
R-10-018	153+00	10 Lt		106.3	100	N/E
A-10-019	166+98	20 Lt		112.2	31	N/E
R-10-020	183+04	10 Lt		116.8	100	N/E
A-10-021	187+82	15 Lt		118.3	101	N/E
CPT-10-022	195+15	10 Lt		123.6	65.8	N/E
R-10-023	202+22	8 Lt		132.0	100	N/E
R-10-024	208+35	10 Lt		137.1	101	N/E
A-10-025	222+30	10 Lt		150.1	101	N/E
R-10-026	226+90	10 Lt		154.5	100	N/E
R-10-027	234+50	10 Lt		162.8	100	N/E
A-10-028	248+00	7 Lt		175.8	31	N/E
A-10-029	264+62	7 Lt		175.0	31	N/E
CPT-10-030	274+04	15 Lt		171.0	73	N/E
A-10-031	281+35	8 Lt		163.3	101	N/E

Notes:

N/E = Not Encountered, GWE = Groundwater Elevation, GSE = Ground Surface Elevation

3.1.3 Crenshaw Boulevard Segment

The field investigation program for the Crenshaw Boulevard was performed between March 10 and April 6, 2010 by EMI. The field investigation included drilling and sampling seventeen (17) exploratory borings and performing six (6) Cone Penetration Test (CPT) soundings. Groundwater sampling and monitoring wells were installed at locations of two (2) soil borings where groundwater was encountered.

Field investigation information for the Crenshaw Boulevard segment is presented in Table 3-3. The existing ground surface elevations at the subsurface exploratory locations within this segment vary from 113.0 feet to 182.2 feet.

Table 3-3 – Field Investigation Information – Crenshaw Boulevard Segment

Boring No.	Approx. Station	Approx. Offset (ft)	Station Line Along Centerline	Approx GSE (ft)	Boring Depth (ft)	Approx. GWE (ft)
CPT-10-032	290+92	0	Crenshaw Boulevard	163.7	79.6	N/E
A-10-033	298+40	0		165.0	100	82.0
A-10-034	305+52	0		169.5	100	N/E
CPT-10-035	312+82	0		172.0	71.5	N/E
A-10-036/ Well	321+43	0		176.7	100	79.8
CPT-10-037	329+15	0		180.4	63	N/E
CPT-10-038	337+17	0		182.2	54.5	N/E
R-10-039	347+36	0		178.0	100	N/E
R-10-040	357+20	0		159.0	100	N/E
A-10-041	362+28	0		149.4	100	N/E
R-10-043	370+75	40 Rt		136.9	100	N/E
A-10-044	375+50	45 Rt		135.4	100	N/E
A-10-045	384+25	0		134.4	100	N/E
CPT-10-045	384+25	0		134.4	32.5	N/E
R-10-046	393+50	0		132.9	100	N/E
CPT-10-046	393+50	0		133.1	33	N/E
R-10-047	401+10	0		126.3	100	61.9
A-10-048/ Well	411+00	0		117.3	100	63.8
R-10-049	416+20	0		115.7	100	92.0
A-10-050	424+35	0		115.0	100	64.0
A-10-051	431+00	0		114.2	100	58.0
R-10-052	438+50	0		113.2	100	91.0
R-10-053	448+42	0		113.0	100	97.0

Notes:

N/E = Not Encountered, GWE = Groundwater Elevation, GSE = Ground Surface Elevation

3.1.4 Maintenance Facilities

The field investigation program for one of the proposed maintenance facility locations (Site 14) was performed by EMI on May 17 and May 18, 2010. The field investigation included drilling and sampling two (2) exploratory borings. Field investigation information for Site 14 is presented in Table 3-4.

Table 3-4 – Field Investigation Information – Site 14

Boring No.	Approx. Station	Approx. Offset (ft)	Station Line Along Centerline	Approx GSE (ft)	Boring Depth (ft)	Approx. GWE (ft)
A-10-054	90+00	1,560 Lt	Harbor S/D Railroad Track	107.0	51.5	N/E
A-10-055	93+00	700 Lt		107.0	51.3	N/E

Notes:

N/E = Not Encountered, GWE = Groundwater Elevation, GSE = Ground Surface Elevation

No borings were drilled specifically at Site 15 due to the presence of nearby exploratory borings within Harbor S/D right-of-way. Additional field investigations may be required for new facility sites.

3.2 Geotechnical Exploration and Soil Sampling

Borings were drilled using a modified CME-75 truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers or a truck-mounted Mayhew-1000 drill rig equipped with a 5-inch diameter rotary wash drilling system. CPTs were conducted in general accordance with the American Society for Testing and Materials (ASTM) standard D-3441. The borings and CPTs were advanced typically to a depth of 100 feet or refusal, whichever was encountered first, at locations where there is a proposed structure and to a depth of 30 feet where the alignment is at-grade. A portable Photo Ionization Detector (PID) meter was used to screen for potential presence of hydrocarbons in the borings during the drilling activities.

Exploratory borings were drilled to collect soil samples for geotechnical and chemical testing. CPTs were conducted to obtain a continuous profile of subsurface stratigraphy in lieu of the spatial data (usually every 5-foot of penetration) obtained from soil borings. These continuous profiles, supplemented by the soil borings, can also be used for soil liquefaction assessment. The boring logs, Log of Test Borings (LOTBs) and CPT data are presented in Appendix B. The approximate exploratory locations and ground surface elevations shown in the LOTBs were based on survey provided by Wagner Engineering and Surveying, except those in Aviation Boulevard/Harbor S/D segment as noted in Table 3-1, which were determined by tape measurement from existing features and topographic contour maps.

Bulk soil samples and relatively undisturbed samples were collected for geotechnical laboratory testing. The large bulk samples were obtained from soil cuttings at depths where future excavations might take place. The relatively undisturbed samples were collected using a 3-inch outside diameter Modified California split-spoon sampler lined with 1-inch high, 2.5-inch outside diameter brass rings. Standard Penetration Tests (SPT) were also performed in alternating manner with relatively undisturbed sampling at every five (5) feet vertical interval using a 1.4-inch inside diameter split-spoon sampler to obtain small bulk soil samples. Both samplers were driven into the ground using a 140-lb automatic trip hammer free falling from a height of 30 inches. The numbers of blow to advance the samplers for every 6 inches of penetration or less was recorded. The LOTB sheets show the uncorrected field blow count to drive the samplers 12 inches or less. The blow counts required to drive the SPT sampler for the last 12 inches or less is referred to as the Standard Penetration Resistance (N-value).

3.3 Pressuremeter Testing

3.3.1 Setup

Pressuremeter testing was performed by EMI engineers to measure stress-strain response of subsurface soil at planned depths within selected boreholes. A total of fourteen (18) tests were performed in Borings A-10-003, A-10-007, A-10-009, A-10-010, A-10-025, A-10-031, A-10-033, A-10-034, A-10-041, A-10-045, and A-10-051 for the project using a TEXAM pressuremeter from RocTest Ltd.

The test was performed by inflating a probe consisting of a flexible membrane enclosed in a tubular stainless steel shield hydraulically to deform the surrounding soil radially. The average radial expansion is measured by volume of the hydraulic fluid (water) injected into the probe by reading a volume counter. The hydraulic pressure applied into the probe is measured by a pressure gauge.

In the field, the pressuremeter was lowered into the drilled borehole by means of the drilling rods. The testing depth was determined on-site upon inspection of the retrieved soil samples. Since the device is designed to fit in a 3-inch diameter borehole, the hollow stem augers (8-inch OD) were usually stopped a few feet above the desired depth and a 3-inch OD sampler was driven to create a smaller-sized open hole for the pressuremeter testing. After inserting the probe into the borehole, the pressure was applied in several increments and volume changes were noted after the pressure was stabilized. Several loading/unloading cycles were performed for each test. The plots with the borehole pressures versus borehole deformation data are presented in Appendix D after calibrating the data to account for internal deformation of the pressuremeter system.

3.3.2 Shear Moduli

The borehole pressures versus borehole deformation curves will have to be evaluated by HMM's tunnel designers to determine the appropriate shear moduli or Young's modulus for their applications. In an elastic medium, the radial expansion of a cylindrical cavity is related to the pressure by the equation:

$$\frac{\Delta r}{r} = \frac{(1+\nu)}{E}\Delta p$$

where r is radius and p is pressure of the cavity (in this case, borehole). The elastic constants in the above equation are Poisson's ratio (ν) and Young's modulus (E). Assuming that the value of Poisson's ratio is known, the Young's modulus (E) and the shear modulus (G) can be determined by the following expressions:

$$E = (1+\nu)\frac{\Delta p}{\Delta r / r}$$

and

$$G = \frac{E}{2(1+\nu)}$$

Since the open borehole was created prior to inserting the cylindrical probe, relaxation of in-situ soil pressure had taken place. Thus, the interpretation of modulus determined at very low pressure (e.g. less than in-situ overburden pressure) is not reliable, as they are influenced by borehole disturbance. The modulus determined from a borehole pressure higher than the in-situ overburden pressure is less affected by the borehole disturbance.

3.4 Downhole Seismic Logging

3.4.1 Logging Procedures

Geophysical logging was performed by Geovision of Corona, California using the suspension method. The logging provided in-situ compressional (P, or primary) and shear (SV, or vertical secondary) wave velocity measurements of the subsurface soil.

Geophysical logging was performed after completion of the borings using an OYO Model 170 Suspension Logging device to obtain in-situ horizontal shear and compressional wave velocity measurements at 5-foot intervals. The device consists of a logging recorder and a suspension logging probe to be lowered into the completed borehole. The probe (20 feet long) contains an impact source in the tip that generates an acoustic. The pressure transforms into P and S waves in the fluid-filled borehole through its walls into the surrounding soils. These waves propagating upward through the surrounding soils create detachable pressure waves in the fluid surrounding the receiver at the top of the borehole. This system directly determines the average wave velocity of the soil surrounding the borehole walls by measuring the elapsed time between arrivals of a wave propagating upward through the soil column.

Seismic velocity information could be used for a variety of purposes such as aiding the interpretation of stratigraphic information, characterization of ground response to earthquake motion, as well as development of ground stiffness for foundation design.

3.4.2 Seismic Velocity Test Results

Seismic compression (P-) and shear (S-) wave velocities of the subsurface soils were measured in four (4) borings (R-10-018, R-10-023, A-10-043, and R-10-052) within the project corridor. A summary plot of all measured P- and S-wave velocity profiles versus depth is shown in Appendix E.

Typically, the velocity profiles on Crenshaw Boulevard show that the upper 40 feet of the subsurface soils has a shear wave velocity ranging from 500 feet/second to 1,200 feet/second. The bottom 60 feet remained relatively uniform with shear wave velocities ranging from 1,200 feet/second to 1,500 feet/second. The velocity profiles on the Florence Avenue/Harbor S/D segment show that the upper 40 feet of the subsurface soils has a shear wave velocity ranging from 1,000 feet/second to 1,200 feet/second. The bottom 60 feet of the subsurface soils has a shear wave velocities ranging from 1,200 feet/second to 1,500 feet/second.

3.5 Packer Testing

3.5.1 Testing Procedures

Packer testing is a common in-situ method of measuring hydraulic conductivity of soils and rock. The purpose of this testing was to provide in-situ transmissivity of the subsurface soils in the region of the tunnel bores, and to aid design of soil excavation, support, lining and dewatering systems for the proposed tunnels.

Packer testing was performed by EMI in three (3) borings (A-10-039, A-10-040, and A-10-041) at selected depth intervals. The depths and soil types tested are summarized in Table 3-5.

The testing procedures generally followed ASTM guidelines for the Constant Head Injection Test (ASTM D-4630–96). In each borehole, packer testing was performed after completion of drilling. Upon reaching the selected depth intervals, the borehole was flushed with clear water until the return water ran clear of any cuttings by visual observation. The test section was then internally sealed by two inflatable rubber packers at selected depths using water to isolate a test section. Water was then pumped through a hollow feed tube into the test section. The lengths of the test sections were typically 20 feet, or they were adjusted after inspection of the soil samples retrieved in that depth range. The water inflow quantity versus time was measured until steady-state flow was reached.

The constant water pressure was applied to the water in the sealed interval through the feed tube and the resulting flow rates were recorded over time. The constant pressures applied (up to three for each test) were less than the anticipated overburden stress at each test depth in order to avoid hydro-fracturing.

Testing details and measured test results are presented in Appendix B for each tested section with the applied pressures and measured water flow quantities.

3.5.2 Permeability

The equations used for calculation of the coefficient of permeability are as follows (Das, 1983):

$$k = \frac{q}{2\pi l h} \log \frac{l}{r} \qquad \text{for } l \geq 10r$$

and

$$k = \frac{q}{2\pi l h} \sinh^{-1} \frac{l}{2r} \qquad \text{for } 10r > l \geq r$$

where

k = coefficient of permeability of the soil,
q = constant rate of water injected into borehole,
l = length of test hole interval,
r = radius of borehole in test hole interval, and
h = differential head of groundwater in casing to ground surface.

The differential head of groundwater h is the total of injection pressure at the pressure gauge at the surface plus the gravity head of water (in the steel tubing) between the center of the packer test interval to the pressure gauge.

Calculated soil permeability ranges from these series of tests are summarized in Table 3-5. The data indicates that flow rates increase with increasing pressure. The k-values developed indirectly from the packer test represent only an estimate of soil permeability and should be cross-checked with other data and measurements.

Table 3-5 – Summary of Packer Testing

Boring No.	Boring Depth (ft)	Approx. GSE (ft)	Test Interval BGS (ft)	Center Depth (ft)	Soil Type (USCS)	Approx. Coefficient of Permeability (in/s)
R-10-039	100	163.8	20-55	37.6	Mostly SP-SM with thin layers of CL and ML	3.5×10^{-3}
R-10-040	100	164.4	30-60	45.0	10-foot thick layer of ML and 20-foot layer of SP-SM	1.0×10^{-3}
R-10-043	100	168.5	20-44.5	32.3	Mostly SP with layers of GP	1.1×10^{-2}

Notes:

USCS = Unified Soil Classification System, BGS = Below Ground Surface, GSE = Ground Surface Elevation

3.6 Well Installation

Groundwater monitoring wells were constructed at the location of Borings A-10-36 and A-10-48. The groundwater monitoring wells were constructed using 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) screen and solid schedule 40 PVC casing. The screened portion of the wells consisted of 0.01-inch wide slots and was placed between approximately 15 feet below the groundwater surface and 5 feet above the groundwater surface. Solid PVC casing was then placed between 0.5 foot below ground surface and the well screen. Number 2/12 Monterey sand was placed in the annulus of the screened interval with approximately 2 feet above the screen, and 1 foot below the screen. A bentonite-chip seal was placed above the filter pack to within approximately 2 feet of the ground surface. The upper portion of the well was sealed with concrete. The wells were finished with a traffic-rated box set in concrete or irrigation box set in earthen ground. The wells were installed with a screw-on cap seal. The well-installation logs are presented in Appendix B.

3.7 Geotechnical Laboratory Testing

Soil samples that were considered representative of the subsurface conditions were tested to obtain or derive relevant physical and engineering soil properties. The laboratory tests were performed in general accordance with the latest American Society for Testing and Materials (ASTM) standards or California Test Methods (CTM). The following geotechnical laboratory tests were conducted to supplement the observations recorded during the field investigation:

- Grain size distribution (ASTM D-422),
- Passing #200 sieve (ASTM D-1140),
- Atterberg Limits (ASTM D-4318),
- In-situ density and moisture content (ASTM D-2216 and D-2937),
- Direct shear (ASTM D-3080),
- Unconfined Compression (ASTM D-2166),
- Unconsolidated-undrained triaxial (ASTM D-2850),
- Consolidation (ASTM D-2435),
- Maximum density and optimum moisture content (ASTM D-1557),
- Expansion Index (ASTM D-4829), and
- Corrosivity (CTM 417, 422, 532 and 643).

In-situ moisture content and total unit weight test results are shown on the boring logs (Appendix B). Corrosion test results are presented in Section 5.5. The remaining laboratory test results are provided in Appendix F.

Other chemical testing of soil samples is reported in the Preliminary Hazardous Substance Identification Technical Memorandum (Hatch Mott MacDonald, 2010).

4 GEOLOGY AND SEISMICITY

4.1 Regional Geology

The Crenshaw/LAX Transit Corridor is in the northern part of the Los Angeles Basin. The Los Angeles Basin is a large low-lying coastal plain bordered by the Santa Monica Mountains on the north, the Repetto and Puente Hills on the northeast, the Santa Ana Mountains on the east, and the San Joaquin Hills on the south. The western margin of the basin is open to the Pacific Ocean except for one prominent hill, the Palos Verdes Hills or Peninsula. The floor of the Los Angeles Basin is a relatively flat surface rising gently from sea level along the coastline to an apron of uplifted terrain along the base of the surrounding mountains which rise abruptly to a few thousand feet above the plain. The apron of elevated terrain surrounding the basin floor includes the Santa Monica, La Brea, Montebello, and Santa Fe Springs plains. The flat basin floor is interrupted in a few localities by small hills, the most prominent of which are a northwest-southeast trending alignment of hills and mesas extending from the Newport Beach area on the south to the Beverly Hills area on the north.

The northwest-trending alignment of hills is due to folding and geological fault displacements along the Newport-Inglewood Structural Zone (NISZ). The NISZ divides the basin floor into two major plains, the Downey-Tustin Plain on the northeast and the Torrance Plain on the southwest.

The floor of the Los Angeles Basin is directly underlain by unconsolidated Quaternary-age sandy sediments. These generally could be subdivided into loose unconsolidated Holocene-age sediments which cover the bulk of the basin, and late-Pleistocene materials which comprise the surface over much of the uplifts of the NISZ and the marginal plains. Hard rocks occur only in the mountains surrounding the basin and at depths ranging from about 5,000 feet to as much as 30,000 feet in the deepest part of the central basin.

Except for the NISZ, most surface geological faults such as the Santa Monica, Hollywood, and Whittier faults occur along the basin margins (Figure 4-1). In addition to these known surface faults, the Los Angeles region appears to be underlain by buried thrust and reverse faults commonly referred to as blind thrust faults. For example, the 1987 Whittier and the1994 Northridge earthquakes occurred on subsurface blind thrust faults. The blind thrust faults are poorly understood features with poorly known locations and orientations: some of them could dip under the project area. However, any large earthquakes associated with these subsurface features are most likely to originate at great depths (e.g. about 10 miles) and thus these should not impact the project area significantly more than similar-sized earthquakes on the other nearer surface faults such as the NISZ.

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4.2 Project Corridor Geology

The project corridor is in the northern part of the Los Angeles Basin. The southern end of the corridor is on the Torrance Plain. As the corridor extends northerly, it crosses the hills and faults of the Newport-Inglewood Structural Zone, specifically the Baldwin Hills. The corridor extends along the east side of the Baldwin Hills onto the Downey Plain and terminates on the north at the southern edge of the La Brea Plain. The southern and central parts of the corridor are underlain by Late Pleistocene-age sediments of the Lakewood Formation. These sediments could be overlain locally by pockets and thin deposits of younger Holocene-age alluvium, and are probably underlain at shallow depth by the Pleistocene San Pedro Formation (Figure 4-2). The northern part of the corridor is directly underlain by Holocene-age basinal and stream alluvium. Most of these were deposited by streams that have meandered across the floor of the Los Angeles Basin such as Ballona Creek, Los Angeles, and San Gabriel rivers. Most creeks and rivers are now confined within concrete- and rip-rap-lined aqueducts. There are no hard rocks along the project corridor. Figure 4-3 depicts geologic structure in relation to estimated groundwater elevations.

4.3 Soil Conditions

A total of thirty-nine (39) soil borings and nine (9) cone penetrometer tests (CPTs) were completed as part of this geotechnical exploration. A subsurface soils stratigraphy along the proposed alignment is depicted on the cross-sections attached in Appendix C. EMI has also reviewed the LOTB sheets included with the as-built plans for the Florence Avenue Overpass at the I-405 crossing and a number of other reports of previous geotechnical explorations along and near the corridor, particularly in the LAX area.

4.3.1 Aviation Boulevard/Harbor S/D Segment

General soil conditions along the Aviation Boulevard/Harbor S/D segment based on EMI's exploration and the subsurface data from soils report by Law and Crandall (1991) are as follows:

- This segment between Imperial Highway and Century Boulevard is underlain by up to 30 feet of light brown to black lean clay and silt. Underlying this upper stratum is brown to light brown unit of poorly-graded sand to silty sand with interlayers of light gray to bluish gray silt and lean clay.
- Between Century Boulevard and Arbor Vitae Street, a surficial 10 to 15 feet thick layer of medium dense to dense, silty to sandy clay is underlain by 15 to 20 feet of dense to very dense, olive brown, poorly-graded sand. Below the sand layer is a 20 to 25 feet thick stiff to hard clay layer overlaying dense silty sands. Very stiff silt and clay lenses are common throughout this section.
- Between Arbor Vitae Street and Manchester Boulevard, a thick layer of silt and clay exists approximately between 0 and 75 ft below existing grade. This unit is olive gray to olive brown, medium stiff to very stiff with areas of high to low-plasticity clays and silts. Underlying the clay unit is an over 100 feet thick unit of very dense, olive brown to olive gray, poorly-graded sand to silty sand.

4.3.2 Florence Avenue/Harbor S/D Segment

General soil conditions along the Florence Avenue/Harbor S/D segment between Manchester Boulevard and Crenshaw Boulevard are as follows:

- Between Manchester Boulevard and Ivy Avenue, the proposed corridor is underlain by a predominantly clayey to silty unit. Stiff to hard, lean to fat clay is found within the upper 70 feet. The clayey unit overlies a very dense, poorly graded sand to silty sand layer. Interlayers of silty sand and silt are prevalent at approximately 15 to 30 feet below existing grade. In the vicinity of Ivy Avenue, the soil condition transitions to a sandy unit which interfingers with some clay layers.
- Between Ivy Avenue and Crenshaw Boulevard, the segment is underlain by mainly sandy units with some intermittent zones of medium stiff to hard silt and clay. The main sandy unit consists of olive to olive brown, medium dense to very dense poorly graded sand to silty sand extending approximately from 0 to over 100 feet below grade.
- Between Ivy Avenue and I-405 freeway, a clayey unit underlies dense to very dense sands at depths of greater than 80 feet below the surface. This cohesive unit is consisting of very stiff to hard, olive to olive gray clay, silt and clayey sand.
- Between Redondo Boulevard and Crenshaw Boulevard, the upper 10 to 15 feet is consisting of brown to dark brown, loose silty to clayey sand.
- The segment between La Brea Avenue and Redondo Boulevard is underlain by discontinuous layers of medium stiff to very stiff clay and silt up to 20 feet thick.

Overall, the Florence Avenue/Harbor S/D segment is underlain by predominantly fine grained, low- to high-plasticity soils between Manchester Boulevard and Ivy Avenue; and predominantly granular, weakly cemented soils between Ivy Avenue and Crenshaw Boulevard.

4.3.3 Crenshaw Boulevard Segment

General soil conditions along the Crenshaw Boulevard segment based on EMI's current exploration are as follows:

- This segment is underlain by up to 25 feet of dark brown to olive brown, stiff to very stiff, sandy clay to lean clay.
- The clayey stratum is underlain by approximately 25 to over 100 feet of weakly cemented, medium dense to very dense, brown to olive brown, poorly to well-graded sand to silty sand. This unit also contains scattered 5 to 10 feet thick pockets of very dense, poorly graded gravel with sand and silt at approximately 40 feet below existing grade.
- Discontinuous lenses of stiff to hard clay and silt layers are prevalent throughout this portion of the alignment. In particular, between 43rd Street and Exposition Boulevard, a stiff to hard clay lens up to 20 feet thick exists at 10 to 30-foot depth below existing grade in the area of the proposed tunnel crown.

- Between 43rd Street and Exposition Boulevard, a 10 to 20 foot layer of weakly cemented, loose to medium dense, silty to clayey sand exists at depths ranging from 0 to 20 feet below the existing grade.
- Between 43rd Street and Brynhurst Avenue, lenses ranging from 5 to 30 feet thick of dark gray to bluish, very stiff to hard silt and clay were encountered at depths within the upper 60 feet below the existing grade.
- Deeper layers of dark brown to olive brown, very dense to hard silt and clay were observed at depths of 60 feet and below. In particular, between Vernon Avenue and Martin Luther King Jr. Boulevard, a 5 to 20 foot thick lens of very stiff to hard, high plasticity clay was observed at a depth of 70 to 85 feet below existing grade.

Geologic cross-sections depicting different geologic units and stratigraphies along the project alignment are presented in Appendix C.

4.4 Groundwater Conditions

4.4.1 Aviation Boulevard/Harbor S/D Segment

Between Imperial Highway and Arbor Vitae Street, groundwater was encountered at various elevations according to Law/Crandall (1991). Just north of Imperial Highway, groundwater was encountered at elevations ranging from approximately 50 to 30 feet (approximately 40 to 63 feet below existing grade). Groundwater appeared to fluctuate locally based on monitoring of an installed piezometer by Law/Crandall near 111th Street and Aviation Boulevard in 1991. Groundwater was measured at a depth of 63 feet in June 1991 and then at 46 feet in July 1991. Further north near the intersection of 102nd Street and Aviation Boulevard., groundwater was observed at elevations between 0 and 25 feet (approximately 68 to 98 feet below existing grade). From EMI's current exploration, groundwater elevations were found to fluctuate from 3 to 47 feet (approximately 62 to 97 feet below ground surface).

According to California Geological Survey maps (1998 a,b) and monitoring well data around Aviation Boulevard (compiled from the State of California GEOtracker system), historical high groundwater varies from 40 to 95 feet below existing grade. The design groundwater depth recommended for the Aviation Boulevard/Harbor S/D segment is 40 feet below ground surface.

4.4.2 Florence Avenue/Harbor S/D Segment

No groundwater was encountered within any of the borings or CPTs completed as part of the Florence Avenue/Harbor S/D segment.

According to California Geological Survey maps (1998 a,b), and various monitoring wells around Florence Avenue compiled from the State of California GEOtracker system, historical high groundwater varies from 95 to 135 feet below existing grade. Researched groundwater elevations, where encountered, were reported to range from 6 to 9 feet.

4.4.3 Crenshaw Boulevard Segment

During EMI's field investigation conducted along Crenshaw Boulevard in March and April of 2010, static groundwater was encountered in 10 boreholes at elevations of approximately 80 to 60 feet (approximately 51 to 97 feet below existing grade). A perched groundwater condition was also observed within borings between 38th Street and Exposition Boulevard at elevations of approximately 90 to 100 feet (approximately 16 to 24 feet below existing grade). In this area, a clayey unit was encountered near the perched groundwater elevations. The base of the proposed tunnel section along Crenshaw Boulevard is located approximately 5 to 10 feet above the observed static groundwater, and the top of the proposed tunnel section is below the observed perched groundwater levels. Two monitoring wells have been installed where groundwater was encountered to monitor the groundwater fluctuation.

According to California Geological Survey maps (1998 a,b) and monitoring well data around Crenshaw Boulevard compiled from the State of California GEOtracker system, historical high groundwater varies from 8 to 60 feet below existing grade. Between Exposition Boulevard and 48th Street, the historical high groundwater table varies from 8 to 30 feet below the surface. Extending southerly along Crenshaw Boulevard, the historical levels are at depths from 40 to 60 feet below existing surface between 48th Street and Florence Avenue. The design groundwater depths recommended are shown in Table 4-1.

Table 4-1 – Groundwater Depth – Crenshaw Boulevard Segment

Approximate Limits	Groundwater Depth Range Observed in Borings (feet)	Historical Groundwater Depth (feet)	Design Groundwater Depth Below Existing Grade (feet)
Exposition Boulevard to W 48th Street	16 to 61 (Average = 40)	10	10
W 48th Street to Florence Avenue	80 to 90 (Average = 85)	40 to 50	40

Notes:

Historical groundwater depth is estimated from CGS map (1998 a,b) and various monitoring wells around Crenshaw Boulevard compiled from the State of California GEOtracker system. Groundwater depths between contours were linearly interpolated.

4.5 Regional Seismic Setting

The project corridor is in seismically active southern California. The present-day seismotectonic stress field in the Los Angeles region is one of north-northeasterly compression. This is indicated by the geologic structures, by earthquake focal-mechanism solutions, and by geodetic measurements. These data suggest crustal shortening of between 5 and 9 mm/year in the north-south direction across the Greater Los Angeles area and about 2.5 mm/yr elongation in the east-west direction (Argus et al., 1999).

Historical epicenter maps show widespread seismicity throughout the region. Earthquakes in the Los Angeles region occur primarily as loose clusters along the Newport-Inglewood Structural Zone, along the southern margin of the Santa Monica Mountains, the margin between the Santa Susana-San Fernando Valley and the southern margin of the San Gabriel Mountains, and in the Coyote Hills-Puente Hills area. Although historical earthquakes have occurred in proximity to known faults, they are often difficult to directly associate with mapped faults. Ward (1994) estimated that about 40% of seismic moment cannot be associated with known faults. Part of this difficulty is due to the fact that the basin is underlain by several poorly known subsurface thrust faults, generally referred to as blind thrust faults.

The largest historical earthquake within the Los Angeles Basin was the 1933 Long Beach event which had a magnitude of about $M_W = 6.4$ ($M_L = 6.3$). This earthquake did not rupture the ground surface but is believed to have been associated with the southern part of the Newport-Inglewood Structural Zone, a major strike-slip fault in the Los Angeles Basin (Benioff, 1938). The association was based on abundant ground failures along the NISZ trend but no unequivocal surface rupture was identified. Reevaluation of the seismicity data by Hauksson and Gross (1991) relocated the 1933 earthquake hypocenter to a depth of about 6 miles below the Huntington Beach-Newport Beach city boundary.

Other major earthquakes in the region include the 1994 Northridge and the 1971 San Fernando earthquake. The 1994 earthquake had a moment magnitude (M_W) of about 6.7 (M_S=6.8, M_L=6.4), and occurred on a southerly dipping subsurface fault which was unknown prior to the earthquake. The main shock occurred at a depth of about 19 km. Earthquake aftershocks clearly defined the rupture surface dipping about 35 degrees southerly from a depth of about 2 or 3 km to 23 km (Hauksson et al, 1995). The causative fault was never identified with certainty. The event could have occurred on an eastern extension of the Oakridge fault (Yeats and Huftile, 1995), a southerly dipping feature fault bounding the Ventura Basin and the Santa Susana Mountains.

The 1971 San Fernando earthquake was of similar size (M_W=6.7, M_S=6.4, M_L=6.4) to the 1994 event but did involve surface rupture. The 1971 event occurred on a northerly dipping thrust fault that dips from the northern side of the San Fernando Valley to a depth of about 15 km under the San Gabriel Mountains. Several mapped surface faults were involved such as the Sylmar fault, Tujunga fault, and Lakeview fault. These faults are commonly considered to be part of the Sierra Madre fault system which extends easterly from the San Fernando Valley to the north side of the San Gabriel Valley, and to the Cucamonga fault in the San Bernardino area.

The 1987 Whittier earthquake (M_L=5.9, M_W=5.9) occurred on a subsurface fault dipping under the Puente Hills to about 10 miles beneath the San Gabriel Basin (Shaw and Shearer, 1999; Shaw et al., 2002). This event did not rupture the ground surface.

Another significant earthquake in the region was the 1812 earthquake which caused damage at the San Juan Capistrano Mission. The location and magnitude of the 1812 earthquake are unknown because of the sparse population at the time, but geological studies (Jacoby et al, 1987; Fumal et al, 1993; Weldon et al, 2004) postulated that it did not occur in the Capistrano area, but rather was a large (M>7.0) distant event on the San Andreas fault in the Wrightwood area of the San Gabriel Mountains.

The earliest documented earthquake in the region was reported by the Portola expedition as they camped near the Santa Ana River in 1769. This event has been attributed by various geoscientists to just about every fault in the Los Angeles area but it could just as well have been a distant event that shook a wide area as did the 1971 San Fernando, the 1987 Whittier, and the 1994 Northridge events, as well as many other more-distant events (for example, 1992 Landers event).

4.6 Faulting

The California Geologic Survey (CGS) establishes criteria for faults as active, potentially active or inactive. Active faults are those that show evidence of surface displacement within the last 11,000 years (Holocene age). Potentially active faults are those that demonstrate displacement within the past 1.6 million years (Quaternary age). Faults showing no evidence of displacement within the last 1.6 million years may be considered inactive for most structures, except for critical or certain life structures. In 1972, the Alquist-Priolo Special Studies Zone Act (now known as the Alquist-Priolo Earthquake Fault Zone Act, 1994, or APEHA) was passed into law which requires studies within 500 feet of active or potentially active faults. The APEHA designs “active” and “potentially active” faults utilizing the same age criteria as that used by the CGS. However, the established policy is to zone active faults and only those potentially active faults that have a relatively high potential for ground rupture.

According to the Alquist-Priolo (AP) Fault Zone Map (Figure 4-4), two active fault zones traverse the proposed project alignment. The principal active faults are within the Newport-Inglewood Structural Zone (NISZ), specifically the Potrero and the Inglewood faults (Figure 3-2). The corridor crosses the Newport-Inglewood fault near La Brea Avenue and Florence Avenue, and the Potrero fault crosses the Inglewood Park Cemetery near Centinela Avenue and Florence Avenue. The 2007 Caltrans fault database describes the NISZ fault as a connected system (Newport-Inglewood fault + Rose Canyon fault) capable of generating a magnitude 7.5 earthquake. As earthquake magnitude is proportional to fault area, a combined fault system tends to increase the controlling earthquake magnitude. In our opinion, since the segment of fault crossing the proposed alignment is actually the Newport-Inglewood fault segment, which is capable of generating a magnitude 7.1 earthquake (Cao et al, 2003), the maximum magnitude of earthquake from NISZ should be taken as 7.1 for this project. There are several other poorly known minor faults within the NISZ. The corridor also crosses the Charnock fault and probably the Overland Avenue fault. Both of these faults are poorly known. They appear to displace Quaternary-age sediments and form subsurface barriers to ground water flow (Figure 3-4). Many geological investigations have speculated that there could be a thrust fault along the northeast side of the Baldwin Hills. But there is little published documentation about such a fault.

5 PRELIMINARY FINDINGS AND RECOMMENDATIONS

5.1 Seismic Data and Evaluation

5.1.1 Ground Motions and Response Spectra

Metro specifies that seismic designs of Metro structures be assessed for a two-level analysis – ODE and MDE. The ODE is the Operating Design Earthquake with a 50 percent chance of exceedance in a 100-year time span (equivalent to roughly a return period of 150 years). The MDE is the Maximum Design Earthquake with a 4 percent chance of exceedance in a 100-year time span (equivalent to roughly a return period of 2,500 years).

For the ODE event, structures are designed to respond to design earthquakes without significant structural damages. For the MDE event, structures are designed to survive earthquake loading with repairable damage and maintain life safety. Furthermore for aerial structures, design acceleration spectra for MDE event is compared with Caltrans seismic design criteria where necessary; and the greater of the spectral coordinates adopted for design. For the tunnels, Metro also requires that at least three sets of spectrum-matched time-histories be used for evaluating seismic performance.

5.1.1.1 Determination of Probabilistic Seismic Hazard Spectra

To develop ODE and MDE event criteria, probabilistic seismic hazard analyses (PSHA) were conducted for the project alignment. The PSHA analytical technique follows a standard approach first developed by Cornell (1968). This approach has been further expanded to fully treat both, the randomness (aleatory variability) and the scientific uncertainty (epistemic uncertainty) of ground motion prediction.

Southern California is seismically very active region, and the major Newport-Inglewood Structural Zone fault system near the site is shown in Figure 4-4. Additional faults were also included in the probabilistic seismic hazard analysis although they did not contribute significantly to the hazard. The return periods considered were the ones corresponding to the ODE and MDE as described above.

The 2008 USGS interactive deaggregations (Beta) online tool was used to develop the spectra. This online tool adopts the 2008 updated source model including refining upon the conventional assumption that an earthquake recurrence is a random process (i.e. Poisson’s distribution). The 2008 updated source model accounted for the time-dependant nature of earthquake recurrence along the adjacent faults to the site. However, such source effect updates generally led to only minor changes in the resultant seismic hazard solutions. The most important changes in the 2008 update relates to the utilization of the Next Generation Attenuation (NGA) relationships that incorporate more recent large magnitude earthquake recordings.

The 2008 USGS interactive probabilistic seismic hazard solutions incorporated three of the five NGA relationships, including: (1) the Boore and Akinson (2008), (2) the Campbell and Bozorgnia (2008), and (3) the Chiou and Young (2008) NGA relationships. The Abrahamson and Silva and the Idriss’s NGA relationships were not incorporated into the 2008 seismic hazard solution because documentations for the two models were not completed on time to be incorporated into the 2008 cycle of the USGS seismic hazard mapping effort.

Table 5-1 tabulates the spectral coordinates of the seismic hazard spectra developed with 5% damping for an average shear wave velocity of the upper 100 feet of soil profile (V_{s30}) of 1,500 feet/second. These seismic hazard spectra represent the reference ground condition associated with outcrop depth of approximately 100 feet below the ground surface (bgs). As the Metro criteria do not require near fault effects, the developed reference spectra do not consider the near fault directivity; i.e., the two horizontal orthogonal directions have the same shaking level. Figures 5-1, 5-2, and 5-3 show the plots of the reference hazard spectra for the ODE and MDE for the three project segments.

Table 5-1 – Reference Seismic Hazard Spectra for V_{s30} of 1,500 ft/sec

Period (sec)	Aviation Boulevard/Harbor S/D		Florence Avenue/Harbor S/D		Crenshaw Boulevard	
	MDE 2,500-year return	ODE 150-year return	MDE 2,500-year return	ODE 150-year return	MDE 2,500-year return	ODE 150-year return
	Acc (g)	Acc (g)	Acc (g)	Acc (g)	Acc (g)	Acc (g)
0.0	0.64	0.23	0.68	0.24	0.73	0.25
0.1	1.29	0.44	1.36	0.46	1.44	0.48
0.2	1.58	0.54	1.65	0.56	1.77	0.59
0.3	1.45	0.49	1.53	0.51	1.65	0.54
0.5	1.14	0.37	1.22	0.39	1.32	0.41
1.0	0.65	0.21	0.69	0.22	0.74	0.23
2.0	0.32	0.1	0.33	0.10	0.34	0.11
3.0	0.20	0.06	0.21	0.06	0.21	0.07
4.0	0.14	0.04	0.15	0.04	0.15	0.05
5.0	0.12	0.03	0.12	0.03	0.12	0.04

5.1.1.2 Development of Spectra Compatible Time-Histories

Metro Design Criteria requires development of spectrum-compatible earthquake time histories for the seismic designs of aerial structures and underground structures. Three recorded ground motions were selected as shown on Table 5-2 as the startup motion for spectrum matching. For this report, only the MDE (2,500-year spectrum) was matched.

Spectrum-compatible time histories were developed by modifying the recorded ground motions so that their spectra are similar to the reference hazard spectra. Various methods have been developed to perform the spectrum matching. A commonly used method adjusts the Fourier amplitude spectrum based on the ratio of the target response spectrum to the time history response spectrum while keeping the Fourier phase of the reference history fixed. An alternative approach for spectral matching adjusts the time history in the time domain by adding wavelets to the reference time history. In this project, the time domain method was used.

As part of the spectral matching procedure, a baseline correction is applied to the ground motions. The baseline is computed by fitting the displacement time history to a high-order polynomial (order 4 to 7) and excluding the constant and linear terms. The second derivative of this displacement baseline is computed and it is subtracted from the acceleration ground motion. The resulting ground motion is baseline corrected in acceleration, velocity, and displacement.

Plots G-1 to G-18 (G-1 through G-6 for Aviation Boulevard/Harbor S/D, G-7 through G-12 for Florence Avenue/Harbor S/D, and G-13 through G-18 for Crenshaw Boulevard) in Appendix G show the three sets horizontal time histories that are spectrum matched to the MDE (2,500-year) reference spectra. Each set has two horizontal components; horizontal 1 (H1) and horizontal 2 (H2). These spectrum-compatible time histories were used to conduct site response analyses to further establish ground shaking criteria at different depths below the ground surface, depending on the types of structures being designed.

Table 5-2 – Startup Earthquake Records for Spectrum Matching

Set	Earthquake	Station	Magnitude
1	1999 Hector mine	Hector	7.1
2	1989 Loma Prieta	Gilroy 03	6.9
3	1979 Imperial Valley	Brawley	6.5

5.1.1.3 Dynamic Soil Properties

Consistent with Metro Design Criteria, one dimensional site response analyses were conducted in which small-strain shear modulus, and the modulus reduction and damping curves are needed. The small-strain shear modulus G_{max} is best estimated from shear wave velocity values that are measured in the field and by using the relationship of

$$G_{max} = \rho V_s^2$$

where ρ is the soil density and V_s is the measured shear wave velocity.

As described in Section 3.4.2 of this report seismic compression (P-) and shear (S-) wave velocities of the subsurface soils were measured in four (4) borings (R-10-018, R-10-023, A-10-043, and R-10-052) within the project corridor. A summary plot of all measured P- and S-wave velocity profiles versus depth is shown in Appendix E. The seismic CPTs conducted are shown on Appendix B. Down-hole seismic suspension logging (P-S logging) and seismic CPTs were conducted to supplement stratigraphic information and establish idealized shear wave velocity profiles of the subsurface. Several representative one-dimensional soil columns were idealized in order to conduct preliminary site response analyses, as shown in Appendix G. At this Advanced Conceptual Design stage, the P-S logs from borings R-10-018 and R-10-023 were used to develop shear wave velocity profiles for the Florence Avenue/Harbor S/D Segment. P-S logs from borings A-10-043 and R-10-052 were used to develop shear wave velocity profiles for the Crenshaw Boulevard Segment. The shear wave velocity profile for the Aviation Boulevard/Harbor S/D Segment was developed using measurements from the P-S log from boring A-10-043 due to similar subsurface soils and similarity with seismic CPT-10-005 (pushed on the Aviation Boulevard/Harbor S/D Segment).

The dynamic properties in terms of normalized shear modulus and damping curves have been studied by many researchers and the data have been correlated to the confining pressure for sand or Plasticity Index (PI) for clay (Darendeli 2001; EPRI 1993; Seed et al. 1986; Sun et al. 1988; Vucetic and Dobry 1991); The EPRI relationships for sands (1993) and the Vucetic and Dobry relationships for clay (1991) represent the most widely adopted model for site response analyses. The procedures have been adopted by Caltrans (CSAB 1996) for major toll bridges as well as by the Nuclear Regulatory Agency (REI 2002) for nuclear power plants.

The EPRI sand curves conform favorably with the well-known Seed et al sand relationship (Seed et al. 1986) at shallow depths. Therefore, we elected to adopt the Seed et al relationship for sand (1986) and the Vucetic and Dobry relationship for clays (1991).

To account for potential variations in the determination of in-situ soil properties, the following parametric studies were considered: (1) the best-estimate case established from the downhole shear-wave velocity measurements, (2) a lower-bound case and (3) an upper-bound case. Scaling factors of 0.75 and 1.25 were used as multiplication factors on the best-estimate shear-wave velocity for lower and upper bound scenarios.

5.1.1.4 Free-Field Site Response Analysis

Site response analyses were conducted using the computer program SHAKE91 (Idriss and Sun 1992) for equivalent linear analysis. The program SHAKE91 has been used for solving one-dimensional shear wave propagation problems for three decades. Engineers have accumulated knowledge from the performance of SHAKE91 in predicting seismic ground responses during earthquakes.

Free-field site response analyses were conducted at each representative soil column for both horizontal components of the ground motions. Free-field ground motions were computed for the ground surface (0-), 10-, 30-, 40- and 50-feet below ground surface with the best estimated, upper-bound and lower-bound soil properties, as shown on Figures 5-4 to 5-9 (Aviation Boulevard/Harbor S/D Segment), Figures 5-10 to 5-15 (Florence Avenue/Harbor S/D Segment), and Figures 5-16 to 5-21 (Crenshaw Boulevard Segment) in terms of spectral accelerations and spectral displacement. These ground motions computed at some depth can be used as input to the structural model for seismic design, depending on the type of structure to be analyzed. As an example, if the structure to be analyzed is founded on a shallow foundation system, the ground motions to be used would be the ones at ground surface. In the same way, if the structure is supported on small-diameter piles, the corresponding ground motions to be used would be at 10 feet to 20 feet below ground surface, and at 30 feet below ground surface for the structures founded on large-diameter piles. Regarding tunnels and other buried structures, the ground motions to be used as input would be the free-field ground motions computed at the mid height of the buried structures to evaluate inertia loading effects.

At the current Advanced Conceptual Design stage, envelop of the free-field spectra presented in Figures 5-4 to 5-21 can be used for the response spectrum analyses of the structures. The acceleration, velocity, and displacement time histories of these motions can be made available if time history analyses are to be performed.

To assist the conceptual design of the underground facilities, earthquake induced shear strains of free-field soils are provided from the one-dimensional site response analyses. The uniform shear strains (defined as 65% of the maximum shear strains) from the site response analysis are presented in Figures 5-22 (Aviation Boulevard/Harbor S/D Segment), Figures 5-23 and 5-24 (Florence Avenue/Harbor S/D Segment), and Figures 5-25 and 5-26 (Crenshaw Boulevard Segment) along the soil column from all three input motions with best estimated, upper- and lower-bound ranges. Generally the uniform shear strains are less than 1.5% for all locations and all sets of input accelerations. The shear strain is a useful parameter to assess the racking behavior of the tunnel structures in addition to the basis inertial loading implied by the response spectra shown in Figures 5-4 to 5-21. The shear strains computed for this case are for the free-field condition which did not include the proposed tunnel or other buried structures in the analyses, but these results should be considered reasonably conservative for the Advanced Conceptual Design stage.

More detailed seismic analyses will be performed in the next design phase to refine the development of the seismic design curves when additional soil investigation and the conceptual design are completed. The future refinement of ground motion assessment is envisaged to include consideration of soil-structure interaction techniques for aerial structures to account for kinematic soil-pile interaction and for underground structures to account for soil-tunnel lining interaction and two-dimensional site response effects.

5.1.2 California Building Code Seismic Coefficients

For the structures on the potential Maintenance Facility, at-grade stations and appurtenant structures that are designed in accordance with the latest version of the California Building Code (CBC), Table 5-3 shows the seismic design parameters that should be used:

Table 5-3 – Summary of CBC Seismic Coefficients

Coefficient	Value
Mapped MCE Spectral Response Acceleration at Short Periods, S_S	1.61
Mapped MCE Spectral Response Acceleration at a Period of 1 second, S_1	0.61
Site Class	D
Fa Factor	1.00
Fv Factor	1.50
Long-period Transition Period, $T_{L\ (seconds)}$	8.0
Mapped MCE, 5% Damped, Spectral Response Acceleration at Short Periods Adjusted for Site Class Effects, S_{MS}	1.61
Mapped MCE, 5% Damped, Spectral Response Acceleration at a Period of 1 second Adjusted for Site Class Effects, S_{M1}	0.92
Mapped Design, 5% Damped, Spectral Response Acceleration at Short Periods, S_{DS}	1.08
Mapped Design, 5% Damped, Spectral Response Acceleration at a Period of 1 second, S_{D1}	0.61

5.1.3 Liquefaction and Seismically-Induced Settlements

Liquefaction is a phenomenon whereby saturated granular soils lose their inherent shear strength due to increased pore water pressures, which may be induced by cyclic loading such as that caused by an earthquake. Low relative density granular soils, shallow groundwater, and long duration and high acceleration seismic shaking are some of the factors favorable to cause liquefaction. Liquefaction is generally considered possible when the depth to groundwater is within about 50 feet from the ground surface.

For liquefaction potential and seismic-induced settlement evaluation purposes, the peak ground accelerations (PGAs) under both levels of ground motions generated by a magnitude 7.1 earthquake from the controlling NISZ as summarized in Table 5-1 were utilized. The liquefaction potential of subsurface soils was evaluated using the procedures outlined by Seed et al. (1983) and updated by NCEER (1997) and Youd et al. (2001). Liquefaction analysis was performed using SPT data from borings. Seismically-induced settlement of saturated soils was estimated using the simplified procedures developed by Tokimatsu and Seed (1987). In these procedures, the correlation of cyclic stress ratio with SPT blowcounts of sands was used to estimate the settlement of saturated sands. The SPT values were adjusted for fines using the correction values recommended by Seed (1987) for post-liquefaction conditions and Idriss' equations for non-liquefiable soils (Youd et al., 2001).

5.1.3.1 Aviation Boulevard/Harbor S/D Segment

After our liquefaction screening and analyses, we concluded that the liquefaction potential for the Aviation Boulevard/Harbor S/D segment is low. Our conclusion is consistent with the CGS Seismic Hazard Zones Map of Inglewood and Venice Quadrangles (Figure 5-27), which indicates that the Aviation Boulevard/Harbor S/D segment is not located in an area that may contain liquefiable materials. Seismically induced settlements are anticipated to be negligible.

5.1.3.2 Florence Avenue/Harbor S/D Segment

Groundwater is a pre-requisite for the occurrence of liquefaction. As discussed in Section 3.4, the highest historical groundwater elevation is approximately 95 feet below existing grade along this segment. Consequently, the potential for liquefaction within the Florence Avenue/Harbor S/D segment is considered very low. Our conclusion is consistent with the CGS Seismic Hazard Zones Map of Inglewood Quadrangle (Figure 5-27), which indicates that the segment is not located in an area that may have liquefaction potential. Seismically induced settlement is expected to be negligible.

5.1.3.3 Crenshaw Boulevard Segment

The north end of the Crenshaw Boulevard segment is mapped on the Seismic Hazard Zones map of Inglewood and Hollywood as having a liquefaction potential (Figure 5-27). We performed a detailed liquefaction potential analysis. Our results indicate that, though the segment is not anticipated to be liquefiable under the ODE, it has a high potential of liquefaction under the MDE. A summary of potentially liquefiable layers and the estimated seismic-induced settlements under the MDE are presented in Table 5-4. The potentially liquefiable layers are also shown on the Subsurface cross-section in Appendix B. Seismic-induced settlements on non-liquefiable soil layers is expected to be negligible.

Table 5-4 – Summary of Liquefiable Layers and Seismic Induced Settlements Under MDE

Boring No.	Approx. Station	Approx. GSE (ft)	Design GWE (ft)	Liquefiable Layer Elevation (ft)	Estimated Seismic-Induced Settlement (inches)
R-10-046	393+50	132.9	122.0	117.9-107.9	1.6
R-10-049	416+20	115.7	105.0	105.7-100.7	0.5
R-10-050	424+35	115.0	105.0	105.0-100.0	0.5
A-10-051	431+00	114.2	104.0	104.2-99.2	1.5
R-10-052	438+50	113.2	103.0	83.2-78.2	1.0
R-10-053	448+42	113.0	103.0	98.0-93.0	0.7
				88.0-83.0	1.0

As liquefaction is expected to occur only under the MDE level of ground motion and design policy of Metro for structures under the MDE is 'non-collapse', mitigation measures under such condition may not be necessary. The liquefiable layers are generally found to be located in the vicinity of the crown of the proposed tunnel, the tunnel designers may have to consider the effect of stress relaxation on the tunnels and impact on tunnel portals.

5.1.4 Fault Rupture

As discussed in Section 4 of this report, two active faults cross the Florence Avenue/Harbor S/D Segment. An underground structure is proposed where the Inglewood fault (part of NISZ fault system) crosses the site. At the location of the Potrero fault, the proposed alignment is at-grade. The Metro Rail Design Criteria requires that a site-specific surface fault rupture displacement hazard (SFRDH) to be evaluated for future displacements. The SFRHD study should be performed in accordance with the procedures outlined in CGS Note 49 (2002). If a fault trace is identified during field investigation, a minimum horizontal setback distance of 50 feet from the fault should be considered as having potential of SFRDH.

Although future rupture displacement can be estimated based on observations of historic movements, there was no unequivocal surface displacement of the last NISZ rupture during the 1933 Long Beach earthquake. So there is no record of how much displacement to be expected during its maximum earthquake. As a result, we estimated the amount of displacement by the empirical Wells and Coppersmith (1994) relationship recommended by the Metro Rail Design Criteria, which relates rupture displacements with earthquake magnitudes using a worldwide earthquake database. By this empirical relationship, a magnitude 7.1 earthquake originated from the NISZ is estimated to be capable of causing an average displacement of about 3.5 to 4 feet. Although the NISZ is primarily a strike-slip fault, there also appears to be some vertical displacements locally along both the Inglewood fault and the Potrero fault. With a generally accepted ratio of 80 (horizontal) to 20 (vertical) for the NISZ, the horizontal and vertical component of displacement is estimated to be about 3.0 feet and 0.7 feet, respectively. For seismic design, both vertical and horizontal components of displacement should be considered. On the next phase of design a probabilistic fault displacement hazard analysis (PFDHA) will be used. The PFDHA relates the occurrence of fault displacement to the occurrence earthquakes in much the same manner as is done in a standard probabilistic seismic hazard analysis for ground shaking, or is based on measured displacements and recurrence intervals from a specific site. The PFDHA method would most likely result in smaller design displacement values than the deterministic methods. We recommend a PFDHA for the Preliminary Engineering phase and a more detailed discussion of the proposed PFDHA is provided in Section 5.11.2.

Currently, a limited fault rupture study of the NISZ fault system is being undertaken for the Florence/La Brea station. The fault study is limited to the area within the baseline configuration location and its alternative site to the west and east of La Brea Avenue, respectively. The purpose of this study is to clear the alternative station site of any hazardous faulting while confirming the presumption that the active trace of the Inglewood segment of the NISZ crosses the corridor to the west of La Brea Avenue as indicated on the Alquist-Priolo Zone Map (Figure 4-4). The findings of this study will be presented in an addendum report.

5.2 Slope Stability

We do not anticipate significant permanent unsupported cut or fill slopes for the project because of the limited ROW and the project alignment is located in a low-lying terrain. Permanent slopes properly constructed at a gradient of 2:1 (horizontal to vertical) are generally stable under both static and seismic loading condition. A site-specific global slope stability analysis should be performed on the most critical sections of supported and unsupported slopes in the next design phase. The analysis should include both static and pseudo-static condition with appropriate groundwater level and shear strength parameters based on laboratory testing results and common correlations to shear strength. A horizontal ground acceleration based on the Metro Design Criteria should be used in the pseudo-static analysis. The assessment should adopt minimum factors of safety of 1.5 for static conditions and 1.1 for pseudostatic conditions. If the factor of safety under seismic condition is found to be below 1.1, a Newmark-type of analysis to estimate the slope displacement should be performed.

5.3 Settlement

Substantial amount of embankment fill will be required for the construction of the approaches to the proposed bridge structures of the Aviation Boulevard/Harbor S/D and Florence Avenue/Harbor S/D segments. Soil below these segments generally consists of marginally medium dense sand and medium stiff clay. Placement of embankment fill can cause measurable ground settlement on order of 3 to 4 inches within these relatively compressible materials. This magnitude of settlement is enough to trigger downdrag load on proposed deep foundations at abutments. To evaluate its impact, a detailed settlement analysis should be performed along the project alignment under various heights of embankment fill during the next design phase. However, as groundwater is estimated to be relatively deep below the existing grade along these segments, the majority of the ground settlements is expected to be results from immediate settlement and is expected to be completed during construction. The settlement period is estimated to be within 30 days. For the present design phase, the impact of ground settlements on finished track bed can be neglected. If settlement under static conditions is found beyond the tolerance of the earth retaining structures, mitigation measures should be evaluated in the next design phase.

5.4 Scour

The project corridor does not cross a creek or channel. As a result, scour is not considered a design issue for the project.

5.5 Soil Corrosivity

Soil samples were tested for minimum resistivity, pH, soluble sulfate content, and soluble chloride content. Results are summarized in Table 5-5.

Table 5-5 – Laboratory Corrosion Test Results

Boring No.	Sample No.	Approx. Depth (ft)	Predominant Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
R-10-002	S7	35	CL	1,050	7.9	120	348
A-10-003	B0	10-15	CL-SC	2,600	6.9	402	216
A-10-003	B1	20-30	SP-SM	13,000	7.7	142	189
A-10-007	B0	5-10	CL	4,100	7.3	85	137
A-10-007	B1	12-17	SC	2,200	7.9	187	205
R-10-008	S9	45	CL	1,500	8.5	40	326
A-10-009	D16	80	CL	830	7.1	25	416
A-10-010	B0	0-8	CL-ML	2,900	7.5	63	213
A-10-015	B0	5	CL	1,100	7.8	63	65
A-10-015	S3	15	SM	2,900	8.5	230	213
A-10-016	B0	3-5	SC	730	7.2	150	276
A-10-016	B4-2	20	SM	2,500	8.0	181	66
R-10-016	D10	50	CL	1,200	8.5	50	290
R-10-018	D2	10	CL	750	8.5	570	308
R-10-018	S5	25	SM	2,500	8.7	50	174
R-10-021	B0	1-5	SC	2,100	7.4	84	70
A-10-029	B0	5	CL	1,800	7.4	60	62
A-10-031	S1	5	SM	3,700	7.8	44	71
A-10-033	B0	3-5	CL	870	8.8	113	232
A-10-033	S11	55	SM	10,000	7.6	31	208
A-10-036	B0	0	CL	1,200	8.9	79	225
A-10-036	D4	20	ML	2,700	8.7	56	238
R-10-039	S5	25	CL	2,900	7.7	79	151
R-10-039	S11	55	CL-ML	2,300	7.7	89	220
R-10-040	D2	10	CL	880	8.6	418	291
R-10-040	S9	45	SM	6,100	8.2	45	152
A-10-041	B0	3-5	SC	1,600	7.6	117	61
A-10-041	S3	15	SC	2,100	7.4	31	72
A-10-041	S11	55	ML	2,900	7.4	49	163
R-10-043	D4	20	ML	2,500	7.2	158	242
A-10-045	S3	15	ML	2,900	7.1	87	134
A-10-045	S7	35	SM	9,000	7.3	45	129
A-10-048	D10	50	SM	5,300	7.2	80	221
A-10-051	B0	0-5	SM	1,000	8.1	1,052	150
R-10-052	D4	20	ML	350	8.0	1,353	527
R-10-052	S11	55	SW-SM	5,300	7.3	199	204

The Caltrans Corrosion Guidelines (2003) considers soil as corrosive if the minimum resistivity is less than 1,000 ohm-cm (as an indicator only), and if the soluble chloride content is higher than

500 ppm, the soluble sulfate content is more than 2,000 ppm, or the pH is 5.5 or less. Based on the test results and the Caltrans criteria, most of the on-site soils are considered non-corrosive to concrete and metals, except at Boring R-10-052 near the northern project limit. For metals in direct contact with the surrounding soil at this location, sacrificial thickness or special protective coating is required per Caltrans Corrosion Guidelines (2003), Section 10.1. Besides the tabulated results, additional soil samples collected from the ongoing borings will be tested and results of these tests will be included in an addendum report.

5.6 Earthwork

5.6.1 Site Preparations

Prior to general site grading, all existing pavement, undocumented fill (if encountered), and vegetation within the construction areas should be excavated and disposed of outside the construction limits under observation by the Geotechnical Engineer-of-Record. Any debris, deleterious materials, and loose native soil disturbed during site preparation should be removed. All active or inactive utilities within the construction limits should be identified for relocation, abandonment, or in-place protection prior to grading. Any pipes greater than 2 inches in diameter to be abandoned in-place should be filled with sand/cement slurry after inspection and approval by the Geotechnical Engineer-of-Record.

5.6.2 Fill Materials

Approach fill is required to elevate the LRT tracks onto the proposed aerial structures. Locally available sand, gravel, recycled concrete and ballast, if non-contaminated, may be suitable for reuse as fill. Slag is considered an unsuitable material and should not be used as fill material. It should be noted that materials generated from the tunnel excavations within the project limits can be reused as fill materials. Any debris, organic material or other unsuitable material should be removed from the fill materials and disposed of in accordance with applicable requirements of Metro, Caltrans and the City of Los Angeles.

Fill used for structural supports below foundations is considered as structure backfill, and it should conform to Section 19-3.06 of the Caltrans Standard Specifications (2006b), or equivalent. Any fill should be free of rocks or hard lumps of materials in excess of 3 inches in greatest dimension. If import materials are needed, they should conform to Section 19-7.02 of the Caltrans Standard Specifications and should be approved by the geotechnical engineer. Expansive soil should not be placed in embankments at bridge abutments within the limits shown on Figure 5-28.

5.6.3 Placement of Fill

Earthwork should be performed in accordance with Section 19 of Caltrans Standard Specifications (2006b). The new approach fill should be brought up in loose lifts not exceeding 8 inches in thickness. The upper 3 feet of fill and subballast should be compacted to 95% of its maximum density as determined by ASTM D-1557. The remaining approach fill should be compacted to 90% of relative compaction. In all cases where the existing ground surface is steeper than 1:5 (vertical to horizontal), a keyway of 12 feet in width should be excavated at least 2 feet into the existing ground at the toe of the new embankment.

5.6.4 Temporary Excavations and Supports

To design temporary cut slopes, excavations into fill and alluvium of height not more than 20 feet should assume an appropriate Cal/OSHA soil type B or C based on the findings of our field exploration (refer to Appendices B and C for soil types). For temporary excavations exceeding 20 feet in height, the contractor should provide temporary shoring and/or bracing, or other provisions for worker protection during excavations.

Temporary shoring and/or bracing should be adequately designed in accordance with recommendations presented in the California Trenching and Shoring Manual (2000), and requirements of Cal/OSHA, City of Los Angeles, and Metro. Selection of shoring system depends largely upon the acceptance criteria for deflection of the retained excavation and for settlement of ground adjacent to the shoring. The selected system will be subjected to lateral earth pressures from both of the retained earth materials and surcharge loads from the vehicular traffic and structures above. Cantilevered shoring can be utilized if some deflection is acceptable. Where shoring is used to support adjacent traffic or structures and excessive deflection cannot be tolerated, a braced or tieback shoring system should be used. Temporary shoring using soil nails will need to consider right-of-way issues and potential conflict with existing underground utilities. Soil nails are not suitable for some of the soil layers found across the alignment (i.e. medium dense sands and collapsible soils).

For preliminary design, a triangular distribution of active lateral earth pressure of 35 pounds per square foot per foot of depth (psf/ft) can be used for design of cantilever shoring. Open excavation can be supported by an internally braced system where struts are added as excavation proceeded from the top downward. Ground loss is generally minimal in a braced cut, since any deflection toward the excavation side is resisted by the trench box walls or by the struts. Because of the presence of braced walls or struts, and difference in construction sequences, the lateral pressure distribution in a braced system will be different from cantilever shoring. To design the struts and walls retaining drained earth, a trapezoidal distribution of lateral earth pressure (Tschebotarioff, 1973) to a maximum of 28 psf per ft as shown in the California Trenching and Shoring Manual is recommended.

An allowable passive lateral resistance of 700 psf/ft up to a maximum value of 7,000 psf can be used for design of soldier piles founded into competent soils. This recommended passive resistance accounts for soil arching effects acting on an effective width equal to 2.5 times the actual pile width and includes a factor of safety of 1.25.

5.7 Foundations

5.7.1 Foundation Type Selection

Aerial structures are planned along Aviation Boulevard/Harbor S/D between Station Nos. 10+00 and 18+25 (I-105), Station Nos. 65+00 and 74+20 (Century Boulevard), and Station Nos. 117+00 and 125+00 (Manchester Avenue) to grade separate LRT and street traffic. Aerial structures are also planned along the Florence Avenue/Harbor S/D alignment at Station No. 140+00 (La Cienega Boulevard and I-405) and Stations 176+00 through 218+00 (from East Eucalyptus Avenue to east of La Brea Avenue) to grade separate LRT and commuter traffic.

Although detailed structural plans are not available, the aerial structures are expected to be bridge structures with earth retaining systems supporting the approach fills. Foundation type for these structures can depend on various factors besides geotechnical conditions and its selection should be evaluated differently based on site-specific information. The underground structures are planned to be constructed by either bored tunneling or cut-and-cover method. The Metro design criteria for these structures are the latest AASHTO LRFD Bridge Design Specifications (2007) with California Amendments.

5.7.1.1 Earth Retaining Structures

Based on the findings of our geotechnical investigation, the upper soils are generally medium stiff clays and are compressible. We anticipated that bearing capacities for shallow foundations founded into the upper soils will be largely controlled by allowable settlement.

Conventional cast-in-place (CIP) retaining walls are generally designed for 1 inch of total settlement under the fully applied live and dead loads. We estimate that CIP above-grade retaining walls up to 10 feet in height can be supported by shallow foundations with an average of 2 feet of over-excavation. The shallow foundations should have a minimum cover of 1½ feet. For CIP walls higher than 10 feet above grade, a deep foundation or a change in wall type to mechanically stabilized earth (MSE) wall may be necessary.

For U-sections with walls below existing grade, the bearing foundation stratum was pre-loaded with the full depth of excavated soil. The pre-loading serves as a surcharge in eliminating portion of load related settlement. In addition, since soil generally increases in relative density or consistency with depth at the locations of the proposed U-sections based on the findings of our geotechnical investigation, we expect that these below-grade retaining walls can be supported on shallow footings to the planned heights of walls up to 30 feet. The success of a cantilever wall will depend on the tolerance of deflection. For the nearby Alameda Corridor project, ground movement was successfully controlled by installing secant piles braced with a top strut.

MSE wall is particularly suitable for the anticipated subsurface conditions of the project because of its flexibility to allow higher settlement. It is not uncommon for MSE walls to be designed for total settlements up to 4 inches and variable. We estimate that MSE wall up to 40 feet in height can be supported on a roughly 2 feet thick fill blanket. The MSE wall should be embedded a minimum of 2 feet, or 10% of the wall height, whichever is larger, below the lowest adjacent grade. The internal stability of MSE walls depends on the pull-out resistance of the embedded metal straps and is usually evaluated by the MSE wall vendor's designers. Standard designs based on the LRFD method are shown in Caltrans Bridge Design Aids 3-8 (2009) and details on bridge 'XS' Detail Sheets XS-13-020-1 through 6.

5.7.1.2 Buildings, At-Grade Stations and Appurtenant Structures

Conventional shallow foundations are feasible for these lightly loaded surface structures. Our geotechnical investigations at the locations of these surface structures indicate that the upper soils are generally medium stiff to very stiff clays. These clayey soils are anticipated to be moderately expansive based on our laboratory testing. To limit volumetric changes due to surface moisture variations, some remedial grading is necessary if shallow foundations are to be used. We recommend an overexcavation of at least 2 feet below the bottom of footing and replacing the excavated soils with non-expansive granular soils, if the bottom of footing is located within the upper 4 feet of the lowest adjacent finished grade.

5.7.1.3 Bridge Structures

Due to the site's seismicity, high vertical and lateral load demands within the Aviation Boulevard/Harbor S/D segment and Florence Avenue/Harbor S/D segment, deep foundations are anticipated for the aerial structures and elevated stations.

Piling is generally categorized according to its installation method into driven or cast-in-drilled-hole (CIDH) piles. In our opinion, unless it is restricted by environmental regulations because of the noise level and vibration during construction, driven piles appear to be a more suitable pile type than CIDH piles for the corridor due to the following reasons:

1. possibility of using battered piles to resist large lateral loads at tall cantilever abutments,
2. reliability of pile end bearing without cleanout effort,
3. potential of encountering caving soils during drilling of CIDH piles cannot be precluded,
4. possibility of future specified pile tip elevations may be below groundwater level,
5. no disposal of soil cuttings and groundwater (particularly for areas with potential contaminants) is necessary, and
6. pile capacity can be verified by blowcounts and/or pile driving analyzer (PDA).

Among commonly available driven pile types are prestressed precast concrete pile, pipe pile, H-pile, and cast-in-steel-shell (CISS) pile. The prestressed precast concrete pile is regarded as a displacement pile, since it displaces surrounding soils during pile driving. Pipe pile, H-pile and CISS pile are non-displacement piles in this regard until a soil plug is formed. Prestressed precast concrete pile is generally the most economical pile type, while the CISS pile is the most expensive due to the ½ inch to ⅝ inch thick steel shell commonly used. Small diameter pipe pile is not favorable for the project, since the pile can be easily plugged and refusal can be encountered before reaching the specified pile tip elevations. In addition, the thin pile shell at the pile head is easy to be damaged during hard driving.

Although CIDH piles may have their shortcomings, CIDH piles, particularly large-diameter drilled shafts, can have some distinct advantages over driven piles under the following circumstances:

1. restrictive noise and vibration levels during construction in sensitive neighborhoods,
2. geometry limitation such as right-of-way or underground utilities to be protected in place that constraints foundation footprint, and
3. high lateral pile capacity to resist seismic demand.

Due to the Inglewood fault crossing the proposed alignment near La Brea Avenue, CISS piles may need to be considered for the foundation system of the aerial structure near the Inglewood fault, as CISS piles have a higher tolerance to lateral loading and can protect the concrete core with the steel shell. Large diameter drilled shaft, though lack redundancy, has high pile stiffness to resist shear and moment generated by the rupture. Small diameter piles are not recommended near the rupture zone.

5.7.2 Preliminary Deep Foundation Recommendations

In order to provide preliminary foundation recommendations for the bridges along the Aviation Boulevard/Harbor S/D segment and the Florence Avenue/Harbor S/D segment, a total of 4 idealized subsurface stratigraphies were developed after generalizing the available boring information. Profile 1 covers the bridge structures at the I-105 and at Century Boulevard. Profile 2 covers the bridge structure at Manchester Boulevard. Profile 3 covers the bridge structures at La Cienega Boulevard, I-405 up to La Brea Avenue. Profile 4 covers the aerial structures east of La Brea Avenue to east of La Brea Avenue.

For Profile 1, two pile types were considered suitable and were selected for analysis: an H-Pile (HP-14x89) and a 24-inch diameter Caltrans standard Class 200 cast-in-drilled-hole (CIDH) concrete pile. Precast prestressed concrete piles were precluded because of potential drivability issue due to the presence of a 15-foot thick layer of very dense sand at approximately 25 feet below ground surface. However, a 14-inch Caltrans standard Class 200 Alternate ‘X’ precast prestressed concrete (PCC) pile was considered drivable at the Manchester Boulevard grade separation and a preliminary recommendation was included for Profile 2.

For Profiles 3 and 4, four pile types were selected for analysis: an H-Pile (HP14x89), a 24-inch cast-in-steel-shell (CISS) pile, a 24-inch diameter Caltrans standard Class 200 cast-in-drilled-hole (CIDH) concrete pile, and a 14-inch diameter precast prestressed concrete (PCC) pile.

5.7.2.1 Axial Capacity

The load demands used on the analyses for the Caltrans Standard piles were the nominal structural capacities of the piles. The HP14x89 and Caltrans standard Class 200 PCC or CIDH piles are designed for standard nominal capacity of 400 kips in compression and 200 kips in tension. The CISS pile is a non-standard Caltrans pile and its nominal capacity will vary according to structural design details. Four charts for nominal downward (compressive) capacities are presented (Figures 5-29 to 5-32) to aid preliminary pile design for structures within the described profiles. The preliminary upward (tension) resistance can be taken as 50% of the downward resistance. For drilled shaft with diameter other than 24 inches, the downward capacity is directly proportional to its pile size.

5.7.2.2 Lateral Pile Capacity

The lateral solutions with a free-head condition were estimated using the computer program LPILE (Reese et al, 2004). Our lateral capacity analyses have included group effect for the proposed piles by using an average 'p-multiplier' of 0.65 for assumed pile spacing of 3-times pile size. The results are tabulated in Tables 5-6 and 5-7.

Table 5-6 – Lateral Pile Capacities for Profiles 1 and 2

Location	Lateral Displacement at Top of Pile (in)	Lateral Load at Top of Pile (kips)	Max. Bending Moment (kip-in)	Depth from Pile Head to Max. Moment (ft)
Profile 1				
HP-14x89	¼	14.9	700.0	6.8
	½	20.5	1116.9	7.7
	1	28.1	1783.7	8.6
24-inch CIDH	¼	22.9	864.2	5.9
	½	31.3	1368.8	6.8
	1	42.6	2168.9	7.7
Profile 2				
14-inch PCC	¼	12.3	408.1	4.5
	½	16.7	650.1	5.0
	1	22.3	1042.1	6.0
HP-14x89	¼	19.4	821.1	6.2
	½	26.7	1306.2	7.2
	1	36.6	2080.3	8.2
24-inch CIDH	¼	22.9	865.5	6.0
	½	31.3	1367.8	6.5
	1	42.7	2173.0	7.5
24-inch CISS	¼	38.8	2213.9	9.0
	½	53.6	3511.3	10.0
	1	74.1	5579.1	11.0

Table 5-7 – Lateral Pile Capacities for Profiles 3 and 4

Location	Lateral Displacement at Top of Pile (in)	Lateral Load at Top of Pile (kips)	Max. Bending Moment (kip-in)	Depth from Pile Head to Max. Moment (ft)
Profile 3				
14-inch PCC	¼	14.5	449.4	4.4
	½	19.7	715.6	4.8
	1	26.4	1143.1	5.6
HP-14x89	¼	22.7	901.5	5.9
	½	31.2	1433.8	6.8
	1	42.8	2284.2	7.7
24-inch CIDH	¼	26.8	954.2	5.6
	½	36.7	1506.0	6.5
	1	50.0	2385.4	6.9
24-inch CISS	¼	45.2	2429.3	8.5
	½	62.4	3843.5	9.5
	1	85.8	6056.3	10.5
Profile 4				
14-inch PCC	¼	14.5	448.9	4.6
	½	19.7	716.1	4.9
	1	26.4	1141.4	5.7
HP-14x89	¼	22.6	896.3	6.0
	½	31.0	1421.3	6.9
	1	42.7	2272.7	7.7
24-inch CIDH	¼	26.8	951.5	5.6
	½	36.5	1491.0	6.0
	1	49.8	2366.2	6.9
24-inch CISS	¼	44.8	2388.3	8.4
	½	62.2	3821.7	9.6
	1	85.9	6072.8	10.8

5.7.3 Preliminary Shallow Foundation Recommendations

5.7.3.1 Allowable Bearing Capacity

An allowable bearing capacity of 2,000 pound per square foot (psf) can be used for design of spread and continuous footings of retaining walls, buildings, at-grade stations and appurtenant structures with a minimum width of 24 inches bearing at least 18 inches into an engineered fill. The engineered fill should be at least two (2) feet below the footing bottoms and should extend at least 5 feet beyond the outside edges of foundations, or equal to the depth of fill, whichever is greater. All exterior footings should be founded at least 18 inches below the lowest adjacent grade, or 18 inches below the top of slab for interior footings.

The given allowable bearing capacity is a net value and has included a safety factor of 3. The weight of the footing and the backfill over the foundation may be neglected when computing dead loads. The recommended bearing value can be increased by one-third for momentary wind or seismic loads. Edge pressure due to any eccentric load should not exceed the bearing values given for permanent and temporary loads.

Total settlement of footings up to a width of 7 feet is estimated to be less than 1 inch under the recommended fully applied bearing pressure. Differential settlement between new footings is not expected to exceed ½ inch.

5.7.3.2 Lateral Load Resistance

Resistance to lateral loads may be provided by frictional resistance between the bottom of concrete footings and the underlying soils, and by passive soil pressure against the sides of the footings. The allowable coefficient of friction between poured-in-place concrete footings and the underlying native soils may be taken as 0.30. The allowable passive pressure can be taken as 250 psf per foot of depth to a maximum value of 2,000 psf. The recommended allowable values have included a factor of safety of at least 1.5. The frictional and passive pressure resistance may be used in combination without reduction.

5.7.3.3 Slab-on-Grade

Slabs-on-grade should be supported on a minimum of 2 feet of non-expansive engineered fill. Slabs-on-grade used to support floor loads should be a minimum of 4 inch thick and reinforced with No. 4 bars spaced at 18 inches on-center each way. The structural engineer's requirements should be followed if they are more stringent. A moisture barrier is recommended under all floor slabs to be overlain by moisture-sensitive floor covering. A plastic or vinyl membrane may be used for this purpose and should be placed between two layers of moist sand, each at least 2 inches thick, to promote uniform curing of the concrete and to protect the membrane during construction.

For design of slabs and hardscape, a modulus of subgrade reaction (k) of 100 pounds per square inch per inch of deflection (pci) may be used for estimating deflections.

5.8 Abutment Wall Resistance

The ultimate passive pressure behind the proposed abutments may be estimated as recommended in Section 7.8 of the Caltrans Seismic Design Criteria (SDC, 2006c). A uniformly distributed, ultimate passive resistance can be calculated using Equation 7.44 from the SDC to a maximum of 5 kips per square foot (ksf) in resisting movement at the abutment walls. However, this given value assumes that the back wall of the abutment will break off during the design seismic event and it would not be suitable for an ODE-level design.

For design under ODE, a value of 200 kips per inch per foot of wall can be used for the lateral stiffness of the abutment as per Caltrans SDC. In addition, a maximum lateral stiffness of 40 kips per inch of deflection can be assumed for each abutment pile.

5.9 Lateral Earth Pressures

Pressures in the form of an equivalent fluid pressure (based on a bulk soil unit weight of 120 lb/ft^3) as shown in Table 5-8 may be used to estimate lateral earth pressures against abutments and retaining walls exerted by structure backfill.

Table 5-8 – Lateral Earth Pressures

Backfill Inclination	Lateral Earth Pressure Condition		Equivalent Fluid Weight (lb/ft^3)
Level	Active		35
	At-rest		55
	Seismic [1]	ODE	5
		MDE	20

Notes:
1. The additional active pressure distribution due to earthquake loading is in the form of an inverted triangle.

The active lateral earth pressure should be used when the retaining walls can be assumed to be free-standing and unrestrained; while the at-rest lateral earth pressure is suitable for walls which are restrained from rotation. An additional seismic lateral earth pressure in the form of an inverted triangle as presented in Table 5-8 should be added to the design static active earth pressure under each level of ground motion.

The recommended values presented in Table 5-8 do not include other surcharge loads resulting from foundations, structures, and traffic. A Cooper E-80 loading should be included as surcharge in the calculation of lateral earth pressure at locations where it is applicable. Lateral pressures resulting from a uniform vertical surcharge behind the wall should be added as a horizontal pressure with a rectangular distribution and calculated using a lateral earth pressure coefficient of 0.30 for the abutment walls and the retaining walls. Surcharges that are set back behind the wall a horizontal distance greater than the exposed wall height do not need to be added to the design pressures.

These values do not include hydrostatic forces (e.g., standing water in the backfill material). Weepholes and a wall drain with filter/drainage materials should be provided similar to those shown on Caltrans Standard Plans. Prefabricated drain composites may be substituted subject to approval by the Engineer. Excessive groundwater, existing or proposed water bearing utilities, and/or surface conditions that could require subsurface drainage beyond that shown on the Standard Plans were not encountered or known to be planned as part of the project.

5.10 Construction Considerations

5.10.1 Cast-In-Drilled-Hole (CIDH) Piles

1. For on-center pile spacing less than six times the pile diameter, no two adjacent piles should be constructed concurrently.
2. Loose soils should be removed from the bottom of the pile boreholes using a cleanout bucket.
3. Pile boreholes should be inspected and approved by the geotechnical engineer prior to the installation of reinforcement. Extreme care in drilling, placement of steel, and the pouring of concrete is essential to avoid excessive disturbance of pile boring walls.
4. Concrete placement by pumping or tremie tube to the bottom of the pile borings is recommended. Specifications should require that sufficient space be provided in the pile reinforcing cage during fabrication to allow the insertion of a tremie tube for concrete placement. The pile reinforcing cage should be installed and the concrete pumped immediately after drilling is completed.
5. Sandy soils were encountered and these materials are susceptible to caving. If caving occurs, a temporary casing or wet construction method may be required during construction. Casings should have an outer diameter equal to or exceeding the pile diameter. Temporary casing should be placed tight-in-hole. Vibratory or impact hammer with or without center-relief drilling can be used to install the temporary casing provided the existing structure is monitored for potential movement due to ground vibration; casing installation using this method should be suspended if excessive movement is detected. The temporary casing should be retrieved as the concrete is being poured, while always maintaining at least a 5-foot head of concrete inside the casing.
6. Groundwater may be encountered during drilling along the Aviation Boulevard/Harbor S/D segment and wet method of construction may be necessary. As a minimum requirement, Gamma-Gamma testing should be performed to detect anomaly in concrete for CIDH piles installed below water. Equally spaced 2-inch diameter (Schedule 40) PVC access tubes should be pre-installed in CIDH piles to facilitate Gamma-Gamma logging. Since Gamma-Gamma logging tests anomalies generally around the PVC tubes, Cross-hole Sonic logging can be performed as a complementary test for anomaly between tubes so that if any anomaly is found, its limits can be more precisely determined.
7. Metro Rail Design Criteria requires that at least one pile load test to be performed for all CIDH piles at each bridge site regardless of pile sizes with a maximum horizontal distance of 5,000 feet between test locations along the guideway alignment.

5.10.2 Driven Piles

1. Piles should be driven at least to the specified tip elevation and the bearing value should be checked with the pile-driving formula given in Section 49-1.08 of the Caltrans Standard Specifications (2006b) or by the use of a pile driving analyzer (PDA). However, if the specified tip elevation is reached without achieving the design load, pile driving should continue until bearing is attained. In this case, pile setup may not be significant due to the sandy nature of the subsurface materials.

2. The selected pile-driving hammer such as diesel-type hammers should be able to deliver sufficient energy to drive the piles at a penetration rate of not less than 1/8 inch per blow at the required bearing value. Vibratory hammers are not allowed for pile installation.
3. Drivability of piles was considered for the bridge sites. Based on the available soil boring data, contractor should be prepared for hard driving conditions for concrete piles. To ensure a proper execution during construction, the geotechnical engineer should review the driving equipment and method proposed by the contractor.
4. Driving piles will generate vibration and noise in the surrounding areas. The contractor should be ready to monitor vibration and noise levels per agency standards.

5.10.3 Trenching and Tunneling

Trenches, bore-tunnels and cut-and-cover type tunneling for the project corridor will be designed by HMM. The following items are provided for consideration in future design and construction:

1. Tunneling in developed urban areas may be conflicted with underground utilities and existing foundations.
2. Although static groundwater was encountered at elevations of approximately 80 to 60 feet (approximately 51 to 97 feet below existing grade), a perched water condition was observed at higher elevations within borings between 38th Street and Exposition Boulevard at levels of approximately 90 to 100 feet (approximately 16 to 24 feet below existing ground surface). This is evident from the results of laboratory moisture content tests on samples collected from these borings. The hydrostatic pressure and rate of seepage from the perched water should be considered in the design and construction of tunnel lining.
3. If significant dewatering becomes necessary during construction, its geotechnical consequences such as settlement, etc. should be considered in design of the dewatering scheme.
4. Although contaminants were detected in some tested soil and water samples, the concentration levels are well below agency action levels.
5. The on-site soils are not corrosive to both concrete and metals. No mitigation measure is necessary for protection against corrosion.
6. Granular soils with weak cementation were observed within pertinent depths of the bored tunnel construction during our field investigation. These materials are generally susceptible to caving. Although our method of drilling precludes the investigation of caving potential, laboratory strength tests and gradation analyses are included in this report to assist the tunnel designers in selection of a suitable tunnel lining.
7. We expect that conventional shoring system is feasible for supporting the temporary excavations at the cut-and-cover section of the project. Selection of shoring system, if needed, depends largely upon the acceptance criteria for deflection of the retained excavation and for settlement of ground adjacent to the shoring. Cantilevered shoring can be utilized if some deflection is acceptable. Where shoring is used to support adjacent traffic or structures and excessive deflection cannot be tolerated, a braced shoring system should be used.
8. Although the determination of rippability of subsurface materials is mostly empirical in nature, standard references such as those of the Caterpillar Company have attempted to correlate rippability with seismic wave velocities. The shear wave velocities measured from the P-S seismic downhole logging indicated that the subsurface soils within pertinent depths

of construction are readily rippable with a proper choice of equipment. Results of the geophysical survey are also confirmed with SPT blowcounts recorded during drilling.

5.11 Additional Work

5.11.1 Project-Wide

Our field investigation planned for this Conceptual Engineering Phase consists of exploratory locations spaced at a horizontal distance of approximately 800 to 1600 feet along the project segment. The exploration was made for the purpose of developing a geologic profile and collecting samples for laboratory testing to identify critical geotechnical and environmental conditions or constraints. This frequency of exploration is generally considered inadequate for design purposes. In addition to our current unfinished exploration, in preparing the final recommendations for this project, the following tasks are recommended for the next design phase:

- Additional field exploration and laboratory testing to fill information gaps. The exploratory locations for the below-grade structures are tentatively planned at a depth of 100 feet spaced at a horizontal distance of about 300 feet from the locations explored in the current program. One 100 feet deep boring or CPT is planned at each support of the proposed aerial structure. For at-grade alignment and structures, borings to a depth of 30 feet are planned at horizontal spacing of 500 feet from the recently explored locations. For the maintenance facility, five (5) borings or CPTs within the building footprints to depths ranging from 30 to 50 feet should be planned.
- Additional Packer tests and Pressuremeter tests in the areas of the proposed tunnels.
- Additional geophysical evaluation of shear wave velocities of subsurface materials using P-S logging methods to fill information gaps.
- Additional liquefaction analyses with information from additional site exploration in areas of interest.
- Site-specific foundation analyses with structural loads and types.
- Selection of most adequate acceleration response spectra for the individual segments.

5.11.2 Fault Study

More-detailed investigations will be needed to refine the locations of the main faults and to determine if any of the other smaller faults within the NISZ represent a significant potential surface-rupture hazard to proposed structures. For example, a relatively small northeast trending branch of the NISZ called the Reservoir fault may have been involved in the catastrophic failure of the Baldwin Hills reservoir in 1963. We propose the following tasks for the next design phase for more detailed evaluation of the two fault zones that cross the Florence Segment:

- LITERATURE REVIEW. More-detailed review of published information is also warranted. Some of these reviews would be to collect more obscure data on the faults from available unpublished sources such oil-field data, consultant’s reports, and university research.
- AERIAL PHOTOGRAPH ANALYSIS. An aerial photograph investigation should be the one of the first of any future investigations and should be undertaken at soon as

possible. Aerial photograph have been proven to be an invaluable tool for identifying fault locations. The best aerial photographs for fault analysis in urban environments are "old" photographs. The first aerial photographs that were flown in a systematic grid pattern so as to allow stereographic viewing (i.e. three-dimensional) were done in the late 1920's and early 1930's. These old photographs are best because they were taken when the area was not as highly urbanized as it is today, and therefore they show the ground surface in a closer-to-natural state than more-recent photographs providing clearer evidence of possible surface fault ruptures.

- GEOLOGICAL MAPPING. Geological field "mapping" should be undertaken after the aerial-photograph analysis. The proposed geological mapping would be of a reconnaissance level because the area is fairly well developed and there are few natural exposures. The primary purpose of this effort is to check geomorphic anomalies related to faulting identified on aerial photographs and topographic maps. Also, the nature of surficial geologic formations shown on published geological maps could be compared to the subsurface data from the borings drilled along the corridor to evaluate whether there are any correlations that might help predict or assess engineering properties between boreholes. The field reconnaissance will also provide information on locations that might be suitable for future fault trenching and or geophysical surveys.
- GEOPHYSICS. Near-surface seismic surveys can provide additional clarity to the current subsurface interpretation before any seismic trenching is planned. Geophysical investigations in the form of a) seismic-reflection profiling, b) surface wave/shear wave, and c) borehole down-hole P & S wave logging will be invaluable for helping to assess the surface fault-rupture potential. Perhaps the best data would come from seismic reflection profiling. This method has already been proven to be effective for detecting faults of the NISZ. For example, the Potrero fault at a site just southeast of the project corridor was clearly imaged. A seismic-reflection survey should consist of at least two parallel lines about 6000-7000 feet long. This would cross both AP faults and any faults in between. It is important to investigate more than just the two AP faults because other investigations and oil field data indicate there are several subparallel as well as cross trending faults within the NISZ (e.g. Hamilton and Mechan, 1971). Down-hole P & S wave and/or surface-wave data may be needed to get seismic velocity data that will help determine the depths to seismic reflectors which in turn is important for assigning ages to the reflectors. Some P & S wave data are available from existing borings and these need to be compiled for the areas of the fault crossings.
- TRENCHING. Extensive urban development has already made successful seismic trenching studies difficult, if not highly unlikely. If the location of fault zones can be identified from the near-surface seismic surveys, a minimum of two (2) seismic trenches should be planned on both sides of Florence Avenue. Trenching is the ultimate and most-definitive method for identifying hazardous faults. Trenches dug across faults can range from simple, shallow (10 feet) excavations dug by a small backhoe to wide (50 feet), deep (25-30 feet), benched excavations dug by a large excavator. Site conditions dictate the best approach. The dense urban development in the fault crossing areas may not allow effective trenching. Preliminary review indicates there are some vacant lots in the fault crossing area where trenches could be excavated if encroachment permits could be obtained. Like the drilling, these investigations would be done later in the project once specific structure sites have been chosen. Soil samples collected from seismic trenches within the potential fault zone should be collected for carbon dating to determine age of activity.

- BORINGS. As the depth of investigation by trenching is limited, closely spaced borings can also be used in case that the NISZ is concealed. Soil samples collected from the borings within the potential fault zone should be collected for carbon dating to determine age of activity. More boreholes may be needed to refine the location and nature of faults. Most of the existing borings are probably too widely spaced to yield useful data. Closely spaced, continuously cored boreholes or cone penetrometer soundings (CPT) could help identify a) fault locations, b) widths of fault disturbance, and c) degree of deformation. Some borings should be drilled at an angle to ensure that the boring intersects the faults. Closely spaced CPTs have proven to help identify the location of faults in some cases. Spacing of CPTs might be on the order of 25 to 50 feet initially depending on the specific type of structures and the preliminary fault data. CPTs may be a cost-effective way to narrow the possible locations of faults so that angled coreholes or trenches could be more precisely placed. This could greatly reduce the cost of the more-expensive corehole drilling and trenching. Drilling would probably best be done after the more-detailed project layouts have been finalized.
- SFRDH STUDY. A site-specific study for the NISZ should be performed in accordance with CGS Note 49 (2002).
- EMPIRICAL FAULT DISPLACEMENT ANALYSIS. In the event that faults cannot be effectively identified and characterized, or discounted completely, it may become necessary to base design criteria on theoretical or empirical data. If reasonable estimates of likely fault displacement amounts or the recurrence intervals between surface-rupture events cannot be made with confidence, it may be necessary to base the design values on comparison to what has happened historically on other faults and earthquakes in similar seismotectonic environments. This is a relatively common approach but commonly results in very conservative estimates that may require very expensive design that would exceed the cost of the investigations summarized above. There are two basic approaches to this type of evaluation, 1) deterministic approach, and 2) probabilistic approach. The deterministic evaluation is basically a worst-case scenario and would result in design fault displacement values approximately in the 3 to 6 feet range. The probabilistic fault displacement hazard analysis (PFDHA) relates the occurrence of fault displacement to the occurrence earthquakes in much the same manner as is done in a standard probabilistic seismic hazard analysis for ground shaking, or is based on measured displacements and recurrence intervals from a specific site. The PFDHA method would most likely result in smaller design displacement values than the deterministic methods, but would require specific acceptance by the regulating agency because there are no widely accepted standards. We have successfully applied these methods to other projects.

Some of these possible methods of investigation should be undertaken before specific design becomes too advanced, whereas other investigations might be better if left to a later date when plans are more definite. Some early investigations might provide information that would allow the location of some structures to be modified slightly to avoid direct rupture affects.

6 LIMITATIONS

This report is intended for the use of HMM and Metro. This report is based on the project as described and the information obtained from the exploratory borings at the approximate locations indicated on the attached plans. The findings and recommendations contained in this report are based on the results of the field investigation, laboratory tests, and engineering analyses. In addition, soils and subsurface conditions encountered in the exploratory borings are presumed to be representative of the project site. However, subsurface conditions and characteristics of soils between exploratory borings could vary. The findings reflect an interpretation of the direct evidence obtained. The recommendations presented in this report are based on the assumption that an appropriate level of quality control and quality assurance (inspections and tests) will be provided during construction. EMI should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations contained in this report are applicable to the specific design elements and locations which are the subject of this report. They have no applicability to any other design elements or to any other locations and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of EMI.

Services performed by EMI have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. No other representation, expressed or implied, and no warranty or guarantee is included or intended.

PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT
PROPOSED ALIGNMENTS FOR THE CRENSHAW-PRAIRIE TRANSIT CORRIDOR PROJECT
LOS ANGELES COUNTY, CALIFORNIA

Prepared For:

Metropolitan Transportation Authority

One Gateway Plaza, 12th Floor
Los Angeles, California 90012-2932

Project No. 602019-002

May 22, 2008

Leighton Consulting, Inc.

A LEIGHTON GROUP COMPANY

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Project No. 602019-002

To: Metropolitan Transportation Authority
One Gateway Plaza, 12th Floor
Los Angeles, California 90012-2932

Attention: Ms. Chris Long

Subject: Phase I Environmental Site Assessment Report, Crenshaw-Prairie Transit Corridor Project, Los Angeles County, California

Leighton Consulting, Inc. (Leighton Consulting) is pleased to present this Phase I Environmental Site Assessment Report for the subject property.

Leighton Consulting has the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. Leighton Consulting has developed and performed the all appropriate inquiries in conformance with the standards and practices prescribed in ASTM International (ASTM) E1527-05.

If you have any questions regarding this report, please do not hesitate to contact me. We appreciate the opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Meredith Church

REGISTERED PROFESSIONAL GEOLOGIST
MEREDITH D. CHURCH
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Exp: 3/31/13
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Project Geologist

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EXECUTIVE SUMMARY

Leighton Consulting, Inc. (Leighton Consulting) performed a Phase I Environmental Site Assessment (ESA) of the Proposed Alignments for the Crenshaw-Prairie Transit Corridor in Los Angeles and Inglewood, Los Angeles County, California. The Crenshaw-Prairie Transit Corridor study area extends approximately ten miles and 33 square miles from Wilshire Boulevard on the north, to El Segundo Boulevard on the south. Several alignment alternatives are currently being considered, and are collectively referred to as the "subject property" (Figure 1, Site Location Map). The purpose of this ESA was to attempt to identify, to the extent feasible pursuant to the processes prescribed in ASTM International (ASTM) E1527-05, recognized environmental conditions (RECs) in connection with the subject property. Exceptions to, or deletions from, this practice are described in Section 1.5 of the Phase I ESA report. The scope of work for this Phase I ESA included: records review; site reconnaissance; interviews; and report preparation.

On February 12, 14, 26, 27, and March 3, 2008, representatives of Leighton Consulting, conducted a reconnaissance–level assessment of the subject property. The site reconnaissance consisted of the observation and documentation of existing subject property conditions and nature of the neighboring property development within 0.25-miles of the subject property. Photographs of the subject property are presented in Appendix B and their view directions are noted on Figures 4a through 4d, Environmental Concern Location Map. Leighton Consulting was provided access only to the railroad and street right-of-ways. Access was not provided on any properties located adjacent to the right-of-way and these properties were only inspected from the property boundaries. Fences, vegetation, buildings, etc. limited the observations on many of these properties.

Historical information was obtained from a review of aerial photographs, Sanborn maps, and historical topographic maps. This review was conducted only on the railroad and street right-of-ways and adjacent sites. Based on historical records, the subject property has consisted primarily of streets and a rail road right-of-way at least since the 1890s. The affected parcels at Venice Boulevard and Crenshaw Boulevard have been used for residential purposes since at least the 1920s. The affected parcels at San Vicente Boulevard and Venice Boulevard appeared to have been occupied by the Pacific Electric Railroad right-of-way until at least the early 1950s, as well as a lumber company from at least 1926 to 1967, and commercial use until the present. The affected parcels at Crenshaw Boulevard and Exposition Boulevard south to Coliseum Street appeared to have been primarily vacant and possibly used for agricultural purposes from the 1920s to the 1950s, and have been built up with commercial structures from the 1950s through the present, with former businesses including an electronics manufacturing facility, a plastics manufacturing facility, and a gas station, and a dry cleaners. Historical and current use of adjacent numerous sites used for residential, commercial (including gas stations, dry cleaners, and auto repair facilities), manufacturing, and industrial purposes.

An environmental database report prepared by FirstSearch™ Report was reviewed for local, state, and federal listings for properties within the vicinity of the subject property. Regulatory database lists were reviewed for cases pertaining to leaking underground storage tanks (USTs), hazardous waste sites, and abandoned sites. The database listings were reviewed within the specified radii of a quarter of a mile as requested by Terry A. Hayes Associates LLC (TAHA).

For this study, Leighton Consulting has established classification criteria to assist in identifying the potential impacts of each contaminated or potentially contaminated facility that was identified in the FirstSearch™ environmental database report system, the site reconnaissance, or reviews of other records. Each facility was classified as High, Moderate, or Low with respect to its type of operation, proximity to the subject property, the anticipated hydrogeologic gradient, field observations, and regulatory information. In general, the classification criteria are:

- High – facilities with known or probable soil/groundwater contamination (i.e. Leaking Underground Storage Tanks [LUSTs]), and facilities where remediation is incomplete or undocumented, and the contamination is known or suspected to exist on the subject property.
- Moderate – facilities with identified or potential soil contamination (i.e. LUSTs), remediation is in progress, or groundwater contamination that does not appear to be migrating and has not been reported on the subject property. Facilities with a heavy industrial/manufacturing background that typically use or have used significant quantities of hazardous materials may also be classified as Moderate.
- Low – facilities that have completed remediation or have historically utilized only small amounts of known contaminants (i.e. small quantity generators or underground storage tanks).

The following table summarizes the environmental concerns identified onsite, or associated with the affected parcels, that have a classification criterion of Moderate to High:

Fig #	**ID**	**Sxn**	**Facility Name/Address**	**Environmental Concern**	**Hazard**
4a	D	A1	CIM/Pico Former Lumber Company & facilities with Underground Storage Tanks (USTs)	4550 Pico Blvd., Los Angeles (LA) 4600-4700 Pico Blvd., LA	Moderate
4a	E	A2	Alright Parking Lot/4180 Wilshire Blvd. to 701 Crenshaw Blvd., LA	Monitoring wells	High

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Fig #	ID	Sxn	Facility Name/Address	Environmental Concern	Hazard
4a	9	A2	Legal Aid Foundation, 1102 Crenshaw Blvd., LA	Borings	High
4a	14	A2	UC Education Center, 1111 Crenshaw Blvd., LA	Borings	High
4a	F	A2	Chevron Gas Station, 1009 Crenshaw Blvd., LA	Monitoring wells	High
4a	I	A1/A2	76 Station, 4176 Venice Blvd., LA	Monitoring wells	High
4a	M	A1/A2	Arco, 3400 Crenshaw Blvd., LA	Monitoring wells	High
4a	P	A1/A2	Former Gulf Oil, 3630 & 3644 Crenshaw Blvd., LA	Former gas station, USTs formerly located fronting Crenshaw Blvd.	High
4a	Q	A1/A2	Cameo Cleaners, 3650 Crenshaw Blvd., LA	Dry Cleaners, release of tetrachloroethylene (PCE) and trichloroethylene (TCE)	Moderate
4c	41	C1/C2	Railroad tracks and East of Victoria Avenue, LA	Staining along railroad tracks	High
4c	38, 39	C1	Directly north of railroad tracks, near La Colina Road, Inglewood	Two buckets of oily water near railroad right-of-way	Moderate
4d	SS	C1	Vacant lot, 5600 Arbor Vitae , LA	Monitoring wells	High
4d	53	C1	West of railroad tracks and south of Manchester Boulevard, LA	55-gallon drum tipped over with 1 quart oil cans spilled on ground, some soil staining	High
4d	54	C1	West of railroad tracks between Manchester Boulevard and Westchester Parkway, LA	Fenced storage area with various retail chemical containers such as strippers, paint thinner, and paint. No soil staining observed.	Moderate
4d	61	C1	Adjacent to railroad tracks, west of Cedar Avenue, Inglewood	Asphalt debris pile	Moderate
4d	58	C1	BNSF Railroad Right-of-Way, 550 South of Arbor Vitae, LA	An unknown release of some type appears to have occurred. May have been mitigated.	Moderate

#: Number ID: Location identification on Figure Sxn: Proposed alignment section LA: Los Angeles

The following offsite facilities have a classification criterion of Moderate and High based on the current site usage, former site usage, observed hazards, and/or known releases to the subsurface. Some of these facilities may have obtained closure for previous releases but are still classified as Moderate based on the close proximity to the subject property and the potential for residual contamination. The concerns identified in the previous table, that are on the affected parcels or that are associated with offsite facilities, are also listed in this table.

Fig #	**ID**	**Sxn**	**Facility Name**	**Address**	**Hazard**
4a	A	A1	Metropolitan Car Wash	900 La Brea Ave., LA	Moderate
4a	B	A1	Harry's Tow Lot (former KCOP Production Studio)	915 La Brea Ave., LA	Moderate
4a	C	A1	Arco Gas Station	5301 Olympic Blvd., LA	Moderate
4a	D	A1	CIM/Pico Former Lumber Company & facilities with USTs	4550 Pico Blvd., LA 4600-4700 Pico Blvd., LA	Moderate
4a	E	A2	Alright Parking Lot, Former Chevron	4180 Wilshire Blvd., LA	High
4a	F	A2	Chevron Gas Station	1009 Crenshaw Blvd., LA	High
4a	G	A2	American Best Auto Repair Service/Shin Brothers Auto Body and Paint	4100 Olympic Blvd., LA	Moderate
4a	H	A1/A2	Arco Gas Station	4169 Venice Blvd., LA	Moderate
4a	I	A1/A2	76 Gas Station	4176 Venice Blvd., LA	High
4a	J	A1/A2	Mobil Station	1925 Crenshaw Blvd., LA	Moderate
4a	K	A1/A2	Chevron Gas Station	3063 Crenshaw Blvd., LA	Moderate
4a	L	A1/A2	System Cleaners	3631 Crenshaw Blvd., LA	Moderate
4a	M	A1/A2	Arco Gas Station	3400 Crenshaw Blvd., LA	High
4a	N	A1/A2	West Angeles Cathedral (formerly 20th Century Plastics)	3628 Crenshaw Blvd., LA	Moderate
4a	O	A1/A2	Shell Gas Station	3645 Crenshaw Blvd., LA	Moderate
4a	P	A1/A2	Former Gulf Oil	3630 & 3644 Crenshaw Blvd., LA	High
4a	Q	A1/A2	Cameo Cleaners	3650 Crenshaw Blvd., LA	Moderate
4a/4b	R	A1/A2 & B	Lula Washington Dance Theatre	3773 Crenshaw Blvd., LA	High
4b	S	B	Shell Gas Station	6805 Crenshaw Blvd., LA	Moderate
4b	T	B	Former Crenshaw Collision Center	6530 Crenshaw Blvd., LA	Moderate

Fig #	ID	Sxn	Facility Name	Address	Hazard
4c	U	C1/C2	Salvage yard	6745 Victoria Ave., LA	Moderate
4c	V	C1/C2	Enderlo Vault Co.	827 Redondo Blvd., Ing	Moderate
4c	W	C1/C2	So Cal Gas Company, Inglewood Manufactured Gas Plant	700 Warren Lane, Ing	Moderate
4c	X	C1/C2	Manufacturing facilities, including plastic and metal manufacturing, machine shop, and plating works	200-330 Beach Ave., Ing	Moderate
4c	Y	C1/C2	Fujita Corporation	230 La Brea Ave., Ing	Moderate
4d	Z	C1	So Cal Edison Electrical Substation	201 Florence Ave., Ing	Moderate
4d	AA	C1	Former Smoot Holman	311 Florence Ave., Ing	Moderate
4d	BB	C1	Former Kroehler Manufacturing	301 Florence Ave., Ing	Moderate
4d	CC	C1	Blue Diamond Materials (441), Cemex (505), formerly - Foundry (401); Salvage Yard (431); Metal Salvage and Melting (441)	401-505 Railroad Place, Inglewood	Moderate
4d	DD	C1	Former Standard Oil Co. of California and Inglewood Foundry	401-417 Florence Ave., Inglewood	Moderate
4d	EE	C1	Mobil Gas Station, formerly Golden Star Laundry	8307 La Cienega Blvd., Inglewood	High
4d	FF	C1	LAX Equipment	830 Florence Ave., Ing	Moderate
4d	GG	C1	Charles Caine Co.	8325 Hindry Avenue, LA	Moderate
4d	HH	C1	Former Circuit Board Manufacturing and Machine Shop	8331-8341 Hindry Ave., LA	Moderate
4d	II	C1	Zephyr Manufacturing	201 Hindry Ave., Ing	Moderate
4d	JJ	C1	Isis Electrical Substation	8331 Isis Avenue, LA	Moderate
4d	KK	C1	Shell Gas Station	1135 Manchester Blvd., LA	
4d	LL	C1	Budget Truck Rental	5560 Manchester Blvd., LA	High
4d	MM	C1	Former metal spinning (1315), machine shop (1319), dry cleaning plant (1325), and the American Bitumuls & Asphalt Company (1401)	1315-1401 Aviation Blvd., Inglewood	Moderate
4d	NN	C1	Unocal/76 Gas Station	8600 Aviation Blvd., Ing	Moderate

Fig #	ID	Sxn	Facility Name	Address	Hazard
4d	OO	C1	Rho-Chem	425 Isis Avenue, Ing	Moderate
4d	PP	C1	Industrial facilities: electronic manufacturing (8700); plastic manufacturing (8900), auto parts manufacturing (8924), and aircraft tool manufacturing and polishing and plating (9030)	8700-9030 Bellanca Ave., LA Manchester Boulevard to Arbor Vitae Street, west of railroad tracks.	Moderate
4d	QQ	C1	Princeland Properties	1237 Arbor Vitae, Ing	Moderate
4d	RR	C1	Formerly Freight Forwarders/Union Bank/Estate of Joseph Collin/Bodycote Hinderliter/Inglewood Suppliers/Sunsetting Auto Body	9007 – 9121 Aviation Blvd., Inglewood	Moderate
4d	SS	C1	King Delivery (currently vacant lot)	5600 Arbor Vitae, LA	High
4d	TT	C1	Numerous manufacturing facilities including aircraft parts (9632)	9630-9998 Bellanca Ave., LA	Moderate
4d	UU	C1	North American Aviation, Inc., Airplane factory	5601 Imperial Highway	Moderate

Ing: Inglewood

Based upon the findings of this Phase I ESA, Leighton Consulting recommends completing the following work discussed below:

- Phase II ESA - Conduct a limited Phase II ESA prior to construction in areas where construction workers may be exposed to impacted soil. A base line soil sampling protocol should be established with special attention to those areas of potential environmental concern identified in this report. The soil should be assessed for constituents likely to be present in the subsurface including, but not limited to, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), pesticides, lead arsenates, and Title 22 metals. The depth of the sampling should be based on the depth of grading or cut and fill activities. In addition, in areas where groundwater will be encountered, samples should also be analyzed for suspected contaminants prior to dewatering. This will ensure that National Pollutant Discharge Elimination System (NPDES) discharge requirements are satisfied.

- Soil Mitigation Plan – A soil mitigation plan should be prepared after final construction plans are prepared showing the lateral and vertical extent of soil excavation during construction. The soil mitigation plan should establish soil reuse criteria, establish a sampling plan for stockpiled materials, describe the disposition of materials that do not satisfy the reuse criteria, and specify guidelines for imported materials. The soil mitigation plan should include a provision that during grading or excavation activities, soil should be screened for contamination by visual observations and field screening for volatile organic compounds with a photo ionization detector (PID). Soil samples that are suspected of contamination based on field observations and PID readings shall be analyzed for suspected chemicals by a California certified laboratory. If contaminated soil is found, it shall be removed, transported to an approved disposal location, and remediated or disposed according to state and federal laws.

- Hazardous Material and Debris Removal - All hazardous materials, drums, trash, and debris shall be removed and disposed of in accordance with regulatory guidelines.

- Health and Safety Plan - A health and safety plan should be developed for persons with potential exposure to the constituents of concern identified in the limited Phase II ESA.

- Construction Observations - Historical and present site usage along the many areas of the proposed alignment included businesses that stored hazardous materials and/or waste and used USTs, from at least the 1920s to the present. It is possible that areas with soil and/or groundwater impacts may be present that were not identified in this report, or were considered a low potential to adversely impact the subject property. In general, observations should be made during any future development activities for features of concern or areas of possible contamination such as, but not limited to, the presence of underground facilities, buried debris, waste drums, tanks, soil staining or odorous soils. Further investigation and analysis may be necessary, should such materials be encountered.

1.0 INTRODUCTION

1.1 Authorization

Leighton Consulting, Inc. (Leighton Consulting) performed a Phase I Environmental Site Assessment (ESA) of the Proposed Alignments for the Crenshaw-Prairie Transit Corridor in Los Angeles and Inglewood, Los Angeles County, California in accordance with authorization received from the Metropolitan Transportation Authority (METRO) and Terry A. Hayes Associates LLC (TAHA) in response to METRO's request for proposal (RFP) number PS43301968, dated December 1, 2006 (Metro, 2006). References are included in Appendix A.

1.2 Purpose

The purpose of the Phase I ESA was to identify, to the extent feasible pursuant to the processes prescribed in ASTM International (ASTM) E1527-05, recognized environmental conditions (RECs) in connection with the subject property. RECs are defined as: *the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include de minimus conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be de minimus are not recognized environmental conditions* (ASTM 1527-05, 2005).

1.3 Scope of Work

The scope of work was performed in accordance with Leighton Consulting's compliance with the RFP scope and included the following tasks:

- A reconnaissance-level visit of the subject property for evidence of release(s) of hazardous materials and petroleum products and to assess the potential for onsite releases of hazardous materials and petroleum products;
- Records Review (including review of previous environmental reports, selected governmental databases, and historical review);

- Interviews; and
- Preparation of a report presenting our findings.

1.4 Significant Assumptions

Leighton Consulting assumes that the information provided by the Client, regulatory database provider, and regulatory agencies is true and reliable.

1.5 Limitations and Exceptions

Site-specific activities performed by Leighton Consulting and information collected regarding these activities are summarized in the following sections. The findings of this ESA are presented in Section 7.0. Opinions, and conclusions drawn by Leighton Consulting, based on the information collected as part of the ESA, are presented in Sections 8.0 and 9.0, respectively.

This Phase I ESA was conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions.

Leighton Consulting was provided access only to the railroad and street right-of-ways. Access was not provided on any properties located adjacent to the right-of-way and these properties were only inspected from the property boundaries. Fences, vegetation, buildings, etc. limited the observations on many of these properties. Due to the large size of the project, the regulatory database was reviewed to limited radii of 0.25 miles. The scope of work for this Phase I ESA did not include environmental lien searches, city directory reviews, or interviews of owners or tenants of the affected or adjacent parcels.

The observations and conclusions presented in this report are professional opinions based on the scope of activities, work schedule, and information obtained through the ESA described herein. Opinions presented herein apply to subject property conditions existing at the time of our study and cannot necessarily be taken to apply to subject property conditions or changes that we are not aware of or have not had the opportunity to evaluate. It must be recognized that conclusions drawn from these data are limited to the amount, type, distribution, and integrity of the information collected at the time of the investigation, the methods utilized to collect and evaluate the data, and that a full and complete evaluation of environmental risks cannot be made. Although Leighton Consulting has taken steps to obtain true copies of available information, we make no representation or warranty with respect to the accuracy or completeness of this information.

This practice does not address whether requirements in addition to all appropriate inquiry have been met in order to qualify for the landowner liability protections including the continuing obligation not to impede the integrity and effectiveness of activity and use limitations, or the duty to take reasonable steps to prevent releases, or the duty to comply with legally required release reporting obligations. Users should also be aware that there are likely to be other legal obligations with regard to hazardous substances or petroleum products discovered on the subject property that are not addressed in this practice and that may pose risks of civil and/or criminal sanctions for non-compliance.

1.6 Special Terms and Conditions

The scope of work for this Phase I ESA did not include testing of electrical equipment for the presence of polychlorinated biphenyls (PCBs) or collection of other environmental samples such as air, water, building materials, or paint; assessment of natural hazards such as naturally occurring asbestos, radon gas, methane gas, or mold; assessment of the potential presence of radionuclides, biological agents, or lead in drinking water; or assessment of nonchemical hazards such as the potential for damage from earthquakes or floods, presence of wetlands, or the presence of endangered species or wildlife habitats. This Phase I ESA also did not include an extensive assessment of the environmental compliance status of the subject property or of businesses operating at the subject property, or a health-based risk assessment.

1.7 User Reliance

This report is for the exclusive use of METRO. Use of this report by other parties shall be at such party’s sole risk.

2.0 SITE DESCRIPTION

2.1 Location and Legal Description

The Crenshaw-Prairie Transit Corridor study area extends approximately ten miles and 33 square miles from Wilshire Boulevard on the north, to El Segundo Boulevard on the south. Several alignment alternatives are currently being considered, and are collectively referred to as the "subject property" (Figure 1, Site Location Map). For the purpose of this report, the "Project area" is referred to as the subject property and a quarter mile radius from all points of the proposed alignment sections.

The Project area is segmented into three primary sections located in roughly the north (Section A), central (Section B), and southern (Section C) portions of the subject property and are briefly described below:

The northern area (Section A) extends from Wilshire Boulevard, past the Exposition Light Rail Transit (LRT) Line (Expoline) under construction, to Rodeo Road. Only below grade alignments are being considered north of the Expo Line under construction. The northern subarea includes potential alignment segments along the following streets:

- Crenshaw Boulevard
- La Brea Avenue
- San Vicente Boulevard
- Venice Boulevard

Section A1 extends from the Crenshaw Boulevard/Wilshire Boulevard intersection, south along Crenshaw Boulevard to Rodeo Road. Section A2 extends from the La Brea Boulevard/Wilshire Boulevard intersection, south along La Brea Boulevard and then east along San Vicente Boulevard and Venice Boulevard to Crenshaw Boulevard, south to Rodeo Road. The area that the two alignments overlap is referred to as Section A1/A2 in this report. Section A3 and A4 extend a short way east from Crenshaw Boulevard and the future Exposition Light Rail Transit Line, at Exposition Boulevard.

The central area, Section B, extends from just south of Rodeo Road to 67th Street and includes potential alignment segments along the following street:

- Crenshaw Boulevard

The southern area extends from just south of 67th Street to El Segundo Boulevard and includes potential alignment segments along the following streets/rights-of-way:

- Harbor Subdivision Railroad right-of-way (i.e., Burlington Northern Santa Fe (BNSF) Railroad – formerly the Atchison Topeka and Santa Fe (A.T. & S.F. Railroad right-of-way)
- La Brea Avenue/Hawthorne Boulevard
- Market Street (in downtown Inglewood)

Section C1 extends from 67th Street to BNSF railroad where it trends west, generally paralleling Florence Avenue, and then turns south generally paralleling Aviation Boulevard to Imperial Highway. Section C2 extends from 67th Street to the BNSF railroad, and then turns south on Market Street which then merges into La Brea Avenue (later named Hawthorne Boulevard) to Imperial Highway. The area that the two alignments overlap is referred to as Section C1/C2 in this report.

The subject property includes the aforementioned streets/rights-of-way as shown on Figure 1, and also includes portions of the following parcels that will be affected or displaced:

(1) Affected Parcels – At San Vicente Boulevard and Venice Boulevard, Zip Code 90019

APN	Address	Property Use
5083-033-015	4600, 4646, 4700 W. Pico Blvd.	Retail shops and restaurants; Metro bus stop
5083-033-016	No Parcel Address. 4550 and 4560 W. Pico Blvd. posted on fence.	All buildings demolished. Earth moving activities have occurred. No construction appears to be taking place presently.

(2) Affected Parcels – Southwest of Venice Boulevard and Crenshaw Boulevard, 90019

APN	Address	Property Use
5071-004-015	1600 S. Wellington Rd.	Single Family Residential
5071-004-001	1601 S. Victoria Ave.	Single Family Residential
5071-004-002	1611 S. Victoria Ave.	Single Family Residential
5071-004-003	1615 S. Victoria Ave.	Single Family Residential
5071-001-011	1614 S. Victoria Ave.	Single Family Residential
5071-001-012	1620 S. Victoria Ave.	Single Family Residential
5071-001-013	1626 S. Victoria Ave.	Single Family Residential
5071-001-014	1632 S. Victoria Ave.	Single Family Residential
5071-001-041	1625 Crenshaw Blvd.	Multi Family Residential
5071-001-028	1641 Crenshaw Blvd.	Multi Family Residential
5071-001-029	1645 Crenshaw Blvd.	Single Family Residential
5071-001-030	1703 Crenshaw Blvd.	Multi Family Residential
5071-001-031	1707 Crenshaw Blvd.	Multi Family Residential
5071-001-032	1709 Crenshaw Blvd.	Multi Family Residential
5071-001-033	1717 Crenshaw Blvd.	Multi Family Residential
5071-001-034	1721 Crenshaw Blvd.	Single Family Residential
5071-001-036	1727 Crenshaw Blvd.	Single Family Residential

(3 & 4) Affected Parcels – East of Crenshaw Boulevard, South of Exposition Boulevard, 90016

APN	Address	Property Use
5044-002-007	3628 & 3630 S. Crenshaw Blvd. (area 3, remainder are in area 4)	Jacks Chili
5044-002-006	3642, 3644, 3646 S. Crenshaw Blvd. 3515, 3519 W. Rodeo Rd.	Yum Yum Donuts, Clean King (coin laundry), Conroys Flowers
5033-001-035	3650 S. Crenshaw Blvd.	Parking Lot fronting Cameo Cleaners, King Donuts, Chinese Food, Ralphs Grocery
5033-001-034	3656 & 3660 S. Crenshaw Blvd.	Same as above
5033-001-033	3662 S. Crenshaw Blvd.	Same as above
5033-001-032	3668 S. Crenshaw Blvd.	Same as above
5033-001-031	3670 S. Crenshaw Blvd.	Same as above
5033-001-030	3680 S. Crenshaw Blvd.	Same as above
5033-001-029	3684 S. Crenshaw Blvd.	Same as above
5033-001-028	3690 S. Crenshaw Blvd.	Same as above
5033-001-027	3694 & 3698 S. Crenshaw Blvd.	Same as above
5033-001-037	No address directly associated with affected area	Crenshaw Boulevard extension fronting Rite Aid and commercial businesses

Photographs of the subject property and Project area are included as Appendix B. Figures 2a through 2c show the affected parcel areas. The assessor's parcel information, including legal descriptions for the affected parcels, obtained from the County of Los

Angeles Assessor's website is included in Appendix C, as well as detailed maps provided by TAHA showing the proposed alignment through the affected parcels.

2.2 Subject Property and Vicinity General Characteristics

The immediate subject property vicinity and the surrounding areas consist of residential, commercial, manufacturing, and industrial properties, as well as transportation corridors (streets and freeways).

2.3 Current Use of the Subject Property

The subject property is currently used for transportation purposes, including paved roads and railroad right-of-ways; however, the railroad right-of-way is reportedly inactive at this time. The current uses of the affected parcels are listed in Section 2.1.

2.4 Descriptions of Structures, Roads and Other Improvements on the Subject Property

The subject property is currently developed with roads and a railroad, and includes portions of the parcels listed in Section 2.1. See Section 2.1 for a list of the road sections included in the subject property and the improvements on the affected parcels.

2.5 Current Uses of Adjoining Properties

Adjacent sites include residential, commercial, manufacturing, and industrial properties. A list of all adjacent sites observed during the site reconnaisance conducted on February 12, 14, 26, 27, and March 3, 2008 is included in the Site Reconnaissance Record Log, Appendix D.

3.0 USER PROVIDED INFORMATION

The user of this Phase I ESA is identified as the client, METRO. As a part of the ASTM 1527-05 process, a User Questionnaire regarding the property was forwarded to Mr. Matt Fraychineaud, an Environmental and Real Estate Consultant for METRO. The User Questionnaire was returned on April 23, 2008 and is included in Appendix E.

3.1 Title Records

A preliminary title report was not provided by METRO.

3.2 Environmental Liens or Activity and Use Limitations

Evidence of environmental liens or activity and land use limitations was not disclosed to Leighton Consulting.

3.3 Specialized Knowledge

METRO did not provide specialized knowledge or experience regarding the subject property to Leighton Consulting with the exception that METRO indicated that the current railroad portion of the site has been used as a railroad right-of-way since circa 1900s.

3.4 Commonly Known or Reasonably Ascertainable Information

METRO did not provide any commonly known or reasonably ascertainable information to Leighton Consulting, with the exception of site use as a railroad right-of-way since circa 1900s.

3.5 Valuation Reduction for Environmental Issues

METRO responded that valuation reduction is not applicable due to the site already being owned by METRO and no real estate transaction is involved.

3.6 Owner, Property Manager, and/or Occupant Information

The railroad right-of-way is currently owned by METRO. The affected parcels are owned by multiple individuals and/or businesses. Site specific owner information was not provided to Leighton Consulting.

3.7 Reason for Performing Phase I ESA

The Phase I ESA is required for a proposed public transportation project. The purpose of the Phase I ESA is to assess the subject property for RECs and to make recommendations for additional work that should be performed for potential redevelopment of the subject property, or a portion thereof, for transportation usage. Identified RECs should be taken into consideration when considering the health and safety of the workers present during the construction phase.

3.8 Other

METRO stated that there may be prior environmental reports for the portion of the Harbor Line Subdivision (railroad right-of-way) that is part of the subject property, and that if so, they would be located in an off-site storage facility. No prior environmental reports were provided to Leighton Consulting for review.

4.0 RECORDS REVIEW

4.1 Physical Setting Source(s)

Leighton Consulting reviewed pertinent maps and readily available literature for information on the physiography and hydrogeology of the subject property. A summary of this information is presented in the following subsections.

4.1.1 Topography

The Project area ranges in elevation across its length from approximately 200 feet above mean sea level (msl) at the northern end to 160 feet msl as it traverses the southern portion of the Baldwin Hills to 100 feet msl at the southern end near its terminus east of Los Angeles International Airport. Review of the Hollywood and Inglewood, California 7.5 minute Quadrangle Topographic Map (USGS, 1953 and 1964, respectively) indicates local surface-water sheet flow is generally toward the south-southeast. As the alignment traverses the southern Baldwin Hills-NIFZ sheet flow is generally toward the south as indicated on the Venice, California 7.5 minute Quadrangle Topographic Map (USGS, 1964).

4.1.2 Surface Water

Ballona Creek is located approximately 0.6 miles to the southwest of the subject property at its closest point at the corner of La Brea Boulevard and San Vicente Boulevard. A tributary of Centinela Creek is located approximately 0.3 miles to the north of the subject property at its closest point at the intersection of the railroad right-of-way and Interstate 405.

4.1.3 Geology and Soils

The near-surface native soils within the Project area are Holocene and Pleistocene-age non-marine alluvium comprised of varying proportions of gravel, sand, silt, and clay deposited by the Los Angeles River, Rio Hondo, San Gabriel River, and ancestral Santa Ana (Yerkes, 1965). Much of this sediment was deposited as sand, silt, and clay as the rivers meandered across the floodplain of the Los Angeles basin. These deposits are anticipated to be on the order of several hundred feet in thickness, subsequently underlain within the Southwestern Block by a thick (several thousands of feet) sequence of Tertiary age sedimentary rock formations locally intruded by igneous rocks of middle Miocene age overlying Cretaceous age basement rocks belonging to the Catalina Schist. Underlying the near-surface Quaternary sediments within the Central Block are a sequence of Tertiary age sedimentary rocks anticipated to be on the order of 16,000 to 31,000 feet thick and are subsequently underlain by basement rocks consisting of granodiorite, gneissic metadiorite, and meta-igneous rocks.

The geologic structure of alluvial materials is anticipated to be generally massive; however, it can be interpreted based on a geologic depositional environment typical of flood plain and alluvial deposits that cross-stratification (channel trough cross-stratification or transverse bar-tabular cross-stratification) sedimentary structure exists at depth. Possible relevance of these sedimentary features could include local impermeable zones with the potential for perched groundwater.

4.1.4 Hydrogeology

The proposed Project traverses the Los Angeles Basin. The Los Angeles Basin, a structural trough, is a northwest-trending alluviated lowland plain approximately 50 miles long and 20 miles wide. Mountains and hills that generally expose Late Cretaceous to Late Pleistocene-age sedimentary and igneous rocks bound the Basin along the north, northeast, east and southeast (Yerkes, 1965). The Basin is part of the Peninsular Ranges geomorphic province of California that is characterized by sub-parallel blocks sliced longitudinally by young, steeply dipping northwest-trending fault zones. The Basin, located at the northerly terminus of the Peninsular Ranges, is the site of active sedimentation and the strata is interpreted to be as much as 31,000 feet thick in the center of the synclinal trough of the Central Block of the Los Angeles Basin. The current proposed Project alignment alternatives traverse the southern portion of the Central Block, Newport Inglewood Fault Zone (NIFZ), and the northern portion of the Southwestern Block of the Los Angeles Basin.

Hollywood Quadrangle: Historic groundwater highs, as interpreted from the Seismic Hazard Evaluation of the Hollywood 7.5 Minute Quadrangle, Los Angeles County, California (CDMG SHZR 026, 1998) indicate groundwater levels from 20 to 80 feet below ground surface (bgs) north of the I-10 to 10 to 20 feet bgs along the northeastern portion of the Baldwin Hills.

Inglewood Quadrangle: Historic groundwater highs, as interpreted from the Seismic Hazard Evaluation of the Inglewood 7.5 Minute Quadrangle, Los Angeles County, California (CDMG OFR 98-18, 1998) indicate groundwater levels from 10 to 40 feet bgs along the eastern portion of the Baldwin Hills.

Venice Quadrangle: Historic groundwater highs, as interpreted from the Seismic Hazard Evaluation of the Venice 7.5 Minute Quadrangle, Los Angeles County, California (CDMG OFR 98-27, 1998) indicate groundwater levels from 10 to 40 feet bgs along the Atchison Topeka and Santa Fe railway right-of-way.

4.1.5 Oil and Gas Fields

Based on the Geologic Map of the Hollywood and Burbank (south ½) quadrangles, Los Angeles County, California the northern portion of the Crenshaw Boulevard segment alignment, south of Olympic Boulevard and east of La Brea Avenue, will traverse the Las Cienegas Oil Field. The oil field was discovered in 1961 and is currently an actively producing oil field (DOGGR, Publication No. TR52) Wells drilled near the Las Cienegas Oil Field bottom at relatively shallow depths in gneissic metadiorite (Yerkes, 1965).

The portion of the alignment crossing the southern Baldwin Hills will traverse a portion of the Inglewood Oil Field. The oil field was discovered in 1948 and is currently an actively producing oil field. Wells drilled in the Inglewood Oil Field bottom in both massive and foliated, intensely altered rhyolite porphyry (Yerkes, 1965). The location of the study area in relation to oil fields is presented on Figure 3, Oil Field Hazard Map.

Common problems associated with oil field properties include methane and hydrogen sulfide soil gas, oil seepage, contaminated soils, leaking wells, and wells not plugged and abandoned to current standards.

No evidence of onsite oil or gas wells or oil field-related facilities was observed along the proposed alignment sections. Leighton Consulting reviewed the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR), Oil and Gas Map Regional Wildcat Map 1-5 and Oil Field Maps 118 and 123 (DOGGR, 2006, 2003a, 2003b, respectively). According to the maps, numerous oil and oil-related wells are located in the vicinity of the study area. The following table summarizes the oil and oil-related wells located within approximately 500 feet of the study area:

Owner and "Name"	~ Location/APN	Well Condition	~ Distance *
Union Oil Co. of CA, "Los Cienegas Core Hole" 20	SW Sycamore Ave. & La Brea Ave. / 5084-014-028	P&A – dry	75 ft. South
Nuevo Energy Co., "1-15, 19" & Union Oil Co. of CA, "Pacific Electric" 16 & 18	Between Pico & Venice Blvd., south of Tremaine Ave. / 5070-013-003	18 well cluster 12 – completed oil 2 – P&A dry 2 – abandoned oil, converted to water disposal 1 – P&A oil 1 – completed water flood	460 ft. South
Chevron U.S.A. Inc., "Wilton Corehole R/D" 2	NE Wilshire & Irving Blvd. / 5504-009-017	P&A – dry	350 ft. East
Union Oil Co. of CA, "Los Cienegas Core Hole" 22	SE of Crenshaw & Olympic Blvd. / 5081-004-022	P&A - dry	150 ft. East
Union Oil Co. of CA, "Los Cienegas Core Hole" 21	NE of Crenshaw Blvd. and I-10 / 5060-004-017	P&A – dry	190 ft. East
Chevron U.S.A. Inc., "Pacific Telephone"1	SE Leimert Blvd. & Vernon Ave., Inglewood	P&A – dry	100 ft. East
Chevron U.S.A. Inc., "Inglewood Cemetary"	NW AT&SF Railroad & Redondo Blvd., Inglewood	P&A – dry	100 ft. North
Petroleum Securities, "Parent" 1	SE Florence & Prairie Ave., Inglewood	P&A – dry	100 ft. South

*: Approximate Distance from Project Alignment in feet (ft.)

APN: Assessor's Parcel Number – not available for wells located in Inglewood

P&A: Plugged and Abandoned

4.2 Standard Environmental Record Sources

A search of selected government databases was conducted by Leighton Consulting using the Environmental FirstSearch™ Report, an environmental database report system, prepared by Track Info Services, LLC, dated January 8, 2008. Details of the database search along with descriptions of each database researched are provided in the FirstSearch™ report, which is included as Appendix F, (see included compact disc (CD)). The database listings were reviewed within the specified radii of a quarter of a mile as requested by TAHA and METRO.

Development of the Classification Criteria

For this study, Leighton Consulting has established classification criteria to assist in identifying the potential impacts of each contaminated or potentially contaminated facilities that were identified in the FirstSearch™ environmental database report system. Each facility was classified as high, moderate, or low with respect to its type of operation, proximity to the subject property, the anticipated hydrogeologic gradient, field observations, and regulatory information. In general, the classification criteria are:

- High – facilities with known or probable soil/groundwater contamination (i.e. Leaking Underground Storage Tanks [LUSTs]), and facilities where remediation is incomplete or undocumented, and the contamination is known or suspected to exist on the subject property.
- Moderate – facilities with identified or potential soil contamination (i.e. LUSTs), remediation is in progress, or groundwater contamination that does not appear to be migrating and has not been reported on the subject property. Facilities with a heavy industrial/manufacturing background that typically use or have used significant quantities of hazardous materials may also be classified as Moderate.
- Low – facilities that have completed remediation or have historically utilized only small amounts of known contaminants (i.e. small quantity generators or underground storage tanks).

Facilities that are adjacent to the subject property that have reported LUSTs that have been issued closure letters have been ranked as Low to Moderate, based on the possibility of residual contamination. In addition, dry cleaning facilities that have not reported spills have been ranked as Low to Moderate, based on their commonly known likelihood of contamination.

4.2.1 Subject Property

The subject property (primarily the affected parcels) was identified on the FirstSearch™ report under several different databases. The following table summarizes the location, description of the database find, and the classification criteria (potential of environmental concern) of the onsite facilities identified by FirstSearch™. The affected parcels are also listed on the offsite facilities table because the actual location of the UST, spill, or other listing, may not have been located directly on the project alignment. A description of each database can be found at the rear of the FirstSearch™ report included in Appendix F.

Alignment Option	FirstSearch ID#	Facility Name and Address	Affected Parcel Area	Database Type	FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)	Hazard Ranking
A1	39	Pacific Electric Railroad, 4600 Venice Blvd., Los Angeles	1	SWL	Date: 7/3/00. Solid Waste Assessment Test Site. No records available with Los Angeles Fire Department or Regional Water Quality Board. Triangular shaped parcel between Pico, San Vicente, Venice, and West Blvds. (4500 to 4700 Pico Blvd.) redeveloped with new structures on western portion in 2006. All buildings on central and eastern portion have been demolished and area has undergone earth moving activities. No RECs observed at reconnaissance	Low to Moderate
A1	171	CIM/PICO, LP, 4550 Pico Blvd., Los Angeles	1	SPILLS	A-030, Met, total petroleum hydrocarbons (TPH). Reopen previously closed case. Site not listed on Geotracker. Review at Los Angeles Fire Department (LAFD) underground straoge tank (UST) Division - UST Removal and Soil Remediation Report (Earth Tech, 2005). Two USTs discovered during site redevelopment, in vicinity of current retail stores at 4700 Pico Blvd., ~ 100 ft east of San Vicente Blvd. One contained heavy petroleum (minor spill at time of discovery) and the other filled with sand/cement slurry. Removed 5/26/05. Over-ex of impacted soil. Minor TPH and gas related Volatile organic compounds (VOCs) in one soil sample. Concluded no significant impact and no further action. Closure letter issued 4/25/06. On a site plan included in the UST removal report, waste oil USTs and a former fuel UST was depicted at the Sears Auto Center (see ID 288). In addition, a historical crude oil tank was depicted in the vicinity of the proposed alignment. No information for this tank was found and it is not certain what facility used this tank.	High
A1	288	Spiderman 2 – Transportation, 4550 Pico Blvd. , Los Angeles	1	RCRAGN, RCRANLR	Motion picture and video production facility. Haz waste information listed various spent non-halogenated solvents. Facility likely used limited amounts of materials and this facility was likely only in operation a short time.	Low
A1	288	Sears Auto Center, 4550 Pico Blvd., Los Angeles	1	UST	Listed as an Inactive UST site. Review at LAFD UST Division - UST Removal Report (PIC, 1989). Four waste oil USTs were located in a concrete vault. No TPH detected in soil beneath vault. Closure letter 4/25/06.	Low
A1	169	Crenshaw Motors Auto Body , 4606 Pico Blvd., Los Angeles	1	UST	No additional details available. This facility was located fronting Pico Blvd., approximately 350 feet east of the proposed alignment.	Low to Moderate
A1/A2	46	Cameo Cleaners, 3650 Crenshaw Blvd., Los Angeles	4	SPILLS	4/26/01 Remedial action underway. VOCs – PCE & TCE	Moderate

Alignment Option	FirstSearch ID#	Facility Name and Address	Affected Parcel Area	Database Type	FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)	Hazard Ranking
C1	NON GC	BNSF HR-LA-C-GET-HB-3/HB-4, Railroad Right-of-Way, 550 South of Arbor Vitae, Los Angeles	--	OTHER	Status Date: 4/30/01. Status: Refer: 1248 Local Agency. Branch: So Cal – Cypress. The local agency in Cypress is the DTSC. According to Ms. Jone Barrio, they have no records for this site. The FirstSearch description for the database "Other" is listed as a State/Tribal Site Listing by DTSC for a No Further Action Determination. The nature of this listing is unclear.	Moderate

Affected Parcels: 1) San Vicente Blvd. and Venice Blvd. 2) Venice Blvd. and Victoria Ave. 3) Crenshaw Blvd. and 36th St 4) Crenshaw Blvd. at Exposition Blvd. south to Coliseum St

4.2.2 Offsite

The following table lists the offsite facilities identified within the FirstSearch™ report that may present concern to the subject property. A facility is listed as "adjacent" if it is located on the parcel that is adjacent to the road or railroad-right-of-way project alignment, and the exact location of the listing may be directly adjacent to the subject property or several hundred feet away.

Alignment Option	FirstSearch ID#	Facility Name and Address	~ Distance from Subject Property (Miles)	Database Type	FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)	Hazard Ranking
A1	290, 369	Lou Ehler's Cadillac, 5151 Wilshire Blvd., Los Angeles	.07 NE	LUST, UST, RCRAGN	New Car Dealer. SWEEPS/FIDS UST listing. SWRCB AST. LUST – Case Closed in 1996. Grounwater (GW) affected – removed free product from water table.	Low
A1	187	AA Custom Cleaners	Adjacent E	RCRAGN	Cleaners	Low to Moderate
A1	220	Metropolitan Paratransit Co., 820 La Brea Ave., Los Angeles	Adjacent E	UST	Active	Low
A1	222	Daryouch Arghavan, 901 La Brea Ave., Los Angeles	Adjacent W	UST	Active	Low
A1	73	Metropolitan Car Wash/Expert Car Wash, 900 South La Brea, Los Angeles	Adjacent E	UST, ERNS, LUST	UST –active. ERNS – 100 gallons of gasoline contained in clarifier, cleaned out. LUST – release of gasoline in 1990, closed in 1998. LUST – release of gasoline in 1993, preliminary site assessment – not listed on Geotracker	Moderate
A1	48	KCOP Production Studio (former), 915 S. La Brea Ave., Los Angeles	Adjacent W	SPILLS	Date listed – 11/6/07. Lead Agency: LA RWQCB, Remediation Plan approved. Not listed in Geotracker. No additional information.	Moderate
A1	110	Mole-Richardson Company, 926 S. La Brea Ave., Los Angeles	Adjacent E	LUST	Gasoline Release 1994. Closed in 1998. Site not tested for methyl tert-butyl ether (MTBE)	Low to Moderate
A1	67	Unocal/Jose Union Service, 5301 W Olympic Blvd., Los Angeles	Adjacent W	ERNS, UST, LUST	8/31/92 – Site being assessed, Soil and GW contamination discovered (gasoline). Closed in 1998.	Low to Moderate
A1	356	Peak Performance Automotive, 1201 S La Brea Ave., Los Angeles	Adjacent W	ERNS	3/8/96 – Contaminated soil found during environmental assessment (unknown oil). 4/9/96 – Hydraulic lift oil leak from hydraulic hoist – soil and GW affected.	Low to Moderate

Alignment Option	**FirstSearch ID#**	**Facility Name and Address**	**~ Distance from Subject Property (Miles)**	**Database Type**	**FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)**	**Hazard Ranking**
A1	324, 403	Swedish Motors, 1210 S La Brea Ave., Los Angeles	Adjacent E	RCRAGN, UST	Active	Low
A1	469	Filipinas Auto Center, 1250 S La Brea, Los Angeles	Adjacent E	UST	Active	Low
A1	39	Pacific Electric Railroad, 4600 Venice Blvd., Los Angeles	Adjacent N	SWL	Date: 7/3/00. Solid Waste Assessment Test Site. No records available with Los Angeles Fire Department or Regional Water Quality Board. Triangular shaped parcel between Pico, San Vicente, Venice, and West Blvds. (4500 to 4700 Pico Blvd.) redeveloped with new structures on western portion in 2006. All buildings on central and eastern portion have been demolished and area has undergone earth moving activities. No RECs observed at reconnaissance	Low to Moderate
A1	482	Service Station 5843, 4777 Pico Blvd.	Adjacent S	UST	Inactive	Low
A1	434	Midtown Dry Cleaners, 4764 W Pico Blvd., Los Angeles	.01 S	RCRAGN	Dry Cleaners	Low
A1	171	CIM/PICO, LP, 4550 Pico Blvd., Los Angeles	Adjacent N	SPILLS	A-030, Met, TPH. Reopen previously closed case. Site not listed on Geotracker. Review at LAFD UST Division - UST Removal and Soil Remediation Report (Earth Tech, 2005). Two USTs discovered during site redevelopment, in vicinity of current retail stores at 4700 Pico Blvd., ~ 100 ft east of San Vicente Blvd. One contained heavy petroleum (minor spill at time of discovery) and the other filled with sand/cement slurry. Removed 5/26/05. Over-ex of impacted soil. Minor TPH and gas related VOCs in one soil sample. Concluded no significant impact and no further action. Closure letter issued 4/25/06. On a site plan included in the UST removal report, waste oil USTs and a former fuel UST was depicted at the Sears Auto Center (see ID 288). In addition, a historical crude oil tank was depicted in the vicinity of the proposed alignment. No information for this tank was found and it is not certain what facility used this tank.	Moderate
A1	265	City of Los Angeles, 4526 Pico Blvd., Los Angeles	Adjacent N	UST	Active	Low
A1/A2	11, 72, 205	Shell, 1860 Crenshaw Blvd., Los Angeles	Adjacent E	LUST, RCRAGN, UST	Gasoline release 1988, soils only. Case closed 1998.	Low to Moderate
A1/A2	17, 204	ExxonMobil Oil Corp.,/Mobile Service Station, 1925 Crenshaw Blvd., Los Angeles	Adjacent W	RCRAGN, UST, LUST	Mobil LUST – Gasoline release 1993. Closed 1997. MTBE not tested.	Low to Moderate
A1/A2	142	Exxon Station, 4180 W Washington Blvd., Los Angeles	Adjacent E	LUST, UST	Gasoline release to soil only 1992. Closed 1997.	Low to Moderate
A1/A2	207	Chevron Station, 4201 Washington Blvd., Los Angeles	Adjacent W	UST	Inactive	Low
Alignment Option	**FirstSearch ID#**	**Facility Name and Address**	**~ Distance from**	**Database Type**	**FirstSearch Details (may include regulatory agency review and/or site reconnaissance**	**Hazard Ranking**

Leighton

			Subject Property (Miles)		information)	
A1/A2	103	Cleaners Plus, 4209 W Washington Blvd., Los Angeles	Adjacent W	RCRAGN	Cleaners	Low to Moderate
A1/A2	160	Chevron Station, 2338 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Active; however, Chevron Station no longer present. Vacant lot.	Low to Moderate
A1/A2	194	4 Day Tire Stores, 2349 Crenshaw Blvd., Los Angeles	Adjacent W	UST	Active	Low
A1/A2	69	U-Haul Co., 2451 Crenshaw Blvd., Los Angeles	Adjacent W	UST	Active	Low
A1/A2	130	Chevron, 2530 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Active	Low
A1/A2	146	Union 76 Station, 2545 Crenshaw Blvd., Los Angeles	Adjacent W	UST	Active	Low
A1/A2	117	Chevron, 2538 Crenshaw Blvd., Los Angeles	Adjacent E	UST, LUST	Gasoline release 1986. Vacuum extraction. Closed 1996.	Low to Moderate
A1/A2	68, 115	Exxon/Arco/Thrifty Oil/Tin Tan Aye, 4406 W Adams Blvd., Los Angeles	Adjacent W	ERNS, RCRAGN, UST, LUST	ERNS – dispenser malfunction while changing filters. Wash down storm drain. LUST (Exxon) – Gasoline release 1992. Closed 1997. MTBE not tested. LUST (Arco) – Spill 2005 – Leak being confirmed. Not listed in Geotracker.	Low to Moderate
A1/A2	303	Esquire Quality Cleaners, 4356 W Adams Blvd., Los Angeles	.08 E	RCRAGN	Cleaners	Low
A1/A2	163	Exxon/Ho Kim/Mobil, 4380 Adams Blvd., Los Angeles	.02 E	RCRAGN, UST, ERNS, LUST	ERNS – 1 gal. gasoline release, leaky dispenser. LUST – Gasoline release 1991, soils only. Closed 2007.	Low to Moderate
A1/A2	232	Bengt Enterprizes Inc./Arakel Benjamin Property, 2641 Crenshaw Blvd., Los Angeles	Adjacent W	UST, LUST	Gasoline release 1993. Closed 1993.	Low to Moderate
A1/A2	229	Pep Boys, 2800 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Inactive	Low
A1/A2	15	Joy Cleaners, 2817 Crenshaw Blvd., Los Angeles	Adjacent W	RCRAGN	Cleaners	Low to Moderate
A1/A2	231	Mark C Bloome, 2850 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Active	Low
A1/A2	233	Marvin Gart Trust, 2929 Crenshaw Blvd., Los Angeles	Adjacent W	UST	Inactive	Low
A1/A2	234	Chevron, 3063 Crenshaw Blvd., Los Angeles	Adjacent W	UST	Active; monitoring well observed on the southeast corner of lot. May be associated with Arco remediation site to the southeast.	Moderate to High
A1/A2	181	Albert Morita, 3400 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Active	Low
A1/A2	64	Arco, 3412 Crenshaw Blvd., Los Angeles	Adjacent E	UST, LUST	Gasoline release 1988. Closed 1996, MTBE not tested. Hydrocarbon release to soil only in 1998 due to piping corrosion. Preliminary site assessment. Plan to excavate and dispose. Numerous wells observed onsite including a well to the northwest across the street.	High
A1/A2	230	Midas Muffler, 3501 Crenshaw Blvd., Los Angeles	Adjacent W	UST	Inactive	Low
A1/A2	74, 84	Crenshaw Car Wash, 3518 Crenshaw Blvd., Los Angeles	Adjacent E	SPILLS	1/3/02 – TPH. No Further Action Required.	Low to Moderate
A1/A2	18, 45	System Cleaners, 3631 Crenshaw Blvd., Los Angeles	Adjacent W	RCRAGN, SPILLS	1/3/02 – Inactive, VOCs. 11/6/07 – SLIC case open, VOCs.	Moderate
A1/A2	70, 83	Fulcor Realty Inc/Film Processing Co, 3602 Crenshaw Blvd., Los Angeles	Adjacent E	UST, SPILLS	Fulcor Realty, UST – noncertified. Film Processing, Spills – VOCs, No further action required.	Low

Alignment Option	FirstSearch ID#	Facility Name and Address	~ Distance from Subject Property (Miles)	Database Type	FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)	Hazard Ranking
A1/A2	77, 86	20th Century Plastics, 3628 Crenshaw Blvd., Los Angeles	Adjacent E	RCRAGN, LUST, SPILLS	Lust – Hydrocarbon release 1997, soils only. Leak being confirmed. Spills – 1/3/02, VOCs. No further action. Review at LAFD UST Division - A 10,000 gallon diesel UST was removed in 1997. A closure letter was issued in 2000. The UST was located at the southeast corner of the property, approximately 500 feet east of Crenshaw Blvd. The site has since been redeveloped with West Angeles Church. Based on the closure letter and the absence of petroleum hydrocarbons detected in the soil or the GW, this former UST is not expected to negatively impact the subject property; however, based on the former usage of this property as an electronics manufacturing facility, Gilfillan Bros. Inc., in the 1950s and 1960s, this facility has a moderate potential to negatively impact the subject property.	Moderate
A1/A2	57	Shell Service Station, 3645 S Crenshaw Blvd., Los Angeles	Adjacent E	UST, RCRAGN, LUST	Gasoline release 2005. Pollution characterization. Not listed in Geotracker.	Moderate
A1/A2	46	Cameo Cleaners, 3650 Crenshaw Blvd., Los Angeles	Adjacent E	SPILLS	4/26/01 Remedial action underway. VOCs – tetrachloroethylene (PCE) & trichloroethylene (TCE)	Moderate
A1/A2	246	Eung Park, 3699 Crenshaw Blvd., Los Angeles	Adjacent W	UST	Active	Low
A1/A2	20	O'Connor Lincoln Mercury, 3737 Crenshaw Blvd., Los Angeles	Adjacent W	UST, LUST, RCRAGN, SPILLS	Gasoline release to soils only in 1988. Excavate and dispose. Closed 1997. Spills – closed 1998.	Low to Moderate
A1/A2	55	Majestic Pontiac and Honda, 3740 S Crenshaw Blvd., Los Angeles	Adjacent E	RCRAGN, UST	Active	Low
A1/A2	65	Matchmaster Dying and Fin, 3700 S Crenshaw Blvd., Los Angeles	Adjacent E	UST	Noncertified	Low
A2	108	Alright Parking Lot (Former Chevron), 4180 Wilshire Blvd., Los Angeles	Adjacent E	LUST	Gasoline release 1982. Remedial Action. Geotracker - 20 monitoring wells, including wells on Crenshaw Blvd. and to the west. GW at site impacted with gasoline compounds. Max detected in May 2007 (µg/L, MW-5) TPHg-44,000; Benzene 2,100; Toluene 970. GW depth – 30–38.71 ft bgs in May 07.	High
A2	100	Oscars Cleaners, 958 Crenshaw Blvd.	Adjacent E	RCRAGN	Cleaners	Low to Moderate
A2	12	Chevron/Sabafed Investments, 1009 Crenshaw Blvd., Los Angeles	Adjacent W	LUST, UST, RCRAGN	Gasoline release 1994. Remedial Action. Geotracker - 20 monitoring wells, including wells along Crenshaw Blvd. GW at site impacted with gasoline compounds. Max detected in Jan 2007 (µg /L, MW-11) TPHg 235, Benzene 2, TBA 45. GW depth 16.66–24.55 ft bgs in May 07. Gradient .02 SW.	High

Alignment Option	FirstSearch ID#	Facility Name and Address	~ Distance from Subject Property (Miles)	Database Type	FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)	Hazard Ranking
A2	53	American Best Auto Repair Service/Shin Brothers AutoBody and Paint, 4100 W Olympic Blvd., Los Angeles	.01 E	UST, LUST	Gasoline release 1991. 2002 – remediation plan. GW affected, MTBE <1.0 in GW.	Moderate
A2	448	Former Pickett Station, 3954 W Olympic Blvd., Los Angeles	.14 E	UST, LUST	Gasoline release in 1989. 2007 – remediation plan. Vacuum extract, pump and treat GW.	Low
A2	199	Mepco Gas/Mobil, 4169 Venice Blvd., Los Angeles	Adjacent E	UST	Active	Low
A2	71, 186	Unocal/Midtown Union 76, Tosco 76 Station, 4176 Venice Blvd., Los Angeles	Adjacent E	ERNS, UST, LUST, RCRANLR	ERNS – gasoline soil contamination found during construction project. LUST – pollution characterization. Gasoline release 1992. 12 monitoring wells, including 3 wells along Crenshaw Blvd. 2 wells with floating product. GW depth 48.3-54.3 ft bgs April 07. Variable gradient.	High
A3/A4	384	Kas Tex Corp/Montique Corp, 3411 Exposition Blvd., Los Angeles	Adjacent N	UST, RCRAGN	UST – Inactive	Low
A3/A4	527	Siskin Ivestment Co, 3217 Exposition Place, Los Angeles	Adjacent S	UST	Active	Low
B	8, 32	Apt Medical Transportation Inc./Lula Washington Dance Theatre, 3773 S. Crenshaw Blvd., Los Angeles	Adjacent W	UST, FED IC/ED, Brownfield	UST removed in 1995, contamination identified but no MTBE. Possible additional UST. Hydraulic lift, 3 ASTs. Formerly used as transportation services company – existing auto bay with hydraulic lifts and 2 former USTs. Two phases of soil investigation have been completed; cleanup by vapor extraction began in 2006 – scheduled to run ~1 year. SVE system still located at this facility. http://www.lacity.org/ead/labf/guide/Appendix%20C%20-%20Sample%20BSIR.pdf http://tosc.oregonstate.edu/about/news/newsletters/Newsletter%20PDFs/LWDT_Brownfield_Fact_Sheet.pdf	High
B	76	Crenshaw Sq Cleaners, 3824 Crenshaw Blvd., Los Angeles	Adjacent E	RCRAGN	Cleaners	Low to Moderate
B	2, 236	Boyd Peterson/Auto Parts, 3833 Crenshaw Blvd., Los Angeles	Adjacent W	LUST, UST	Gasoline release to soils only, 1989. Closed 1989.	Low to Moderate
B	6	Angelus Funeral Home, Inc., 3875 Crenshaw Blvd., Los Angeles	Adjacent W	UST, LUST	Gasoline release 1991. Excavate and dispose soil in 1993. Closed 1995. MTBE not tested.	Low to Moderate
B	52	Softone Cleaners, 3939 Crenshaw Blvd., Los Angeles	.01 W	RCRAGN	Cleaners	Low to Moderate
B	58, 63	Unocal/Lees Union 76, 3555 Martin Luther King/4040 Crenshaw Blvd., Los Angeles	Adjacent E	LUST, UST	Gasoline release 1994. Closed 1996. MTBE not tested.	Low to Moderate
B	235, 302	Alexander Haagen Company, 4101 S Crenshaw Blvd./3636 Martin Luthor King, Los Angeles	Adjacent W	Other, UST	Abated 4/6/88. No additional information.	Low
B	104	Debbie Imperial Cleaners, 4132 S Crenshaw Blvd., Los Angeles	Adjacent E	RCRAGN	Cleaners	Low to Moderate
B	242	AAA Market, 4140 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Active	Low
B	54	Thrifty Oil/Robert French, 4200 Crenshaw Blvd., Los Angeles	Adjacent E	UST, LUST	Gasoline release to soils only 1995. Closed 1997. Gasoline release to soils only (?) 1996. Closed 2006. Max MTBE in GW 150 ppb.	Low to Moderate
B	177	Enz Enterprise Inc, 4220 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Inactive	Low
B	22	Classic Cleaners, 4233 Crenshaw Blvd., Los Angeles	Adjacent W	RCRAGN	Cleaners	Low to Moderate
Alignment Option	**FirstSearch ID#**	**Facility Name and Address**	**~ Distance from Subject**	**Database Type**	**FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)**	**Hazard Ranking**

			Property (Miles)			
B	183	Jerry Harmon Buick, 4252 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Active	Low
B	21	Windsor Cleaners, 4293 Crenshaw Blvd., Los Angeles	Adjacent W	RCRAGN	Cleaners	Low to Moderate
B	269	Chevron USA, 3511 Homeland, Los Angeles	Adjacent W	UST	Listed as active. Appears to currently be addressed as 4299 Crenshaw Blvd., NW corner of Crensaw and 43rd (homeland), and is redeveloped with commercial retail businesses.	Low
B	301	Admires Scientific Cleaners, 3438 W 43rd St, Los Angeles	Adjacent E	RCRAGN	Unclear if this facility had been a drycleaners; however, no cleaning business currently located onsite. Site area is occupied by an office building and McDonalds.	Low
B	2	Arco Station, 4371 Crenshaw Blvd., Los Angeles	Adjacent W	UST, RCRAGN, LUST	Gasoline release 2003. Closed 2004.	Low to Moderate
B	25	Shell Service, 3350 Vernon Ave., Los Angeles	Adjacent E	UST	Active	Low
B	112	Firestone/Rod Davis Property, 5300 Crenshaw Blvd., Los Angeles	Adjacent E	LUST	Gasoline release to soils only 1993. Closed 1995. Site not tested for MTBE.	Low to Moderate
B	245	Crenshaw Motors, 5311 Crenshaw Blvd., Los Angeles	Adjacent W	RCRANLR, UST	Active	Low
B	240	Boyd Peterson Oldsmobile, 5401 Crenshaw Blvd., Los Angeles	Adjacent W	UST	Inactive	Low
B	66, 87, 88, 221	Harrison Ross Funeral Homes/Thrifty Payless, 5701-49 Crenshaw Blvd., Los Angeles	Adjacent W	UST, SPILLS	UST – noncertified/Active for current occupant. Spills – 1/3/02. No further action required. Closed.	Low
B	164	Continental Cleaners, 5700 S Crenshaw Blvd., Los Angeles	Adjacent E	RCRAGN	Cleaners	Low to Moderate
B	176	LA Fire Station 54, 5730 Crenshaw Blvd., Los Angeles	Adjacent E	RCRANLR, UST	Active	Low
B	201	Shell Station, 5805 Crenshaw Blvd., Los Angeles	Adjacent W	RCRANLR, UST, LUST, RCRAGN	Gasoline release to soils only 2003. Leak being confirmed. Not listed in Geotracker.	Moderate
B	180	Ray Fa Cleaners, 3286 W Slauson Ave., Los Angeles	.04 E	RCRAGN	Cleaners	Low
B	200	Arco, 5804 Crenshaw Blvd., Los Angeles	Adjacent E	UST, LUST	Arco Products Company, Gasoline release to soils only 1988. Vacuum extract. Closed 1994.	Low to Moderate
B	202	F and J Auto Clinic, 5975 Crenshaw Blvd., Los Angeles	Adjacent W	UST	Inactive	Low
B	79	Volvos Only, 6415 Crenshaw Blvd., Los Angeles	Adjacent W	RCRAGN	Haz waste info – Benzene, PCE, TCE, ignitable waste	Low
B	91	Golden Day Schools, 6422 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Noncertified	Low
B	14, 93	Former Crenshaw Collision Center/Crenshaw Body Shop, 6530 Crenshaw Blvd., Los Angeles	Adjacent E	LUST, RCRAGN, UST	Hydrocarbon release in 2003. Pollution characterization. Not listed in Geotracker.	Moderate
B	92	Eddie Valentin, 6666 Crenshaw Blvd., Los Angeles	Adjacent E	UST	Active	Low
Alignment Option	**FirstSearch ID#**	**Facility Name and Address**	**~ Distance from Subject Property (Miles)**	**Database Type**	**FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)**	**Hazard Ranking**

C1/C2	120	Batson Cleaners, 6732 Crenshaw Blvd., Los Angeles	.02 S	RCRAGN, UST	Cleaners; inactive UST	Low
C1/C2	267	Whistler Hardwoods, 6800 Victoria, Los Angeles	Adjacent S	UST	Active	Low
C1/C2	271	Frank Milne, 6810 West Blvd., Los Angeles	Adjacent N	UST	Inactive	Low
C1/C2	158	DAve. S Truck, 1135 E Florence Ave., Inglewood	Adjacent S	UST	Last update 1998, no status information	Low
C1/C2	322	Marine Cleaners, 6741 West Blvd., Inglewood	.10 N	RCRAGN	Cleaners	Low
C1/C2	148	Inglewood Park Cemetery, 720 E Florence Ave., Inglewood	Adjacent S	LUST, UST	Release to soils only 1997. Closed 1997. Diesel and Unleaded tanks. 3 USTs reported removed in 1987, 2 in 1997, and 2 remaining USTs.	Low
C1/C2	392	So Cal Gas Company, Inglewood Manufactured Gas Plant, 700 Warren Lane, Inglewood	Adjacent N	VCP, STATE	DTSC Envirostor website confirms that remediation was complete in 1995. Site is certified (cleanup complete). Site is currently Centinela Park.	Moderate
C1/C2	266	Delkay Plastics, 200 E Beach Ave., Inglewood	Adjacent N	NFRAP	1986-Discovery. 1987-Preliminary assessment. No further action planned. No details on type of release. Not listed in Geotracker.	Low to Moderate
C1/C2	94	Fujita Corp., 230 N La Brea Ave., Inglewood	Adjacent N	LUST, UST	Gasoline release 2002. Preliminary site assessment.	Moderate
C1/C2	113	Inglewood Car Wash, 320 N La Brea Ave., Inglewood	Adjacent N	LUST	Gasoline release to soils only 1991. Closed 1996.	Low to Moderate
C1	41, 42, 508	Simons, R.G. Estate; R.G.S. Estate I; R.G.S. Estate II, 435 & 447 North Eucalyptus Ave. & 400 Beach Blvd.	Adjacent N or ~.01 N	SWL	Solid Waste Assessment Test Site. Closed/cease discharge. Operator – Mobile Oil Company. Current land use – residential, park (Rogers Park), commercial. Regulatory status – to be determined.	Low
C1	75	SCE Inglewood Substation, 229 W Florence Ave., Inglewood	Adjacent N	RCRAGN	Large quantity generator, >1,000 kg/month (probable PCBs).	Low
C1	44, 89, 145	Faithful Central Baptist Church/Trinity Bldg E Parking Lot, 301 W Florence Ave., Inglewood	Adjacent N	SPILLS	1/3/02 – TPH, inactive. 11/6/07 – petroleum, case open.	Low to Moderate
C1	147	Trinity Building W Parking Lot, 401 W Florence Ave., Inglewood	Adjacent N	SPILLS	11/6/07 – Case closed.	Low to Moderate
C1	121	Blue Diamond Materials, 441 Railroad, Inglewood	Adjacent N	UST	Inactive	Low
C1	99	Cemex/Transit Mixed Concrete Company, 505 W Railroad Pl, Inglewood	Adjacent N	UST, LUST	Diesel release to soil only 1988. Excavate and dispose. Close 1996.	Low to Moderate
C1	276	Regent Point, 601 W Regent St, Inglewood	Adjacent S	UST	Installed 1965, removed 1998. Unsure if USTs remain onsite.	Low
C1	286	Mobil Oil Corp, 8307 La Cienega, Inglewood	Adjacent S	UST, LUST	Gasoline release 1990. Pollution characterization. Free product removal. 16 monitoring wells, including along Florence Ave.nue, adjacent to rail alignment. Gasoline compounds present in GW, max TPHg 9,700 ppb 8/13/07. Not sampled or non-detect in wells nearest railroad alignment. GW depth 92.84-100.13 ft bgs on 8/13/07.	High
C1	111	LAX Equipment, 830 W Florence Ave., Inglewood	.01 S	LUST	Diesel release 1999. Leak being confirmed.	Moderate
C1	139	Ryder Truck Rental, 5366 83rd St, Los Angeles	Adjacent N	UST, RCRAGN, LUST	Lubricating release to soils only 2003. Remedial Action.	Low
C1	294	Kaplan Enterprises, 634 Gramercy, Los Angeles	Adjacent N	UST	Inactive	Low

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Alignment Option	FirstSearch ID#	Facility Name and Address	~ Distance from Subject Property (Miles)	Database Type	FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)	Hazard Ranking
C1	213	Charles Caine Co, 8325 Hindry Ave., Los Angeles	.03 N	STATE, RCRAGN	Spray painting facility ~1950-1999. Prior, site used as machine shop and die-casting. 2000-removal of hazardous waste, site abandoned. Phase II assessment detected 800 ppm PCE, 5.6 ppm TCE, and other VOCs. Site impacted with VOCs and TRPH. Vertical and lateral extent not delineated. DTSC approved Remedial investigation workplan. Working on additional soil and VOCs sampling.	Moderate
C1	174	John MacFarlane, 8330 Hindry Ave., Los Angeles	Adjacent S	UST	Active	Low
C1	374	Ultra Cleaners, 1117 W Manchester Blvd., Inglewood	.06 SE	RCRAGN	Cleaners	Low
C1	252, 338, 347	P & S Service Station/Ziba Investment, 1100 & 1110 W Manchester Blvd., Inglewood	.09 SE	UST, LUST	Hydrocarbon release to soils only 1996. Leak being confirmed.	Low
C1	284	Shell, 1135 W Manchester Blvd., Inglewood	.01 S	RCRAGN, LUST, UST	Waste oil release to soils only 1986. Pollution characterization. Geotracker – 4th Qtr '07 – TPHg 74-210 ppb, Benzene – ND-1.2; MTBE ND-110, DIPE ND-16. Five monitoring wells. GW 95.68-99.58. Gradient direction variable.	Moderate
C1	162, 175	Unocal/Tosco 76 Station/Sinai Western Properties, 8600 Aviation Blvd., Inglewood	.04 E	ERNS, LUST, UST	Gasoline release 1990. Remedial action. 7 onsite wells. Max free product – 54.36 feet. Currently only .01ft free product in one well. GW impacted with gasoline compounds. Also impacted with other VOCs such as PCE (1,800 ppb), TCE (1,600 ppb) – source unknown.	Moderate
C1	326, 430	Hewlett Packard, 5651 W Manchester Blvd., Westchester	.06 NW	LUST, UST	Release to soils only 1986. Closed 1990.	Low
C1	140	Budget Rent a Car/Spectrum Investment Corp, 5560 W Manchester Ave., Westchester/Los Angeles	Adjacent W	RCRAGN, LUST, UST	Hydrocarbon release 1992. Max MTBE 6,600 ppb. Geotracker - Remove free product and soil vapor extract. 8 wells, 1st GW at unconfined semi-perched aquifer ~100 ft bgs. Max TPHg 96,500 ppb. Benzene 18,000 ppb. SW gradient. SVE system observed adjacent to tracks.	High
C1	268, 333	Tyco Printed Circuit Group, 8636 Aviation Blvd.	.06 SE	RCRACOR, RCRAGN	Large quantity generator, manufacturing electronic components. 2002, Remedial Feasibility Investigation Workplan, Electroplating Operations.Wastewater treatment sludges from electroplating operations except from 1) sulfuric acid anodizing of aluminum, 2) tin plating on carbon steel, 3) zinc plating on carbon steel; spent cyanide plating bath solutions from electroplating operations, ignitable and corrosive waste, chromium, arsenic, lead.	Low to Moderate
C1	332, 349	Frito Lay/Enterprise Rent A Car, 8734 Bellanca Ave., Los Angeles	Adjacent W	UST, LUST	Diesel release to soils only 1987. 2000 - Excavate and treat, included spreading or land farming.	Low to Moderate
C1	406	Certified Aircraft Processing/Hi-Grade Polishing & Plating Co, 8722 Aviation Blvd., Inglewood	.09 E	RCRAGN	Electroplating, plating, polishing, anodizing, and coloring	Low

Alignment Option	FirstSearch ID#	Facility Name and Address	~ Distance from Subject Property (Miles)	Database Type	FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)	Hazard Ranking
C1	440	Rho Chem Corp, 425 Isis Ave.nue, Inglewood	.13 E	RCRA, RCRACOR, OTHER, STATE, UST, NFRAP, LUST	DTSC Fact Sheet 2006 – 1.1 acre facility that recycles solvents. Facility transfers, treats, and stores haz waste. Facility operated since 1953 – bulk storage and distribution of oils, lubricants, and solvents. Began recycling solvents in 1964. Current operations include liquid fuel blending, solvent recycling, solvent distribution, and accepts solid waste for fuel blending. 3 drum storage areas, 23 ASTs. Initial assessment in 1983. Soils and GW at 100' bgs contaminated with chlorinated and non-chlorinated VOCs (see database report for list). Proposed SVE system.	Moderate
C1	313, 410	Your Man Tours, 8831 Aviation Blvd., Inglewood	Adjacent E	LUST, UST, RCRAGN	Diesel release to soils only 1992. Closed 1996.	Low to Moderate
C1	431	WTC Air Freight, 8900 Bellanca, Los Angeles	Adjacent W	UST	Inactive	Low
C1	312	Northrop University, 8911 S Aviation Blvd., Inglewood	Adjacent E	UST	Leaded gasoline 1992. Unsure if tank is present or has been removed.	Low
C1	318, 331	Merle Norman Cosmetics, 9130 Bellanca, Inglewood	Adjacent W	UST, LUST	Gasoline release 1990. Closed 1997.	Low to Moderate
C1	316	Harry's Airport Garage, 9131 S Aviation Blvd., Inglewood	.04 E	LUST, UST	Gasoline release 1994. Remediation plan.	Low to Moderate
C1	182, 299, 306, 314, 317, 413	Formerly Freight Forwarders/Union Bank/Estate of Joseph Collin/Bodycote Hinderliter/Inglewood Suppliers/Sunsetting Auto Body, 9007 – 9121 Aviation Blvd., Inglewood	.04 E	LUST, SPILLS, UST, RCRAGN	LUST – Gasoline release 1990. Closed 2004, not tested for MTBE. Spills – VOCs, site assessment. Geotracker – release 1988. 1997 – Pollution characterization. No later records. LUST – hydrocarbon release to soils only 1996. Excavate and dispose. Close 1997. LUST – hydrocarbon release to soils only 1993. Remedial actions other than those accounted for by the codes have taken place. Preliminary site assessment work plan submitted.	Moderate
C1	257, 277	Princeland Properties, 1237 W. Arbor Vitae St, Inglewood	Adjacent E	SPILLS, UST	11//07. Remedial action underway – no additional information. 1/3/02 – Remediation VOCS. UST listing indicates removal of all USTs.	Moderate
C1	348, 335	California Avitron Corp/Alamo Rent-A-Car, 8900 - 9020 Aviation Blvd., Inglewood	.09 E	STATE, UST, OTHER, UST, LUST, NFRAP	Cal. Avitron – manufacture of aircraft parts, machining, painting, degreasing, cleaning, treating (1950-1985 at least). 1986 – Preliminary assessment submitted to EPA. 1994 – Database verification confirms no further action by DTSC. 1995 – Refer to County. Potential contaminants: Acid solution 2>pH with metals, sludge – degreasing, paint; unspecified acid solution, sludge waste, and solvent mixtures; waste oil and mixed oil. LUST – release to soils only 2004. Leak being confirmed.	Low to Moderate
C1	116	King Delivery Inc, 5600 Arbor Vitae, Westchester (LA)	Adjacent W	UST, LUST	Gasoline release 1987. Remedial action. Cap site, cleanup and abatement orders. Geotracker - 4 onsite wells west of railroad, 3 offsite to the east. TPHg – 3,600 to 200,000 ppb, Benzene 310 – 28,000 ppb. GW 92.23 – 97.81 ft bgs.	High

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Alignment Option	FirstSearch ID#	Facility Name and Address	~ Distance from Subject Property (Miles)	Database Type	FirstSearch Details (may include regulatory agency review and/or site reconnaissance information)	Hazard Ranking
C1	179, 307, 308, 309	Garrett Airesearch/Honeywell International Corp/Hertz Rent-A-Car, 9225 Aviation Blvd., Los Angeles	Adjacent E	RCRAGN, UST, SPILLS	11/6/07 – Petroleum, VOCs, verification monitoring underway. Listed as Brownfield site on Geotracker.	Moderate
C1	228, 238	Blanca Air Freight/Allan Jones, 9320 & 9326 Bellanca, Los Angeles	Adjacent W	UST	Active	Low
C1	248	Flying Tiger Line, Inc, 9432 Bellanca, Los Angeles	Adjacent W	UST	Inactive	Low
C1	370	Ampco Park/Regency Development/Wally Park/Arrowsmith Industries, 9700 Bellanca Ave., Los Angeles	Adjacent W	UST, OTHER, UST, RCRAGN	UST – active. Other – abated 7/1/89, no additional information.	Low
C1	311	Texaco Station, 5551 W Century Blvd., Los Angeles	Adjacent E	RCRAGN, UST	Active	Low
C1	378, 404	Unocal/Airport Union Service/Circle K Stores/76 Products Station, 5552 W Century Blvd., Los Angeles	Adjacent E	ERNS, UST, LUST	Hydrocarbon release to soils only 1994. Closed 1999.	Low
C1	498, 541	Thrifty Car Rental, 5440 W Century Blvd., Los Angeles	.18 E	UST, LUST	Release of aviation gasoline and additives 1993 and 2001. Pollution characterization. Vertical and lateral extent in soil has been addressed. Extent of GW contamination not assessed. 10 monitoring wells. GW 52.6-59.9 ft bgs 3/28/07. Gradient southwest.	Low
C1	129	Northwest Orient Cargo, 11101 Aviation, Los Angeles	Adjacent W	UST	Inactive	Low
C2	97	Carriage Cleaners, 246 N Market Blvd., Inglewood	Adjacent E	RCRAGN	No car or dry cleaners onsite during recon. Occupied by retail stores. ~225 ft parking lot between Market St. & stores.	Low
C2	98	Pep Boys, 200 E Spruce Ave., Inglewood	Adjacent E	UST	Tanks removed in 1992 & 2004. Existing tanks?	Low
C2	105, 114	Prince Dodge, Inc./Airline Coach Service, 636 S La Brea Ave., Inglewood	Adjacent E	UST, LUST	Waste oil release 2002. Leak being confirmed. Not listed on Geotracker	Low to Moderate
C2	80	Toyota of Inglewood, 700 S La Brea Ave., Inglewood	Adjacent E	RCRAGN, LUST, UST	Gasoline release to soils only 1991. Closed 1993. Site not tested for MTBE.	Low to Moderate
C2	35	Tosco/Unocal, 843 S La Brea Ave., Inglewood	Adjacent W	UST, LUST	Gasoline release to soils only 1990. Closed 1998.	Low to Moderate
C2	96	U-Haul, 964 S La Brea Ave., Inglewood	Adjacent E	UST	1 fuel tank removed 1987. 2 fuel tanks removed 1996. Existing tanks?	Low
C2	217	Paragon Cleaners, 959 S La Brea Ave., Inglewood	Adjacent W	RCRAGN	Cleaners	Low to Moderate
C2	50	Delorme Chevrolet, 1175 S La Brea Ave., Inglewood	Adjacent W	LUST, RCRANLR	Waste oil release to soils only 1988. Closed 1990.	Low
C2	95, 215	Winston Tire Co, 1140 S La Brea Ave., Los Angeles	Adjacent E	UST, RCRAGN	Active	Low
C2	372	Platinum Stereo, 4490 W Century Blvd., Inglewood	.08 W	LUST	Gasoline release to soils only. Leak being confirmed. Topographically down-gradient. Appears to be hydrogeologically down-gradient.	Low
C2	85	Byront's Auto Repair/Henry's Auto Repair, 10101 S Hawthorne Blvd., Inglewood	Adjacent W	UST, RCRAGN	Waste oil UST	Low
C2	30	My Tire Store, 10127 S Hawthorne Blvd., Inglewood	Adjacent W	UST	Waste oil UST and gasoline UST removed in 1998. Existing tanks?	Low
Alignment Option	**FirstSearch ID#**	**Facility Name and Address**	**~ Distance from**	**Database Type**	**FirstSearch Details (may include regulatory agency review and/or site reconnaissance**	**Hazard Ranking**

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			Subject Property (Miles)		information)	
C2	26	El Rancho Market, 10412 S Hawthorne Blvd., Inglewood	Adjacent E	UST	Gasoline and Waste Oil USTs, removed 1998. Existing tanks?	Low
C2	23	Lennox Car Wash, 10709 Hawthorne Blvd., Lennox	Adjacent W	UST, LUST	Gasoline release in 1990. MTBE in GW up to 49 ppb. Soil vapor extraction operated. Closed 1999.	Low to Moderate
C2	24	Credit Auto Center Inc, 10914 S Hawthorne Blvd., Inglewood	Adjacent E	UST	Waste oil UST	Low

4.3 Additional Environmental Record Sources

4.3.1 Regulatory Agency Consultations

Leighton Consulting requested regulatory records from the agencies listed below for the following addresses associated with the affected parcels: 1600 Wellington Road; 1601, 1611, 1615, 1614, 1620, 1626, and1632 Victoria Avenue; 1625, 1641, 1645, 1703, 1707, 1709, 1717, 1721, 1727, 3628, 3630, 3642, 3644, 3646, 3650, 3656, 3660, 3662, 3668, 3670, 3680, 3684, 3690, 3694, 3698, 3722, 3724, 3726, 3728, 3730, and 3732 Crenshaw Boulevard; 4526, 4550, 4600, 4646, and 4700 Pico Boulevard; and 3515 and 3519 Rodeo Road. All of the regulatory agency reviews are included in Appendix G (see included CD).

Southern California Air Quality Management District (SCAQMD)

On April 7, 2008, Leighton Consulting reviewed the Facility Information Detail System (FIND) for the SCAQMD files. The FINDS review indicated that records were found for the following affected parcels: 3628, 3650, 3670, and 3730 Crenshaw Boulevard. The records reviewed are summarized in the following tables:

3628 Crenshaw Boulevard - 20th Century Plastics, Inc. Plating & Polishing

Date	Permit Type	Status
08/16/1990	Oven, Drying, Screen Printing	Application cancelled
06/21/1985	Printing Press Misc. Heat Set	Inactive

3650 Crenshaw Boulevard - Cameo Cleaners

Date	Permit Type	Status
02/23/2001	Vapor recovery unit, compress & condense	Inactive
02/23/2001	Dry Cleaning, dry-to-dry, non-vent, Perchloroethylene	Inactive
04/24/2002	Dry Cleaning, dry-to-dry, NV, W/ SIC, Perchloroethylene	Active

3670 Crenshaw Boulevard - Ralphs Grocery

Date	Permit Type	Status
04/14/2000 02/14/2006	Rule 1415 plan notification – Plans excavation	Banking/Plant Granted

3730 Crenshaw Boulevard – H & S Holiday Bowl, Inc.

Date	Permit Type	Status
09/28/1992	Charbroiler – Natural Gas	Inactive

Department of Toxic Substance Control (DTSC)

On April 7, 2008, file review requests were forwarded to the DTSC-Chatsworth Division and the DTSC-Cypress Division via facsimile.

On April 24, 2008, Ms. Vivien Tutaan of the DTSC-Chatsworth office indicated via mail that there were no records for the addresses requested.

On May 6, 2008, Leighton Consulting called the DTSC-Cypress office to inquire about the status of the records request. According to Ms. Julie Johnson, they had not received the file review request sent on April 7, 2008; therefore, the request was again sent via facsimile on May 6 and 13, 2008. On May 15, 2008, Ms. Julie Johnson of the DTSC-Cypress office indicated via mail that there were no records for the addresses requested.

On May 9, 2008, a records request was emailed to Ms. Jone Barrio of the DTSC-Cypress office regarding a listing on the FirstSearch™ report that appeared to be located on the subject property: BNSF HR-LA-C-GET-HB-3/HB-4, Railroad Right-of-Way, 550 South of Arbor Vitae, Los Angeles. The local agency for this site was listed as Branch: So Cal – Cypress. The local agency in Cypress appears to be the DTSC. According to Ms. Jone Barrio, who returned a phone call on May 12, 2008, the DTSC-Cypress office has no records for this site.

City of Los Angeles, Bureau of Sanitation, Industrial Waste Management Division

On April 7, 2008, a file review request was forwarded to the Los Angeles Industrial Waste Management Division via facsimile. A response letter dated April 15, 2008 and records were received via mail for the following addresses: 4700 Pico Boulevard, 3515 Rodeo Road, and 3630, 3642, 3644, 3656, 3515, 3650, 3660, 3670, 3724, 3728, and 3730 Crenshaw Boulevard. All of the records reviewed pertained to restaurant establishments with the exception of the following:

1. Gulf Oil Corporation located at 3630 Crenshaw Boulevard. Processes involved auto lube and wash, and waste water included detergents and oils. According to the permit conditions, the facility was required to adopt and use a program of regular and frequent maintenance and skimming of the clarifier so as to prevent the discharge of grease, oil, and/or industrial waste in excess of the legal limits into the sanitary sewer.

2. Clean King Laundry Services, a coin laundry Laundromat located at 3644 Crenshaw Boulevard. The permit code for the site was listed as "coin-operated laundries and dry cleaning", however, no dry cleaning activities were observed on the premises during the site inspection.

3. Gulf Oil Company, located at 3644 Crenshaw Boulevard. Processes involved included a wash service station and minor auto repairs and waste water included grease and oil from wash-up.

4. Cameo Cleaners, a dry cleaning and laundry establishment located at 3650 Crenshaw Boulevard.
5. Rocket Cleaners, listed as "laundries – linen and general", located at 3650 Crenshaw Boulevard.

6. Walgreen Company, One-Hour Photo Lab, located at 3724 Crenshaw Boulevard.

7. Holiday Bowl, a bowling alley, coffee shop, and dining room, located at 3730 Crenshaw Boulevard, generating waste water composed of commercial dishwashing compound, soap, and detergent from equipment and floor washing activities.

Regional Water Quality Control Board (RWQCB)

On April 7, 2008, a file review request was forwarded to the Los Angeles RWQCB Spills, Leaks, and Investigations (SLIC), Well Investigation Program (WIP), and UST Divisions via facsimile.

On April 9, 2008, Ms. Oronne Wami of the RWQCB, WIP Division indicated via telephone and email that no records were found for any of the addresses requested.

On April 16, Mr. Matt Gunter of the RWQCB, UST Division indicated via telephone that no records were found for the addresses requested.

On April 16, Ms. Daisy of the RWQCB, SLIC Division indicated via telephone that no records were found for the addresses requested with the exception of 3650 South Crenshaw Boulevard. The SLIC records available for 3650 Crenshaw Boulevard were reviewed on the Geotracker database on May 6, 2008. According to these records, Cameo Cleaners had a release of PCE and TCE to groundwater. No additional information was available on the database.

<u>Los Angeles Fire Department (LAFD), Hazardous Materials Division</u>

On April 8, 2008, a file review request was forwarded to the LAFD, Hazardous Materials Division, via facsimile. The response forms were returned via facsimile on April 9, 2008. No information was on file for any of the addresses with the exception of 3650 and 3670 Crenshaw Boulevard and 4550 Pico Boulevard.

A file review was conducted at the LAFD, Hazardous Materials Division, on May 8, 2008, and is summarized in the following paragraphs:

1. Cameo Cleaners, 3650 Crenshaw Boulevard, was reported to store up to 400 gallons of pure tetrachloroethylene in steel drums onsite for its dry cleaning operations, as well as up to 55 gallons of tetrachloroethylene waste. Permit dates ranged from 1998 to 2007.

2. Ralph's Grocery, 3670 Crenshaw Boulevard, was reported to store chlorine bleach consumer product, Freon 22, Freon 408A, Freon 502, helium, laundry detergent, anti-freeze consumer products, charcoal lighter consumer products, deodorants, drain cleaner consumer products, engine cleaners, hair spray, insecticide consumer products, motor oil, oven cleaner consumer products, rubbing alcohol, and toilet bowl cleaners.

3. Builders Discount, 4550 Pico Boulevard, was reported to store numerous retail construction products.

Los Angeles Fire Department (LAFD), Underground Storage Tank (UST) Division

On April 8, 2008, a file review request was forwarded to the LAFD, UST Division, via facsimile. Fire fighter Kehoe responded to Leighton via telephone that records were available for 3628, 3630, and 3644 Crenshaw Boulevard. In addition, Ms. Katie responded to Leighton via telephone that records were also available for 4526 and 4550 Pico Boulevard.

A file review was conducted at the LAFD, UST Division, on May 8, 2008, and the results are summarized in the following tables:

3628 Crenshaw Boulevard (Adjacent Parcel)

Date	**Owner**	**Description**
02/19/97	20th Century Plastics	Haz waste manifest – 99% water, 1% oil.
03/19/97	20th Century Plastics	UST Closure Activities Report (Park Corporation, 1997), 1-10,000 gallon diesel UST, located in southeast corner of property, ~ 500 ft. east of Crenshaw Blvd. UST removed on 2/19/97. Soil and groundwater not impacted with petroleum hydrocarbons. Site lies within a regional groundwater plume of halogenated volatile organic compounds (VOCs) and groundwater conditions have been monitored for several years. Site map shows wells located east and west of Crenshaw Blvd.
06/30/00	West Angeles Church	No Further Action at this time letter

3630 Crenshaw Boulevard (Affected Parcel)

Date	**Owner**	**Description**
03/31/81	Not Stated	Notification of UST abandonment, 3 USTs, 2-10,000-gallon USTs, 1-8,000-gallon UST. Sketch showed USTs to be fronting Rodeo Road, north of Crenshaw Blvd.

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3644 Crenshaw Boulevard - formerly 3630 Crenshaw Blvd. (Affected Parcel)

Date	Owner	Description
06/09/47	Craig Oil Co.	3-4,000 gallon gasoline USTs, 1-3,000 gallon gasoline UST, 1-550-gallon waste oil UST. Notes were added for abandonment of two of the 4,000-gallon USTs on 1/4/66.
03/18/48	Craig Oil Co. Inc.	Chain of occupancy, 24' x 138' service station
03/09/54	Colorado Self Service Inc.	3-4,000-gallon USTs, 1-3,000-gallon UST, 1-500-gallon UST. Note that all tanks were abandoned on 5/17/68 (however no removal permits were reviewed for the 3,000 gallon UST).
12/15/65	Gulf Oil Corp.	Plans – Storage Tank Replacement. Approved 1/4/65. 4 USTs fronting Crenshaw Blvd. Noted removal of 2- 4,000-gallon USTs and relocation of 1-8,0000-gallon UST and 1-9,400-gallon UST to front Rodeo Road, east of service station.
12/30/65	Gulf Oil corp.	Application for permit – Relocated 1-8,000-gallon UST and 1-9,940-gallon UST
01/04/66	Gulf Oil Corp.	Install 2 atmospheric tanks
01/04/66	Gulf Oil Corp.	Abandon 2 atmospheric tanks
01/05/66	Not Stated	Notification of UST abandonment – 2-4,000-gallon USTs removed in compliance with Fire Department regulations
05/09/68	Gulf Oil Corp.	Install 4 atmospheric tanks, shop built and abandon 3 atmospheric tanks
05/09/68	Gulf Oil Corp.	Application for permit – 1-9,940-gallon UST, 1-280-gallon UST, 1-9,940-gallon used UST, 1-8,000-gallon used tank; abandon 3 tanks
05/10/68	Gulf Oil Corp.	Authorization to install 4 atmospheric tanks.
05/13/68	Gulf Oil Corp.	Application for permit – 2-4,000-gallon USTs, 1-waste oil UST.
05/15/68	Gulf Oil Corp.	Abandon 3 atmospheric tanks
No Date	Not Stated	Notification of UST abandonment – 2-4,000-gallon USTs and 1-1,000-gallon waste oil removed in compliance with Fire Department regulations. Plan indicated the relocation of 1-

		8,000-gallon UST and 1-10,000 UST (elsewhere referred to 9,940 gallon). * This document did not expressly refer to the 3,000 gallon UST installed in 1947.
06/16/69	Crenshaw Rodeo Gulf	Auto fueling station
06/26/73	Mons Gulf	Auto fueling station, formerly at 2349 Crenshaw Blvd.
07/09/74	Gulf Oil Co.	Alteration of piping
07/29/74	Gulf Oil Co.	Install vapor recovery system
03/28/78	Gulf Oil Co.	Permit to transfer liquefied flammable gas in a manner not otherwise regulated

No removal reports or closure letters were available for this facility

UST Summary for 3630 and 3644 Crenshaw Boulevard (Affected Parcel)

Installation Date	Tank Size & Contents	Removal Date
06/09/47	4,000 gallon gasoline	01/04/66
06/09/47	4,000 gallon gasoline	01/04/66
06/09/47	4,000 gallon gasoline	05/15/68
06/09/47	3,000 gallon gasoline	*05/17/68 (?)
06/09/47	550 gallon waste oil	5/15/68
Not stated Relocated 05/09/68	8,000 gallon gasoline	03/31/81
Not Stated Relocated 05/09/68	9,940 gallon gasoline (also referred to as 10,000 gallon)	03/31/81
05/09/68	9,940 gallon gasoline (also referred to as 10,000 gallon)	03/31/81
05/09/68	280 gallon, content not listed, presumed waste oil	Not stated

* A note on the 03/09/54 document stated that all tanks were abandoned on 05/17/1968; however, none of the permits or Notification of Abandonments issued from the Fire Department expressly referred to the 3,000 gallon UST, and no maps indicated its location.

4526 Pico Boulevard (Affected Parcel)

Date	Owner	Description
10/11/48	City of LA, Bureau of Construction & Bldg. Maintenance	Install 1,200 gallon gasoline UST on south side of street between West Blvd. and Highland Ave. Previous permit granted 10-6-25. Remark: 1-550 filled with sand 11-2-49.
01/28/69	City of LA Wilshire Police Dept	Application for fire permit, auto fueling facility, started 12/13/1962
09/20/73	Wilshire Police Dept.	Request for sprinkler piping modification
03/26/75	City of LA	Abandon 5,000 gallon atmospheric tank
04/30/75	Roger Ray Inc.	Abandon atmospheric tanks
04/30/75	Roger Ray Inc.	Abandon atmospheric tanks
05/28/75	City of LA, City Hall	Abandon 2,000 gallon gasoline tank

No site maps, removal reports, or closure letters were available for this facility

4550 Pico Boulevard (Affected Parcel)

Date	Owner	Description
11/09/88	Sears Auto Center	Plans to remove four oil USTs
11/14/88	Sears	Permit application to remove 4 USTs
03/02/89	Not Stated	UST Unit cover letter indicating site with no contamination.
01/24/89	Not Stated	Notice of Abandonment of 4 USTs in compliance with FD regulations, signed by fire inspector.
03/07/89	Sears	UST Removal Report (PIC, 1989). Waste oil USTs were located in a concrete vault. No total petroleum hydrocarbons (TPH) detected in soil beneath vault.

10/05	CIM/PICO LP	UST Removal and Soil Remediation Report (Earth Tech, 2005). 2 USTs discovered during site redevelopment, in vicinity of current retail stores at 4700 Pico Blvd., ~ 100 ft. east of San Vicente Blvd. One contained heavy petroleum (minor spill at time of discovery) and the other filled with a sand/cement slurry. Removed 5/26/05. Over-excavation of impacted soil. Minor TPH and gas related VOCs in one soil sample. Concluded no significant impact and no further action.
04/25/06	CIM/PICO LP	No Further Action at this time letter

LAFD UST Review Summary:

3628 Crenshaw Boulevard – A 10,000 gallon diesel UST was removed in 1997. A closure letter was issued in 2000. The UST was located at the southeast corner of the property, approximately 500 feet east of Crenshaw Boulevard. The site has since been redeveloped with West Angeles Church. Based on the closure letter and the absence of petroleum hydrocarbons detected in the soil or the groundwater, this former UST is not expected to negatively impact the subject property; however, based on the former usage of this property as an electronics manufacturing facility, Gilfillan Bros. Inc., in the 1950s and 1960s, and its presence within a regional groundwater plume, this facility has a moderate potential to negatively impact the subject property.

3630 & 3644 Crenshaw Boulevard - There is no documentation of the removal of the 280 gallon UST and it is unclear if the 3,000 gallon UST was removed from the site. Maps indicated that at least four gasoline USTs previously fronted Crenshaw Boulevard at the northeast intersection with Rodeo Road. There was no documentation for environmental sampling from beneath the USTs when they were removed, and this location has a high potential to negatively impact the subject property.

4526 Pico Boulevard – A 2,000-gallon and 5,000 gallon UST were removed from the site in 1975. In addition, it appears that a 550-gallon UST of unknown contents was filled in place with sand in 1949 and there is no evidence of its removal. No maps indicated the location of these USTs in the file; however, a

1954 Sanborn Map shows that the Police Department was located just south of Pico Boulevard at the Pico Boulevard and Muirfield Road intersection, approximately 400 feet east of the proposed alignment on a separate parcel (not located on an affected parcel). There was no documentation of environmental sampling beneath any of the USTs; however, due to the distance of the proposed alignments and the present construction and excavation activities at this location, it is expected to have low potential to adversely affect the subject property.

4550 Pico Boulevard - Based on closure letter, distance to the proposed alignment, and/or low or no concentrations of TPH or VOCs detected in the soil beneath the USTs, they are expected to have low to moderate potential to adversely affect the subject property. However, a site plan included in the UST removal report depicted a historical crude oil tank in the vicinity of the proposed alignment, near the junction of San Vicente Boulevard and Venice Boulevard. No information for this tank was found and it is not certain what facility used this tank. This is expected to have moderate potential to adversely affect the subject property.

State of California Radon Survey

In 1990, the State of California conducted a radon survey in the state. The results of the survey indicate that for the 182 samples obtained from residential homes in Region 9, which includes Los Angeles County, the arithmetic mean radon levels were 0.6 picoCuries per liter of air (pCi/l). This average total is below the U. S. EPA radon action level of 4 pCi/l of air. Therefore, the potential for elevated radon levels at the site appears to be low (California Department of Health Services, 1990).

4.4 Historical Use Information on the Property

Leighton Consulting reviewed selected historical information on the subject property. These references were reviewed for evidence of activities, which would suggest the potential presence of hazardous substances at the subject property and to evaluate the potential for the subject property to be impacted by offsite sources of contamination. The following paragraphs are a chronological summary of the review.

4.4.1 Aerial Photographs

Historical aerial photographs were reviewed for information regarding past subject property uses. Aerial photographs were reviewed for the following years: 1928, 1938, 1947, 1952, 1968, 1976, 1982, 1994, and 2002. Copies of the aerial photographs are included in Appendix H; however, detail is difficult to discern on the inserts; therefore, digital copies showing the site location, have been included in the CD insert.

1928: The subject property appeared to be occupied by streets and a railroad right-of-way, similar in configuration as it appears today. La Brea Boulevard, between Dockweiler Street and San Vicente Boulevard (1 block) had not yet been reoriented and straightened to its present position, slightly east of its former location (one lane of the pre-existing La Brea Boulevard is still present). A transportation feature appeared to extend between Pico Boulevard and Venice Boulevard at San Vicente Boulevard; according to the 1927 Sanborn Map, the Pacific Electric Railroad right-of-way extends along San Vicente Boulevard and through this area; however, San Vicente Boulevard itself does not extend between Pico Boulevard and Venice Boulevard. The affected parcel at this location appears to possibly have been used for lumberyard or industrial purposes. The affected parcels at Venice Boulevard, between Wellington Road and Crenshaw Boulevard, appeared to be occupied by residential houses and undeveloped parcels. The affected parcels East of Crenshaw Boulevard, between Exposition Boulevard and Coliseum Street appeared to be occupied by vacant land (possible agricultural usage). A railroad right-of-way appeared to extend along Exposition Boulevard at Crenshaw Boulevard. Interstates 10, 105 and 405 appeared to have not yet been constructed.

Adjacent properties and the surrounding vicinity appeared to be occupied primarily by residential and commercial structures in Sections A1 and A2, from Wilshire Boulevard to Exposition Boulevard; however, there appeared to be large structures between Pico Boulevard and Venice Boulevard that may be industrial. In addition, there was a large aboveground storage tank located at Exposition Boulevard and 12th Street, approximately 950 feet east of Crenshaw Boulevard (labeled as gas tank on 1950 topographic map). The central portion of the subject property, Section B, appeared to be occupied primarily by vacant land (possibly some agricultural usage) between Exposition Boulevard and Stocker Street; however, there were a few structures and a possible airstrip located west of Crenshaw Boulevard and the area was labeled as “American Airport”. The southern portion of this area appeared to be occupied primarily by commercial and residential structures. The C1/C2 and C-2 alignment appeared to be occupied primarily by residential and commercial structures, some vacant parcels, a cemetery, and an industrial facility north of the cemetary. The C-1 alignment appeared to be occupied primarily by commercial and industrial structures and agricultural land/scattered structures west and south of Manchester Boulevard. West of Aviation Boulevard (then Redondo Boulevard), between Century Boulevard and Imperial Highway, it appeared that a runway had been constructed and there were several scattered structures. The property for the Los Angeles International Airport (then known as Mines Field) was purchased in 1928 and initially dirt landing strips were constructed. Previously the land had been occupied by agricultural fields.

1938: The subject property appeared to be relatively unchanged from the 1928 aerial photograph. The affected parcels area east of Crenshaw Boulevard, between Exposition Boulevard and 39th Street appeared to be occupied by vacant land with the exception of a structure located in the southeast corner of Crenshaw Boulevard and Exposition Boulevard.

There appeared to be some additional development in the vicinity of the subject property; however, the adjacent and surrounding property appeared to be similar to the 1928 aerial photograph. The American Airport was not identified south of Exposition Boulevard. Centinela Park appeared to exist north of Inglewood Park Cemetery; however, it may have still been undergoing development. An airport hangar appeared to have been constructed at the northwest corner of Aviation Boulevard and Imperial Highway and the previous structures in the airport vicinity appeared to have been demolished. There appeared to be a possible pond feature, in the shape of a figure 8, located to the east of the airport hangar and Aviation Boulevard.

1947: The subject property appeared to be relatively unchanged from the 1938 aerial photograph, with the exception that there appeared to be at least three residential or commercial structures located east of the former La Brea Boulevard (the present La Brea alignment). The adjacent sites appeared to be almost completely developed with residential, commercial, or industrial property, with the exception of some vacant land immediately adjacent to Crenshaw Boulevard between Rodeo Road and 39th Street and some vacant parcels east and west of Aviation Boulevard, south of Manchester Boulevard. The Los Angeles

International Airport appeared to be developed between Aviation Boulevard and Sepulveda Boulevard.

1952: The subject property appeared to be relatively unchanged from the 1947 aerial photograph. The affected parcels area east of Crenshaw Boulevard, between Exposition Boulevard and Coliseum Street appeared to be occupied by commercial property, and between Coliseum Street and 39th Street it appeared to be occupied by vacant land.

The adjacent sites appeared to be almost completely developed with residential, commercial (including a park and a cemetery), and industrial property. Industrial areas appeared to be primarily concentrated north of Florence Avenue and east and west of Aviation Boulevard. The Los Angeles International Airport appeared to be developed west of Aviation Boulevard, between Aviation Boulevard and Sepulveda Boulevard, with a vacant parcel directly east of Aviation and the airport runway, for incoming planes.

1968, 1976, 1982, 1994, and 2002: The subject property appeared to be relatively unchanged from the 1952 aerial photograph, with the exception that the Pacific Electric Railroad did not appear to be located along San Vicente Boulevard and San Vicente Boulevard appeared to extend between Pico Boulevard and Venice Boulevard. This newly constructed portion of San Vicente Boulevard appeared to follow the path of the railroad near Pico Boulevard and then jog to the south through vacant land to join up with Venice Boulevard at Vineyard Avenue. The affected parcels area east of Crenshaw Boulevard, between Exposition Boulevard and 39th Street appeared to be occupied by commercial structures. In addition, Interstates 10 and 405 appeared to have been constructed and the associated overpasses were constructed along Crenshaw Boulevard at Interstate 10 and along Florence Avenue/railroad right-of-way at Interstate 405.

The adjacent sites appeared to be completely developed with residential, commercial (including a park and a cemetery), and industrial property. Industrial areas appeared to be primarily concentrated north of Florence Avenue and east and west of Aviation Boulevard. The Los Angeles International Airport appeared to be developed west of Aviation Boulevard and south of Century Boulevard, with a vacant parcel directly east of Aviation and the airport runway, for incoming planes. The aboveground storage tank previously located at Exposition Boulevard and 12th Street appeared to have been removed. Redevelopment of some parcels adjacent to the subject property occurred between the 1968 and 2002 aerial photographs.

4.4.2 Historical Topographic Maps

Historical topographic maps were reviewed for information regarding past subject property uses. Topographic maps were reviewed for the following years: 1950 (Beverly Hills, Venice, and Inglewood quadrangles), 1953 (Hollywood quadrangle), 1964 (Venice and Inglewood quadrangles), 1966 (Beverly Hills and Hollywood quadrangles), 1972, and 1981. Copies of the topographic maps are included in Appendix I; however, detail is difficult to discern on the inserts; therefore, digital copies, including notes regarding selected features, have been included in the CD insert.

1950/1953: The subject property is primarily depicted in a red-shaded area indicative of a developed or "built up" area, where only primary structures are shown. Select areas are depicted in white areas that depict the structures present. The subject property appears to be relatively unchanged from its present configuration of roads and the A.T. & S.F. railroad right-of-way, with the exception that San Vicente Boulevard presently extends from Pico Boulevard to Venice Boulevard; however, in the 1950 topographic map a structure, a circular feature identified as "Sandpipe", and an intermittent stream is identified in this area. The Pacific Electric Railroad was depicted along Exposition Boulevard and Crenshaw Boulevard. In addition, Interstates 10, 105 and 405 had not yet been constructed; therefore, the overpasses at these freeways did not yet exist.

Primary structures including churches, schools, and unidentified buildings are noted adjacent to the subject property. An aboveground gas tank is identified at Exposition Boulevard and 12th Street, approximately 950 feet east of Crenshaw Boulevard. Centinela Park and Inglewood Park Cemetery are depicted in their present location at Florence Avenue and Prairie Avenue. Los Angeles International Airport is also depicted at its present location west of Aviation Boulevard between Century Boulevard and Imperial Highway. Two oil tanks are depicted adjacent to the east of Aviation Boulevard at 111th Street.

1964/66: Changes to note from the 1950/53 topographic maps:

- Interstate 10 and 405 had been constructed;
- The orientation of La Brea Boulevard (the subject property) was altered slightly between Dockweiler Street and San Vicente Boulevard.
- San Vicente Boulevard extended from Pico Boulevard to Venice Boulevard, the sandpipe feature was not identified, and new structures had been built;
- The aboveground gas tank was not depicted at Exposition Boulevard and 12th Street. The railroad at Exposition Boulevard was identified as Southern Pacific;
- A shopping center was depicted west of Crenshaw Boulevard at Santa Barbara; and
- The oil tanks were not depicted at Aviation Boulevard and 111th Street.

1972: No significant changes or items of concern were identified on or adjacent to the subject property on the 1972 topographic map. Building additions since the 1964/1966 maps were identified in purple.

1981: No significant changes or items of concern were identified on or adjacent to the subject property on the 1981 topographic map.

4.4.3 Fire Insurance Maps

Fire insurance maps, or Sanborn® maps, are detailed city plans showing building footprints, construction details, use of structure, street address, etc. The maps were designed to assist fire insurance agents in determining the degree of hazard associated with a particular property. Sanborn maps were produced from approximately 1867 to the present for commercial, industrial, and residential sections of approximately 12,000 cities and towns in the United States.

Sanborn® map coverage was available for portions of the subject property for the following years: 1927, 1929, 1931, 1950, 1954, 1966, and 1969. The subject property was identified to consist of the present-day alignment of streets and the railroad right-of-way. The Sanborn® maps and a summary review of the Sanborn® maps, listing businesses adjacent to the subject property alignment, that potentially used or stored hazardous materials or waste onsite, are included in Appendix J (see CD insert for Sanborn® maps). Numerous industrial facilities, manufacturing facilities, gas stations, laundry and/or dry cleaners, auto service stations, auto wrecking, and painting facilities were identified adjacent to the proposed subject property alignment on the Sanborn® maps. In addition, an asphalt plant, salvage yard, metal melting and salvage yard, airplane factory, and plating facilities were identified adjacent to the proposed alignment.

4.4.4 Property Tax Files

Property tax files were reviewed on the Los Angeles County Assessor's website for the affected parcels. Information printed from this website is included in Appendix C; however, it does not include the 2007 annual tax report.

4.4.5 Recorded Land Title Records

Chain of Title Reports were not provided by METRO.

4.4.6 Building Department, Zoning and/or Land Use Records

On April 9 and 10, 2008, selected permits for the addresses associated with the affected parcels (with the exception of the residential properties) were reviewed at the City of Los Angeles Department of Building and Safety. The building permits that indicate a potential environmental concern, based on the tenant name and/or permit type, are listed below.

Date	Address	Owner and/or Tenant	Permit Type and/or Building Use
10/08/1926	4600 Pico Blvd.	J.B. Lumber Co.	New construction
05/20/1935	4620 Pico Blvd.	L.A.R.Y. Corp.	Umbrella shed
09/03/1940	4636 Pico Blvd.	W.E. Lumber Co.	Shed #1, Current bldgs – 4 offices, warehouse, saw, plaining mill
12/28/1944	4646 Pico Blvd.	L.A. Railway Corp.	C of O – toilet rooms
1922	4650 Pico Blvd.	The Vineyard Lumber Co.	Construct shed for assembling sectional house units
04/21/1958	4650 Pico Blvd.	Cooper Lumber Co.	Saw dust bin

03/03/1967	4650 Pico Blvd.	W.E. Cooper Lumber Co.	4 existing storage & retail sales. Construct new lumber storage structure
Illegible	4650 Pico Blvd.	W.E. Cooper Lumber Co.	Roof over machinery
08/19/1941	4700 Pico Blvd.	W.E. Cooper Lumber Co.	Add wood on fence. One office & warehouse
02/14/1961	4700 Pico Blvd.	Metropolitan Transit	Demolish 50' x 200' garage
05/12/1952	3628 Crenshaw Blvd.	Gilfillan Bros. Inc.	New bldg - manufacture of electronic products
04/10/1967	3628 Crenshaw Blvd.	I.T.T. Gilfillan	Construct utility bldg., 4 factory/office bldgs. onsite

Date	Address	Owner and/or Tenant	Permit Type and/or Building Use
01/17/1969	3628 Crenshaw Blvd.	Carter-Wallace Inc.	123' x 438' C of O, change use from manf. to warehouse & manf. Bldg.
06/20/1974	3628 Crenshaw Blvd.	20th Century Plastics, Inc.	C of O, 12'9" x 23' machinery room
09/20/1976	3628 Crenshaw Blvd.	20th Century Plastics, Inc.	Construct shade trellis
10/20/1976	3628 Crenshaw Blvd.	20th Century Plastics, Inc.	Fence; offices, warehouse, manufacturing
03/12/1980	3628 Crenshaw Blvd.	20th Century Plastics, Inc.	C of O, 193'6" x 208' warehouse & office
03/30/1988	3628 Crenshaw Blvd.	20th Century Plastics, Inc.	C of O, 117' x 280'8" addition to warehouse, office, & manf. bldg.
09/10/1947	3630 Crenshaw Blvd.	Craig Oil Co.	New bldg. - super service station
05/10/1968	3644 Crenshaw Blvd.	Gulf Oil Corp.	New service station
01/25/1955	3650 Crenshaw Blvd.	Rocket Cleaners	New drop-off bldg. for cleaning & sign

C of O: Chain of Occupancy Bldg: Building Manf: Manufacturing

4.4.7 Other Historical Sources.

Additional resources were not researched as a part of this assessment

4.4.8 Summary of Historical Land Use

Based on historical records, the subject property has consisted primarily of streets and a railroad right-of-way at least since the late 1800s. The affected parcels at Venice Boulevard and Crenshaw Boulevard have been used for residential purposes since at least the 1920s. A small portion of the subject property at San Vicente Boulevard and Venice Boulevard appeared to have been occupied by vacant land prior to the construction of San Vicente Boulevard between Pico Boulevard and Venice Boulevard in the 1950s or 1960s. The affected parcels at San Vicente Boulevard and Venice Boulevard appeared to have been occupied by the Pacific Electric Railroad right-of-way until at least the early 1950s, as well as a lumber company from at least 1926 to 1967, and commercial uses until the present. The affected parcels at Crenshaw Boulevard and Exposition Boulevard south to Coliseum Street appeared to have been primarily vacant and possibly used for agricultural purposes from the 1920s to the 1950s, and have been built up with commercial structures from the 1950s through the present, with the following notable businesses: 3628 Crenshaw Boulevard – Gilfillan Electronics Manufacturing from at least 1952 to 1968 and 20th Century Plastics from at least 1974 to 1988; 3630 & 3644 Crenshaw Boulevard – Gas station from at least 1947 to 1978.

5.0 SITE RECONNAISSANCE

5.1 Methodology and Limiting Conditions

On February 12, 14, 26, 27, and March 3, 2008, representatives of Leighton Consulting, Ms. Shannon Siegel and Ms. Meredith Church, a licensed Professional Geologist, conducted a reconnaissance–level assessment of the subject property. The site reconnaissance consisted of the observation and documentation of existing subject property conditions and nature of the neighboring property development within 0.25-miles of the subject property. Photographs of the subject property are presented in Appendix B and their view directions are noted on Figures 4a through 4d, Environmental Concern Location Map.

Leighton Consulting was provided access only to the railroad and street right-of-ways. Access was not provided on any properties located adjacent to the right-of-way and these properties were only inspected from the property boundaries. Fences, vegetation, buildings, etc. limited the observations on many of these properties.

5.2 General Site Setting

The subject property is currently used for transportation purposes, including paved roads and railroad right-of-ways; however, the railroad right-of-way is reportedly inactive at this time. The immediate subject property vicinity (including affected parcels) and the surrounding areas consist of residential, commercial, and industrial properties, as well as transportation corridors (streets and freeways). Exterior observations for the subject property are summarized in the section below.

The Site Reconnaissance Record Log lists hazardous substances, USTs, and other items observed on adjacent properties (Appendix D). In addition, a list of adjacent sites identified during the site reconnaissance that were observed to use hazardous materials, have USTs, monitoring wells, soil borings, or any items or business types such as dry cleaners, auto repair, gas stations, etc. that may represent an environmental concern to the subject property are listed in the Site Reconnaissance Summary - Adjacent Sites of Potential Environmental Concern also included in Appendix D.

5.3 Exterior Observations

5.3.1 Hazardous Substances, Drums, and Other Chemical Containers

No hazardous materials, drums, or other chemical containers were observed directly on the road or railroad; however, hazardous materials observed within 20 feet of the railroad included the following:

Sxn	Address/Location	Hazardous Materials Observed	Photo
C1/ C2	200 Beach Avenue	Numerous 55-gallon drums of machine oil and heat transfer fluid. ASTs for waste cooking oil and used white grease, and sodium hypochlorite. No soil staining observed.	36 & 37
C1/ C2	~ Railroad tracks and La Colina	5-gallon bucket of apparent oil/water. No soil staining observed.	38
C1/ C2	~ Railroad tracks and La Colina	5-gallon bucket of apparent oil/water. No soil staining observed.	39
C1	Railroad tracks south of Manchester Blvd.	55-gallon drum tipped over in soil with 1 qt. oil cans spilled on ground. Some soil staining.	53
C1	Railroad tracks between Manchester Blvd. & Westchester Parkway	Various retail chemical containers such as strippers, paint thinner, and paint. No soil staining observed.	54 & 65
C1	Railroad tracks between Manchester Blvd. & Westchester Parkway	5-gallon buckets of latex paint and paint remover. No soil staining observed; however, standing water from rain beneath buckets.	55
C1	Northwest of Westchester Parkway and Arbor Vitae	2-55 gallon drums and diesel AST. Contents of drums unknown. No concrete staining observed.	58
C1	Hertz Rental Cars, Westchester Parkway & Railroad tracks	55-gallon drums of washing solution and antifreeze. No concrete staining observed.	67

5.3.2 Storage Tanks

Evidence of underground storage tanks (USTs) (such as vent lines, fill or overfill ports) was not observed on the subject property.

5.3.3 Polychlorinated Biphenyls (PCBs)

PCBs were once used as industrial chemicals whose high stability contributed to both their commercial usefulness and their long-term deleterious environmental and health effects. PCBs can be present in coolants or lubricating oils used in older electrical transformers, hydraulic systems, and other similar equipment. In 1979, the USEPA generally prohibited the domestic use of PCBs in electrical capacitors, electrical transformers, vacuum pumps, hydraulic pumps, and gas turbines.

Pad-mounted transformers were observed at numerous adjacent sites; however, no pad-mounted transformers were observed on the subject property. Two electrical substations were observed adjacent to the subject property: Inglewood substation at Florence Avenue and Ivy Avenue (Photo No. 43), and another substation at the railroad right-of-way and Isis Avenue (Photo No. 50).

Pole-mounted transformers were not common along the subject property; however, there were some observed along the east-west trending railroad tracks between Crenshaw Boulevard and the Interstate 405 overpass (Photo Nos. 42, 62, and 68). No staining was observed around any of the transformers observed. Should fluid spills or releases from electrical transformers occur, associated remediation efforts are typically the responsibility of the transformer owner per Federal Regulation (40 CFR 761.125).

Based on the above information, the potential for PCBs to have impacted the subject property is considered to be low.

5.3.4 Waste Disposal

Dumpsters for solid waste disposal were observed in the street at some locations for trash pickup for the adjacent sites. No permanent waste disposal containers were observed onsite.

5.3.5 Dumping

Evidence of dumping was not observed on the subject property, with the exception of some debris along the railroad line (Photo Nos. 45 and 59). Some of the debris appeared to be partly burned (Photo No. 45).

5.3.6 Pits, Ponds, Lagoons, Septic Systems, Wastewater, Drains, Cisterns, and Sumps

No drains were observed on the subject property with the exception of frequent storm drains along the roads (Photo Nos. 2 and 3).

5.3.7 Pesticide Use

Pesticides were not observed on the subject property.

5.3.8 Staining, Discolored Soils and/or Corrosion

Minor oil staining of the asphalt from parked cars was observed along the subject property roadways and there was minor to moderate cracking of the asphalt observed that appeared to have a low impact potential (Photo Nos. 13, 15, and 17). Minor oil staining was observed on or adjacent to the railroad right-of-way east of Victoria Avenue (Photo No. 41), and a 55-gallon drum was observed to be leaking oil onto the soil approximately 25 to 50 feet east of the railroad tracks between Manchester Boulevard and Westchester Parkway (Photo No. 53). Staining appeared to be minor and surficial in each instance.

5.3.9 Stressed Vegetation

Stressed vegetation was not observed on the subject property.

5.3.10 Unusual Odors

Unusual odors were not detected on the property, with the exception of paint odors that appeared to emanate from adjacent spray paint facilities for auto body work.

5.3.11 Onsite Wells

Oil or gas production, wells were not observed or reported at the subject property. Groundwater monitoring wells were observed along and adjacent to the alignment corridor at the following locations:

Monitoring Wells Onsite or Crossing Site

Address	Facility Name	Photo
4180 Wilshire Blvd.	Alright Parking Lot (Former Chevron); 1 monitoring well east Lane Crenshaw Blvd., and 2 on west, 20 wells total (2 on property to the west)	6,7,17
701 Crenshaw Blvd.	Vacant Lot – one monitoring well located at west lane of Crenshaw Blvd., part of the former Chevron site listed above	16
1009 Crenshaw Blvd.	Chevron - 1 in west lane, 3 on east lane Crenshaw Blvd., adjacent to Century Sports Club	8
4176 Venice Blvd.	76 Station - west lane of Crenshaw Blvd. (did not observe)	11
3400 Crenshaw Blvd.	Arco - offsite well appears to cross Crenshaw Blvd. and is located northwest at Chevron station	23, 24
5600 Arbor Vitae Street	Dirt lot under construction (former Honeywell) – at least four wells observed west of railroad tracks. Geotracker indicates that wells are also located east of the tracks	57

Borings Locations Onsite

La Brea Blvd.& Sycamore	West lane of La Brea Ave., - two, near storm drain, ~4", possibly utility related	3
817 La Brea Blvd.	In La Brea Ave., near center/west, fronting Goodwill store – two borings, one ~3” & one ~ 6", possibly utility related	5
1102 Crenshaw Blvd.	East of Crenshaw Boulevard, fronting Legal Aid Foundation office – appears to be former monitoring wells and/or borings	9
1235 Crenshaw Blvd.	West lane of Crenshaw Blvd., fronting residential structures - ~12” diameter. Possibly utility related.	12
1111 Crenshaw Blvd.	West lane of Crenshaw Blvd., fronting UC Education Center – labeled as Boring B11	14

Monitoring wells locate onsite are considered to have a High potential to adversely impact the site. The borings located at 1102 and 1111 Crenshaw Boulevard are also considered to have a High potential to adversely impact the subject property; however, the remaining boring locations that appear to likely be utility related and are not located near facilities of concern, are expected to have a Low to Moderate potential to adversely impact the subject property.

5.3.12 Other Observations

Utility plates were observed along Crenshaw Boulevard for sewer, water, and gas. Utility plates were observed along the adjacent sidewalks for traffic signal, lights, and water, as well as water meters and fire hydrants (Photo Nos. 3 and 13).

Numerous patches were observed in the road right-of-ways that appeared to be typical repair or utility work (Photo Nos. 1 and 13).

6.0 INTERVIEWS

Leighton Consulting conducted interviews with persons having knowledge of current or past subject property usage. Interviews were conducted either orally or in the form of a written questionnaire. See Appendix E for a completed Interview Forms.

6.1 Interview with Owner

Leighton Consulting sent an Owner Interview Form to METRO, the owner of the railroad right-of-way. Mr. Matt Fraychineaud, an Environmental and Real Estate Consultant for METRO, returned the form on April 23, 2008. According to Mr. Fraychineaud, the Harbor Subdivision right-of-way has been used as a railroad right-of-way since circa 1900 and METRO purchased the property in approximately 1992. Mr. Fraychineaud was not aware of any environmental concerns associated with the property; however, he sated that Phase I and perhaps Phase II ESAs were conducted for the purchase of the property from BNSF, and that subsurface sampling may have been conducted on portions of the property. Previous reports were not provided to Leighton Consulting for review.

Owner information for the affected parcels was not provided to Leighton Consulting, and interview owner or tenant interviews were not conducted for these properties.

6.2 Interview with Site Property/Manager

See Section 6.1. Leighton Consulting was not provided property manager information for the subject property.

6.3 Interviews with Occupants

See Section 6.1. Leighton Consulting did not interview any occupants associated with the affected parcels.

6.4 Interviews with Local Government Officials

Leighton Consulting did not interview employees with local government agencies to request information regarding historic and current uses of the subject property with the exception of those noted in Section 4.2.

6.5 Interviews with Others

Leighton Consulting did not conduct other interviews for this Phase I ESA.

7.0 FINDINGS

For this study, Leighton Consulting has established classification criteria to assist in identifying the potential impacts of each contaminated or potentially contaminated facility that was identified in the FirstSearch™ environmental database report system, the site reconnaissance, or reviews of other records. Each facility was classified as high, moderate, or low with respect to its type of operation, proximity to the subject property, the anticipated hydrogeologic gradient, field observations, and regulatory information. In general, the classification criteria are:

- High – facilities with known or probable soil/groundwater contamination (i.e. Leaking Underground Storage Tanks [LUSTs]), and facilities where remediation is incomplete or undocumented, and the contamination is known or suspected to exist on the subject property.
- Moderate – facilities with identified or potential soil contamination (i.e. LUSTs), remediation is in progress, or groundwater contamination that does not appear to be migrating and has not been reported on the subject property. Facilities with a heavy industrial/manufacturing background that typically use or have used significant quantities of hazardous materials may also be classified as Moderate.
- Low – facilities that have completed remediation or have historically utilized only small amounts of known contaminants (i.e. small quantity generators or underground storage tanks).

It should be noted that the company names may be former businesses that operated at the associated address.

7.1 Onsite

The following table summarizes the environmental concerns identified onsite, or associated with the affected parcels, that have a classification criterion of Moderate to High. The "ID" column in the table refers to the location identification on Figures 4a to 4d, Environmental Concern Location Maps – letters indicate the offsite facility source of the monitoring well or boring, and numbers refer to the photo number (Appendix B). The "Sxn" column refers to the alignment section within the feature is located. In the "Environmental Concern" column, "monitoring well" indicates that this feature was observed within the subject property right-of-way or that wells cross the subject property. Localized contamination of shallow groundwater may exist in the vicinity of the monitoring wells.

Fig #	ID	Sxn	Facility Name/Address	Environmental Concern	Hazard
4a	D	A1	CIM/Pico Former Lumber Company & facilities with USTs	4550 Pico Blvd., LA 4600-4700 Pico Blvd., LA	Moderate
4a	E	A2	Alright Parking Lot/4180 Wilshire Blvd. to 701 Crenshaw Blvd., LA	Monitoring wells	High
4a	9	A2	Legal Aid Foundation, 1102 Crenshaw Blvd., LA	Borings	High
4a	14	A2	UC Education Center, 1111 Crenshaw Blvd., LA	Borings	High
4a	F	A2	Chevron Gas Station, 1009 Crenshaw Blvd., LA	Monitoring wells	High
4a	I	A1/A2	76 Station, 4176 Venice Blvd., LA	Monitoring wells	High
4a	M	A1/A2	Arco, 3400 Crenshaw Blvd., LA	Monitoring wells	High
4a	P	A1/A2	Former Gulf Oil, 3630 & 3644 Crenshaw Blvd., LA	Former gas station, USTs formerly located fronting Crenshaw Blvd.	High
4a	Q	A1/A2	Cameo Cleaners, 3650 Crenshaw Blvd., LA	Dry cleaners, release of PCE and TCE	Moderate
4c	41	C1/C2	Railroad tracks and East of Victoria Avenue, LA	Staining along railroad tracks	High
4c	38, 39	C1	Directly north of railroad tracks, near La Colina Road, Inglewood	Two buckets of oily water near railroad right-of-way	Moderate
4d	SS	C1	Vacant lot, 5600 Arbor Vitae , LA	Monitoring wells	High
4d	53	C1	West of railroad tracks and south of Manchester Boulevard, LA	55-gallon drum tipped over with 1 quart oil cans spilled on ground, some soil staining	High
4d	54	C1	West of railroad tracks between Manchester Boulevard and Westchester Parkway, LA	Fenced storage area with various retail chemical containers such as strippers, paint thinner, and paint. No soil staining observed.	Moderate
4d	61	C1	Adjacent to railroad tracks, west of Cedar Avenue, Inglewood	Asphalt debris pile	Moderate

Fig #	ID	Sxn	Facility Name/Address	Environmental Concern	Hazard
4d	58	C1	BNSF Railroad Right-of-Way, 550 South of Arbor Vitae, Los Angeles	An unknown release of some type appears to have occurred. May have been mitigated.	Moderate

7.2 Offsite

The following offsite facilities have a classification criterion of Moderate and High based on the current site usage, former site usage, observed hazards, and/or known releases to the subsurface. Some of these facilities may have obtained closure for previous releases but are still classified as Moderate based on the close proximity to the subject property and the potential for residual contamination. The concerns identified in Section 7.1 that are on the affected parcels, or that are associated with offsite facilities, are also listed in this table. Localized contamination of shallow groundwater likely exists in the vicinity of the sites ranked as a High hazard, and may exist around some of the sites ranked as a Moderate hazard.

Fig #	ID	Sxn	Facility Name	Address	Hazard
4a	A	A1	Metropolitan Car Wash	900 La Brea Ave., LA	Moderate
4a	B	A1	Harry's Tow Lot (former KCOP Production Studio)	915 La Brea Ave., LA	Moderate
4a	C	A1	Arco Gas Station	5301 Olympic Blvd., LA	Moderate
4a	D	A1	CIM/Pico Former Lumber Company & facilities with USTs	4550 Pico Blvd., LA 4600-4700 Pico Blvd., LA	Moderate
4a	E	A2	Alright Parking Lot, Former Chevron	4180 Wilshire Blvd., LA	High
4a	F	A2	Chevron Gas Station	1009 Crenshaw Blvd., LA	High
4a	G	A2	American Best Auto Repair Service/Shin Brothers Auto Body and Paint	4100 Olympic Blvd., LA	Moderate
4a	H	A1/A2	Arco Gas Station	4169 Venice Blvd., LA	Moderate
4a	I	A1/A2	76 Gas Station	4176 Venice Blvd., LA	High
4a	J	A1/A2	Mobil Station	1925 Crenshaw Blvd., LA	Moderate
4a	K	A1/A2	Chevron Gas Station	3063 Crenshaw Blvd., LA	Moderate
4a	L	A1/A2	System Cleaners	3631 Crenshaw Blvd., LA	Moderate

Fig #	ID	Sxn	Facility Name	Address	Hazard
4a	M	A1/A2	Arco Gas Station	3400 Crenshaw Blvd., LA	High
4a	N	A1/A2	West Angeles Cathedral (formerly 20th Century Plastics)	3628 Crenshaw Blvd., LA	Moderate
4a	O	A1/A2	Shell Gas Station	3645 Crenshaw Blvd., LA	Moderate
4a	P	A1/A2	Former Gulf Oil	3630 & 3644 Crenshaw Blvd., LA	High
4a	Q	A1/A2	Cameo Cleaners	3650 Crenshaw Blvd., LA	Moderate
4a/4b	R	A1/A2 & B	Lula Washington Dance Theatre	3773 Crenshaw Blvd., LA	High
4b	S	B	Shell Gas Station	6805 Crenshaw Blvd., LA	Moderate
4b	T	B	Former Crenshaw Collision Center	6530 Crenshaw Blvd., LA	Moderate
4c	U	C1/C2	Salvage yard	6745 Victoria Ave., LA	Moderate
4c	V	C1/C2	Enderlo Vault Co.	827 Redondo Blvd., Ing	Moderate
4c	W	C1/C2	So Cal Gas Company, Inglewood Manufactured Gas Plant	700 Warren Lane, Ing	Moderate
4c	X	C1/C2	Manufacturing facilities, including plastic and metal manufacturing, machine shop, and plating works	200-330 Beach Ave., Ing	Moderate
4c	Y	C1/C2	Fujita Corporation	230 La Brea Ave., Ing	Moderate
4d	Z	C1	So Cal Edison Electrical Substation	201 Florence Ave., Ing	Moderate
4d	AA	C1	Former Smoot Holman	311 Florence Ave., Ing	Moderate
4d	BB	C1	Former Kroehler Manufacturing	301 Florence Ave., Ing	Moderate
4d	CC	C1	Blue Diamond Materials (441), Cemex (505), formerly - Foundry (401); Salvage Yard (431); Metal Salvage and Melting (441)	401-505 Railroad Place, Inglewood	Moderate
4d	DD	C1	Former Standard Oil Co. of California and Inglewood Foundry	401-417 Florence Ave., Inglewood	Moderate
4d	EE	C1	Mobil Gas Station, formerly Golden Star Laundry	8307 La Cienega Blvd., Inglewood	High
4d	FF	C1	LAX Equipment	830 Florence Ave., Ing	Moderate
4d	GG	C1	Charles Caine Co.	8325 Hindry Avenue, LA	Moderate
4d	HH	C1	Former Circuit Board Manufacturing and Machine Shop	8331-8341 Hindry Ave., LA	Moderate
4d	II	C1	Zephyr Manufacturing	201 Hindry Ave., Ing	Moderate

Fig #	ID	Sxn	Facility Name	Address	Hazard
4d	JJ	C1	Isis Electrical Substation	8331 Isis Avenue, LA	Moderate
4d	KK	C1	Shell Gas Station	1135 Manchester Blvd., LA	
4d	LL	C1	Budget Truck Rental	5560 Manchester Blvd., LA	High
4d	MM	C1	Former metal spinning (1315), machine shop (1319), dry cleaning plant (1325), and the American Bitumuls & Asphalt Company (1401)	1315-1401 Aviation Blvd., Inglewood	Moderate
4d	NN	C1	Unocal/76 Gas Station	8600 Aviation Blvd., Ing	Moderate
4d	OO	C1	Rho-Chem	425 Isis Avenue, Ing	Moderate
4d	PP	C1	Industrial facilities: electronic manufacturing (8700); plastic manufacturing (8900), auto parts manufacturing (8924), and aircraft tool manufacturing and polishing and plating (9030)	8700-9030 Bellanca Ave., LA Manchester Boulevard to Arbor Vitae Street, west of railroad tracks.	Moderate
4d	QQ	C1	Princeland Properties	1237 Arbor Vitae, Ing	Moderate
4d	RR	C1	Formerly Freight Forwarders/Union Bank/Estate of Joseph Collin/Bodycote Hinderliter/Inglewood Suppliers/Sunsetting Auto Body	9007 – 9121 Aviation Blvd., Inglewood	Moderate
4d	SS	C1	King Delivery (currently vacant lot)	5600 Arbor Vitae, LA	High
4d	TT	C1	Numerous manufacturing facilities including aircraft parts (9632)	9630-9998 Bellanca Ave., LA	Moderate
4d	UU	C1	North American Aviation, Inc., Airplane factory	5601 Imperial Highway	Moderate

7.3 Data Gaps

ASTM E 1527-05 requires review of standard historical sources (SHS) at approximate five-year intervals from at least 1940 to the present, or the earliest development of the site. The availability of extensive historical information varies significantly between locations and it is common to have gaps in the data for one or more of the periods where historical property uses are unknown or uncertain. There is also a potential for unidentified uses to have occurred between data points, or prior to the earliest acquired data.

The earliest data acquired for the subject property indicating past property usage was from 1892. There were intermittent gaps throughout the data collected, where historical property uses are unknown or uncertain.

Leighton Consulting was provided access only to the railroad and street right-of-ways. Access was not provided on any properties located adjacent to the right-of-way and these properties were only inspected from the property boundaries. Fences, vegetation, buildings, etc. limited the observations on many of these properties. Due to the large size of the project, the regulatory database was reviewed to limited radii of 0.25 miles. The scope of work for this Phase I ESA did not include environmental lien searches, city directory reviews, or interviews of owners or tenants of the affected or adjacent parcels.

Based on the use of the subject property for transportation corridor purposes, the data gaps are considered unlikely to alter the conclusions or recommendations of this report.

8.0 OPINION

8.1 Onsite

It is Leighton Consulting's opinion that this assessment has identified areas of potential environmental concern that warrant further investigation prior to construction activities and that this information, as well as any additional subsurface assessment, should be included in a soil mitigation plan prior to construction.

Pesticides and lead arsenates were historically used by railroad companies as a means of week control along right-of-ways and it is Leighton Consulting's opinion that pesticides and lead arsenates may be present in surface soils in the vicinity of the right-of-ways. In addition, railroad ties are often treated with creosote which may be present in the surface soils beneath.

8.2 Offsite

It is Leighton Consulting's opinion that this assessment has identified areas of potential environmental concern that warrant further investigation prior to construction activities and that this information, as well as any additional subsurface assessment, should be included in a soil mitigation plan prior to construction.

Portions of the adjacent properties were formerly used for agricultural purposes, primarily east and west of Crenshaw Boulevard from Exposition Boulevard to Vernon Avenue and east and west of the BNSF railroad right-of-way. It is Leighton Consulting's opinion that pesticides may be present in the near-surface soils in these areas.

9.0 CONCLUSIONS

Leighton Consulting has performed a Phase I ESA in accordance with the scope and limitations of ASTM Practice E 1527-05 of the subject property including the proposed alignments for the Crenshaw-Prairie Transit Corridor Project located in the cities of Los Angeles and Inglewood. Exceptions to, or deletions from this practice are described in Section 1.5 of this report. This assessment has revealed no evidence of RECs in connection with the property with the exception of the following:

- Former agricultural usage adjacent to portions of the subject property that may have used pesticides.
- Usage of portions of the subject property for railroad purposes. Pesticides and lead arsenates were historically used by railroad companies as means of weed control along right-of-ways. In addition, railroad ties are often treated with creosote which may be present in the near-surface soils and undocumented spills from railroad cars may have occurred in the past.
- Hazardous materials, monitoring wells, and borings were observed on the subject property. See Section 7.0 for a full list of items observed and their locations.
- Businesses that operated on the affected parcels or adjacent parcels that represent a moderate to high potential for environmental concern. Localized contamination of groundwater and/or soil was associated with many of these sites. See Section 7.0 for a full list of the identified sites.

Based upon the findings of this Phase I ESA, Leighton Consulting recommends completing the following work discussed below:

- <u>Phase II ESA</u> - Conduct a limited Phase II ESA prior to construction in areas where construction workers may be exposed to impacted soil. A base line soil sampling protocol should be established with special attention to those areas of potential environmental concern identified in this report. The soil should be assessed for constituents likely to be present in the subsurface including, but not limited to, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), pesticides, lead arsenates, and Title 22 metals. The depth of the sampling should be based on the depth of grading or cut and fill activities. In addition, in areas where groundwater will be encountered, samples should also be analyzed for suspected contaminants prior to dewatering. This will ensure that National Pollutant Discharge Elimination System (NPDES) discharge requirements are satisfied.

- Soil Mitigation Plan – A soil mitigation plan should be prepared after final construction plans are prepared showing the lateral and vertical extent of soil excavation during construction. The soil mitigation plan should establish soil reuse criteria, establish a sampling plan for stockpiled materials, describe the disposition of materials that do not satisfy the reuse criteria, and specify guidelines for imported materials. The soil mitigation plan should include a provision that during grading or excavation activities, soil should be screened for contamination by visual observations and field screening for volatile organic compounds with a photo ionization detector (PID). Soil samples that are suspected of contamination based on field observations and PID readings shall be analyzed for suspected chemicals by a California certified laboratory. If contaminated soil is found, it shall be removed, transported to an approved disposal location, and remediated or disposed according to state and federal laws.

- Hazardous Material and Debris Removal - All hazardous materials, drums, trash, and debris shall be removed and disposed of in accordance with regulatory guidelines.

- Health and Safety Plan - A health and safety plan should be developed for persons with potential exposure to the constituents of concern identified in the limited Phase II ESA.

- Construction Observations - Historical and present site usage along the many areas of the proposed alignment included businesses that stored hazardous materials and/or waste and used USTs, from at least the 1920s to the present. It is possible that areas with soil and/or groundwater impacts may be present that were not identified in this report, or were considered a low potential to adversely impact the subject property. In general, observations should be made during any future development activities for features of concern or areas of possible contamination such as, but not limited to, the presence of underground facilities, buried debris, waste drums, tanks, soil staining or odorous soils. Further investigation and analysis may be necessary, should such materials be encountered.

10.0 DEVIATIONS

Leighton Consulting did not deviate from or alter the scope of work, as defined in Section 1.3 of this report.

11.0 ADDITIONAL SERVICES

Leighton Consulting did not perform work outside the scope of work as defined in Section 1.3 of this report.

12.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

12.1 Corporate

Leighton Consulting, Inc. is a California corporation, providing geotechnical and environmental consulting services throughout California. We are solely a consulting firm without interests in real property other than our eight offices in Southern California. We provide professional environmental consulting services including application of science and engineering to environmental compliance, hazardous materials/waste assessment and cleanup, and management of hazardous, solid and industrial waste. Phase I Environmental Site Assessments are a part of this practice area and have been conducted by us.

12.2 Individual

The qualifications of the Project Manager and the other Leighton Consulting environmental professionals involved in this Phase I ESA meet the Leighton corporate requirements for performing Phase I ESAs as specified by ASTM 1527-05. In addition, Ms. Meredith Church is a Registered Professional Geologist.

12.3 Environmental Professional Statement

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental professional as defined by §312.10 of 40 CFR Part 312.

I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Meredith Church, P.G.
Project Geologist

Leighton

Preliminary Hazardous Substance Identification Technical Memo (Subtask 6.2.4)

Crenshaw/LAX Transit Corridor Project
Advanced Conceptual Engineering
Contract E0117

Prepared for:
LA County Metropolitan Transportation Authority
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Prepared by:
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October 2010

This document has been prepared by the Hatch Mott MacDonald Crenshaw/LAX Transit Corridor Team including Hatch Mott MacDonald and the following subconsultants:

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- Base Architecture
- DCA Civil Engineering Group
- Earth Mechanics, Inc.
- Epic Land Solutions
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- Jacobs Engineering Group, Inc.
- J. L. Patterson & Associates
- McKissack & McKissack
- PQM, Inc.
- The Solis Group
- Ultrasystems
- Wagner Engineering & Survey
- Wilson Ihrig & Associates

ISSUE AND REVISION RECORD

Rev	Date	Originator	Checker	Approver	Description
0	6/21/10	M. Hoshiyama	A. Lee, G. Ueblacker, R. Quraishi	H. Law, F. Nourbakhsh	Draft to Metro
1	10/04/10	M. Hoshiyama	A. Lee	H. Law, F. Nourbakhsh	ACE final

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1 EXECUTIVE SUMMARY

The Los Angeles County Metropolitan Transportation Authority (Metro) is planning transit improvements in the Crenshaw/LAX Transit Corridor to accommodate demand for travel in north-south and east-west directions. These improvements will provide more direct service between downtown Los Angeles and Los Angeles International Airport (LAX), and important connections between the Crenshaw corridor and downtown Los Angeles, the Westside, and the South Bay.

As part of the advanced conceptual engineering design, Metro has requested that Hatch Mott MacDonald prepare a preliminary hazardous substance identification technical memo. As a subconsultant to Hatch Mott MacDonald, Earth Mechanics, Inc. (EMI) assists the design team in geotechnical engineering and environmental sampling in this advanced conceptual engineering design phase.

Based on the knowledge of the geotechnical conditions along the project alignment and the understanding of the project requirements, it was originally planned to conduct a field exploration program consisting of drilling thirty three (33) borings along the proposed structure alignments, including one boring at each elevated station, to a depth of about 100 feet and eleven (11) borings to a depth of 30 feet for at-grade tracks and stations. Four (4) of the borings to a depth of 30 feet were originally planned at the potential maintenance facility sites. One of the potential sites (Site 11) was no longer considered by the project team, which resulted in the elimination of two (2) 30-foot borings. Four (4) downhole P-S loggings to measure shear wave velocities of the upper 100 feet of soil, four (4) Packer testing to estimate groundwater extraction rates, and ten (10) pressuremeter tests to determine stress-strain relationship of subsurface soils were performed during our field exploration. Where groundwater was encountered, up to four (4) borings were converted to monitoring wells. In addition, thirteen (13) Cone Penetration Tests (CPTs) were to be performed to obtain continuous profile of subsurface soils. Besides geotechnical sampling, environmental sampling of soil and water were performed within eighteen (18) of the 100 feet deep borings, three (3) of the 30 feet deep borings, two (2) of the 50 feet deep borings at each maintenance facility site. This technical memo presents the results of the environmental analytical testing conducted to date as part of the Crenshaw/LAX Transit Corridor Project.

4 HAZARDOUS MATERIALS

4.1 General

The proposed Crenshaw/LAX Corridor utilizes both local arterial streets and railroad right-of-ways, and its alignment is entirely within urbanized areas. With single- and multi-family residential properties at its outskirt, land uses within the study areas include: primarily commercial along Crenshaw Blvd., light industrial and commercial along the BNSF Harbor Subdivision railroad track, LAX and its supporting facilities along Aviation Blvd. Past agricultural usage are known for lands around Crenshaw Blvd. between Exposition Blvd. and Vernon Ave., as well as lands around railroad tracks between Regent St. and Imperial Highway prior to their redevelopment. In addition, the alignment traverses the northern margin of the Potrero oilfield approximately between La Brea Ave. and Manchester Blvd., with the Inglewood oilfield located to its immediate northwest. For a transit corridor crossing densely populated urbanized areas and production oilfields, the potential of encountering hazardous wastes as well as petroleum-contaminated soils and groundwater during tunnel excavations and structural foundation installations is always present.

A Phase-I Environmental Site Assessment was performed by Leighton Consulting, Inc. in 2008 to identify environmental conditions of the proposed alignment. Results of the assessment were included in the Environmental Impact Statement/Environmental Impact Report in 2009. The assessment ranked potentially contaminated parcels both on- and off-site along the corridor alignment with a three-grade (high, moderate, and low) classification system. Table 4-1 summarized the environmental issues concerning the affected on-site parcels.

Table 4-1 – On-Site Identified Areas of Concerns and Potential Hazardous Materials

Facility Name/ Location	Observed Concerns	Hazard Level
Crenshaw Blvd. between Exposition Blvd. and Vernon St.	Former agricultural usage; possible pesticides.	High
Former Gulf Oil at 3640 & 3644 Crenshaw Blvd.	Former gas station; UST's formerly fronting Crenshaw Blvd.	High
Camao Cleaner at 3650 Crenshaw Blvd.	Dry cleaner; release of perchloroethylene and trichloroethylene to subsurface	Moderate
Railroad tracks and east of Victoria Ave.	Staining along railroad tracks	High
Harbor Subdivision railroad	Railroad usage; possible lead arsenates and/or pesticides for weed control, likely creosote for railroad ties.	High
Directly north of railroad tracks near La Colina	Two buckets of oily water near railroad right-of-way	Moderate
Vacant lot at 5600 Arbor Vitae	Monitoring wells to east and west of railroad tracks	High
West of railroad tracks and south of Manchester Blvd.	55-gallon drum tipped over with 1-quart spilled oil cans on the ground, some soil staining	High
West of railroad tracks between Manchester Blvd. and Westchester Parkway	Fenced storage area with various retail chemical containers such as strippers, paint thinner and paint, no soil staining observed	Moderate
Adjacent to railroad tracks west of Cedar Ave.	Asphalt debris pile	Moderate
East and west of Harbor Subdivision railroad tracks between Regent St. and Imperial Highway	Former agricultural usage; possible pesticides.	High

4.2 Naturally Occurring Contamination

4.2.1 Oil Fields

According to the California Conservation Division of Oil, Gas, and Geothermal Resources (DOGGR), the proposed transit corridor is within the vicinity of numerous oil fields, including Las Cienegas Oil Field to the north, El Segundo Oil Field to the South, and Inglewood Oil Field to the northwest (see Figure 4-1). The Florence Avenue/Harbor Subdivision segment of the transit corridor traverses through the existing Potrero Oil Field (Figure 4-2).

Common problems associated with oil field properties include methane and hydrogen sulfide soil gas, oil seepage, contaminated soils, leaking wells, and wells not plugged and abandoned to current standards.

Based on review of the Oil Field Map and the DOGGR database, there are numerous plugged and abandoned oil wells that exist proximal to the project alignment. EMI performed environmental soil and groundwater testing for Total Petroleum Hydrocarbons (TPH) throughout the project alignment. The results are discussed in section 6.

4.2.2 Methane

Existing oil fields may contain naturally occurring methane. The City of Los Angeles has delineated Methane and Methane Buffer Zones that require soil gas evaluations and appropriate mitigation if necessary (Figure 4-3). The proposed corridor alignment traverses through an identified Methane Buffer Zone. The accumulation of methane gas in an enclosed area can create a highly flammable condition. In addition, the breathing of methane in high concentrations can lead to asphyxiation and the burning of methane produces toxic gases (Eltschaleger and others, 2001). EMI tested groundwater samples for dissolved methane as part of the environmental screening for the site. Results are provided in section 6.2.

4.3 Artificial (Man-Made) Contamination

The project corridor is located within the Los Angeles Basin and traverses through heavily urbanized areas of Los Angeles. As a result, man-made hazardous materials are likely to exist throughout the areas in and around the project alignment. Hazardous materials associated with artificial contamination include petroleum hydrocarbons, volatile organic compounds, pesticides, and metals. These contaminants are usually associated with industrial and/or commercial land uses. As an example, soil and groundwater contamination is often found at gas stations, dry cleaners, and manufacturing facilities. Residential land uses can also lead to contamination through activities often associated with lead-based paints, asbestos, and pesticides. Contamination is most often derived from gasoline and solvents. Metals like lead, mercury, arsenic, and chromium are also common.

The results of the environmental field and laboratory soil and groundwater testing for man-made contaminants are provided in section 6.

5 ENVIRONMENTAL SCREENING

5.1 Environmental Soil and Water Sampling

Environmental sampling of twenty three (23) exploratory geotechnical soil borings (Borings A-10-003, A-10-007, A-10-009, A-10-010, A-10-011, A-10-014, A-10-016, A-10-019, A-10-021, A-10-025, A-10-029, A-10-031, A-10-033, A-10-034, A-10-036, A-10-041, A-10-044, A-10-045, A-10-048, A-10-050, A-10-051, A-10-054, and A-10-055) was performed along transit corridor. Locations of these borings are shown on Figure 5-1. Selected soil and groundwater samples collected from each boring were scheduled for chemical analyses. The environmental evaluation was not intended to delineate and fully assess the extent of contamination beyond the boundaries of the subject area, but to characterize the soils within the subject area only.

A qualified EMI environmental scientist conducted the environmental soil and groundwater sampling. A portion of soil from each sample collected was placed into a sterilized glass container provided by the environmental testing company. Sample labels with appropriate information were affixed onto the sides of the jars for identification purposes. Samples were stored in an ice-filled chest until delivery to the analytical laboratory at the end of the field day.

Water samples were obtained from the borings listed above, where groundwater was found. The water samples were collected using a new sterile plastic bailer. Once the samples were collected, they were placed in designated and sterilized glass containers, depending on the type of testing to be performed. These glass containers were stored in an ice-filled chest until delivery to the analytical laboratory at the end of the same day. Additional water samples were taken during well monitoring and new water samples were tested from the existing wells (A-10-036 and A-10-048). Test results are in Appendix C.

Each soil sample was screened in the field for volatile organic compound vapors using a portable Photoionization Detector (PID). The PID was calibrated to isobutylene according to the manufacturer’s instructions. Field screening was performed to detect the presence of volatile organic compounds in soil samples and as a health and safety-monitoring tool. Headspace measurements of each collected soil sample were also conducted during sampling activities, utilizing the PID. These tests were conducted by placing a soil-sample in a sealed bag, breaking up the soil, and then letting it sit for approximately 15 minutes. A reading was then taken by placing the PID tip into the sealed bag. Wells were also sniffed for VOC release after opening the well cover.

Drillers were instructed to notify the onsite engineer/geologist of any potential odors emanating from soil cuttings. Such odors were not encountered during drilling. The onsite geologist/engineer also reviewed each soil sample for possible staining and/or odor.

5.2 Environmental Laboratory (Soil and Water) Testing

Soil and groundwater samples obtained from the borings drilled along the project alignment were transported under standard chain-of-custody to Test America Laboratories, Inc. in Irvine, California. Test America Laboratories, Inc. is accredited by the California State Department of Health Services under the Environmental Laboratory Accreditation Program for the analytical methods used in testing the soil samples (Accreditation Nos. 2706 and 1108, respectively).

Selected soil samples from each boring were analyzed for the following potential contaminants:

- Petroleum hydrocarbons using EPA Methods 8015 (carbon chain) and 418.1
- Volatile organic compounds using EPA Method 8260B;
- Title 22 metals using EPA Method 6010B; and
- Pesticides using EPA Method 8270.

Each collected groundwater sample was analyzed for the following potential contaminants:

- Total Petroleum Hydrocarbons quantified against a gasoline standard (TPHg) by modified EPA Method 8015;
- Dissolved Methane by EPA Method 3810;
- Polynuclear Aromatic Hydrocarbons (PNAs) by EPA Method 8270C; and
- pH by EPA Method 9040.

The laboratory testing was performed using appropriate QA/QC procedures. A copy of the laboratory report for the soil and groundwater sample analyses is provided at the end of Appendix C.

6 PRELIMINARY FINDINGS AND CONCLUSIONS

6.1 Soil Contamination

6.1.1 Field Screening Observations

Field screening of the soil samples collected during the current investigation included: (1) screening for organic vapor emissions using a PID; (2) visual observation of the soil samples for integrity, discoloration and staining; and (3) noting the presence of any unusual odors. The PID readings were measured in volumetric parts per million (ppm) and are shown on the subsurface cross section in Appendix B.

The results of the field screening generally provided no visual indication of significant chemical contamination within the soil samples collected from the borings. With the exception of Boring R-10-002, A-10-009, A-10-010, and R-10-053, the recorded PID readings were non-detectable or relatively low. Boring R-10-002 yielded VOC levels ranging from 11 to 214 ppm with high VOC levels at depths of 20’, 50’, 60’, and 80’. Boring A-10-009 VOC levels that ranged from 54.1 to 82.7 ppm at depths of 5’, 25’, and 55’. High PID readings in Boring A-10-010 ranged from 20.7 to 21.8 ppm depths of 20’ and 60’. Boring R-10-053 yielded a PID sample reading of 45.5 ppm at a depth of 10 feet. PID readings are shown on the Subsurface Cross Section in Appendix B.

6.1.2 Soil Analysis Summary and Conclusions

The laboratory analytical reports and chain of custody records are provided in Appendix C. The following conclusions regarding soil contamination are based upon the information obtained during the field investigation and from laboratory analyses.

Petroleum Hydrocarbons. Visual evidence of soils impacted with petroleum hydrocarbon was not encountered during soil sampling. Twenty three of the 65 soil samples analyzed for the Crenshaw Boulevard segment were reported with very low petroleum hydrocarbon concentrations. The concentrations reported (5.2 to 73 mg/kg) are significantly lower than agency action limits (generally between 100 and 1,000 mg/kg). The soil samples reported with detectable petroleum hydrocarbons were collected between 0 and 50 feet below ground surface. The source of these hydrocarbons is unknown, but suspected of being either related to the overlying asphalt, decomposing organics or minor motor oil releases, as indicated by the higher carbon range detected.

Based on the petroleum hydrocarbon data collected, relatively low petroleum hydrocarbon concentrations should be anticipated locally in the near surface soils along the Crenshaw Boulevard segment. Soils impacted with significant petroleum hydrocarbons quantities are not, however, anticipated. Test results for Petroleum Hydrocarbons are shown in Table 6-1.

Table 6-1 – Petroleum Hydrocarbon Analyses

Sample ID (Depth)	**GRO (C4–C12) (mg/kg)**	**DRO (C13–C23) (mg/kg)**	**ORO (C24–C44) (mg/kg)**	**EFH (C13–C44) (mg/kg)**
Detection Limits	0.38-0.40	5	5	5
A-10-003 (0-10’)	-	ND	36	40
A-10-003 (10’)	-	ND	ND	ND
A-10-003 (20’)	-	ND	5.2	7.4
A-10-003 (30’)	-	18	27	45
A-10-003 (40’)	-	ND	ND	ND
A-10-007 (0-5’)	-	7.9	65	73
A-10-007 (10’)	-	6.9	9.3	16
A-10-007 (20’)	-	ND	ND	ND
A-10-007 (30’)	-	ND	ND	7.8
A-10-007 (40’)	-	ND	ND	ND
A-10-009 (0-5’)	-	7.7	20	28
A-10-009 (10’)	-	ND	ND	ND
A-10-009 (20’)	-	ND	ND	7.6
A-10-009 (30’)	-	24	14	37
A-10-009 (40’)	-	9.3	8.6	18
A-10-010 (0-5’)	ND	ND	ND	ND
A-10-011 (15’)	ND	ND	ND	5.9
A-10-011 (20’)	ND	19	11	31
A-10-011 (25’)	ND	ND	ND	ND
A-10-014 (15’)	ND	ND	ND	ND
A-10-014 (25’)	ND	ND	ND	ND
A-10-014 (50’)	ND	ND	22	25
A-10-016 (10’)	ND	ND	ND	ND
A-10-016 (20’)	ND	ND	ND	ND
A-10-016 (30’)	ND	ND	ND	ND
A-10-019 (10’)	ND	ND	ND	ND
A-10-019 (20’)	ND	ND	ND	ND
A-10-019 (30’)	ND	ND	ND	ND
A-10-021 (5’)	ND	ND	ND	7.0

Sample ID (Depth)	GRO (C4–C12) (mg/kg)	DRO (C13–C23) (mg/kg)	ORO (C24–C44) (mg/kg)	EFH (C13–C44) (mg/kg)
A-10-021 (25’)	ND	ND	ND	6.0
A-10-021 (35’)	ND	ND	ND	ND
A-10-021 (51’)	ND	ND	ND	ND
A-10-025 (5’)	ND	ND	ND	ND
A-10-025 (25’)	ND	ND	ND	ND
A-10-025 (30’)	ND	ND	ND	ND
A-10-025 (45’)	ND	ND	ND	ND
A-10-029 (5’)	ND	ND	ND	5.6
A-10-029 (10’)	ND	ND	ND	ND
A-10-029 (20’)	ND	ND	ND	ND
A-10-031 (10’)	ND	ND	ND	ND
A-10-031 (20’)	ND	5.7	ND	9.9
A-10-031 (30’)	ND	ND	ND	ND
A-10-031 (40’)	ND	ND	ND	6.1
A-10-033 (10’)	ND	ND	ND	ND
A-10-033 (20’)	ND	ND	ND	ND
A-10-033 (30’)	ND	ND	ND	ND
A-10-033 (40’)	ND	ND	ND	ND
A-10-033 (50’)	ND	ND	ND	ND
A-10-034 (3’-5’)	-	ND	15	16
A-10-034 (20’)	-	18	26	44
A-10-034 (30’)	-	ND	ND	ND
A-10-034 (40’)	-	ND	ND	ND
A-10-034 (50’)	-	ND	ND	ND
A-10-041 (5’)	ND	ND	ND	ND
A-10-041 (15’)	ND	ND	ND	ND
A-10-041 (21’)	ND	ND	ND	ND
A-10-045 (10’)	ND	ND	ND	ND
A-10-045 (20’)	ND	ND	ND	ND
A-10-045 (40’)	ND	ND	ND	ND
A-10-045 (50’)	ND	ND	ND	ND
A-10-051 (15’)	-	ND	ND	7.5
A-10-051(25’)	-	ND	ND	ND

Sample ID (Depth)	GRO (C4–C12) (mg/kg)	DRO (C13–C23) (mg/kg)	ORO (C24–C44) (mg/kg)	EFH (C13–C44) (mg/kg)
A-10-051 (40’)	-	12	11	22
A-10-054 (0-5’)		ND	15	19
A-10-055 (0-5’)		5.2	10	16

Notes:
Analyzed using EPA Test Method 8015B.
GRO = Gasoline Range Organics, DRO = Diesel Range Organics, ORO = Oil Range Organics, EFH = Extractable Hydrocarbons
mg/kg Milligrams per kilogram; equivalent to parts per million.
ND Not detected at or above the laboratory detection limit cited.
--- Not analyzed.

Volatile Organic Compounds. VOC levels for all 65 samples tested as part of this phase of testing were below detection limits except for one sample in Boring A-10-031 at 10 feet below grade. This sample was reported with a relatively low concentration of tetra-chloroethene. The reported concentration is considered well below environmental screening levels (RWQCB). Test results for VOC levels are shown in Table 6-2.

Table 6-2 – Volatile Organic Compound Analyses

Sample ID (Depth)	Benzene (µg/kg)	Ethyl-benzene (µg/kg)	Naphthalene (µg/kg)	Toluene (µg/kg)	1,2,4-TMB (µg/kg)	1,3,5-TMB (µg/kg)	Xylenes (µg/kg)	Tetra-chloroethene (µg/kg)
Detection Limits	2.0	2.0	5.0	2.0	2.0	2.0	2.0	2.0
A-10-003 (0-10’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-003 (10’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-003 (20’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-003 (30’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-003 (40’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-007 (0-5’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-007 (10’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-007 (20’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-007 (30’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-007 (40’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-009 (0-5’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-009 (10’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-009 (20’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-009 (30’)	ND	ND	ND	ND	ND	ND	ND	ND

Sample ID (Depth)	Benzene (µg/kg)	Ethyl-benzene (µg/kg)	Naphthalene (µg/kg)	Toluene (µg/kg)	1,2,4-TMB (µg/kg)	1,3,5-TMB (µg/kg)	Xylenes (µg/kg)	Tetra-chloroethene (µg/kg)
A-10-009 (40')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-010 (0-5')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-011 (15')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-011 (20')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-011 (25')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-014 (15')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-014 (25')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-014 (50')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-016 (10')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-016 (20')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-016 (30')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-019 (10')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-019 (20')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-019 (30')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-021 (5')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-021 (25')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-021 (35')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-021 (51')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-025 (5')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-025 (25')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-025 (30')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-025 (45')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-029 (5')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-029 (10')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-029 (20')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-031 (10')	ND	ND	ND	ND	ND	ND	ND	2.0
A-10-031 (20')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-031 (30')	ND	ND	ND	ND	ND	ND	ND	ND
A-10-031 (40')	ND	ND	ND	ND	ND	ND	ND	ND

Sample ID (Depth)	Benzene (µg/kg)	Ethyl-benzene (µg/kg)	Naphthalene (µg/kg)	Toluene (µg/kg)	1,2,4-TMB (µg/kg)	1,3,5-TMB (µg/kg)	Xylenes (µg/kg)	Tetra-chloroethene (µg/kg)
A-10-033 (10’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-033 (20’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-033 (30’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-033 (40’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-033 (50’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-034 (3’-5’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-034 (20’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-034 (30’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-034 (40’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-034 (50’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-041 (5’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-041 (15’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-041 (21’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-045 (10’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-045 (20’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-045 (40’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-045 (50’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-051 (15’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-051 (25’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-051 (40’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-054 (0-5’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-055 (0-5’)	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
Analyzed using EPA Test Method 8260B.
TMB Trimethylbenzene
µg/kg Micrograms per kilogram; equivalent to parts per billion.
ND Not detected at or above the laboratory detection limit cited.

Metals. All 65 soil samples collected during this investigation were analyzed for toxic metals (Title 22 metals). Six to thirteen metals were detected in each collected soil sample. Most of the reported metal concentrations were within anticipated background levels for Southern California. None of the reported results yielded contamination levels exceeding the referenced Total Threshold Limit Concentrations (TTLC). One sample at A-10-031 at 10 feet of depth yielded an elevated arsenic level (28 mg/kg) well above the Western U.S. Mean. As a guideline, the state regulations stipulate that the STLC test shall be performed if the analytical result for TTLC shows a result greater than 10 times the STLC limit. Based on this guideline, the elevated arsenic level is still considered non-hazardous as it is still below 10 times the STLC limit of 50 mg/kg. The source of these metals is unknown. Test results for Metals levels are shown in Table 6-3.

Table 6-3 – Metal Analyses

Sample ID (Depth)	METALS													
	As	**Ba**	**Be**	**Cd**	**Cr**	**Co**	**Cu**	**Pb**	**Hg**	**Mo**	**Ni**	**Se**	**V**	**Zn**
Detection Limits	**2.0**	**0.99**	**0.49**	**0.49**	**0.99**	**0.99**	**2.0**	**2.0**	**0.020**	**2.0**	**2.0**	**2.0**	**0.99**	**4.9**
TTLC	500	10,00	75	100	2,500	8,000	2,500	1,000	20	3,500	2,000	100	2,400	5,000
STLC (mg/L)	5	100	0.75	1	560	80	25	5	0.2	350	20	1	24	250
Western*** U.S. Mean	6.1	560	0.6	1	38	8	21	18	0.055	3	16	0.25	66	51
A-10-003 (0-10’)	9.1	76	ND	0.67	14	5.0	14	21	0.023	ND	7.8	ND	28	45
A-10-003 (10’)	3.5	120	0.54	0.98	24	9.8	50	4.5	0.032	ND	13	ND	54	69
A-10-003 (20’)	2.5	46	ND	ND	14	3.4	8	ND	0.037	ND	7.2	ND	19	19
A-10-003 (30’)	ND	25	ND	ND	9.1	2.3	9	ND	ND	ND	6.5	ND	13	13
A-10-003 (40’)	5.5	160	0.61	1.4	28	12	50	4.9	0.055	ND	24	ND	64	80
A-10-007 (0-5’)	9.6	94	ND	0.83	16	5.6	25	27	0.038	ND	9.5	ND	33	64
A-10-007 (10’)	3.2	120	0.57	0.93	20	9.0	36	3.9	0.044	ND	13	ND	48	60
A-10-007 (20’)	4.7	190	ND	1.6	26	13	39	8.0	0.082	ND	25	ND	61	75
A-10-007 (30’)	4.1	190	0.72	1.3	27	13	40	6.1	0.053	ND	17	ND	63	83
A-10-007 (40’)	3.4	20	ND	ND	11	1.8	21	ND	ND	ND	6.0	ND	19	17
A-10-009 (0-5’)	2.4	87	ND	0.60	14	5.6	10	5.2	0.048	ND	8.9	ND	28	32
A-10-009 (10’)	3.1	120	ND	0.77	17	8.0	17	4.4	0.059	ND	12	ND	41	51
A-10-009 (20’)	2.3	100	ND	0.72	14	6.9	22	3.4	0.024	ND	9.6	ND	35	50
A-10-009 (30’)	2.1	140	0.51	0.98	21	9.1	28	6.1	0.047	ND	13	ND	46	69
A-10-009 (40’)	8.9	160	ND	1.4	25	13	53	6.9	0.026	ND	23	ND	63	88
A-10-010 (0-5’)	3.7	150	0.66	0.96	26	11	19	6.3	0.068	ND	16	ND	56	61
A-10-011 (15’)	4.0	160	0.91	ND	32	10	27	6.0	0.030	ND	19	ND	58	68
A-10-011 (20’)	5.6	90	0.61	ND	26	8.2	24	4.3	0.036	ND	14	ND	48	49
A-10-011 (25’)	2.0	25	ND	ND	15	2.1	5.0	ND	0.030	ND	6.9	ND	17	12
A-10-014 (15’)	3.5	150	0.74	ND	22	9.9	21	4.4	0.035	ND	16	ND	55	58
A-10-014 (25’)	6.0	180	0.92	0.69	39	12	36	6.6	0.051	ND	25	ND	79	79

Sample ID (Depth)	METALS													
	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	V	Zn
A-10-014 (50’)	3.2	130	0.72	ND	37	8.5	24	4.8	0.043	2.7	17	ND	55	54
A-10-016 (10’)	2.1	120	0.50	0.82	21	9.9	36	4.1	0.044	ND	14	ND	49	64
A-10-016 (20’)	ND	120	ND	0.74	21	8.2	19	3.4	0.049	ND	13	ND	44	55
A-10-016 (30’)	ND	160	ND	ND	14	5.6	25	ND	ND	ND	9.7	ND	27	40
A-10-019 (10’)	4.5	150	ND	1.2	33	13	33	7.8	0.070	ND	25	ND	73	72
A-10-019 (20’)	ND	100	ND	0.79	21	7.3	16	2.7	0.16	ND	12	ND	35	56
A-10-019 (30’)	2.1	70	ND	0.61	20	5.7	14	3.2	0.038	ND	9.3	ND	39	37
A-10-021 (5’)	3.3	130	0.50	1.1	26	9.9	21	4.2	0.034	ND	17	ND	54	62
A-10-021 (25’)	ND	42	ND	ND	22	3.0	6.3	ND	0.022	ND	4.7	ND	19	19
A-10-021 (35’)	ND	30	ND	ND	5.8	1.6	3.3	ND	0.025	ND	2.6	ND	11	10
A-10-021 (51’)	3.7	56	ND	0.76	18	7.0	48	2.5	0.042	ND	11	ND	46	50
A-10-025 (5’)	3.3	120	ND	1.0	23	10	21	4.4	0.033	ND	16	ND	47	57
A-10-025 (25’)	3.1	140	ND	1.1	25	11	23	4.3	0.076	ND	18	ND	55	61
A-10-025 (30’)	ND	36	ND	ND	7.5	2.6	15	ND	0.051	ND	4.2	ND	15	20
A-10-025 (45’)	ND	58	ND	0.50	11	3.7	8.7	2.0	ND	ND	6.2	ND	28	22
A-10-029 (5’)	6.7	140	ND	1.1	22	8.4	16	9.1	0.035	ND	15	ND	43	48
A-10-029 (10’)	ND	73	ND	0.73	14	4.3	8.8	ND	0.048	ND	6.7	ND	42	24
A-10-029 (20’)	ND	61	ND	0.73	15	5.9	79	2.4	0.046	ND	11	ND	30	64
A-10-031 (10’)	28	110	ND	1.1	20	7.2	18	7.5	0.050	ND	12	ND	42	73
A-10-031 (20’)	ND	120	ND	0.62	17	8.1	19	2.3	0.041	ND	12	ND	41	53
A-10-031 (30’)	ND	110	ND	0.63	16	8.2	20	2.7	0.058	ND	12	ND	42	51
A-10-031 (40’)	2.9	91	0.57	0.77	16	7.7	38	4.7	0.027	ND	11	ND	51	53
A-10-033 (10’)	3.1	120	0.68	ND	23	9.3	21	4.3	ND	ND	14	4.0	62	54
A-10-033 (20’)	3.6	92	0.79	ND	21	7.2	43	5.3	0.023	ND	13	4.0	63	49
A-10-033 (30’)	ND	74	ND	ND	48	3.4	6.5	2.0	0.039	5.3	4.2	ND	23	18
A-10-033 (40’)	ND	200	0.79	ND	28	22	35	7.7	0.034	ND	19	5.0	52	67
A-10-033 (50’)	ND	170	0.79	ND	23	13	79	5.6	0.049	ND	15	4.1	55	85
A-10-034 (3’-5’)	2.5	150	0.77	ND	24	9.4	15	6.0	0.055	ND	16	4.2	43	76

Sample ID (Depth)	METALS												
	As	**Ba**	**Be**	**Cd**	**Cr**	**Co**	**Cu**	**Pb**	**Hg**	**Mo**	**Ni**	**Se**	**V**	**Zn**
A-10-034 (20')	2.2	110	ND	ND	18	5.9	13	2.7	0.084	ND	7.8	ND	40	240
A-10-034 (30')	ND	65	ND	ND	12	4.3	26	ND	0.029	ND	5.8	3.3	34	37
A-10-034 (40')	2.3	95	ND	ND	25	6.3	13	2.9	0.073	2.0	8.7	5.2	36	49
A-10-034 (50')	2.0	87	0.50	ND	17	6.2	48	3.2	0.026	ND	8.6	2.3	36	82
A-10-041 (5')	2.1	150	0.52	0.95	23	9.4	17	4.1	0.034	ND	14	ND	45	47
A-10-041 (15')	2.2	150	0.52	0.96	24	11	18	4.1	0.031	ND	16	ND	42	50
A-10-041 (21')	ND	27	ND	ND	4.6	2.0	4.0	ND	0.041	ND	3.0	ND	13	14
A-10-045 (10')	ND	100	ND	0.65	18	6.6	13	2.7	ND	ND	11	ND	36	39
A-10-045 (20')	2.5	120	ND	0.75	21	8.4	18	3.3	0.15	ND	12	ND	44	50
A-10-045 (40')	ND	45	ND	ND	11	2.8	5.3	ND	0.037	ND	3.4	ND	21	18
A-10-045 (50')	ND	28	ND	ND	3.3	1.5	6.0	ND	ND	ND	ND	ND	9.7	11
A-10-051 (15')	2.8	100	0.50	ND	17	8.3	18	3.4	0.045	2.8	11	4.7	37	67
A-10-051 (25')	2.8	170	0.59	ND	25	8.9	20	4.2	0.040	2.3	13	3.9	42	63
A-10-051 (40')	ND	60	ND	ND	17	3.7	37	ND	0.076	2.0	3.5	3.2	25	86
A-10-054 (0-5')	3.4	110	0.58	0.95	26	9.0	19	5.7	0.047	ND	16	ND	45	56
A-10-055 (0-5')	3.0	120	ND	0.89	23	8.3	20	6.4	0.030	ND	15	ND	44	52

* Metal analyses conducted using EPA Method 6010B, except mercury – analyzed using EPA Method 7471. Results reported in milligrams per kilogram.
** Sb = Antimony, As = Arsenic, Ba = Barium, Be = Beryllium, Cd = Cadmium, Cr = Chromium, Co = Cobalt, Cu = Copper, Pb = Lead, Hg = Mercury, Mo = Molybdenum, Ni = Nickel, Se = Selenium, Ag = Silver, Tl = Thallium, V = Vanadium, Zn = Zinc.
*** From Conner & Schachlette, 1975, Background Geochemistry of Some Rocks, Soil, Plants, and Vegetables in the Conterminous U.S, U.S. Dept of the Interior.
ND Not detected at or above the laboratory detection limit cited.
TTLC Total threshold limit concentration. If a substance in a waste equals or exceeds its TTLC level (bold results), it is considered a hazardous toxic waste.
STLC Soluble threshold limit concentration. These limits are used for a separate analyses referred to as the Waste Extraction Test (WET) not conducted during this investigation.

Pesticides. Samples collected in the upper five feet were also tested for pesticide contamination. No pesticides were detected during this phase of environmental testing. Test results for Pesticides levels are shown in Table 6-4.

Table 6-4 – Pesticide Analyses

Sample ID (Depth)	DDD (µg/kg)	DDE (µg/kg)	DDT (µg/kg)
Detection Limits	**5.0**	**5.0**	**5.0**
A-10-003 (0-10')	ND	ND	ND
A-10-007 (0-5')	ND	ND	ND
A-10-009 (0-5')	ND	ND	ND
A-10-010 (0-5')	ND	ND	ND
A-10-021 (5')	ND	ND	ND
A-10-025 (5')	ND	ND	ND
A-10-029 (5')	ND	ND	ND
A-10-034 (3'-5')	ND	ND	ND
A-10-041 (5')	ND	ND	ND
A-10-054 (0-5')	ND	ND	ND
A-10-055 (0-5')	ND	ND	ND

Notes:
Analyzed using EPA Test Method 8081A.
DDD = Dichlorodiphenyl-dichloroethane, DDE = Dichlorodiphenyl-dichloroethylene,
DDT = Dichlorodiphenyl-trichloroethane
µg/kg Micrograms per kilogram; equivalent to parts per billion.
ND Not detected at or above the laboratory detection limit cited.

6.2 Groundwater Contamination

Chemical analyses were conducted on groundwater samples collected from four boreholes during the site investigation program at various times. Additional samples were taken and tested from the two installed groundwater monitoring wells at Borings A-10-036 and A-10-048. The laboratory analytical reports and chain of custody records are provided in Appendix C.

Groundwater Field Measurements. Field screening of water samples collected from the installed wells was conducted during groundwater monitoring. Water samples were screened for organic vapor emissions using a PID. Sample readings ranged from 0.9 to 22.3 ppm as shown in Table 6-5.

Table 6-5 – Groundwater PID Field Measurements

Sample ID (Depth)	Date	Initial Reading – P.I.D. (ppm)	Reading After 1 Minute -P.I.D.(ppm)
A-10-036-W (98.2')	4/26/10	11.0	0.9
A-10-048-W (54.5')	4/26/10	22.3	3.6

Notes:
Ppm – parts per million

Petroleum Hydrocarbons. Based on the laboratory test results, only four of the eight water samples were reported to have petroleum hydrocarbon concentrations. Samples from A-10-003 and A-10-009 were reported to have concentrations of GRO (C4-C12) ranging from 86 to 110 micrograms per liter. The sample from boring A-10-048 was reported to have low concentrations of both DRO (C13-23) and EFH (C13-C44). Also a sample from boring A-10-051 was reported to have concentrations of DRO (C13-23), ORO (C24-C44), and EFH (C13-C44) all above the detection limits. The concentration levels ranged from 0.6 to 1.9 mg/l and are considered to be well below environmental screening levels, which are on the order of 25 mg/L or 25,000 **µ**g/L for groundwater contamination [Regional Water Quality Control Board (RWQCB)]. Test results for Petroleum Hydrocarbons levels are shown in Table 6-6.

Table 6-6 – Groundwater Petroleum Hydrocarbon Analyses

Sample ID (Depth)	GRO (C4–C12) (µg/)	DRO (C13–C23) (mg/l)	ORO (C24–C44) (mg/l)	EFH (C13–C44) (mg/l)
Detection Limits	50	0.50	0.50	0.50
A-10-003-W (87')	86	-	-	-
A-10-009-W (86')	110	-	-	-
A-10-036-W (97')	-	ND	ND	ND
A-10-048-W (54')	-	0.6	ND	0.94
A-10-050-W (50')	-	ND	ND	ND
A-10-051-W (56')	70	1.2	0.65	1.9
A-10-036-W (98.2')	-	ND	ND	ND
A-10-048-W (54.5')	-	ND	ND	ND

Notes:
Analyzed using EPA Test Method 8015B
GRO = Gasoline Range Organics, DRO = Diesel Range Organics, ORO = Oil Range Organics, EFH = Extractable Hydrocarbons
mg/l Milligrams per liter; equivalent to parts per million.
µg /l Micrograms per liter
ND Not detected at or above the laboratory detection limit cited.
-- Not analyzed.

Dissolved Methane. Six groundwater samples were tested for dissolved methane. The samples from borings A-10-003 and A-10-048 were reported to have methane concentrations ranging from 0.0041 mg/l (0.0041ppm) to 0.53mg/l (0.53ppm) of dissolved Methane. The reported concentration level is well below recommended action levels (Eltschlager and others, 2001), which are usually on the order of 10 ppm to 28 ppm for dissolved methane. Test results for Dissolved Methane levels are shown in Table 6-7.

Table 6-7 – Dissolved Methane Analyses

Sample ID (Depth)	Methane (mg/l)
Detection Limits	0.0010
A-10-003-W (87’)	0.53
A-10-009-W (86’)	ND
A-10-036-W (97’)	ND
A-10-048-W (54’)	0.0041
A-10-036-W (98.2’)	ND
A-10-048-W (54.5’)	0.093

Notes:
Analyzed using EPA Test Method RSK-175 MOD
mg/l Milligrams per liter
ND Not detected at or above the laboratory detection limit cited.

Polynuclear Aromatic Hydrocarbons. No concentrations (above the detection limit) of Polynuclear Aromatic Hydrocarbons were detected within all seven groundwater samples tested. Test results for Polynuclear Aromatic Hydrocarbons levels are shown in Table 6-8.

Table 6-8 – Polynuclear Aromatic Hydrocarbon Analyses

Sample ID (Depth)	Acena-phthene (µg/l)	Acena-phthylene (µg/l)	Anthra-cene (µg/l)	Naph-thalene (µg/l)	Pyrene (µg/l)	Chrysene (µg/l)	Phe-nanthrene (µg/l)	Benzo-perylene (µg/l)
Detection Limits	10	10	10	10	10	10	10	10
A-10-003-W (87’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-009-W (86’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-036-W (97’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-048-W (54’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-050-W (50’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-051-W (56’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-036-W (98.2’)	ND	ND	ND	ND	ND	ND	ND	ND
A-10-048-W (54.5’)	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
Analyzed using EPA Test Method 8270C.
µg/l Micrograms per liter; equivalent to parts per billion.
ND Not detected at or above the laboratory detection limit cited.

pH. The pH levels reported for the seven groundwater samples taken ranged from 7.14 to 8.20. As a result, there were no major concerns regarding pH related contamination. Test results for pH levels are shown in Table 6-9.

Table 6-9 – pH Level Analyses

Sample ID (Depth)	pH
Detection Limits	0.100
A-10-003-W (87’)	8.20
A-10-009-W (86’)	7.71
A-10-036-W (97’)	7.39
A-10-048-W (54’)	7.40
A-10-050-W (50’)	7.14
A-10-051-W (56’)	7.33
A-10-036-W (98.2’)	7.09
A-10-048-W (54.5’)	7.63

Notes:
Analyzed using EPA Test Method 8081A.
µg/l Micrograms per liter; equivalent to parts per billion.
ND Not detected at or above the laboratory detection limit cited.

7 LIMITATIONS

This report is intended for the use of HMM and Metro. This report is based on the project as described and the information obtained from the exploratory borings at the approximate locations indicated on the attached plans. The findings and recommendations contained in this report are based on the results of the field investigation, laboratory tests, and engineering analyses. In addition, soils and subsurface conditions encountered in the exploratory borings are presumed to be representative of the project site. However, subsurface conditions and characteristics of soils between exploratory borings could vary. The findings reflect an interpretation of the direct evidence obtained. The recommendations presented in this report are based on the assumption that an appropriate level of quality control and quality assurance (inspections and tests) will be provided during construction. EMI should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations contained in this report are applicable to the specific design element(s) and location(s) which is (are) the subject of this report. They have no applicability to any other design elements or to any other locations and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of EMI.

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Hydrology/Hydraulics and Drainage Report
(Subtask 6.2.2.6)

Crenshaw/LAX Transit Corridor Project
Advanced Conceptual Engineering
Contract E0117

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ISSUE AND REVISION RECORD

Rev	Date	Originator	Checker	Approver	Description
0	6/21/10	K. Guzman	P. Cornwall J. Tran	F. Nourbakhsh	Draft
1	10/04/10	K. Guzman	P. Cornwall J. Tran	F. Nourbakhsh	ACE final

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1 EXECUTIVE SUMMARY

The Los Angeles County Metropolitan Transportation Authority (Metro) is planning transit improvements in the Crenshaw/LAX Transit Corridor (Project) to accommodate demand for travel in north-south and east-west directions. These improvements will provide more direct service between downtown Los Angeles and Los Angeles International Airport (LAX), and important connections between the Crenshaw corridor and downtown Los Angeles, the Westside, and the South Bay.

As part of the advanced conceptual engineering design services, Metro has requested that Hatch Mott MacDonald (HMM) prepare a series of specific studies to address key design issues.

This report discusses the hydrologic setting, regulatory requirements, construction impacts and specific drainage issues/solutions as they impact the Crenshaw/LAX Transit Corridor Project. It concludes that there are no construction impacts that cannot be mitigated, and implementation of the Project will not result in alteration of the existing watershed drainage pattern. It further discusses proposed storm drain facilities and measures. Impacts included in this report address drainage, flood hazards, and water quality. Information regarding the proposed project site drainage and grading conditions are taken from Los Angeles County Drainage Area Master Plan: Master Drainage Plan for the City of Los Angeles Area (Los Angeles County Flood Control and Water Conservation District 1991); Ballona Creek Watershed and Dominguez Creek Management Master Plan (County of Los Angeles Department of Public Works 2004); City of Los Angeles Integrated Resources Plan, (City of Los Angeles 2006), and California's Groundwater Bulletin 118 (California Department of Water Resources 2004).

4 HYDROLOGIC SETTING

4.1 General

The Crenshaw/LAX Transit Corridor Project area has a Mediterranean climate characterized by mild, wet winters and long, dry summers. The proximity and steep rise of the San Gabriel Mountains from the coast creates a barrier that traps moist ocean air against the mountain slopes and partially blocks summer heat coming from the desert and winter cold coming from the interior northeast. Mean monthly temperature ranges from 71.7 degrees Fahrenheit (°F) in August to 56.7°F in December, and mean annual precipitation is 13.32 inches per year with 92 percent of the rainfall occurring from October through March (WRCC 2007).

4.1.1 Drainage

The northern and central half of the Crenshaw/LAX Transit Corridor Project, which includes the entire alignment along Crenshaw Boulevard and a portion of the alignment along Florence Avenue, drain to Ballona Creek, which is located within the Ballona Creek watershed. *Figure 4-1 - Ballona Creek Drainage Features* illustrates the location of the Ballona Creek watershed. The remaining half of the study area, which includes a portion of alignment along Florence Boulevard and the entire alignment along Aviation Boulevard, drain to the Dominguez Channel which is located within the Dominguez Watershed. *Figure 4-2 - Dominguez Channel Drainage Features*, illustrates the location of the Dominguez watershed.

It should be noted that the proposed study area (LRT Alternative Track Alignment) lies approximately on the common boundary between the Dominguez Watershed and the Ballona Creek Watershed along portions of Segments 2, 3, 4 (for detailed segments description refer to Section 5.1.1.5 of this report). Therefore, at this ridgeline, stormwater flows away from these segments in a northwest direction above the Crenshaw/LAX Transit Corridor Project area and in a southeast direction below the Crenshaw/LAX Transit Corridor Project area.

The Ballona Creek watershed drains an approximately 130-square-mile area consisting primarily of urban developed land. Surface runoff in the Ballona Creek watershed originates from many sources, including point-source discharges from industrial sources and stormwater. Irrigation runoff, residential car washing, fire fighting, groundwater dewatering at construction sites, and miscellaneous debris from illegal dumping and litter may also be discharged.

Structural flood control features consisting of debris basins, storm drains, underground culverts, and open concrete channels provide most of the storm drainage capacity within the watershed. Many of these flood control features, managed by the Los Angeles County Flood Control District (LACFCD), were designed and implemented by the United States Army Corps of Engineers (USACE) in the early twentieth century. Ballona Creek runs through an underground culvert in the east of the watershed, transitioning to an open, concrete-lined channel near Venice Boulevard and Pickford Street. Ballona Creek's major tributaries, the Benedict Canyon Channel and the Sawtelle-Westwood Flood Control System, are also channelized. Only a few channels remain open for major portions of their length, including the Sepulveda Channel (also known as Walnut Creek) and Centinela Creek. A small number of natural stream channels are found in the upper reaches of the watershed; however, these are several miles from the Crenshaw/LAX Transit Corridor Project area and at a higher elevation. Numerous storm drains also drain to Ballona Creek via an underground drainage system.

4.1.1.2 Ballona Creek

Ballona Creek is designed to convey approximately 71,400 cubic feet per second from the 50-year frequency storm event to Santa Monica Bay (Ballona Creek watershed Task Force 2004). Because of historic modifications to Ballona Creek and its tributaries, natural hydrologic conditions have been substantially modified within the watershed. Approximately 40 percent of the watershed is covered with impervious surfaces resulting from urban development; therefore, runoff enters the Ballona Creek and its tributaries at a more accelerated rate and in greater volume than it did historically (Ballona Creek Watershed Task Force 2004). Since most of the tributary channels are concrete-lined or within Underground box culverts, natural erosion and sedimentation processes have been altered. Under current conditions, eroded materials in stormwater runoff from the more natural upstream areas are transported downstream to the mouth of Ballona Creek where they collect and cause sedimentation and periodic closure of public boating facilities in Marina del Rey.

4.1.1.3 Dominguez Watershed

The Dominguez watershed is located in the coastal plain in the southwestern portion of the Los Angeles Basin with Baldwin Hills on the north and the Los Angeles and Long Beach Harbors on the south. Dominguez Channel flows downstream in a southerly direction, from the northerly area of the City of Hawthorne near the 105 Freeway. It traverses the Cities of Hawthorne, Torrance, Gardena, Carson and Los Angeles and ultimately discharges into the Pacific Ocean at the Ports of Los Angeles and Long Beach (City of Wilmington), as shown in *Figure 4-2*.

The Dominguez watershed drains an approximately 133-square-mile area consisting primarily of urban developed land. Surface runoff in the Dominguez watershed originates from many sources, including point-source discharges from industrial sources and stormwater. Irrigation runoff, residential car washing, fire fighting, groundwater dewatering at construction sites, and miscellaneous debris from illegal dumping and litter may also be discharged.

Structural flood control features consisting of debris basins, storm drains, underground culverts, and open concrete channels provide most of the storm drainage capacity within the watershed.

Many of these flood control features, managed by the Los Angeles County Flood Control District (LACFCD), were designed and implemented by the United States Army Corps of Engineers (USACE) in the early twentieth century.

4.1.1.4 Dominguez Channel

Dominguez Channel has evolved over time as the region of Los Angeles has developed. Because of historic modifications to Dominguez Channel and its tributaries, natural hydrologic conditions have been substantially modified within the watershed. Approximately 62 percent of the watershed is covered with impervious surfaces resulting from urban development; therefore, runoff enters the Dominguez Channel and its tributaries at a more accelerated rate and in greater volume than it did historically. Since most of the tributary channels are concrete-lined or within underground box culverts, natural erosion and sedimentation processes have been altered. Under current conditions, eroded materials in stormwater runoff from the more natural upstream areas are transported downstream to the harbor where they collect and cause sedimentation.

4.1.1.5 LRT (General Alignment & Drainage Overview)

The following is a more detailed description of the previously described Crenshaw/LAX Transit Corridor Project segments. Both vertical and horizontal components are discussed with brief comments on drainage. All lengths were approximated.

Segment 1, BNSF ROW, City of Los Angeles

Segment 1 of the alignment corridor begins at the existing Aviation/105 Freeway Station and continues northerly within the BNSF ROW to the proposed Aviation/Century Station. Along this portion of the corridor alignment, land uses are primarily for the Los Angeles Airport (LAX).

Beginning at the existing Aviation/105 Freeway Station, the alignment remains aerial for 500 linear feet, at which point the alignment enters a 900 linear feet transition to a below-grade segment that continues for 2900 linear feet. Near the intersection with 104^{th} Street, the alignment goes through a 1000 linear feet transition back to an aerial section and arrives at the proposed Aviation/Century Station.

This segment does not lie within any Federal Emergency Management Agency (FEMA) designated floodplain. While some site grading and a minor increase in impervious area (support columns and grade transitions) will occur, drainage patterns will not be substantially altered. This is due to the fact that this entire segment is aerial or below-grade. A substantial drainage structure (6' x 10' open trapezoidal channel to west) exists along the west boundary of this segment from approximately Imperial Highway to Century Boulevard on LAX property. This structure will be replaced with a below-grade storm drain system constructed on top of the proposed tunnel structure. This will have the effect of increasing the pervious area by approximately 1 acre. An 8' x 8' concrete box culvert (approximately 11 feet to the bottom of the structure) crosses the BNSF ROW easterly at 111^{th} Street where the LAX channels converge. Therefore, adequate storm drain systems are available to this segment to provide for proper drainage and flood protection. For this segment, storm water is collected and discharged, eventually to the Dominguez Channel.

Segment 2, BNSF ROW, Cities of Inglewood and Los Angeles

Segment 2 of the alignment corridor begins at the proposed Aviation/Century Station and continues northerly and easterly within the BNSF ROW to the proposed Florence/La Brea Station. Along this portion of the corridor alignment, land uses which lie adjacent to the Crenshaw/LAX Transit Corridor Project are primarily commercial/industrial.

Starting at the proposed Aviation/Century Station, the alignment remains aerial for 500 linear feet, at which point it enters a 600 linear feet transition into an at-grade segment that is 3200 linear feet in length. A 500 linear feet segment transitions the alignment back into an aerial segment that is 680 linear feet in length, crossing Manchester Avenue. From there, a 320 linear feet transition converts the alignment back to an at-grade configuration that is 1100 linear feet in length, heading northeasterly down Florence Avenue until it transitions for 600 linear feet into an aerial alignment that is 1000 linear feet in length. It crosses Interstate Highway 405. An additional 420 linear feet transition leads back to a 3800 linear feet at-grade alignment down Florence Avenue. The segment ends at the Florence/La Brea Station.

This segment does not lie within any FEMA designated floodplains. While some site grading and a minor increase in impervious area (support column bases for aerial alignment) will occur, drainage patterns will not be substantially altered. This segment is either at the natural grade established by the BNSF rail-bed or aerial, and will not significantly impact drainage patterns. Adequate storm drain systems are available to provide drainage protection for the at-grade portion of this segment. Because localized drainage is already established based on the existing BNSF track and rail bed, at-grade drainage patterns are not anticipated to be altered.

Segment 3, BNSF ROW, City of Inglewood

Segment 3 of the alignment corridor begins at the proposed Florence/La Brea Station and continues northeasterly within the BNSF ROW to the proposed West Boulevard Station. Along this portion of the corridor alignment, land uses which lie adjacent to the Crenshaw/LAX Transit Corridor Project are mixed and include commercial/office, industrial, residential and open-space park land.

Starting at the proposed Florence/La Brea Station, the alignment continues in a northeasterly direction within the BNSF ROW. It enters a 300 linear feet transition from an at-grade configuration to a below-grade alignment at La Brea Avenue and continues for 535 linear feet. From there, the proposed alignment goes through an additional 600 linear feet transition back to an at-grade configuration in a northeasterly direction along the northern side of the Florence Avenue ROW. At the Florence/Redondo Boulevard split, the alignment continues northeast alongside Redondo Boulevard in BNSF ROW towards the Florence/West Station. The at-grade segment accounts for 5200 linear feet of the remaining alignment.

This segment does not lie within any FEMA designated floodplains. While some site grading, retaining walls, and a minor increase in impervious area (support column bases for aerial alignment) will occur, drainage patterns will not be substantially altered. The majority of this segment is at the natural grade and will not significantly impact drainage patterns. Adequate storm drain systems are available to provide drainage protection for the at-grade portion of this segment. Aerial guideway drains at support column bases, will be designed to connect into the existing systems. This is typical throughout the proposed alignment for aerial structures and stations. Because localized drainage is already established based on the existing BSNF track and rail bed, at-grade drainage pattern alterations are not anticipated.

Segment 3, Option 3 (Centinela)

Option 3 of the alignment corridor begins at the proposed Florence/La Brea Station and continues northeasterly within the BNSF ROW to the proposed Florence/West Station. Along this portion of the corridor alignment, land uses which lie adjacent to the Crenshaw/LAX Transit Corridor Project are mixed and include commercial/office, industrial, residential and open-space park land.

Option 3 consists of a below-grade alignment at the intersection with Centinela Avenue. The same comments previously discussed in Segment 3 apply to this Option.

Segment 4, Crenshaw ROW/BNSF ROW, Cities of Los Angeles and Inglewood

Segment 4 of the alignment corridor begins at the proposed Florence/West Station and continues northeasterly at-grade within BNSF ROW along Florence Avenue. Next it continues northerly along Crenshaw Boulevard to the proposed Crenshaw/Slauson Station. Adjacent land uses along both portions of the segment are commercial and industrial mixed with some residential.

Segment 4 of the alignment corridor begins at the proposed Florence/West Station and continues northeasterly at-grade within BNSF ROW along Florence Avenue for 780 linear feet, at which point a 750 linear feet transition leads to a below-grade alignment. This continues for 3000 linear feet. Within the below-grade design, the Crenshaw/LAX Transit Corridor alignment changes direction from a northeasterly bearing to a northerly bearing adjacent to the intersection of Crenshaw Boulevard and 66th Place. Once below Crenshaw Boulevard, the proposed alignment goes from being within BNSF ROW to Crenshaw Boulevard ROW. Adjacent to the 60th Street/Crenshaw Boulevard intersection, the project alignment goes through a 500 linear feet transition to an at-grade design (at the 59th Street intersection). It continues for 500 linear feet before terminating at the Crenshaw/Slauson Station.

The alignment corridor along the Crenshaw Boulevard portion of the alignment is mostly paved with some adjacent landscaping. The portion of the segment that is within the BNSF ROW is unpaved area but would not be expected to have high stormwater storage capacities or infiltration rates due to low vegetation and high compaction needed to support the existing railroad bed.

The segment does not lie within any FEMA designated floodplains. While some site grading will occur, there will be no increase in impervious area and, drainage patterns will not be substantially altered. Adequate storm drain systems are available to the segment to provide for proper drainage and flood protection with the development of the Crenshaw/LAX Transit Corridor Project. For Segment 4, surface water is collected by these storm drains that eventually discharge to the Ballona Creek and Dominguez Channel.

Segment 5, Crenshaw Boulevard ROW, City of Los Angeles

The Segment 5 alignment corridor begins at the Crenshaw/Slauson station, and continues north along Crenshaw Boulevard and ends south of Martin Luther King Jr. Boulevard at the proposed Crenshaw/MLK Station. An optional station, Crenshaw/Vernon, may be incorporated between the two aforementioned stations. The surface conditions along the at-grade portions include the fully paved street (Crenshaw Boulevard) with primarily commercial/office and high-density residential land uses.

The first 4500 linear feet of Segment 5 consists of an at-grade design within Crenshaw Boulevard ROW. The surface conditions along this portion include the fully paved street (Crenshaw Boulevard) with land use primarily commercial/office and high-density residential. Surface water in this area is collected by storm drains that eventually discharge to Ballona Creek. Near the 48th Street/Crenshaw Boulevard intersection, a 430 linear feet segment transitions the alignment below-grade. This continues 2700 linear feet north and ends at the Crenshaw/MLK Station.

Surface water in the at-grade area is collected by storm drains that eventually discharge to Ballona Creek. The below-grade portion of the alignment shall only be impacted by stormwater at station access points for the proposed underground Crenshaw/MLK Station. Although Segment 5 does <u>not</u> lie within either a 100-year or 500-year FEMA Flood Plain Area, City of Los Angeles maps do log several "drainage complaints" in the area of Vernon Avenue at Crenshaw Boulevard. However, with the proposed below-grade alignment in that area, this should not present additional drainage issues. While some site grading will occur, there will be no increase in impervious area and drainage patterns will not be substantially altered. Adequate storm drain systems do exist in the area to provide protection from flooding for the Crenshaw/LAX Transit Corridor Project.

Segment 5, Option 5 (Vernon)

Option 5 consists of below-grade station alternative, along with the associated below-grade alignment. The alternative alignment begins as a transition below ground at the 50th Street/Crenshaw Boulevard intersection and shifts east outside of the Crenshaw Boulevard ROW, at the Leimert Boulevard/Crenshaw Boulevard intersection. It adjoins back to the proposed baseline alignment immediately north of the Crenshaw Boulevard/43rd Street intersection.

The first 3700 linear feet of Segment 5 consists of an at-grade design within Crenshaw Boulevard ROW. As with the baseline alignment option, the surface conditions along this portion include the fully paved street (Crenshaw Boulevard) with land use primarily commercial/office and high-density residential.

Surface water in this area is collected by storm drains that eventually discharge to Ballona Creek.

Near the 50th Street/Crenshaw Boulevard intersection, a 430 linear feet segment transitions the alignment below-grade. This continues 3500 linear feet north and ends at the Crenshaw/MLK Station. The below-grade portion of the alignment shall only be impacted by stormwater at station access points for the proposed underground Crenshaw/MLK Station.

Although Segment 5 does not lie within either a 100-year or 500-year FEMA Flood Plain Area, City of Los Angeles maps do log several "drainage complaints" in the area of Vernon Avenue at Crenshaw Boulevard. However, with the proposed below-grade alignment in that area, this should not present additional drainage issues. As with the baseline alignment option, some site grading will occur, but there will be no increase in impervious area and drainage patterns will not be substantially altered. Adequate storm drain systems do exist in the area that provides protection from flooding for the Crenshaw/LAX Transit Corridor Project.

Segment 6, Option 6 (Expo West) and Option 6 (Expo East)

Option 6 consists of two below-grade station options located either the east or west side of Crenshaw Boulevard and the associated tunnel alignments that extend from 39th Street to Jefferson Boulevard. Option 6 (East) involves a below-grade alignment that shifts east, out of the Crenshaw Boulevard ROW, at the Coliseum Street/Crenshaw Boulevard intersection. A below-grade station is proposed at the location of an existing parking lot located southeast of the Exposition Boulevard/Crenshaw Boulevard intersection. Afterwards, the alignment transitions back into the Crenshaw Boulevard ROW and ends at station 457+20.55 rather than 450+00.00 (baseline alignment). Option 6 (West) involves a below-grade alignment that shifts out of Crenshaw Boulevard ROW to the west, beginning at the Coliseum Street/Crenshaw Boulevard intersection. The alignment meets a below-grade station immediately west of the Exposition Boulevard/Crenshaw Boulevard intersection before transitioning back into the Crenshaw Boulevard ROW. The alignment ends at station 459+78.95 rather than 450+00.00 (baseline alignment).

Option 6 (East and West) consists of a below-grade alignment for the entire length of Segment 6, therefore there shall be no change in the percentage of impervious areas along Crenshaw Boulevard ROW, nor shall drainage patterns be substantially altered.

It should be noted that Segment 6 is located within a 500-year FEMA floodplain for the entire alignment length. However, the City of Los Angeles mapping of "Drainage Complaints Received" shows no complaints for this area of Crenshaw Boulevard in regards to flooding. Some site grading will occur.

4.1.2 Flooding

4.1.2.1 Regional

Los Angeles and nearby cities are located in a relatively flat alluvial plain, about 30 miles wide lying on uplift terraces surrounded by mountain ranges. From the outwash fans at the northern edge of this alluvial plain to the tops of the higher peaks, there is a difference in elevation of as much as 4,500 feet.

Los Angeles County is subject to a wide range of flood hazards, including floods caused by earthquakes, intense storms, and failure of man-made structures. Two damaging regional tsunamis caused by the 1812 Santa Barbara and the 1927 Point Arguello earthquakes indicate that faults off the coast of Southern California are capable of producing large local tsunamis. The tsunami concern is heightened because the short historical record does not adequately characterize the long-term tsunami risk.

The USACE operates and maintains five major flood control reservoirs within the Los Angeles System: the Hansen, Lopez, Santa Fe, Sepulveda, and Whittier Narrows reservoirs. The Los Angeles County Department of Public Works operates and maintains 15 dams, about 143 sediment entrapment basins, and 29 spreading grounds. Local storm drains and pump stations are maintained by the Department, cities, Caltrans, and certain homeowner associations.

The Federal Emergency Management Agency (FEMA) has prepared flood maps identifying areas in Los Angeles County that would be subject to flooding during 100-year and 500-year storms events. **Note that these maps indicate that no portion of the proposed Crenshaw/LAX Transit Corridor Project is located within a Special Flood Hazard Area (SFHA) for 100-year storm events**. However, Segment 6, along Crenshaw Boulevard between Exposition Boulevard and Martin Luther King Jr. Boulevard, lies within the 500-year flood plain as shown on the FEMA maps.

4.2 Surface Water Quality

4.2.1 Ballona Creek Watershed

According to the Water Quality Control Plan for the Los Angeles Region (Basin Plan), prepared by the Regional Water Quality Control Board (RWQCB) Region 4, the designated beneficial uses for upper Ballona Creek are water non-contact recreation and wildlife habitat. Potential beneficial uses are municipal and domestic water supply and water contact recreation, although access to the creek is prohibited by the Los Angeles County Department of Public Works. The lower reaches of Ballona Creek (to the estuary) have the same potential and designated beneficial uses as upper Ballona Creek, except that wildlife habitat is listed as only a potential beneficial use.

The Ballona Lagoon/Venice Canals and Ballona Estuary have a number of designated beneficial uses, according to the Region 4 (RWQCB) Basin Plan, including: navigation; water contact and water non-contact recreation; commercial and sport fishing; estuarine habitat; marine habitat; wildlife habitat; rare, threatened, and endangered species; migration of aquatic organisms; spawning, reproduction, and early development of fish; and, shellfish harvesting. Santa Monica Bay and Marina Del Rey, are designated for existing navigation; contact and non-contact recreation; commercial and sport fishing; estuarine habitat; marine habitat; wildlife habitat; rare, threatened or endangered species habitat; migration habitat; spawning habitat; and shellfish harvesting.

Once beneficial uses have been designated, appropriate water quality objectives can be established and programs that maintain or enhance water quality can be implemented to ensure the protection of beneficial uses. These designated beneficial uses, together with water quality objectives (referred to as water quality criteria in federal regulations), form water quality standards. Such standards are mandated for all water bodies within the state under the California Water Code. In addition, the federal *Clean Water Act* (CWA) mandates standards for all surface waters, including wetlands.

Where multiple uses exist, water quality standards must protect the most sensitive use. Water quality standards are typically numeric, although narrative criteria based upon biomonitoring methods may be employed where numerical standards cannot be established or where they are needed to supplement numerical standards. Section 303(c)(2)(b) of the CWA requires states to adopt numerical water quality standards for toxic pollutants for which the Environmental Protection Agency (EPA) has published water quality criteria and which reasonably could be expected to interfere with designated uses in a water body.

The Basin Plan indicates that Ballona Creek is impaired by pollutants from industrial and municipal effluent, and urban nonpoint runoff. In addition, untreated sewage overflows discharged into Ballona Creek during the rainy season have historically caused beach closures along Santa Monica Bay. Specific pollutants include high levels of dissolved solids (e.g., chlorides, sulfates, heavy metals), bacteria, nutrients from fertilizers and other sources, petroleum hydrocarbons, sediment, solid waste and debris. Rainfall results in these contaminants entering municipal storm drains, which subsequently convey the contaminants to surface waters. In addition, high concentrations of DDT in sediments at the mouth of Ballona Creek and in Marina del Rey provide evidence of past discharges that have resulted in long-term water quality issues.

The State of California's principal water quality law is the Porter-Cologne Water Quality Act (Porter Cologne). Porter Cologne is implemented in the Los Angeles Region by the California Water Quality Control Plan, Los Angeles Region (Basin Plan). The Basin Plan sets water quality standards for the Los Angeles Region, which includes beneficial uses for surface and ground water with the numeric and narrative objectives necessary to support those uses, and the state's antidegradation policy. The Basin Plan also describes implementation programs to protect all waters in the region. The Basin Plan, along with the Water Quality Control Plan for Ocean Waters of California (Ocean Plan), serves as the State Water Quality Control Plan for the channels, marinas and harbors within the Los Angeles Region.

These plans are required by and in compliance with the federal Clean Water Act (CWA). Section 303(d)(1)(A), of the CWA, requires each state to conduct a biennial assessment of its waters, and identify those waters that are not achieving water quality standards (Los Angeles Regional Water Quality Control Board, 2003a). The resulting list is referred to as the "303(d) list of impaired waters." The list is required to develop and implement Total Maximum Daily Loads (TMDL) for these waters.

A TMDL specifies the maximum amounts of each pollutant that water body can receive and still meet water quality standards, and allocates the pollutant loadings to point and nonpoint sources. The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and Section 303(d) of the CWA, as well as in U.S. Environmental Protection Agency guidance (U.S. EPA, 1991). A TMDL is defined as the "sum of the individual waste load allocations for point sources and load allocations for nonpoint sources and natural background" (40 CFR 130.2) such that the capacity of the waterbody to assimilate pollutant loads (the loading capacity) is not exceeded. TMDLs must take into account seasonal variations and include a margin of safety to address uncertainty in the analysis (40 CFR 130.7(c)(1)). Finally, states must develop water quality management plans to implement the TMDLs (40 CFR 130.6).

The U.S. EPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the state's 303(d) list and each TMDL developed by the state. If the state fails to develop a TMDL in a timely manner or if the U.S. EPA disapproves a TMDL submitted by a state, EPA is required to establish a TMDL for that waterbody (40 CFR 130.7(d)(2).

As part of its 1996 and 1998 regional water quality assessments, the Regional Board identified over 700 water body-pollutant combinations in the Los Angeles Region where TMDLs would be required (LARWqcb, 1996, 1998). A 13-year schedule for development of TMDLs in the Los Angeles Region was established in a consent decree (Heal the Bay, Inc., et al. v. Browner, et al. C-98-4825 SBA) (United States District Court, Northern District of California, 1999) approved on March 22, 1999.

All projects resulting in discharges, whether to land or water, are subject to Section 13263 of the California Water Code and are required to obtain approval of Waste Discharge Requirements (WDRs) by the RWQCBs. Land and groundwater-related WDRs (i.e., non-NPDES WDRs) regulate discharges of privately or publicly treated domestic wastewater and process and wash down wastewater. WDRs for discharges to surface waters also serve as National Pollutant Discharge Elimination System (NPDES) permits, which are further described below.

Point sources of discharges to surface waters, such as those from industrial facilities, contain a broad range of potential contaminants. Locally, these discharges are regulated by the RWQCB under NPDES permit regulations, which have been in effect since the 1970s. The quality of base flow waters is defined by these discharges along with other, nonregulated dry weather flow such as landscape irrigation, car washing, drainages from upland areas, and others.

The quality of water in Ballona Creek is monitored monthly by the Los Angeles County Department of Public Works, Flood Control Division. Water sampling stations in the vicinity are located along Ballona Creek. Stormwater quality will generally be affected by both the site land use, adjacent land use, amount of impervious surfaces, any stormwater quality best management practices (BMPs) implemented, the amount of rainfall (concentration dilution and total load), and amount of time between rainfall events (pollutant build-up). From this information gathered by Los Angeles County, the 303(d) list is prepared in compliance with the requirements of CWA and is attached as *Table 4-1 – 2006 CWA Section 303 (d) List of Water Quality Limited Segments Requiring TMDLs for Ballona Creek*.

Table 4-1 - 2006 CWA Section 303 (d) List of Water Quality Limited Segments Requiring TMDLs for Ballona Creek

2006 CWA Section 303(d) List of Water Quality Limited Segments Requiring TMDLs

Region	Name	Calwater Watershed	Pollutant/Stressor	Potential Sources	Estimated Size Affected	Proposed TMDL Completion
4	Ballona Creek	40513000	Cadmium (sediment)	Nonpoint/ Point Sources	6.5 miles	2005
			Cyanide	Source Unknown	6.5 miles	2019
			Silver (sediment)	Nonpoint Sources	6.5 miles	2005

Source Los Angeles Regional Water Quality Control Board. USEPA Approved June 24, 2007

4.2.2 Dominguez Watershed

According to the Water Quality Control Plan for the Los Angeles Regional (Basin Plan) prepared by said RWQCB, the watershed of the Dominguez Channel and the Los Angeles and Long Beach Harbors is an enormously important industrial, commercial and residential area with unique and important historical and environmental resources. The area includes 18 municipalities within and including Los Angeles County and roughly 1 million residents. Prior to its development, the area was largely marshland and now, almost no wetland or original coastline exists. Water quality decreased until development reached a nadir in the 1970s. Since then, the water quality has improved but there are still significant water quality and sediment quality challenges.

The ports of Los Angeles and Long Beach occupy over 10,500 acres of land and water. The Inner Harbors contains piers for ship loading and unloading and several marinas. The outer part of both harbors (the greater San Pedro Bay) has been less disrupted than the inner areas and supports a great diversity of marine life. It is open to the ocean and its eastern end and receives much greater ocean flushing than inner harbor areas.

There are many permitted discharges to the watershed. There are approximately 60 active, individual NPDES permitted discharges to the Dominguez channel and to the Los Angeles and Long Beach Harbors. These include four refineries which discharge stormwater to the Dominguez Channel intermittently, two generation stations which discharge to the inner harbor areas and the Terminal Island Treatment Plant. The Terminal Island Treatment Plant is the single POTW which discharges to the watershed. This secondary-treated effluent is discharged to the outer Los Angeles and Long Beach Harbor and is under a time schedule order to eliminate the discharge. In addition, there are approximately 50 active, general NPDES-permitted discharges to the watershed.

The Basin Plan designates beneficial uses for water bodies in the Los Angeles Region. These uses are recognized as existing (E), potential (P), or intermittent (I) uses. All beneficial uses, whether E, P or I, must be protected. Beneficial use designations in the Dominguez Channel and the Harbors include Industrial Service Supply (IND), Navigation (NAV), Contact (REC-1) and Non-contact Recreation (REC-2), Commercial and Sport Fishing (COMM), Estuarine Habitat

(EST), Marine Habitat (MAR), Wildlife Habitat (WILD), Rare, Threatened, or Endangered Species Habitat (RARE), Migration of Aquatic Organisms (MIGR), Spawning, Reproduction and/or Early Development (SPWN), Shellfish Harvesting (SHELL) and associated wetlands (WET).

Surface water quality runoff is regulated by the same federal and state laws as stated previously. The quality of runoff waters from the Dominguez Watershed is monitored monthly by the Los Angeles County Department of Public Works, Flood Control Division. Stormwater quality will generally be affected by both the site land use, adjacent land use, amount of impervious surfaces, any stormwater quality best management practices (BMPs) implemented, the amount of rainfall (concentration dilution and total load), and amount of time between rainfall events. From this information, gathered by Los Angeles County, the 303(d) list is prepared in compliance with the requirements of the CWA and is attached as *Table 4-2 – 2006 CWA Section 303 (d) List of Water Quality Limited Segments Requiring TMDLs for Dominguez Channel.*

Table 4-2 - 2006 CWA Section 303 (d) List of Water Quality Limited Segments Requiring TMDLs for Dominguez Channel

Region	Name	Calwater Watershed	Pollutant/Stressor	Potential Sources	Estimated Size Affected	Proposed TMDL Completion
4	Dominguez Channel Estuary	40512000	Dieldrin (tissue)	Nonpoint/ Point Source	140 Acres	2019
			Lead (Tissue)	Nonpoint/ Point Source	140 Acres	2019
			PCBs (Polychlorinated byphenyls)	Source Unknown	140 Acres	2019
			Phenanthrene	Source Unknown	140 Acres	2019
			Pyrene	Source Unknown	140 Acres	2019
			Zinc (sediment)	Nonpoint/ Point Source	140 Acres	2019
			Benzo(a) Pyrene (PAHs)	Source Unknown	140 Acres	2019
			Benzo(a) Anthracene	Source Unknown	140 Acres	2019
			Chlordane (tissue)	Nonpoint/ Point Source	140 Acres	2019
			Chrysine (C1-C4)	Source Unknown	140 Acres	2019
			Coloform Bacteria	Nonpoint/ Point Source	140 Acres	2007
			DDT (tissue & sediment)	Nonpoint/ Point Source	140 Acres	2019

Region	Name	Calwater Watershed	Pollutant/Stressor	Potential Sources	Estimated Size Affected	Proposed TMDL Completion
4	Dominguez Channel	40351000	Ammonia	Nonpoint/ Point Source	6.7 mile	2019
			Copper	Nonpoint/ Point Source	6.7	2019
			Dieldrin (tissue)	Nonpoint/ Point Source	6.7	2019
			Indicator bacteria	Nonpoint/ Point Source	6.7	2007
			Sediment Toxicity	Source Unknown	6.7	2019
			Zinc (sediment)	Nonpoint/ Point Source	6.7	2019
4	Dominguez Channel Estuary	40512000	Ammonia	Nonpoint/ Point Source	140 Acres	2019
			Benthic Community Effects	Nonpoint/ Point Source	140 Acres	2019

Source: Los Angeles Regional Water Quality Control Board. USEPA Approved June 24, 2007

4.3 Groundwater

The northerly portion of the Crenshaw/LAX Transit Corridor Project study area, which includes segments 4, 5 and a portion of 6, overlies the Santa Monica Sub-basin. The westerly and southerly portions of the Crenshaw/LAX Transit Corridor Project study area overlie the West Coast Groundwater Basin. The beneficial uses for these basins include municipal and domestic supply, industrial supply, industrial process supply and agricultural supply.

4.3.1 Santa Monica Sub-basin

The Santa Monica Sub-basin underlies the northwestern part of the Coastal Plain of Los Angeles Groundwater Basin. It is bounded by the impermeable rocks of the Santa Monica Mountains on the north and by the Ballona escarpment on the south. The sub-basin extends from the Pacific Ocean on the west to the Inglewood fault on the east. The Santa Monica Sub-basin is within the service areas of the Metropolitan Water District of California (MWD) and member agencies of the cities of Santa Monica, Los Angeles, Beverly Hills, and West Basin MWD. It underlies the cities of Santa Monica, Culver City, and Beverly Hills and the communities of Pacific Palisades, Brentwood, Venice, Marina del Rey, West Los Angeles, Century City and Mar Vista. The Santa Monica Sub-basin is divided into five additional sub-basins: Arcadia, Olympic, Coastal, Charnock, and Crestal (CDWR 2004; MWDC 2007, 5-1).

and the remaining portion of 4, fall within the existing BNSF rail-bed alignment. Rail-beds are placed on highly compacted soils. Crushed rock, under the rails and ties allow surface water to drain to subterranean structures that then collect the water into underground storm drain systems. No standing water will accumulate along the alignment, so no infiltration will occur in the non-vegetated, compacted soils. Light rainfall will evaporate. Therefore, rail-bed areas will also not contribute to groundwater recharge.

Due to the possibility of high groundwater table, dewatering systems may be proposed for certain areas as required (such as where tunneling and caissons are used). In addition, any contaminated groundwater will not be discharged to the storm drain system. All groundwater encountered during construction will be properly treated in accordance with local, state and federal regulations as stated within this report. (**Section 5.3.7**)

4.4 Water Supplies and Groundwater Usage

4.4.1 City of Los Angeles

The residents of West Los Angeles do not use any groundwater resources for public water supplies (U.S. EPA 2007). Surface water supplies are obtained from Colorado River Aqueduct, LA Aqueduct from Owens Valley, and State Water Project Aqueduct from the Northern California rivers (U.S. EPA 2007). Los Angeles joined MWD as a founding member in 1928. MWD provides a mix of municipal and industrial water services to a population of approximately 4,002,071. The Los Angeles Department of Water and Power (LADWP) is responsible for supplying the city with water and electricity. Los Angeles primary source of water comes from the Owens Valley and Mono Basin areas of the eastern Sierra Nevada through the gravity-flow Los Angeles Aqueduct system (LAA) extending some 338 miles. Because of environmental commitments in the Mono Basin and Owens Valley, less water is available to Los Angeles from its LAA system.

4.4.2 City of Inglewood

The City of Inglewood provides water to 86 percent of the residences and businesses within the City. Water is provided in the remaining areas by Golden State Water Company and Cal-American Water. The Cal-American Water Company serves a small area in the northwest portion of the City. The Golden State Water Company, formerly Southern California Water Co., provides water to a significant area located south of Century Boulevard to the City's boundary. The City purchases approximately 55 percent of its water from West Basin Municipal Water District (MBMWD) and pumps approximately 45 percent from the City's local groundwater basin. The water provided by the City is pumped from City-owned wells, treated, and blended with water purchased from the West Basin Municipal Water District.

4.4.3 City of El Segundo

The City of El Segundo purchases all of their water from the Metropolitan Water District (MWD). Therefore, the residents of El Segundo do not use any local groundwater resources in a very similar manner as the City of Los Angeles. El Segundo's water division supplies water to the City's customers and performs the operation maintenance and repair of the City's water distribution system.

5 REGULATORY OVERVIEW (WATER QUALITY)

5.1 Federal

5.1.1 Clean Water Act

The federal CWA was designed to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The CWA also directs states to establish water quality standards for all "waters of the United States" and to review and update such standards on a triennial basis. Other provisions of the CWA related to basin planning include Section 208, which authorizes the preparation of waste treatment management plans, and Section 319, which mandates specific actions for the control of pollution from nonpoint sources. The EPA has delegated responsibility for implementation of portions of the CWA to the State Water Resource Control Board (SWRCB) and the RWQCB, including water quality control planning and control programs, such as the National Pollutant Discharge Elimination System (NPDES) Program.

5.1.2 Executive Order 11988 (Floodplain Management)

Executive Order 11988 (Floodplain Management) links the need to protect lives and property with the need to restore and preserve natural and beneficial floodplain values. Specifically, Federal agencies are directed to avoid conducting, allowing, or supporting actions on the base location. Similarly, Department of Transportation (DOT) Order 5650.2, which implements Executive Order 11988 (Floodplain Management) and was issued pursuant to the *National Environmental Policy Act of 1969*, the *National Flood Insurance Act of 1968*, and the *Flood Disaster Protection Act of 1973*, prescribes policies and procedures for ensuring that proper consideration is given to the avoidance and mitigation of adverse floodplain impacts in agency actions, planning programs, and budget requests. Refer to **Appendix B** for details.

5.1.3 Floodplain Development

Federal Emergency Management Agency (FEMA) is responsible for determining flood elevations and floodplain boundaries based on USACE studies and approved agency studies. FEMA is also responsible for distributing the Flood Insurance Rate Maps (FIRMs), which are used in the National Flood Insurance Program (NFIP). These maps identify the locations of Special Flood Hazards Areas (SFHAs), including the 100-year flood zone. FEMA allows nonresidential development in SFHAs; however, construction activities are restricted depending upon the potential for flooding within each area. Federal regulations governing development in a SFHA are set forth in Title 44, Part 60 of the Code of Federal Regulations (CFR), which enables FEMA to require municipalities that participate in the National Flood Insurance Program (NFIP) to adopt certain flood hazard reduction standards for construction and development in 100-year floodplains. In addition, the *Flood Disaster Protection Act of 1973* and the *National Flood Insurance Reform Act of 1994* mandate the purchase of flood insurance as a condition of Federal or federally-related financial assistance for acquisition and/or construction of buildings in SFHAs of any community.

5.2 State

Responsibility for the protection of water quality in California rests with the SWRCB and nine RWQCBs. The SWRCB establishes statewide policies and regulations for the implementation of water quality control programs mandated by federal and state water quality statutes and regulations. The RWQCBs develop and implement Water Quality Control Plans (Basin Plans) that consider regional beneficial uses, water quality characteristics, and water quality problems. The Los Angeles RWQCB implements a number of federal and state laws, the most important of which are the state *Porter-Cologne Water Quality Control Act* and the federal CWA. In California, the RWQCB issues Water Quality Certifications pursuant to Section 401 of the CWA.

All projects resulting in discharges, whether to land or water, are subject to Section 13263 of the California Water Code and are required to obtain approval of Waste Discharge Requirements (WDRs) by the RWQCB. WDRs for discharges to surface waters meet requirements for National Pollution Discharge Elimination System (NPDES) permits, which are further described below. Land and groundwater-related WDRs (i.e., non-NPDES WDRs) regulate discharges of privately or publicly treated domestic wastewater, and process and wash-down wastewater.

5.2.1 Porter-Cologne Water Quality Control Act

The *Porter-Cologne Water Quality Control Act* authorizes the SWRCB to adopt, review, and revise policies for all waters of the state (including both surface and groundwaters) and directs the RWQCB to develop regional Basin Plans. Section 13170 of the California Water Code also authorizes the SWRCB to adopt water quality control plans on its own initiative.

5.2.2 National Pollutant Discharge Elimination System (NPDES)

The NPDES permit system was established in the CWA to regulate point source discharges (a municipal or industrial discharge at a specific location or pipe) to surface waters of the U.S. Nonpoint source pollution often enters the receiving water in the form of overland flow, which is surface runoff that is not delivered by pipelines or other discrete conveyances. As defined in the federal regulations, nonpoint sources are generally exempt from federal NPDES permit program requirements. Two exceptions that are regulated under the NPDES program are: (1) diffuse source discharges caused by general construction activities of over one acre; and (2) stormwater discharges in municipal stormwater systems as a separate system in which runoff is carried through a developed conveyance system to specific discharge locations. These are apparent nonpoint source discharges, but because the diffuse source pollution is conveyed in a confined, discrete conveyance system that discharges at a specific location or locations to surface water, for regulatory purposes, they are considered point source dischargers.

For point source discharges, each NPDES permit contains limits on allowable concentrations and mass emissions of pollutants contained in the discharge. However, because municipal stormwater and construction stormwater sources are diffuse and vary with site characteristics, effluent limitations are not practical. Therefore, because the actual source is diffuse and spread out over a large area, instead of effluent limits, the reduction of pollutants in urban stormwater discharge is regulated through the use of structural and nonstructural best management practices (BMPs) to the maximum extent practicable (MEP).

For these diffuse source discharges, the NPDES program establishes a comprehensive stormwater quality program to manage urban stormwater and minimize pollution of the environment to the maximum extent practicable. The NPDES program consists of (1) characterizing receiving water quality, (2) identifying harmful constituents, (3) targeting potential sources of pollutants, and (4) implementing a Comprehensive Stormwater Management Program. Each NPDES permit contains limits on allowable concentrations and mass emissions of pollutants contained in the discharge. Sections 401 and 402 of the CWA contain general requirements regarding NPDES permits, while Section 307 of the CWA describes the factors that the EPA must consider in setting effluent limits for priority pollutants. Typical BMPs used to manage runoff water quality during operational activities include controlling roadway and parking lot contaminants by installing oil and grease separators at storm drain inlets, cleaning parking lots on a regular basis, incorporating peak-flow \reduction and infiltration features (such as grass swales, infiltration trenches, and grass filter strips) into the landscaping, and implementing educational programs.

The RWQCB also requires that coverage under the General Construction NPDES Permit be obtained for construction grading activities for all projects greater than one acre in compliance with the state Construction General Permit (see below for more details). This permit requires implementation of nonpoint source control of stormwater pollution runoff through the application of BMPs meant to reduce the amount of pollutants entering streams and other water bodies.

The 1987 amendments to the CWA directed the federal EPA to implement the stormwater program in two phases. Phase I addressed discharges from large (population 250,000 or above) and medium (population 100,000 to 250,000) municipalities and certain industrial activities. Phase II (1999) addresses smaller discharges defined by EPA that are not included in Phase I, and construction activities that affect one to five acres. Under Phase II, each permittee must implement a Stormwater Management Program that addresses six minimum control measures associated with construction and operational activities, including (1) public education and outreach, (2) public participation/ involvement, (3) illicit discharge detection and elimination, (4) construction site stormwater runoff control for sites greater than 1 acre, (5) post-construction stormwater management in new development and redevelopment, and (6) pollution prevention/good housekeeping for municipal operations. These control measures will typically be addressed by developing BMPs.

5.2.2.1 Construction General Permit

The SWRCB permits all regulated construction activities under Order No. 98-08-DWQ (1999), which requires that, prior to beginning any construction activities, the permit applicant must obtain coverage under the Construction General Permit by preparing and submitting a Notice of Intent (NOI) and Stormwater Pollution Prevention Plan (SWPPP) to the SWRCB; and by implementing the SWPPP to mitigate potential construction effects on receiving water quality. In addition, 2003 revisions to the original Construction General Permit clarify that all construction activity, including small construction sites that are part of a larger common plan, must obtain coverage under this Construction General Permit. Because construction of the Crenshaw/LAX Transit Corridor Project would disturb more than one acre, it would be subject to these permit requirements. New revisions, which go into effect July 1, 2010, include stricter requirements for processing of this permit.

Required elements of a SWPPP include (1) a site description addressing the elements and characteristics specific to the site; (2) descriptions of BMPs for erosion and sediment controls; (3) BMPs for construction waste handling and disposal; (4) implementation of approved local plans; (5) proposed post-construction controls, including a description of local post-construction erosion and sediment control requirements; and (6) non-stormwater management. The SWPPP must include BMPs that address source control, and, if necessary, include BMPs that address specific pollutant control.

Examples of typical construction BMPs in completed SWPPPs include scheduling or limiting activities to certain times of year; prohibiting certain construction practices; implementing equipment maintenance schedules and procedures; implementing a monitoring program; implementing other management practices to prevent or reduce pollution, such as using temporary mulching, seeding, or other suitable stabilization measures to protect uncovered soils; storing materials and equipment to ensure that spills or leaks cannot enter the storm drain system or surface water; developing and implementing a spill prevention and cleanup plan; installing traps, filters, or other devices at drop inlets to prevent contaminants from entering storm drains; and using barriers, such as straw bales or plastic, to minimize the amount of uncontrolled runoff that could enter drains or surface water.

5.2.2.2 Industrial General Permit

The SWRCB and RWQCBs regulate all specified industrial activities under the Waste Discharge Requirements (WDRs) for Discharges of Stormwater Associated with Industrial Activities Excluding Construction Activities (Industrial General Permit, SWRCB Order No. 97-03-DQ, NPDES General Permit No. CAS000001). The Industrial General Permit requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT). The Industrial General Permit also requires the development of a SWPPP and a monitoring plan. Through the SWPPP, sources of pollutants are to be identified and the means to manage the sources to reduce stormwater pollution are described. Any Industrial General Permit noncompliance constitutes a violation of the CWA and the Porter-Cologne Water Quality Control Act and is grounds for *(a)* enforcement action, *(b)* Industrial General Permit termination, revocation and reissuance, or modification, or *(c)* denial of an Industrial General Permit renewal application. The proposed Crenshaw/LAX Transit Corridor Project is a Category 8 industrial discharger because of the associated maintenance facilities (Category 8 includes transportation facilities that conduct any type of vehicle maintenance such as fueling, cleaning, repairing, and others), and therefore, is subject to conditions of the Industrial General Permit.

5.3 Regional

5.3.1 Water Quality Control Plan for the Los Angeles Region (Basin Plan)

The Los Angeles RWQCB has prepared the Basin Plan in accordance with state and federal law. The Basin Plan sets forth the regulatory water quality standards for surface waters and groundwater within its region. The applicable water quality standards address both the designated beneficial use for each water body and the water quality objectives to meet designated beneficial uses. Where multiple designated beneficial uses exist, water quality standards must protect the most sensitive use. Water quality objectives are typically numeric, although narrative criteria, based upon biomonitoring methods, may be employed where numerical objectives cannot be established or where they are needed to supplement numerical objectives.

5.3.2 Total Maximum Daily Loads (TMDL)

In accordance with the federal CWA and state *Porter-Cologne Water Quality Control Act*, TMDLs have been developed and incorporated into the Basin Plan for some pollutants identified on the 303(d) list as causing contamination in project sites receiving waters. For other pollutants listed on the 303(d) list (e.g., Section 303[d] of the *Clean Water Act*), TMDLs are scheduled for development, undergoing development, or in the process of review by the SWRCB.

5.3.3 NPDES Municipal Permit

The Crenshaw/LAX Transit Corridor Project area is located in Los Angeles County and would therefore be regulated under the Los Angeles County Municipal NPDES Stormwater Permit (Municipal Permit), NPDES Permit No. CAS004001 (Order No. 01-182) (LARWQCB2007). This permit is soon to change on July 1, 2010. Under the Municipal Permit, development would have to comply with the Los Angeles County Drainage Area Master Plan and the Standard Urban Stormwater Mitigation Plan (SUSMP).

5.3.4 Master Drainage Plan for the Los Angeles County

The Los Angeles County Department of Public Works (LACDPW) has developed Master Drainage Plans (MDPs) that address many individual watershed areas within the District's jurisdiction. The MDPs include proposed drainage facilities to protect upstream and downstream properties from serious flooding. Conceptual designs and Crenshaw/LAX Transit Corridor Project cost estimates are included in most plans. Some MDPs are the basis for Area Drainage Plans (ADPs), which are funding mechanisms established to pay for major drainage facilities within some MDPs. The ADPs impose fees that must be paid by land developers.

5.3.5 Standard Urban Stormwater Mitigation Plan (SUSMP)

The SUSMP requires that all projects that fall into one of nine categories incorporate appropriate SUSMP requirements into the Crenshaw/LAX Transit Corridor Project plans. All permittees (including the City of Inglewood, City of Los Angeles, and City of El Segundo) are required to approve plans as part of the development approval process before issuing a building or grading permit for projects in the nine mentioned categories. The proposed Crenshaw/LAX Transit Corridor Project would be subject to SUSMP requirements because it would include development of parking lots that would be 5,000 square feet or larger, or would have 25 or more parking spaces. Verification that the construction of all stormwater pollution control Best Management Practices (BMPs) and treatment control BMPs have been properly installed and will be properly maintained is required through a signed certification statement by the owner.

5.3.6 Discharge of Nonhazardous Contaminated Soils WDRs

Waste Discharge Requirements (WDRs) for Discharge of Non-Hazardous Contaminated Soils and Other Wastes in Los Angeles River and Santa Clara River Basins (Order No. 91-93) allows the disposal of up to 100,000 cubic yards of nonhazardous contaminated soils and other wastes for a maximum period of 90 days. This requirement applies to the proposed Crenshaw/LAX Transit Corridor Project because there may be contaminated soils near the alignment and because major portions of the alignment are along an old railroad right-of-way, where contaminated soils may exist. This WDR also requires that waste used as soil backfill shall not contain any substance in concentrations toxic to human, animal, plant, or aquatic life. The Construction General Permit allows for temporary stockpiling of nonhazardous, contaminated soils until they can be appropriately disposed of or reused, per permit conditions.

5.3.7 Construction Dewatering General Permit

*Waste Discharge Requirements (WDRs) for Discharges of Groundwater from Construction Project Dewatering to Surface Waters In Coastal Watersheds of Los Angeles and Ventura Counties (R4-2003-0111, General NPDES Permit No. CAG99400); p*rovides permitting for treated or untreated groundwater generated from permanent or temporary dewatering operations. This permit includes effluent and receiving water limitations for metals and other potential contaminants in discharges from dewatering operations to freshwater and saltwater, as well as monitoring and reporting requirements. This WDR would apply to the proposed Crenshaw/LAX Transit Corridor Project if there are construction dewatering activities. (Also see Section 4.3.3).

5.4 Local

5.4.1 City of Los Angeles Municipal Code

The City of Los Angeles incorporates requirements of the Municipal NPDES Permit into its Municipal Code. The proposed Crenshaw/LAX Transit Corridor Project would be considered a Planning Priority Project and Significant Development/Redevelopment project according to local guidelines because it would create more than 100,000 square feet of impervious industrial or commercial surfaces and/or 5,000 square feet (with at least 25 spaces) of surface parking. Municipal Code requirements are discussed in more detail under Section 7, Construction Impacts.

5.4.2 City of Inglewood Municipal Code

The City of Inglewood incorporates requirements of the Municipal NPDES Permit into its Municipal Code. The proposed Crenshaw/LAX Transit Corridor Project would be considered a Planning Priority Project and Significant Development/Redevelopment project according to local guidelines because it would create more than 100,000 square feet of impervious industrial or commercial surfaces and/or 5,000 square feet (with at least 25 spaces) of surface parking. Municipal Code requirements are discussed in more detail under Section 7, Construction Impacts.

5.4.3 City of El Segundo

The City of El Segundo incorporates requirements of the Municipal NPDES Permit into its Municipal Code. The proposed Crenshaw/LAX Transit Corridor Project would be considered a Planning Priority Project and Significant Development/Redevelopment project according to local guidelines because it would create more than 100,000 square feet of impervious industrial or commercial surfaces and/or 5,000 square feet (with at least 25 spaces) of surface parking. Municipal Code requirements are discussed in more detail under Section 7, Construction Impacts.

6 CONSTRUCTION IMPACTS

6.1 General Project Construction

Construction of the Baseline Alignment would include installation of two parallel LRT tracks, relocation of BNSF tracks, an overhead catenary wire system, traction power substations, ventilation structures, signaling and communication systems, a maintenance facility, possible parking lots, and five to seven stations. Along some segments of the alignment, construction would also include aerial track structures, below-grade structures (bored or cut/cover tunnels), platforms, street widening and/or existing track-bed widening. In at-grade segments, along Crenshaw Boulevard., LRT tracks would be installed in the existing roadway center median or a designated traffic lane and separated from street traffic by curbs, and, in some locations, fencing or other barriers. At-grade tracks within the BNSF ROW will generally conform to the existing track alignment with widening of the ROW as needed. Construction activities associated with the baseline alignment would include temporary land-disturbing activities such as demolition of existing structures, grading and excavation of retaining walls, filling and compaction paving, trenching for utility infrastructure installation/relocation, planting, irrigation, and painting.

6.2 Water Quality and Control During Construction

The delivery, handling, and storage of construction materials and wastes, as well as the use of construction equipment, would increase the potential of stormwater contamination. Potential pollutants include spills or leaks from heavy equipment and machinery resulting in oil and grease contamination; release of paints, solvents, cleaning agents, and metals; exposure and erosion of contaminated soils as a result of the demolition of structures and soil excavation; release of concrete compounds and paving materials; release of pesticides (hericides, insecticides, fungicides) associated with site preparation work; and larger debris such as trash and organic matter. These contaminants have varying effects, including toxicity to aquatic organisms, contamination of drinking supplies, bioaccumulation in larger species, and health hazards and aquatic ecosystem damage associated with introduction of bacteria, viruses, and other vector-borne contaminants.

Construction activities would also increase the potential for erosion and sedimentation in surface water bodies. Removal of existing structures, pavement, and vegetation could expose underlying soils to stormwater runoff or wind which could result in increased sediment release and transport in the Ballona Creek and Dominguez Channel watersheds. Erosion and sedimentation affect water quality by interfering with photosynthesis, oxygen exchange, and the respiration, growth, and reproduction of aquatic species. Other pollutants such as nutrients, trace metals, and hydrocarbons, can attach to sediment and be transported downstream, which can contribute to overall degradation of water quality.

Potential construction effects specific to individual segments of the proposed LRT alignment are discussed below.

6.2.1 Segment 1: Aviation/105 Station to Aviation/Century Station

In addition to the general construction water quality effects discussed above, construction activities along Segment 1 could result in water quality impacts at several specific locations. Widening of the BNSF ROW along the at-grade alignment of Segment 1 (from Century

Boulevard to the 105 Freeway), track road-bed improvements and relocation of the trapezoidal drainage channel on top of the proposed tunnel structure, would involve the excavation and placement of material around substantial existing drainage structures. This could release wastes and reconstruction materials into stormwater runoff. Also, pavement and structures and paving activities could release contaminants into surface water bodies.

Construction of the proposed aerial structures (from Century Boulevard to 102nd Street and south of 111th Street to 105 Freeway) and connection to Metro Green Line Aviation/LAX Station would require fill materials and excavation for aerial structure piles and supports. Excavated soil and fill materials for construction of aerial support structures could be susceptible to erosion and sediment transport.

Construction of the proposed below-grade structures (tunnel or "U" channel section from 102nd Street to 111th Street) and the surface, at-grade improvements to the BNSF ROW at the transitions to at-grade improvements mentioned above, would require hauling of excavation material. Excavated soil could be susceptible to erosion and sediment transport.

6.2.2 Segment 2: Aviation/Century Station to Florence/La Brea Station

In addition to the general construction water quality effects discussed above, construction activities along Segment 2 could result in water quality impacts at several specific locations. Installation of the LRT tracks, relocation of the BNSF track along at-grade portions of Segment 2 (from North Inglewood Avenue to North Oak Street, Hindry Avenue to Isis Avenue and north of Arbor Vitae Street to 98th Street) including road-bed widening along BNSF ROW, construction at road crossings, relocation of the City of Los Angeles Central Out-Fall Sewer, would involve minimal grading, which would not contribute to a substantial erosion and sediment transport hazard. However, as discussed above, removal of pavement and structures and paving activities could release contaminants into surface water bodies.

Construction of the proposed aerial structures (from LaBrea Avenue to North Inglewood Avenue, North Oak Street to Hindry Avenue and Isis Avenue to Century Boulevard) and aerial Aviation/Century Station would require fill materials and excavation for installation of pilings and supports for the overhead aerial structures. Excavated soil and fill materials for construction of aerial support structures could be susceptible to erosion and sediment transport.

6.2.3 Segment 3: Florence/La Brea Station to Florence/West Station

In addition to the general construction water quality effects discussed above, construction activities along Segment 3 could result in water quality impacts at several specific locations. Installation of the LRT tracks and relocation of the BNSF Track along at-grade portions of Segment 3 (from Long Street to east of Prairie Avenue), including road-bed widening along BNSF ROW, construction at road crossings, reconstruction of the East Redondo Boulevard alignment and construction of retaining walls adjacent to Centinela Park, would involve minimal grading, which would not contribute to a substantial erosion and sediment transport hazard. However, as discussed above, removal of pavement and structures and paving activities could release contaminants into surface water bodies.

Construction of the proposed below-grade structures (tunnel from Prairie Avenue to Locust Street) and the surface, at-grade improvements to the BNSF Row at the transitions to at-grade improvements mentioned above, would require handling of excavation material. Excavated soil could be susceptible to erosion and sediment transport.

Construction of the proposed aerial structure (from Locust Street to La Brea Avenue) and aerial Florence/La Brea Station would require fill materials and excavation for installation of pilings and supports for the overhead aerial structures. Excavated soil and fill materials for construction of aerial support structures could be susceptible to erosion and sediment transport.

6.2.4 Segment 3: Option 3 (Centinela)

The below-grade alignment being considered at the project intersection with Centinela Avenue will have little impact on water quality within the project alignment. Additional excavation would be required and would be subject to the same comments as previously discussed. Also, a major 39" existing storm drain will require relocation and further excavation.

6.2.5 Segment 4: Florence/West Station to Crenshaw/Slauson Station

In addition to the general construction water quality effects discussed above, construction activities along Segment 4 could result in water quality impacts at several specific locations. Installation of the LRT tracks and relocation of the BNSF tracks along at-grade portions of Segment 4 (from Brynhurst Avenue to Long Street [West Boulevard Station]) and Slauson to 59th Street, including road bed widening to BNSF ROW, road closure at west 71st Street and Victoria Street, construction at road crossings, and construction of the at-grade West Boulevard Station would involve minimal grading, which would not contribute to a substantial erosion and sediment transport hazard. However, as discussed above, removal of pavement and structures and paving activities could release contaminants into surface water bodies.

Construction of the proposed below-grade structures (tunnel from 59th Street to Brynhurst Avenue) and the surface, at-grade improvements to Crenshaw Boulevard and the BNSF ROW at the transitions to at-grade improvements mentioned above, would require hauling of excavation material.

6.2.6 Segment 5: Crenshaw/Slauson Station to Crenshaw/Martin Luther King Station

In addition to the general construction water quality effects discussed above, construction activities along Segment 5 could result in water quality impacts at several specific locations. Installation of the LRT tracks along at-grade portions of Segment 5 (from 48th Street to Slauson Avenue), including road improvements to Crenshaw Boulevard, construction at road crossings, construction of the (optional) below-grade Crenshaw/Vernon Station, and construction of the at-grade Slauson Station would involve minimal grading, which would not contribute to a substantial erosion and sediment transport hazard. However, as discussed above, removal of pavement and structures and paving activities could release contaminants into surface water bodies.

Construction of the proposed below-grade structures (tunnel from Martin Luther King Jr. Boulevard to 48th Street), below-grade Crenshaw/Vernon Station, and the surface, at-grade improvements to Crenshaw Boulevard, at the transition to at-grade improvements mentioned above, would require hauling of excavation material.

6.2.7 Segment 5: Option 5 (Vernon)

This option consists of the southerly extension of the below-grade alignment 1050 feet, moving the LRT guideway opening from just north of 48th Street to a new location just north of 50th

Street. Also, a below-grade station is added (Crenshaw/Vernon Station) on the East side of Crenshaw Boulevard (west side of S. Leimert Boulevard) between Brynhurst Avenue to the south and W. Vernon Avenue to the north. The below-grade alignment, presented with this option, will have little impact on water quality within the project alignment. Additional excavation would be required for the extended tunneling and station work. This construction would be subject to the same comments as previously discussed above, including comments regarding surface improvement for ingress/egress to the new station. A major advantage in extending the below grade alignment 1050 feet south is that the alignment will not interfere with the existing 39” stormdrain that is in conflict with the LRT alignment, allowing the storm drain system to remain in-place.

6.2.8 Segment 6: Crenshaw/Martin Luther King Station to Crenshaw/Exposition Station

In addition to the general construction water quality effects discussed above, construction activities along Segment 6 could result in water quality impacts at several specific locations. Installation of the LRT tracks along at-grade portions of Segment 6 (from Exposition Boulevard to south of Coliseum Place), construction at road crossings, construction of the at-grade Crenshaw/Exposition and below-grade Crenshaw/MLK Stations would involve minimal grading, which would not contribute to a substantial erosion and sediment transport hazard. However, as discussed above, removal of pavement and structures and paving activities could release contaminants into surface water bodies.

Construction of the proposed below-grade structures (tunnel or “U” channel section from south of Coliseum Place to Martin Luther King Jr. Boulevard) and the surface, at-grade improvements to Crenshaw Boulevard, mentioned above for the Crenshaw/MLK Station, would required handling of excavation material.

6.2.9 Segment 6: Option 6 (Exposition West and Exposition East)

The below-grade alignment being considered with these two options would have little impact on existing water quality within the project alignment. Excavation would be required and would be subject to the same comments as shown above for this segment. A major advantage of this option is that no existing drainage structures will require relocation/disturbance.

6.3 Regulatory Requirements (Construction)

All construction activities, including construction of the stations, road crossings, installation and realignment of utilities, installation of aerial structures, installation of tracks, and demolition activities would be subject to existing regulatory requirements, including BMPs for erosion and sediment control, and material and waste handling and management, as outlined below.

6.4 City Municipal Codes

City Municipal Codes regulate potential discharge of pollutants associated with construction activities and would require the Project Developer to implement construction BMPs prior to receiving a building or grading permit.

The City of Los Angeles, City of Inglewood and City of El Segundo Departments of Building and Safety also require that prior to issuing a grading permit or building permit, the applicant must incorporate into the plan documentation of BMPs necessary to control stormwater pollution from sediments, erosion, and construction materials leaving the construction site in accordance with the provisions contained in the "Development Best Management Practices Handbook, Construction Activities". Furthermore, other sections include restrictions on construction and work during the rainy season (October 1 to April 15); describes the requirements for erosion control and drainage devices; and provides additional construction requirements and limitations to protect disturbed areas from erosion and sediment transport such as finished slope characteristics and requirement for flood and mudflow protection. The Public Works Departments may also require that the permittee prepare and submit plans for the installation of temporary erosion control devices not later than September 15, preceding the rainy season. The authority to inspect and enforce stormwater pollution control measure is provided for in City Codes.

6.5 Standard Urban Stormwater Mitigation Plan (SUSMP)

The proposed Crenshaw/LAX Transit Corridor Project would also be required to comply with the Los Angeles County SUSMP provisions. The SUSMP was developed for compliance with the Municipal NPDES Permit conditions. Provisions within the SUSMP include:

- Post-development peak storm water runoff discharge rates shall not exceed the estimated pre-development rate for developments where the increased peak stormwater discharge rate will result in increased potential for downstream erosion. The proposed Crenshaw/LAX Transit Corridor Project would not be subject to this requirement because it discharges into storm drain culverts or lined channels.
- The development must be designed so as to minimize, to the maximum extent practicable, the introduction of pollutants of concern that may result in significant effects, generated from site runoff of directly connected impervious areas (DCIA), to the stormwater conveyance system as approved by the building official. This will require the incorporation of a BMP or combination of BMPs best suited to maximize the reduction of pollutant loadings in that runoff to the Maximum Extent Practicable and as listed in the referenced handbooks and guidelines. The proposed Crenshaw/LAX Transit Corridor Project would be subject to this SUSMP requirement.
- Crenshaw/LAX Transit Corridor Project plans must include BMPs consistent with local codes and ordinances and the SUSMP to decrease the potential of slopes and/or channels from eroding and impacting stormwater runoff. The proposed Crenshaw/LAX Transit Corridor Project would be subject to this SUSMP requirement.
- Where proposed Crenshaw/LAX Transit Corridor Project plans include outdoor areas for storage of materials that may contribute pollutants to the stormwater conveyance system, structural or treatment BMPs are required. The proposed project would be subject to this requirement wherever there are any outdoor materials storage areas.
- All trash container areas (including areas associated with the proposed Crenshaw/LAX Transit Corridor Project, such as stations) must meet the following Structural or Treatment Control BMP requirements:
  - Trash container areas must have drainage from adjoining roofs and pavement diverted around the areas.
  - Trash container areas must be screened or walled to prevent off-site transport of trash.
- As part of project review, if a project applicant has included or needs to include Structural or Treatment Control BMPs in project plans, the Permittee shall require that the applicant provide verification of maintenance provisions through such means as may be appropriate,

including, but not limited to legal agreements, covenants, CEQA mitigation requirements, and/or Conditional Use Permits. The proposed Crenshaw/LAX Transit Corridor Project would be subject to this SUSMP requirement.

- Design Standards for post-construction Structural BMPs. The proposed would be subject to this SUSMP requirement. To minimize the offsite transport of pollutants, the following design criteria are required:
  - Reduce impervious land coverage of parking areas
  - Infiltrate runoff before it reaches storm drain system
  - Treat runoff before it reaches storm drain system
- Limitations on Infiltration BMPs: a water table distance separation of 10 feet depth in California presumptively poses negligible risk for stormwater not associated with industrial activity or high vehicular traffic (25,000 or greater average daily traffic (ADT) on main roadway or 15,000 or more ADT on any intersecting roadway). The proposed Crenshaw/LAX Transit Corridor Project would be subject to this SUSMP requirement for any portions of the alignment within industrial areas and high traffic. The proposed Crenshaw/LAX Transit Corridor Project may be subject to this requirement in other areas if the water table is within 10 feet of the bottom of any potential infiltration BMP.
- Low Impact Development (LID) is a design strategy using naturalistic, on-site Best Management Practices to lessen the impacts of development on stormwater quality and quantity. LID practices are designed to protect surface and groundwater quality, maintain the integrity of the ecosystems, and preserve the physical integrity of receiving waters by controlling rainfall and stormwater runoff at or close to the source. As of Jan. 1, 2009, the County of Los Angeles instituted LID requirements for development occurring within unincorporated portions of the County. The goal of LID is to mimic the undeveloped site hydrology using site-design techniques that may store, infiltrate, evaporate or detain surface runoff. LID incorporates multifunctional Best Management Practices (BMPs) for stormwater detention and water quality improvement. The multifunctional site design elements include the use of bioretention/filtration landscape areas, disconnected hydrologic flowpaths, reduced impervious surfaces, functional landscaping to maintain pre-developed hydrologic functions such as infiltration, frequency and volume of discharges, and groundwater recharge.

The Cities of Los Angeles, Inglewood, and El Segundo include provisions within their Municipal Code requiring construction stormwater BMPs and compliance with the SUSMP and Municipal NPDES Permit conditions. Municipal Codes also provide for review of construction plans and construction inspection to ensure that the proposed Crenshaw/LAX Transit Corridor Project complies with permit conditions. Therefore, construction of the LRT Project should not violate waste discharge requirements.

6.6 Construction General Permit

The proposed project would cumulatively disturb more than one acre of land and would therefore require coverage under the Construction General Permit. Coverage under this permit would include preparation of a SWPPP, including typical construction BMPs. Typical construction BMPs for compliance with the NPDES Construction General Permit include, but are not limited to: scheduling or limiting activities to certain times of year; prohibiting certain construction practices; vehicle and equipment maintenance and operations; implementing a monitoring program; erosion and sediment control BMPs; vehicle tracking BMPs; waste and materials management such as concrete wash out areas, stockpile management, and spill prevention and control; protected designated staging areas; and others. The Construction General Permit is considered protective of water quality, and the Cities' Municipal Code would ensure compliance with the Construction General Permit.

6.7 Construction Dewatering General Permit

If construction dewatering activities are necessary, due to flooding of trenches and excavations during the rainy season or locally high groundwater, METRO and their contractor(s) would have to comply with the Construction Dewatering General Permit. This General Permit includes effluent and receiving water limitations for metals and other potential contaminants in discharges from dewatering operations to freshwater and saltwater, as well as monitoring and reporting requirements that are considered protective of water quality. To be covered under this General Permit, a discharger must do the following:

- Demonstrate that pollutant concentrations in the discharge shall not cause violation of any applicable water quality objective for the receiving waters, including discharge prohibitions.
- Demonstrate that discharge shall not exceed the water quality criteria for toxic pollutants (Attachment B and Part E of this Order), and there shall be no reasonable potential to cause or contribute to an excursion above the criteria.
- Perform reasonable potential analysis using a representative sample of groundwater to be discharged. The sample shall be analyzed and the data compared to the water quality screening criteria for the constituents listed on Attachment A (of this Order) to determine the most appropriate permit.
- The discharge shall not cause acute nor chronic toxicity in receiving waters.
- If necessary, the discharge shall pass through a treatment system designed and operated to reduce the concentration of contaminants to meet the effluent limitations of this Order.
- The discharger shall be able to comply with the terms or provisions of this General Permit.

To be authorized to discharge under this General Permit, the discharger must submit an ROWD and an application for an NPDES permit. Upon receipt of the application, the Executive Officer would determine the applicability of this Order to such a discharge. If the discharge is eligible, the Executive Officer would notify the discharger that the discharge is authorized under the terms and conditions of this Order and prescribe an appropriate monitoring and reporting program. For new discharges, the discharge shall not commence until receipt of the Executive Officer's written determination of eligibility for coverage under this general permit or until an individual NPDES permit is issued by the Regional Board.

6.8 Groundwater Contamination

A construction health and safety plan will address proper handling procedures in the event that groundwater is unexpectedly encountered. In addition, if construction plans change and dewatering is required, groundwater sampling and analysis should be conducted prior to dewatering activities.

Contaminated groundwater, if identified, could be transported to an appropriate water treatment facility, or could be treated on-site prior to discharge to the municipal sewer system or storm drain under an approved NPDES permit.

As discussed briefly above, during construction of the LRT Project, temporary dewatering may be required if groundwater is encountered or if construction occurs during the wet-weather season and dewatering of excavations is required. The potential for construction dewatering would not likely be substantial because groundwater resources in the area are at least 60 feet below ground surface. However, perched (water trapped near the surface of the soil) groundwater may be encountered. Dewatering activities would require coverage under the Construction Dewatering General Permit and be temporary in nature.

The depth to groundwater is estimated to be between 180 feet below ground surface (bgs) to 60 feet bgs according to existing reports in the area. Therefore, the potential for construction pollutants from spills and leaks to migrate to groundwater is minimal. Additionally, construction activities would require coverage under the Construction General Permit and preparation of a SWPPP, including spill prevention and control BMPs, waste and materials management BMPs, and other BMPs designed to protect both surface and groundwater quality. Municipal Codes require compliance with these General Permits ensuring that General Permit provisions are met. Further, if unanticipated groundwater is encountered, it would be subject to the Construction Dewatering General Permit previously described in the Regulatory section.

7 PROJECT DRAINAGE IMPACTS

7.1 Pre-developed Drainage Areas

As previously noted, the Crenshaw/LAX Transit Corridor Project alignment lies close to the common boundary line between two major watershed areas, the Dominguez Channel and Ballona Creek Watersheds (*Figure 4-1* and *Figure 4-2*). This occurrence is a positive factor in regards to impacts to the lower portion of the Crenshaw/LAX Transit Corridor Project alignment from stormwater runoff and flooding. “Headwaters” are generally flowing away from the Crenshaw/LAX Transit Corridor Project area along the Florence Avenue/BNSF ROW portion of the alignment (City of Inglewood). Furthermore, the remaining two Crenshaw/LAX Transit Corridor Project areas, Aviation Boulevard/BNSF ROW and Crenshaw Boulevard, provide existing stormwater drainage facilities along their alignments with the capacity to isolate and protect the drainage demands of the Crenshaw/LAX Transit Corridor Project and adjacent developments.

7.1.1 Watershed Drainage Pattern

In the pre-developed condition, it is discovered that the tributary areas of the Ballona Creek and Dominguez Channel Watersheds generate approximately 1,049 cfs during a 25-yr, 24-hour storm event. This calculated flow rate is not localized in any particular areas but is spread out over a tributary area of approximately 798 acres. To better understand the watershed conditions along the proposed LRT alignment, a map was prepared utilizing Los Angeles County Department of Public Works drainage structure overlay-maps (*Figure 7-1*). The overlay-maps show the regions significant storm drain systems (in blue) superimposed on the local Thomas Guide Map pages. Approximate areas of those maps were combined to cover the Crenshaw/LAX Transit Corridor Project alignment area. The Crenshaw/LAX Transit Corridor Project location (LRT alignment), primary channels (Dominguez and Ballona), watershed boundary and the general direction of stormwater were then color-coded onto the base map.

A review of the map provides a regional overview of stormwater flow which impacts the project. Note that the majority of these hydrology subareas either flow away from the Crenshaw/LAX Transit Corridor Project alignment or are intercepted prior to making contact with the project alignment.

7.1.2 Project Contributory Areas

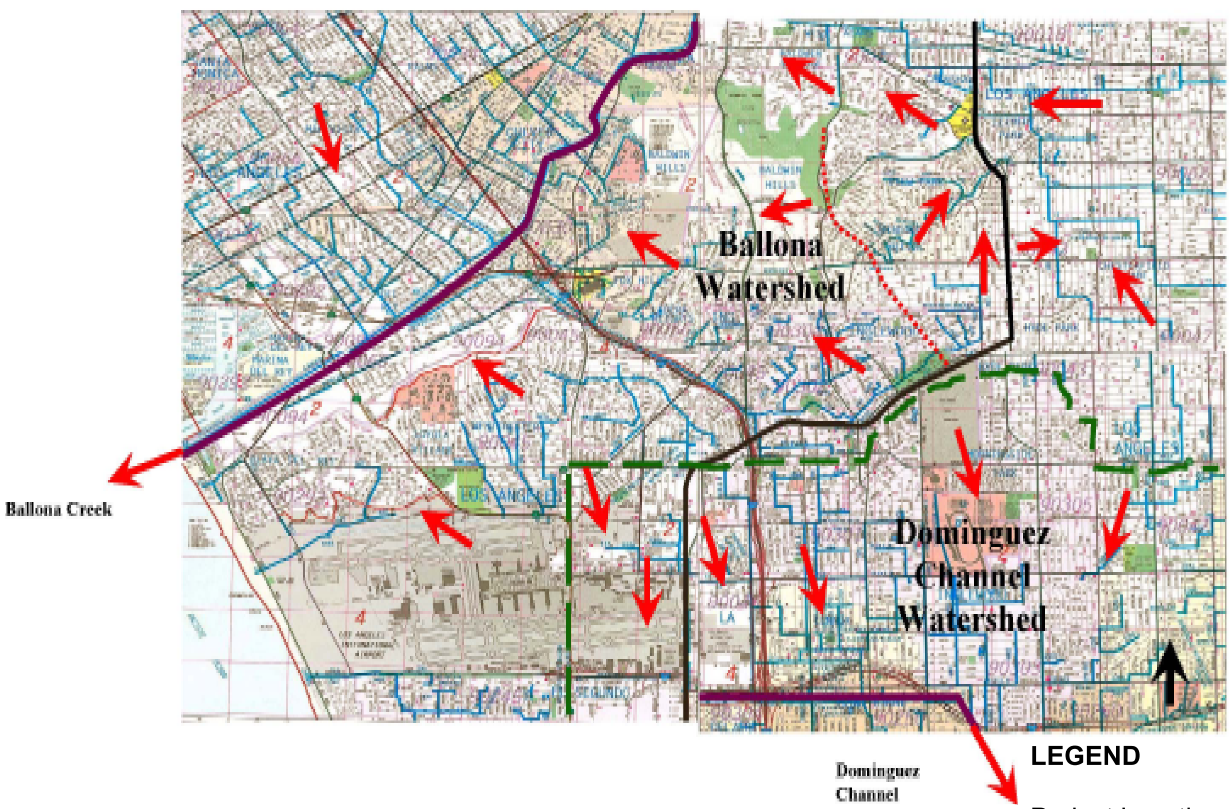
The northern and central half of the Crenshaw/LAX Transit Corridor Project area (Segments 4, 5, 6 and a portion of 2, or all of the Crenshaw Boulevard segments and a portion of the Florence Avenue segments) drain to Ballona Creek, which is located within the Ballona Creek watershed. The remaining half of the study areas (remaining half of Segment 4 and Segments 1, 3 and portion of 2, or a portion of Florence Boulevard and all of Aviation Boulevard Segments) drain to the Dominguez Channel which is located within the Dominguez watershed. *Figure 7-1 – Watershed Drainage Patterns* illustrates these areas.

The entire alignment of the Crenshaw/LAX Transit Corridor Project is protected from stormwater flow. Research of flooding with local jurisdictions revealed the only drainage complaints filed (City of Los Angeles) were in the area of Crenshaw Boulevard at Vernon Avenue. A field observation investigation of the entire proposed alignment showed no signs of erosion or potential flooding. Some areas of past standing water were observed due to flat existing grades within the BNSF ROW. However, those portions of the alignment drainage can be easily corrected with local grading and the installation of localized drainage devices.

The existing protective conditions within all segments of the Crenshaw/LAX Transit Corridor Project alignment create localized hydrology drainage areas that are for the most part, completely within the Crenshaw Boulevard ROW and BNSF ROW general boundaries. However, concerns will be discussed in Section 9 of the Report, regarding the results of possible blockage of certain protective drainage systems within Segment 1.

Drainage runoff quantities for the pre-developed condition are calculated by using the TC (Time of Concentration) Calculator. The TC Calculator is a method utilized and referenced in the Los Angeles County Hydrology Manual in which parameters such as subarea basin size, percent impervious surface, average basin slope, basin runoff length, and precipitation (isohyets value) are utilized for large watersheds in order to calculate total runoff as well as runoff to individual catch basins. The TC Calculator is based on equations and empirical data outlined by the Modified Rational Method. Refer to **Appendix G** for all hydrologic runoff calculations/results as well as the Hydrology Exhibits.

Figure 7-1 – Watershed Drainage Patterns



LEGEND

Project Location

Primary Channels

Watershed Boundary

Storm Water flow

Ridge Line

Source: Thomas Guide 2006
Watershed Boundary – Los Angeles County Engineer Map
Primary Channels - Los Angeles County Engineer Map
Project Location – METRO Study
Stormwater Flow Arrows – Quad Sheet/Area Topography
Drainage Structure Locations (Blue) - Los Angeles County Engineer Map
Ridge Line - Quad Sheet/Area Topography

The following is a segment by segment discussion of these localized contributory areas along the alignment. Detailed descriptions of the grade separations can be found in **Section 5.1.1.5**.

7.1.2.1 Segment 1: Aviation/105 Station to Aviation/Century Station

Segment 1 of the alignment corridor begins at the existing Aviation Boulevard/105 Freeway Station and continues northerly within the BNSF ROW to the proposed Aviation/Century Station. This segment, which requires some ROW to the west of the BNSF ROW, currently has protected drainage areas on both the east and west sides of the Crenshaw/LAX Transit Corridor Project alignment. Located on the east is Aviation Boulevard, and on the west is an open (partially closed) trapezoidal storm drain channel.

The current alignment of the Crenshaw/LAX Transit Corridor Project will require that the existing channel to the west be replaced with a newly designed system (underground instead of open channel). Surface water within the alignment can be delivered to this new main line improvement, including drainage originating from the aerial portion of the alignment.

In all, Segment 1 of the Crenshaw/LAX Transit Corridor has approximately 1000 linear feet of aerial alignment and 4200 linear feet of below-grade alignment. The below-grade portion is not subject to stormwater runoff or flooding, however some portions of the below-grade alignment shall be provided with localized area drains and sump pumps that will allow for water conveyance into the adjacent public storm drain systems. The aerial segment adjacent to the Aviation/Century station shall have localized area drains placed in-line with the support columns so that runoff generated on the raised track can be collected and transferred via vertical drains that lead to the existing ground or drainage facilities below. Drainage protection measures shall be installed at the entrances to both the aerial to below-grade transition as well as the below-grade to aerial transition.

Also of special interest in this segment is the crossing of the alignment with two major existing drainage structures at 111th Street; a 48" storm drain pipe and an 8' x 10' storm drain box culvert. This crossing occurs at the transition from below-grade to aerial alignments. Further consideration in the Preliminary Engineering Phase will be required to arrive at a feasible solution to this conflict.

7.1.2.2 Segment 2: Aviation/Century Station to Florence/La Brea Station

Segment 2 of the alignment corridor begins at the proposed Aviation/Century Station and continues northerly and easterly within the BNSF ROW to the proposed Florence/La Brea Avenue Station. The Segment 2 drainage area (fully within the BSNF ROW) is designed at-grade, slopes westerly and is protected by Florence Avenue to the south. Adjacent grades to the north fall away from the Crenshaw/LAX Transit Corridor Project alignment. This continues along the entire alignment, including at all intersecting streets. On the aerial portion of the alignment (as with other aerial project conditions) the downpipes at columns will be integrated with the projects subterranean drains and connected to existing storm drain systems.

The aerial segments at Manchester Avenue and Interstate Freeway 405 overpasses shall have localized area drains placed in-line with the support columns so that runoff generated on the raised track will be collected and transferred via vertical drains that outlet to the existing ground or drainage facilities below. Drainage protection measures shall be installed at the entrances to both the aerial to at-grade transition as well as the at-grade to aerial transition. In addition, the at-grade street crossing at Arbor Vitae Street (which flows away in both directions from the alignment) must accommodate stormwater flow from subterranean drains within the alignment. The graded drains along both sides of the alignment section will adequately accommodate the storm flows generated from each of the designated drainage subareas.

7.1.2.3 Segment 3: Florence/La Brea Station to Florence/West Station

Segment 3 of the alignment corridor begins at the proposed Florence/La Brea Station and continues northeasterly within the BNSF ROW to the proposed Florence/West Station. This segment alignment is almost entirely within the BNSF ROW, or in a below-grade alignment not within the existing ROW.

East of the Florence/La Brea Station, the adjacent land to the north of the alignment drains northerly and is not affected by offsite runoff. The at-grade portions of the alignment east of the La Brea underpass slopes westerly for the entire alignment length leading to the West Boulevard Station. Minimal amounts of off-site water enter the ROW from the south, but the majority of the alignment is protected by Florence Boulevard along the southern boundary.

There are only two streets crossing the alignment along the at-grade portion; Redondo Boulevard and Centinela Avenue. At Redondo Boulevard, water flows away from the Crenshaw/LAX Transit Corridor Project alignment in both directions. Redondo Boulevard is also located at a “high point” in the alignment grade so a culvert or drainage structure would not be required. Centinela Avenue drops off abruptly from the at-grade alignment as it drains north. A storm drain/catch basin system protects the alignment immediately to the south at the Florence Avenue intersection. Crenshaw/LAX Transit Corridor Project drainage flow lines coming from the east can utilize the storm drain pipe to drain the project at that point.

Special design consideration must be given to the at-grade alignment between Centinela Avenue and La Brea Avenue. In particular, the existing 39” storm drain facility on La Brea Avenue will need to be relocated so that it does not conflict with the proposed below-grade alignment at La Brea Avenue. In the pre-developed condition, the existing storm drain crosses Florence Avenue and captures runoff along the north half of Florence Avenue. This system is of significant importance since it will protect the BNSF rail crossing and also provide pick-up points for the grated drains flowing westerly along the proposed alignment section.

7.1.2.4 Segment 3: Option 3 (Centinela Avenue)

Option 3 calls for a below-grade alignment as the project approaches the intersection with Centinela Avenue. This design option requires a relocation and redesign of the existing 39” storm drain that traverses Florence Avenue and captures storm runoff from the northern half of the existing street section.

7.1.2.5 Segment 4: Crenshaw/West Station to Crenshaw/Slauson Station

Segment 4 of the alignment corridor begins at the proposed Florence/West Station and continues within BNSF ROW northeasterly along the Florence Avenue and turns toward a northerly bearing on Crenshaw Boulevard, ending at the Crenshaw/Slauson Station. This segment is broken into 2 portions; the first portion is from the Florence/West Station to the 67th Street/Crenshaw Boulevard intersection within the BNSF ROW, and the second portion is from the 67th Street intersection to the Crenshaw/Slauson Station, within the Crenshaw Boulevard ROW.

The first portion of the Segment 4 (along BNSF ROW) transitions from an at-grade design to U-section immediately northeast of the Florence/West Station. The U-section design continues for approximately 650 linear feet and then transitions to a cut and cover (tunnel) design. The alignment continues below-grade until it reaches the second portion designated in Crenshaw Boulevard ROW. In general, off-site surface drainage for the 600 linear feet at-grade portion of the segment does not enter the BNSF ROW. Street grades fall away either north or south at the West Boulevard intersection, thus preventing the affects of runoff. The remainder of the first portion of Segment 4 is located below ground and henceforth not affected by stormwater or flooding. Some portions of the below-grade tunnel alignment shall be provided with localized area drains and sump pumps that will allow for water conveyance into the adjacent public storm drain systems. In addition, drainage protection measures shall be installed at the tunnel portals.

The second portion of Segment 4 (along the Crenshaw Boulevard ROW) consists of a below-grade alignment from the intersection with 67th Street to immediately south of Slauson Station, adjacent to the intersection with 59th Street. The remaining 300 linear feet of Segment 4 is at-grade in order to meet the proposed at-grade Crenshaw/Slauson Station. The below-grade design is protected from the affects of stormwater and flooding. The brief at-grade portion of the alignment within Crenshaw Boulevard is protected on the west by an existing storm drain system. However, the east side of the alignment is protected because existing runoff is directed east, away from the Crenshaw Boulevard centerline and 59th Street.

At 59th Street, where the alignment transitions back to an at-grade design, added drainage protection will need to be considered. In addition, the existing drop inlet located at the Crenshaw Boulevard left turn lane and its associated 12" storm drain lateral will need to be relocated due to conflicts with the proposed alignment. There is also an additional conflict with an existing 24" storm drain facility at the 60th Street/Crenshaw Boulevard intersection. This relocation will require future evaluation during the Preliminary Engineering phase to determine a feasible solution.

7.1.2.6 Segment 5: Crenshaw/Slauson Station to Crenshaw/Martin Luther King Station

The Segment 5 alignment corridor begins at the Crenshaw/Slauson Station and continues north along the centerline of Crenshaw Boulevard and ends just south of Martin Luther King Jr. Boulevard at the proposed Crenshaw/MLK Station.

The first 4500 linear feet of Segment 5 is within Slauson Avenue/Crenshaw Boulevard ROW, with a center crown, associated curb and gutter, and various landscaping areas on both sides. Local storm drain systems on the west half of the street protect the westerly side of Crenshaw Boulevard from stormwater coming from the Baldwin Hills area, including the localized cross streets of 48th Street and Slauson Avenue. Although all of these systems are functioning adequately for their current purposes, an upgrade will be required at each of the six (6) intersecting streets along this portion of the alignment. The eastern half of Crenshaw Boulevard drains easterly away from the Crenshaw centerline alignment. This existing design prevents any runoff to the east from affecting the proposed at-grade Crenshaw alignment, including all encompassing street intersections.

Near the 48th Street/Crenshaw Boulevard intersection, the alignment consists of a 480 linear feet U-section design. Following this portion, the cut and cover tunnel runs for the remaining 3000 linear feet, ending at the proposed underground Crenshaw/MLK Station. There are a series of catch basins on 48th Street (west side of Crenshaw Boulevard) in addition to a super-elevated street cross-section on Crenshaw Boulevard that directs surface runoff towards the alignment transition at this location. Special drainage protection and possible upgrading of the existing catch basin system is recommended for this area.

The below-grade portion of Segment 5 alignment shall only be impacted by stormwater at station access points for the proposed Crenshaw/MLK Station. Some portions of the below-grade tunnel alignment shall be provided with localized area drains and sump pumps that will allow for water conveyance into the adjacent public storm drain systems. In addition, drainage protection measures shall be installed at tunnel portals.

Although Segment 5 does not lie within either a 100-year or 500-year FEMA Flood Plain Area, the City of Los Angeles maps log several "drainage complaints" near the vicinity of the Vernon/Crenshaw intersection. The project alignment is below-grade in this area and therefore shall not be affected by any of the reported drainage issues.

7.1.2.7 Segment 5: Design Option 5 (Vernon)

Option 5 involves moving the transition point for the U-section alignment from just north of 48th Street to just north of 50th Street. By relocating this transition approximately 850 linear feet further south, the aforementioned existing storm drain facilities (21"/39" storm drain) no longer needs to be relocated at the Crenshaw Boulevard/Leimert Boulevard intersection. Other drainage will be affected same as the baseline alignment.

7.1.2.8 Segment 6: Crenshaw/Martin Luther King Station to Crenshaw/Exposition Station

Segment 6 begins at the proposed underground Crenshaw/MLK Station and continues north along the Crenshaw Boulevard before ending at the proposed Crenshaw/Exposition Station. This particular segment begins as a below-grade tunnel alignment for the first 1600 linear feet and then transitions to an at-grade design in the vicinity of the 39th Street/Crenshaw Boulevard intersection. Segment 6 is entirely within Crenshaw Boulevard ROW, which is a fully paved street with a center crown and curb and gutter on either side.

The first 1600 linear feet of Segment 6 is below-grade and therefore not exposed to surface water runoff conditions. The only possible issues of flooding that could take place would be at the access openings to the Crenshaw/MLK Station. Some portions of the below-grade tunnel alignment shall be provided with localized area drains and sump pumps that will allow for water conveyance into the adjacent public storm drain systems. In addition, drainage protection measures shall be installed at the tunnel portal.

The remainder of the Segment 6 (approximately 2100 linear feet) is proposed as an at-grade design. Existing underground storm drain systems are present for the full length of this segment. This portion of the alignment is protected from storm runoff by implementation of a street crown, channelization by the adjacent curb and gutter, and conveyance into the existing underground storm drain systems.

As noted earlier in this report, Segment 6 is the only portion of the Crenshaw/LAX Transit Corridor Project alignment that is shown in a 500-year floodplain on FEMA Maps (**Appendix G**). No flooding of the streets was reported in this area. However, three (3) major storm drain systems cross the at-grade portion of the alignment; a 63" RCP at Rodeo Road, a 22'x14' box culvert at Coliseum Street and a 36" RCP at 39th Street. In addition, major storm drain systems cross the below-grade alignment at Martin Luther King Jr. Boulevard—an 11'x 11' double box culvert, a 9'x7' box culvert, and a 60"storm drain. The existing street grade along Crenshaw Boulevard continues in a northerly direction from the Martin Luther King Jr. Boulevard and Crenshaw Boulevard intersection. The Martin Luther King Jr. Boulevard intersection is at a 118'

AMSL elevation (per Crenshaw/LAX Transit Corridor Project topography) and descends to an elevation of 115' AMSL over a span of approximately 700 linear feet. From there, the grade descends in the northerly direction along Crenshaw Boulevard only an additional 2 to 3 feet over a distance of 3300 linear feet, to an approximate elevation of 112' AMSL at Exposition Boulevard. In other words, this is a very flat area, hence being designated as a flood plain. These above mentioned storm drain conduits transport all of the stormwater from the southeast quadrant of the Ballona Watershed to Ballona Creek. Partial or full failure of any of these systems, either up or down stream of the project alignment, would cause flooding of the at-grade portion of the alignment.

7.1.2.9 Segment 6: Design Option 6 (Exposition West and Exposition East)

Option 6 is designed entirely below-grade and will not be impacted or have an impact on existing surface drainage conditions.

7.2 Existing Storm Drain Facilities

Existing drainage systems along the entire length of the alignment have been identified in contract drawing sheets U-001 thru U-045, "Composite Existing Utilities". For purposes of this report, these utility sheets have been reproduced at a smaller scale, highlighting only the existing drainage systems and depicting the proposed drainage systems. These exhibits are included in **Appendix C** and **Appendix D**.

7.3 Post-developed Drainage Areas

As previously noted in the pre-developed condition, the Crenshaw/LAX Transit Corridor Project alignment lies close to the common boundary line between two major watershed areas, the Dominguez Channel and Ballona Creek Watersheds (*Figure 4-1* and *Figure 4-2*). Hence, impacts from storm runoff and flooding are minimized for the lower post-developed segment of the Crenshaw/LAX Transit Corridor Project alignment. In general, storm water is flowing away from the Crenshaw/LAX Transit Corridor Project area along the Florence Avenue/BNSF ROW portion of the alignment (City of Inglewood). Furthermore, the remaining two Crenshaw/LAX Transit Corridor Project areas, Aviation Boulevard/BNSF ROW and Crenshaw Boulevard, have existing drainage facilities along their alignments with the capacity to isolate and protect against major storm runoff generated from the adjacent developments. Additional catch basin drop inlet structures shall be designed and strategically placed in order to protect the Crenshaw/LAX Transit Corridor Project from future storm flows. In addition, facilities may need to be upgraded and/or relocated to account for possible conflicts with proposed Crenshaw/LAX Transit Corridor below-ground alignments.

7.3.1 Watershed Drainage Pattern

The post-developed watershed is very similar to that of the existing condition. In the proposed condition, the peak flow rate increases from 1,049 cfs to approximately 1,056 cfs. This slight increase in total runoff is due to minimal changes in the time of concentration (TC) for several of the individual Subareas as well as changes in some of the Subarea basin sizes, due in part to the proposed placement of the Crenshaw/LAX Transit Corridor future alignment. The increase of 7 cfs is considered to be miniscule (0.67%) when taking into account the entire Ballona Creek & Dominguez Channel Watersheds. In addition, the 7 cfs increase is configured by summing up the total calculated runoff numbers from all of the project basin subareas. This is a conservative analysis since it does not take into consideration lag times or time of concentration for the entire project area and/or watersheds.

Note that the post-developed condition does not include any redirection of surface runoff or changes in the percentage of impervious areas. The post-developed condition shall not have any negative impacts on any of the adjacent properties and/or residents.

None of the design alternatives or options will result in delineation from the drainage basins defined for the baseline alignment. The existing and proposed crowns in the encompassing streets divide runoff on respective sides (north/south or east/west) of each and every street alignment, regardless of alignment alternative or option.

Refer to *Figure 7-1 - Watershed Drainage Pattern* for the watershed conditions, which will not be altered by the Project. Note that the majority of these hydrology subareas either flow away from the Crenshaw/LAX Transit Corridor Project alignment or are intercepted prior to making contact with the project alignment.

Drainage runoff quantities for the post-developed condition are calculated by using the TC (Time of Concentration) Calculator. The TC Calculator is a method utilized and referenced in the Los Angeles County Hydrology Manual in which parameters such as subarea basin size, percent impervious surface, average basin slope, basin runoff length, and precipitation (isohyets value) are utilized for large watersheds in order to calculate total runoff as well as runoff to individual catch basins. The TC Calculator is based on equations and empirical data outlined by the Modified Rational Method. Refer to **Appendix G** for all hydrologic runoff calculations/results as well as the Hydrology Exhibits.

7.3.2 Project Contributory Areas

The northern and central half of the Crenshaw/LAX Transit Corridor Project area (Segments 5, 6, 7 and a portion of 2 and 4, or all of the Crenshaw Boulevard Segments and a portion of the Florence Avenue Segments) drain to Ballona Creek, which is located within the Ballona Creek watershed. The remaining half of the study area (remaining part of Segment 4 and Segments 1, 3 and portion of 2; [portion of Florence Boulevard and all of Aviation Boulevard Segments]) drain to the Dominguez Channel which is located within the Dominguez watershed.

The areas along the Project alignment does not exhibit any existing drainage problems. Research of flooding with local jurisdictions revealed one drainage complaint filed with the City of Los Angeles. It stated that the area near Crenshaw Boulevard and Vernon Avenue had potential issues. However, a field investigation of the entire proposed alignment, including this area of concern, showed no signs of erosion or potential flooding. In the post-developed condition, some areas of past standing water (due to flat existing grades) shall be corrected within the BNSF ROW. Runoff mitigation in these portions of the alignment will be corrected with some minor grading and installation of numerous drainage devices.

The post-developed condition within all segments of the Crenshaw/LAX Transit Corridor Project alignment creates localized hydrology drainage subareas that are for the most part, completely within the Crenshaw Boulevard ROW and BNSF ROW general boundaries. This does not deter from what is defined and observed in the existing pre-developed condition.

8 CONCLUSIONS

8.1 Proposed Storm Drain Facilities/Measures

8.1.1 Segment 1

- For segment 1 the primary recommendation is the relocation of the trapezoidal channel/storm drain to the west of the Crenshaw/LAX Transit Corridor Project ROW. This storm drain will be required to be underground for the full length of the Los Angeles Airport frontage between Imperial Highway, on the South, and Century Boulevard on the North. Existing storm drain systems and collection points entering the channel from the west will require that appropriate connections be designed to join the mainline storm drain pipe. The Northerly portion of the system (111th Street to Century Boulevard) flows to the South. The Southerly portion of the system (Imperial Highway to 111th Street) flows to the North. The two portions converge at 111th Street and then drain east through an 8' x 10" Box Culvert storm drain. This crossing is in conflict with the transition of the alignment from aerial to below grade. In addition, a 48" storm drain exists independently to the north of the box culvert and is also in conflict with the vertical Crenshaw/LAX Transit Corridor Project alignment. Relocation of either of these two drainage structures is considered impractical. Further evaluation is required in the Preliminary Engineering Phase to determine a solution.
- This segment will also include graded flow lines, along the surface of the alignment, with pick-up points which discharge into the relocated main channel/storm drain.
- A temporary construction easement is needed along the westerly side of the alignment between Imperial Highway and Century Boulevard for the relocation of the storm drain. The ROW width ranges from 23' to 30' for most of the length with a variable width at the intersection with Century Boulevard.
- The aerial segment adjacent to the Aviation/Century Station shall have localized area drains placed in-line with the support columns so that runoff generated on the raised track will be collected and transferred via vertical drains to ground level or into drainage facilities below. Drainage protection measures shall be installed at the transitions between aerial and below-grade segments.

8.1.2 Segment 2 & 2A

- Flow line grading along both sides of the entire alignment for segment 2 and 2A is recommended to control drainage within the at-grade ROW. Culverts will be required where storm drain systems do not currently exist at street grade crossings (Ivy Avenue, Eucalyptus Avenue, Railroad Place and Oak Street).
- It is recommended to install catch basins and associated storm drain laterals at the following intersecting street crossings: Hyde Park Boulevard, Hindry Avenue, Aviation/Manchester, Arbor Vitae/Aviation and Century/Aviation. These proposed structures will connect to the existing storm drain system within each respective location. These systems will control the remainder of the surface runoff within these segments.
- The aerial segments at Manchester Avenue and Interstate Freeway 405 overpasses shall have localized area drains placed in-line with the support columns so that runoff generated on the raised track will be collected and transferred via vertical drains to ground level or into

drainage facilities below. Drainage protection measures shall be installed at the transitions between aerial and at-grade segments.

- A northerly storm drain lateral extension will be necessary for the existing 108" storm drain facility located just north of Century Boulevard.

8.1.3 Segment 3

- Normal flow line grading along both sides of entire length of the at-grade alignment will be required for control of drainage within the Crenshaw/LAX Transit Corridor Project ROW. This will be typical for all segments within the existing BNSF ROW.
- Drainage catch basins and laterals are recommended to be constructed on the easterly sides of Centinela Avenue and La Brea Avenue within the alignment ROW. These will serve to pick up the surface run-off being controlled by the graded flow lines. The catch basin will be connected to the existing storm drain systems at these two locations.
- At the beginning and end of aerial alignment sections, the central track drainage swales require drainage devices to collect and divert drainage from the swales or the bridge away from the area. This applies to all segments.
- Horizontal relocation is recommended for the existing 39" storm drain adjacent to the proposed below-grade alignment at the La Brea Avenue/Florence Avenue intersection. This can be accomplished by redirecting the storm drain at the La Brea Avenue/Florence Avenue intersection to drain west and cross the proposed at-grade alignment near Station 196+00. This design shall also avoid conflict with the proposed Florence/La Brea Station and reconnect to the existing 39" storm drain facility further downstream along La Brea Avenue.

8.1.4 Segment 3: Option 3 (Centinela)

Vertical relocation is recommended for the existing 39" storm drain over the proposed below-grade alignment adjacent to the Centinela Avenue/Florence Avenue intersection. This can be accomplished by increasing the new pipe's grade northerly in order to allow crossing over the below-grade portion of the alignment. The new pipe alignment would then continue north at a relatively flat grade and reconnect to the existing 39" storm drain facility further downstream along Centinela Avenue.

8.1.5 Segment 4

- The relatively flat at-grade portions of Segment 4 from Brynhurst Avenue to the West Boulevard Station will need graded flow lines to adequately provide flood protection. Small drainage culverts will be required at West Boulevard and Brynhurst Avenue to transport water easterly. The proposed structure shall connect to the nearest existing underlying storm drain system.
- Surface drainage, directed easterly within the alignment area, will require a connection to the existing storm drain at the intersection of 67th Street and Crenshaw Boulevard.
- Victoria Avenue (to be closed) may need a drainage device installed on the north side of the Crenshaw/LAX Transit Corridor Project alignment. The proposed structure shall be connected to the nearest existing underlying storm drain system.
- The existing drop inlet structure located in the left turn lane and associated storm drain lateral at the Crenshaw Boulevard/59th Street intersection will need to be relocated in order to

account for the proposed at-grade alignment immediately south of the Crenshaw/Slauson Station.

- Additional drainage protection is recommended at 59th Street where the alignment transitions from below-grade to at-grade. Refer to **Appendix D** for details.

8.1.6 Segment 5

- It is recommended that the project provide raised curbs (8" minimum curb face) along at-grade portions of this Segment 5 on both the east and west sides of the proposed alignment.
- Install drop inlet catch basins structures across the project alignment north of the 48th Street/Crenshaw Boulevard intersection and at the transition entrance to the below-grade alignment located approximately 300 linear feet north of the 48th Street intersection. Connect these proposed conduits to the existing 36"/39" storm drain system located within the west half of Crenshaw Boulevard.
- The proposed alignment is in conflict with an existing 39" storm drain that runs north along Crenshaw Boulevard and diverges onto Leimert Boulevard at the intersection of Leimert Boulevard and Crenshaw Boulevard. Here, the proposed project alignment crosses the storm drain and continues northwesterly along Crenshaw Boulevard. It is recommended that the conflicting section of pipe be increased to a 45" storm drain and realigned to run adjacent to the proposed alignment. The storm drain will eventually turn east, traversing beneath an existing parking lot (located on the east side of Crenshaw Boulevard) once enough clearance has been provided to cross the proposed below-grade alignment. The storm drain conduit will connect to the existing 45" storm drain facility that continues north along Leimert Boulevard.
- Adjacent to the Crenshaw/Leimert intersection, an existing 21" storm drain lateral is in conflict with the proposed below-grade Crenshaw/LAX Transit Corridor Project alignment. This lateral currently connects to the aforementioned existing 39" storm drain facility that continues north onto Leimert Boulevard. It is proposed that this 21" storm drain lateral connect to the proposed 39" realigned pipe that is to continue along Crenshaw Boulevard.

8.1.7 Segment 5: Option 5 (Vernon)

See comments for Segment 5 (above). Added drainage protection is proposed at the 50th Street intersection rather than 48th Street intersection.

8.1.8 Segment 6

- Segment 6 has been identified as a 500 year "Flood Hazard Zone". Catch basin and lateral pipe systems are required at track drainage swale to remove drainage from the proposed alignment subareas. Connect these proposed structures to the existing underlying storm drain system.
- The vertical alignment for the Crenshaw/LAX Transit Corridor Project is in conflict with the existing 36" storm drain that crosses the alignment at 39th Street. We recommend construction of a "horseshoe" of the 36" pipe to the south, where there would be sufficient clearance to pass over the alignment, and return north to reconnect on the opposite side of the proposed alignment to the existing pipe.

- Where the alignment transitions from below-grade to at-grade, 130 feet south of Coliseum Place, catch basins or other flood protection devices will need to be incorporated into the drainage design.
- It is recommended that the project provide raised curbs (8” minimum curb face) along at-grade portions of Segment 6 on both the east and west sides of the proposed alignment.
- Install drop inlet catch basin structures across the alignment width at the below-grade to at-grade transition entrance, as well as on the north and south sides of the intersection crossings at Coliseum Street, Rodeo Place, and Rodeo Road. Connect these proposed structures to each of their respective existing localized storm drain systems.

8.1.9 Segment 6: Option 6 (Exposition West and Exposition East)

The hydrology study shows that the post-developed watershed associated with Options 6 is very similar to that of the existing condition. Therefore, there are no drainage impacts or modifications.