

APPENDIX D



WATER/RECLAIMED WATER TECHNICAL STUDY

BY: KIMLEY-HORN AND ASSOCIATES, INC.

Water / Reclaimed Water Technical Study

Douglas Park Rezone Application
Long Beach, CA

August 25, 2008

Prepared for:

The Boeing Company
4501 E. Conant Street
Long Beach, CA 90808

Prepared by:

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1. Introduction

This document complies with the City of Long Beach Water Department (LBWD) Water Design Criteria.

The proposed project involves the rezoning of approximately 100 acres of the Douglas Park project formerly called PacifiCenter @ Long Beach. The site is located at the southwest corner of Carson Street and Lakewood Boulevard in the City of Long Beach. **Exhibit A** contains a vicinity map for the project. The site is vacant and has been mass graded per plans for PacifiCenter @ Long Beach, a redevelopment project of The Boeing Company's C-1 Aircraft Production facility. The area to be rezoned consists of relatively flat, non-graded pads prepared for continued improvements. Portions of this area, under PacifiCenter plans, were designated for residential uses. A rezone application for the property has been filed that will change the land use of the area to mixed use, retail, commercial/office, research and development and hotel uses. **Exhibit B** contains the proposed land use by Quadrant. **Exhibit C** contains the aerial photo identifying the current project site and infrastructure built-out under the PacifiCenter project.

As stated in the December 2003 report, this project is within the LBWD jurisdiction. Water is supplied by LBWD through active groundwater wells and the Metropolitan Water District. Reclaimed Water is provided from the Long Beach Water Reclamation Plant, owned and operated by the County Sanitation District of Los Angeles.

2. Executive Summary

The Water Master Plan Study (which included Water and Reclaimed Water), dated December 2003, was completed by Kimley-Horn and Associates, Inc., for use as the technical basis for the Final Environmental Impact Report (Final EIR) prepared in accordance with the California Environmental Quality Act (CEQA) requirements for the PacifiCenter Project @ Long Beach. The project design features completed as part of the site development and will remain with the rezone area include:

- The construction of Phase 1 Water Improvements which include Bayer Avenue, Worsham Avenue, Schaufelle Avenue, and Cover Street (from Lakewood Boulevard to Schaufelle Avenue) and Conant Street (from Lakewood Boulevard to Heinemann Avenue).
- The construction of Segment 3 Water Improvements which include Heineman Avenue.
- The design of Segment 4 Water Improvements currently in construction on Cover Street (from Schaufelle Avenue to the City of Long Beach/ Lakewood Boundary) and a portion of Conant Street (from the Boeing Enclave Boundary to Cover Street).
- The design of Segment 5 Water Improvements in Steineman Avenue and extending the water on Conant Street to Heinemann Avenue.

The proposed approximate 100-acre rezone will change the land use north of Cover Street from residential to commercial/office/R&D and maintain the previously proposed 400 room hotel. The project design features as part of the rezone area include the following:

- The overall water and reclaimed water capacity north of Cover as a result of the rezone will be significantly reduced. **Appendix A** summarizes the demand calculation used to size the reclaimed water and domestic water system from the Long Beach Water Department Design Standards.



Table 1 shows the proposed water and reclaimed water capacity for the rezone area as well as the entire site (260 acres total), before (approved Final EIR) and after (current re-entitlement effort) the zoning changes.

- The proposed rezone area would include water system improvements designed to provide adequate water service to all future development on the site. The existing infrastructure built as part of Phase 1 and Segment 3 and the infrastructure designed and approved by the local municipalities as part of Segment 4 and Segment 5 remain unchanged and are adequately designed to serve the rezone area. The water and reclaimed water models have included (and appropriately aged) this existing infrastructure to determine adequate service. Current fire flow tests with the existing infrastructure of Phase 1 and Segment 3 have been performed to calibrate the model results.
- Peak hour flows for the area south of Cover Street were calculated using the total square footage for each quadrant. The current site plans for Blocks 1 through 5 are less than the square footages identified in Proposed Land Use; **Exhibit B**.

Table 1: Summary of the Douglas Park Domestic Water and Reclaimed Water Capacity Long Beach Portion

Year	Domestic Water		Reclaimed Water	
	Average Daily Demand (GPD)	Maximum Daily Demand (GPD)	Average Daily Demand (GPD)	Maximum Daily Demand
Approved Douglas Park Project	1,105,000	1,900,600	402,715	939,669
August 25, 2008 Water Technical Study for the Rezone Area	940,000	1,616,800	312,203	536,990

3. Existing Conditions

Kimley-Horn has reviewed documents and files from the City of Long Beach including basin-wide maps, contractor mark-ups of the installed infrastructure on-site and conceptual plans of Blocks 1 through 5 currently in the City of Long Beach. A hydrant flow test in Carson Street near Lakewood Boulevard dated November 10, 2006, was used to calibrate the existing system. The standard modeling technique for representing a hydrant test adds a pump and reservoir to the existing system connection at the approximate location of the hydrant that was tested. **Exhibit D** identifies the existing infrastructure designed and/or constructed to serve the rezone area as well as the proposed improvements within the rezone area.

4. Proposed Improvements

The water and reclaimed water lines north of Cover Street for the approximate 100-acre rezone will be reconfigured to accommodate the changes to the land use, lot configuration, lot sizes as well as proposed buildings. As specified in the LBWD Rules and Regulations, the rezone area conceptual Water and



Reclaimed Water alignments and sizes have been designed to meet LBWD criteria. The following assumptions have been made for this model:

- A Hazen-Williams C-value of 130 was used for all ductile iron pipes and 110 for existing cast iron pipes. Demands were estimated using 200 gallons per day (GPD) per 1,000 square feet (SF) of development for commercial development, office, retail, research and development, and light industrial for average daily flows, and 150 gallons per room per day for hotels. This demand rate was taken from the City of Long Beach Water Department Tables located in Appendix A of the Water Master Plan Study. The building square footages and land uses for blocks one through four were assumed using current land use plans and assuming that individual building sizes would not exceed 250,000 SF. The peak hour flows were calculated using a factor of 2.31 (from page 12 of the Water Master Plan Study) multiplied times the average daily flows. Peak hour flows were added to various nodes within the model.
- Peak hour flows for the area north of Cover Street were calculated using the total square footage for each quadrant. Once the peak hour flows were calculated for Quadrants 1 and 2 using the peaking factor and demand rates described above, the total was divided evenly among the lots. The demands for each lot were then applied to the closest node to each lot.
- Peak hour flows for the area south of Cover were calculated using the total square footage for each block, or for Block Four, each parcel within that block. The peaking factors and demand rates described above were also used. The total peak hour for those blocks and parcels was then divided equally among the closest nodes around the block or parcel.
- A 400 room hotel will be added to Quadrant 2. The peak hour demand from a 400 room hotel was added to node J-44 on top of the peak hour flows for the buildings. J-44 appears to be worst case scenario for a hotel in Quadrant 2 since it is longest run of deadend pipe.
- Junction elevations were assumed to be the same as the previous model. Junction elevations for new pipes were estimated based on current plans showing the estimated water elevations which are similar to the existing junction elevations used in the previous model.
- It was assumed that buildings would be Type IIA construction as defined in the California Building Code. Since the building square footage is subject to change, the system was analyzed to determine the largest square footage that a Type IIA building can be in order to meet the fire flow requirements in fire code. Based on the California Fire Code (CFC) Table B105.1 (appropriate sections attached to this study), a Type IIA building that is 166,501 SF and greater will require that a fire flow of 6,000 gallons per minute (GPM) be supplied. Based on discussions with the Long Beach Water Department, they typically approve a 50% reduction for buildings with sprinklers. This would mean that the water system is required to provide a minimum of 3,000 GPM for Type IIA buildings that are 166,501 SF or greater and that have sprinkler systems. The system is also analyzed to determine the maximum available fire flows that can be provided by the system with the existing and proposed piping systems and connections in place, while still maintaining a residual pressure of 20 pounds per square inch (PSI).

Domestic Water Analysis:

The model was set up to match pipe types and sizes of the recently installed piping system and new pipes added to serve the area north of Cover Street. **Appendix B** contains the domestic and fire water system analysis results. The model analyzed the system using the connections to the 12-inch line in Lakewood Boulevard at Cover Street and Conant Street to the Long Beach system and the connection to the existing 20-inch line in Carson Street at Worsham Avenue. In addition, a new connection to the 12-inch line in



Lakewood Boulevard at McGowen Street was added to the model. At this phase in design, all lines in the project area were modeled including the existing lines that were installed south of Cover Street for Phase 1 (including the 16-inch line in Worsham Avenue) and the proposed lines north of Cover Street. Peak hour flow demands were calculated based on preliminary land uses and square footages as noted in the assumptions section. These peak hour flows were applied to the respective nodes throughout the model.

A pump with a reservoir was included to represent the hydrant flow test at the approximate location of the hydrant that was tested on Carson Street, just west of Lakewood Boulevard. The pump and reservoir are located where the hydrant test was conducted to represent the conditions of the existing system that are known at this location. The pump and reservoir represent the supply of water and pressure as water is needed in the new lines similar to the way that the existing system would supply the new system at this location. The reservoir represents the water supplied by the existing system and the pump models the pressure drop in the existing system as the flow increases, which is determined based on the hydrant tests.

Once the model was set up, pipe sizes north of Cover Street were adjusted to determine what size would be required to supply a fire flow of 3,000 GPM to any node within the system while still maintaining a minimum residual pressure of 20 PSI. It was determined that 12-inch pipes installed in the configuration shown in **Exhibit D**, will supply a minimum of 3,000 GPM to any node within the system while still maintaining a residual pressure of 20 PSI. This is enough fire flow to supply a maximum building size of 250,000 SF anywhere in the Douglas Park Project. Per the CFC (**Appendix D**), a Type IIA building that is 166,501 SF or greater requires a 6,000 GPM fire flow be supplied. With sprinklers, the required fire flow is reduced to 3,000 GPM. 12-inch pipe was chosen because using 8-inch pipe would not supply the required fire flow to areas of the system that are connected to dead end runs of pipe.

The fire flow spreadsheet attached to this study titled “Calculated Fire Flow at 20PSI” uses the minimum allowed pressure of 20 psi for each node, and calculates the available fire flow at each node in the system. The 3,000 GPM flow required by the California Fire Code for a Type IIA building that is 166,501 SF or greater, was also modeled to identify the pressure changes. The model was also set up to show that the system can provide a 3,000 GPM fire flow in addition to the applied peak hour flows calculated for assumed buildings in the project area, while maintaining a minimum residual pressure of 20 PSI at each node in the system. The spreadsheet titled “Calculated Pressure at 3,000 GPM Fire Flow” shows the minimum pressure for each node assuming a 3,000 GPM fire flow in the system. **Table 2** shows the calculated available fire flow at the corresponding nodes while maintaining the minimum residual pressure of 20 PSI for areas at dead end runs of pipe or areas far from connection points to show worst case scenarios. The remaining information for the other nodes is not shown in this table but can be found in the fire flow spreadsheet attached to this study as **Appendix B**.

Table 2: Available Fire Flow at a fixed 20 PSI Minimum Pressure

Location	Available Fire Flow at Node (GPM)	Minimum Residual System Pressure (PSI)
Schaufele Ave (4 th St) and Conant St Node J-23	4,301	20
Conant Street at Cover Street Node J-42	3,580	20
Heinemann Avenue at Cover Street Node J-10	4,171	20



Brizendine Avenue South of Carson St Node J-31	3,949	20
Easement between Carson St, Brizendine Ave, and McGowen St Node J-39	3,776	20
Bayer Ave North of McGowen St Node J-44	3,947	20
Huggins St between Lakewood Ave and Bayer Ave, Node J-45	3,890	20

Table 3 is a summary of the residual pressures in the system corresponding to a 3,000 GPM fire flow applied in addition to peak hour flows. The fire flow spreadsheet is also attached.

Table 3: System Pressures at a Fixed 3,000 GPM Fire Flow

Location	Fire Flow at Node (GPM)	Calculated System Pressure (PSI)
Schaufele Ave (4 th St) and Conant St Node J-23	3,000	34
Conant Street at Cover Street Node J-42	3,000	28
Heinemann Avenue at Cover Street Node J-10	3,000	33
Brizendine Avenue South of Carson St Node J-31	3,000	32
Easement between Carson St, Brizendine Ave, and McGowen St Node J-39	3,000	31
Bayer Ave North of McGowen St Node J-44	3,000	33
Huggins St between Lakewood Ave and Bayer Ave, Node J-45	3,000	32

Reclaimed Water Analysis:

The demand for the reclaimed water system is broken up into demand for street landscaping and the demand for irrigation within the proposed private lots. **Appendix C** contains the reclaimed water system analysis results for street flow the demand for street flow was determined based upon the requirements



defined by the LBWD. The total square footage for the landscaped area is required to receive 2-inches of irrigation within a week and irrigation shall occur during the night-time hours for 3 days out of the week. Based upon these requirements the peak GPM for reclaimed water along the street frontage was determined. For the private development each lot is required to contain 15% landscaping area. The calculated demand for each development block and street landscaping was applied to a specific node in the WaterCAD model.

The overall WaterCAD model was set up to match pipe types and sizes of the recently installed piping system as designed by Hunsaker and Associates and Barghausen Consulting Engineers as well as the proposed pipes for the rezone area. The model analyzed the system using the connection to the 12-inch City of Long Beach reclaimed water line located in the intersection Worsham Avenue and Carson Street and the intersection of Cover Street and Lakewood Boulevard. The peak hour flows determined from the demand calculation were applied to the respective nodes throughout the model and include both the demand for the Rezone area as well as the Phase 1 area south of Cover Street. The reservoir location on Lakewood Boulevard represents the City of Long Beach reclaimed water plant.

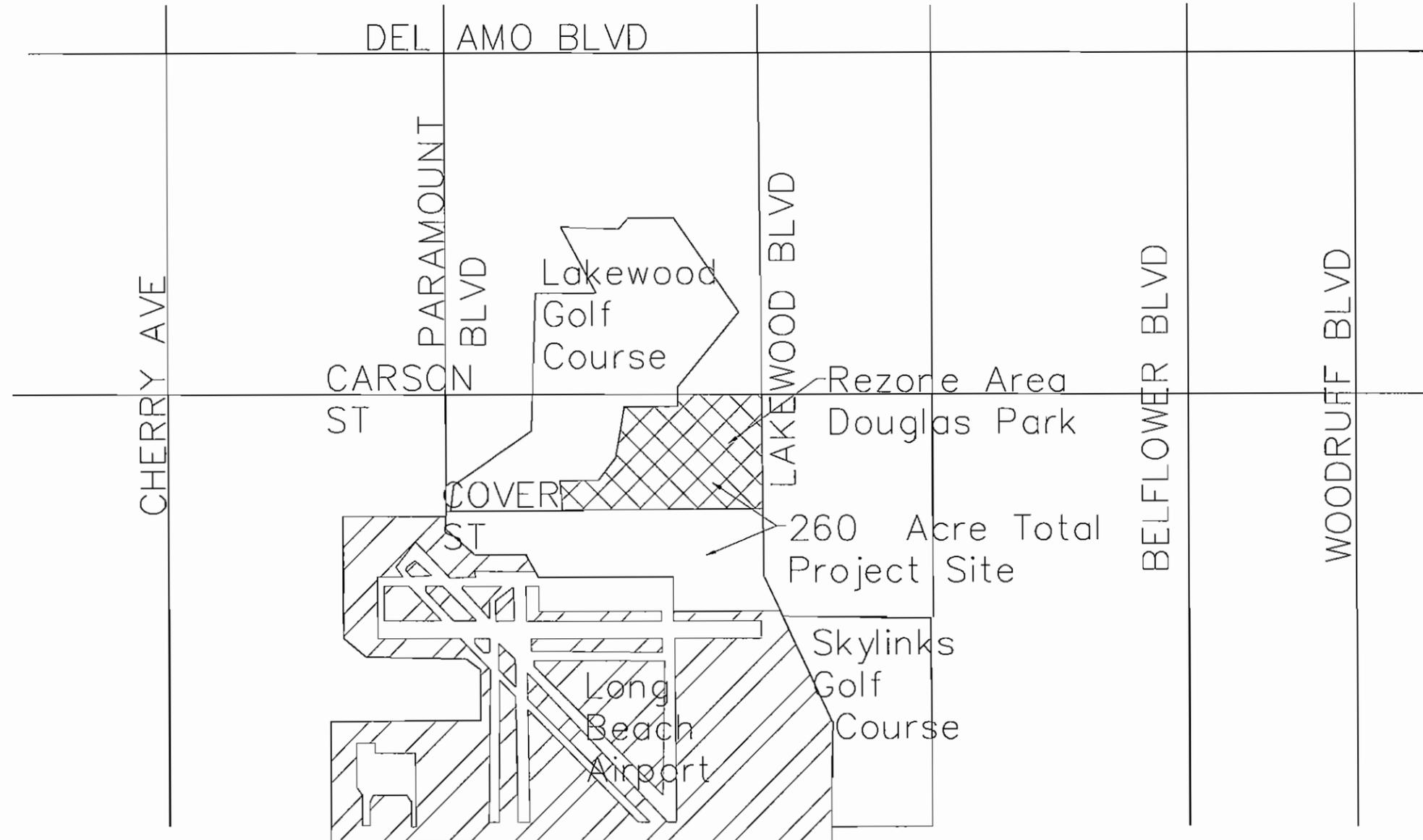
The water and reclaimed water system improvements on-site shall be constructed concurrently with the street improvements to accommodate future build-out of the site and not at a specific development increment or threshold. This ensures that the system improvements will be constructed in a logical manner and will reduce the potential for additional trenching and resurfacing of streets for subsequent sewer system improvements.



5. References

- City of Long Beach, Department of Public Works, Handbook of Design Standards, June, 1995.
- City of Long Beach, Water Department; Rules, Regulations and Charges Governing Potable Water, Reclaimed Water, Sewer Service, and the Emergency Water Conservation Plan.
- “Long Beach Water Department Sewer Calculations and Improvement Map”.
- Los Angeles County Sanitation District Sewage Design Manual.
- Watson, Montgomery, “Long Beach C1 Facility Spill Containment Plan”, McDonnell Douglas Corporation, September, 1994.

VICINITY MAP



July 14, 2008



This plan is conceptual in nature and subject to change



VICINITY MAP - EXHIBIT A



LAND USE SUMMARY

QUADRANT	PARCEL	USE	NET AREA	PROPOSED GROSS SQUARE FOOTAGE	AVG. F.A.R.	MAX. BUILDING HEIGHTS
1		OFFICE AND R&D / LIGHT INDUSTRIAL	48.1 AC	857,000 S.F.	0.41 F.A.R.	3 STORIES
2		MIXED USE	29.2 AC	727,000 S.F.*	0.57 F.A.R.	5 STORIES
SUBTOTAL (NORTH OF COVER STREET):			77.3 AC	1,584,000 S.F.	0.47 F.A.R.	
3		R&D / LIGHT INDUSTRIAL	67.9 AC	1,194,000 S.F.	0.40 F.A.R.	2 STORIES
4	1	R&D / LIGHT INDUSTRIAL	12.5 AC	244,000 S.F.	0.45 F.A.R.	2 STORIES
	2	OFFICE	9.9 AC	170,000 S.F.	0.39 F.A.R.	3 STORIES
	3	OFFICE	11.4 AC	217,000 S.F.	0.44 F.A.R.	3 STORIES
	4	OFFICE	19.5 AC	740,000 S.F.**	0.87 F.A.R.	9 STORIES
	5	R&D / LIGHT INDUSTRIAL	14.6 AC	251,000 S.F.	0.39 F.A.R.	2 STORIES
SUBTOTAL (QUADRANT 4):			67.9 AC	1,622,000 S.F.	0.55 F.A.R.	
SUBTOTAL (SOUTH OF COVER STREET):			135.8 AC	2,816,000 S.F.	0.48 F.A.R.	

PARKS, LANDSCAPE BUFFERS & ENTRY FEATURES	9.9 AC
ELECTRICAL SUBSTATION	1.4 AC
STREETS	36.6 AC

PROJECT TOTAL: 261.0 AC 4,400,000 S.F.

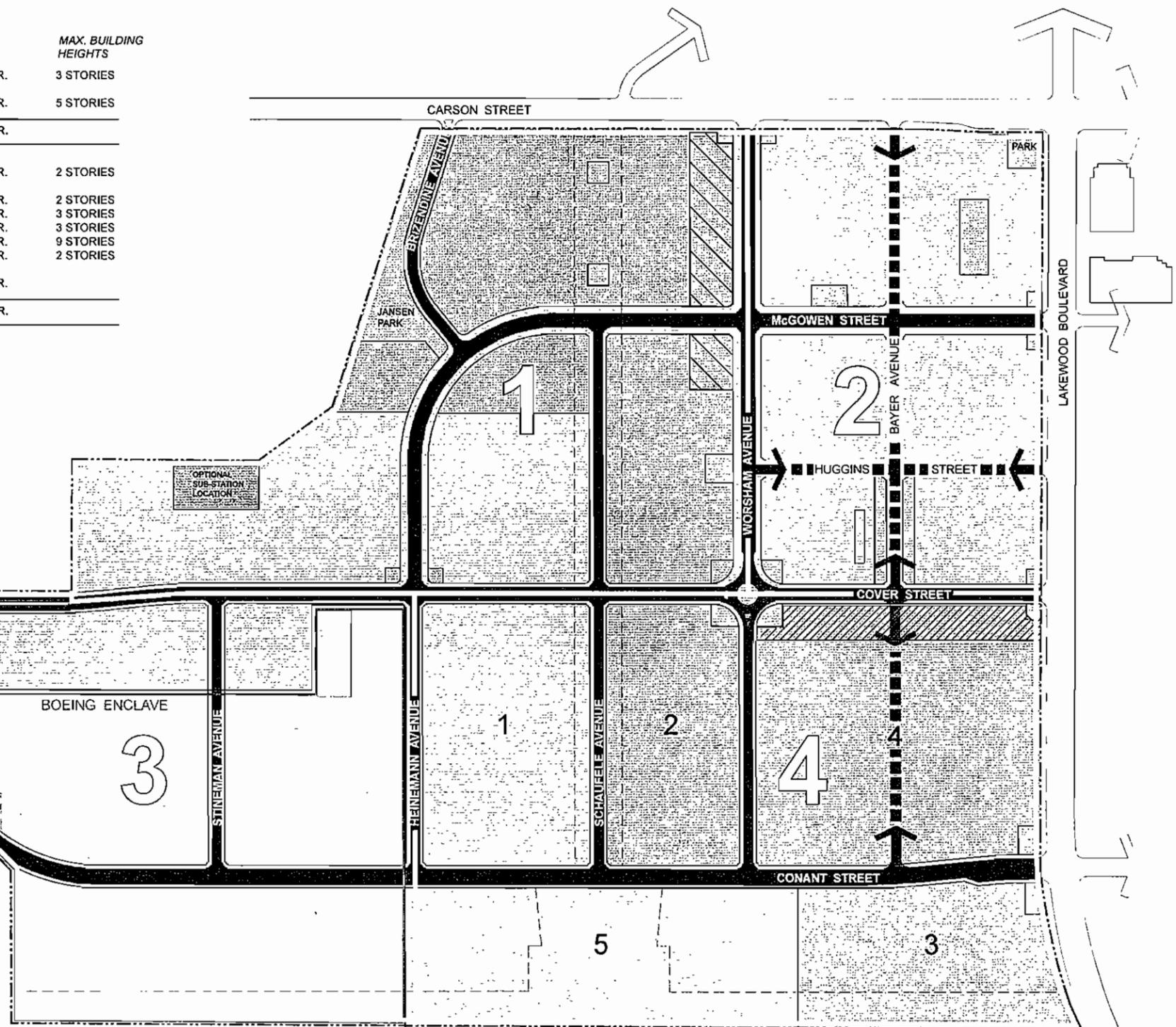
*ACREAGE INCLUDES 200,000 S.F. OF HOTEL (UP TO 200 KEYS)

**ACREAGE INCLUDES 200,000 S.F. OF HOTEL (UP TO 200 KEYS)

LEGEND

-  OFFICE
-  R & D AND LIGHT INDUSTRIAL (CITY OF LONG BEACH)
-  R & D AND LIGHT INDUSTRIAL (CITY OF LONG BEACH, BOEING ENCLAVE)
-  LIGHT INDUSTRIAL (CITY OF LAKEWOOD)
-  MIXED USE (RETAIL, OFFICE, HOTEL)
-  PARKS, OPEN SPACE AND ENTRY FEATURES
-  EXPANDED PARKWAY (OPEN SPACE)
-  ELECTRICAL SUBSTATION
-  MIXED-USE OVERLAY ZONE
-  OPTIONAL RETAIL EXPANSION DISTRICT
-  BUILDING RESTRICTION ZONE
-  OPTIONAL STREETS

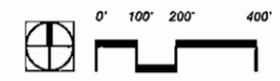
OPEN SPACE AND LANDSCAPE REQUIREMENTS WILL BE ADDRESSED AS PART OF INDIVIDUAL PARCEL IMPROVEMENT PLANS.



Land Use Plan



EXHIBIT B



This plan is conceptual in nature and subject to change



LEGEND
 PROJECT BOUNDARY ———
 ENCLAVE BOUNDARY - - - - -
 CITY BOUNDARY ———
 REZONE BOUNDARY ———



0 50 100 200
 July 14, 2008



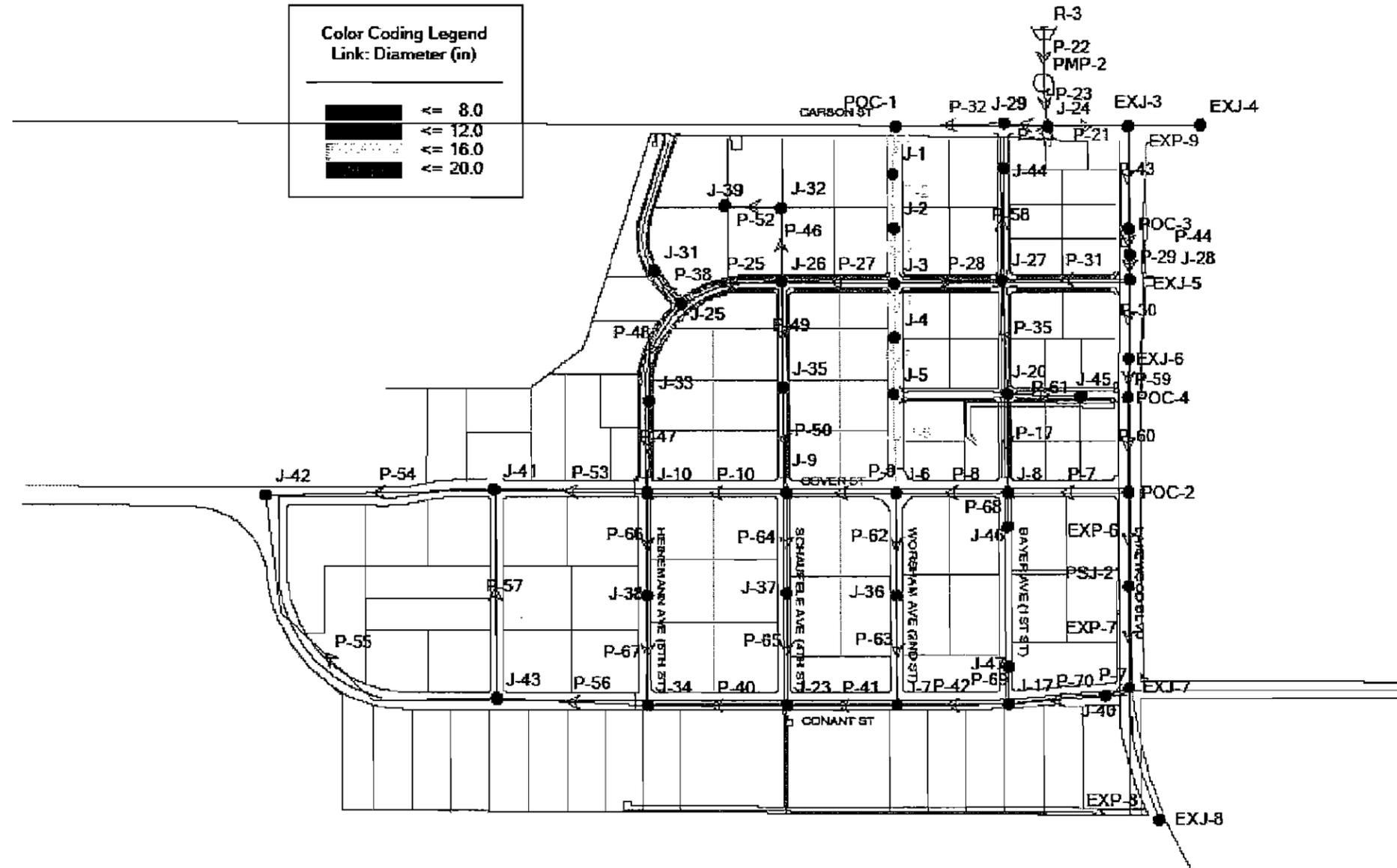
This plan is conceptual in nature and subject to change



AERIAL PHOTO- EXHIBIT C



Scenario: Calculated Pressure at 3,000 gpm Fire Flow



July 14, 2008



This plan is conceptual in nature and subject to change

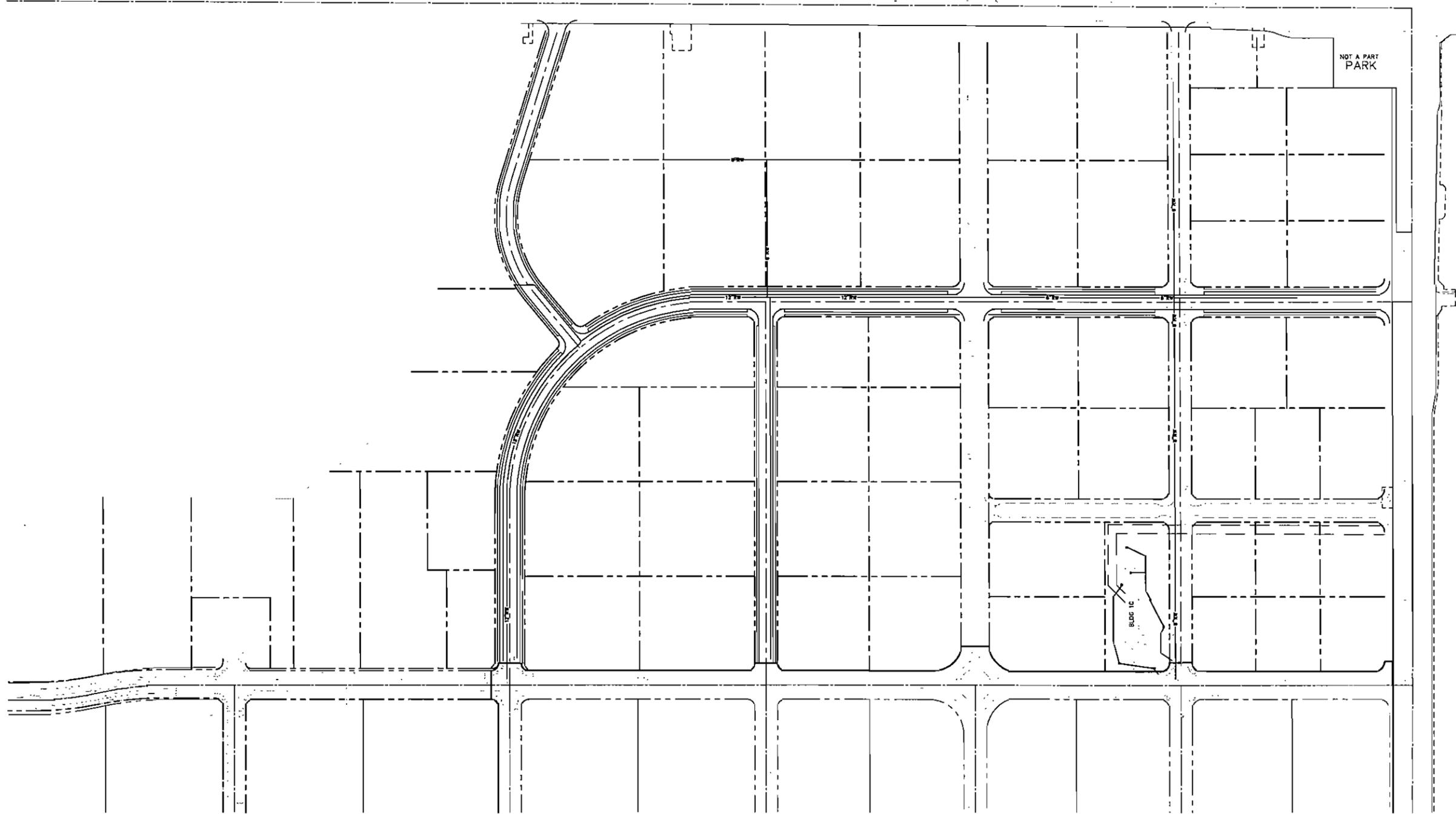


DOUGLAS PARK



**WATERCAD NODES FOR DOMESTIC WATER
EXHIBIT E**





November 17, 2008



This plan is conceptual in nature and subject to change



DOUGLAS PARK



REZONE AREA RECLAIMED WATER LINE



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and Associates, Inc.



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and Associates, Inc.

Appendix A – Demand Calculations Summarized from the LBWD

Domestic Water Demand Coefficient

Use:	Demand Coefficient	Remarks:
Office	200 gallons per 1,000 sf per day	
Retail	200 gallons per 1,000 sf per day	
Hotel	150 gallons per room per day	
Research and Development	200 gallon/per 1000 sf per day	
Light Industrial	200 gallon/per 1000 sf per day	
Housing	110 gallons per person/per day	2.5 persons per DU

Footnote:

Housing demand coefficients typically range from 80-110 gallons per person per day. A conservative 110 gpd was used for water modeling purposes. This assumes the use of reclaimed water for irrigation.

Domestic Water Demand Summary by User (Average Daily Demand)

	Commercial (SF)	Hotel Rooms	Housing Units
Project Totals:	3,300,000 SF	400	2,500
Demand (Long Beach):	565,900 GPD		
2 Demand (Lakewood):	94,100 GPD		
TOTALS:	660,000 GPD	60,000 GPD	687,500 GPD
TOTAL USAGE	1,407,500 GPD		

Footnote:

¹Retail square footage is included in commercial SF.

Table 3-2 summarizes unit flow coefficients for the various City Residential Zoning Classifications. These values are based upon 85 gallons per person per day and 2.5 persons per dwelling unit(DU). Current census (1990) information for the City of Long Beach indicates the 2.5 person per DU figure. Analysis of the R4H zoning classification revealed a ceiling of 250 dwelling units per acre. Discussion with city planning staff and an examination of neighborhood population goals, however, indicate that this type of development is expected to maximize at no more than 110 dwelling units per acre, as shown below.

Table 3-2 Residential Unit Flow Coefficients *

<u>Zoning Map Classification</u>	<u>Density (DU/Acre)</u>	<u>Flow Coefficient Average cfs/acre</u>
R1S	18 —	.0059
R1N	7	.0023
R1L	4	.0013
R2S	18	.0059
R2N	15	.0049
R2I	15	.0049
R2L	11	.0036
R3S	21 —	.0069
R34	39 —	.0128
R3L	29	.0095
R3T	27	.0089
R4R	54	.0178
R4N	62	.0204
R4H	110 <i>✍</i>	.0362
RM	9	.0029

* Based upon 85 gpcd & 2.5 persons per dwelling unit

See 2-25 for definition of zoning

Domestic Water Demand Summary

Planned Development Unit	Average Daily Demand (GPD)	Maximum Daily Demand (GPD)	Peak Hour Demand (GPM)
R1	44,275	76,153	71
R2	41,250	70,950	66
R3	36,300	62,436	58
R4	56,925	97,911	91
R5	27,225	46,827	44
R6	37,675	64,801	60
R7	26,125	44,935	42
R8	26,125	44,935	42
R9 (b)	97,900	168,388	157
R10 (b)	97,900	168,388	157
R11 (b)	97,900	168,388	157
R12 (b)	97,900	168,388	157
C1	36,600	61,232	57
C2	18,000	30,960	29
C3	58,500	100,620	94
C4	27,400	47,128	44
C5	29,260	50,327	47
C6	42,680	73,410	68
C7	42,100	72,412	68
C8	42,300	72,756	68
C9	44,600	76,712	72
C10	44,380	76,334	71
C11	44,560	76,643	71
C12	42,420	72,962	68
C13	45,840	78,844	74
C14	45,760	78,707	73
C15	46,160	79,395	74
C16	50,440	86,757	81
Hotel (a)	60,000	103,200	96
Total	1,407,500	2,420,900	2,258
(a) Commercial land uses include 400 hotel rooms and 150,000 SF of retail.			
(b) Medium to high density residential.			

Maximum Daily Demand = 1.72 * Average Daily Demand

Peak Hour Flows = 2.31 * Average Daily Demand

Table 2-4 Non-Residential Zoning Characteristics

<u>Zoning Map Classification</u>	<u>Typical Development</u>
CC	Commercial Corridor
CR	Retail Center
CB	Central Business
CO	Office Commercial
CP	Pedestrian Commercial
CH	Highway Commercial
CL	Limited Commercial
CN	Neighborhood Commercial
CT	Tourist and Entertainment Commercial
CS	Commercial Storage
CMR	Mixed Commercial/Residential
CU	Urban Commercial
CO (HR)	Office Commercial High Rise
CH (HR)	Highway Commercial High Rise
M	Manufacturing
MC	Mixed Manufacturing and Commercial
ML	Limited Manufacturing
MG	General Manufacturing
MR	Restricted Manufacturing
MP	Port District
I	Institutional
P	Park
PR	Public Right-of-Way
PR (H)	Public Right-of-Way (Horse)

Table 3-3 Non-Residential Unit Flow Coefficients

<u>Land Use Type</u>		<u>Flow Coefficient Average (cfs/acre)</u>
CC	Commercial Corridor	0.006
CR	Retail Center	0.006
CB	Central Business	0.006
CO	Office Commercial	0.006
CP	Pedestrian Commercial	0.006
CH	Highway Commercial	0.006
CL	Limited Commercial	0.006
CN	Neighborhood Commercial	0.006
CT	Tourist and Entertainment Commercial	0.006
CS	Commercial Storage	0.003
CMR	Mixed Commercial/Residential	0.006
CU	Urban Commercial	0.006
CO (HR)	Office Commercial (High Rise)	0.013
CH (HR)	Highway Commercial (High Rise)	0.013
M	Manufacturing	0.008
MC	Mixed Manufacturing and Commercial	0.008
ML	Limited Manufacturing	0.008
MG	General Manufacturing	0.010
MP	Port District	0.008
MR	Restricted Manufacturing	0.006
I	Institutional	0.006
P	Park	0.0003
PR	Public Right-of-Way	N/A
PR (H)	Public Right-of-Way (Horse)	N/A



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Scenario: Calculated Fire Flow at 20 PSI

Fire Flow Analysis

Fire Flow Report

Label	Zone	Fire Flow Iterations	Fire Flow Balanced?	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Calculated Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Minimum Zone Pressure (psi)	Minimum Zone Junction	Minimum System Pressure (psi)	Calculated Minimum System Pressure (psi)	Minimum System Junction
EXJ-3	Zone-1	6	true	true	3,000.00	4,890.68	3,015.54	4,906.22	21.80	20.00	J-42	N/A	-0.00	PMP-2
EXJ-4	Zone-1	6	true	true	3,000.00	4,890.75	3,000.00	4,890.75	20.99	20.00	J-42	N/A	-0.00	PMP-2
EXJ-5	Zone-1	6	true	true	3,000.00	4,664.40	3,000.00	4,664.40	20.68	20.00	J-42	N/A	-0.00	PMP-2
EXJ-6	Zone-1	4	true	true	3,000.00	4,520.98	3,000.00	4,520.98	20.00	20.51	J-43	N/A	-0.00	PMP-2
EXJ-7	Zone-1	4	true	true	3,000.00	4,355.99	3,000.00	4,355.99	20.00	20.10	J-40	N/A	-0.00	PMP-2
EXJ-8	Zone-1	4	true	true	3,000.00	3,701.78	3,000.00	3,701.78	20.00	28.26	J-43	N/A	-0.00	PMP-2
J-1	Zone-1	6	true	true	3,000.00	4,716.91	3,000.00	4,716.91	20.56	20.00	J-42	N/A	-0.00	PMP-2
J-2	Zone-1	6	true	true	3,000.00	4,642.64	3,015.86	4,658.50	20.98	20.00	J-42	N/A	-0.00	PMP-2
J-3	Zone-1	6	true	true	3,000.00	4,578.12	3,031.72	4,609.84	21.42	20.00	J-42	N/A	-0.00	PMP-2
J-4	Zone-1	6	true	true	3,000.00	4,538.96	3,015.86	4,554.82	21.61	20.00	J-42	N/A	-0.00	PMP-2
J-5	Zone-1	6	true	true	3,000.00	4,510.27	3,015.86	4,526.13	21.94	20.00	J-42	N/A	-0.00	PMP-2
J-6	Zone-1	6	true	true	3,000.00	4,467.53	3,055.11	4,522.64	22.69	20.00	J-42	N/A	-0.00	PMP-2
J-7	Zone-1	6	true	true	3,000.00	4,392.85	3,090.37	4,483.22	21.99	20.00	J-43	N/A	-0.00	PMP-2
J-8	Zone-1	6	true	true	3,000.00	4,500.30	3,053.31	4,553.61	21.47	20.00	J-43	N/A	-0.00	PMP-2
J-9	Zone-1	6	true	true	3,000.00	4,348.88	3,038.80	4,387.68	20.54	20.00	J-42	N/A	-0.00	PMP-2
J-10	Zone-1	4	true	true	3,000.00	4,171.08	3,093.40	4,264.48	20.00	20.14	J-41	N/A	-0.00	PMP-2
J-17	Zone-1	4	true	true	3,000.00	4,422.38	3,053.85	4,476.23	20.00	20.05	J-43	N/A	-0.00	PMP-2
J-20	Zone-1	4	true	true	3,000.00	4,258.69	3,023.31	4,282.00	20.00	20.00	J-45	N/A	-0.00	PMP-2
J-23	Zone-1	6	true	true	3,000.00	4,301.25	3,049.89	4,351.14	22.01	20.00	J-43	N/A	-0.00	PMP-2
J-24	Zone-1	6	true	true	3,000.00	4,934.19	3,000.00	4,934.19	21.78	20.00	J-42	N/A	-0.00	PMP-2
J-25	Zone-1	6	true	true	3,000.00	4,167.95	3,016.18	4,184.13	20.87	20.00	J-31	N/A	-0.00	PMP-2
J-26	Zone-1	6	true	true	3,000.00	4,390.03	3,016.18	4,406.21	21.58	20.00	J-10	N/A	-0.00	PMP-2
J-27	Zone-1	6	true	true	3,000.00	4,597.75	3,023.31	4,621.06	20.17	20.00	J-42	N/A	-0.00	PMP-2
J-28	Zone-1	6	true	true	3,000.00	4,624.25	3,015.54	4,639.79	21.08	20.00	J-42	N/A	-0.00	PMP-2
J-29	Zone-1	6	true	true	3,000.00	4,893.36	3,000.00	4,893.36	21.18	20.00	J-42	N/A	-0.00	PMP-2
J-31	Zone-1	4	true	true	3,000.00	3,949.13	3,016.18	3,965.31	20.00	23.65	J-25	N/A	-0.00	PMP-2
J-32	Zone-1	4	true	true	3,000.00	4,024.52	3,008.09	4,032.61	20.00	20.00	J-39	N/A	-0.00	PMP-2
J-33	Zone-1	4	true	true	3,000.00	4,204.26	3,032.36	4,236.62	20.00	20.45	J-10	N/A	-0.00	PMP-2
J-34	Zone-1	6	true	true	3,000.00	4,130.27	3,134.49	4,264.76	22.45	20.00	J-43	N/A	-0.00	PMP-2
J-35	Zone-1	4	true	true	3,000.00	4,323.53	3,032.36	4,355.89	20.00	20.57	J-42	N/A	-0.00	PMP-2
J-36	Zone-1	4	true	true	3,000.00	4,391.88	3,039.25	4,431.13	20.00	20.45	J-43	N/A	-0.00	PMP-2
J-37	Zone-1	4	true	true	3,000.00	4,286.34	3,022.62	4,308.96	20.00	20.50	J-43	N/A	-0.00	PMP-2
J-38	Zone-1	6	true	true	3,000.00	4,173.22	3,077.22	4,250.44	20.52	20.00	J-43	N/A	-0.00	PMP-2
J-39	Zone-1	4	true	true	3,000.00	3,776.21	3,024.27	3,800.48	20.00	23.39	J-32	N/A	-0.00	PMP-2
J-40	Zone-1	4	true	true	3,000.00	4,323.85	3,053.85	4,377.70	20.00	20.94	EXJ-7	N/A	-0.00	PMP-2
J-41	Zone-1	4	true	true	3,000.00	3,881.51	3,112.39	3,993.90	20.00	20.43	J-42	N/A	-0.00	PMP-2
J-42	Zone-1	4	true	true	3,000.00	3,580.60	3,063.85	3,644.45	20.00	24.50	J-41	N/A	-0.00	PMP-2
J-43	Zone-1	4	true	true	3,000.00	3,877.74	3,063.85	3,941.59	20.00	20.77	J-42	N/A	-0.00	PMP-2
J-44	Zone-1	4	true	true	3,000.00	3,946.92	3,127.33	4,074.25	20.00	27.02	J-42	N/A	-0.00	PMP-2
J-45	Zone-1	4	true	true	3,000.00	3,889.61	3,031.08	3,920.69	20.00	24.72	J-20	N/A	-0.00	PMP-2
J-46	Zone-1	7	true	true	3,000.00	4,500.38	3,000.00	4,500.38	36.44	20.00	J-43	N/A	-0.00	PMP-2
J-47	Zone-1	7	true	true	3,000.00	4,422.44	3,000.00	4,422.44	33.45	20.00	J-17	N/A	-0.00	PMP-2
POC-1	Zone-1	6	true	true	3,000.00	4,793.95	3,000.00	4,793.95	20.16	20.00	J-42	N/A	-0.00	PMP-2
POC-2	Zone-1	6	true	true	3,000.00	4,512.78	3,030.77	4,543.55	22.73	20.00	J-43	N/A	-0.00	PMP-2
POC-3	Zone-1	6	true	true	3,000.00	4,696.62	3,015.59	4,712.21	20.57	20.00	J-42	N/A	-0.00	PMP-2
POC-4	Zone-1	6	true	true	3,000.00	4,550.45	3,000.00	4,550.45	21.71	20.00	J-43	N/A	-0.00	PMP-2
PSJ-21	Zone-1	4	true	true	3,000.00	4,351.34	3,030.00	4,381.34	20.00	21.48	J-43	N/A	-0.00	PMP-2

Scenario: Calculated Pressure at 3,000 gpm Fire Flow

Fire Flow Analysis

Fire Flow Report

Label	Zone	Fire Flow Iterations	Fire Flow Balanced?	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Calculated Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Residual Pressure (psi)	Minimum Zone Pressure (psi)	Minimum Zone Junction	Minimum System Pressure (psi)	Calculated Minimum System Pressure (psi)	Minimum System Junction
EXJ-3	Zone-1	2	true	false	3,000.00	3,000.00	3,015.54	3,015.54	39.70	37.75	J-42	N/A	-0.00	PMP-2
EXJ-4	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	39.37	37.75	J-42	N/A	-0.00	PMP-2
EXJ-5	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	38.13	36.37	J-42	N/A	-0.00	PMP-2
EXJ-6	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	37.19	35.80	J-42	N/A	-0.00	PMP-2
EXJ-7	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	36.71	35.11	J-43	N/A	-0.00	PMP-2
EXJ-8	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	31.64	35.11	J-43	N/A	-0.00	PMP-2
J-1	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	37.39	36.79	J-42	N/A	-0.00	PMP-2
J-2	Zone-1	2	true	false	3,000.00	3,000.00	3,015.86	3,015.86	37.36	36.35	J-42	N/A	-0.00	PMP-2
J-3	Zone-1	2	true	true	3,000.00	3,000.00	3,031.72	3,031.72	37.37	35.94	J-42	N/A	-0.00	PMP-2
J-4	Zone-1	2	true	false	3,000.00	3,000.00	3,015.86	3,015.86	37.44	35.69	J-42	N/A	-0.00	PMP-2
J-5	Zone-1	2	true	false	3,000.00	3,000.00	3,015.86	3,015.86	37.64	35.51	J-42	N/A	-0.00	PMP-2
J-6	Zone-1	2	true	false	3,000.00	3,000.00	3,055.11	3,055.11	38.05	35.25	J-42	N/A	-0.00	PMP-2
J-7	Zone-1	2	true	false	3,000.00	3,000.00	3,090.37	3,090.37	37.73	34.72	J-43	N/A	-0.00	PMP-2
J-8	Zone-1	2	true	true	3,000.00	3,000.00	3,053.31	3,053.31	38.02	35.44	J-42	N/A	-0.00	PMP-2
J-9	Zone-1	2	true	true	3,000.00	3,000.00	3,038.80	3,038.80	35.22	34.46	J-42	N/A	-0.00	PMP-2
J-10	Zone-1	2	true	false	3,000.00	3,000.00	3,093.40	3,093.40	33.29	33.34	J-41	N/A	-0.00	PMP-2
J-17	Zone-1	2	true	true	3,000.00	3,000.00	3,053.85	3,053.85	37.39	34.93	J-43	N/A	-0.00	PMP-2
J-20	Zone-1	2	true	false	3,000.00	3,000.00	3,023.31	3,023.31	34.94	34.94	J-45	N/A	-0.00	PMP-2
J-23	Zone-1	2	true	true	3,000.00	3,000.00	3,049.89	3,049.89	36.69	34.13	J-43	N/A	-0.00	PMP-2
J-24	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	39.69	37.92	J-42	N/A	-0.00	PMP-2
J-25	Zone-1	2	true	true	3,000.00	3,000.00	3,016.18	3,016.18	34.59	33.73	J-31	N/A	-0.00	PMP-2
J-26	Zone-1	2	true	true	3,000.00	3,000.00	3,016.18	3,016.18	36.90	34.72	J-42	N/A	-0.00	PMP-2
J-27	Zone-1	2	true	false	3,000.00	3,000.00	3,023.31	3,023.31	37.37	36.03	J-42	N/A	-0.00	PMP-2
J-28	Zone-1	2	true	false	3,000.00	3,000.00	3,015.54	3,015.54	38.11	36.14	J-42	N/A	-0.00	PMP-2
J-29	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	38.96	37.72	J-42	N/A	-0.00	PMP-2
J-31	Zone-1	2	true	true	3,000.00	3,000.00	3,016.18	3,016.18	32.05	34.16	J-10	N/A	-0.00	PMP-2
J-32	Zone-1	2	true	false	3,000.00	3,000.00	3,008.09	3,008.09	33.07	33.07	J-39	N/A	-0.00	PMP-2
J-33	Zone-1	2	true	false	3,000.00	3,000.00	3,032.36	3,032.36	34.35	33.76	J-10	N/A	-0.00	PMP-2
J-34	Zone-1	2	true	false	3,000.00	3,000.00	3,134.49	3,134.49	35.69	32.96	J-43	N/A	-0.00	PMP-2
J-35	Zone-1	2	true	false	3,000.00	3,000.00	3,032.36	3,032.36	35.23	34.65	J-42	N/A	-0.00	PMP-2
J-36	Zone-1	2	true	true	3,000.00	3,000.00	3,039.25	3,039.25	35.91	34.97	J-43	N/A	-0.00	PMP-2
J-37	Zone-1	2	true	false	3,000.00	3,000.00	3,022.62	3,022.62	34.95	34.33	J-43	N/A	-0.00	PMP-2
J-38	Zone-1	2	true	false	3,000.00	3,000.00	3,077.22	3,077.22	34.75	33.27	J-43	N/A	-0.00	PMP-2
J-39	Zone-1	2	true	true	3,000.00	3,000.00	3,024.27	3,024.27	30.84	33.07	J-32	N/A	-0.00	PMP-2
J-40	Zone-1	2	true	true	3,000.00	3,000.00	3,053.85	3,053.85	36.30	35.07	J-43	N/A	-0.00	PMP-2
J-41	Zone-1	2	true	false	3,000.00	3,000.00	3,112.39	3,112.39	31.03	31.28	J-42	N/A	-0.00	PMP-2
J-42	Zone-1	2	true	false	3,000.00	3,000.00	3,063.85	3,063.85	28.15	31.42	J-41	N/A	-0.00	PMP-2
J-43	Zone-1	2	true	false	3,000.00	3,000.00	3,063.85	3,063.85	31.00	31.46	J-42	N/A	-0.00	PMP-2
J-44	Zone-1	2	true	false	3,000.00	3,000.00	3,127.33	3,127.33	32.64	36.03	J-42	N/A	-0.00	PMP-2
J-45	Zone-1	2	true	true	3,000.00	3,000.00	3,031.08	3,031.08	32.01	34.94	J-20	N/A	-0.00	PMP-2
J-46	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	54.45	35.44	J-42	N/A	-0.00	PMP-2
J-47	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	52.37	34.93	J-43	N/A	-0.00	PMP-2
POC-1	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	37.44	37.21	J-42	N/A	-0.00	PMP-2
POC-2	Zone-1	2	true	false	3,000.00	3,000.00	3,030.77	3,030.77	39.61	35.48	J-43	N/A	-0.00	PMP-2
POC-3	Zone-1	2	true	true	3,000.00	3,000.00	3,015.59	3,015.59	38.25	36.55	J-42	N/A	-0.00	PMP-2
POC-4	Zone-1	2	true	true	3,000.00	3,000.00	3,000.00	3,000.00	39.41	35.71	J-42	N/A	-0.00	PMP-2
PSJ-21	Zone-1	2	true	false	3,000.00	3,000.00	3,030.00	3,030.00	36.11	35.27	J-43	N/A	-0.00	PMP-2



Kimley-Horn
and Associates, Inc.

Appendix C – Reclaimed Water System Analysis Results

**Scenario: Reclaimed Water
Steady State Analysis
Pipe Report**

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Minor Loss Coefficient	Velocity (ft/s)	Discharge (gpm)	Headloss Gradient (ft/1000ft)
P-2	88.00	12.0	Ductile Iro	130.0	0.00	5.91	2,084.10	9.88
P-10	61.00	12.0	Ductile Iro	130.0	0.00	2.78	979.08	2.44
P-11	97.00	12.0	Ductile Iro	130.0	0.00	1.31	462.92	0.61
P-14	508.00	8.0	Ductile Iro	130.0	0.00	2.20	343.90	2.53
P-15	239.00	8.0	Ductile Iro	130.0	0.00	3.24	507.16	5.19
P-16	230.00	8.0	Ductile Iro	130.0	0.00	3.10	485.16	4.79
P-17	315.00	6.0	Ductile Iro	130.0	0.00	0.75	65.72	0.48
P-25	336.00	12.0	Ductile Iro	130.0	0.00	0.61	216.00	0.15
P-26	661.00	12.0	Ductile Iro	130.0	0.00	0.49	174.00	0.10
P-27	316.00	12.0	Ductile Iro	130.0	0.00	2.18	768.95	1.56
P-28	382.00	12.0	Ductile Iro	130.0	0.00	2.18	768.95	1.56
P-30	234.00	12.0	Ductile Iro	130.0	0.00	2.18	768.95	1.56
P-31	585.00	8.0	Ductile Iro	130.0	0.00	2.07	-325.03	2.28
P-32	295.00	6.0	Ductile Iro	130.0	0.00	0.75	65.72	0.48
P-33	396.00	6.0	Ductile Iro	130.0	0.00	0.71	-62.28	0.43
P-34	671.00	8.0	Ductile Iro	130.0	0.00	0.11	-16.66	0.01
P-35	503.00	8.0	Ductile Iro	130.0	0.00	1.88	-293.95	1.89
P-36	552.00	12.0	Ductile Iro	130.0	0.00	1.35	475.00	0.64
P-37	669.00	8.0	Ductile Iro	130.0	0.00	0.61	95.45	0.24
P-38	171.00	6.0	Ductile Iro	130.0	0.00	0.05	4.34	0.00
P-39	834.00	6.0	Ductile Iro	130.0	0.00	0.19	-16.66	0.04
EXP-	807.00	20.0	Cast iron	130.0	0.00	2.61	2,553.00	1.19
P-40	912.00	12.0	Ductile Iro	130.0	0.00	3.13	-1,102.08	3.03
P-41	654.00	12.0	Ductile Iro	130.0	0.00	5.76	-2,032.10	9.42
P-53	504.00	8.0	Ductile Iro	130.0	0.00	3.61	-564.89	6.34
P-55	508.00	8.0	Ductile Iro	130.0	0.00	2.27	-355.89	2.70
P-57	93.00	8.0	Ductile Iro	130.0	0.00	0.70	-109.89	0.31
P-58	810.00	8.0	Ductile Iro	130.0	0.00	1.34	-209.89	1.01
P-59	424.00	6.0	Ductile Iro	130.0	0.00	0.81	-126.13	0.39
P-60	533.00	6.0	Ductile Iro	130.0	0.00	0.93	-146.13	0.52
P-61	1,549.00	20.0	Ductile Iro	130.0	0.00	0.00	0.00	0.00
P-62	1,042.00	20.0	Ductile Iro	130.0	0.00	2.13	-2,084.10	0.82
P-63	1,835.00	8.0	Ductile Iro	130.0	0.00	2.99	468.90	4.49
P-64	88.00	8.0	Ductile Iro	130.0	0.00	2.33	365.13	2.83
P-65	431.00	6.0	Ductile Iro	130.0	0.00	2.04	319.13	2.20
P-66	50.00	8.0	Ductile Iro	130.0	0.00	1.03	161.00	0.62
P-67	252.00	6.0	Ductile Iro	130.0	0.00	0.81	127.00	0.40
P-68	76.00	8.0	Ductile Iro	130.0	0.00	1.65	259.00	1.50

Title:

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Project Engineer: Kimley-Horn and Associates, Inc.

WaterCAD v7.0 [07.00.049.00]

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**Scenario: Reclaimed Water
Steady State Analysis
Junction Report**

Label	Elevation (ft)	Type	Base Flow (gpm)	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
EXJ-3	47.00	Demand	0.00	0.00	148.18	43.78
C-1	44.00	Demand	0.00	0.00	148.18	45.07
EXJ-1	44.00	Demand	0.00	0.00	149.04	45.44
J-2	36.00	Demand	125.00	125.00	140.79	45.34
J-3	39.00	Demand	52.00	52.00	147.31	46.86
J-9	35.00	Demand	123.00	123.00	138.38	44.73
J-10	35.00	Demand	9.00	9.00	138.23	44.66
J-11	35.00	Demand	19.00	19.00	138.17	44.64
J-13	35.00	Demand	145.00	145.00	139.51	45.22
J-14	37.00	Demand	22.00	22.00	136.99	43.26
J-15	38.00	Demand	163.00	163.00	135.89	42.35
J-16	34.00	Demand	0.00	0.00	135.74	44.02
J-17	35.00	Demand	215.00	215.00	135.77	43.60
J-19	37.00	Demand	0.00	0.00	135.76	42.73
J-21	35.00	Demand	0.00	0.00	136.72	44.01
J-23	32.00	Demand	0.00	0.00	136.37	45.16
J-24	32.00	Demand	42.00	42.00	136.32	45.13
J-25	35.00	Demand	174.00	174.00	136.25	43.81
J-26	35.00	Demand	0.00	0.00	137.68	44.43
J-27	34.00	Demand	0.00	0.00	137.09	44.60
J-28	34.00	Demand	128.00	128.00	135.60	43.96
J-29	39.50	Demand	201.00	201.00	135.73	41.64
J-30	37.50	Demand	21.00	21.00	135.73	42.50
J-31	41.00	Demand	0.00	0.00	141.15	43.33
J-32	42.00	Demand	209.00	209.00	137.95	41.51
J-33	42.50	Demand	19.00	19.00	136.58	40.71
J-36	42.60	Demand	173.00	173.00	139.95	42.12
J-38	40.00	Demand	100.00	100.00	135.76	41.43
J-39	38.70	Demand	20.00	20.00	139.67	43.69
J-37	41.00	Demand	46.00	46.00	140.90	43.22
J-40	38.00	Demand	161.00	161.00	135.86	42.34
J-41	44.00	Demand	127.00	127.00	136.48	40.01
J-42	35.00	Demand	259.00	259.00	136.26	43.81

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APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psig) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m²), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the fire code official is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code*.

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the exterior walls, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by fire walls without openings, constructed in accordance with the *California Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings. The minimum fire-flow requirements for one- and two-family dwellings having a fire-flow calculation area which does not exceed 3,600 square feet (334.5 m²) shall be 1,000 gallons per minute (3785.4 L/min). Fire-flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600 square feet (334.5 m²) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire flow of 50 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system.

B105.2 Buildings other than one- and two-family dwellings. The minimum fire-flow and flow duration for buildings other than one- and two-family dwellings shall be as specified in Table B105.1.

Exception: A reduction in required fire-flow of up to 75 percent, as approved, is allowed when the building is provided with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. The resulting fire-flow shall not be less than 1,500 gallons per minute (5678 L/min) for the prescribed duration as specified in Table B105.1.

SECTION B106 REFERENCED STANDARDS

CBC-07	California Building Code	B104.2, Table B105.1
ICC	IWUIC-06 International Wildland-Urban Interface Code	B103.3
NFPA	1142-01 Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3

TABLE B105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS^a

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute) ^c	FLOW DURATION (hours)
Type IA and IB ^b	Type IIA and IIIA ^b	Type IV and V-A ^b	Type IIB and IIIB ^b	Type V-B ^b		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	
22,701-30,200	12,701-17,600	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,601-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,500	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,501-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,600	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,601-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	4
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m²; 1 gallon per minute = 3.785 L/min; 1 pound per square inch = 6.895 kPa.

a. The minimum required fire flow shall be allowed to be reduced by 25 percent for Group R.

b. Types of construction may be set on the *California Building Code*.

c. Measured at 20 psi.