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CALIFORNIA

ANTONIO R. VILLARAIGOSA

MAYOR

DEPARTMENT OF

PUBLIC WORKS

BUREAU OF SANITATION

RITA L. ROBINSON
DIRECTOR

ENRIQUE C. ZALDIVAR
EXECUTIVE OFFICER

VAROUJ S. ABKIAN
TRACI J. MINAMIDE
ASSISTANT DIRECTORS

WATERSHED PROTECTION DIVISION
PUBLIC WORKS BUILDING
1149 S. BROADWAY STREET, 10TH FLOOR
LOS ANGELES, CA 90015

October 19, 2006

Mr. Jonathan Bishop, Executive Officer
Los Angeles Regional Water Quality Control Board
320 W. Fourth Street, Suite 200
Los Angeles, CA 90013

Attention: Xavier Swamikannu

REQUEST FOR FULL CAPTURE CERTIFICATION OF A CATCH BASIN INSERT

Last September 29, 2006, the City submitted to your Board the *Compliance Report for the Trash TMDL in the Ballona Creek and Wetland – Year 2006* in which we requested that your office assess the performance of our catch basin (CB) inserts as Full Capture Devices. Through subsequent discussions with your staff, it was recommended that the City makes a formal request for Certification of the catch basin insert as a Full Capture System. Therefore, **we are formally requesting that the Regional Board certify the use of the catch basin insert described in the attachments as a Full Capture System in the City of Los Angeles.**

The catch basin insert being deployed in the City of Los Angeles meets the Board's definition of a Full Capture Device as described in the Trash TMDL. Attachment A is the white paper analysis of the hydraulic capacity of the CB insert. The white paper concluded that the CB inserts used by the City, meet the Trash TMDL definition of a full capture system, specifically the inserts are manufactured of 5 millimeter perforated sheets and treat the storm flow of a 1-year, 1-hour storm. Attachment B is the pilot study conducted by the City this past wet season reaffirming that the CB insert does meet the definition of a Full Capture Device in actual field conditions. The pilot study concluded that the CB inserts manufactured from 5 millimeter perforated sheets retain 99% of the trash that enters the CB over the course of a year.

We look forward to receiving your approval, and will be eager to discuss any of the information presented herein. Should you have any questions, please contact Shahram Kharaghani, Stormwater Program Manager, at (213) 485-0587, or Morad Sedrak, TMDL Implementation Manager at (213) 485-3951.

Sincerely,

RITA L. ROBINSON, Director
Bureau of Sanitation

SK/MS/AM:a
WPDCR 8291

Attachments

c: Nancy Sutley, Mayor's Office
Cynthia Ruiz, BPW, President
Paula Daniels, BPW, Commissioner
Rafael Prieto, CLA
Patty Huber, CAO
Enrique C. Zaldivar, BOS-Executive Officer
Varouj Abkian, BOS Assistant Director
Traci Minamide, BOS Assistant Director

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Catch Basin Inserts:

Method to Determine CB Inserts Act as Full Capture Devices

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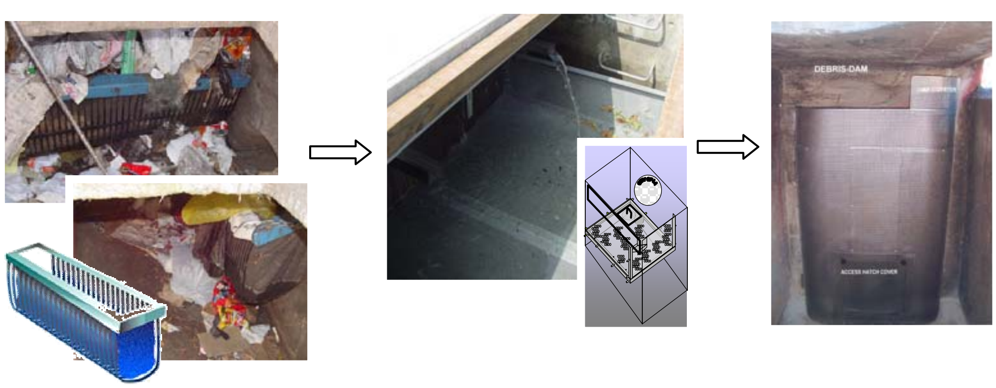
Catch Basin Inserts:

Method to Determine CB Inserts Act as Full Capture Devices

Background

The intent of this paper is to present a method to determine if the existing configurations of the City of Los Angeles' catch basin (CB) inserts with 5 millimeter openings meet the definition of a full capture device as defined in the Trash Total Maximum Daily Loads (TMDLs) documents.

The City has explored several configurations of catch basin inserts in order to select one that met the regulatory requirements and had minimal impact on its existing storm drain system. Figure 1 below shows the evolution of CB inserts that the City investigated during the past 4 years.



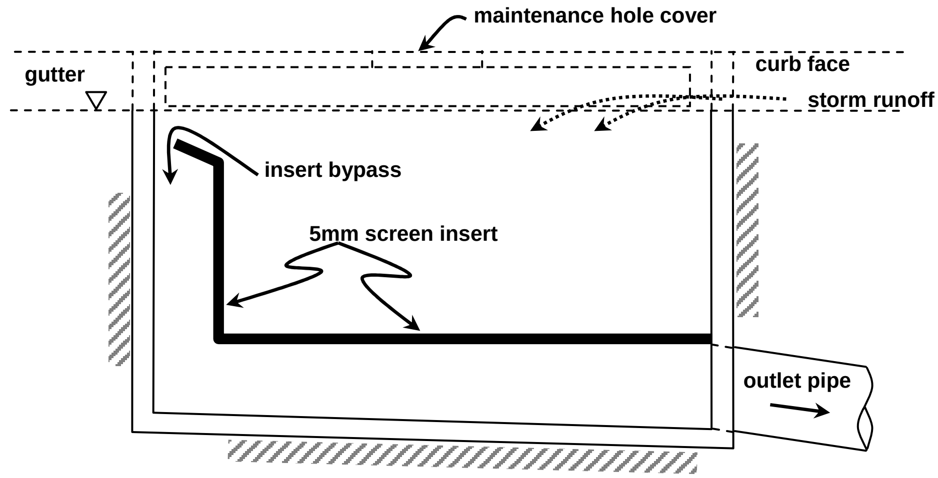
a) hanging basket b) horizontal c) vertical

Figure 1. Evolution of catch basin inserts in the City of Los Angeles

As can be seen, the City has examined three distinct configurations of inserts. The hanging basket type insert was examined in pilot installations with discouraging results. The demise of the basket insert is its limited capacity for trash capture and the associated tedious maintenance requirements. The City did not proceed with extensive installations of this insert but opted to proceed with that of the horizontal and vertical insert that are described below. The approach described herein will apply to both the horizontal and vertical inserts.

The horizontal insert (See Figure 2) was considered because it addressed the City's concern for increasing trash capture and improving maintenance. The inserts are manufactured from hot dipped galvanized steel or 316-stainless steel sheets with 5 millimeter (0.197 inch) diameter circular openings. Inserts installed in curb opening catch basins encompass the entire width and approximately 85% of the entire length of the basin. An overflow is provided to alleviate hydraulic conditions from major rain events to ensure public safety. Figure 2 depicts typical insert installation in curb opening catch basins. Those installed in grated inlets fit the entire opening. The City has installed several hundred of these inserts in the high trash areas.

The vertical insert is the last in the evolution of inserts that the City is deploying in the high trash areas. The inserts are manufactured from 304-stainless steel, gauge 14, screen sheets with 5 millimeter (0.197 inch) diameter circular openings. These inserts only have a vertical component and are installed just outside the outlet pipe of the catch basin. See Figure 3 for typical insert installation. The insert extends vertically to approximately 2-inches to 3-inches below the bottom lip of the curb opening. This insert has an overflow to alleviate hydraulic conditions from major rain events to ensure public safety. The absence of a horizontal screen allows for increase trash capture volume and lessens the frequency of inserts' maintenance. The City has installed several thousands of these inserts in the high trash areas.



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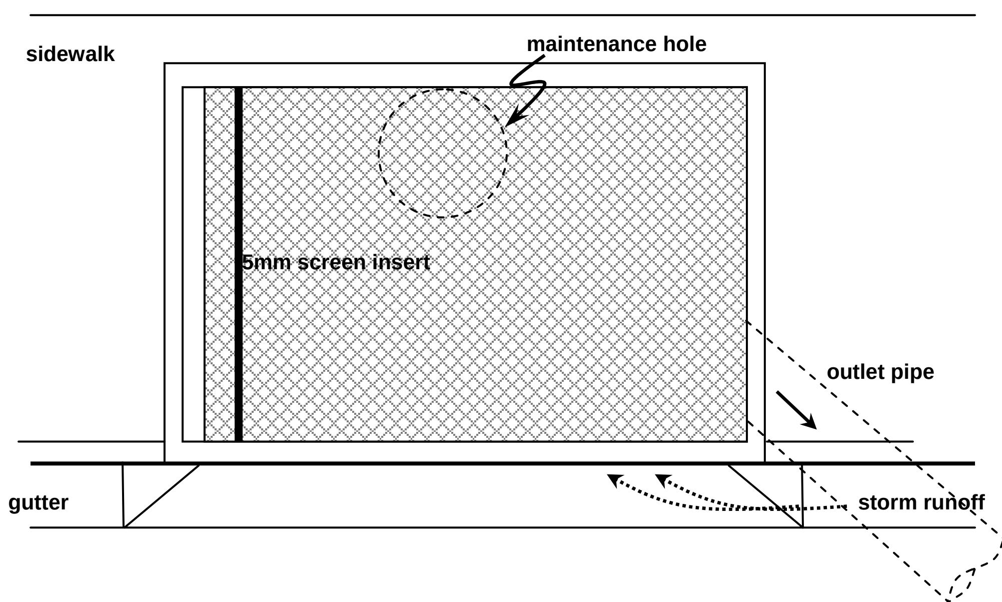
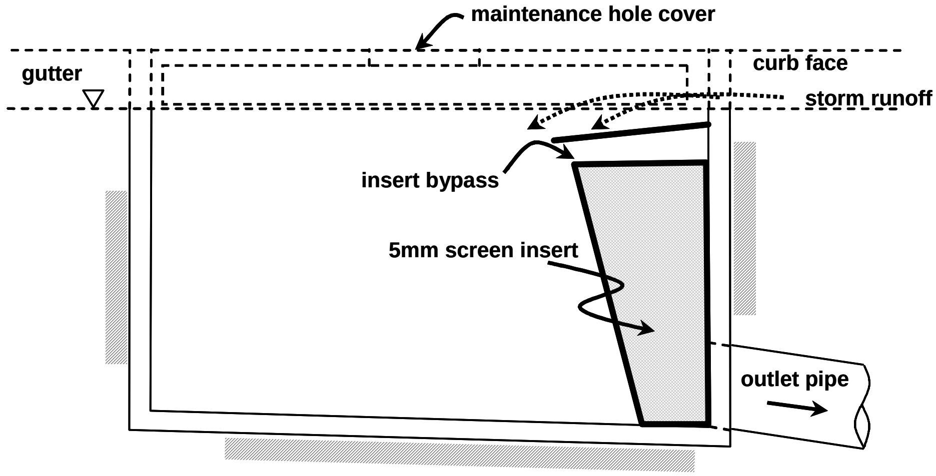


Plan

Figure 2. Typical City of Los Angeles horizontal insert installation



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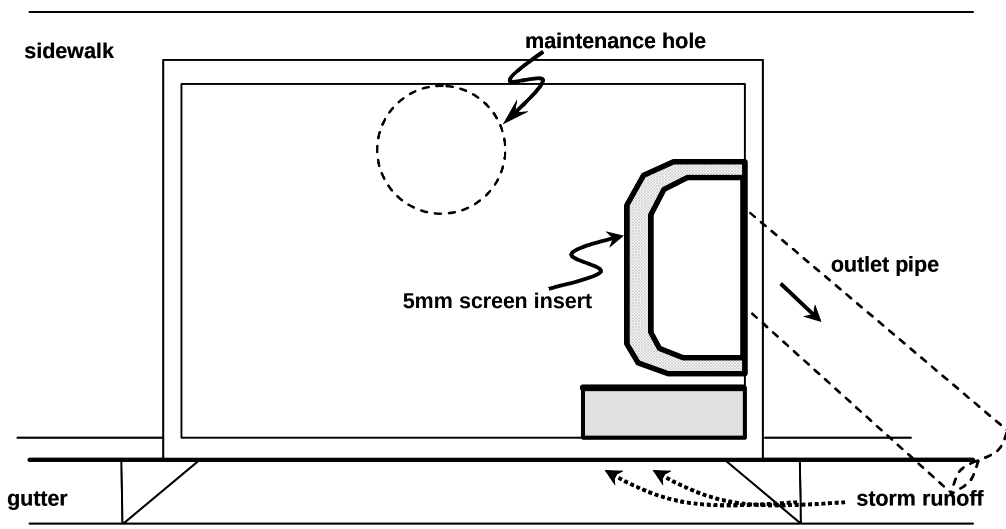

Plan

Figure 3. Typical City of Los Angeles vertical insert installation

Method

The following assertions are made:

1. Catch basins in the City of Los Angeles have been designed to intercept runoff from a ten-year storm. (Source: City of Los Angeles, Bureau of Engineering, Storm Drain Design Manual, Part G, Section G222, June 1969).

2. Catch basin outlet pipes have been designed to be a minimum of 18 inches. (Source: City of Los Angeles, Bureau of Engineering, Storm Drain Design Manual, Part G, Section G353, June 1969).

The following steps are taken to determine if the inserts with 5 millimeter are full capture devices, i.e., will treat flows from a 1-year, 1-hour storm.

1. Determine the gross area of the CB insert installed within the catch basin, both horizontal and vertical sections.

2. Determine the percentage (%) open area of the CB insert. Percentage was provided by the manufacturer.

3. Determine the net area of the CB insert. This is done by multiplying the gross area by the percentage of the open area.

4. Determine an effective pipe diameter based on the net area of the CB insert. This is done by using the area of a circle equation and solving for the diameter.

5. Interpretation of effective pipe diameter:
    a. Greater than 18 inches would indicate that the CB insert can treat more flow than existing CB outlet pipe, thus it will pass flow from a ten-year storm.
    b. Less than 18 inches would indicate the CB insert is unable to pass more flow than existing CB outlet pipe, thus it will not pass flow from a ten-year storm.
        i. Proceed in calculating the 1-year, 1-hour storm flow for the CB of concern using the Rational Method and using the rain intensity as determined by the County of Los Angeles intensity isohyetal map for Los Angeles County.
        ii. Determine an effective pipe diameter that would transport the 1-year, 1-hour flow determined above.
        iii. Compare effective pipe diameter with actual outlet diameter. If actual outlet diameter is smaller than effective pipe diameter, insert is a full capture device.

Example – Horizontal Insert

The example below is presented to illustrate the sequence of the method proposed.

Problem: *Determine if the* ***horizontal*** *insert acts as a full capture device.*

Given:

1. CB insert dimensions
   horizontal section is 3.5 feet by 3.6 feet
   vertical section is 1.5 feet by 3.5 feet
2. Tributary area of CB is 120 feet by 150 feet (0.41 acres)
3. Rainfall intensity is 0.52 in/hr
4. Percent open area of insert is equal to fifty percent (50%)
5. Street slope is 0.002 ft/ft

Solution:

1. Determine Gross Area:
   horizontal section = $3.5\,ft \times 3.67\,ft = 12.85\,ft^2$
   vertical section = $1.5\,ft \times 3.67\,ft = 5.5\,ft^2$
   Total Gross Area = $12.85\,ft^2 + 5.5\,ft^2 = 18.35\,ft^2$

2. Percent open area of insert:
   Open area = 50%

3. Determine Net Area of Insert:
   Net Area = $18.35\,ft^2 \times 50\%$
   Net Area = $9.18\,ft^2$

4. Determine Effective Pipe Diameter (d_{new}):
   Area of Circle = $\pi d^2 / 4$
   $d_{new} = \left[4 \times area / \pi \right]^{\frac{1}{2}}$
   $d_{new} = \left[4 \times 9.18\,ft^2 / \pi \right]^{\frac{1}{2}}$
   $d_{new} = 3.42\,ft$

5. Interpretation of Effective Pipe Diameter:
   The *effective pipe diameter* resulted in 3.42 ft. This diameter is greater than 18 inches, thus CB insert can pass/treat more flow than the existing outlet pipe which is designed for a 10-

year storm, so at this point we can stop and conclude that this insert is a full capture device.

Example – Vertical Insert

The example below is presented to illustrate the sequence of the method proposed.

Problem: *Determine if the* ***vertical*** *insert acts as a full capture device.*

Given:

1. CB insert dimensions
   vertical section is 1.5 feet by 3.5 feet
6. Tributary area of CB is 120 feet by 150 feet (0.41 acres)
7. Rainfall intensity is 0.52 in/hr
8. Percent open area is equal to fifty percent (50%)
9. Street slope equals 0.002 ft/ft

Solution:

1. Determine Gross Area:
   vertical section = $1.5\,ft \times 3.67\,ft = 5.5\,ft^2$
   Total Gross Area = $5.5\,ft^2$

2. Percent open area of insert:
   Open area = 50%

3. Determine Net Area of Insert:
   Net Area = $5.5\,ft^2 \times 50\%$
   Net Area = $2.75\,ft^2$

4. Determine Effective Pipe Diameter (d_{new}):
   Area of Circle = $\pi d^2 / 4$
   $d_{new} = \left[4 \times area / \pi\right]^{\frac{1}{2}}$
   $d_{new} = \left[4 \times 2.75\,ft^2 / \pi\right]^{\frac{1}{2}}$
   $d_{new} = 1.87\,ft$

5. Interpretation of Effective Pipe Diameter:
   The *effective pipe diameter* resulted as 1.87 ft. This diameter is greater than 18 inches, thus CB insert can pass more flow than the existing outlet pipe which we assume was designed for a 10-year storm, so at this point we can stop and say that this insert indeed is a full capture device.

Discussion

The above approach provides a method that can be easily applied to the inserts currently being used by the City to demonstrate their use as full capture devices. The initial calculations, allow us to see if placement of the catch basin (CB) insert would hinder the existing conditions of the CB. In the example above, the dimensions given are for a shallow basin found in the City's storm drain system and thus the insert installed would have the smallest opened surface area that could be expected. One would expect the open area of the inserts to increase for larger CBs with longer curb openings (varying from 7 ft to 48 ft long) and depth varying from 4 ft to 12 ft. The example illustrates that even inserts with minimal opened surface area that could be expected in shallow CBs are adequate to handle the 10-year flow that the CB is designed to intercept, but as well can easily accommodate the 1-year, 1-hour rain intensity.

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Technical Report:

Assessment of Catch Basin Inserts

JUNE 2006

REVISED 02/21/07

WATERSHED PROTECTION
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TABLE OF CONTENTS

List of Tables

List of Figures

Executive Summary

Introduction

The intent of this report is to present the results obtained by the City of Los Angeles through a pilot study to determine the trash capture effectiveness of the insert during the wet season. The inserts were sized to accommodate the existing 10-year storm design of City-owned catch basins.

In compliance with the Federal Clean Water Act (CWA) and existing consent decree between the U.S. EPA and the environmental groups, the Los Angeles Regional Water Quality Control Board (RWQCB) approved the Trash Total Maximum Daily Loads (TMDLs) for the Los Angeles River and Ballona Creek and Wetlands on September 19, 2001. This Trash TMDL requires a reduction of 10% of trash per year for a ten-year period starting from the year 2005. The RWQCB has based compliance on a three-year rolling average, with the first milestone in September 2006 when the City must achieve a 20% trash reduction.

Pilot Study

The inserts being used in this pilot study are made of galvanized steel plates with 5 mm openings. They have been confirmed to meeting the requirements of the RWQCB for a full capture device, i.e., the ability to treat the storm flow of a 1-year, 1-hour storm. This was determined by calculating the surface area of an insert and translating it into *effective pipe diameter* and comparing it to the existing size of the outlet pipe for a catch basin. All catch basins in the City have been designed to intercept runoff from a ten-year storm with outlet pipes designed to be a minimum of 18 inches (Source: City of Los Angeles, Bureau of Engineering, Storm Drain Manual, Part G, Section G222 and Section G353, June 1969). If the *effective pipe diameter* of the insert is greater than 18 inches, then the insert can pass more flow than the existing outlet pipe, thus it will pass flow from a ten-year storm, above and beyond the 1-year, 1-hour storm criterion for a full capture device. Supplementary analysis further showed that if the insert area progressively becomes blocked, only a small percentage of that area will be required to remain open to pass the 1-year, 1-hour storm.

The sole purpose of the pilot study was to determine the trash capture effectiveness of catch basin (CB) inserts during a typical calendar year. The pilot study location is adjacent to the Coliseum/Exposition Park area in the City of Los Angeles and has a drainage area of approximately 138 acres. Stormwater runoff from this area is captured by a total of 50 catch basins and a CDS unit located at the base of this drainage area. All 50 catch basins were retrofitted with inserts having a mesh opening of 5 millimeters (0.197 inch) that capture trash mobilized by storm flow. Field measurements from both the catch basins and the CDS unit were obtained during the past wet season, FY 2005/06, by crews from the Wastewater Collection Systems Division after every storm greater than 0.25 inches.

Conclusion

The study objective was to determine the trash capture effectiveness during the wet season for inserts sized to accommodate the existing 10-year storm design of City-owned catch basins. These inserts were deemed to have a 92 to 97 percent trash capture effectiveness during storms greater than 0.25 inches. For dry days the trash capture effectiveness of the inserts is 100 percent, given that no flow is generated.

It should be noted that the City of Los Angeles during a typical year experiences twenty five (25) wet days and three hundred forty (340) dry days. **Therefore, the year-round effectiveness of the tested insert is calculated to be 99.2% to 99.7% (e.g., {340X(100%) + 25X(92%)}/365 = 99.2%).**

Since the tested insert was sized for a 10 year storm, a set of calculation was performed afterwards to calculate the performance of the insert for a 1 year, 1 hour storm event. This was done by comparing the flow rates for both storm events. It became evident that the flow rate of the 10 year storm is approximately 70% higher than the 1yr / 1hr flow (2.01cfs versus 2.01cfs). An adjustment factor was then applied to the test results to reflect the adjustment in performance. The CB insert capture effectiveness for the 1 year /1 hour storm was deemed to be 100% effective.

CHAPTER

1

PILOT STUDY

Background

The intent of this report is to present the results gathered by the City of Los Angeles through a pilot study to determine insert trash capture effectiveness during the wet season for inserts sized to accommodate the existing 10-year storm design of City-owned catch basins .

In compliance with the CWA and existing consent decree between the U.S. EPA and the environmental groups, RWQCB approved the TMDLs for the Los Angeles River and Ballona Creek and Wetlands on September 19, 2001. This Trash TMDL requires a reduction of 10% of trash per year for a ten-year period. The RWQCB has based compliance on a three-year rolling average, with the first milestone in September 2006 when the City must achieve a 20% trash reduction.

The RWQCB further identified trash in urban runoff that is conveyed through the storm drain as a primary source of pollution reaching the Los Angeles River and Ballona Creek. Trash that gets into the water bodies can cause water quality problems. Settleables, such as glass, cigarette butts, rubber, and construction debris, can be a problem for bottom feeders and can contribute to sediment contamination. Some debris, such as diapers, medical and household waste, is a source of bacteria and toxic substances. The Trash TMDL identified the following beneficial uses as being impaired due to trash in these waterbodies: 1) contact recreation like bathing and swimming; 2) non-contact recreation such as fishing, hiking, jogging, and bicycling; and 3) habitat for aquatic life and bird life.

The inserts being used in this pilot study are made of galvanized steel plates with 5 mm openings. They have been confirmed to meeting the requirements of the RWQCB for a full capture device, i.e., the ability to treat the storm flow of a 1-year, 1-hour storm. This was determined by calculating the surface area of an insert and translating it into *effective pipe diameter* and comparing it to the existing size of the outlet pipe for a catch basin. All catch basins in the City have been designed to intercept runoff from a ten-year storm with outlet pipes designed to be a minimum of 18 inches (Source: City of Los Angeles, Bureau of Engineering, Storm Drain Manual, Part G, Section G222 and Section G353, June 1969). The method states that if the *effective pipe diameter* of the insert is greater than 18 inches, then the insert can pass more flow than the existing outlet pipe, thus it will pass flow from a ten-year storm, above and beyond the 1-year, 1-hour storm criterion for a full capture device. Supplementary analysis further showed that if the insert area progressively becomes blocked, only a small percentage of that area will be required to remain open to pass the 1-year, 1-hour storm.

Throughout the study the word "trash" has been used to represent sediment, debris, vegetation and litter and should not be misconstrued to represent only anthropogenic trash.

Description of Study Area

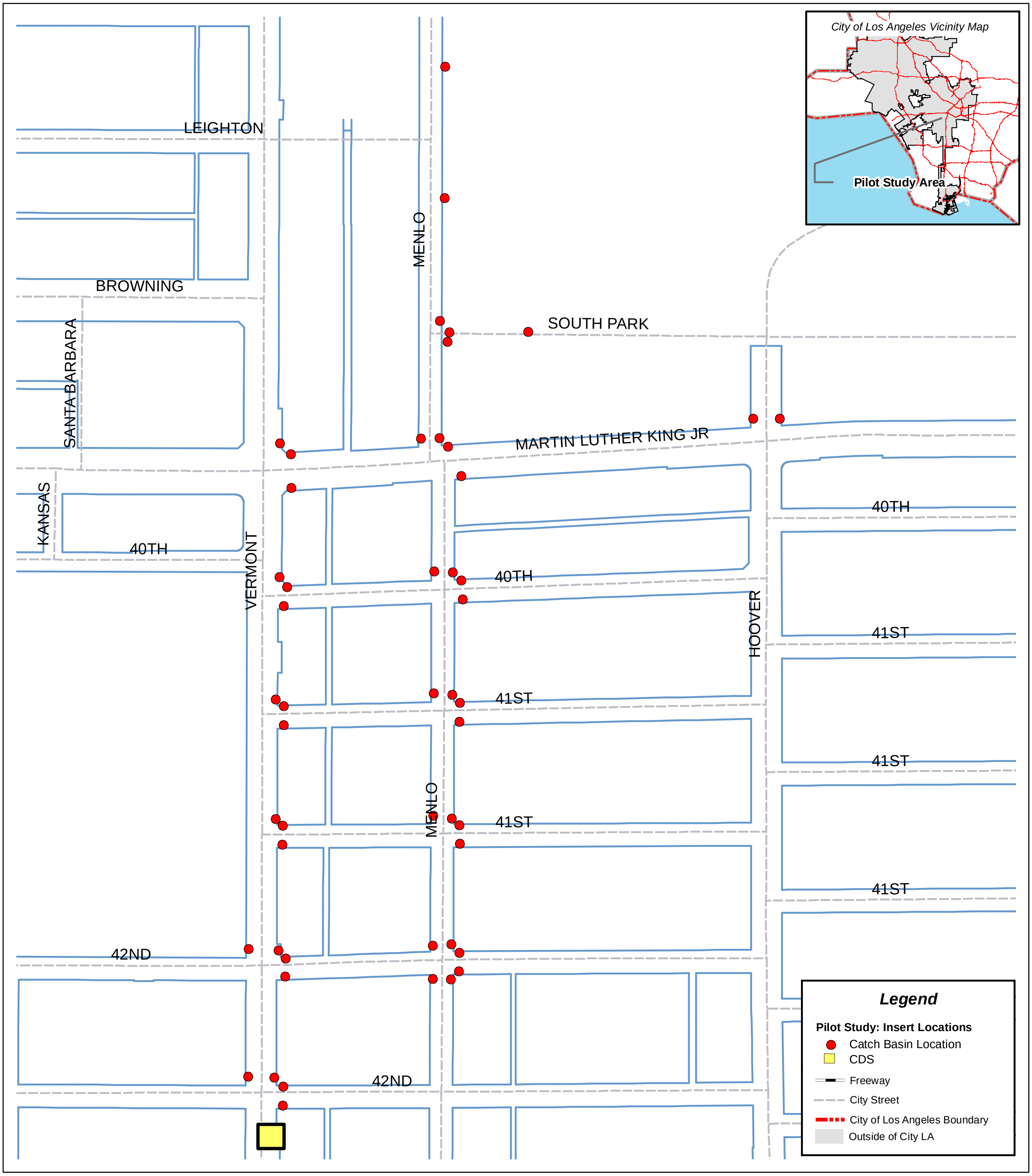
The catch basins retrofitted with inserts were located southwest of the downtown Los Angeles Civic Center adjacent to the Coliseum/Exposition Park area of the City (See Figure 1.1). The drainage area is approximately 138 acres, with three-quarters commercial land use and the remaining multi-family residential land use (see Figure 1.2). This area is regarded as a high trash generation area within the City.

Catch Basin and CDS Details

The physical parameters of the fifty (50) catch basins (CBs) included in the study were consistent. Table 1 shows the parameters for each CB. As the Table shows, over two-thirds of the CBs had a curb opening length of 3.5 feet and curb opening height of eight (8) to ten (10) inches. Additionally, many of the CBs had a depth that was shallow to moderate. The catch basin drainage area in which these catch basins are found had a hydrodynamic system installed on the downstream end of the mainline storm drain located at Vermont and 43rd Street. The system being used is a CDS Technologies Continuous Deflective Separation (CDS) unit Model PSW 70-70 with treatment design flow rate of 26.5 cubic feet per second (cfs). A CDS unit is recognized by the RWQCB as a full capture device.

Catch Basin Insert Details

The inserts being used in the study have been verified as meeting the requirements of the RWQCB for a full capture device, i.e., the ability to treat the storm flow of a 1-year, 1-hour storm. The CB inserts evaluated for the study have been purchased and installed by Practical Technology, Inc. They are manufactured from hot dipped galvanized steel screen sheets with 5 millimeters (0.197 inch) diameter circular openings. Inserts installed in curb opening CBs encompass the entire width and approximately 80% of the entire length of the basin; whereas, inserts installed in grate CBs fit the entire opening. See Figure 1.3 for typical insert installation and configuration. During a typical rain event trash that has accumulated in the street gutters is washed into the catch basin. The function of the CB inserts is to capture all trash greater than 5 mm while maintaining adequate drainage capacity of the CB and storm drain system. If the storm event is of great intensity, flow will begin to backup into the catch basin causing the floatable trash within the catchment area to rise. Excessive flow will go into the overflow, thus preventing any flooding of the streets.



0 0.015 0.03 0.06 0.09 Miles

Figure 1.1 Study Area

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RITA L. ROBINSON
DIRECTOR

SHAHRAM KHARAGHANI
PROGRAM MANAGER

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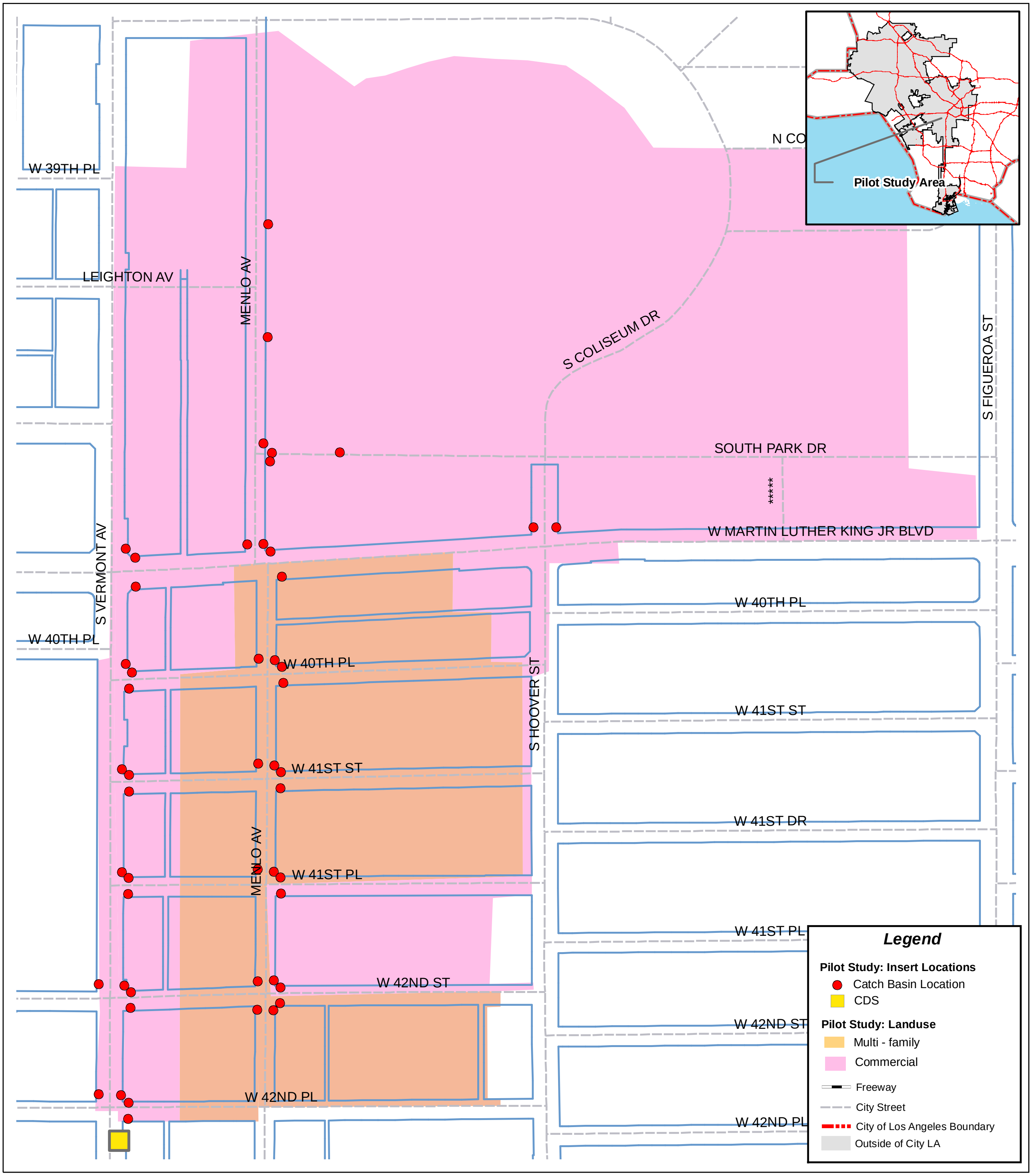

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Figure 1.2 Study Area: Landuse

CITY OF LOS ANGELES SANITATION DEPARTMENT OF PUBLIC WORKS	RITA L. ROBINSON DIRECTOR			SHAHRAM KHARAGHANI PROGRAM MANAGER	WATERSHED PROTECTION CITY OF LOS ANGELES
	FILE-LOC H:/GIS/PilotStudyLanduse	DRAWN BY: AM	CHECKED BY: MS	DATE 05/19/06 DATE REVISED X	This map shall not be copied or reproduced, all or any part thereof, whether for distribution or resale, without the proper written permission of the Dept. of Public Works, City of Los Angeles. Thomas Bros Data reproduced with permission granted by THOMAS BROS MAP

Table 1.1 Pilot Study Catch Basin Parameters

No	Address	Location	CLAMMS ID No.	Catch Basin Dimensions (ft) Length	Width	Depth	Vol. ft^3	Street Cleaning Frequency
1	MENLO AVE & LEIGHTON AVE	NE	53608461111100	7.25	3.67	1.75	46.56	WEEKLY
2	MENLO AVE & LEIGHTON AVE	SE	53608461111104	3.5	3.75	1.33	17.46	WEEKLY
3	MENLO AVE & MARTIN LUTHER KING JR BLVD	200' E OF MENLO AVE	53612461111012	3.58	3.92	1.5	21.05	WEEKLY
4	MENLO AVE & MARTIN LUTHER KING JR BLVD	NE 300' N OF MLK	53612461111013	3.67	3.75	1.33	18.30	WEEKLY
5	MARTIN LUTHER KING JR BLVD & MENLO AVE	EN 300' N OF MLK	53612461111014	3.83	3.75	1.167	16.76	WEEKLY
6	MARTIN LUTHER KING JR BLVD & MENLO AVE	ES 300' N OF MLK	53612461111015	3.58	3.67	1.83	24.04	WEEKLY
7	HOOVER ST & MARTIN LUTHER KING JR BLVD	NE	53612461111016	14.75	3.83	2.83	159.87	DAILY
8	HOOVER ST & MARTIN LUTHER KING JR BLVD	NW	53612461111017	7.33	1.92	1.92	27.02	DAILY
9	MENLO AVE & MARTIN LUTHER KING JR BLVD	NE	53612461111020	14.58	3.83	2.83	158.03	WEEKLY
10	MENLO AVE & MARTIN LUTHER KING JR BLVD	NW	53612461111022	4.25	3.67	1.08	16.85	WEEKLY
11	VERMONT AVE & MARTIN LUTHER KING JR BLVD	NE	53612461111025	4	7	2	56.00	DAILY
12	MARTIN LUTHER KING JR BLVD & MENLO AVE	EN	53612461111026	7.42	4	1.33	39.47	DAILY
13	MARTIN LUTHER KING JR BLVD & VERMONT AVE	EN	53612461111028	7	2.083	1.67	24.35	DAILY
14	MARTIN LUTHER KING JR BLVD & MENLO AVE	ES	53612461111030	3.5	3.83	2	26.81	DAILY
15	MARTIN LUTHER KING JR BLVD & VERMONT AVE	ES	53612461111031	--	--	--	--	DAILY
16	MENLO AVE & 40TH PL	NW	53612461111036	3.583	3.5	1.75	21.95	WEEKLY
17	MENLO AVE & 40TH PL	NE	53612461111037	3.583	3.667	2.416	31.74	WEEKLY
18	VERMONT AVE & 40TH PL	NE	53612461111038	3.833	3.75	2.47	35.50	DAILY
19	40TH PL & MENLO AVE	EN	53612461111039	3.583	3.75	2	26.87	WEEKLY
20	40TH PL & VERMONT AVE	EN	53612461111040	3.667	3.75	1.5	20.63	WEEKLY
21	40TH PL & MENLO AVE	ES	53612461111042	3.583	3.583	1.667	21.40	WEEKLY
22	40TH PL & VERMONT AVE	ES	53612461111043	3.583	3.667	1.083	14.23	WEEKLY
23	MENLO AVE & 41ST ST	NW	53612461111047	3.583	3.583	2.63	33.76	WEEKLY
24	MENLO AVE & 41ST ST	NE	53612461111048	3.667	3.667	1.83	24.61	WEEKLY
25	VERMONT AVE & 41ST ST	NE	53612461111049	3.667	3.75	1.75	24.06	DAILY
26	41ST ST & MENLO AVE	EN	53612461111050	3	3.667	2.083	22.92	WEEKLY
27	41ST ST & VERMONT AVE	EN	53612461111052	3.667	2.5	1.25	11.46	WEEKLY
28	41ST ST & MENLO AVE	ES	53612461111054	3.667	3.75	1.417	19.49	WEEKLY
29	41ST ST & VERMONT AVE	ES	53612461111056	3.25	3.583	1.45	16.88	WEEKLY
30	MENLO AVE & 41ST DR	NW	53612461111061	3.5	3.583	1.917	24.04	WEEKLY
31	MENLO AVE & 41ST DR	NE	53612461111062	3.25	3.667	2.25	26.81	WEEKLY
32	VERMONT AVE & 41ST DR	NE	53612461111063	3.75	3.5	1.25	16.41	DAILY
33	41ST DR & MENLO AVE	EN	53612461111064	3.667	3.75	1.167	16.05	WEEKLY
34	41ST DR & VERMONT AVE	EN	53612461111066	3.667	3.583	1.67	21.94	WEEKLY
35	41ST DR & MENLO AVE	ES	53612461111068	2	3.667	1.167	8.56	WEEKLY
36	41ST DR & VERMONT AVE	ES	53612461111069	3.667	3.583	1.67	21.94	WEEKLY
37	MENLO AVE & 42ND ST	NE	53612461111076	3.5	3.667	2.417	31.02	WEEKLY
38	MENLO AVE & 42ND ST	NW	53612461111077	3.667	3.75	1.833	25.21	WEEKLY
39	VERMONT AVE & 42ND ST	NW	53612461111081	3.583	7.4167	1.75	46.50	DAILY
40	VERMONT AVE & 42ND ST	NE	53612461111082	--	--	--	--	WEEKLY
41	42ND ST & MENLO AVE	EN	53612461111083	3.9167	3.75	1.5	22.03	WEEKLY
42	42ND ST & VERMONT AVE	EN	53612461111086	3.583	3.667	1.5	19.71	WEEKLY
43	42ND ST & MENLO AVE	ES	53612461111088	3.583	3.667	1.75	22.99	WEEKLY
44	42ND ST & VERMONT AVE	ES	53612461111090	3.5	3.583	1.833	22.99	WEEKLY
45	MENLO AVE & 42ND ST	SW	53612461111092	2.75	3.33	2.45	22.44	WEEKLY
46	MENLO AVE & 42ND ST	SE	53612461111093	3.583	3.667	2	26.28	WEEKLY
47	VERMONT AVE & 42ND PL	NW	53612461111099	3.1667	2.25	1.25	8.91	DAILY
48	VERMONT AVE & 42ND PL	NE	53612461111100	3.5	3.583	2.33	29.22	DAILY
49	42ND PL & VERMONT AVE	EN	53612461111101	3.75	3.833	1.83	26.30	WEEKLY
50	42ND PL & VERMONT AVE	ES	53612461111102	2.25	3.75	1.83	15.44	WEEKLY

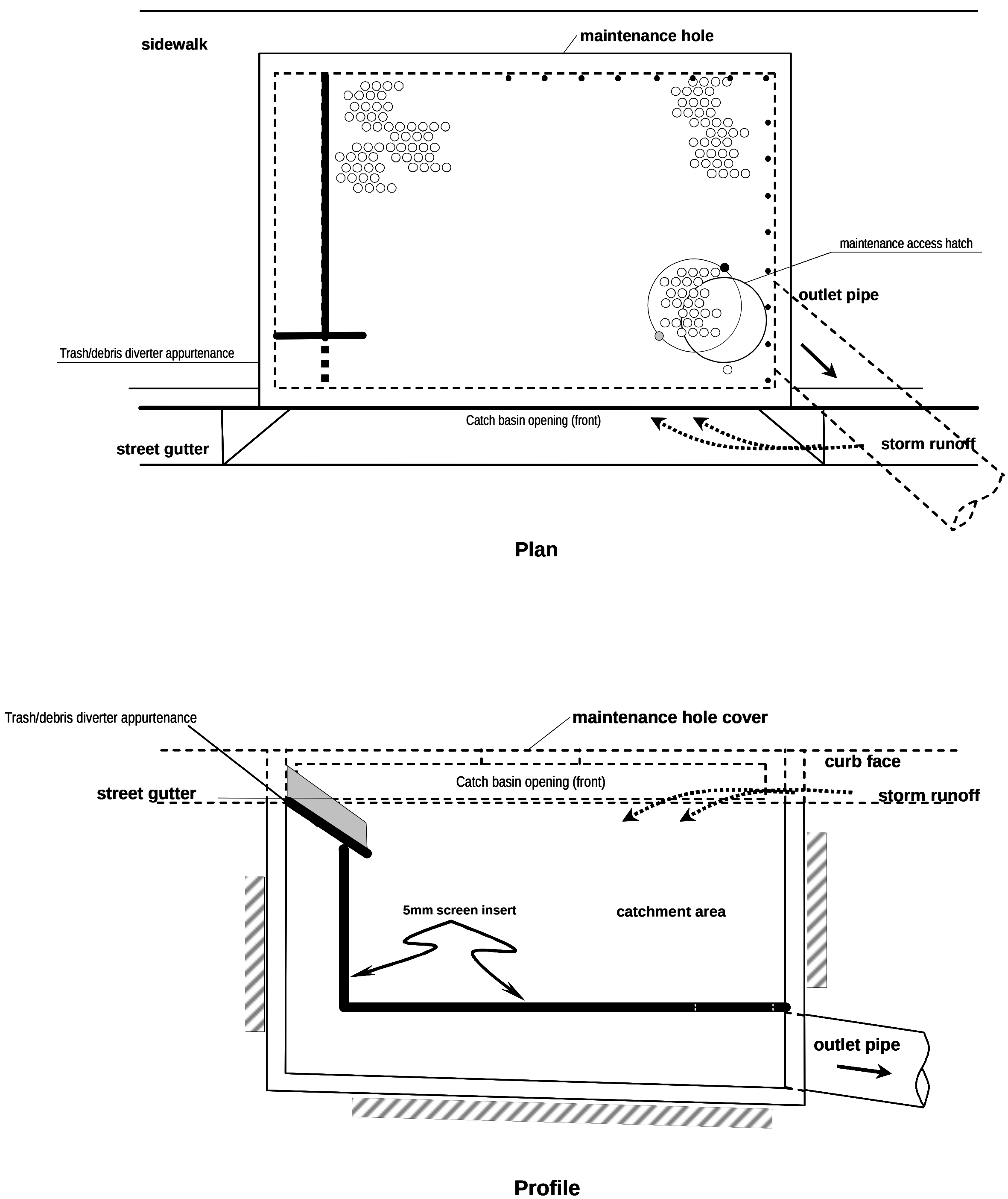


Figure 1.3 Typical Insert Installation

CHAPTER

2

PILOT STUDY – TEST PROTOCOL

Goal

The goal of this test protocol is:

1. To determine CB insert trash capture effectiveness during wet weather.

Test Protocol

General

1. The inserts evaluated for the pilot study were purchased from Practical Technology, Inc. They are constructed from hot dipped galvanized steel screen sheets with 5mm openings. Inserts installed in curb opening CBs encompass the entire width and approximately 80% of the entire length of the basin; whereas inserts installed in grate inlet CBs (3 total) fit the entire opening.

2. Wastewater Collection Systems Division (WCSD) crews will perform data collection and measurements after a storm event having an accumulation greater than 0.25 inches as measured at the civic center of the City of Los Angeles. Collection and measurements will be from October 1, 2005 to April 30, 2006.

3. Existing data collection procedures will be employed and amended, if necessary. Data from individual measurements will be recorded in tabular form (see Fig. 2.1), using existing WCSD data collection forms or amended forms provided by Watershed Protection Division (WPD).

4. Existing historical CB and CDS cleaning data will be gathered for comparison with that of the data collection from this study.

5. Data collection and measurements will be performed if the storm events occurred ten or more days apart.

6. Precipitation data of every storm event will be obtained from the County of Los Angeles, Department of Public Works real time rain gauge identified as the Los Angeles-Ducommun (#377, Lat. 34-03-09; Long. 118-14-13; Elev. 306). Data will be analyzed for total rainfall, one-hour maximum rainfall, and 30-minute maximum rainfall (rainfall intensity).

7. The following field conditions will be recorded by WPD staff at the start of the study at each retrofitted CB:
    a. Location;
    b. Volume of insert and size of CB opening;
    c. Height of insert;
    d. Visual observations of street surroundings;
    e. Visual observations of inside of catch basin; and
    f. Street cleaning frequency at CB location.

8. The following field conditions will be recorded during data collection at each retrofitted catch basin:
    a. Existing weather conditions;
    b. Fullness of insert (i.e., none, minimal, ¼ full, ½ full, ¾ full, full);
    c. Visual observations for signs of ponding immediately adjacent to CB opening; and
    d. Other parameters, as the study proceeds.

9. Following each cleaning WCSD will forward the results to WPD for data assessment.

Evaluation of Capture Effectiveness

Determination of an overall trash capture effectiveness of inserts will rely on field measurements and visual observations.

1. WCSD crews will visually monitor the CDS unit for floating trash after every storm event described. If no floating trash is visible, such result shall be recorded, otherwise crews will remove the floating trash.

2. WCSD crews will remove all accumulated trash after every storm from all retrofitted CBs.

3. Trash Capture (TC) effectiveness of inserts will be determined as follows for each set of cleaning data:

$$TC_{Effectiveness} = \frac{\sum_{i}^{n} CB_{trash}}{\sum_{i}^{n} CB_{trash} + CDS_{trash}}$$

Where CB_{trash} and CDS_{trash} are the trash quantities for the CBs and CDS unit, respectively. These quantities will be expressed in both weight (lbs) and in-place-volume based on the height of the trash and cross-sectional area of the units.

WORK ORDER NO:

ENTRY DATE

Originator: Action Code: Routine Maintenance

Requester: Shutdown: No Priority: Normal

Planner: Parts Reqd: No Project:

Reference: Date Reqd:

Late Date: TBM

Description: INSPECT AND CLEAN STRUCTURE AS NECESSARY

Asset Name: CATCH BASIN Revision:

Asset No: W______ Category:

Asset Description:

Location: ______

Map and Grid

Steps

Step	Crew	Craft	Schedule date	Persons	Hours
1	W387	WW		2	.33

INSPECT AND CLEAN
STRUCTURE AS NECESSARY

Record Daily Time

Date:	Employee #:	Hours:	Enter:	Date:	Employee #:	Hours:	Enter:

Completion Date: ______ Reconciliation: ______ Work Sub-Class Cleaning Method ______ Failure (Finding/Condition): ______

Completed by Employee # ______ Accepted by Empl #: ______

Signature: ______ Signature: ______

Figure 2.1 WCSD data collection form

CHAPTER

3

PILOT STUDY – RESULTS

The intent of this section is to present the results obtained by the WCSD crews during the cleaning of the CBs and CDS unit after every storm greater than 0.25 inch. There were a total of 4 rain events of a magnitude that triggered a cleaning event during the 2005/2006 wet season. Though there were several small rain events (< 0.25 inch) during this wet season, the maintenance crews were not asked to clean either the catch basins or CDS. For these smaller rain events, visual observations, were made by staff and documented through photos. Table 3.1 illustrates the rain event data and the corresponding capture effectiveness based on the Test Protocol procedure.

Table 3.1 CB Insert Capture Effectiveness Per Rain Event > 0.25 inches (Wet Season Only)

Event	Storm Size (in)	Date	Collected Trash (lbs)		Insert % Capture Effectiveness (c)
			CBs (a)	CDS (b)	
1	1.02	10/17-18/05	1,911	128	97
2	2.05	12/31/05- 1/2/06	2,159	160	93
3	.31	2/17-18/06	2,253	160	93
4	.28	3/20-21/06	1,736	142	92

Figures 3.1 through 3.3 below, show typical contents found in the catchment area of the inserts just after a storm event. Depending on the catch basin location, the contents may differ. For example, more sediment and vegetation were found in those CBs in the multi-family landuse, while those in the commercial landuse had more trash (i.e., Styrofoam cups, plastic bags, etc.). Figures 3.4 through 3.5 show the typical contents of the CDS unit after a storm event. This material is what escaped the inserts through the overflow due to large flows mobilizing floatable trash found within the catchment area. As the pictures show, much of the contents are materials that easily float such as Styrofoam cups and containers, light film plastics,

and some paper products. Figures 3.6 through 3.9 show trash captured in the catch basins following rain events.

Figure 3.1 Typical CB insert with trash in catchment area

Figure 3.2 Typical CB insert with vegetation in catchment area

Figure 3.3 Typical CB insert with sediment in catchment area

Figure 3.4 Typical CDS unit contents after storm event

Figure 3.5 WCSD crews cleaning the CDS unit after a storm event

a. 41^{st} and Menlo Ave.

b. 42^{nd} and Vermont Ave.

Figure 3.6 Typical debris in CB after rain event No. 1, 10/17-18/2005

a. 41^{st} and Menlo Ave.

b. 42^{nd} and Vermont Ave.

Figure 3.7 Typical debris in CB after rain event No. 2, 12/31/2005-01/02/2006

a. 41^{st} and Menlo Ave.

b. 42^{nd} and Vermont Ave.

Figure 3.8 Typical debris in CB after rain event No. 3, 02/17-18/2006

a. 41st and Menlo Ave. b. 42nd and Vermont Ave.

Figure 3.9 Typical debris in CB after rain event No. 4, 03/19-20/2006

CHAPTER

4

PILOT STUDY
ANALYSIS AND RECOMMENDATIONS

Data Analysis

The study objective was to determine the trash capture effectiveness during the wet season for inserts sized to accommodate the existing 10-year storm design of City-owned catch basins. These inserts were deemed to have a 92 to 97 percent trash capture effectiveness during storms greater than 0.25 inches. The only time trash escapes the insert catchment area is when sufficient flow is generated to mobilize floatable trash in the catchment area and push it over the overflow. Hence, for dry days the trash capture effectiveness of the insert is 100 percent, given that no flow is generated.

It should be noted that the Trash TMDL document established a yearly Waste Load Allocation for each municipality within the watershed(s) based on a phased reduction of a 10% per year from the estimated current discharge (baseline) over a 10-year period. In addition, the City of Los Angeles during a typical year experiences twenty five (25) wet days and three hundred forty (340) dry days.

Therefore, the year-round effectiveness of the insert is calculated to be 99.2% to 99.7% (e.g., {(340 X 100%) + (25 X 92%)}/365 = 99.2%).

In accordance with the Trash TMDL document, a full capture device is defined as any single device or series of devices that traps all particles retained by a 5 mm mesh screen and has a design treatment capacity of not less than the peak flow rate of a 1-year/1-hour storm.

Therefore, the inserts piloted herein and deployed by the City in its catch basins clearly satisfy the above definition.

It is also important to point out that the inserts tested were sized for a 10 year storm, therefore their performance under a lesser flow rate, such as, a 1-year/1-hour storm is expected to show higher efficiency than the 92% – 97% documented in this study. This can be demonstrated by the following set of calculations:

The flow rate for a 1 year / 1 hour storm for each catch basin in the pilot study area is calculated as follows:

Q =CiA

C = .95
i = 0.46 in/hr (LADPW isohyetal map, 1yr, 30min)
A = 134 acres (drainage area of Coliseum area)/ 50 (# of catch basins in Coliseum area)
= 2.68 acres

Q = (.95) (.46) (2.68)
= **1.17 cfs**

Similarly, the flow rate for a 10 yr/ 1 hr storm for each catch basin is calculated as follows:

Q =CiA

C = .95
i = .79 in/hr*
A = 2.68 acres

Q = (.95) (.79) (2.68)
= **2.01 cfs**

By comparing both flow rates, it is evident that the flow rate of the 10 year storm is approximately 70% higher than the 1yr / 1hr flow.

*Converting Storm Events for a Given Location

Location: Downtown Los Angeles (See map in Attachment)[1]

Depth for a 50yr-24hr storm event: 6.0 inches[1]

$$\text{Intensity} = \left(\frac{RainDepth}{Duration}\right) = \left(\frac{6\ \ inches}{24\ \ hrs}\right) = \ 0.250\ \ in/hr$$

Convert from 50yr-24hr storm to 10yr-24 hr storm:

To convert to a 10yr-24 hr storm multiply by LA County 10yr Rainfall Frequency Multiplication Factor.[2]

10yr-24hr factor = 0.714 (See attachment Table 5.3.1)

Therefore, 10yr-24 hr equivalent storm:

$$\text{Depth}_{\text{10yr-24hr}} = 6.0\ in\ *\ 0.714 = 4.28\ in$$

$$\text{Intensity} = \left(\frac{RainDepth}{Duration}\right) = \left(\frac{4.28\ inches}{24\ hrs}\right) = 0.178\ in/hr$$

$I_{\text{10yr-24hr}}$ **= 0.178 in/hr**

Convert from 10yr-24 hr storm to a 10yr-1hr storm:

To convert from a 10yr-24 hr storm to a 10yr-1hr storm, use normalized intensity equation which relates intensity, duration, and frequency (IDF).[3]

$$\frac{I_t}{I_{1440}} = \left(\frac{1440}{t}\right)^{0.47}$$

Where:

I_t = Rainfall intensity for the duration given in inch/hr

t = Converting time in minutes (60 min = 1 hr)

I_{1440} = 24 hr rainfall intensity in inch/hr

$\frac{I_t}{I_{1440}}$ = Peak Normalized intensity, dimensionless

Therefore, Intensity (I) for a 10yr-1hr storm:

$$I_{\text{10yr-60min}} = \left(\frac{1440\,\text{min}}{60\,\text{min}}\right)^{0.47} \bullet\ 0.178\ in/hr$$

$I_{\text{10yr-60min}}$ **= 0.79 in/hr**

Therefore, the surface area of the current insert that is sized to handle the 10 year storm can be reduced by 70% to treat the 1 year / 1 hour storm.

---

[1] Los Angeles County Rainfall data: http://www.ladpw.org/wrd/publication/Rain Depth (50yr_24hr-rain.shp). (See Attachment)

[2] Los Angeles County Department of Public Works, Hydrology Manual, Jan 2006, Chapter 5, Table 5.3.1, Pg. 43 (See Attachment)

[3] Los Angeles County Department of Public Works, Hydrology Manual, Jan 2006, Chapter 5, Equation 5.1.2, Pg. 38.

An adjustment factor as high as 70% may be applied to the test results to reflect the adjustment in performance. Table 4.1 reflects the CB insert capture effectiveness for the two different storm events after applying the adjustment factor for the 1 year /1 hour storm.

Table 4.1 CB Insert Capture Effectiveness Comparison by Storm Flow Rates **(Wet Season Only)**

Event	Date	Insert % Capture Effectiveness	
		10-year/1-hour (a.)	1-year/1-hour (b.)
1	10/17-18/05	97	100
2	12/31/05- 1/2/06	93	100
3	2/17-18/06	93	100
4	3/20-21/06	92	100

Note:
a. Percent capture effectiveness based on the study.
b. Capture effectiveness = a. X 1.70
Example: 92% X 1.70 = 156%, thus 100%.

Observations

Throughout the study many observations, other than capture effectiveness, were recorded and below are some aspects that need to be considered with the use of this type of insert:

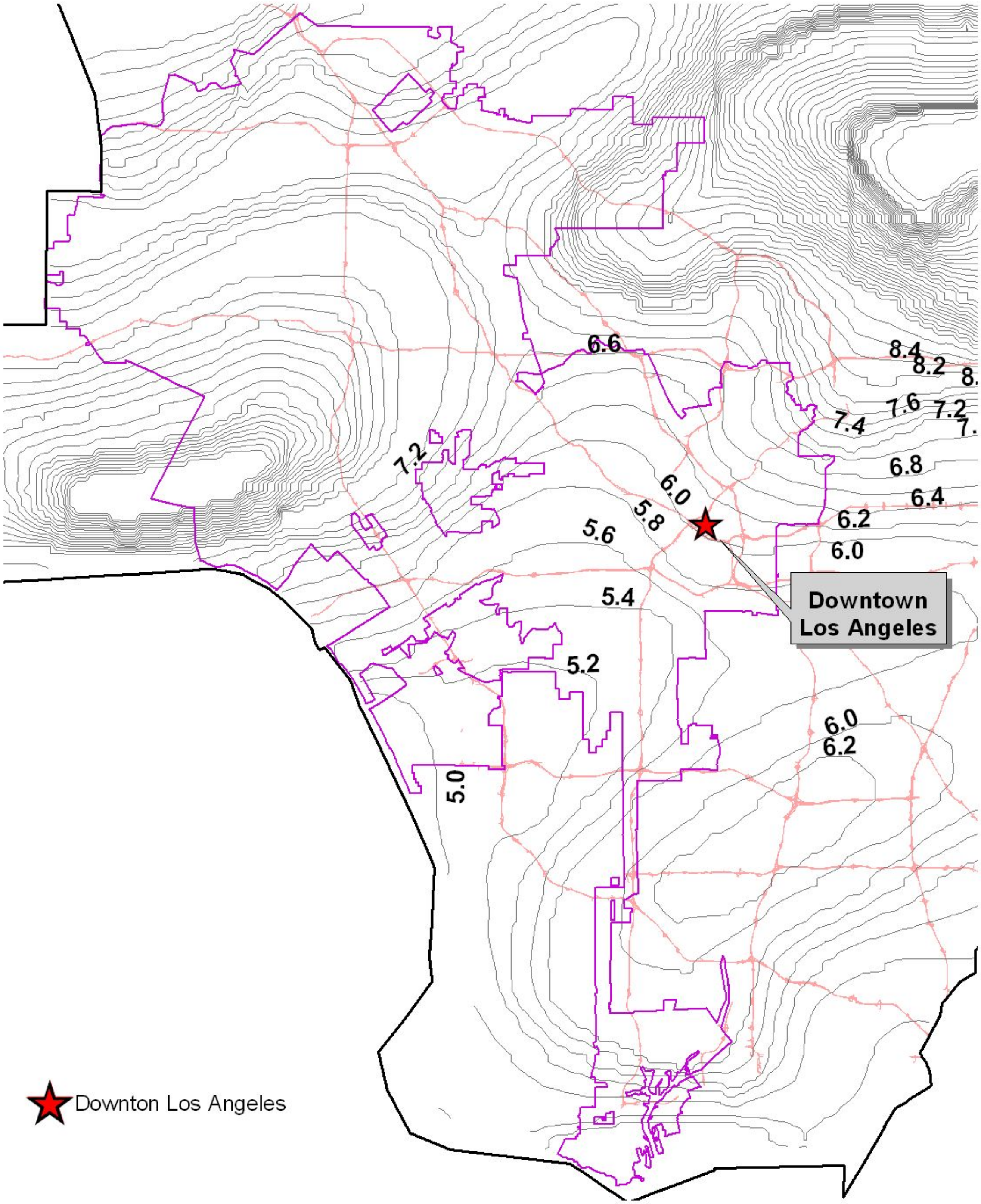
- Appropriate siting of an insert is essential due to the maintenance requirements. As was observed, inserts in areas that are heavy with vegetation (i.e., tree lined streets, parkways with grassy areas, etc.) exacerbate the cleaning requirements of the insert. Lack of cleaning will result in the insert clogging, diminishing it ability to retain trash and increasing the probability of that trash going over the overflow.
- The 5mm screen openings are problematic, in that they tend to close/clog with minimal debris and may result in localized ponding.
- The use of this insert configuration in shallow catch basins is not recommended. The insert significantly decreases the volume of the catch basin.
- Cross bracing shall be provided for inserts having a bottom screen section to avoid failure through shearing around the perimeter anchoring points.
- Inserts having a bottom screen section need to provide a means for access to the CB outlet pipe.

Recommendations

The City should continue to use catch basin inserts in high trash generation areas based on the inserts high trash capture capability. However, the City should continue to evaluate different configurations of inserts based on the following criteria:

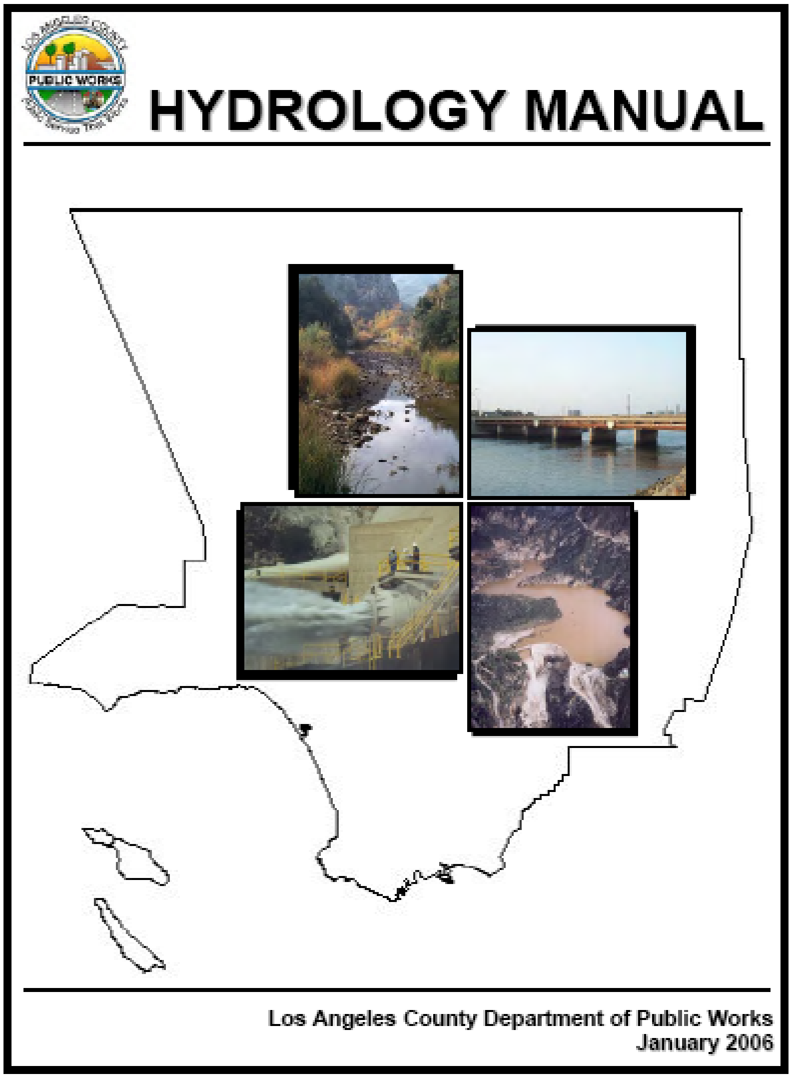
- Maximizing trash capture area;
- Minimizing flooding potential;
- Optimizing insert screen material openings; and
- Ease of maintenance.

Attachment



Isohyetal Map
24-hour rainfall depths expected for a 50-yr Storm frequency

Los Angeles County Rainfall data: http://www.ladpw.org/wrd/publication/Rain Depth (50yr_24hr-rain.shp).


HYDROLOGY MANUAL
Los Angeles County Department of Public Works
January 2006

Design decisions often require assigning a probability of occurrence to the rainfall event. Statistical analysis of rainfall intensity data yields a probability that such a rainfall will occur in a given year. The reciprocal of this probability is the frequency. The frequency represents the time between two occurrences of a specific rainfall event. The rainfall frequency is inversely proportional to the size of the event. Large rainfall events are much less common than small rainfall events.[1]

A study of rain gage data provided relationships between intensity, duration, and frequency within the County of Los Angeles. The study analyzed historic records for 107 rain gages and determined the maximum intensities for rainfall durations of 5, 10, 15, 30, 60, 120, 180, 240, 300, 720, and 1440 minutes. The analysis looked at the frequencies associated with the various intensities. Each intensity was assigned frequencies of 2-, 5-, 10-, 25-, 50-, 100-, and 500-years based on the Gumbel extreme value distribution of each gage.

The 1440 minute, or 24-hour duration, was a primary focus of this analysis. Sets of factors were developed to relate the rainfall depths of various frequencies to the 50-year rainfall frequency. Section 5.3 details the development of these factors.

The normalized intensity equation relates the intensity, duration, and frequency (IDF). The Hydrologic Method authorization memorandum outlines development of the equation.[2] Equation 5.1.2 provides the normalized IDF relationship:

$$\frac{I_t}{I_{1440}} = \left(\frac{1440}{t}\right)^{0.47}$$

Equation 5.1.2

Where:
- t = Duration in minutes
- I_t = Rainfall intensity for the duration in in/hr
- I_{1440} = 24-hour rainfall intensity in in/hr
- $\frac{I_t}{I_{1440}}$ = Peak normalized intensity, dimensionless

Table 5.3.1
Rainfall Frequency Multiplication Factors

Frequency	Multiplication Factor
2-yr	0.387
5-yr	0.584
10-yr	0.714
25-yr	0.878
50-yr	1.000
100-yr	1.122
500-yr	1.402

Appendix B contains isohyetal maps for the 50-year, 24-hour rainfall depth. The isohyetal contour lines are spaced at intervals of two-tenths of an inch. The spatial rainfall distributions for the county design storms were converted to grid data for use with Geographic Information System (GIS) compatible hydrologic models.

5.4 DESIGN STORM

The three components of the design storm include the IDF equation, the unit hyetograph curve, and the isohyets. These components are used to define the design storm for a particular location and frequency. As an example, consider the 25-year design storm for the Palmer Canyon watershed in Figure 5.4.1. Subarea 1A of this watershed, shown in Figure 5.4.2, will be used for the sample calculations.

1. Compute the area between successive isohyetal lines and multiply by the average of the isohyet values. Table 5.4.1 shows the areas between isohyets for Subarea 1A.

2. The sum of these precipitation-area values divided by the total subarea area provides the area weighted average rainfall depth. The average rainfall should be calculated to the nearest two-tenths of an inch. Table 5.4.1 contains the calculations for the isohyetal values in this subarea.

It may be noted that for small subareas, the isohyet nearest the centroid of the subarea usually equals the design depth. Selecting the isohyets nearest the subarea centroid is an acceptable method for determining the design rainfall for subareas of approximately 40 acres.