Appendix E

Phillip Williams & Associates Refined Modeling

PWA
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MEMORANDUM

DATE: March 11, 2005
TO: Michael Stevenson
COMPANY: JONES AND STOKES
FROM: Ann Borgonovo, Matt Wickland
COPY TO: Carolyn Shoulders
RE: Big Lagoon Wetland and Creek Restoration Project EIR/EIS Hydraulic Model
PWA Ref. #: 1769.03

Overview

The one–dimensional hydrodynamic modeling software MIKE 11 was used to model the various alternatives of the restoration project, including the no-action alternative. Each alternative's network is comprised of main branch, various overbank and floodplain flow paths, and linkages connecting the different paths and branches.

PWA updated cross sections and flow paths of the existing un-calibrated Big Lagoon MIKE 11 model with new survey data provided by the National Park Service (NPS) for the area around stations 1,750 to 2,150. This new data reflected the creek's current flow path closer to the road upstream of the parking lot. A new bridge modeling function available with the most updated version of MIKE 11 was utilized to better reflect Pacific Way Bridge under current conditions. Alternatives 2 and 4 were modeled with the proposed new bridge at Pacific Way. This soffit of the 200 foot long bridge was set at 16.5 ft NGVD. Additionally, PWA used a site visit and a 2003 color orthophoto to better specify the roughness values (Manning's n) for different reaches, branches, and floodplains of Redwood Creek. Low roughness areas include the recently-dredged portion of the channel and furthest downstream section near the beach. High roughness areas include the vegetated portions of the floodplain and the willow-choked zone near the parking lot.

The hydraulic model did not include flows from the two Green Gulch tributaries (Green Gulch Creek and the unnamed tributary). At present, the hydrology of Green Gulch Creek is not well defined. The limited information available on Green Gulch flows (PWA et al., 1994; PWA et al., 2003) suggests that Green Gulch flows are not significant relative to flows on Redwood Creek.

Alternative 1 Calibration

NPS provided PWA with measured flow rates and daily stage data at the Highway 1 Bridge and peak water surface elevations (WSE) at several points in the project site from storm events in December 2004 and January 2005. The measured flow rates at Highway 1 from water year 2005 were used to create a rating curve (R^2 = 0.986) for the current channel. This was then applied to the stage data in order to create several hydrographs that could be inputted into the model for calibration purposes. Peak water surface elevation data was available for several days in the winter of water year 2005 at three locations: upstream and downstream of Pacific Way Bridge and at the pedestrian bridge. To calibrate the model, roughness values were adjusted for different portions of the channel and floodplain. Table 1 compares the measured water surface elevations with those predicted by the calibrated model.

Table 1: Comparison of Measured Water Surface Elevations and those Predicted by the MIKE Model

	WSE at Station 2,875		WSE at Station 2,330		WSE at Station 1,190	
	Measured	Predicted	Measured	Predicted	Measured	Predicted
December 7	-	-	3.34	3.53	-	-
December 8	4.33	4.36	3.98	4.00	-	-
December 29	4.46	4.43	4.13	4.02	2.86	2.89
December 31	4.18	3.79	3.76	3.53	2.37	2.16
January 1	3.88	3.84	3.76	3.57	2.34	2.21

Alternatives 2 and 4 Calibration

For existing conditions, the roughness in the main channel ranged from 0.03 in sandy areas to 0.08 in areas with dense vegetation. The majority of the channel had n values around 0.045. For both Alternatives 2 and 4, the roughness in the main channel ranged from 0.03 in sandy areas to 0.09 in areas anticipated to have high concentrations of large woody debris. A typical n value that characterized the rest of the main channel after restoration was 0.06. Alternative 4 had a roughness value of 0.03 in the large lagoon, with n values of approximately 0.09 for the wetland vegetation surrounding the lagoon. The overbank and floodplain areas had Manning's n values of 0.10 and 0.12 depending on the relative amount of roughness and the expected flow depth.

Results

Time-series hydrographs for the 5-year, 50-year, and 100-year flood events were used as an upstream boundary for each model. The downstream boundary was set at a constant water level of mean higher high water (MHHW). The model was run for a period of 32 hours, which allowed enough time for the

peak flows to migrate through the entire reach. Peak water surface elevations were recorded at each cross section for each of the three flow regimes. These results are shown in Figures 1.1, 1.2, and 1.3. In addition, peak flood water surface elevations are shown in comparison with the channel thalweg used in the hydraulic model for each alternative in Figures 2.1, 2.2, and 2.3.

Model Flow Paths

Model Cross Sections

0 250 500 1,000 Feet

figure **A-1**

Big Lagoon Wetland and Creek Restoration Project EIR/EIS

Alternative 1: MIKE 11 Network

PWA #: 1769.03

PWA

Appendix F

DKS Associates Traffic Memorandum

DKS Associates
TRANSPORTATION SOLUTIONS

MEMORANDUM

TO: Michael Stevenson, Jones & Stokes

FROM: Mark Spencer and Patty Camacho

DATE: June 21, 2006

SUBJECT: Muir Beach EIR – Traffic LOS Analysis & Parking Analysis P/A No. 05005-000

This memo provides supplemental analysis to the April 04, 2005 submittal by DKS Associates to include changes in the traffic and parking circulation. DKS Associates has reviewed supplemental traffic and parking data collected by Robert Peccia & Associates during the summer of 2004. The most recent data were used for comparison to the 2001 and 2002 data used in the Existing Conditions Technical Memorandum for the Comprehensive Transportation Management Plan (CTMP), which was the basis for the preliminary traffic analysis for the Muir Beach EIR prepared by DKS Associates.

2004 Traffic and Parking Data

Data collected during the summer of 2004 is representative of the peak season and was reviewed to establish the accuracy and validate the 2001 and 2002 conditions during both the peak season. The data collected consisted of hourly roadway traffic volumes from mid-June to mid-September at 14 locations within the CTMP area and parking surveys at four areas with the Marin Parklands including Muir Beach.

When compared to data collected in 2001 and 2002, on average, data collected in July 2004 was found to be less than the 2001 peak season, during the weekday and weekend periods. The traffic analysis considers the traffic conditions of the Peak, Shoulder and Off-Peak Seasons during the weekday and weekend peak hours. In addition, the traffic analysis also considers the effect of the parking alternatives considered under the various restoration alternatives.

Revised Traffic LOS Analysis & Parking Analysis

Based on the 2004 traffic and parking data results, it was found that the traffic LOS and parking analysis previously prepared provide a conservative estimate of the potential impacts under each scenario analyzed.

Intersection level of service was performed for the weekday and weekend peak hours at the following intersections:

1. Shoreline Highway & Muir Woods Road
2. Shoreline Highway & Pacific Way
3. Shoreline Highway & Panoramic Highway (three corners)

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Average Daily Traffic (ADT)[1] volumes for the weekday and weekend conditions were provided (bi-directional) for the Peak, Shoulder and Off-Peak Seasons for the following roadway segments:

1. Panoramic Highway at Shoreline Highway "Three Corners"
2. Shoreline Highway south of Panoramic Highway
3. Shoreline Highway between Panoramic Highway and Muir Woods Road (Frank Valley Road)
4. Muir Woods Road (Frank Valley Road) near Shoreline Highway
5. Shoreline Highway north of Muir Woods Road (Frank Valley Road)

Peak Hour[2] volumes for the weekday condition were also provided (by direction) for the Peak and Shoulder Seasons only for the roadway segments mentioned above. Intersection turning movement counts were also made available for the Peak Season[3] for the intersections of Shoreline Highway & Muir Woods Road and Shoreline Highway & Panoramic Highway.

I. Study Methodology

Existing Conditions – Weekday Peak

Since weekday peak hour volumes were only available for the Peak and Shoulder season, the Off-Peak season volumes were calculated based on the average percent differential between the Peak and Shoulder season roadway volumes (by direction). The percent for the Peak and Shoulder season was determined based on the peak hour roadway differential volumes (given) divided by the Average Daily Traffic Volumes of the same roadway segment.

In order to evaluate existing weekday peak conditions for the Peak, Shoulder and Off-Peak Seasons, a turning movement percent, by approach, was determined for the intersections of Shoreline Highway & Muir Woods Road and Shoreline Highway & Panoramic Highway (three corners) using the weekday midday intersection turning movement counts. Using the weekday peak hour roadway volumes, the turning movement percent was then applied to each approach to determine the overall turning movement volumes. This same methodology was applied to the Shoulder and Off-Peak Season conditions.

Since no data were available for the intersection of Shoreline Highway and Pacific Way, DKS recently performed weekday midday and p.m. peak counts during the off-peak season. In order to evaluate the weekday peak hour condition for this intersection, a seasonal average percent increase was calculated for the adjacent intersections and applied to this intersection. The average percent increase was based on the overall weekday peak hour intersection total volumes from season to season periods.

[1] CTMP. Robert Peccia & Associates Existing Conditions Technical Memorandum. Chapter 4, Figure 4.1 and 4.2.
[2] CTMP. Robert Peccia & Associates. Existing Conditions Technical Memorandum. Chapter 4, Figure 4.3 and 4.4.
[3] Robert Peccia & Associates.

Table 1 shows the intersection level of service for the weekday peak hour conditions.

Table 1

Intersection Level of Service Summary - Weekday Peak Hour

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	16.5	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	14.8	B	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Existing Conditions – Weekend Peak

Weekend peak hour volumes were determined using the same percent differential of the weekday peak volumes to the weekday ADT and applying it to the ADT of the weekend condition to derive peak hour volumes for each of the roadway segments in the study area. This was done for the Peak, Shoulder and Off-Peak seasons.

In order to evaluate existing weekend peak conditions for the Peak, Shoulder and Off-Peak Seasons, a turning movement percent, by approach, was determined for the intersections of Shoreline Highway & Muir Woods Road and Shoreline Highway & Panoramic Highway (three corners) using the weekend midday intersection turning movement counts. Using the weekend peak hour roadway volumes the turning movement percent was then applied to each approach to determine the overall turning movement volumes. This same methodology was applied to the Shoulder and Off-Peak Season conditions.

Since no data were available for the intersection of Shoreline Highway and Pacific Way, DKS calculated the percent increase from weekday to weekend intersection volumes of the adjacent street and applied it to the weekday volumes at Shoreline Highway and Pacific Way. In order to evaluate the weekend peak hour condition for this intersection, an average percent increase was calculated for the adjacent intersections and applied to this intersection. The average percent increase was based on the overall weekend peak hour intersection total volumes of the adjacent street from season to season periods.

Table 2 shows the intersection level of service for the weekend peak hour conditions.

Table 2

Intersection Level of Service Summary – Weekend Peak Hour

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	24.3	C
2.	Shoreline Highway & Pacific Way	17.9	C	15.2	C	11.3	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

II. Public Access Alternatives

This section provides the context by which changes in the traffic circulation and parking supply for the various restoration alternatives will be measured for the traffic analysis.

Table 3 shows the existing parking demand for the weekday and weekend during the Peak, Shoulder and Off-Peak seasons. The parking demand is based on a supply of 175 spaces. **Table 4** shows a comparison between the alternatives and the parking surplus/shortage for the weekday and weekend conditions during the Peak, Shoulder and Off-Peak Seasons. Parking demand surplus/shortage is based on the existing demand (**Table 3**).

Table 3
Parking Demand for Weekday and Weekend

Day of Week	Peak[1]		Shoulder[2]		Off-Peak[2]	
	%	# of Veh	%	# of Veh	%	# of Veh
Weekday	91	159	66	115	17	30
Weekend	115	201	91	160	69	120

[1] CTMP. Robert Peccia & Associates Existing Conditions Technical Memorandum. Chapter 5.
[2] CTMP Parking Information. Working Draft. August 29, 2003

Table 4
Parking Demand Analysis – Weekday and Weekend
Surplus/Shortfall

Alternative	# of Spaces	Peak		Shoulder		Off-Peak	
		Weekday (159)	Weekend (201)	Weekday (115)	Weekend (160)	Weekday (30)	Weekend (120)
B-1	50	-109	-151	-65	-110	20	-70
B-2	145	-14	-56	30	-15	115	25
B-3	175	16	-26	60	15	145	55
B-4	175	16	-26	60	15	145	55
B-5	200	41	-1	85	40	170	80
C	118	-41	-83	3	-42	88	-2

(#) Estimated parking demand based on existing conditions, see Table 3.
Parking Shortfall

Alternative B-1

In order to evaluate the change in traffic conditions associated with Alternative B-1, it was assumed that 25% of the vehicles would remain in the parking lot while 75% of the vehicles would exit and travel to an alternate site. For example, during the Peak Season, Weekday peak period, 109 vehicles would be unable to find parking in the lot. Of these, approximately 27 would remain in the parking lot and wait for an open spot while 82 of the vehicles would circulate out of the lot and travel back via Pacific Way and Shoreline Highway

This assumption was applied for all scenarios (weekday and weekend) during the peak season in which there was a parking shortage.

Excess vehicles were re-routed at the intersection of Shoreline Highway and Pacific Way, assuming a 75% northbound and 25% southbound split at Shoreline Highway. This distribution is based on existing travel patterns and the locations of complementary land uses. The number of vehicles traveling northbound and/or southbound were then split assuming a 50-50 percent split at the intersection of Shoreline Highway and Muir Woods and Shoreline Highway and Panoramic Highway. For example, out of the 82 vehicles leaving the parking lot (under Alt. B1), 62 would travel north towards Muir Woods Road and 20 vehicles towards Panoramic Highway. Once these vehicles reach the other intersections the 50-50 split was assumed. At Muir Woods Road, approximately 31 vehicles would travel eastbound on Muir Woods Road, while the remaining 31 would continue traveling northbound on Shoreline Highway towards Stinson Beach.

Tables 5-9 show the level of service at the study intersections under all studied alternatives.

Table 5A - Weekday
Intersection Level of Service Summary – Alternative B1

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	21.3	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	15.3	C	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 5B - Weekend
Intersection Level of Service Summary – Alternative B1

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	26.5	D
2.	Shoreline Highway & Pacific Way	29.9	D	17.9	C	12.7	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Alternative B-2

Table 6A – Weekday
Intersection Level of Service Summary – Alternative B2

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	19.9	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	13.1	B	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 6B
Intersection Level of Service Summary – Alternative B2

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	24.6	C
2.	Shoreline Highway & Pacific Way	21.3	C	15.2	C	11.5	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Alternative B-3

Table 7A - Weekday
Intersection Level of Service Summary – Alternative B3

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	16.5	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	14.8	B	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 7B - Weekend
Intersection Level of Service Summary – Alternative B3

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	24.3	C
2.	Shoreline Highway & Pacific Way	19.4	C	15.2	C	11.3	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Alternative B-4

Table 8A – Weekday
Intersection Level of Service Summary – Alternative B4

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	16.5	C	13.1	B	12.4	B
2.	Shoreline Highway & Pacific Way	14.8	B	11.5	B	11.0	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	28.9	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 8B - Weekend
Intersection Level of Service Summary – Alternative B4

#	Intersection	Peak		Shoulder		Off-Peak	
		Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]	Appr. Delay[1]	LOS[2]
1.	Shoreline Highway & Muir Woods Road	>50	F	>50	F	24.3	C
2.	Shoreline Highway & Pacific Way	19.4	C	15.2	C	11.3	B
3.	Shoreline Highway & Panoramic Highway	>50	F	>50	F	>50	F

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Alternative B-5

This alternative would result in similar intersection operation as the existing condition. The parking lot operation during the peak season would improve as a result of the additional spaces, but the number of vehicles at the study intersections during peak periods would remain the same.

Alternative C

Under Alternative C, a new parking lot would be constructed at Alder Grove located along Shoreline Highway (Highway 1), north of Pacific Way. It in anticipated that vehicles entering and existing this site would only affect the operation of Shoreline Highway & Muir Woods Road. The operation of the two other study intersection is not anticipated to differ under this scenario. **Table 9** shows the intersection level of service for this alternative.

Table 9
Intersection Level of Service Summary – Alternative C

#	Intersection	Weekday				Weekend			
		Peak		Peak		Shoulder		Off-Peak	
		Appr. Delay	LOS	Appr. Delay	LOS	Appr. Delay	LOS	Appr. Delay	LOS
1.	Shoreline Highway & Muir Woods Road	20.5	C	>50	F	>50	F	25.4	D

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 10 and Table 11 provide a summary comparison of the intersection level of service for each alternative during the weekday and weekend conditions.

Table 10 – Weekday
Intersection Level of Service Comparison Summary

#	Alternative	Parking Spaces	Peak Appr. Delay	Peak LOS	Shoulder Appr. Delay	Shoulder LOS	Off-Peak Appr. Delay	Off-Peak LOS
Shoreline Hwy & Muir Woods Rd	Existing	175	16.5	C	13.1	B	12.4	B
	B1	50	21.3	C	13.1	B	12.4	B
	B2	145	19.9	C	13.1	B	12.4	B
	B3	175	16.5	C	13.1	B	12.4	B
	B4	175	16.5	C	13.1	B	12.4	B
	C	118	20.5	C	-	-	-	-
Shoreline Hwy & Pacific Wy	Existing	175	14.8	B	11.5	B	11.0	B
	B1	50	15.3	C	11.5	B	11.0	B
	B2	145	13.1	B	11.5	B	11.0	B
	B3	175	14.8	B	11.5	B	11.0	B
	B4	175	14.8	B	11.5	B	11.0	B
	C	118	-	-	-	-	-	-
Shoreline Hwy & Panoramic Hwy	Existing	175	>50	F	>50	F	28.9	D
	B1	50	>50	F	>50	F	28.9	D
	B2	145	>50	F	>50	F	>50	F
	B3	175	>50	F	>50	F	28.9	D
	B4	175	>50	F	>50	F	28.9	D
	C	118	-	-	-	-	-	-

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

Table 11 – Weekend
Intersection Level of Service Comparison Summary

#	Alternative	Parking Spaces	Peak Appr. Delay	Peak LOS	Shoulder Appr. Delay	Shoulder LOS	Off-Peak Appr. Delay	Off-Peak LOS
Shoreline Hwy & Muir Woods Rd	Existing	175	>50	F	>50	F	24.3	C
	B1	50	>50	F	>50	F	26.5	D
	B2	145	>50	F	>50	F	24.6	D
	B3	175	>50	F	>50	F	24.3	D
	B4	175	>50	F	>50	F	24.3	D
	C	118	>50	F	>50	F	25.4	D
Shoreline Hwy & Pacific Wy	Existing	175	17.9	C	15.2	C	11.3	B
	B1	50	29.9	D	17.9	C	12.7	B
	B2	145	21.3	C	15.2	C	11.5	B
	B3	175	19.4	C	15.2	C	11.3	B
	B4	175	19.4	C	15.2	C	11.3	B
	C	118	-	-	-	-	-	-
Shoreline Hwy & Panoramic Hwy	Existing	175	>50	F	>50	F	>50	F
	B1	50	>50	F	>50	F	>50	F
	B2	145	>50	F	>50	F	>50	F
	B3	175	>50	F	>50	F	>50	F
	B4	175	>50	F	>50	F	>50	F
	C	118	-	-	-	-	-	-

[1]Appr. Delay: Approach delay per vehicle, in seconds per vehicle.
[2]LOS: Level of Service, as defined by Transportation Research Board Special Report 209, Highway Capacity Manual 2000.

III. Parking Analysis

This section evaluates the potential parking queue for the restoration alternatives listed in **Table 4** for Peak, Shoulder and Off-Peak conditions. Based on parking utilization surveys conducted at the Muir Beach parking lot during the peak and shoulder seasons, a maximum hourly arrival rate (in vehicles) was calculated for each season except for the off-season. The maximum parking demand estimated for the off-peak season during a weekday and weekend period was assumed to be the same as the maximum arrival rate. **Table 12** lists the maximum hourly arrival rate (in vehicles), as well as the calculated vehicles per minute rate and the potential maximum number of vehicles queued at the parking lot entry point during the Peak, Shoulder and Off-Peak conditions for weekday and weekend periods.

Table 12

Queuing Analysis

Peak	Intersection	Peak[1]	Shoulder[1]	Off-Peak[2]
Weekday	Maximum Arrival Rate (vehicles)	103	103	30
	Vehicles per minute[3]	1.72	1.72	0.50
	Maximum # of Vehicles Queue[4]	26	26	8
Weekend	Maximum Arrival Rate (vehicles)	122	88	124
	Vehicles per minute	2.03	1.47	2.07
	Maximum # of Vehicles Queue	31	22	31

[1] Robert Peccia & Associates – Parking Demand Summary (Table 5-2 and Table 5-3).
[2] No arrival rate was available for the off-season. Maximum arrival rate assumed to be max parking demand (Table 3).
[3] Calculated based on the maximum arrival rate (vehicles) divided by 60 minutes.
[4] Queue = vehicles per minute * 15 minutes. Fifteen minutes is assumed to be the maximum time a vehicle would wait for a parking spot.

Based on the information shown in **Table 12**, the maximum number of vehicles queued is estimated to be 26 during the weekday peak season and 31 vehicles during the peak weekend condition and also during the weekend off-peak condition. A vehicle queue at the parking lot entrance would only be expected to occur when the parking demand exceed the supply under any given alternative. **Table 4** shows the scenarios in which this is expected to occur (see shaded areas).

The maximum queue would be the same under each alternative because the location of the bottleneck, under a worse case scenario, would be at the parking lot entrance, regardless of the size of the parking lot.

Preferred Alternative

A revised parking layout for the preferred alternative (B-4) includes a stacking area for approximately 15 vehicles.