APPENDIX A

CAPITAL PROJECT FACT SHEETS

Capital Project Fact Sheet

Basin Name: Santa Clara Basin

Project #: A1-1

Project Identifier	**A1-1**
Project Title	**A1 Channel Open Channel Improvement**

Project Location

The proposed CP is located in modeled drainage segment RSA1090B. The CP is proposed to reduce flooding in the segment itself and in the upstream open channel and piped system segments including RSA1090C and RSA1090D.

Subbasin	**RSA1090**
GIS U/S Node Location	**72789**
GIS D/S Node Location	**72790**
Drainage Area Served by Capital Project	**281.4** Acres
% Impervious (Existing Land Use)	**42.9**
% Impervious (Future Land Use)	**53.6**

Project Description

Regrade the existing Type I open channel segment RSA1090B. Maintain the existing upstream invert elevation of 374.27 and adjust the downstream elevation to eliminate the reverse grade in the channel.

Project Elements

18 LF – Open Channel Improvements (Type 1)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in this segment (RSA1090B) and upstream segments RSA1090C and RSA1090D were predicted for the 10-year existing condition storm event, due to lack of capacity in the existing open channel and observed backslope on channel segment.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Open Channel Improvements (Type 1)	Inspect sediment loading and vegetation, remove sediment and debris.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified in this area.

Water Quality

N/A

Natural Resources

N/A

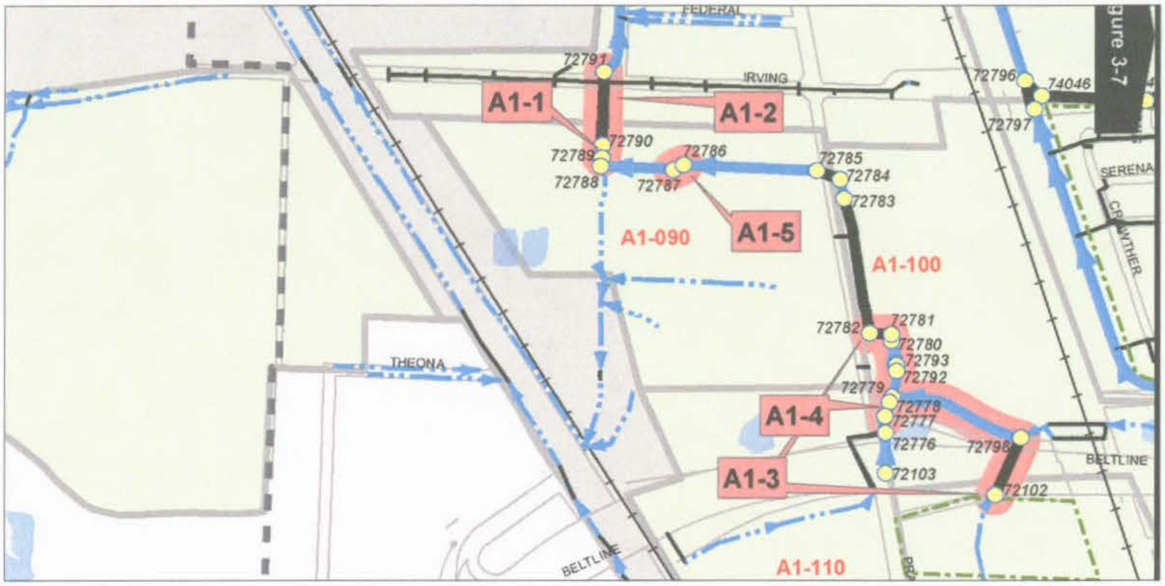
Costs

Construction Costs:	$6,300
Site Acquisition:	$0
Engineering / Administration:	$1,200
Capital Project Implementation Costs	**$7,500**
Annual Maintenance Costs	**$3,800**

Design Assumptions

Flood reduction in this reach and upstream open channel segments (RSA1090C and RSA1090D) would also be addressed by CP A1-2 and A1-3.

Project #: A1-1


FEDERAL
IRVING
THEONA
BELTLINE
SERENA
CROWTHER
A1-1
A1-2
A1-5
A1-4
A1-3
A1-090
A1-100
A1-110
72791
72790
72789
72788
72787
72786
72785
72784
72783
72782
72781
72780
72793
72792
72779
72778
72777
72776
72103
72798
72102
72796
74046
72797

Project #: A1-2

Project Identifier	A1-2
Project Title	A1 Channel Culvert Replacement at Irving Road

Project Location

The proposed CP is located in modeled drainage segment RSA1090A. The segment runs north-south, ending just south of the Irving Road and Gent Road intersection. The CP is proposed to reduce flooding in the segment itself and in the upstream open channel and piped system segments including RSA1090B, RSA1090C, and RSA1090D.

Subbasin	RSA1090
GIS U/S Node Location	72790
GIS D/S Node Location	72791
Drainage Area Served by Capital Project	281.4 Acres
% Impervious (Existing Land Use)	42.9
% Impervious (Future Land Use)	53.6

Project Description

Replace the existing 36" CMP culvert (segment RSA1090A) with 438 ft. of 42" CSP.

Project Elements

438 Ft – 42" CSP (2-5 ft. cover)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in segment RSA1090A were predicted for the 25-year winter, future condition storm event, and modeled flooding problems in upstream segments RSA1090B, RSA1090C, and RSA1090D were predicted for the 10-year existing condition storm event, due to lack of capacity in the existing open channels and pipes.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
42" CSP (2-5 ft. cover)	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified in this segment and upstream.

Water Quality

N/A

Natural Resources

N/A

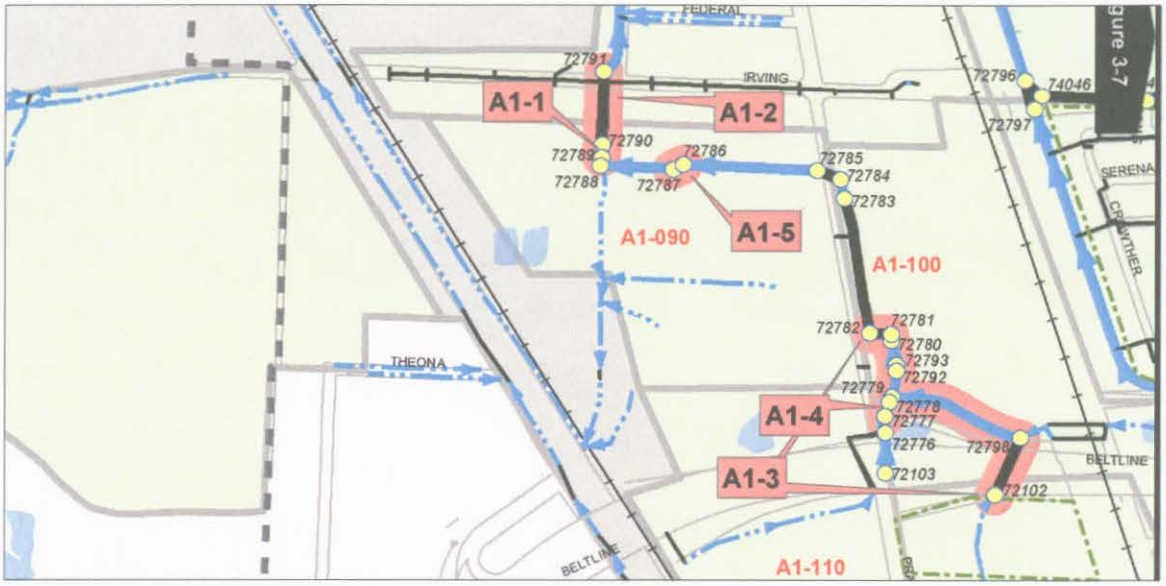
Costs

Construction Costs:	$109,500
Site Acquisition:	$0
Engineering / Administration:	$21,900
Capital Project Implementation Costs	**$131,400**
Annual Maintenance Costs	

Design Assumptions

Flood reduction in this segment and upstream open channel segments (RSA1090B, RSA1090C, and RSA1090D) would also be addressed by CP A1-1, A1-3, A1-6 and A1-7.

Project #: A1-2



FEDERAL
IRVING
72791
A1-1
A1-2
72790
72789
72788
72786
72787
72785
72784
72783
A1-090
A1-5
A1-100
72796
74046
72797
SERENA
CROWTHER
THEONA
72782
72781
72780
72793
72792
72779
A1-4
72778
72777
72776
72798
BELTLINE
A1-3
72103
72102
BELTLINE
A1-110

Project Identifier	**A1-3**
Project Title	**A1 Channel Flood Control Facility at Prairie Road and Beltline Road**

Project Location

The proposed storage CP would be located at node 72782 and 72102. The CP includes 40 acre-feet of storage at node 72102 and 45 acre-feet of storage at node 72782. Storage associated with node 72102 would be located in tax lots 200 and 202. These tax lots are located south of Beltline and east of Prairie Road. Storage associated with node 72782 would be located in tax lot 4400. This tax lot is between Hwy 99N and Prairie Road, south of Irving Road.

Subbasin	**RSA1110 and RSA1120**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**72782 and 72102**
Drainage Area Served by Capital Project	**141.5** Acres
% Impervious (Existing Land Use)	**34.6**
% Impervious (Future Land Use)	**54.2**

Project Description

Construct 85 ac-ft of storage in two locations to minimize flow in downstream open channel system.

Project Elements

85 Ac-Ft – Flood Control Facility

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in segments RSA1060H, M, O, Q and U; RSA1080B; RSA1090 A through F, and RSA1100 B through K, were generally predicted for the 10-year existing condition storm event, due to lack of capacity in the existing open channel and pipe segments. Storage proposed to minimize flow in downstream system and reduce magnitude of open channel improvements (see A1-1).

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Flood Control Facility	Inspect and clean inlet and outlet, maintain vegetation, inspect sediment loading, remove sediment, remove debris, inspect and repair separation berm (if applicable).

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems in this area.

Water Quality

N/A

Natural Resources

N/A

Costs

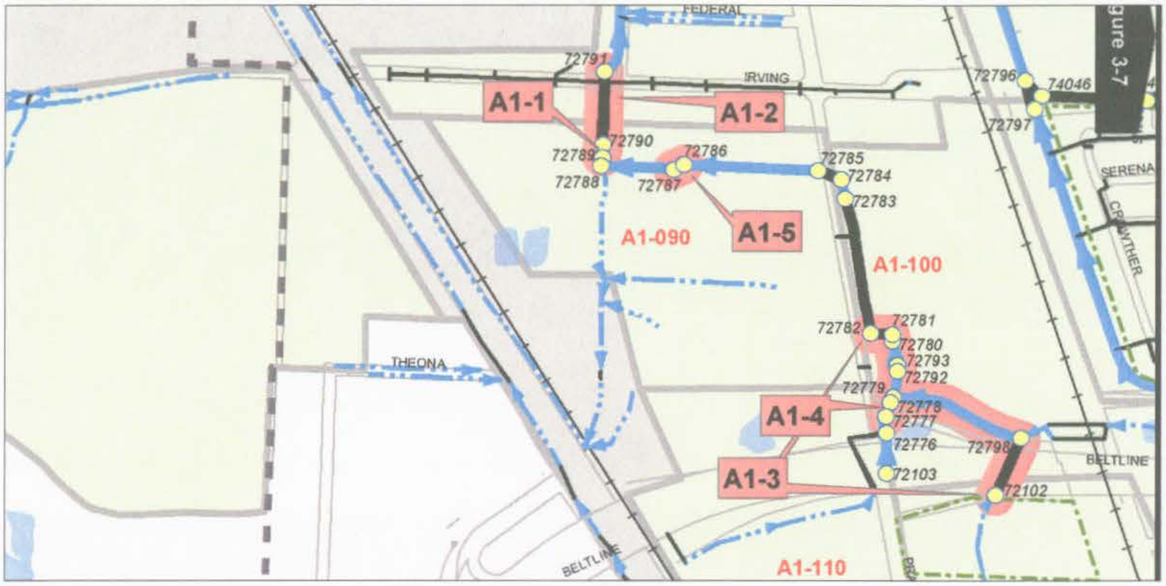
Construction Costs:	$5,074,500
Site Acquisition:	$5,059,000
Engineering / Administration:	$2,026,700
Capital Project Implementation Costs	**$12,160,200**
Annual Maintenance Costs	**$81,700**

Design Assumptions

Flood reduction in the downstream open channels would also be addressed by CP A1-1, A1-2, A1-5, A1-6, and A1-7.

Acquisition costs are based on an industrial land cost of $370,300/acre and calculated using the detention pond footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-3



FEDERAL
IRVING
72791
A1-1
A1-2
72790
72789
72788
72786
72787
A1-5
72785
72784
72783
A1-090
A1-100
72796
74046
72797
SERENA
CROWTHER
72782
72781
72780
72793
72792
72779
72778
72777
72776
A1-4
A1-3
72103
72798
72102
BELTLINE
THEONA
BELTLINE
A1-110

Project Identifier	A1-4
Project Title	A1 Channel Culvert Replacement at Prairie Road and Beltline Road

Project Location

The proposed CP is located in modeled drainage segment RSA1100I. The segment runs north-south along Prairie Road, beginning just north of the Beltline Road and Prairie Road intersection. The CP is proposed to reduce flooding in the segment itself and in the upstream open channel segment RSA1100J and upstream piped segments RSA1110A1 and A2.

Subbasin	RSA1100
GIS U/S Node Location	72777
GIS D/S Node Location	72778
Drainage Area Served by Capital Project	57.8 Acres
% Impervious (Existing Land Use)	54.3
% Impervious (Future Land Use)	55.2

Project Description

Replace the existing 24" CMP culvert (segment RSA1100I) with 70 ft. of 36" CSP.

Project Elements

70 Ft – 36" CSP (2-5 ft. cover)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in this segment (RSA1100I) were predicted for the 50-year existing condition storm event; upstream open channel segment RSA1100J during the 10-year existing condition event; and upstream piped segment RSA1110A1 and RSA1110A2 during the 25-year, summer, existing condition event due to restriction and lack of capacity in the existing open channels and pipes.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
36" CSP (2-5 ft. cover)	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified in this segment and upstream.

Water Quality

N/A

Natural Resources

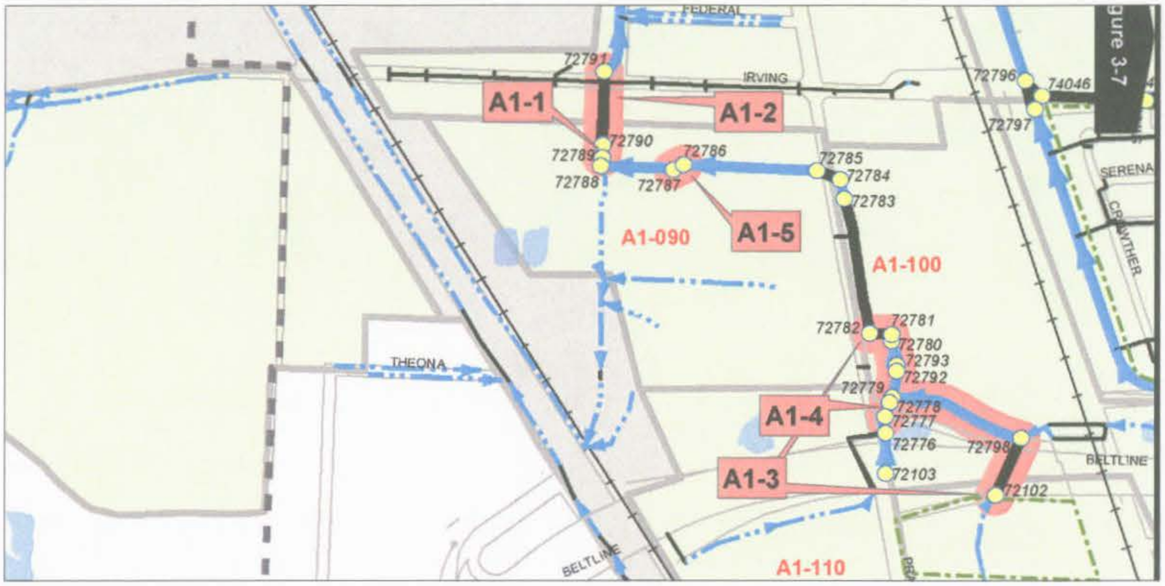
N/A

Costs

Construction Costs:	$15,400
Site Acquisition:	$0
Engineering / Administration:	$3,000
Capital Project Implementation Costs	**$18,400**
Annual Maintenance Costs	

Design Assumptions

Project #: A1-4


FEDERAL
IRVING
72791
A1-1
A1-2
72790
72789
72788
72786
72787
72785
72784
72783
A1-5
A1-090
A1-100
72796
74046
72797
SERENA
CROWTHER
THEONA
72782
72781
72780
72793
72792
72779
72778
72777
72776
A1-4
72798
BELTLINE
A1-3
72103
72102
BELTLINE
A1-110

Project #: A1-5

Project Identifier	**A1-5**
Project Title	**A1 Channel Culvert Replacement South of Irving Road**

Project Location

The proposed CP is located in modeled drainage segment RSA1090E. The segment runs east-west between Prairie Road and Gent Road, south of Irving Road. The CP is proposed to reduce flooding in the segment itself; in the upstream open channel segments RSA1090F, RSA1100C, E, G, and K; and upstream piped segments RSA1100B, D, and F.

Subbasin	**RSA1090**
GIS U/S Node Location	**72786**
GIS D/S Node Location	**72787**
Drainage Area Served by Capital Project	**231.3** Acres
% Impervious (Existing Land Use)	**44.0**
% Impervious (Future Land Use)	**53.5**

Project Description

Replace the three existing 24" CMP culverts (segment RSA1090E) with 40 ft. of a 2'x8' box culvert.

Project Elements

40 LF – 2' x 8' box culvert

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in segment RSA1090E were predicted for the 10-year existing condition storm event as a result of a restriction. Modeled flooding problems in upstream open channel segments RSA1090F, RSA1100C, E, G, and K were also predicted for the 10-year existing condition event, and upstream piped segments RSA1100B, D, and F during the 25-year, summer future condition storm event.

Opportunities

N/A

Project #: A1-5

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
2' x 8' box culvert	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified in this segment and upstream.

Water Quality

N/A

Natural Resources

N/A

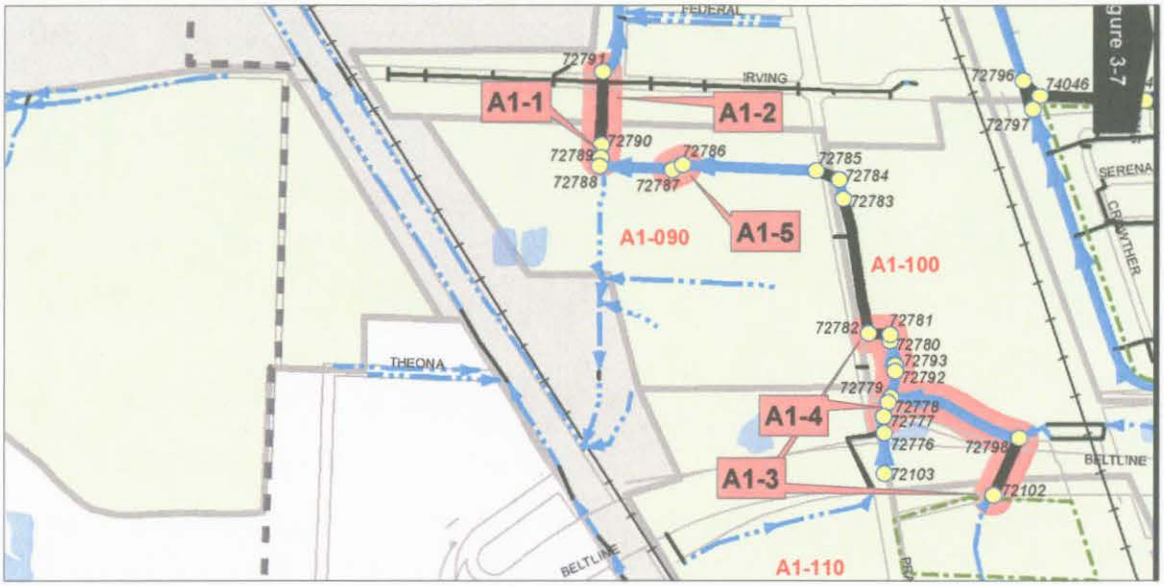
Costs

Construction Costs:	$22,000
Site Acquisition:	$0
Engineering / Administration:	$4,400
Capital Project Implementation Costs	**$26,400**
Annual Maintenance Costs	**$0**

Design Assumptions

Flood reduction in this segment and others specified would also be addressed by CP A1-3.

Project #: A1-5



FEDERAL
IRVING
72791
A1-1
A1-2
72790
72789
72788
72786
72787
72785
72784
72783
A1-090
A1-5
A1-100
72796
74046
72797
SERENA
CROWTHER
Figure 3-7
THEONA
72782
72781
72780
72793
72792
72779
A1-4
72778
72777
72776
72798
BELTLINE
A1-3
72103
72102
BELTLINE
A1-110

Project Identifier	A1-6
Project Title	A1 Channel Culvert Replacement at Carol Avenue

Project Location

The proposed CP is located in modeled drainage segment RSA1060L. The segment runs north-south across Carol Avenue north of Cecil Avenue. The CP is proposed to reduce flooding in upstream open channel segments RSA1060M, Q and U and RSA1080B and upstream piped segments RSA1090A.

Subbasin	RSA1060
GIS U/S Node Location	71207
GIS D/S Node Location	71208
Drainage Area Served by Capital Project	354.4 Acres
% Impervious (Existing Land Use)	44.4
% Impervious (Future Land Use)	53.7

Project Description

Replace the existing 24" CMP culvert (segment RSA1060L) with 40 ft. of 2' by 4' box culvert.

Project Elements

40 LF – 2' x 4' box culvert

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems were predicted for upstream open channel segments RSA1060M, RSA1060Q, RSA1060U, and RSA1080B during the 10-year existing condition event, and upstream piped segment RSA1090A during the 25-year, winter future condition storm event.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
2' x 4' box culvert	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified upstream.

Water Quality

N/A

Natural Resources

N/A

Costs

Construction Costs:	$18,000
Site Acquisition:	$0
Engineering / Administration:	$3,600
Capital Project Implementation Costs	**$21,600**
Annual Maintenance Costs	**$0**

Design Assumptions

Flood reduction in the upstream segments specified would also be addressed by CP A1-2, A1-3, and A1-7.

Project #: A1-6

A1-050
A1-060
A1-070
A1-7
A1-6
FC-020
FC-030
A1-130
99-020
A1-13-UIC
KORBEL
IRVINGTON
HALLET
KELSO
ZUMWALT
CLEO
CAROL
CECIL
KAISER
ZINFANDEL
NAPA VALLEY
CABERNET
GOLDBERRY
KORBEL
FLAT CREEK
ARROWHEAD
BARSTOW
WINERY
STONE CREEK
SONOMA
NORTHWEST EXPRESSWAY
A1 Chann
HWY 99N
This segement contains three 72 inch pipes
71215
85030
71214
71213
72741
72740
72739
72754
72737
72738
71212
71208
71211
71207
72753
72752
72751
72750
71210
85031
71209
72749
72748
72762
72761
72244
75660

Project Identifier	**A1-7**
Project Title	**A1 Channel Culvert Replacement at Kelso Street**

Project Location

The proposed CP is located in modeled drainage segment RSA1060G. The segment runs north-south across Kelso Street west of Zumwalt Street. The CP is proposed to reduce flooding in upstream open channel segments RSA1060H and U, RSA1080B, and upstream piped segment RSA1090A.

Subbasin	**RSA1060**
GIS U/S Node Location	**71213**
GIS D/S Node Location	**71214**
Drainage Area Served by Capital Project	**354.4** Acres
% Impervious (Existing Land Use)	**44.4**
% Impervious (Future Land Use)	**53.7**

Project Description

Replace the existing 18" and 24" CSP culvert (segment RSA1060G) with 31 ft. of 2' by 4.5' box culvert.

Project Elements

31 LF – 2' x 4.5' box culvert

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in upstream open channel segments RSA1060U and RSA1080B were predicted for the 10-year existing condition event, and were predicted for upstream open channel segment RSA1060H and piped segment RSA1090A during the 25-year, winter future condition storm event.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
2' x 4.5' box culvert	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified upstream.

Water Quality

N/A

Natural Resources

N/A

Costs

Construction Costs:	$13,900
Site Acquisition:	$0
Engineering / Administration:	$2,700
Capital Project Implementation Costs	**$16,600**
Annual Maintenance Costs	**$0**

Design Assumptions

Flood reduction in the upstream segments specified would also be addressed by CP A1-2, A1-3, and A1-6.

Project #: A1-7

A1-050
A1-060
A1-7
A1-070
A1-6
FC-020
FC-030
A1-130
A1-13-UIC KORBEL
99-020
IRVINGTON
HALLET
KELSO
ZUMWALT
CLEO
CAROL
CECIL
KAISER
ZINFANDEL
NAPA VALLEY
CABERNET
GOLDBERRY
KORBEL
ARROWHEAD
BARSTOW
WINERY
STONE CREEK
SONOMA
Flat Creek
A1 Channel
NORTHWEST EXPRESSWAY
HWY 99N
This segement contains three 72 inch pipes
71215
85030
71214
71213
72741
72740
72739
72754
72753
72752
72751
72750
72738
72737
71212
71211
71208
71207
71210
85031
71209
72749
72748
72762
72761
72244

Project Identifier	**A1-8**
Project Title	**A1 Channel Flood Control Facility at Maxwell Road West of N Park Avenue**

Project Location

The proposed storage CP would be located at node 72725 and 59020. The CP includes 53 acre-feet of storage at node 72725 and 81.8 acre-feet of storage at node 59020. Storage associated with node 72725 would be located in tax lot 2400 and storage associated with node 59020 would be located in tax lots 3800 and 3801. These tax lots are located south of Maxwell and east of N Park Ave.

Subbasin	**RSA1200 and RSA1160**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**72725 and 59020**
Drainage Area Served by Capital Project	**864.4** Acres
% Impervious (Existing Land Use)	**39.2**
% Impervious (Future Land Use)	**42.4**

Project Description

Construct 135 ac-ft of storage in two locations to minimize flow in downstream open channel system.

Project Elements

135 Ac-Ft – Flood Control Facility

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in segments RSA1160B, D, F and H are predicted for the 10-year existing condition storm event due to shallow depth of the existing open channel. Storage is proposed to minimize flow in downstream system because of the limited ability to modify open channel segments to reduce water surface elevation.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Flood Control Facility	Inspect and clean inlet and outlet, maintain vegetation, inspect sediment loading, remove sediment, remove debris, inspect and repair separation berm (if applicable).

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problem identified in this area.

Water Quality

N/A

Natural Resources

N/A

Costs

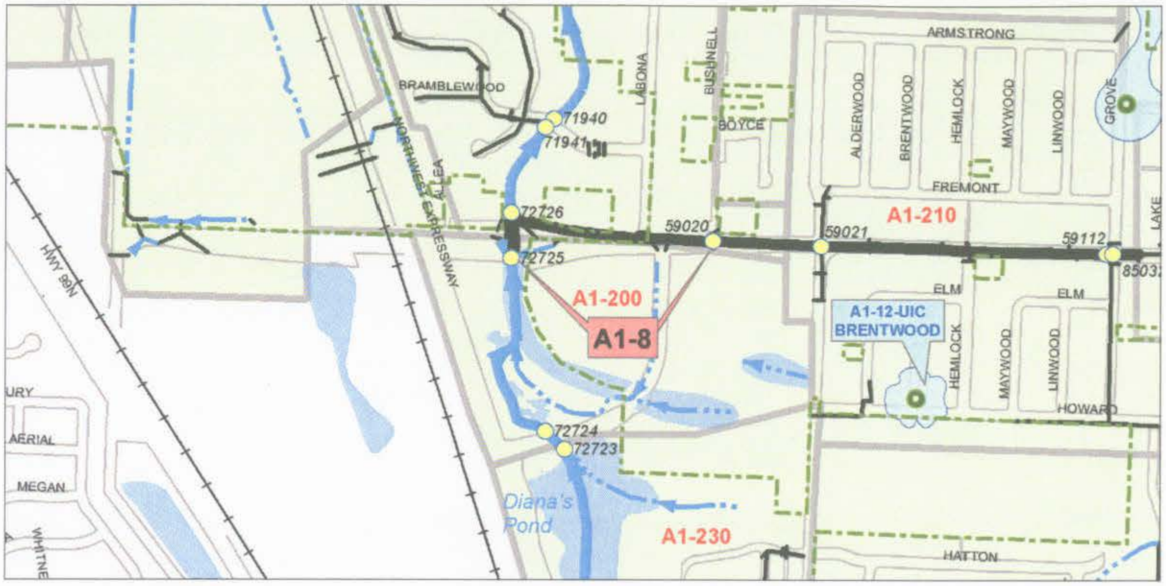
Construction Costs:	$8,059,500
Site Acquisition:	$6,007,000
Engineering / Administration:	$2,813,300
Capital Project Implementation Costs	**$16,879,800**
Annual Maintenance Costs	**$129,800**

Design Assumptions

Flood reduction in downstream open channel segments RSA1160D and RSA1160H would also be addressed by CP A1-9.

Acquisition costs are based on an industrial land cost of $370,300/acre and calculated using the detention pond footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-8


ARMSTRONG
BRAMBLEWOOD
LABONA
BUSHNELL
BOYCE
ALDERWOOD
BRENTWOOD
HEMLOCK
MAYWOOD
LINWOOD
GROVE
FREMONT
LAKE
71940
71941
NORTHWEST EXPRESSWAY
72726
72725
59020
59021
A1-210
59112
85032
HWY 66N
A1-200
A1-8
ELM
A1-12-UIC
BRENTWOOD
HOWARD
URY
AERIAL
MEGAN
WHITNE
72724
72723
Diana's
Pond
A1-230
HATTON

Project #: A1-9

Project Identifier	A1-9
Project Title	A1 Channel Survey

Project Location

The proposed survey would be conducted along A1 Channel segments RSA1160D and RSA1160H (in subbasin RSA1160), segment RSA1080B (in subbasin RSA1090) and RSA1060K (in subbasin RSA1060).

Subbasin	A1160, RSA1090, and RSA1060
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	1470.6 Acres
% Impervious (Existing Land Use)	40.6
% Impervious (Future Land Use)	46.1

Project Description

Conduct survey of open channel segments RSA1160 D and H, RSA1080B, and RSA1060K. These segments were identified as requiring additional survey due to the fact that survey used for the modeling did not coincide with field observations. Also, the depth of the channel as modeled is less than the diameter of the adjacent culverts, which results in flooding conditions. Would like to get more information regarding available storage that exists in the system above the top of banks.

Project Elements

0 N/A – Survey

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in segments RSA1160D and H, RSA1080B, and RSA1060K were predicted for the 10-year existing condition storm event. Given the shallow depth of the existing open channel, flooding along segments is prevalent and (for RSA1160D and H), not completely addressed with other CPs. Survey is proposed because the survey used to conduct the modeling did not coincide with recent field observations and more information is desired regarding available storage in the system above the top of banks.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Survey	

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Verifies modeled system survey and obtains additional information regarding available storage.

Water Quality

N/A

Natural Resources

N/A

Costs

Construction Costs:	
Site Acquisition:	$0
Engineering / Administration:	
Capital Project Implementation Costs	
Annual Maintenance Costs	**$0**

Design Assumptions

Project Identifier	A1-1-UIC
Project Title	Crocker 1 UIC Cluster - Pipe and Pre-treat

Project Location

The UICs associated with the Crocker UIC clusters run north-south, just east of Stark Street in the Spring Creek and Flat Creek subbasins. A total of seven county UICs are associated with this cluster.

This CP includes a water quality treatment facility and necessary piping to route runoff from the five southern UICs that comprise the Crocker 1 drainage to node 76483 on Irving Road (in the A1 Channel subbasin). Although included in the Flat Creek subbasin, this CP is classified as an A1 Channel CP because drainage from Crocker 1 is proposed for discharge in the A1 Channel.

Subbasin	RSFC060
GIS U/S Node Location	N/A
GIS D/S Node Location	76483
Drainage Area Served by Capital Project	14.4 Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Crocker 1 UIC cluster to Irving Road (node 76483). The required piping for the Crocker 1 UIC cluster was estimated at 1060 feet of 36" CSP.

Project Elements

1 Ea – CSF 8x6 (max 11 cartridges)

1 Ea – CSF 16x8 (max 33 cartridges)

1060 Ft – 36" CSP (2-5 ft. cover)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
CSF 8x6 (max 11 cartridges)	Cartridge replacement by vendor.
CSF 16x8 (max 33 cartridges)	Cartridge replacement by vendor.
36" CSP (2-5 ft. cover)	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$441,700
Site Acquisition:	$0
Engineering / Administration:	$88,300
Capital Project Implementation Costs	**$530,000**
Annual Maintenance Costs	**$8,500**

Design Assumptions

StormFilter sizing assumes that two facilities would be needed to accommodate the number of required cartridges. Each facility would be offline and would operate at 7.5 gpm per cartridge. A total of 42 cartridges would be required for treatment of the water quality flow rate.

The drainage area was deliniated and the drainage configuration (pipe) associated with the Crocker 1 UIC cluster was included in the XP SWMM CP model.

Project #: A1-1-UIC

Project #: A1-2-UIC

Project Identifier	A1-2-UIC
Project Title	Crocker 2 UIC Cluster - Raingarden

Project Location

The UICs associated with the Crocker UIC clusters run north-south, just east of Stark Street in the Spring Creek and Flat Creek subbasins. A total of seven county UICs are associated with this cluster.

Given design constraints, the UIC cluster was divided into two drainage areas (Crocker 1 and Crocker 2). This CP includes a raingarden to accommodate runoff from the two northern UICs that comprise the Crocker 2 drainage. Although included in the Spring Creek subbasin, this CP is classified as an A1 Channel CP because drainage from Crocker 1 is proposed for discharge in the A1 Channel.

Subbasin	RSSC120
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	5.4 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Crocker 2 UIC cluster. Preliminary estimates indicate that approximately 0.32 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

13758 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$110,000
Site Acquisition:	$116,000
Engineering / Administration:	$45,200
Capital Project Implementation Costs	**$271,200**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$17,800**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 5.4 acres. A more detailed deliniation of drainage area to the Crocker 2 UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-2-UIC

Project Identifier	A1-3-UIC
Project Title	Shirley 1 UIC Cluster - Pipe and Pre-treat

Project Location

The UICs associated with the Shirley UIC cluster are scattered east and west of Shirley Street, between Crocker Road and Ferndale Drive in the Spring Creek subbasin. Ten city UICs are associated with this cluster.

Given design constraints, the UIC cluster was divided into two drainage areas (Shirley 1 and Shirley 2). This CP includes a water quality treatment facility and necessary piping to route runoff from the two southern UICs (Shirley 1 drainage) to node 74030 on Irving Road (in the A1 Channel subbasin).

Subbasin	RSSC120
GIS U/S Node Location	N/A
GIS D/S Node Location	74030
Drainage Area Served by Capital Project	20.1 Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Shirley 1 UIC cluster to Irving Road (node 74030). The required piping for the Shirley 1 UIC cluster was estimated at 1090 feet of 2-30" CSP.

Project Elements

2180 Ft – 30" CSP (2-5 ft. cover)
2 Ea – CSF 16x8 (max 33 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
30" CSP (2-5 ft. cover)	N/A
CSF 16x8 (max 33 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$647,700
Site Acquisition:	$0
Engineering / Administration:	$129,500
Capital Project Implementation Costs	**$777,200**
Annual Maintenance Costs	**$12,800**

Design Assumptions

StormFilter sizing assumes that two facilities would be needed to accommodate the number of required cartridges. Each facility would be offline and would operate at 7.5 gpm per cartridge. A total of 59 cartridges would be required for treatment of the water quality flow rate.

The drainage area was deliniated and the drainage configuration (pipe) associated with the Shirley 1 UIC cluster was included in the XP SWMM CP model.

Project #: A1-3-UIC

Project Identifier	**A1-4-UIC**
Project Title	**Shirley 2 UIC Cluster - Raingarden**

Project Location

The UICs associated with the Shirley UIC cluster are scattered east and west of Shirley Street, between Crocker Road and Ferndale Drive in the Spring Creek subbasin. Ten city UICs are associated with this cluster.

Given design constraints, the UIC cluster was divided into two drainage areas (Shirley 1 and Shirley 2). This CP includes a installation of a raingarden to manage runoff from the eight northern UICs (Shirley 2 drainage). Although included in the Spring Creek subbasin, this CP is classified as an A1 Channel CP because drainage from Shirley 1 is proposed for discharge in the A1 Channel.

Subbasin	**RSSC120**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**21.6 (estimated)** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Construct raingardens throughout the drainage area associated with the Shirley 2 UIC cluster. Preliminary estimates indicate that approximately 1.26 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

55033 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$440,200
Site Acquisition:	$452,000
Engineering / Administration:	$178,400
Capital Project Implementation Costs	**$1,070,600**

Costs do not account for soil amendment.

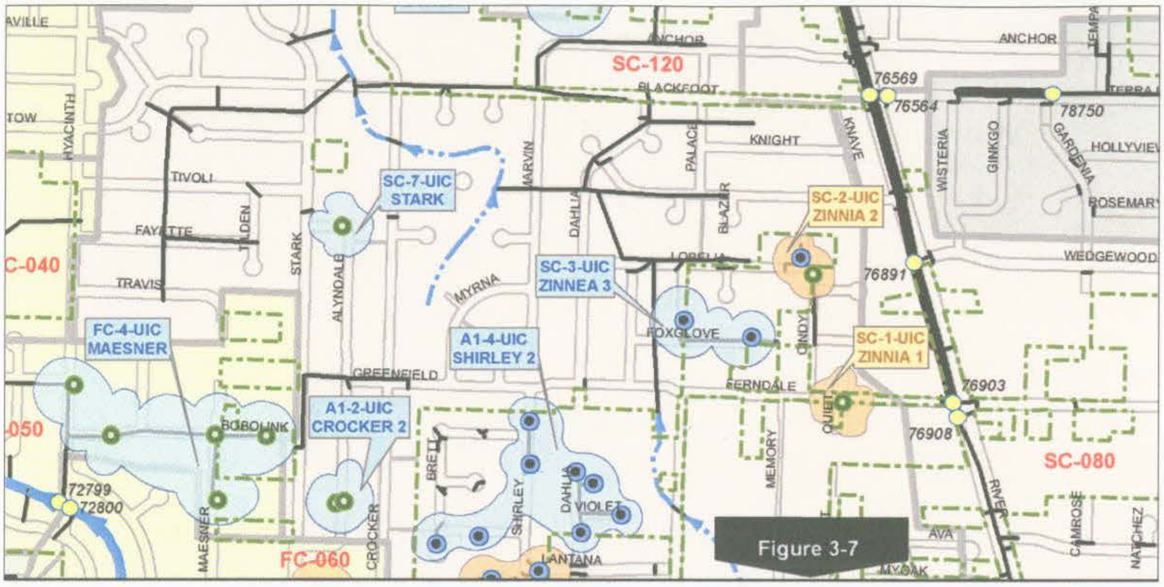
Annual Maintenance Costs	**$71,500**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 21.6 acres. A more detailed deliniation of drainage area to the Shirley 2 UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-4-UIC



Project #: A1-5-UIC

Project Identifier	**A1-5-UIC**
Project Title	**Hamilton UIC Cluster - Pipe and Pre-treat**

Project Location

The UICs associated with the Hamilton UIC cluster are located along Hamilton Avenue south of Kourt Drive in the A1 Channel subbasin. Four county UICs are associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster to node 76744 on Maxwell Road.

Subbasin	**RSA1220 and RSA1190**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**76744**
Drainage Area Served by Capital Project	**13.9** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Hamilton UIC cluster to Maxwell Road (node 76744). The required piping for the Hamilton UIC cluster was estimated at 1100 feet of 36" CSP.

Project Elements

1100 Ft – 36" CSP (2-5 ft. cover)
1 Ea – CSF 8x6 (max 11 cartridges)
1 Ea – CSF 16x8 (max 33 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
36" CSP (2-5 ft. cover)	N/A
CSF 8x6 (max 11 cartridges)	Cartridge replacement by vendor.
CSF 16x8 (max 33 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$450,500
Site Acquisition:	$0
Engineering / Administration:	$90,100
Capital Project Implementation Costs	**$540,600**
Annual Maintenance Costs	**$8,500**

Design Assumptions

StormFilter sizing assumes that two facilities would be needed to accommodate the number of required cartridges. Each facility would be offline and would operate at 7.5 gpm per cartridge. A total of 41 cartridges would be required for treatment of the water quality flow rate.

The drainage area was deliniated and the drainage configuration (pipe) associated with the Hamilton UIC cluster was included in the XP SWMM CP model.

Project #: A1-5-UIC

Project #: A1-6-UIC

Project Identifier: **A1-6-UIC**

Project Title: **Bushnell UIC Cluster - Pipe and Pre-treat**

Project Location

The UICs associated with the Bushnell UIC cluster are located along Bushnell Lane east of Smithoak Street in the A1 Channel subbasin. Two county UICs are associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster east to node 72730 to the A-1 channel.

Subbasin	**RSA1160**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**72730**
Drainage Area Served by Capital Project	**2.2** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Bushnell UIC cluster east to node 72730. The required piping for the Bushnell UIC cluster was estimated at 1015 feet of 18" CSP.

Project Elements

1 Ea – CSF 12x6 (max 11 cartridges)
1015 Ft – 18" CSP (2-5 ft. cover)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
CSF 12x6 (max 11 cartridges)	Cartridge replacement by vendor.
18" CSP (2-5 ft. cover)	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

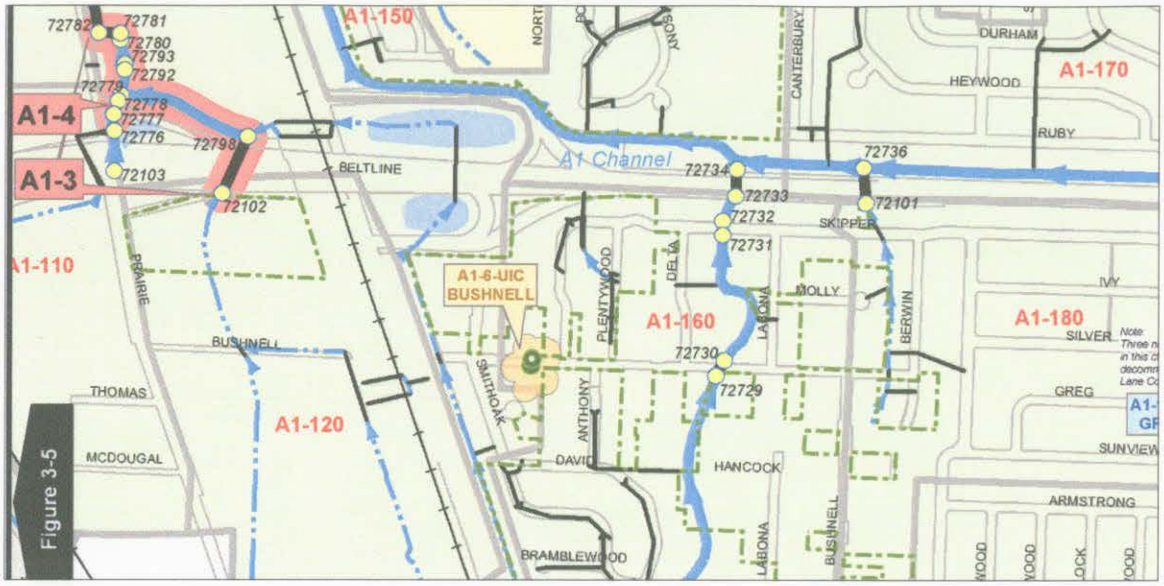
Construction Costs:	$164,500
Site Acquisition:	$0
Engineering / Administration:	$32,900
Capital Project Implementation Costs	**$197,400**
Annual Maintenance Costs	**$2,100**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. A total of 7 cartridges would be required for treatment of the water quality flow rate.

The drainage area was deliniated and the drainage configuration (pipe) associated with the Bushnell UIC cluster was included in the XP SWMM CP model.

Project #: A1-6-UIC



Project #: A1-7-UIC

Project Identifier	**A1-7-UIC**
Project Title	**Anderson UIC Cluster - Raingarden**

Project Location

The UICs associated with the Anderson UIC cluster are scattered between Golden Avenue and Melvina Way, south of Howard Avenue in the A1 Channel subbasin. Eight county UICs and 14 city UICs are associated with this cluster.

The CP involves installation of raingardens.

Subbasin	**RSA1245**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**59.4 (estimated)** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Construct raingardens throughout the drainage area associated with the Anderson UIC cluster. Preliminary estimates indicate that approximately 3.47 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

151342 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$1,210,700
Site Acquisition:	$1,236,000
Engineering / Administration:	$489,300
Capital Project Implementation Costs	**$2,936,000**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$196,700**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 59.4 acres. A more detailed deliniation of drainage area to the Anderson UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-7-UIC

Project Identifier	**A1-8-UIC**
Project Title	**Escalante UIC Cluster - Raingarden**

Project Location

The UICs associated with the Escalante UIC cluster are along Escalante Street south of Howard Avenue in the A1 Channel subbasin. Four city UICs are associated with this cluster.

The CP involves installation of raingardens.

Subbasin	**RSA1240**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**10.8 (estimated)** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Construct raingardens throughout the drainage area associated with the Escalante UIC cluster. Preliminary estimates indicate that approximately 0.63 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

27517 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$220,100
Site Acquisition:	$228,000
Engineering / Administration:	$89,600
Capital Project Implementation Costs	**$537,700**

Costs do not account for soil amendment.

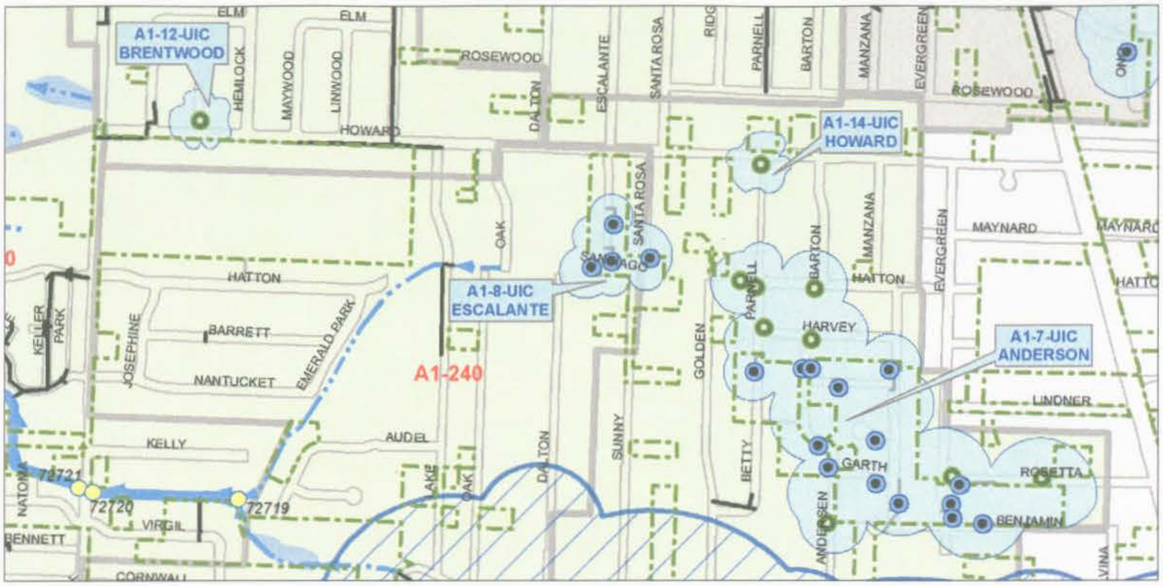
Annual Maintenance Costs	**$35,700**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 10.8 acres. A more detailed deliniation of drainage area to the Escalante UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-8-UIC



Project #: A1-9-UIC

Project Identifier	A1-9-UIC
Project Title	Greenleaf UIC Cluster - Pipe and Pre-treat

Project Location

The UIC associated with the Greenleaf UIC cluster is located outside of the River Road Santa Clara basin, east of River Road on Greenleaf Ave. No drainage area for this cluster was calculated for purposes of the CP because the drainage area is outside of the RR-SC basin. One county UIC is associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster east to node 59062 on River Road.

Subbasin	N/A
GIS U/S Node Location	N/A
GIS D/S Node Location	59062
Drainage Area Served by Capital Project	2.7 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Greenleaf UIC cluster west to node 59062. The required piping for the Greenleaf UIC cluster was estimated at 220 feet of 18" CSP.

Project Elements

220 Ft – 18" CSP (2-5 ft. cover)
1 Ea – CSF 12x6 (max 11 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
18" CSP (2-5 ft. cover)	N/A
CSF 12x6 (max 11 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$93,000
Site Acquisition:	$0
Engineering / Administration:	$18,600
Capital Project Implementation Costs	**$111,600**
Annual Maintenance Costs	**$2,100**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. As no drainage area was delineated for the Greenleaf UIC cluster, an estimated drainage area of 2.7 acres (per the raingarden sizing) was assumed. The facility would be offline and would operate at 7.5 gpm per cartridge. A total of 8 cartridges would be required for treatment of the water quality flow rate.

Because no drainage area was deliniated for this UIC cluster, the drainage configuration (pipe) was not specifically included in the XP SWMM CP model for this cluster.

Project #: A1-9-UIC

Project Identifier	A1-10-UIC
Project Title	Grove UIC Cluster - Raingarden

Project Location

The UICs associated with the Grove UIC cluster are located along Grove Street south of Beltline Road in the A1 Channel subbasin. Four county UICs are associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSA1180 and RSA1190
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	10.8 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Grove UIC cluster. Preliminary estimates indicate that approximately 0.63 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

27517 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$220,100
Site Acquisition:	$228,000
Engineering / Administration:	$89,600
Capital Project Implementation Costs	**$537,700**
Annual Maintenance Costs	**$35,700**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters (including this one) and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 10.8 acres. A more detailed deliniation of drainage area to the Grove UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-10-UIC

Project Identifier	A1-11-UIC
Project Title	Exeter UIC Cluster - Raingarden

Project Location

The UICs associated with the Exeter UIC cluster are located along Exeter Avenue and Quince Street in the A1 Channel subbasin. Three city UICs are associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSA1190
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	8.1 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Exeter UIC cluster. Preliminary estimates indicate that approximately 0.47 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

20637 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$165,000
Site Acquisition:	$172,000
Engineering / Administration:	$67,400
Capital Project Implementation Costs	**$404,400**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$26,800**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 8.1 acres. A more detailed deliniation of drainage area to the Exeter UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-11-UIC

Project Identifier	A1-12-UIC
Project Title	Brentwood UIC Cluster - Raingarden

Project Location

The UIC associated with the Brentwood UIC cluster is located on Brentwood Road just north of Howard Avenue in the A1 Channel subbasin. One county UIC is associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSA1210
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	2.7 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Brentwood UIC cluster. Preliminary estimates indicate that approximately 0.16 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

6879 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$55,000
Site Acquisition:	$60,000
Engineering / Administration:	$23,000
Capital Project Implementation Costs	**$138,000**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$8,900**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters (including this one) and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 2.7 acres. A more detailed deliniation of drainage area to the Brentwood UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-12-UIC

Project Identifier	A1-13-UIC
Project Title	Korbel UIC Cluster - Pipe and Pre-treat

Project Location

The UICs associated with the Korbel UIC cluster are located on Korbel Street, west of Merryvale Road in the Flat Creek and A1 Channel subbasins. Two city UICs are associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster to node 72223 (in the A1 Channel subbasin).

Subbasin	RSFC030 and RSA1130
GIS U/S Node Location	N/A
GIS D/S Node Location	72223
Drainage Area Served by Capital Project	1.4 Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Korbel UIC cluster to node 72223. The required piping for the Korbel UIC cluster was estimated at 650 feet of 18" CSP.

Project Elements

650 Ft – 18" CSP (2-5 ft. cover)
1 Ea – CSF 8x6 (max 6 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
18" CSP (2-5 ft. cover)	N/A
CSF 8x6 (max 6 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$117,000
Site Acquisition:	$0
Engineering / Administration:	$23,400
Capital Project Implementation Costs	**$140,400**
Annual Maintenance Costs	**$1,100**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. A total of 5 cartridges would be required for treatment of the water quality flow rate.

The drainage area associated with the Korbel UIC cluster was deliniated for the XP SWMM CP model. However, the drainage configuration (pipe) was not included in the model because there appears to be a discrepancy in invert elevations between the model and as-builts in this location. Invert elevations would need to be surveyed for final design.

Project #: A1-13-UIC

Project #: A1-14-UIC

Project Identifier	A1-14-UIC
Project Title	Howard UIC Cluster - Raingarden

Project Location

The UIC associated with the Howard UIC cluster is located at the intersection of Howard and Parnell in the A1 Channel subbasin. One county UIC is associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSA1245
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	2.7 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Howard UIC cluster. Preliminary estimates indicate that approximately 0.16 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

6879 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$55,000
Site Acquisition:	$60,000
Engineering / Administration:	$23,000
Capital Project Implementation Costs	**$138,000**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$8,900**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster (including this one) and the original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 2.7 acres. A more detailed deliniation of drainage area to the Howard UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-14-UIC

Project Identifier	A1-15-UIC
Project Title	South of Horn Lane UIC Cluster - On-Street Raingarden

Project Location

The UICs associated with the South of Horn Lane UIC cluster are located south of Horn Lane in the A1 Channel subbasin. 26 county UICs and one city UIC are associated with this cluster.

The CP involves installation of raingardens in conjunction with street improvements.

Subbasin	RSA1240 and RSA1245
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	72.9 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens in conjunction with street improvements throughout the drainage area associated with the South of Horn Lane UIC cluster. Preliminary estimates indicate that approximately 4.26 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

185737 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$1,485,800
Site Acquisition:	$1,515,000
Engineering / Administration:	$600,100
Capital Project Implementation Costs	**$3,600,900**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$241,400**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters (including this one) and the original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 72.9 acres. A more detailed deliniation of drainage area to the South of Horn Lane UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: A1-15-UIC

Project #: FC-1

Project Identifier	FC-1
Project Title	Flat Creek Culvert Replacement at Calla Street

Project Location

The proposed CP is located in modeled drainage segment RSFC050D. The segment runs east-west, north of Calla Street and west of Hyacinth Street. The CP is proposed to reduce flooding in upstream open channel segments RSFC050E.

Subbasin	RSFC050
GIS U/S Node Location	75654
GIS D/S Node Location	78673
Drainage Area Served by Capital Project	119.2 Acres
% Impervious (Existing Land Use)	39.6
% Impervious (Future Land Use)	42.4

Project Description

Replace the three existing 12" CSP culverts with 25' of a 1.5' x 5' box culvert.

Project Elements

25 LF – 1.5' x 5' box culvert

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in upstream open channel segment RSFC050E were predicted for the 10-year existing condition event.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
1.5' x 5' box culvert	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified upstream.

Water Quality

N/A

Natural Resources

N/A

Costs

Construction Costs:	$11,200
Site Acquisition:	$0
Engineering / Administration:	$2,200
Capital Project Implementation Costs	**$13,400**
Annual Maintenance Costs	**$0**

Design Assumptions

Project #: FC-1

FC-1
FC-040
FC-050
FC-060
A1-130
SC-12
A1-13-UIC
KORBEL
FC-4-UIC
MAESNER
SC-7-UIC
STARK
SC-3-UIC
ZINNEA 3
A1-4-UIC
SHIRLEY 2
A1-2-UIC
CROCKER 2
NAPA VALLEY
SAVILLE
STILLMAN
BARSTOW
GINGER
TIVOLI
FAYETTE
TRAVIS
WINERY
STONE CREEK
SONOMA
FROGS LEAP
NAPA CREEK
DRY CREEK
GREENFIELD
MYRNA
VIOLET
LANTANA
NORTHWEST EXPRESSWAY
72244
75660
75659
78673
75654
72799
72800
70756
69264

Project #: FC-1-UIC

Project Identifier	**FC-1-UIC**
Project Title	**Willowbrook 1 UIC Cluster - Raingarden**

Project Location

The UICs associated with the Willowbrook UIC cluster are located from Tyson Lane to Swenson Lane, east of Lancaster Drive in the Flat Creek and Spring Creek subbasins. Twelve city UICs are associated with this cluster.

Given design constraints, the UIC cluster was divided into three drainage areas (Willowbrook 1, Willowbrook 2, and Willowbrook 3). This CP includes installation of a raingarden to manage runoff from the three eastern UICs (Willowbrook 1 drainage). Although included in the Spring Creek subbasin, this CP is classified as a Flat Creek CP because drainage from a majority of the Willowbrook cluster is included in the Flat Creek subbasin.

Subbasin	**RSSC110**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**N/A**	
Drainage Area Served by Capital Project	**8.1 (estimated)**	Acres
% Impervious (Existing Land Use)	**N/A**	
% Impervious (Future Land Use)	**N/A**	

Project Description

Construct raingardens throughout the drainage area associated with the Willowbrook 1 UIC cluster. Preliminary estimates indicate that approximately 0.47 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

20637 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$165,000
Site Acquisition:	$172,000
Engineering / Administration:	$67,400
Capital Project Implementation Costs	**$404,400**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$26,800**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 8.1 acres. A more detailed deliniation of drainage area to the Willowbrook 1 UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: FC-1-UIC

Project Identifier	**FC-2-UIC**
Project Title	**Willowbrook 2 UIC Cluster - Pipe and Pre-treat**

Project Location

The UICs associated with the Willowbrook UIC cluster are located from Tyson Lane to Swenson Lane, east of Lancaster Drive in the Flat Creek and Spring Creek subbasins. Twelve city UICs are associated with this cluster.

Given design constraints, the UIC cluster was divided into three drainage areas (Willowbrook 1, Willowbrook 2, and Willowbrook 3). This CP includes a water quality treatment facility and necessary piping to route runoff from the two southwestern UICs (Willowbrook 2 drainage) to node 79031 on Irvington Drive.

Subbasin	**RSFC020**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**79031**
Drainage Area Served by Capital Project	**3.6** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Willowbrook 2 UIC cluster to node 79031. The required piping for the Willowbrook 2 UIC cluster was estimated at 440 feet of 18" CSP.

Project Elements

440 Ft – 18" CSP (2-5 ft. cover)
1 Ea – CSF 12x6 (max 11 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
18" CSP (2-5 ft. cover)	N/A
CSF 12x6 (max 11 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

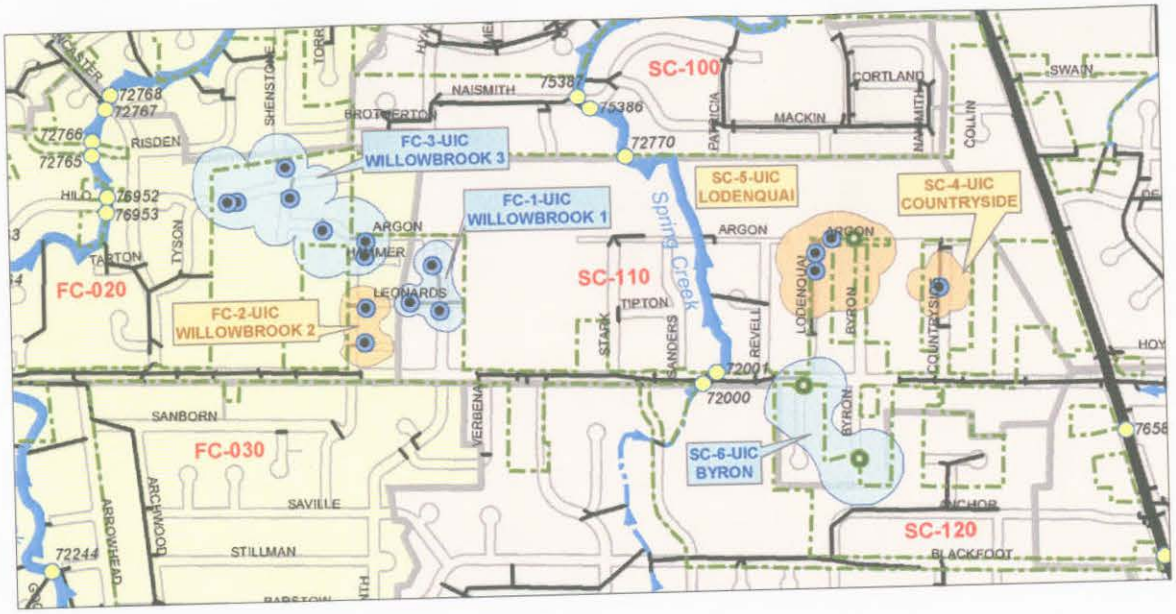
Construction Costs:	$112,800
Site Acquisition:	$0
Engineering / Administration:	$22,500
Capital Project Implementation Costs	**$135,300**
Annual Maintenance Costs	**$2,100**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. A total of 11 cartridges would be required for treatment of the water quality flow rate.

The drainage area associated with the Willowbrook 2 UIC cluster was deliniated for the XP SWMM CP model. However, the drainage configuration (pipe) was not included in the model because there appears to be a discrepancy in invert elevations between the model and as-builts in this location. Invert elevations would need to be surveyed for final design.

Project #: FC-2-UIC



Project #: FC-3-UIC

Project Identifier	FC-3-UIC
Project Title	Willowbrook 3 UIC Cluster - Raingarden

Project Location

The UICs associated with the Willowbrook UIC cluster are located from Tyson Lane to Swenson Lane, east of Lancaster Drive in the Flat Creek and Spring Creek subbasins. Twelve city UICs are associated with this cluster.

Given design constraints, the UIC cluster was divided into three drainage areas (Willowbrook 1, Willowbrook 2, and Willowbrook 3). This CP includes installation of a raingarden to manage runoff from the seven northwestern UICs (Willowbrook 3 drainage).

Subbasin	RSFC020
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	18.9 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Willowbrook 3 UIC cluster. Preliminary estimates indicate that approximately 1.11 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

48154 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$385,200
Site Acquisition:	$396,000
Engineering / Administration:	$156,200
Capital Project Implementation Costs	**$937,400**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$62,600**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 18.9 acres. A more detailed deliniation of drainage area to the Willowbrook 3 UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: FC-3-UIC

Project Identifier	FC-4-UIC
Project Title	Maesner UIC Cluster - Raingarden

Project Location

The UICs associated with the Maesner UIC cluster are located surrounding Bobolink Avenue in the Flat Creek subbasin. Five county UICs are associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSFC050
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	13.5 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Maesner UIC cluster. Preliminary estimates indicate that approximately 0.79 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

34396 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$275,100
Site Acquisition:	$284,000
Engineering / Administration:	$111,800
Capital Project Implementation Costs	**$670,900**

Costs do not account for soil amendment.

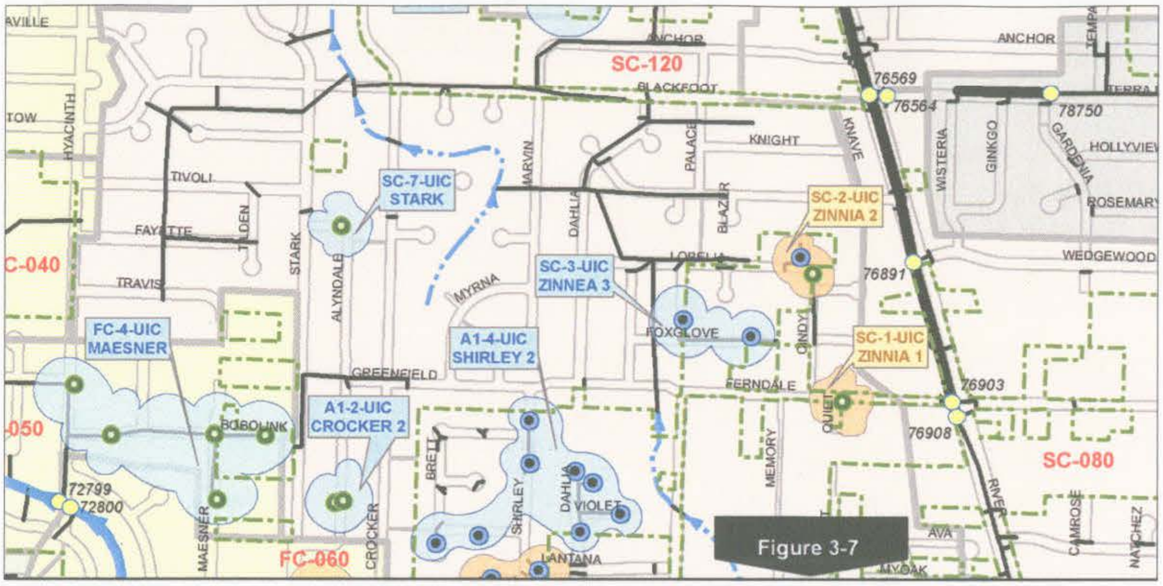
Annual Maintenance Costs	**$44,700**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 13.5 acres. A more detailed deliniation of drainage area to the Maesner UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: FC-4-UIC



Project Identifier	SC-1
Project Title	Spring Creek Culvert Replacement at Katy Lane

Project Location

The proposed CP is located in modeled drainage segment RSSC040B. The segment runs north-south west of Berry Lane and south of Katy Lane.

Subbasin	RSSC040
GIS U/S Node Location	72006
GIS D/S Node Location	72007
Drainage Area Served by Capital Project	823.8 Acres
% Impervious (Existing Land Use)	39.9
% Impervious (Future Land Use)	44.4

Project Description

Replace the two existing 30" CSP culverts with pedestrian bridge (12' span).

Project Elements

1 EA – Pedestrian Bridge - metal

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in segment RSSC040B are predicted for the 10-year existing condition event.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Pedestrian Bridge - metal	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified in this segment.

Water Quality

N/A

Natural Resources

N/A

Costs

Construction Costs:	$15,000
Site Acquisition:	$0
Engineering / Administration:	$3,000
Capital Project Implementation Costs	**$18,000**
Annual Maintenance Costs	**$0**

Design Assumptions

Project #: SC-1


SC-1
Modeled segment extends from node 76560 to 72011
SC-9-UIC CALUMET
WO-11-UIC WARRINGTON
SC-040
SC-050
SC-090
WO-005
WO-020
WO-030
East Santa Clara Waterway
72012
72011
72010
72009
72008
72007
72006
72005
72004
72003
76560
72033
72032
72031
72030
79470
99827
99820
72088
SPRING CREEK
HAMPSHIRE
VICTORIA
BRADFORD
LYNNBROOK
WENDOVER
NOTTINGHAM
WATSON
EDWARDS
CLAIRMONT
WARRINGTON
SHAMROCK
BANOVER
KILDARE
THUNDERBIRD
SCOTTDALE
HERMAN
MAHONIA
EMILY
CALUMET
BAMPTON
JILL
OROYAN
CORONA
DOYLE

Project Identifier	**SC-1-UIC**
Project Title	**Zinnia 1 UIC Cluster - Pipe and Pre-treat**

Project Location

The UICs associated with the Zinnia UIC cluster are scattered between Zinnia Street and Cindy Street in the Spring Creek subbasin. Three city UICs and two county UICs are associated with this cluster.

Given design constraints, the UIC cluster was divided into three drainage areas (Zinnia 1, Zinnia 2, and Zinnia 3). This CP includes a water quality treatment facility and necessary piping to route runoff from the one southeastern UIC (Zinnia 1 drainage) to node 76903 on River Road.

Subbasin	**RSSC120**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**76903**
Drainage Area Served by Capital Project	**4.44** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Zinnia 1 UIC cluster east to node 76903. The required piping for the Zinnia 1 UIC cluster was estimated at 575 feet of 24" CSP.

Project Elements

575 Ft – 24" CSP (2-5 ft. cover)
1 Ea – CSF 16x8 (max 33 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
24" CSP (2-5 ft. cover)	N/A
CSF 16x8 (max 33 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$207,500
Site Acquisition:	$0
Engineering / Administration:	$41,500
Capital Project Implementation Costs	**$249,000**
Annual Maintenance Costs	**$6,400**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. A total of 13 cartridges would be required for treatment of the water quality flow rate.

The drainage area was deliniated and the drainage configuration (pipe) associated with the Zinnia 1 UIC cluster was included in the XP SWMM CP model.

Project #: SC-1-UIC

Project Identifier	**SC-2-UIC**
Project Title	**Zinnia 2 UIC Cluster - Pipe and Pre-treat**

Project Location

The UICs associated with the Zinnia UIC cluster are scattered between Zinnia Street and Cindy Street in the Spring Creek subbasin. Three city UICs and two county UICs are associated with this cluster.

Given design constraints, the UIC cluster was divided into three drainage areas (Zinnia 1, Zinnia 2, and Zinnia 3). This CP includes a water quality treatment facility and necessary piping to route runoff from the two northeastern UICs (Zinnia 2 drainage) to node 76891 on River Road.

Subbasin	**RSSC120**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**76891**
Drainage Area Served by Capital Project	**7.25** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Zinnia 2 UIC cluster east to node 76891. The required piping for the Zinnia 2 UIC cluster was estimated at 675 feet of 24" CSP.

Project Elements

675 Ft – 24" CSP (2-5 ft. cover)
1 Ea – CSF 16x8 (max 33 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
24" CSP (2-5 ft. cover)	N/A
CSF 16x8 (max 33 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$219,500
Site Acquisition:	$0
Engineering / Administration:	$43,900
Capital Project Implementation Costs	**$263,400**
Annual Maintenance Costs	**$6,400**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. A total of 22 cartridges would be required for treatment of the water quality flow rate.

The drainage area was deliniated and the drainage configuration (pipe) associated with the Zinnia 2 UIC cluster was included in the XP SWMM CP model.

Project #: SC-2-UIC

Project #: SC-3-UIC

Project Identifier	SC-3-UIC
Project Title	Zinnia 3 UIC Cluster - Raingarden

Project Location

The UICs associated with the Zinnia UIC cluster are scattered between Zinnia Street and Cindy Street in the Spring Creek subbasin. Three city UICs and two county UICs are associated with this cluster.

Given design constraints, the UIC cluster was divided into three drainage areas (Zinnia 1, Zinnia 2, and Zinnia 3). This CP includes installation of a raingarden to manage runoff from the two western UICs (Zinnia 3 drainage).

Subbasin	RSSC120
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	5.4 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Zinnia 3 UIC cluster. Preliminary estimates indicate that approximately 0.32 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

13758 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$110,000
Site Acquisition:	$116,000
Engineering / Administration:	$45,200
Capital Project Implementation Costs	**$271,200**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$17,800**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 5.4 acres. A more detailed deliniation of drainage area to the Brentwood UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: SC-3-UIC

Project Identifier	SC-4-UIC
Project Title	Countryside UIC Cluster - Pipe and Pre-treat

Project Location

The UIC associated with the Countryside UIC cluster is located along Countryside Lane, north of Irvington Drive, in the Spring Creek subbasin. One city UIC is associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster to node 76858 on River Road.

Subbasin	RSSC110
GIS U/S Node Location	N/A
GIS D/S Node Location	76858
Drainage Area Served by Capital Project	11.5 Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Countryside UIC cluster to node 76858. The required piping for the Countryside UIC cluster was estimated at 860 feet of 2-24" CSP.

Project Elements

1720 Ft – 24" CSP (2-5 ft. cover)
1 Ea – CSF 16x8 (max 39 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
24" CSP (2-5 ft. cover)	N/A
CSF 16x8 (max 39 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$363,400
Site Acquisition:	$0
Engineering / Administration:	$72,600
Capital Project Implementation Costs	**$436,000**
Annual Maintenance Costs	**$7,600**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. A total of 34 cartridges would be required for treatment of the water quality flow rate.

The drainage area associated with the Counrtyside UIC cluster was deliniated for the XP SWMM CP model. However, the drainage configuration (pipe) was not included in the model because elevations (to determine feasibility) were estimated from two foot contours. A more detailed survey and analysis will be required to confirm feasibility of design.

Project #: SC-4-UIC

Project Identifier	**SC-5-UIC**
Project Title	**Lodenquai UIC Cluster - Pipe and Pre-treat**

Project Location

The UICs associated with the Lodenquai UIC cluster are located along Gibson Street and Argon Avenue in the Spring Creek subbasin. Three city UICs and one county UIC is associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster to node 78723 on the A-1 channel.

Subbasin	**RSSC110**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**78723**
Drainage Area Served by Capital Project	**13.2** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Lodenquai UIC cluster to node 78723. The required piping for the Lodenquai UIC cluster was estimated at 815 feet of 2-24" CSP.

Project Elements

1630 Ft – 24" CSP (2-5 ft. cover)

1 Ea – CSF 16x8 (max 39 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
24" CSP (2-5 ft. cover)	N/A
CSF 16x8 (max 39 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$352,600
Site Acquisition:	$0
Engineering / Administration:	$70,500
Capital Project Implementation Costs	**$423,100**
Annual Maintenance Costs	**$7,600**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. A total of 39 cartridges would be required for treatment of the water quality flow rate.

The drainage area associated with the Lodenquai UIC cluster was deliniated for the XP SWMM CP model. However, the drainage configuration (pipe) was not included in the model because elevation information (to determine feasibility) was interpolated from the model. A more detailed survey would be needed to verify feasibility of this option.

Project #: SC-5-UIC

Project #: SC-6-UIC

Project Identifier	SC-6-UIC
Project Title	Byron UIC Cluster - Raingarden

Project Location

The UICs associated with the Byron UIC cluster are located at the south end of Byron Street in the Willamette Overflow subbasin. Two county UIC is associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSSC110
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	5.4 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Byron UIC cluster. Preliminary estimates indicate that approximately 0.32 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

13758 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$110,000
Site Acquisition:	$116,000
Engineering / Administration:	$45,200
Capital Project Implementation Costs	**$271,200**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$17,800**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster (including this one) and the original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 5.4 acres. A more detailed deliniation of drainage area to the Byron UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: SC-6-UIC

Project #: SC-7-UIC

Project Identifier	SC-7-UIC
Project Title	Stark UIC Cluster - Raingarden

Project Location

The UIC associated with the Stark UIC cluster is located on Alyndale Lane, east of Stark Street in the Spring Creek subbasin. One county UICs is associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSSC120
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	2.7 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Stark UIC cluster. Preliminary estimates indicate that approximately 0.16 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

6879 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$55,000
Site Acquisition:	$60,000
Engineering / Administration:	$23,000
Capital Project Implementation Costs	**$138,000**

Costs do not account for soil amendment.

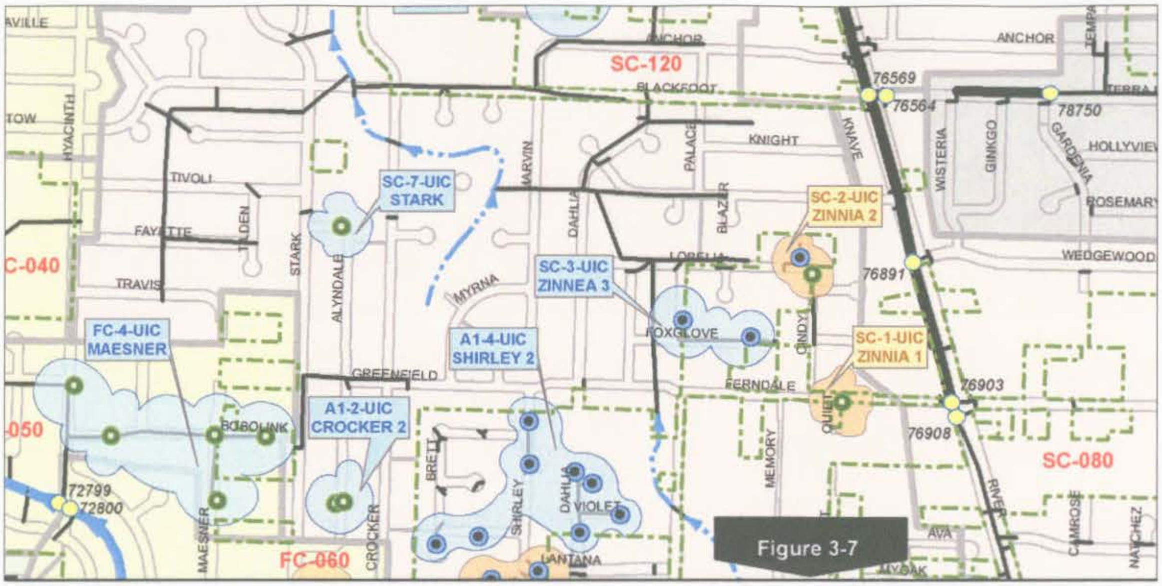
Annual Maintenance Costs	**$8,900**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters (including this one) and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 2.7 acres. A more detailed deliniation of drainage area to the Stark UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: SC-7-UIC



Project Identifier	**SC-8-UIC**
Project Title	**Castrey UIC Cluster - Raingarden**

Project Location

The UICs associated with the Castrey UIC cluster are located on Castrey Street, north of Greenwood Drive in the Spring Creek subbasin. Two county UICs is associated with this cluster.

The CP involves installation of raingardens.

Subbasin	**RSSC060**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**5.4 (estimated)** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Construct raingardens throughout the drainage area associated with the Castrey UIC cluster. Preliminary estimates indicate that approximately 0.32 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

13758 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$110,000
Site Acquisition:	$116,000
Engineering / Administration:	$45,200
Capital Project Implementation Costs	**$271,200**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$17,800**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 5.4 acres. A more detailed deliniation of drainage area to the Castrey UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: SC-8-UIC

Project Identifier	**SC-9-UIC**
Project Title	**Calumet UIC Cluster - Raingarden**

Project Location

The UICs associated with the Calumet UIC cluster are located on Calumet Way, north of Herman Street in the Spring Creek subbasin. Two city UICs is associated with this cluster.

The CP involves installation of raingardens.

Subbasin	**RSSC030**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**5.4 (estimated)** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Construct raingardens throughout the drainage area associated with the Calumet UIC cluster. Preliminary estimates indicate that approximately 0.32 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

13758 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$110,000
Site Acquisition:	$116,000
Engineering / Administration:	$45,200
Capital Project Implementation Costs	**$271,200**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$17,800**

Design Assumptions

Because drainage areas were not delineated for all UIC clusters and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 5.4 acres. A more detailed deliniation of drainage area to the Calumet UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: SC-9-UIC

Project Identifier	WO-1
Project Title	Willamette Overflow Culvert Replacement east of Azalea Dr.

Project Location

The proposed CP is located in modeled drainage segment RSWO070D, downstream of segment RSWO070E. The location is east of Azalea Dr. and north of Yvonne Street.

Subbasin	RSWO070
GIS U/S Node Location	74006
GIS D/S Node Location	74007
Drainage Area Served by Capital Project	352.6 Acres
% Impervious (Existing Land Use)	52.1
% Impervious (Future Land Use)	54.5

Project Description

Replace the existing 18" CMP culvert with 253 ft. of 66" CSP.

Project Elements

253 Ft – 66" CSP (2-5 ft. cover)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in segment RSWO070D and upstream segment RSWO070E were predicted for the 10-year existing condition storm event.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
66" CSP (2-5 ft. cover)	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified in this segment and upstream segment.

Water Quality

N/A

Natural Resources

N/A

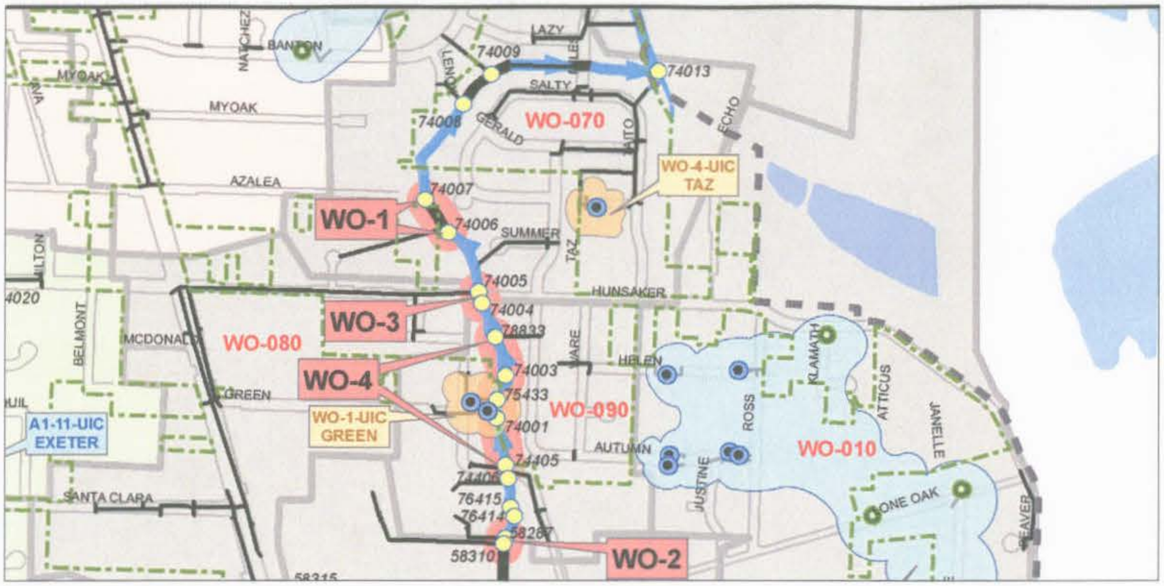
Costs

Construction Costs:	$121,400
Site Acquisition:	$0
Engineering / Administration:	$24,200
Capital Project Implementation Costs	**$145,600**
Annual Maintenance Costs	

Design Assumptions

Flooding in this segment and upstream segment RSWO070E would also be addressed by CP WO-5.

Project #: WO-1



WO-1
WO-2
WO-3
WO-4
WO-070
WO-080
WO-090
WO-010
WO-4-UIC
TAZ
WO-1-UIC
GREEN
A1-11-UIC
EXETER
74009
74013
74008
74007
74006
74005
74004
78833
74003
75433
74001
74405
74406
76415
76414
58267
58310
4020
MYOAK
AZALEA
SUMMER
HUNSAKER
MCDONALD
GREEN
AUTUMN
HELEN
SANTA CLARA
BELMONT
SALTY
LAZY
GERALD
ECHO
TAZ
ROSS
JUSTINE
KLAMATH
ATTICUS
JANELLE
LONE OAK
BANTON
NATCHEZ

Project Identifier	WO-2
Project Title	Willamette Overflow Culvert Replacement east of Edgewood Dr.

Project Location

The proposed CP is located in modeled drainage segment RSWO110A. The location is east of Edgewood Drive and west of Lone Oak Way. The CP is proposed to eliminate flooding in upstream segments RSWO110B and RSWO110C.

Subbasin	RSWO110
GIS U/S Node Location	58310
GIS D/S Node Location	58287
Drainage Area Served by Capital Project	264.5 Acres
% Impervious (Existing Land Use)	52.8
% Impervious (Future Land Use)	55.3

Project Description

Replace the existing 36" CSP culvert (segment RSWO110A) with 47 ft. of 60" CSP.

Project Elements

47 Ft – 60" CSP (2-5 ft. cover)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in upstream segments RSWO110B and RSWO110C were predicted for the 10-year future condition storm event, due to lack of capacity in the existing pipes. No flooding was predicted for segment RSWO110A, but replacement of the existing tip-up in segment RSWO110A alleviates upstream flooding issues.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
60" CSP (2-5 ft. cover)	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified upstream.

Water Quality

N/A

Natural Resources

N/A

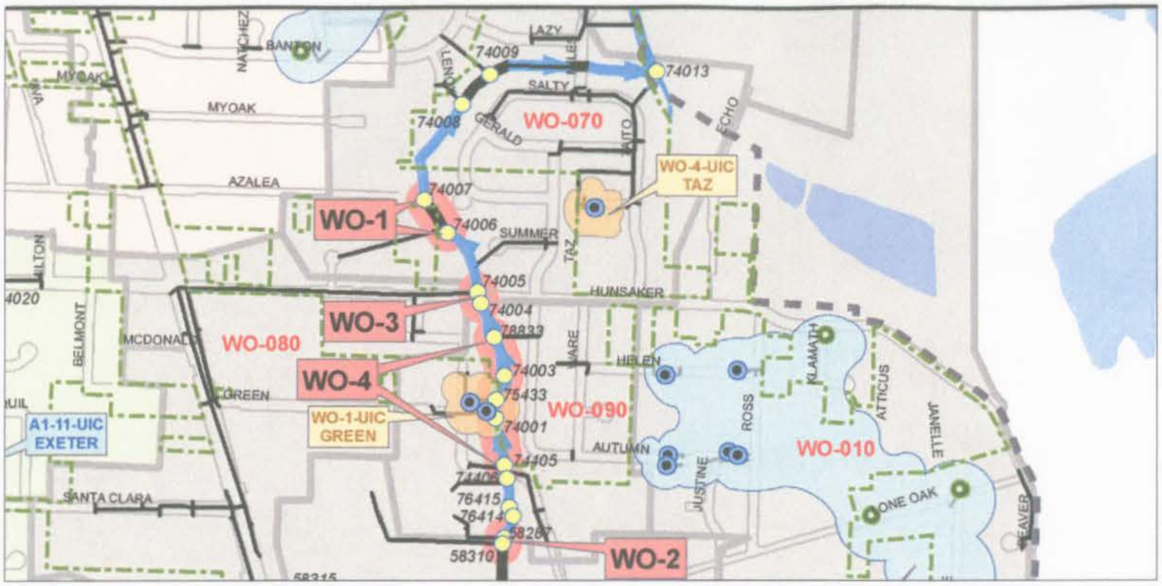
Costs

Construction Costs:	$18,800
Site Acquisition:	$0
Engineering / Administration:	$3,700
Capital Project Implementation Costs	**$22,500**
Annual Maintenance Costs	**$0**

Design Assumptions

Flood reduction in the upstream segments RSWO110B and RSWO110C would also be addressed by CP WO-5.

Project #: WO-2



WO-1
WO-2
WO-3
WO-4
WO-070
WO-080
WO-090
WO-010
WO-4-UIC
TAZ
WO-1-UIC
GREEN
A1-11-UIC
EXETER
MYOAK
AZALEA
SUMMER
HUNSAKER
MCDONALD
BELMONT
GREEN
SANTA CLARA
HELEN
AUTUMN
ROSS
JUSTINE
KLAMATH
ATTICUS
JANELLE
ONE OAK
SALTY
LAZY
GERALD
ECHO
NATCHEZ
BANTON
TAZ
74009
74013
74008
74007
74006
74005
74004
78833
74003
75433
74001
74405
74406
76415
76414
58267
58310
4020

Project Identifier	**WO-3**
Project Title	**Willamette Overflow Culvert Replacement east of Yvonne St.**

Project Location

The proposed CP is located in modeled drainage segment RSWO080A. The location is east of Yvonne Street. The CP is proposed to eliminate flooding in upstream open channel segments including RSWO090A, RSWO090Aa, RSWO090B, RSWO090C, RSWO090F, and RSWO090H.

Subbasin	**RSWO080**
GIS U/S Node Location	**74004**
GIS D/S Node Location	**74005**
Drainage Area Served by Capital Project	**352.6** Acres
% Impervious (Existing Land Use)	**52.1**
% Impervious (Future Land Use)	**54.5**

Project Description

Replace the existing 48" CSP culvert (segment RSWO110A) with 43 ft. of 66" CSP.

Project Elements

43 Ft – 66" CSP (5-10 ft. cover)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in upstream segments RSWO090A, RSWO090Aa, RSWO090B, RSWO090C, RSWO090F, and RSWO090H were predicted for the 10-year existing condition storm event. No flooding was predicted in segment RSWO080A, but replacement of the existing culvert at RSWO080A alleviates upstream flooding issues.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
66" CSP (5-10 ft. cover)	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified upstream.

Water Quality

N/A

Natural Resources

N/A

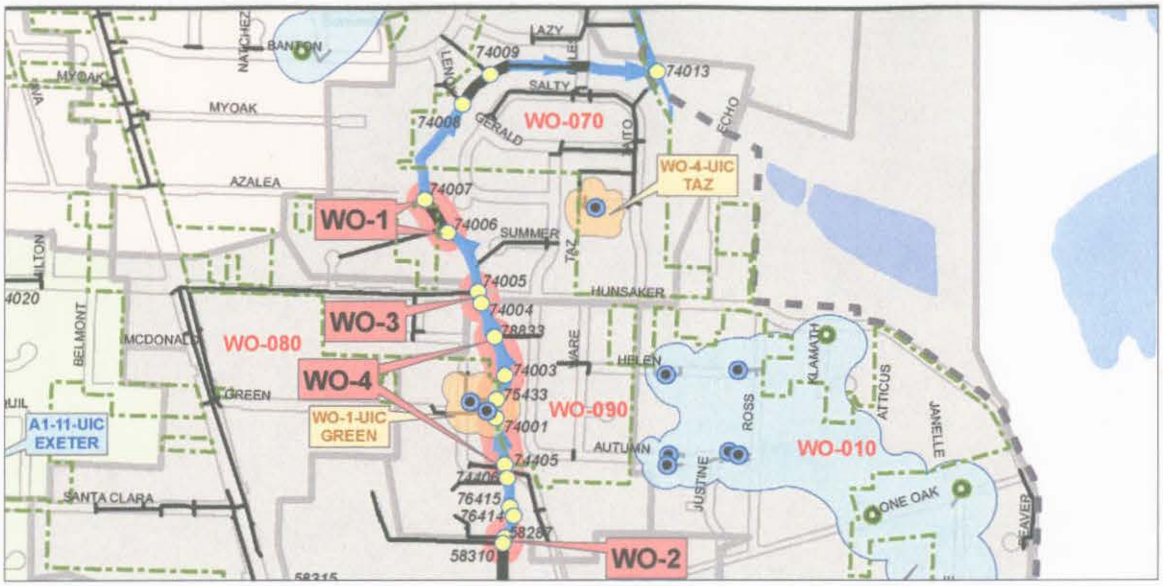
Costs

Construction Costs:	$23,200
Site Acquisition:	$0
Engineering / Administration:	$4,600
Capital Project Implementation Costs	**$27,800**
Annual Maintenance Costs	

Design Assumptions

Flood reduction in the upstream reaches would also be addressed by CP WO-4 and WO-5.

Project #: WO-3



WO-1
WO-2
WO-3
WO-4
WO-070
WO-080
WO-090
WO-010
WO-4-UIC
TAZ
WO-1-UIC
GREEN
A1-11-UIC
EXETER
74009
74013
74008
74007
74006
74005
74004
78833
74003
75433
74001
74405
74406
76415
76414
58267
58310
MYOAK
AZALEA
SUMMER
HUNSAKER
MCDONALD
BELMONT
GREEN
SANTA CLARA
AUTUMN
HELEN
ROSS
JUSTINE
KLAMATH
ATTICUS
JANELLE
ONE OAK
ECHO
SALTY
LAZY
GERALD
NATCHEZ
TAZ
WARE

Project Identifier	**WO-4**
Project Title	**Willamette Overflow Open Channel Improvement**

Project Location

The proposed CP is located in modeled drainage segments RSWO090A, RSWO090Aa, RSWO090B, RSWO090C, and RSWO090D. The location is west of Summer Lane and east of Edgewood Drive.

Subbasin	**RSWO090**
GIS U/S Node Location	**74405**
GIS D/S Node Location	**78833**
Drainage Area Served by Capital Project	**297.2** Acres
% Impervious (Existing Land Use)	**52.1**
% Impervious (Future Land Use)	**54.5**

Project Description

Regrade the existing Type II open channel segments (RSWO090Aa, RSWO090B, RSWO090C, and RSWO090D).

Project Elements

724 LF – Open Channel Improvements (Type 2)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in segments RSWO090A, RSWO090Aa, RSWO090B, and RSWO090C were predicted for the 10-year existing condition storm event, due to lack of capacity in the existing open channels. No flooding was predicted for segment RSWO090D, but regrading of the overall channel segment alleviates flooding issues.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Open Channel Improvements (Type 2)	Inspect sediment loading and vegetation, remove sediment and debris.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified in this area.

Water Quality

N/A

Natural Resources

N/A

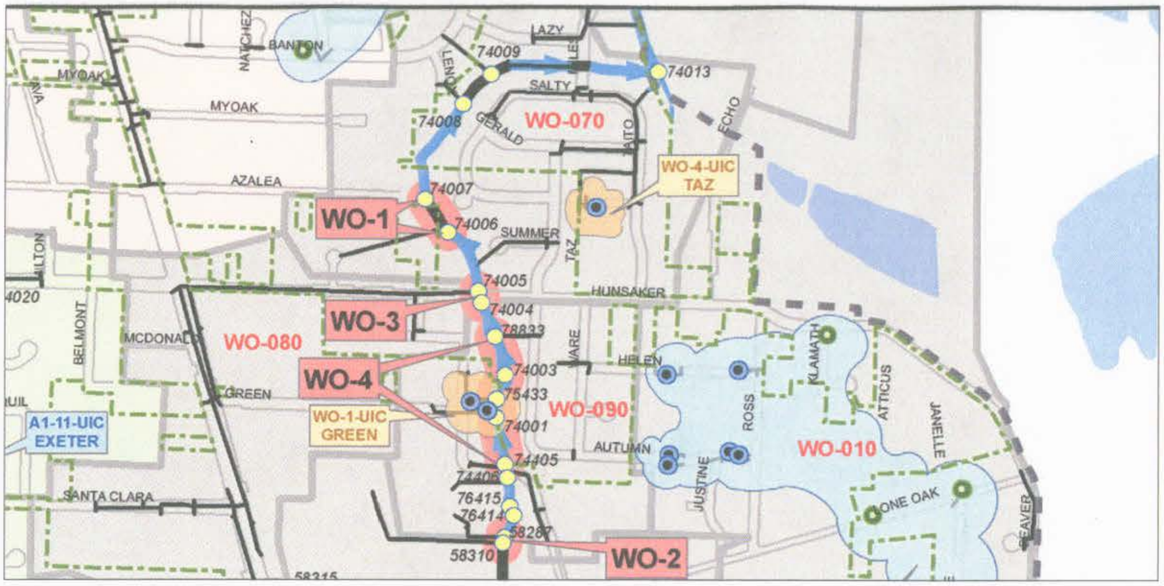
Costs

Construction Costs:	$434,400
Site Acquisition:	$0
Engineering / Administration:	$86,800
Capital Project Implementation Costs	**$521,200**
Annual Maintenance Costs	**$5,500**

Design Assumptions

Flood reduction in these reaches would also be addressed by CP WO-3 and WO-5.

Project #: WO-4


LAZY
74009
74013
MYOAK
SALTY
74008
WO-070
AZALEA
WO-4-UIC
TAZ
74007
WO-1
74006
SUMMER
74005
HUNSAKER
WO-3
74004
MCDONALD
WO-080
78833
HELEN
WO-4
74003
GREEN
75433
WO-090
74001
A1-11-UIC
EXETER
WO-1-UIC
GREEN
AUTUMN
74405
WO-010
SANTA CLARA
74406
76415
76414
58287
58310
WO-2
BELMONT
ROSS
ATTICUS
JANELLE
ONE OAK
KLAMATH
JUSTINE
ECHO
GERALD

Capital Project Fact Sheet

Basin Name: Santa Clara Basin

Project #: WO-5

Project Identifier	**WO-5**
Project Title	**Willamette Overflow Flood Control Facility at River Avenue**

Project Location

The proposed storage CP would be located at node 77703. The CP includes 124 ac-ft of storage, located in in tax lots 1700, 1800, 1900, 203, 204, 202, and 302. These tax lots are located east of River Road and north of River Avenue.

Subbasin	**RSWO130**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**77703**
Drainage Area Served by Capital Project	**198.4** Acres
% Impervious (Existing Land Use)	**35.3**
% Impervious (Future Land Use)	**36.4**

Project Description

Construct 124 ac-ft of storage to minimize flow in downstream open channel system.

Project Elements

124 Ac-Ft – Flood Control Facility

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Modeled flooding problems in segments RSWO090A, RSWO090Aa, RSWO090B, and RSWO090C were predicted for the 10-year existing condition storm event, due to lack of capacity in the existing open channels. Storage proposed to minimize flow in downstream open channel system and reduce magnitude of open channel improvements (see WO-4).

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Flood Control Facility	Inspect and clean inlet and outlet, maintain vegetation, inspect sediment loading, remove sediment, remove debris, inspect and repair separation berm (if applicable).

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Expected to reduce model-predicted flooding problems identified in this area.

Water Quality

N/A

Natural Resources

N/A

Costs

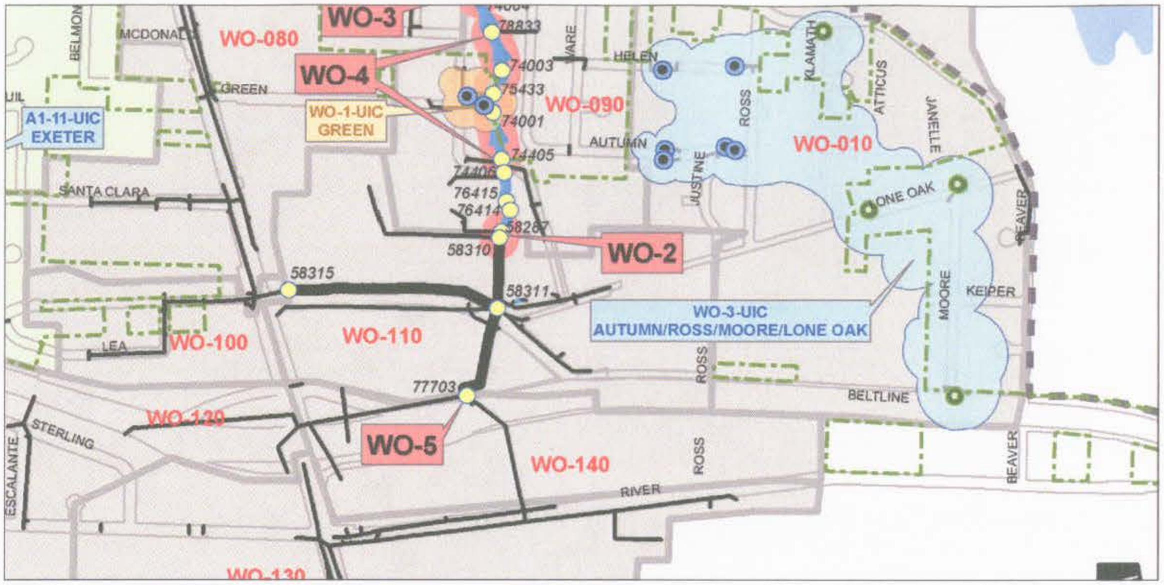
Construction Costs:	$7,402,800
Site Acquisition:	$5,622,380
Engineering / Administration:	$2,605,000
Capital Project Implementation Costs	**$15,630,180**
Annual Maintenance Costs	**$119,200**

Design Assumptions

Flood reduction in the downstream open channels would also be addressed by CP WO-3 and WO-4.

Acquisition costs are based on an industrial land cost of $370,300/acre and calculated using the area of each tax lot required to construct the detention pond plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: WO-5



WO-3
WO-4
WO-1-UIC GREEN
A1-11-UIC EXETER
WO-080
WO-090
WO-010
WO-2
WO-3-UIC AUTUMN/ROSS/MOORE/LONE OAK
WO-100
WO-110
WO-120
WO-5
WO-140
WO-130
78833
74003
75433
74001
74405
74406
76415
76414
58267
58310
58315
58311
77703
MCDONALD
BELMONT
GREEN
SANTA CLARA
LEA
STERLING
ESCALANTE
HELEN
AUTUMN
JUSTINE
ROSS
KLAMATH
ATTICUS
JANELLE
LONE OAK
MOORE
KEIPER
BEAVER
BELTLINE
RIVER

Project #: WO-1-UIC

Project Identifier	WO-1-UIC
Project Title	Green UIC Cluster - Pipe and Pre-treat

Project Location

UICs associated with the Green UIC cluster are located east of Edgewood Drive and west of Summer Lane in the Willamette Overflow subbasin. Two city UICs are associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster to node 76943 at the East Santa Clara Waterway.

Subbasin	RSWO090
GIS U/S Node Location	N/A
GIS D/S Node Location	76943
Drainage Area Served by Capital Project	2.7 Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter and pipe drainage from the Green UIC cluster east to node 76943 using 215 feet of 18" CSP pipe.

Project Elements

215 Ft – 18" CSP (2-5 ft. cover)
1 Ea – CSF 12x6 (max 11 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
18" CSP (2-5 ft. cover)	N/A
CSF 12x6 (max 11 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

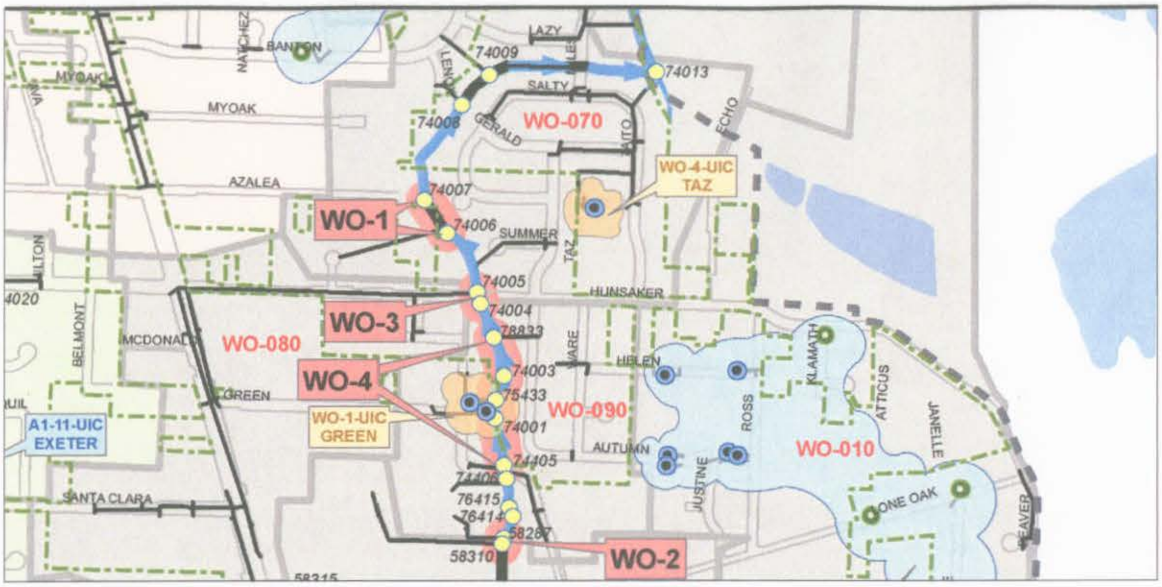
Construction Costs:	$92,500
Site Acquisition:	$0
Engineering / Administration:	$18,500
Capital Project Implementation Costs	**$111,000**
Annual Maintenance Costs	**$2,100**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. Eight cartridges would be required for treatment of the water quality flow rate.

The drainage area associated with the Green UIC cluster was deliniated for the XP SWMM CP model. However, the drainage configuration (pipe) was not included in the model because elevations (to determine feasibility) were estimated from two foot contours. A more detailed survey and analysis will be required to confirm feasibility of design.

Project #: WO-1-UIC



Project Identifier	WO-2-UIC
Project Title	Corliss/Carolyn/Onyx UIC Cluster - Raingarden

Project Location

UICs associated with the Corliss/ Carolyn UIC cluster are located east of River Road, adjacent to Ono Road and Camelot Avenue in the Willamette Overflow subbasin. Four city UICs are associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSWO130
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	10.8 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Corliss/ Carolyn UIC cluster. Preliminary estimates indicate that approximately 0.63 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

27517 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and/or disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$220,100
Site Acquisition:	$228,000
Engineering / Administration:	$89,600
Capital Project Implementation Costs	**$537,700**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$35,700**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 10.8 acres. A more detailed deliniation of drainage area to Corliss/Carolyn/Onyx UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: WO-2-UIC

Project Identifier	**WO-3-UIC**
Project Title	**Autumn/ Ross/ Moore-Oak UIC Cluster - Raingarden**

Project Location

UICs associated with the Autumn/ Ross/ Moore-Oak UIC clusters are located southwest of Beaver Street and east of Warren Land and Ross Lane in the Willamette Overflow subbasin. Four county and six city UICs are associated with these clusters.

The CP involves installation of raingardens.

Subbasin	**RSWO150**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**N/A**	
Drainage Area Served by Capital Project	**27.0 (estimated)**	Acres
% Impervious (Existing Land Use)	**N/A**	
% Impervious (Future Land Use)	**N/A**	

Project Description

Construct raingardens throughout the drainage area associated with the Autumn/ Ross/ Moore-Oak UIC clusters. Preliminary estimates indicate that approximately 1.58 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

68792 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and/or disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$550,300
Site Acquisition:	$564,000
Engineering / Administration:	$222,800
Capital Project Implementation Costs	**$1,337,100**

Costs do not account for soil amendment.

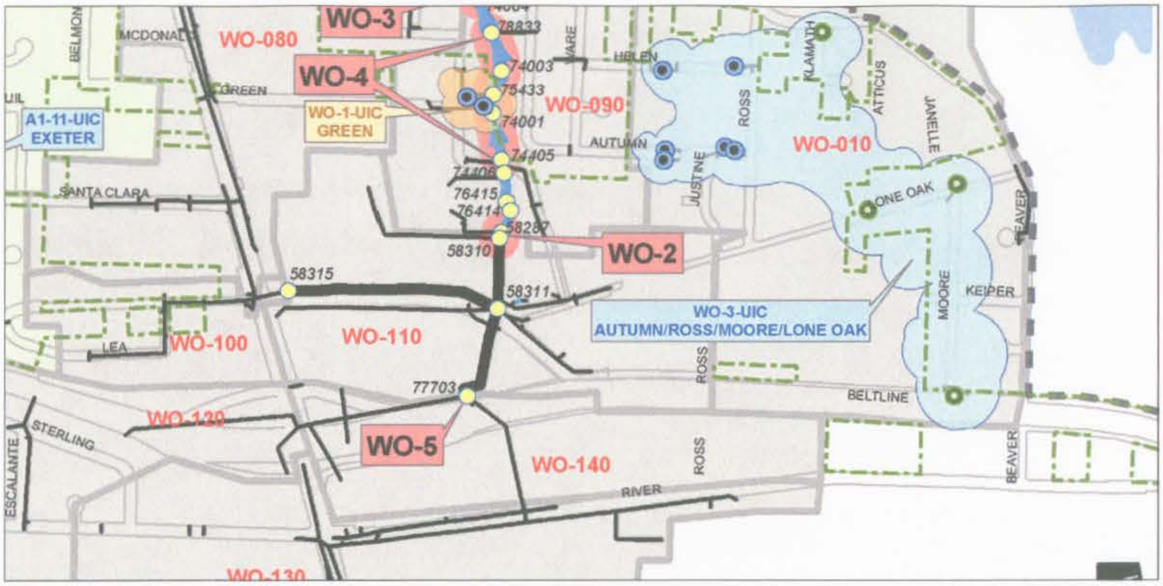
Annual Maintenance Costs	**$89,400**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 27 acres. A more detailed deliniation of drainage area to Autumn/ Ross/ Moore-Oak UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: WO-3-UIC



Project Identifier	WO-4-UIC
Project Title	Taz UIC Cluster - Pipe and Pre-treat

Project Location

The UIC associated with the Taz UIC cluster is located east of Summer Lane on Taz Street in the Willamette Overflow subbasin. One city UIC is associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster to node 72126 on Hunsaker.

Subbasin	RSWO070
GIS U/S Node Location	N/A
GIS D/S Node Location	72126
Drainage Area Served by Capital Project	3.5 Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter and pipe drainage from the Taz UIC cluster to node 72126 using 340 feet of 18" CSP pipe.

Project Elements

340 Ft – 18" CSP (2-5 ft. cover)

1 Ea – CSF 12x6 (max 11 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
18" CSP (2-5 ft. cover)	N/A
CSF 12x6 (max 11 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

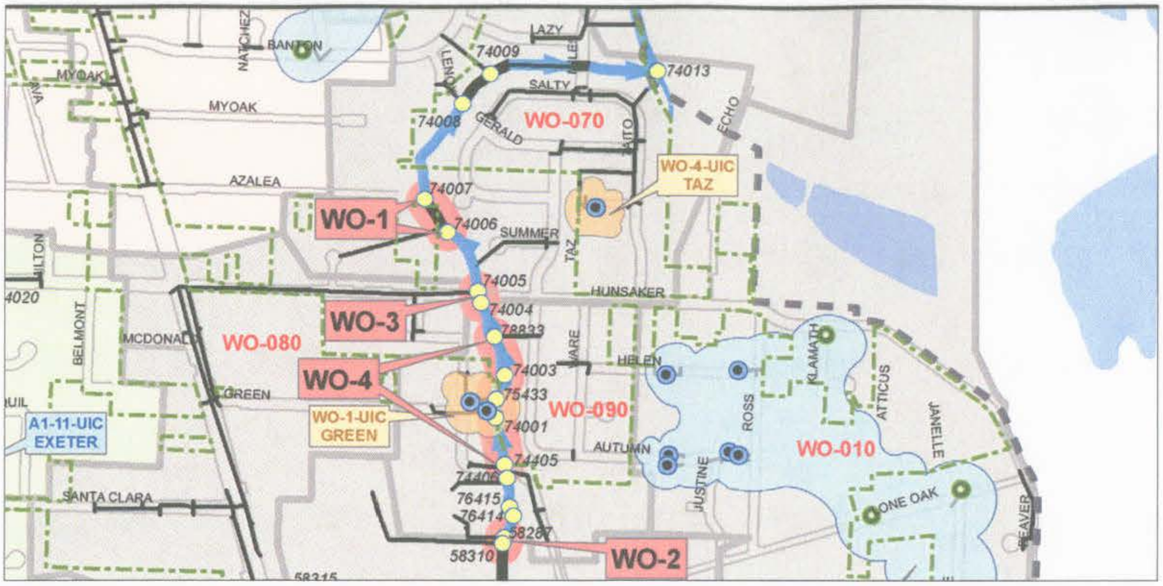
Construction Costs:	$103,800
Site Acquisition:	$0
Engineering / Administration:	$20,700
Capital Project Implementation Costs	**$124,500**
Annual Maintenance Costs	**$2,100**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. Eleven cartridges would be required for treatment of the water quality flow rate.

The drainage area associated with the Taz UIC cluster was deliniated for the XP SWMM CP model. However, the drainage configuration (pipe) was not included in the model because elevations (to determine feasibility) were estimated from two foot contours. A more detailed survey and analysis will be required to confirm feasibility of design.

Project #: WO-4-UIC



Project Identifier	WO-5-UIC
Project Title	Silver Meadows UIC Cluster - Raingarden

Project Location

The UIC associated with the Silver Meadows UIC cluster is located on Silver Meadows Drive in the Willamette Overflow subbasin. Three county UICs are associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSWO050
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	8.1 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Silver Meadows UIC cluster. Preliminary estimates indicate that approximately 0.47 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

20637 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$165,000
Site Acquisition:	$172,000
Engineering / Administration:	$67,400
Capital Project Implementation Costs	**$404,400**

Costs do not account for soil amendment.

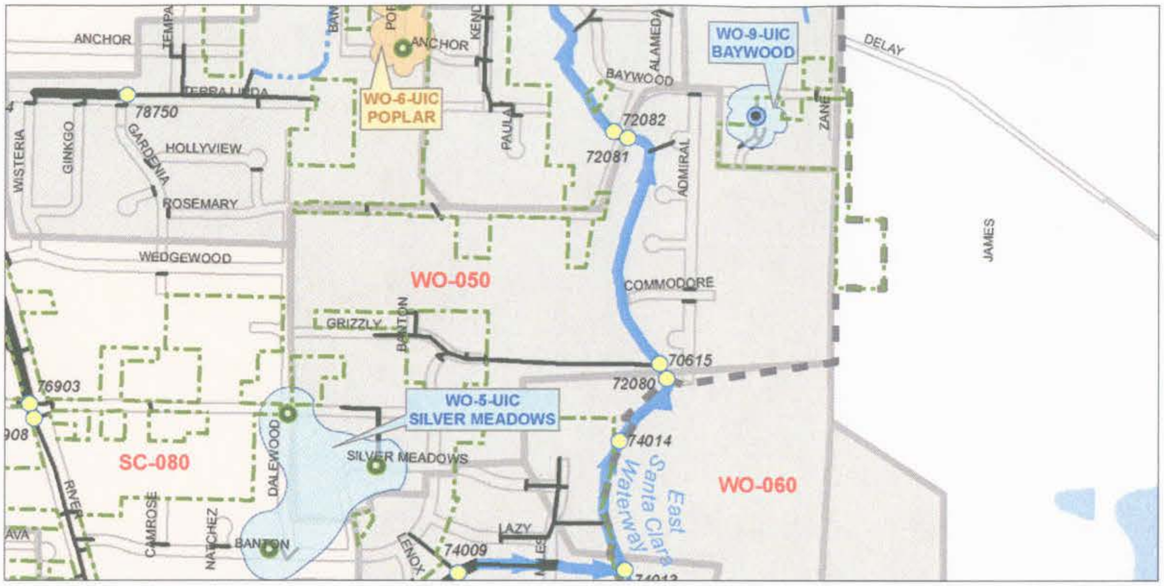
Annual Maintenance Costs	**$26,800**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 8.1 acres. A more detailed deliniation of drainage area to the Silver Meadows UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: WO-5-UIC



Project #: WO-6-UIC

Project Identifier	WO-6-UIC
Project Title	Poplar UIC Cluster - Pipe and Pre-treat

Project Location

The UICs associated with the Poplar UIC cluster are located along Poplar Street in the Willamette Overflow subbasin. Three county UICs are associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster to node 72084 on Wilkes Street.

Subbasin	RSWO035
GIS U/S Node Location	N/A
GIS D/S Node Location	72084
Drainage Area Served by Capital Project	4.2 Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter and pipe drainage from the Poplar UIC cluster to node 72084 using 1100 feet of 30" CSP pipe.

Project Elements

1100 Ft – 30" CSP (2-5 ft. cover)

1 Ea – CSF 16x8 (max 33 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
30" CSP (2-5 ft. cover)	N/A
CSF 16x8 (max 33 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

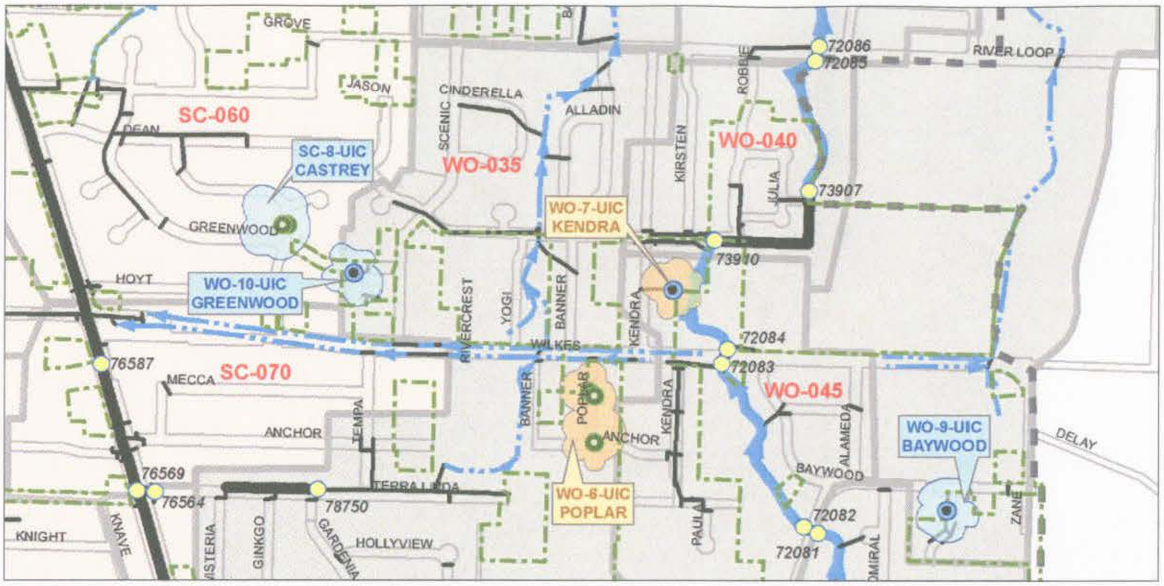
Construction Costs:	$325,500
Site Acquisition:	$0
Engineering / Administration:	$65,100
Capital Project Implementation Costs	**$390,600**
Annual Maintenance Costs	**$0**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. 13 cartridges would be required for treatment of the water quality flow rate.

The drainage area was deliniated and the drainage configuration (pipe) associated with the Poplar UIC cluster was included in the XP SWMM CP model.

Project #: WO-6-UIC



Project #: WO-7-UIC

Project Identifier	WO-7-UIC
Project Title	Kendra UIC Cluster - Pipe and Pre-treat

Project Location

The UIC associated with the Kendra UIC cluster is located east of Kendra Street and south of Dean Avenue in the Willamette Overflow subbasin. One city UIC is associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the cluster to node 73028 on the East Santa Clara Waterway.

Subbasin	RSWO045
GIS U/S Node Location	N/A
GIS D/S Node Location	73028
Drainage Area Served by Capital Project	1.3 Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter and pipe drainage from the Kendra UIC cluster to node 73028. As node 73028 is located in extremely close proximity to the UIC, required piping was estimated to be a maximum of 50' of 18" CSP.

Project Elements

50 Ft – 18" CSP (2-5 ft. cover)

1 Ea – CSF 8x6 (max 6 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
18" CSP (2-5 ft. cover)	N/A
CSF 8x6 (max 6 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

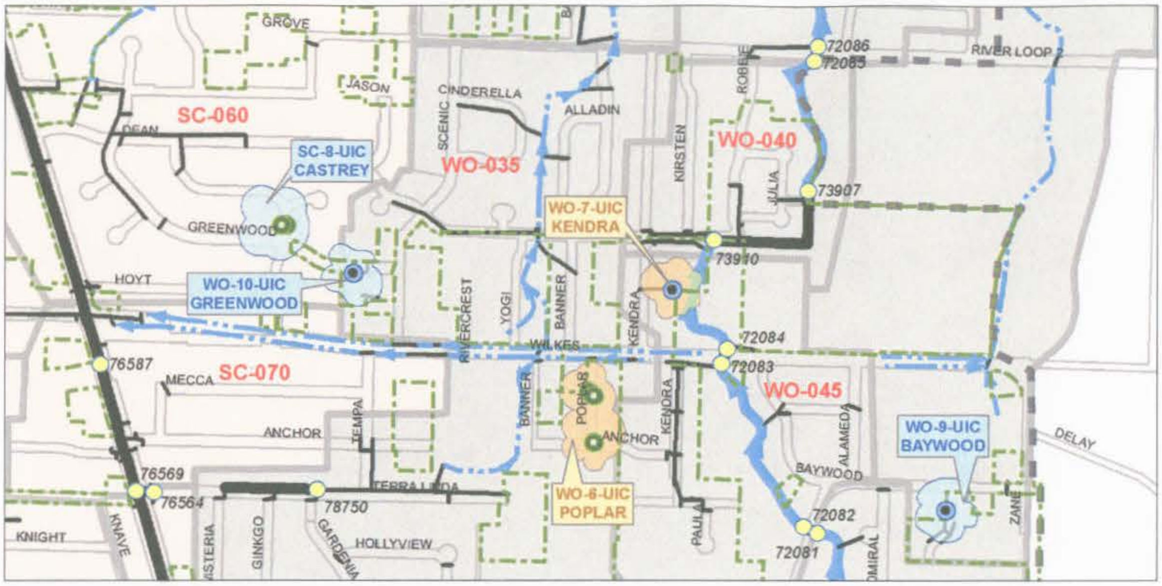
Construction Costs:	$63,000
Site Acquisition:	$0
Engineering / Administration:	$12,600
Capital Project Implementation Costs	**$75,600**
Annual Maintenance Costs	**$1,100**

Design Assumptions

StormFilter sizing assumes that one facility would be needed to accommodate the number of required cartridges. The facility would be offline and would operate at 7.5 gpm per cartridge. Four cartridges would be required for treatment of the water quality flow rate.

The drainage area associated with the Kendra UIC cluster was deliniated for the XP SWMM CP model. However, the drainage configuration (pipe) was not included in the model. The UIC is located almost directly above the storm system, and field verification is needed to confirm the UIC can be properly connected at node 73028.

Project #: WO-7-UIC



Project Identifier	WO-8-UIC
Project Title	Kent UIC Cluster - Pipe and Pre-treat

Project Location

The UICs associated with the Kent UIC cluster are located on Kent Lane at Kourt Drive in the Willamette Overflow subbasin. One city UIC and one county UIC are associated with this cluster.

The CP includes a water quality treatment facility and necessary piping to route drainage associated with the Kent UICs to Kourt Drive.

Subbasin	RSWO130
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	12.8 Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Provide water quality treatment in the form of a StormFilter compost filter, and pipe drainage from the Kent UICs to Kourt Drive. The required piping for Kent UIC #1 was estimated at 430 feet of 24" CSP. As the Kent UIC #2 UIC is located directly above an existing 18" diameter pipe along Kourt Drive, the required piping to plumb that UIC was estimated to be a maximum of 25' of 18" CSP.

Project Elements

25 Ft – 18" CSP (2-5 ft. cover)
430 Ft – 24" CSP (2-5 ft. cover)
2 Ea – CSF 16x8 (max 33 cartridges)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
18" CSP (2-5 ft. cover)	N/A
24" CSP (2-5 ft. cover)	N/A
CSF 16x8 (max 33 cartridges)	Cartridge replacement by vendor.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Provides treatment of the water quality design storm using an approved proprietary treatment system.

Natural Resources

N/A

Costs

Construction Costs:	$330,900
Site Acquisition:	$0
Engineering / Administration:	$66,100
Capital Project Implementation Costs	**$397,000**
Annual Maintenance Costs	**$12,800**

Design Assumptions

StormFilter sizing assumes that two facilities would be needed, one for each UIC due to the different locations of UICs. Each facility would be offline and would operate at 7.5 gpm per cartridge. Assuming relatively equal drainage areas for each UIC, each facility would require 19 cartridges for treatment of the water quality flow rate.

The drainage area associated with the Kent UIC cluster was deliniated for the XP SWMM CP model. However, the drainage configuration (pipe) was not included in the model because elevations (to determine feasibility) were estimated. A more detailed survey and analysis will be required to confirm feasibility of design.

Project #: WO-8-UIC

Project Identifier	**WO-9-UIC**
Project Title	**Baywood UIC Cluster - Raingarden**

Project Location

The UIC associated with the Baywood UIC cluster is located on Pegrine Street in the Willamette Overflow subbasin. One city UIC is associated with this cluster.

The CP involves installation of raingardens.

Subbasin	**RSWO0000**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**2.7 (estimated)** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Construct raingardens throughout the drainage area associated with the Baywood UIC cluster. Preliminary estimates indicate that approximately 0.16 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

6879 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$55,000
Site Acquisition:	$60,000
Engineering / Administration:	$23,000
Capital Project Implementation Costs	**$138,000**

Costs do not account for soil amendment.

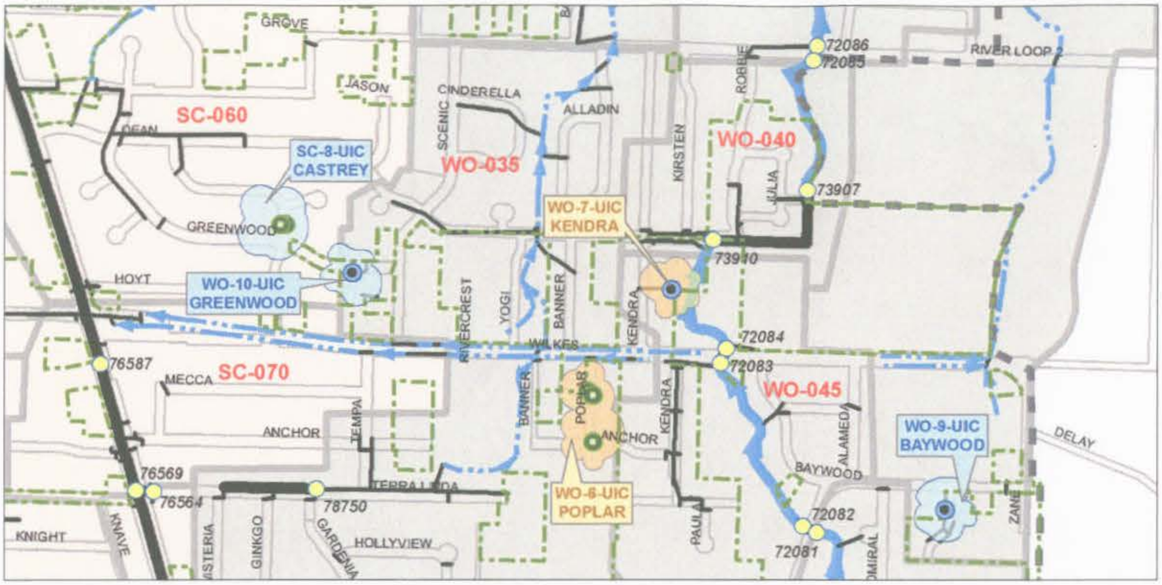
Annual Maintenance Costs	**$8,900**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 2.7 acres. A more detailed deliniation of drainage area to the Baywood UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: WO-9-UIC



Project #: WO-10-UIC

Project Identifier	WO-10-UIC
Project Title	Greenwood UIC Cluster - Raingarden

Project Location

The UIC associated with the Greenwood UIC cluster is located on Greenwood Street in the Willamette Overflow subbasin. One city UIC is associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSWO035
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	2.7 (estimated) Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Construct raingardens throughout the drainage area associated with the Greenwood UIC cluster. Preliminary estimates indicate that approximately 0.16 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

6879 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$55,000
Site Acquisition:	$60,000
Engineering / Administration:	$23,000
Capital Project Implementation Costs	**$138,000**

Costs do not account for land acquisition and soil amendment.

Annual Maintenance Costs	**$8,900**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster and original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 2.7 acres. A more detailed deliniation of drainage area to the Greenwood UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: WO-10-UIC

Project #: WO-11-UIC

Project Identifier	WO-11-UIC
Project Title	Warrington UIC Cluster - Raingarden

Project Location

The UIC associated with the Warrington UIC cluster is located on Scenic Drive in the Willamette Overflow subbasin. One county UIC is associated with this cluster.

The CP involves installation of raingardens.

Subbasin	RSWO030	
GIS U/S Node Location	N/A	
GIS D/S Node Location	N/A	
Drainage Area Served by Capital Project	2.7 (estimated)	Acres
% Impervious (Existing Land Use)	N/A	
% Impervious (Future Land Use)	N/A	

Project Description

Construct raingardens throughout the drainage area associated with the Warrington UIC cluster. Preliminary estimates indicate that approximately 0.16 acres of raingarden would be required to manage treatment and runoff volumes associated with the 5-year, 24 hour storm event.

Project Elements

6879 SF – Raingarden (native soils)

Problems and/or Opportunities Addressed by the Capital Projects

Problems

High groundwater and insufficient pretreatment of runoff prior to disposal in UICs prompted consideration of alternatives to UICs for treatment and disposal of stormwater runoff.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Raingarden (native soils)	Litter and debris removal, reestablishment of vegetation

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Disposes of increased runoff that would result from the required decommissioning of public drywells.

Water Quality

Promotes stormwater treatment through filtration, sedimentation, infiltration, and vegetative uptake within the rain garden.

Natural Resources

N/A

Costs

Construction Costs:	$55,000
Site Acquisition:	$60,000
Engineering / Administration:	$23,000
Capital Project Implementation Costs	**$138,000**

Costs do not account for soil amendment.

Annual Maintenance Costs	**$8,900**

Design Assumptions

Because drainage areas were not delineated for all UIC cluster (including this one) and the original drainage area deliniation did not account for all UICs, a modified drainage area for each UIC cluster, assuming 2.7 acres area per UIC was used for sizing raingardens. Therefore, preliminary raingarden sizing for this UIC cluster assumes a drainage area of 2.7 acres. A more detailed deliniation of drainage area to the Warrington UIC cluster would be needed prior to CP design.

Acquisition costs are based on a residential land cost of $337,600/acre and calculated using the raingarden footprint area plus 5% for accessibility. An additional $4,000/project is included for administrative activities associated with land acquisition.

Project #: WO-11-UIC

Project Identifier	RRSC-1
Project Title	Annual Budget Line Item for Streambank Stabilization

Project Location

Open waterways throughout the River Road Santa Clara Basin.

Subbasin	N/A
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	N/A Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Maintain an annual budget line item in the CIP for implementation of streambank stabilization projects to help streams adjust to increased runoff volumes while limiting negative impacts associated with downcutting, sedimentation, and erosion. Where appropriate, use bioengineering techniques to stabilize streambanks.

Project Elements

0 SY – Streambank Stabilization

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Downcutting, sedimentation, and erosion problems have been observed in open waterways that are receiving increased runoff volumes associated with urbanization

Opportunities

Streambank stabilization provides the opportunity to improve or restore riparian vegetation and aquatic habitat conditions.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Streambank Stabilization	Inspect vegetation and banks for erosion.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP eliminates localized erosion of streambeds and streambanks.

Natural Resources

This CP can help restore native riparian vegetation and improve aquatic habitat conditions.

Costs

Construction Costs:	$0
Site Acquisition:	$0
Engineering / Administration:	$0
Capital Project Implementation Costs	**$0**

There will be a annual line item in the capital projects budget to address streambank stabilization projects on a city-wide basis.

Annual Maintenance Costs	**$0**

Design Assumptions

Project Identifier	RRSC-2
Project Title	Annual Budget Line Item for Water Quality Facilities for High Source Areas

Project Location

Piped storm drainage systems located throughout the City of Eugene that convey stormwater runoff from mostly developed (i.e., no space for above ground water quality facilities) high pollutant source areas (i.e., commercial and industrial areas).

Subbasin	N/A
GIS U/S Node Location	N/A
GIS D/S Node Location	N/A
Drainage Area Served by Capital Project	N/A Acres
% Impervious (Existing Land Use)	N/A
% Impervious (Future Land Use)	N/A

Project Description

Maintain an annual budget line item in the CIP for construction of offline, underground structural water quality facilities in developed, high pollutant source areas. Types of facilities include sedimentation manholes and proprietary stormwater treatment devices. Depending on flow rate and type of facility installed, costs can widely vary.

Project Elements

0 ea. – Water Quality Facility for High Source Areas

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Based on monitoring data collected within the City of Eugene, stormwater from high pollutant source areas is a significant source of pollutant loads to receiving waters.

Opportunities

Opportunity to reduce pollutant discharges in stormwater runoff from high pollutant sources in developed areas.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Water Quality Facility for High Source Areas	

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP provides treatment of stormwater runoff from various high pollutant source drainage areas. Pollutant load reductions will depend on the type of facilities used and the locations of the facilities.

Natural Resources

N/A

Costs

Construction Costs:	
Site Acquisition:	$0
Engineering / Administration:	
Capital Project Implementation Costs	

There will be an annual line item in the capital projects budget to address water quality facilities for high source areas on a city-wide basis.

Annual Maintenance Costs	**$0**

Design Assumptions

Possible high source retrofit locations:
Willamette Overflow Drainage System:
1) Node 68485
2) Nodes 58315, 58314, 58313, and 58312
3) Node 58319
4) Node 67014
Spring Creek Drainage System:
5) 48" pipe east of River Road, north of River Loop 2, south of Swain Lane
Flat Creek Drainage System:
6) Nodes 72206, 72210, 72215, 72218, and 72223
7) Node 72321
8) Node 72326
A1 Channel Drainage System
9) 54" pipe running west between nodes 59020 and 59021 between Bushnell and Park Ave.

Project Identifier	**RRSC-3**
Project Title	**Annual Budget Line Item for Outfall Stabilization**

Project Location

All storm drainage system outfalls in the River Road Santa Clara basin that are causing erosion and bank stabilization problems.

Subbasin	**N/A**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**N/A** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Maintain an annual budget line item in the CIP for identification and retrofit of storm drainage system outfalls creating bank stability problems along open waterways in the River Road Santa Clara basin.

Project Elements

0 N/A – Outfall Stabilization

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Erosion and bank stabilization problems, and in some cases maintenance access problems, exist at storm drainage system outfalls draining into open waterways in the River Road Santa Clara basin.

Opportunities

Opportunity to retrofit storm drainage system outfalls to provide maintenance access, energy dissipation, and bank stabilization.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Outfall Stabilization	

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP provides bank stabilization that will reduce sedimentation from erosion caused by storm drainage system outfalls draining into open waterways in the River Road Santa Clara basin.

Natural Resources

This CP will reduce impacts on streambank vegetation and aquatic habitat.

Costs

Construction Costs:	
Site Acquisition:	$0
Engineering / Administration:	
Capital Project Implementation Costs	

There will be a annual line item in the capital projects budget to address outfall stabilization projects on a city-wide basis.

Annual Maintenance Costs	**$0**

Design Assumptions

Project Identifier	**RRSC-4**
Project Title	**Annual Budget Line Item for Stream Corridor Acquisition**

Project Location

Stream corridors with relatively high stormwater values and at risk for future development throughout the River Road Santa Clara Basin.

Subbasin	**N/A**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**N/A** Acres
% Impervious (Existing Land Use)	**N/A**
% Impervious (Future Land Use)	**N/A**

Project Description

Maintain an annual budget line item in the CIP for acquisition of stream corridors in locations with high development potential in order to buffer streams and minimize impacts associated with increased runoff volumes and other negative impacts associated with urbanization.

Project Elements

0 N/A – Stream Corridor Acquisition

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Downcutting, sedimentation, and erosion problems have been observed in open waterways that are receiving increased runoff volumes associated with urbanization.

Opportunities

Stream corridor acquisition provides the opportunity to improve or restore riparian vegetation conditions in locations that otherwise would develop and encroach on the stream corridor.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Stream Corridor Acquisition	

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Provides additional space allowing for water levels to rise above the top of banks without damaging encroaching structures.

Water Quality

This CP eliminates localized erosion of streambeds and streambanks associated with encroaching development.

Natural Resources

This CP can help restore native riparian vegetation and improve aquatic habitat conditions.

Costs

Construction Costs:	
Site Acquisition:	$0
Engineering / Administration:	
Capital Project Implementation Costs	

There will be a annual line item in the capital projects budget to address stream corridor acquisition projects on a city-wide basis.

Annual Maintenance Costs	**$0**

Design Assumptions

The Willamette Overflow (or East Santa Clara Waterway) has been identified for stream corridor acquisitions.

APPENDIX B

HYDROLOGIC/HYDRAULIC MODEL OUTPUT TABLES

APPENDIX B
TABLE B-1
MAJOR HYDROLOGIC INPUT DATA FOR THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM

Subbasin Name	Inlet Node	Subbasin Area (acres)	Impervious Area (%)				Average Subbasin Slope (ft/ft)	Subbasin Width (ft)	Overland Flow Roughness Coefficient		Depression Storage (inch)		Green-Ampt Infiltration Parameters		
			Existing Land Use		Future Land Use								Average Capillary Suction (in)	Initial Moisture Deficit (ft/ft)	Saturated Hydraulic Conductivity (inch/hour)
			Mapped	Effective	Mapped	Effective			Impervious	Pervious	Impervious	Pervious			
River Road-Santa Clara - A1-Channel															
RSA1-010	72757	34.6	3.7	0.7	35.4	21.1	0.025	2540	0.012	0.20	0.05	0.15	10.70	0.43	0.08
RSA1-020	72757	87.3	13.0	4.7	14.8	5.7	0.014	1446	0.012	0.20	0.05	0.15	10.70	0.43	0.08
RSA1-030	72744	239.8	24.3	12	37.1	22.6	0.016	11160	0.012	0.20	0.05	0.15	10.45	0.41	0.07
RSA1-050	72746	65.4	15.5	6.1	56.3	42.2	0.007	1543	0.012	0.20	0.05	0.15	10.70	0.43	0.08
RSA1-060	72740	152.8	36.8	22.3	49.4	34.7	0.016	20023	0.012	0.20	0.05	0.15	9.99	0.40	0.07
RSA1-070	72742	63.6	29.3	15.9	51.0	36.4	0.015	2570	0.012	0.20	0.05	0.15	10.18	0.41	0.08
RSA1-080	72748	73.1	50.4	35.8	54.0	39.7	0.021	2693	0.012	0.20	0.05	0.15	10.46	0.42	0.08
RSA1-090	72788	50.0	37.9	23.3	54.4	40.1	0.024	3434	0.012	0.20	0.05	0.15	10.35	0.44	0.12
RSA1-100	72784	82.1	49.1	34.4	51.5	37	0.043	3276	0.012	0.20	0.05	0.15	8.43	0.44	0.26
RSA1-110	72103	57.8	54.3	40	55.2	41	0.043	2500	0.012	0.20	0.05	0.15	9.23	0.44	0.21
RSA1-120	72102	91.4	32.8	18.8	54.1	39.8	0.050	4154	0.012	0.20	0.05	0.15	9.43	0.45	0.21
RSA1-130	72737	107.1	36.0	21.6	45.3	30.5	0.023	7687	0.012	0.25	0.05	0.15	10.70	0.43	0.08
RSA1-140	69264	54.3	38.1	23.5	39.3	24.6	0.017	3325	0.012	0.20	0.05	0.15	10.70	0.43	0.08
RSA1-150	72797	73.5	43.9	29.1	49.4	34.7	0.043	2701	0.012	0.20	0.05	0.15	9.45	0.45	0.21
RSA1-160	72733	106.5	40.1	25.4	43.1	28.3	0.022	6146	0.012	0.40	0.05	0.15	9.90	0.44	0.16
RSA1-170	72736	98.9	45.5	30.7	47.7	32.9	0.017	5947	0.012	0.45	0.05	0.15	10.70	0.43	0.08
RSA1-180	72101	78.8	42.7	27.9	43.5	28.7	0.014	2650	0.012	0.45	0.05	0.15	10.60	0.43	0.09
RSA1-190	72100	59.6	43.6	28.8	43.6	28.8	0.011	1623	0.012	0.45	0.05	0.15	10.38	0.43	0.09
RSA1-200	72725	42.2	40.2	25.5	50.1	35.5	0.042	1297	0.012	0.25	0.05	0.15	6.06	0.33	0.23
RSA1-210	59021	99.0	45.6	30.8	46.0	31.2	0.006	4869	0.012	0.45	0.05	0.15	10.56	0.43	0.09
RSA1-220	85032	53.8	45.9	31.1	46.8	32	0.005	1315	0.012	0.45	0.05	0.15	9.63	0.43	0.11
RSA1-230	72723	86.7	34.3	20.1	38.8	24.2	0.030	4686	0.012	0.40	0.05	0.15	7.80	0.38	0.20
RSA1-240	72719	169.1	38.4	23.8	42.2	27.4	0.015	4837	0.012	0.45	0.05	0.15	10.67	0.43	0.08
RSA1-245	72719	566.3	40.1	25.4	42.5	27.7	0.014	9500	0.012	0.45	0.05	0.15	10.59	0.43	0.08
RSA1-270	74040	28.3	46.8	32	47.1	32.3	0.008	4532	0.012	0.45	0.05	0.15	9.01	0.45	0.25
RSA1-280	74030	39.2	45.2	30.4	45.3	30.5	0.004	3610	0.012	0.45	0.05	0.15	10.70	0.43	0.08
RSA1-290	74020	48.4	43.3	28.5	44.3	29.5	0.013	2809	0.012	0.45	0.05	0.15	10.70	0.43	0.08
River Road-Santa Clara - Flat Creek															
RSFC-010	70197	51.3	44.0	29.2	44.1	29.3	0.024	2500	0.012	0.40	0.05	0.15	9.64	0.40	0.11
RSFC-020	72767	84.7	42.8	28	46.8	32	0.015	3743	0.012	0.40	0.05	0.15	10.70	0.43	0.08
RSFC-030	72761	104.2	41.9	27.1	45.1	30.3	0.016	5722	0.012	0.30	0.05	0.15	10.70	0.43	0.08
RSFC-040	75659	35.9	42.1	27.3	43.7	28.9	0.013	1700	0.012	0.45	0.05	0.15	10.70	0.43	0.08
RSFC-050	72799	42.8	36.9	22.4	42.9	28.1	0.013	1680	0.012	0.45	0.05	0.15	10.70	0.43	0.08
RSFC-060	72800	46.2	44.8	30	44.8	30	0.010	2412	0.012	0.45	0.05	0.15	9.90	0.44	0.16
RSFC-070	72794	30.2	35.7	21.3	38.2	23.6	0.016	2903	0.012	0.45	0.05	0.15	10.43	0.43	0.11
River Road-Santa Clara - Spring Creek															
RSSC-010	72013	50.5	38.2	23.6	43.1	28.3	0.024	2938	0.012	0.37	0.05	0.15	10.70	0.43	0.08
RSSC-035	76560	51.9	44.8	30	45.8	31	0.009	1200	0.012	0.30	0.05	0.15	10.70	0.43	0.08
RSSC-040	72008	42.8	38.1	23.5	40.1	25.4	0.027	1869	0.012	0.45	0.05	0.15	9.01	0.43	0.13
RSSC-050	72030	54.4	43.3	28.5	44.9	30.1	0.013	2656	0.012	0.35	0.05	0.15	7.44	0.43	0.18
RSSC-060	79470	114.1	41.4	26.6	47.9	33.1	0.013	4948	0.012	0.45	0.05	0.15	8.96	0.43	0.13
RSSC-070	76587	40.4	47.2	32.4	47.5	32.7	0.009	1941	0.012	0.45	0.05	0.15	10.09	0.43	0.10
RSSC-080	76564	100.3	41.2	26.4	45.9	31.1	0.008	1424	0.012	0.45	0.05	0.15	10.70	0.43	0.08

APPENDIX B
TABLE B-1
MAJOR HYDROLOGIC INPUT DATA FOR THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM

Subbasin Name	Inlet Node	Subbasin Area (acres)	Impervious Area (%)				Average Subbasin Slope (ft/ft)	Subbasin Width (ft)	Overland Flow Roughness Coefficient		Depression Storage (inch)		Green-Ampt Infiltration Parameters		
			Existing Land Use		Future Land Use								Average Capillary Suction (in)	Initial Moisture Deficit (ft/ft)	Saturated Hydraulic Conductivity (inch/hour)
			Mapped	Effective	Mapped	Effective			Impervious	Pervious	Impervious	Pervious			
RSSC-090	72004	82.8	43.3	28.5	43.6	28.8	0.020	3761	0.012	0.30	0.05	0.15	10.70	0.43	0.08
RSSC-100	72002	66.4	40.6	25.9	43.0	28.2	0.013	2722	0.012	0.30	0.05	0.15	10.70	0.43	0.08
RSSC-110	72770	95.9	27.3	14.3	42.5	27.7	0.010	2777	0.012	0.30	0.05	0.15	10.70	0.43	0.08
RSSC-120	72000	323.9	40.8	26.1	43.4	28.6	0.014	4475	0.012	0.45	0.05	0.15	10.54	0.43	0.10
River Road-Santa Clara - Willamette Overflow															
RSWO-010	99820	54.8	11.3	3.8	27.5	14.4	0.034	4578	0.012	0.20	0.05	0.15	7.92	0.43	0.24
RSWO-020	99827	27.5	39.7	25	45.4	30.6	0.015	2261	0.012	0.45	0.05	0.15	3.50	0.43	0.30
RSWO-030	99827	47.8	36.3	21.9	42.8	28	0.018	2282	0.012	0.45	0.05	0.15	3.50	0.43	0.30
RSWO-035	99827	110.8	39.9	25.2	44.5	29.7	0.014	4687	0.012	0.45	0.05	0.15	6.17	0.44	0.31
RSWO-040	73907	25.4	37.1	22.6	38.0	23.4	0.024	5712	0.012	0.20	0.05	0.15	6.50	0.43	0.25
RSWO-045	73910	44.7	36.0	21.6	43.7	28.9	0.027	3000	0.012	0.20	0.05	0.15	6.65	0.42	0.41
RSWO-050	72081	80.0	25.3	12.7	39.0	24.4	0.019	3396	0.012	0.45	0.05	0.15	6.29	0.41	0.52
RSWO-060	72080	37.9	4.0	0.8	12.5	4.4	0.025	1817	0.012	0.20	0.05	0.15	5.33	0.41	0.77
RSWO-070	74013	66.1	31.4	17.6	41.4	26.6	0.022	5273	0.012	0.45	0.05	0.15	9.41	0.43	0.25
RSWO-080	74004	55.4	51.8	37.3	54.6	40.3	0.008	3737	0.012	0.45	0.05	0.15	10.70	0.43	0.08
RSWO-090	74405	34.2	44.9	30.1	45.8	31	0.022	3460	0.012	0.45	0.05	0.15	9.80	0.43	0.20
RSWO-100	58315	15.2	40.3	25.6	40.4	25.7	0.009	3030	0.012	0.45	0.05	0.15	10.70	0.43	0.08
RSWO-110	58311	49.4	57.7	43.8	64.7	52	0.012	2980	0.012	0.45	0.05	0.15	10.65	0.43	0.09
RSWO-120	77703	30.9	56.5	42.5	57.3	43.4	0.044	2010	0.012	0.45	0.05	0.15	10.69	0.43	0.08
RSWO-130	77703	136.9	50.6	36	52.2	37.7	0.010	4533	0.012	0.45	0.05	0.15	9.16	0.43	0.13
RSWO-140	77703	30.6	59.4	45.8	62.2	49.1	0.033	1773	0.012	0.45	0.05	0.15	10.28	0.43	0.13

APPENDIX B
TABLE B-2
HYDROLOGIC MODEL OUTPUT DATA UNDER EXISTING AND FUTURE CONDITIONS
FOR THE RIVER ROAD SANTA CLARA BASIN

Subbasin Name	Inlet Node	Subbasin Area (acres)	Subbasin Peak Flow (cfs) Existing Land Use Conditions					Subbasin Peak Flow (cfs) Future Land Use Conditions				
			10-Year	25-Year-W1	25-Year-S2	50-Year	100-Year	10-Year	25-Year-W1	25-Year-S2	50-Year	100-Year
River Road-Santa Clara - A1-Channel												
RSA1-010	72757	34.6	11	4	8	13	19	15	12	12	25	33
RSA1-020	72757	87.3	12	7	10	16	22	12	8	11	18	24
RSA1-030	72744	239.8	73	44	61	103	139	87	70	76	149	191
RSA1-050	72746	65.4	8	5	7	11	15	24	31	22	47	56
RSA1-060	72740	152.8	76	57	63	140	180	82	77	70	171	212
RSA1-070	72742	63.6	18	13	15	28	37	26	27	23	51	63
RSA1-080	72748	73.1	30	31	26	58	71	32	34	28	63	77
RSA1-090	72788	50.0	17	13	11	29	37	21	22	16	44	54
RSA1-100	72784	82.1	19	31	20	52	61	20	34	21	56	66
RSA1-110	72103	57.8	16	26	16	44	52	16	26	17	45	53
RSA1-120	72102	91.4	12	19	12	34	42	25	40	26	70	82
RSA1-130	72737	107.1	41	29	33	67	88	46	39	38	84	107
RSA1-140	69264	54.3	21	16	17	35	45	21	16	17	36	46
RSA1-150	72797	73.5	14	24	15	41	48	17	28	18	49	57
RSA1-160	72733	106.5	23	30	19	53	64	25	34	21	59	71
RSA1-170	72736	98.9	33	35	28	66	79	34	37	30	69	84
RSA1-180	72101	78.8	20	25	18	43	51	20	25	18	44	52
RSA1-190	72100	59.6	15	19	13	32	38	15	19	13	32	38
RSA1-200	72725	42.2	8	12	8	21	26	11	17	11	29	34
RSA1-210	59021	99.0	27	34	24	58	69	27	35	24	59	69
RSA1-220	85032	53.8	13	19	12	28	33	13	19	12	29	34
RSA1-230	72723	86.7	13	19	12	35	43	15	23	15	42	50
RSA1-240	72719	169.1	126	49	40	86	104	45	55	44	96	115
RSA1-245	72719	566.3	41	168	127	274	326	135	182	136	298	348
RSA1-270	74040	28.3	6	10	6	17	20	6	10	6	17	20
RSA1-280	74030	39.2	12	14	11	25	30	12	14	11	25	30
RSA1-290	74020	48.4	15	16	13	29	35	15	16	13	30	36

APPENDIX B
TABLE B-2
HYDROLOGIC MODEL OUTPUT DATA UNDER EXISTING AND FUTURE CONDITIONS
FOR THE RIVER ROAD SANTA CLARA BASIN

Subbasin Name	Inlet Node	Subbasin Area (acres)	Subbasin Peak Flow (cfs) Existing Land Use Conditions					Subbasin Peak Flow (cfs) Future Land Use Conditions				
			10-Year	25-Year-W1	25-Year-S2	50-Year	100-Year	10-Year	25-Year-W1	25-Year-S2	50-Year	100-Year
River Road-Santa Clara - Flat Creek												
RSFC-010	70197	51.3	16	17	13	32	38	16	17	13	32	38
RSFC-020	72767	84.7	25	27	22	50	60	27	31	24	56	67
RSFC-030	72761	104.2	36	33	30	65	81	38	37	32	71	88
RSFC-040	75659	35.9	10	11	9	20	25	10	12	9	21	26
RSFC-050	72799	42.8	10	11	9	20	24	12	14	10	24	29
RSFC-060	72800	46.2	11	15	10	26	30	11	15	10	26	30
RSFC-070	72794	30.2	8	7	6	15	18	9	8	6	16	20
River Road-Santa Clara - Spring Creek												
RSSC-010	72013	50.5	16	14	14	29	36	18	17	15	33	41
RSSC-035	76560	51.9	14	18	12	29	34	14	18	13	29	35
RSSC-040	72008	42.8	10	11	8	21	25	10	12	8	22	26
RSSC-050	72030	54.4	12	17	11	30	35	13	18	12	32	37
RSSC-060	79470	114.1	26	34	22	60	70	31	42	27	73	84
RSSC-070	76587	40.4	12	15	10	25	30	12	15	10	26	30
RSSC-080	76564	100.3	20	29	19	44	51	24	35	22	50	58
RSSC-090	72004	82.8	28	27	24	53	65	28	28	24	53	66
RSSC-100	72002	66.4	19	20	17	37	45	20	22	18	40	48
RSSC-110	72770	95.9	17	16	14	30	38	26	30	23	52	62
RSSC-120	72000	323.9	65	94	60	145	169	71	103	66	157	182
River Road-Santa Clara - Willamette Overflow												
RSWO-010	99820	54.8	1	2	1	5	10	5	9	6	16	22
RSWO-020	99827	27.5	5	8	5	13	16	6	9	6	16	19
RSWO-030	99827	47.8	7	12	7	20	24	9	15	9	25	30
RSWO-035	99827	110.8	19	31	20	51	59	22	37	23	60	69
RSWO-040	73907	25.4	4	6	4	13	17	4	7	4	13	18
RSWO-045	73910	44.7	7	11	7	18	20	9	14	9	24	27
RSWO-050	72081	80.0	7	11	7	19	21	13	22	14	36	41

APPENDIX B
TABLE B-2
HYDROLOGIC MODEL OUTPUT DATA UNDER EXISTING AND FUTURE CONDITIONS
FOR THE RIVER ROAD SANTA CLARA BASIN

Subbasin Name	Inlet Node	Subbasin Area (acres)	Subbasin Peak Flow (cfs) Existing Land Use Conditions					Subbasin Peak Flow (cfs) Future Land Use Conditions				
			10-Year	25-Year-W1	25-Year-S2	50-Year	100-Year	10-Year	25-Year-W1	25-Year-S2	50-Year	100-Year
RSWO-060	72080	37.9	0	0	0	1	1	1	2	1	3	4
RSWO-070	74013	66.1	8	13	8	22	26	12	20	12	33	38
RSWO-080	74004	55.4	20	23	17	42	50	21	25	18	45	53
RSWO-090	74405	34.2	7	11	7	20	24	7	12	7	21	24
RSWO-100	58315	15.2	6	5	5	11	14	6	5	5	11	14
RSWO-110	58311	49.4	19	24	17	43	50	22	29	20	49	58
RSWO-120	77703	30.9	14	17	13	31	37	14	17	13	31	37
RSWO-130	77703	136.9	38	55	37	91	107	40	58	39	95	111
RSWO-140	77703	30.6	12	16	10	29	34	13	17	11	31	36

Note.
1. W = Winter
2. S = Summer

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
A-1 Channel																						
RSA1010A	72757	72745	Bridge	42	25	383	283	419	474	587	352.1	352.3	356.3	355.5	356.0	355.1	356.5	355.6	356.6	355.7	357.0	356.0
RSA1010B	72744	72757	Natural	2400	25	369	282	405	458	563	356.2	352.1	359.8	356.3	359.3	356.0	359.9	356.5	360.2	356.6	360.6	357.0
RSA1030A	72743	72744	Natural	4200	25	328	294	358	417	505	362.8	356.2	367.4	359.8	367.4	359.3	367.6	359.9	368.0	360.2	368.4	360.6
RSA1030B.1	72742	72743	Bridge	32	25	326	294	356	413	499	362.9	362.8	367.6	367.4	367.5	367.4	367.8	367.6	368.1	368.0	368.5	368.4
RSA1030BRD	72742	72743	Roadway	32		0	0	0	0	0	372.3	372.3	367.4	367.4	367.4	367.4	367.6	367.6	368.0	368.0	368.4	368.4
RSA1030C	73394	72744	Natural	1633	10	6	2	6	6	10	362.3	356.2	362.7	359.8	362.5	359.3	362.7	359.9	362.7	360.2	362.7	360.6
RSA1030D	75021	73394	Natural	1016	10	7	3	6	7	10	366.1	362.3	366.6	362.7	366.5	362.5	366.5	362.7	366.6	362.7	366.6	362.7
RSA1030Da.	75020	75021	24" x 141" CMP Culvert	96	10	7	3	6	7	10	366.3	366.1	367.3	366.6	367.0	366.5	367.2	366.5	367.3	366.6	367.4	366.6
RSA1030DaR	75020	75021	Roadway	96		0	0	0	0	0	370.7	370.7	366.6	366.6	366.5	366.5	366.5	366.5	366.6	366.6	366.6	366.6
RSA1030Db	73395	75020	Natural	522	10	7	4	6	7	10	366.8	366.3	367.3	367.3	367.2	367.0	367.3	367.2	367.3	367.3	367.5	367.4
RSA1030E	72747	73395	Natural	1633	10	8	4	7	8	13	368.2	366.8	368.8	367.3	368.7	367.2	368.7	367.3	368.8	367.3	368.9	367.5
RSA1030F1	72746	72747	14" CSP Culvert	55	10	4	3	4	5	5	368.8	368.2	369.9	368.8	369.6	368.7	369.8	368.7	370.2	368.8	370.5	368.9
RSA1030F2	72746	72747	24" CSP Culvert	55	10	4	2	3	6	10	369.1	368.8	369.9	369.5	369.6	369.3	369.8	369.4	370.2	369.7	370.5	369.9
RSA1030FRD	72746	72747	Roadway	55		0	0	0	0	0	372.1	372.1	368.8	368.8	368.7	368.7	368.7	368.7	368.8	368.8	368.9	368.9
RSA1060A	71215	72742	Natural	1140	25	313	289	343	396	477	365.0	362.9	368.8	367.6	368.7	367.5	369.0	367.8	369.4	368.1	370.0	368.5
RSA1060B	72741	71215	Natural	560	25	291	273	321	379	456	366.6	365.0	369.9	368.8	369.8	368.7	370.1	369.0	370.4	369.4	370.9	370.0
RSA1060C	72740	72741	Bridge	39	25	291	274	321	379	457	366.7	366.6	370.2	369.9	370.1	369.8	370.3	370.1	370.6	370.4	371.1	370.9
RSA1060D	72739	72740	Natural	1000	25	254	237	280	311	375	367.6	366.7	371.8	370.2	371.7	370.1	372.0	370.3	372.2	370.6	372.6	371.1
RSA1060E	72738	72739	Natural	500	25	234	220	260	290	354	367.8	367.6	372.2	371.8	372.0	371.7	372.4	372.0	372.6	372.2	373.0	372.6
RSA1130A1	72737	72738	72" CSP Culvert	600	25	77	73	86	96	118	370.2	367.9	372.8	372.2	372.7	372.0	373.1	372.4	373.4	372.6	373.9	373.0
RSA1130A2	72737	72738	72" CSP Culvert	600	25	79	75	88	99	120	370.1	367.8	372.8	372.2	372.7	372.0	373.1	372.4	373.4	372.6	373.9	373.0
RSA1130A3	72737	72738	72" CSP Culvert	600	25	77	73	86	96	118	370.2	367.9	372.8	372.2	372.7	372.0	373.1	372.4	373.4	372.6	373.9	373.0
RSA1130ARD	72737	72738	Roadway	600		0	0	0	0	0	381.7	381.7	372.2	372.2	372.0	372.0	372.4	372.4	372.6	372.6	373.0	373.0
RSA1130B	70756	72737	Natural	2145	25	213	208	239	255	307	372.1	370.1	377.4	372.8	377.4	372.7	377.6	373.1	377.7	373.4	378.1	373.9
RSA1140A	72796	70756	Natural	1155	25	203	204	228	240	282	372.8	372.1	378.2	377.4	378.2	377.4	378.4	377.6	378.5	377.7	378.9	378.1
RSA1140B.1	69264	70756	36" CSP Culvert	839	10	21	15	17	27	27	374.1	373.3	379.8	377.4	378.3	377.4	379.3	377.6	382.1	377.7	382.2	378.1
RSA1140BRD	69264	70756	Roadway	839		0	0	0	1	10	382.0	380.0	377.4	377.4	377.4	377.4	377.6	377.6	382.1	380.0	382.2	380.2
RSA1270A.1	74046	72796	60" CSP Culvert	160	10	25	28	25	46	60	372.9	372.8	378.2	378.2	378.2	378.2	378.4	378.4	378.5	378.5	378.9	378.9
RSA1270ARD	74046	72796	Roadway	160		0	0	0	0	0	384.3	386.4	378.2	378.2	378.2	378.2	378.4	378.4	378.5	378.5	378.9	378.9
RSA1270B.1	74044	74046	60" CSP Culvert	463	10	25	29	25	46	60	373.1	372.9	378.2	378.2	378.2	378.2	378.5	378.4	378.6	378.5	379.1	378.9
RSA1270BRD	74044	74046	Roadway	463		0	0	0	0	0	383.0	384.3	378.2	378.2	378.2	378.2	378.5	378.5	378.6	378.6	379.1	379.1
RSA1270C.1	74042	74044	60" CSP Culvert	412	10	25	31	26	47	61	373.3	373.1	378.2	378.2	378.2	378.2	378.5	378.5	378.7	378.6	379.2	379.1
RSA1270CRD	74042	74044	Roadway	412		0	0	0	0	0	382.2	383.0	378.2	378.2	378.2	378.2	378.5	378.5	378.7	378.7	379.2	379.2

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1270D.1	74040	74042	60" CSP Culvert	409	10	26	32	26	47	61	373.5	373.3	378.2	378.2	378.2	378.2	378.5	378.5	378.8	378.7	379.5	379.2
RSA1270DRD	74040	74042	Roadway	409		0	0	0	0	0	383.4	382.2	378.2	378.2	378.2	378.2	378.5	378.5	378.7	378.7	379.2	379.2
RSA1280A.1	74034	74040	60" CSP Culvert	216	10	21	23	21	38	50	373.6	373.5	378.3	378.2	378.2	378.2	378.5	378.5	378.9	378.8	379.5	379.5
RSA1280ARD	74034	74040	Roadway	216		0	0	0	0	0	383.3	383.4	378.3	378.3	378.2	378.2	378.5	378.5	378.9	378.9	379.5	379.5
RSA1280B.1	74032	74034	60" CSP Culvert	269	10	21	23	21	38	50	373.8	373.6	378.3	378.3	378.3	378.2	378.5	378.5	378.9	378.9	379.7	379.5
RSA1280BRD	74032	74034	Roadway	269		0	0	0	0	0	382.4	383.3	378.3	378.3	378.3	378.3	378.5	378.5	378.9	378.9	379.7	379.7
RSA1280C.1	74031	74032	60" CSP Culvert	1331	10	22	26	21	39	50	374.4	373.8	378.3	378.3	378.3	378.3	378.6	378.5	379.2	378.9	380.2	379.7
RSA1280CRD	74031	74032	Roadway	1331		0	0	0	0	0	383.0	382.4	378.3	378.3	378.3	378.3	378.5	378.5	378.9	378.9	379.7	379.7
RSA1280D.1	74030	74031	60" CSP Culvert	1012	10	24	28	21	40	51	374.9	374.4	378.4	378.3	378.4	378.3	378.7	378.6	379.5	379.2	380.6	380.2
RSA1280DRD	74030	74031	Roadway	1022		0	0	0	0	0	384.9	383.0	378.3	378.3	378.3	378.3	378.6	378.6	379.2	379.2	380.2	380.2
RSA1290A.1	74026	74030	54" CSP Culvert	496	10	13	15	12	22	29	375.7	375.4	378.4	378.4	378.4	378.4	378.7	378.7	379.5	379.5	380.7	380.6
RSA1290ARD	74026	74030	Roadway	496		0	0	0	0	0	384.0	384.9	378.4	378.4	378.4	378.4	378.7	378.7	379.5	379.5	380.7	380.7
RSA1290B.1	74024	74026	48" CSP Culvert	182	10	14	15	12	23	30	376.3	376.2	378.5	378.4	378.4	378.4	378.7	378.7	379.6	379.5	380.8	380.7
RSA1290BRD	74024	74026	Roadway	182		0	0	0	0	0	384.8	384.0	378.4	378.4	378.4	378.4	378.7	378.7	379.5	379.5	380.7	380.7
RSA1290C.1	74022	74024	48" CSP Culvert	410	10	14	16	12	25	30	376.6	376.3	378.5	378.5	378.5	378.4	378.8	378.7	379.7	379.6	380.9	380.8
RSA1290CRD	74022	74024	Roadway	410		0	0	0	0	0	383.4	384.8	378.5	378.5	378.5	378.5	378.8	378.8	379.7	379.7	380.9	380.9
RSA1290D.1	74020	74022	42" CSP Culvert	880	10	14	16	13	28	32	377.4	376.6	379.2	378.5	379.3	378.5	379.2	378.8	380.3	379.7	381.9	380.9
RSA1290DRD	74020	74022	Roadway	880		0	0	0	0	0	385.7	383.4	378.5	378.5	378.5	378.5	378.8	378.8	379.7	379.7	380.9	380.9
RSA1150A1	72797	72796	72" CSP Culvert	167	25	92	93	103	109	126	374.8	375.0	378.8	378.2	378.8	378.2	379.0	378.4	379.2	378.5	379.6	378.9
RSA1150A2	72797	72796	72" CSP Culvert	155	25	93	94	104	110	128	374.8	375.0	378.8	378.2	378.8	378.2	379.0	378.4	379.2	378.5	379.6	378.9
RSA1150ARD	72797	72796	Roadway	160		0	0	0	0	0	384.4	384.7	378.8	378.8	378.8	378.8	379.0	379.0	379.2	379.2	379.6	379.6
RSA1150B	72734	72797	Natural	3273	25	180	182	199	211	246	377.1	375.1	382.6	378.8	382.6	378.8	382.8	379.0	382.9	379.2	383.3	379.6
RSA1160A.1	72733	72734	Bridge	92	25	144	154	156	171	195	378.7	378.6	382.7	382.6	382.7	382.6	382.9	382.8	383.0	382.9	383.3	383.3
RSA1160ARD	72733	72734	Roadway	92		0	0	0	0	0	387.8	387.8	382.6	382.6	382.6	382.6	382.8	382.8	382.9	382.9	383.3	383.3
RSA1160B	72732	72733	Natural	165	25	136	152	150	162	185	377.1	378.7	382.7	382.7	382.8	382.7	382.9	382.9	383.1	383.0	383.4	383.3
RSA1160C1	72731	72732	60" CSP Culvert	61	25	68	76	75	81	92	377.0	377.1	382.9	382.7	383.0	382.8	383.2	382.9	383.4	383.1	383.8	383.4
RSA1160C2	72731	72732	60" CSP Culvert	61	25	68	76	75	81	92	377.0	377.1	382.9	382.7	383.0	382.8	383.2	382.9	383.4	383.1	383.8	383.4
RSA1160CRD	72731	72732	Roadway	61		0	0	0	0	0	383.9	383.8	382.7	382.7	382.8	382.8	382.9	382.9	383.1	383.1	383.4	383.4
RSA1160D	72730	72731	Natural	769	25	136	150	149	162	184	377.9	377.0	383.2	382.9	383.3	383.0	383.5	383.2	383.8	383.4	384.3	383.8
RSA1160E1	72729	72730	72" CMP Culvert	89	25	68	74	74	81	92	378.4	377.9	383.4	383.2	383.5	383.3	383.7	383.5	384.0	383.8	384.7	384.3

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1160E2	72729	72730	72" CMP Culvert	89	25	68	75	74	81	92	378.4	377.9	383.4	383.2	383.5	383.3	383.7	383.5	384.0	383.8	384.7	384.3
RSA1160ERD	72729	72730	Roadway	89		0	0	0	0	0	386.5	386.5	383.2	383.2	383.3	383.3	383.5	383.5	383.8	383.8	384.3	384.3
RSA1160F	71940	72729	Natural	1207	25	136	149	147	163	184	379.1	378.4	383.5	383.4	383.6	383.5	383.8	383.7	384.1	384.0	384.7	384.7
RSA1160G.1	71941	71940	60" x 144" CMP Culvert	61	25	139	155	148	167	185	379.2	379.1	383.8	383.5	384.0	383.6	384.1	383.8	384.5	384.1	385.1	384.7
RSA1160GRD	71941	71940	Roadway	61		0	0	0	0	0	388.2	388.2	383.5	383.5	383.6	383.6	383.8	383.8	384.1	384.1	384.7	384.7
RSA1160H	72726	71941	Natural	650	25	141	159	151	169	188	379.5	379.2	383.9	383.8	384.1	384.0	384.2	384.1	384.6	384.5	385.3	385.1
RSA1170A	72736	72734	Natural	610	10	56	76	53	104	125	379.9	377.1	382.6	382.6	382.7	382.6	382.8	382.8	383.0	382.9	383.3	383.3
RSA1170B.1	72101	72736	60" CSP Culvert	140	25	20	25	17	43	51	380.1	380.0	382.7	382.6	382.7	382.7	382.9	382.8	383.0	383.0	383.3	383.3
RSA1170BRD	72101	72736	Roadway	140		0	0	0	0	0	393.0	393.0	382.6	382.6	382.7	382.7	382.8	382.8	383.0	383.0	383.3	383.3
RSA1170C	72735	72736	Natural	2200	10	14	18	13	23	27	382.7	379.9	383.8	382.6	384.0	382.7	383.8	382.8	384.2	383.0	384.3	383.3
RSA1170D.1	72100	72735	36" CSP Culvert	150	25	15	19	13	32	37	383.5	382.7	384.8	383.8	385.1	384.0	384.7	383.8	385.7	384.2	385.9	384.3
RSA1170DRD	72100	72735	Roadway	150		0	0	0	0	0	393.0	393.0	383.8	383.8	384.0	384.0	383.8	383.8	384.2	384.2	384.3	384.3
RSA1200A1	72725	72726	60" CMP Culvert	200	25	61	69	64	73	79	379.8	379.7	384.4	383.9	384.7	384.1	384.7	384.2	385.3	384.6	386.1	385.3
RSA1200A2	72725	72726	60" CMP Culvert	200	25	59	68	64	73	79	380.0	379.8	384.4	383.9	384.7	384.1	384.7	384.2	385.3	384.6	386.1	385.3
RSA1200ARD	72725	72726	Roadway	200		0	0	0	0	0	393.0	393.0	383.9	383.9	384.1	384.1	384.2	384.2	384.6	384.6	385.3	385.3
RSA1200B	72724	72725	Natural	950	25	124	142	128	152	163	380.6	379.8	384.4	384.4	384.8	384.7	384.8	384.7	385.3	385.3	386.1	386.1
RSA1230A.1	72723	72724	60" CMP Culvert	136	25	134	158	135	170	184	381.9	380.6	386.8	384.4	387.6	384.8	387.0	384.8	388.3	385.3	389.2	386.1
RSA1230ARD	72723	72724	Roadway	136		0	0	0	0	5	389.0	389.0	384.4	384.4	384.8	384.8	384.8	384.8	385.3	385.3	389.2	389.1
RSA1230B	72722	72723	Natural	900	25	129	149	128	164	177	381.6	381.9	386.9	386.8	387.7	387.6	387.1	387.0	388.3	388.3	389.2	389.2
RSA1230C	72721	72722	Natural	1400	25	140	172	134	212	235	382.6	381.6	387.0	386.9	387.8	387.7	387.2	387.1	388.4	388.3	389.3	389.2
RSA1230D1	72720	72721	36" CSP Culvert	68	25	49	62	46	81	90	382.7	382.7	388.0	387.0	389.3	387.8	388.1	387.2	390.5	388.4	391.8	389.3
RSA1230D2	72720	72721	36" CSP Culvert	68	25	49	62	46	81	90	382.6	382.6	388.0	387.0	389.3	387.8	388.1	387.2	390.5	388.4	391.8	389.3
RSA1230D3	72720	72721	36" CSP Culvert	68	25	49	62	46	81	90	382.6	382.6	388.0	387.0	389.3	387.8	388.1	387.2	390.5	388.4	391.8	389.3
RSA1230DRD	72720	72721	Roadway	68		0	0	0	0	0	393.7	393.7	387.0	387.0	387.8	387.8	387.2	387.2	388.4	388.4	389.3	389.3
RSA1230E	72719	72720	Natural	900	25	153	198	141	296	337	384.2	382.6	388.3	388.0	389.4	389.3	388.3	388.1	390.7	390.5	391.9	391.8
RSA1060F.1	85030	71215	48" CMP Culvert	30	10	23	21	27	30	34	366.2	365.7	368.8	368.8	368.7	368.7	369.1	369.0	369.4	369.4	370.0	370.0
RSA1060Fa	71214	85030	Natural	415	10	23	20	26	29	33	368.7	366.2	369.7	368.8	369.6	368.7	369.7	369.1	369.8	369.4	370.0	370.0
RSA1060FRD	85030	71215	Roadway	30		0	0	0	0	0	371.2	371.2	368.8	368.8	368.7	368.7	369.0	369.0	369.4	369.4	370.0	370.0
RSA1060G1	71213	71214	18" CMP Culvert	31	10	12	12	13	14	15	369.1	368.7	371.6	369.7	371.5	369.6	371.8	369.7	372.0	369.8	372.2	370.0
RSA1060G2	71213	71214	24" CMP Culvert	28	10	11	8	13	16	19	370.5	369.4	371.6	370.1	371.5	370.0	371.8	370.1	372.0	370.2	372.2	370.3
RSA1060GRD	71213	71214	Roadway	31		0	0	0	0	0	373.7	373.7	369.7	369.7	369.6	369.6	369.7	369.7	369.8	369.8	370.0	370.0

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft) 10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1060H	71212	71213	Natural	1034	10	23	21	27	30	34	370.3	369.1	371.8	371.6	371.8	371.5	372.0	371.8	372.2	372.0	372.4	372.2
RSA1060I1	71211	71212	18" CMP Culvert	42	10	11	10	13	15	18	370.7	370.5	372.4	371.8	372.3	371.8	372.6	372.0	372.9	372.2	373.2	372.4
RSA1060I2	71211	71212	18" CMP Culvert	42	10	12	11	14	16	18	370.7	370.3	372.4	371.8	372.3	371.8	372.6	372.0	372.9	372.2	373.2	372.4
RSA1060IRD	71211	71212	Roadway	42		0	0	0	0	0	375.7	375.7	371.8	371.8	371.8	371.8	372.0	372.0	372.2	372.2	372.4	372.4
RSA1060J	71210	71211	Natural	712	10	24	21	27	32	37	372.0	370.7	373.5	372.4	373.4	372.3	373.6	372.6	373.7	372.9	373.8	373.2
RSA1060S.1	85031	71210	36" x 72" CMP Culvert	18	10	32	31	30	38	43	371.8	372.1	373.8	373.5	373.8	373.4	373.9	373.6	374.0	373.7	374.2	373.8
RSA1060Sa	71209	85031	Natural	586	10	32	31	30	38	43	371.5	371.8	374.0	373.8	374.0	373.8	374.0	373.9	374.2	374.0	374.3	374.2
RSA1060SRD	85031	71210	Roadway	18		0	0	0	0	0	375.9	375.9	373.5	373.5	373.4	373.4	373.6	373.6	373.7	373.7	373.8	373.8
RSA1060U	72749	71209	Natural	308	10	55	54	53	67	74	371.3	371.5	374.2	374.0	374.2	374.0	374.2	374.0	374.5	374.2	374.6	374.3
RSA1080A.1	72748	72749	48" CMP Culvert	40	10	55	54	53	67	75	371.7	371.3	374.9	374.2	374.9	374.2	374.9	374.2	375.3	374.5	375.6	374.6
RSA1080ARD	72748	72749	Roadway	40		0	0	0	0	0	376.5	376.5	374.2	374.2	374.2	374.2	374.2	374.2	374.5	374.5	374.6	374.6
RSA1080B	72791	72748	Natural	1857	10	29	31	30	32	33	372.4	371.7	375.7	374.9	375.7	374.9	375.7	374.9	376.1	375.3	376.3	375.6
RSA1090A.1	72790	72791	36" CMP Culvert	438	10	29	30	30	31	32	374.4	372.4	378.7	375.7	379.0	375.7	378.9	375.7	379.3	376.1	379.9	376.3
RSA1090ARD	72790	72791	Roadway	438		0	0	0	0	1	379.8	379.7	375.7	375.7	375.7	375.7	375.7	375.7	376.1	376.1	379.9	379.7
RSA1090B	72789	72790	Natural	18	10	29	30	30	31	34	374.3	374.4	378.7	378.7	379.0	379.0	378.9	378.9	379.3	379.3	379.9	379.9
RSA1090C1	72788	72789	27" x 40" CMP Culvert	30	10	14	15	14	15	14	374.4	374.3	378.7	378.7	379.0	379.0	378.9	378.9	379.3	379.3	379.9	379.9
RSA1090C2	72788	72789	27" x 40" CMP Culvert	30	10	14	15	14	15	14	374.5	374.3	378.7	378.7	379.0	379.0	378.9	378.9	379.3	379.3	379.9	379.9
RSA1090CRD	72788	72789	Roadway	30		24	28	27	31	35	378.1	378.1	378.7	378.7	379.0	379.0	378.9	378.9	379.3	379.3	379.9	379.9
RSA1090D	72787	72788	Natural	386	10	23	25	25	25	27	374.7	374.4	378.7	378.7	379.0	379.0	379.0	378.9	379.4	379.3	379.9	379.9
RSA1090E1	72786	72787	24" CMP Culvert	40	10	7	8	7	7	7	375.1	374.7	378.7	378.7	379.0	379.0	379.0	379.0	379.4	379.4	379.9	379.9
RSA1090E2	72786	72787	24" CMP Culvert	40	10	7	8	7	7	7	375.2	374.7	378.7	378.7	379.0	379.0	379.0	379.0	379.4	379.4	379.9	379.9
RSA1090E3	72786	72787	24" CMP Culvert	40	10	7	8	7	7	7	375.0	374.7	378.7	378.7	379.0	379.0	379.0	379.0	379.4	379.4	379.9	379.9
RSA1090ERD	72786	72787	Roadway	40		19	25	23	28	27	377.9	377.9	378.7	378.7	379.0	379.0	379.0	379.0	379.4	379.4	379.9	379.9
RSA1090F	72785	72786	Natural	772	10	26	35	27	43	42	375.1	375.0	378.7	378.7	379.0	379.0	379.0	379.0	379.4	379.4	379.9	379.9
RSA1090G1	72784	72785	36" CMP Culvert	91	10	14	18	14	25	26	375.0	375.1	378.8	378.7	379.1	379.0	379.0	379.0	379.4	379.4	379.9	379.9
RSA1090G2	72784	72785	36" CMP Culvert	91	10	14	18	14	25	26	375.1	375.1	378.8	378.7	379.1	379.0	379.0	379.0	379.4	379.4	379.9	379.9
RSA1090GRD	72784	72785	Roadway	91		0	0	0	0	0	381.0	380.9	378.7	378.7	379.0	379.0	379.0	379.0	379.4	379.4	379.9	379.9
RSA1100A	72783	72784	Natural	19	10	14	16	16	16	17	376.0	375.0	378.8	378.8	379.1	379.1	379.0	379.0	379.4	379.4	379.9	379.9

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1100B.1	72782	72783	24" x 42" CMP Culvert	858	10	13	15	15	16	17	376.5	376.0	379.0	378.8	379.3	379.1	379.4	379.0	379.6	379.4	380.1	379.9
RSA1100BRD	72782	72783	Roadway	800		0	0	0	0	1	380.0	380.0	378.8	378.8	379.1	379.1	379.0	379.0	379.4	379.4	380.1	380.0
RSA1100C	72781	72782	Natural	9	10	13	15	15	16	17	376.5	376.5	379.1	379.0	379.4	379.3	379.4	379.4	379.6	379.6	380.1	380.1
RSA1100D.1	72780	72781	30" CSP Culvert	24	10	13	15	15	16	17	376.5	376.5	379.1	379.1	379.4	379.4	379.5	379.4	379.7	379.6	380.2	380.1
RSA1100DRD	72780	72781	Roadway	24		0	0	0	0	0	380.2	380.2	379.1	379.1	379.4	379.4	379.4	379.4	379.6	379.6	380.2	380.2
RSA1100E	72793	72780	Natural	133	10	12	14	14	15	16	376.6	376.5	379.1	379.1	379.4	379.4	379.5	379.5	379.7	379.7	380.2	380.2
RSA1100F.1	72792	72793	30" CSP Culvert	30	10	13	13	14	15	16	376.7	376.6	379.2	379.1	379.6	379.4	379.6	379.5	379.8	379.7	380.2	380.2
RSA1100FRD	72792	72793	Roadway	30		0	0	0	0	11	380.0	380.0	379.1	379.1	379.4	379.4	379.5	379.5	379.7	379.7	380.2	380.2
RSA1100G	72779	72792	Natural	135	10	13	14	14	16	16	376.8	376.7	379.2	379.2	379.6	379.6	379.6	379.6	379.8	379.8	380.2	380.2
RSA1100K	72798	72779	Natural	740	10	6	9	6	19	23	376.9	376.8	379.2	379.2	379.6	379.6	379.6	379.6	379.8	379.8	380.2	380.2
RSA1100L.1	72102	72798	36" CMP Culvert	292	10	12	19	12	34	42	378.2	376.9	379.8	379.2	380.4	379.6	379.9	379.6	382.4	379.8	383.9	380.2
RSA1100LRD	72102	72798	Roadway	292		0	0	0	0	0	413.5	413.5	379.2	379.2	379.6	379.6	379.6	379.6	379.8	379.8	380.2	380.2
RSA1100H	72778	72779	Natural	50	10	13	20	14	20	29	376.7	376.8	379.2	379.2	379.6	379.6	379.6	379.6	379.8	379.8	380.2	380.2
RSA1100I.1	72777	72778	24" CMP Culvert	70	25	15	21	15	22	22	376.9	376.7	380.3	379.2	381.8	379.6	380.7	379.6	382.3	379.8	382.5	380.2
RSA1100IRD	72777	72778	Roadway	70		0	0	0	0	10	382.3	382.3	379.2	379.2	379.6	379.6	379.6	379.6	382.3	382.3	382.5	382.4
RSA1100J	72776	72777	Natural	180	10	15	23	16	32	35	377.2	376.9	380.3	380.3	381.8	381.8	380.7	380.7	382.3	382.3	382.5	382.5
RSA1110A1	72103	72776	30" CSP Culvert	280	25	8	13	8	19	17	377.6	377.2	380.5	380.3	382.1	381.8	380.8	380.7	382.3	382.3	382.5	382.5
RSA1110A2	72103	72776	30" CSP Culvert	280	25	8	13	8	19	17	377.6	377.2	380.5	380.3	382.1	381.8	380.8	380.7	382.3	382.3	382.5	382.5
RSA1110ARD	72103	72776	Roadway	280		0	0	0	12	28	382.0	382.0	380.3	380.3	382.1	382.0	380.7	380.7	382.3	382.3	382.5	382.5
RSA1060K	71208	72740	Natural	800	10	25	27	28	29	26	371.6	366.7	372.3	370.2	372.3	370.1	372.3	370.3	372.3	370.6	372.3	371.1
RSA1060L	71207	71208	24" CMP Culvert	40	10	8	9	8	8	8	371.6	371.6	373.5	372.3	373.4	372.3	373.6	372.3	373.7	372.3	373.8	372.3
RSA1060M	71210	71207	Natural	550	10	10	11	9	9	8	370.8	371.6	373.5	373.5	373.4	373.4	373.6	373.6	373.7	373.7	373.8	373.8
RSA1060N.1	72754	72739	36" CMP Culvert	25	10	20	21	22	25	27	368.9	368.4	372.0	371.8	371.9	371.7	372.2	372.0	372.5	372.2	373.0	372.6
RSA1060NRD	72754	72739	Roadway	25		0	0	0	0	0	373.1	373.0	371.8	371.8	371.7	371.7	372.0	372.0	372.2	372.2	372.6	372.6
RSA1060O	72753	72754	Natural	320	10	21	21	22	24	26	371.4	368.9	372.7	372.0	372.7	371.9	372.7	372.2	372.8	372.5	373.0	373.0
RSA1060P.1	72752	72753	26" x 42" CMP Culvert	40	10	21	21	22	24	26	371.6	371.4	373.4	372.7	373.3	372.7	373.4	372.7	373.5	372.8	373.6	373.0
RSA1060PRD	72752	72753	Roadway	40		0	0	0	0	0	374.9	374.9	372.7	372.7	372.7	372.7	372.7	372.7	372.8	372.8	373.0	373.0
RSA1060Q	72751	72752	Natural	330	10	21	21	22	25	27	371.2	371.6	373.5	373.4	373.4	373.3	373.5	373.4	373.6	373.5	373.7	373.6
RSA1060R.1	72750	72751	36" CMP Culvert	40	10	22	22	22	26	29	371.5	371.2	373.9	373.5	373.9	373.4	373.9	373.5	374.1	373.6	374.3	373.7
RSA1060RRD	72750	72751	Roadway	40		0	0	0	0	0	375.4	375.4	373.5	373.5	373.4	373.4	373.5	373.5	373.6	373.6	373.7	373.7
RSA1060T	71209	72750	Natural	270	10	22	22	22	26	29	371.5	371.5	374.0	373.9	374.0	373.9	374.0	373.9	374.2	374.1	374.3	374.3

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1160I.1	59020	72726	60" CMP Culvert	1081	10	37	52	33	78	92	380.8	379.5	384.3	383.9	384.8	384.1	384.6	384.2	386.9	384.6	388.2	385.3
RSA1160IRD	59020	72726	Roadway	1081		0	0	0	0	0	388.8	393.0	384.3	384.3	384.8	384.8	384.6	384.6	386.9	386.9	388.2	388.2
RSA1210A.1	59021	59020	54" CSP Culvert	560	10	38	52	34	84	92	381.2	380.8	384.6	384.3	385.2	384.8	384.8	384.6	387.9	386.9	389.7	388.2
RSA1210ARD	59021	59020	Roadway	560		0	0	0	0	0	390.6	388.8	384.3	384.3	384.8	384.8	384.6	384.6	386.9	386.9	388.2	388.2
RSA1210B.1	59112	59021	48" CSP Culvert	1506	10	12	18	11	28	36	382.3	381.2	384.7	384.6	385.5	385.2	384.9	384.8	388.5	387.9	390.0	389.7
RSA1210BRD	59112	59021	Roadway	1506		0	0	0	0	0	390.0	390.6	384.7	384.7	385.5	385.5	384.9	384.9	388.5	388.5	390.0	390.0
RSA1210C.1	85032	59112	36" CSP Culvert	33	10	13	19	12	28	40	382.8	382.8	384.8	384.7	385.6	385.5	384.9	384.9	388.5	388.5	390.1	390.0
RSA1210CRD	85032	59112	Roadway	33		0	0	0	0	4	390.0	390.0	384.7	384.7	385.5	385.5	384.9	384.9	388.5	388.5	390.1	390.1
Flat Creek																						
RSFC010A	99329	70197	Natural	850	10	57	46	57	66	81	364.6	364.3	368.0	367.8	368.0	367.8	368.0	367.8	368.1	367.8	368.2	367.8
RSFC010B1	99330	99329	41' x 60" CMP Culvert	92	10	28	23	28	32	40	365.0	364.7	368.2	368.0	368.1	368.0	368.2	368.0	368.4	368.1	368.6	368.2
RSFC010B2	99330	99329	41' x 60" CMP Culvert	92	10	29	23	29	34	40	365.4	364.6	368.2	368.0	368.1	368.0	368.2	368.0	368.4	368.1	368.6	368.2
RSFC010BRD	99330	99329	Roadway	92		0	0	0	0	0	371.5	371.5	368.0	368.0	368.0	368.0	368.0	368.0	368.1	368.1	368.2	368.2
RSFC020A	72768	99330	Natural	750	10	57	46	57	66	81	365.3	364.7	368.4	368.2	368.2	368.1	368.4	368.2	368.5	368.4	368.8	368.6
RSFC020B1	72767	72768	36" CSP Culvert	72	10	28	23	28	33	41	366.1	365.3	368.7	368.4	368.4	368.2	368.7	368.4	369.0	368.5	369.5	368.8
RSFC020B2	72767	72768	36" CSP Culvert	72	10	29	23	29	33	41	366.3	365.3	368.7	368.4	368.4	368.2	368.7	368.4	369.0	368.5	369.5	368.8
RSFC020BRD	72767	72768	Roadway	72		0	0	0	0	0	372.0	372.0	368.4	368.4	368.2	368.2	368.4	368.4	368.5	368.5	368.8	368.8
RSFC020C	72766	72767	Natural	200	10	41	32	42	48	58	366.5	366.1	369.0	368.7	368.7	368.4	369.0	368.7	369.2	369.0	369.7	369.5
RSFC020D1	72765	72766	36" CSP Culvert	68	10	18	14	18	22	28	367.2	367.0	369.2	369.0	368.9	368.7	369.2	369.0	369.5	369.2	370.0	369.7
RSFC020D2	72765	72766	36" CSP Culvert	68	10	23	18	23	26	30	366.7	366.5	369.2	369.0	368.9	368.7	369.2	369.0	369.5	369.2	370.0	369.7
RSFC020Da	76952	72765	Natural	233	10	41	32	41	48	58	366.7	366.7	369.3	369.2	368.9	368.9	369.3	369.2	369.6	369.5	370.1	370.0
RSFC020Db.	76953	76952	50" x 76" CMP Culvert	63	10	41	32	41	48	58	366.8	366.7	369.5	369.3	369.1	368.9	369.5	369.3	369.8	369.6	370.3	370.1
RSFC020DbR	76953	76952	Roadway	63		0	0	0	0	0	373.9	374.0	369.5	369.5	369.1	369.1	369.5	369.5	369.8	369.8	370.3	370.3
RSFC020DRD	72765	72766	Roadway	68		0	0	0	0	0	372.2	372.2	369.0	369.0	368.7	368.7	369.0	369.0	369.2	369.2	369.7	369.7
RSFC020E	72764	76953	Natural	809	10	41	32	41	47	58	367.7	366.8	369.7	369.5	369.4	369.1	369.7	369.5	370.0	369.8	370.4	370.3
RSFC020F1	72763	72764	36" x 48" CMP Culvert	65	10	14	12	14	16	19	367.2	367.7	369.9	369.7	369.5	369.4	369.9	369.7	370.2	370.0	370.7	370.4
RSFC020F2	72763	72764	36" x 48" CMP Culvert	65	10	12	9	12	15	20	367.2	368.2	369.9	369.7	369.5	369.4	369.9	369.7	370.2	370.0	370.7	370.4

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSFC020F3	72763	72764	36" x 48" CMP Culvert	65	10	14	11	14	16	19	367.2	367.9	369.9	369.7	369.5	369.4	369.9	369.7	370.2	370.0	370.7	370.4
RSFC020FRD	72763	72764	Roadway	65		0	0	0	0	0	373.1	373.1	369.7	369.7	369.4	369.4	369.7	369.7	370.0	370.0	370.4	370.4
RSFC020G	72762	72763	Natural	800	10	42	33	41	52	64	368.2	367.2	370.1	369.9	369.8	369.5	370.1	369.9	370.3	370.2	370.9	370.7
RSFC030A1	72761	72762	82" x 84" CSP Culvert	55	10	22	17	21	29	36	368.5	368.2	370.2	370.1	369.9	369.8	370.2	370.1	370.4	370.3	370.9	370.9
RSFC030A2	72761	72762	82" x 84" CSP Culvert	55	10	22	17	21	29	36	368.5	368.2	370.2	370.1	369.9	369.8	370.2	370.1	370.4	370.3	370.9	370.9
RSFC030ARD	72761	72762	Roadway	55		0	0	0	0	0	374.7	374.7	370.1	370.1	369.8	369.8	370.1	370.1	370.3	370.3	370.9	370.9
RSFC030B	72244	72761	Natural	1456	10	18	16	20	22	26	370.4	368.5	371.0	370.2	371.2	369.9	371.3	370.2	371.3	370.4	371.4	370.9
RSFC050A	75660	72244	Natural	1294	10	19	17	20	24	28	372.2	370.4	373.3	371.0	373.1	371.2	373.1	371.3	373.2	371.3	373.3	371.4
RSFC050B1	75659	75660	24" CSP Culvert	61	10	6	6	7	8	10	372.5	372.2	373.6	373.3	373.5	373.1	373.7	373.1	373.8	373.3	374.0	373.3
RSFC050B2	75659	75660	24" CSP Culvert	61	10	7	6	7	9	10	372.5	372.2	373.6	373.3	373.5	373.1	373.7	373.1	373.8	373.2	374.0	373.3
RSFC050B3	75659	75660	24" CSP Culvert	61	10	6	6	6	8	10	372.5	372.3	373.6	373.3	373.5	373.1	373.7	373.2	373.8	373.3	374.0	373.4
RSFC050BRD	75659	75660	Roadway	61		0	0	0	0	0	376.9	377.0	373.6	373.6	373.5	373.5	373.7	373.7	373.8	373.8	374.0	374.0
RSFC050C	78673	75659	Natural	1056	10	13	11	13	14	17	375.9	372.5	376.6	373.6	376.6	373.5	376.7	373.7	376.7	373.8	376.7	374.0
RSFC050D1	75654	78673	12" CSP Culvert	25	10	6	5	6	6	7	376.1	375.9	378.4	376.6	378.2	376.6	378.5	376.7	378.6	376.7	379.0	376.7
RSFC050D2	75654	78673	12" CSP Culvert	25	10	3	3	4	4	5	377.2	377.0	378.4	377.8	378.2	377.7	378.5	377.9	378.6	377.9	379.0	377.9
RSFC050D3	75654	78673	12" CSP Culvert	25	10	3	3	4	4	5	377.2	377.0	378.4	377.8	378.2	377.7	378.5	377.8	378.6	377.9	379.0	377.9
RSFC050DRD	75654	78673	Roadway	25		0	0	0	0	0	379.2	379.2	376.6	376.6	376.6	376.6	376.7	376.7	376.7	376.7	376.7	376.7
RSFC050E	72799	75654	Natural	1016	10	15	15	15	21	24	374.9	376.1	378.4	378.4	378.2	378.2	378.5	378.5	378.6	378.6	379.0	379.0
RSFC060A.1	72800	72799	30" CSP Culvert	56	10	12	16	10	15	17	375.6	374.9	378.5	378.4	378.3	378.2	378.6	378.5	378.7	378.6	379.1	379.0
RSFC060ARD	72800	72799	Roadway	56		0	0	0	0	0	379.8	379.8	378.4	378.4	378.2	378.2	378.5	378.5	378.6	378.6	379.0	379.0
RSFC060B	72795	72800	Natural	850	10	6	6	4	6	8	376.7	375.6	378.5	378.5	378.3	378.3	378.6	378.6	378.7	378.7	379.1	379.1
RSFC070A.1	72794	72795	30" CSP Culvert	45	5	8	7	6	15	18	377.2	376.7	378.5	378.5	378.3	378.3	378.6	378.6	378.8	378.7	379.1	379.1
RSFC070ARD	72794	72795	Roadway	45		0	0	0	0	0	381.0	381.0	378.5	378.5	378.3	378.3	378.6	378.6	378.7	378.7	379.1	379.1
Spring Creek																						
OFALL#1	72014	76427	Natural	200	25	149	151	158	191	225	358.4	356.5	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8
RSSC010A1	72013	72014	48" x 72" CMP Culvert	51	25	75	75	79	96	112	358.7	358.4	363.5	362.8	363.5	362.8	363.5	362.8	363.9	362.8	364.3	362.8
RSSC010A2	72013	72014	48" x 72" CMP Culvert	51	25	75	75	79	96	112	358.8	358.5	363.5	362.8	363.5	362.8	363.5	362.8	363.9	362.8	364.3	362.8

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS		(ft)		10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSSC010ARD	72013	72014	Roadway	51		0	0	0	0	0	365.0	365.0	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8
RSSC010B	85033	72013	Natural	150	25	139	147	148	179	210	358.9	358.7	363.5	363.5	363.5	363.5	363.6	363.5	363.9	363.9	364.3	364.3
RSSC010D	79483	85033	Natural	392	25	139	146	148	179	210	358.9	358.9	363.6	363.6	363.6	363.6	363.7	363.7	364.1	364.0	364.5	364.4
RSSC010Da1	79482	79483	68" x 144" Box Culvert	38	25	69	72	74	89	104	359.0	359.0	363.6	363.6	363.7	363.6	363.7	363.7	364.1	364.1	364.5	364.5
RSSC010Da2	79482	79483	68" x 144" Box Culvert	38	25	70	73	75	90	105	358.9	358.9	363.6	363.6	363.7	363.6	363.7	363.7	364.1	364.1	364.5	364.5
RSSC010DaR	79482	79483	Roadway	38		0	0	0	0	0	367.1	367.1	363.6	363.6	363.6	363.6	363.7	363.7	364.1	364.1	364.5	364.5
RSSC010Db	72012	79482	Natural	1620	25	139	145	150	186	214	360.8	358.9	364.1	363.6	364.2	363.7	364.2	363.7	364.6	364.1	365.0	364.5
RSSC010E.1	72011	72012	Natural	13	25	141	148	153	193	224	360.5	360.8	364.1	364.1	364.2	364.2	364.2	364.2	364.6	364.6	365.0	365.0
RSSC010ERD	72011	72012	Roadway	13		0	0	0	0	0	368.3	368.3	364.1	364.1	364.2	364.2	364.2	364.2	364.6	364.6	365.0	365.0
RSSC035A	76560	72011	42" CSP Culvert	127	10	14	18	12	29	34	360.9	360.5	364.2	364.1	364.2	364.2	364.3	364.2	364.7	364.6	365.1	365.0
RSSC035ARD	76560	72011	Roadway	127		0	0	0	0	0	370.0	370.0	364.1	364.1	364.2	364.2	364.2	364.2	364.6	364.6	365.0	365.0
RSSC010F	72010	72011	Natural	100	25	132	138	144	182	210	361.1	360.6	364.1	364.1	364.2	364.2	364.2	364.2	364.6	364.6	365.0	365.0
RSSC010G.1	72009	72010	Natural	12	25	132	138	144	183	211	361.1	361.1	364.3	364.1	364.4	364.2	364.4	364.2	364.8	364.6	365.2	365.0
RSSC010GRD	72009	72010	Roadway	12		0	0	0			368.0	368.0										
RSSC010H	72008	72009	Natural	300	25	133	138	144	185	213	361.7	361.1	364.6	364.3	364.7	364.4	364.7	364.4	365.1	364.8	365.4	365.2
RSSC040D	72033	72008	Natural	800	10	12	17	11	23	26	364.2	361.7	365.1	364.6	365.3	364.7	365.1	364.7	365.5	365.1	365.6	365.4
RSSC040E.1	72032	72033	40" x 54" CMP Culvert	90	10	12	17	11	24	28	365.1	364.2	366.3	365.1	366.6	365.3	366.3	365.1	367.0	365.5	367.2	365.6
RSSC040ERD	72032	72033	Roadway	33		0	0	0	0	0	370.2	370.2	365.1	365.1	365.3	365.3	365.1	365.1	365.5	365.5	365.6	365.6
RSSC040F	72031	72032	Natural	530	10	12	17	11	27	32	365.9	365.1	367.1	366.3	367.3	366.6	367.0	366.3	367.6	367.0	367.8	367.2
RSSC050A1	72030	72031	48" CMP Culvert	50	10	6	9	6	15	18	363.4	363.9	367.1	367.1	367.3	367.3	367.0	367.0	367.7	367.6	367.8	367.8
RSSC050A2	72030	72031	48" CMP Culvert	50	10	6	9	5	15	17	363.6	364.0	367.1	367.1	367.3	367.3	367.0	367.0	367.7	367.6	367.8	367.8
RSSC050ARD	72030	72031	Roadway	33		0	0	0	0	0	373.5	373.5	367.1	367.1	367.3	367.3	367.0	367.0	367.6	367.6	367.8	367.8
RSSC040A	72007	72008	Natural	120	25	119	123	130	163	188	362.4	361.7	365.0	364.6	365.0	364.7	365.1	364.7	365.4	365.1	365.7	365.4
RSSC040B1	72006	72007	30" CSP Culvert	12	25	55	55	55	55	55	362.6	362.5	367.0	365.0	367.0	365.0	367.0	365.1	367.2	365.4	367.4	365.7
RSSC040B2	72006	72007	30" CSP Culvert	12	25	55	55	55	56	56	362.4	362.4	367.0	365.0	367.0	365.0	367.0	365.1	367.2	365.4	367.4	365.7
RSSC040BRD	72006	72007	Roadway	12		9	13	20	56	86	366.8	366.8	367.0	366.9	367.0	366.9	367.0	367.0	367.2	367.2	367.4	367.3
RSSC040C	72005	72006	Natural	800	25	119	123	130	164	188	363.5	362.4	367.3	367.0	367.4	367.0	367.4	367.0	367.7	367.2	367.9	367.4
RSSC060A.1	79470	72005	42" CSP Culvert	383	10	53	72	49	86	86	365.1	363.5	368.6	367.3	369.4	367.4	368.6	367.4	371.1	367.7	371.2	367.9
RSSC060ARD	79470	72005	Roadway	383		0	0	0	0	4	371.1	370.4	367.3	367.3	367.4	367.4	367.4	367.4	371.1	370.4	371.2	370.4
RSSC060B.1	76587	79470	54" CSP Culvert	2906	10	31	41	29	47	44	368.2	365.1	370.5	368.6	371.3	369.4	370.4	368.6	373.1	371.1	372.8	371.2
RSSC060BRD	76587	79470	Roadway	2906		0	0	0	0	0	374.4	371.1	368.6	368.6	369.4	369.4	368.6	368.6	372.0	371.1	372.1	371.2

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSSC070A.1	76569	76587	48" CMP Culvert	919	10	20	29	19	41	51	369.2	368.4	371.3	370.5	372.0	371.3	371.3	370.4	373.6	373.1	373.5	372.8
RSSC070ARD	76569	76587	Roadway	919		0	0	0	0	0	375.2	374.4	370.5	370.5	371.3	371.3	370.4	370.4	373.1	373.1	372.8	372.8
RSSC080A.1	76564	76569	36" CSP Culvert	69	10	20	29	19	44	51	369.3	369.2	371.6	371.3	372.3	372.0	371.5	371.3	374.0	373.6	374.3	373.5
RSSC080ARD	76564	76569	Roadway	69		0	0	0	0	0	375.3	375.2	371.3	371.3	372.0	372.0	371.3	371.3	373.6	373.6	373.5	373.5
RSSC090A1	72004	72005	48" x 84" Box Culvert	92	10	40	40	43	52	62	364.4	364.1	367.4	367.3	367.4	367.4	367.5	367.4	367.8	367.7	368.0	367.9
RSSC090A2	72004	72005	48" x 84" Box Culvert	92	10	40	40	43	52	62	364.4	364.1	367.4	367.3	367.4	367.4	367.5	367.4	367.8	367.7	368.0	367.9
RSSC090ARD	72004	72005	Roadway	92		0	0	0	0	0	370.4	370.4	367.3	367.3	367.4	367.4	367.4	367.4	367.7	367.7	367.9	367.9
RSSC090B	72003	72004	Natural	2880	10	61	62	65	78	93	367.1	364.1	370.2	367.4	370.3	367.4	370.4	367.5	370.8	367.8	371.1	368.0
RSSC100A1	72002	72003	48" CMP Culvert	85	10	32	32	35	45	52	367.0	367.1	370.5	370.2	370.6	370.3	370.7	370.4	371.2	370.8	371.6	371.1
RSSC100A2	72002	72003	48" CMP Culvert	85	10	32	32	35	45	52	367.0	367.1	370.5	370.2	370.6	370.3	370.7	370.4	371.2	370.8	371.6	371.1
RSSC100ARD	72002	72003	Roadway	85		0	0	0	0	0	372.4	372.4	370.2	370.2	370.3	370.3	370.4	370.4	370.8	370.8	371.1	371.1
RSSC100B	75387	72002	Natural	1238	10	54	59	58	80	90	366.9	367.0	370.6	370.5	370.6	370.6	370.7	370.7	371.2	371.2	371.7	371.6
RSSC100C.1	75386	75387	48" x 96" Box Culvert	92	10	59	71	61	97	112	366.9	366.9	370.6	370.6	370.7	370.6	370.8	370.7	371.3	371.2	371.8	371.7
RSSC100CRD	75386	75387	Roadway	92		0	0	0	0	0	373.7	373.7	370.6	370.6	370.7	370.7	370.8	370.8	371.3	371.3	371.8	371.8
RSSC100D	72770	75386	Natural	371	10	61	75	62	102	118	367.5	366.9	370.6	370.6	370.7	370.7	370.8	370.8	371.3	371.3	371.8	371.8
RSSC110A	72001	72770	Natural	1700	10	56	84	54	114	131	367.9	367.5	370.7	370.6	370.8	370.7	370.9	370.8	371.3	371.3	371.8	371.8
RSSC110B.1	72000	72001	72" CMP Culvert	61	10	65	94	60	145	169	368.2	367.9	371.3	370.7	371.9	370.8	371.4	370.9	372.9	371.3	373.4	371.8
RSSC110BRD	72000	72001	Roadway	61		0	0	0	0	0	378.2	378.2	370.7	370.7	370.8	370.8	370.9	370.9	371.3	371.3	371.8	371.8
Willamette Overflow																						
RSWO010A	99820	72088	Natural	1050	25	97	76	109	110	153	362.6	362.4	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.7
RSWO020A.1	99827	99820	36" CSP Culvert	675	5	31	46	32	47	48	367.7	365.8	372.7	370.7	375.1	370.7	372.8	370.7	375.4	370.7	375.5	370.7
RSWO020ARD	99827	99820	Roadway	675		0	1	0	11	21	375.0	375.0	372.7	372.7	375.1	375.0	372.8	372.8	375.4	375.1	375.5	375.2
RSWO010B	72086	99820	Natural	1950	10	85	56	91	94	105	364.9	362.6	370.8	370.7	370.7	370.7	370.8	370.7	370.8	370.7	370.8	370.7
RSWO040A1	72085	72086	72" CMP Culvert	61	10	7	3	8	9	11	370.6	369.3	371.1	370.8	370.9	370.7	371.2	370.8	371.2	370.8	371.3	370.8
RSWO040A2	72085	72086	72" CMP Culvert	61	10	5	2	7	7	9	370.6	369.5	371.1	370.8	370.9	370.7	371.2	370.8	371.2	370.8	371.3	370.8
RSWO040A3	72085	72086	60" CMP Culvert	61	10	73	52	76	78	84	366.6	364.9	371.1	370.8	370.9	370.7	371.2	370.8	371.2	370.8	371.3	370.8
RSWO040ARD	72085	72086	Roadway	61		0	0	0	0	0	380.1	380.1	370.8	370.8	370.7	370.7	370.8	370.8	370.8	370.8	370.8	370.8
RSWO040B	73907	72085	Natural	570	10	85	56	91	94	105	368.1	366.6	371.2	371.1	371.0	370.9	371.3	371.2	371.3	371.2	371.4	371.3
RSWO040C.1	73910	73907	60" CMP Culvert	760	10	83	56	88	92	103	370.8	368.1	375.1	371.2	373.9	371.0	375.5	371.3	376.0	371.3	376.8	371.4

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSWO040CRD	73910	73907	Roadway	760		0	0	0	0	0	382.0	382.0	371.2	371.2	371.0	371.0	371.3	371.3	371.3	371.3	371.4	371.4
RSWO045A	72084	73910	Natural	570	10	81	56	85	90	100	371.5	370.8	375.2	375.1	374.1	373.9	375.5	375.5	376.0	376.0	376.9	376.8
RSWO045B1	72083	72084	72" CMP Culvert	68	10	42	30	43	47	51	371.5	371.5	375.3	375.2	374.3	374.1	375.6	375.5	376.1	376.0	376.9	376.9
RSWO045B2	72083	72084	72" CMP Culvert	68	10	40	27	42	45	51	371.8	371.6	375.3	375.2	374.3	374.1	375.6	375.5	376.1	376.0	376.9	376.9
RSWO045BRD	72083	72084	Roadway	68		0	0	0	0	0	380.5	380.5	375.2	375.2	374.1	374.1	375.5	375.5	376.0	376.0	376.9	376.9
RSWO045C	72082	72083	Natural	850	10	83	59	87	95	105	372.2	371.5	375.7	375.3	374.9	374.3	375.9	375.6	376.3	376.1	377.1	376.9
RSWO050A1	72081	72082	72" CSP Culvert	46	10	41	29	43	48	53	372.2	372.4	375.8	375.7	375.0	374.9	376.0	375.9	376.4	376.3	377.1	377.1
RSWO050A2	72081	72082	72" CSP Culvert	46	10	43	31	45	50	55	372.4	372.2	375.8	375.7	375.0	374.9	376.0	375.9	376.4	376.3	377.1	377.1
RSWO050ARD	72081	72082	Roadway	46		0	0	0	0	0	384.7	384.7	375.7	375.7	374.9	374.9	375.9	375.9	376.3	376.3	377.1	377.1
RSWO050B	70615	72081	Natural	1353	10	83	62	86	98	109	375.2	372.2	377.4	375.8	377.1	375.0	377.4	376.0	377.6	376.4	377.7	377.1
RSWO050C	72080	70615	Natural	141	10	83	63	86	98	109	375.5	375.2	378.2	377.4	377.9	377.1	378.2	377.4	378.4	377.6	378.5	377.7
RSWO060A	74014	72080	Natural	693	10	83	65	86	98	109	370.5	375.5	378.2	378.2	377.9	377.9	378.3	378.2	378.4	378.4	378.5	378.5
RSWO060B	74013	74014	Natural	420	10	85	75	88	100	111	369.2	370.5	378.2	378.2	377.9	377.9	378.3	378.3	378.4	378.4	378.5	378.5
RSWO070A	74009	74013	Natural	288	10	83	79	83	98	107	377.0	371.4	378.5	378.2	378.5	377.9	378.5	378.3	378.7	378.4	378.8	378.5
RSWO070B1	74008	74009	48" CSP Culvert	501	10	29	28	29	34	37	378.3	376.8	380.2	378.5	380.1	378.5	380.2	378.5	380.4	378.7	380.5	378.8
RSWO070B2	74008	74009	48" CSP Culvert	501	10	27	25	27	32	35	378.2	377.0	380.2	378.5	380.1	378.5	380.2	378.5	380.4	378.7	380.5	378.8
RSWO070B3	74008	74009	48" CSP Culvert	501	10	28	26	28	33	35	378.1	377.0	380.2	378.6	380.1	378.5	380.2	378.6	380.4	378.7	380.5	378.8
RSWO070BRD	74008	74009	Roadway	501		0	0	0	0	0	384.1	384.1	378.5	378.5	378.5	378.5	378.5	378.5	378.7	378.7	378.8	378.8
RSWO070C	74007	74008	Natural	826	10	83	80	83	98	107	378.9	378.1	381.1	380.2	381.1	380.1	381.1	380.2	381.3	380.4	381.4	380.5
RSWO070D.1	74006	74007	18" CMP Culvert	253	10	9	9	9	9	9	378.5	378.9	386.7	381.1	386.7	381.1	386.7	381.1	386.8	381.3	386.8	381.4
RSWO070DRD	74006	74007	Roadway	250		75	72	75	90	99	386.0	386.0	386.7	386.4	386.7	386.4	386.7	386.4	386.8	386.4	386.8	386.4
RSWO070E	74005	74006	Natural	296	10	83	80	83	98	107	378.3	378.5	386.7	386.7	386.7	386.7	386.7	386.7	386.8	386.8	386.8	386.8
RSWO080A.1	74004	74005	48" CSP Culvert	43	10	83	80	83	99	107	378.5	378.3	387.5	386.7	387.4	386.7	387.5	386.7	387.9	386.8	388.1	386.8
RSWO080ARD	74004	74005	Roadway	43		0	0	0	0	0	388.2	388.2	386.7	386.7	386.7	386.7	386.7	386.7	386.8	386.8	386.8	386.8
RSWO090A	78833	74004	Natural	197	10	69	71	69	83	88	377.2	378.5	387.5	387.5	387.4	387.4	387.5	387.5	387.9	387.9	388.1	388.1
RSWO090Aa	74003	78833	Natural	208	10	68	69	68	82	88	380.1	377.2	387.5	387.5	387.5	387.4	387.5	387.5	387.9	387.9	388.2	388.1
RSWO090B	75433	74003	Natural	153	10	68	83	68	82	87	380.6	380.1	387.6	387.5	387.5	387.5	387.6	387.5	388.0	387.9	388.3	388.2
RSWO090C	74001	75433	Natural	112	10	68	88	68	82	87	377.5	380.6	387.6	387.6	387.5	387.5	387.6	387.6	388.0	388.0	388.3	388.3
RSWO090D	74405	74001	Natural	251	10	67	99	67	82	87	379.3	377.5	387.6	387.6	387.5	387.5	387.6	387.6	388.0	388.0	388.3	388.3
RSWO090E.1	74406	74405	84" x 120" CMP Culvert	71	10	63	94	62	77	81	379.8	379.3	387.6	387.6	387.5	387.5	387.6	387.6	388.0	388.0	388.3	388.3
RSWO090ERD	74406	74405	Roadway	71		0	0	0	0	0	389.4	389.4	387.6	387.6	387.5	387.5	387.6	387.6	388.0	388.0	388.3	388.3
RSWO090F	76415	74406	Natural	146	10	63	95	62	76	80	380.0	379.8	387.6	387.6	387.5	387.5	387.6	387.6	388.0	388.0	388.3	388.3

APPENDIX B
TABLE B-3
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER EXISTING LAND USE CONDITIONS

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) Existing Land Use Conditions					Invert Elevation (ft)		Water Surface Elevation under Existing Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS
RSWO090G.1	76414	76415	84" x 120" CMP Culvert	57	10	63	97	64	76	80	379.9	380.0	387.6	387.6	387.6	387.5	387.6	387.6	388.1	388.0	388.3	388.3
RSWO090GRD	76414	76415	Roadway	57		0	0	0	0	0	390.1	390.0	387.6	387.6	387.5	387.5	387.6	387.6	388.0	388.0	388.3	388.3
RSWO090H	58287	76414	Natural	116	10	62	98	66	76	80	380.5	379.9	387.6	387.6	387.6	387.6	387.6	387.6	388.1	388.1	388.3	388.3
RSWO110A.1	58310	58287	36" CSP Culvert	47	10	62	99	68	76	80	381.0	380.5	389.2	387.6	389.1	387.6	389.1	387.6	390.4	388.1	390.8	388.3
RSWO110ARD	58310	58287	Roadway	26		0	0	0	0	0	392.0	389.0	387.6	387.6	387.6	387.6	387.6	387.6	388.1	388.1	388.3	388.3
RSWO110B.1	58311	58310	54" CSP Culvert	387	10	62	99	68	64	63	376.5	374.8	389.7	389.2	389.8	389.1	389.7	389.1	390.4	390.4	390.9	390.8
RSWO110BRD	58311	58310	Roadway	388		0	0	0	59	76	389.8	389.8	389.2	389.2	389.1	389.1	389.1	389.1	390.4	390.4	390.9	390.8
RSWO110C.1	58315	58311	27" CSP Culvert	1155	10	5	7	6	7	7	379.9	376.5	389.6	389.7	389.6	389.8	389.6	389.7	390.4	390.4	390.9	390.9
RSWO110CRD	58315	58311	Roadway	1154		0	0	0	-49	-69	389.8	389.1	389.6	389.7	389.6	389.8	389.6	389.7	390.4	390.4	390.9	390.9
RSWO140	77703	58311	54" CSP Culvert	544	10	64	85	56	139	162	379.7	376.5	390.3	389.7	390.8	389.8	390.2	389.7	393.1	390.4	394.4	390.9

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
Spring Creek																						
OFALL#1	72014	76427	Natural	200	25	358.4	356.5	175	180	182	211	243	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8
RSSC010A1	72013	72014	48" x 72" CMP Culvert	51	25	358.7	358.4	87	90	91	105	121	363.7	362.8	363.8	362.8	363.8	362.8	364.1	362.8	364.5	362.8
RSSC010A2	72013	72014	48" x 72" CMP Culvert	51	25	358.8	358.5	87	90	91	105	121	363.7	362.8	363.8	362.8	363.8	362.8	364.1	362.8	364.5	362.8
RSSC010ARD	72013	72014	Roadway	51		365.0	365.0	0	0	0	0	0	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8	362.8
RSSC010B	85033	72013	Natural	150	25	358.9	358.7	163	175	172	199	229	363.7	363.7	363.8	363.8	363.8	363.8	364.1	364.1	364.5	364.5
RSSC010D	79483	85033	Natural	392	25	358.9	358.9	163	174	172	199	229	363.9	363.8	364.0	363.9	364.0	363.9	364.3	364.3	364.7	364.7
RSSC010Da1	79482	79483	68" x 144" Box Culvert	38	25	359.0	359.0	81	86	85	99	114	363.9	363.9	364.0	364.0	364.0	364.0	364.3	364.3	364.8	364.7
RSSC010Da2	79482	79483	68" x 144" Box Culvert	38	25	358.9	358.9	82	87	87	100	115	363.9	363.9	364.0	364.0	364.0	364.0	364.3	364.3	364.8	364.7
RSSC010DaR	79482	79483	Roadway	38		367.1	367.1	0	0	0	0	0	363.9	363.9	364.0	364.0	364.0	364.0	364.3	364.3	364.7	364.7
RSSC010Db	72012	79482	Natural	1620	25	360.8	358.9	166	173	174	202	231	364.4	363.9	364.5	364.0	364.5	364.0	364.8	364.3	365.2	364.8
RSSC010E.1	72011	72012	Natural	13	25	360.5	360.8	170	175	176	211	237	364.4	364.4	364.5	364.5	364.5	364.5	364.8	364.8	365.2	365.2
RSSC010ERD	72011	72012	Roadway	13		368.3	368.3	0	0	0	0	0	364.4	364.4	364.5	364.5	364.5	364.5	364.8	364.8	365.2	365.2
RSSC035A	76560	72011	42" CSP Culvert	127	10	360.9	360.5	14	18	13	29	35	364.5	364.4	364.6	364.5	364.6	364.5	364.9	364.8	365.3	365.2
RSSC035ARD	76560	72011	Roadway	127		370.0	370.0	0	0	0	0	0	364.4	364.4	364.5	364.5	364.5	364.5	364.8	364.8	365.2	365.2
RSSC010F	72010	72011	Natural	100	25	361.1	360.6	161	165	166	199	221	364.4	364.4	364.5	364.5	364.5	364.5	364.8	364.8	365.2	365.2
RSSC010G.1	72009	72010	Natural	12	25	361.1	361.1	162	166	167	200	222	364.6	364.4	364.7	364.5	364.7	364.5	365.0	364.8	365.4	365.2
RSSC010GRD	72009	72010	Roadway	12		368.0	368.0	0	0	0	0	0										
RSSC010H	72008	72009	Natural	300	25	361.7	361.1	163	167	167	201	224	364.9	364.6	365.0	364.7	365.0	364.7	365.3	365.0	365.6	365.4
RSSC040D	72033	72008	Natural	800	10	364.2	361.7	12	18	11	24	27	365.2	364.9	365.3	365.0	365.1	365.0	365.5	365.3	365.6	365.6
RSSC040E.1	72032	72033	40" x 54" CMP Culvert	90	10	365.1	364.2	13	18	12	25	29	366.4	365.2	366.7	365.3	366.3	365.1	367.1	365.5	367.3	365.6
RSSC040ERD	72032	72033	Roadway	33		370.2	370.2	0	0	0	0	0	365.2	365.2	365.3	365.3	365.1	365.1	365.5	365.5	365.6	365.6
RSSC040F	72031	72032	Natural	530	10	365.9	365.1	13	18	12	29	33	367.1	366.4	367.3	366.7	367.0	366.3	367.7	367.1	367.8	367.3
RSSC050A1	72030	72031	48" CMP Culvert	50	10	363.4	363.9	7	9	6	16	18	367.1	367.1	367.3	367.3	367.0	367.0	367.7	367.7	367.9	367.8
RSSC050A2	72030	72031	48" CMP Culvert	50	10	363.6	364.0	6	9	6	16	18	367.1	367.1	367.3	367.3	367.0	367.0	367.7	367.7	367.9	367.8
RSSC050ARD	72030	72031	Roadway	33		373.5	373.5	0	0	0	0	0	367.1	367.1	367.3	367.3	367.0	367.0	367.7	367.7	367.8	367.8
RSSC040A	72007	72008	Natural	120	25	362.4	361.7	147	149	151	179	202	365.3	364.9	365.3	365.0	365.3	365.0	365.6	365.3	365.9	365.6
RSSC040B1	72006	72007	Pedestrian Bridge	12	25	362.4	362.4	147	149	151	179	191	365.9	365.3	366.0	365.3	366.0	365.3	366.6	365.6	367.0	365.9
RSSC040BRD	72006	72007	Roadway	12		366.8	366.8	0	0	0	0	13	365.3	365.3	365.3	365.3	365.3	365.3	365.6	365.6	367.0	366.9
RSSC040C	72005	72006	Natural	800	25	363.5	362.4	148	150	152	180	203	367.1	365.9	367.1	366.0	367.1	366.0	367.5	366.6	367.8	367.0
RSSC060A.1	79470	72005	42" CSP Culvert	383	10	365.1	363.5	68	88	64	88	88	369.5	367.1	371.1	367.1	369.2	367.1	371.2	367.5	371.4	367.8

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
RSSC060ARD	79470	72005	Roadway	383		371.1	370.4	0	0	0	4	12	367.1	367.1	371.1	370.4	367.1	367.1	371.2	370.5	371.4	370.5
RSSC060B.1	76587	79470	54" CSP Culvert	2906	10	368.2	365.1	41	50	38	49	47	371.3	369.5	373.2	371.1	371.0	369.2	373.0	371.2	373.1	371.4
RSSC060BRD	76587	79470	Roadway	2906		374.4	371.1	0	0	0	0	0	369.5	369.5	373.1	371.1	369.2	369.2	372.1	371.2	372.3	371.4
RSSC070A.1	76569	76587	48" CMP Culvert	919	10	369.2	368.4	29	33	27	46	51	372.0	371.3	373.8	373.2	371.8	371.0	373.6	373.0	373.7	373.1
RSSC070ARD	76569	76587	Roadway	919		375.2	374.4	0	0	0	0	0	371.3	371.3	373.2	373.2	371.0	371.0	373.0	373.0	373.1	373.1
RSSC080A.1	76564	76569	36" CSP Culvert	69	10	369.3	369.2	2	2	2	4	4	372.0	372.0	373.8	373.8	371.8	371.8	373.6	373.6	373.7	373.7
RSSC080ARD	76564	76569	Roadway	69		375.3	375.2	0	0	0	0	0	372.0	372.0	373.8	373.8	371.8	371.8	373.6	373.6	373.7	373.7
RSSC090A1	72004	72005	48" x 84" Box Culvert	92	10	364.4	364.1	43	43	47	55	65	367.2	367.1	367.2	367.1	367.2	367.1	367.6	367.5	367.9	367.8
RSSC090A2	72004	72005	48" x 84" Box Culvert	92	10	364.4	364.1	43	43	47	55	65	367.2	367.1	367.2	367.1	367.2	367.1	367.6	367.5	367.9	367.8
RSSC090ARD	72004	72005	Roadway	92		370.4	370.4	0	0	0	0	0	367.1	367.1	367.1	367.1	367.1	367.1	367.5	367.5	367.8	367.8
RSSC090B	72003	72004	Natural	2880	10	367.1	364.1	66	69	72	86	102	370.5	367.2	370.5	367.2	370.6	367.2	371.0	367.6	371.3	367.9
RSSC100A1	72002	72003	48" CMP Culvert	85	10	367.0	367.1	35	36	38	50	57	370.8	370.5	370.9	370.5	371.0	370.6	371.5	371.0	372.0	371.3
RSSC100A2	72002	72003	48" CMP Culvert	85	10	367.0	367.1	35	36	38	50	57	370.8	370.5	370.9	370.5	371.0	370.6	371.5	371.0	372.0	371.3
RSSC100ARD	72002	72003	Roadway	85		372.4	372.4	0	0	0	0	0	370.5	370.5	370.5	370.5	370.6	370.6	371.0	371.0	371.3	371.3
RSSC100B	75387	72002	Natural	1238	10	366.9	367.0	60	67	64	90	101	370.8	370.8	370.9	370.9	371.0	371.0	371.5	371.5	372.0	372.0
RSSC100C.1	75386	75387	48" x 96" Box Culvert	92	10	366.9	366.9	66	81	68	110	123	370.8	370.8	371.0	370.9	371.1	371.0	371.6	371.5	372.1	372.0
RSSC100CRD	75386	75387	Roadway	92		373.7	373.7	0	0	0	0	0	370.8	370.8	371.0	371.0	371.1	371.1	371.6	371.6	372.1	372.1
RSSC100D	72770	75386	Natural	371	10	367.5	366.9	68	86	69	116	131	370.9	370.8	371.0	371.0	371.1	371.1	371.6	371.6	372.1	372.1
RSSC110A	72001	72770	Natural	1700	10	367.9	367.5	58	86	57	117	135	370.9	370.9	371.1	371.0	371.2	371.1	371.7	371.6	372.2	372.1
RSSC110B.1	72000	72001	72" CMP Culvert	61	10	368.2	367.9	69	99	63	152	177	371.5	370.9	372.0	371.1	371.6	371.2	373.1	371.7	373.6	372.2
RSSC110BRD	72000	72001	Roadway	61		378.2	378.2	0	0	0	0	0	370.9	370.9	371.1	371.1	371.2	371.2	371.7	371.7	372.2	372.2
Pipe Segments associated with some UIC CP Pipe and Pretreat Projects																						
Cindy	Zinnia-2	76891	24" CSP Culvert	675	10	375.5	373.1	2	2	2	4	5	376.0	374.9	377.0	377.0	376.0	374.6	377.4	377.5	378.1	377.8
Ferndale	Zinnia-1	76903	24" CSP Culvert	575	10	375.5	374.5	2	6	2	8	-8	378.4	378.4	380.9	380.9	377.9	377.9	381.3	381.8	381.6	381.8
River R	76908	76903	24" CSP Culvert	79.91	10	374.6	374.5	15	20	13	25	25	378.8	378.4	381.6	380.9	378.3	377.9	382.4	381.8	382.8	381.8
River R-1	76903	76891	24" CSP Culvert	758.5	10	374.5	373.1	16	19	14	19	19	378.4	374.9	380.9	377.0	377.9	374.6	381.8	377.5	381.8	377.8
River R-2	76891	76569	27" CSP Culvert	905.75	10	373.1	369.2	18	20	16	21	21	374.9	372.0	377.0	373.8	374.6	371.8	377.5	373.6	377.8	373.7

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
Willamette Overflow																						
RSWO010A	99820	72088	Natural	1050	25	362.6	362.4	96	106	99	137	171	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.7
RSWO020A.1	99827	99820	36" CSP Culvert	675	5	367.7	365.8	36	47	38	48	49	373.4	370.7	375.3	370.7	373.6	370.7	375.5	370.7	375.6	370.7
RSWO020ARD	99827	99820	Roadway	675		375.0	375.0	0	10	0	25	41	373.4	373.4	375.3	375.1	373.6	373.6	375.5	375.2	375.6	375.2
RSWO010B	72086	99820	Natural	1950	10	364.9	362.6	58	41	65	53	63	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.8	370.7
RSWO040A1	72085	72086	72" CMP Culvert	61	10	370.6	369.3	3	1	3	2	3	370.9	370.7	370.8	370.7	371.0	370.7	370.9	370.7	371.0	370.8
RSWO040A2	72085	72086	72" CMP Culvert	61	10	370.6	369.5	2	1	3	1	2	370.9	370.7	370.8	370.7	371.0	370.7	370.9	370.7	371.0	370.8
RSWO040A3	72085	72086	60" CMP Culvert	61	10	366.6	364.9	53	38	59	44	55	370.9	370.7	370.8	370.7	371.0	370.7	370.9	370.7	371.0	370.8
RSWO040ARD	72085	72086	Roadway	61		380.1	380.1	0	0	0	0	0	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.7	370.8	370.8
RSWO040B	73907	72085	Natural	570	10	368.1	366.6	58	40	65	47	61	371.0	370.9	370.9	370.8	371.1	371.0	370.9	370.9	371.0	371.0
RSWO040C.1	73910	73907	60" CMP Culvert	760	10	370.8	368.1	56	34	62	45	59	373.9	371.0	373.0	370.9	374.2	371.1	373.4	370.9	374.0	371.0
RSWO040CRD	73910	73907	Roadway	760		382.0	382.0	0	0	0	0	0	371.0	371.0	370.9	370.9	371.1	371.1	370.9	370.9	371.0	371.0
RSWO045A	72084	73910	Natural	570	10	371.5	370.8	53	22	58	42	54	374.1	373.9	373.1	373.0	374.3	374.2	373.7	373.4	374.2	374.0
RSWO045B1	72083	72084	72" CMP Culvert	68	10	371.5	371.5	27	11	30	22	28	374.2	374.1	373.2	373.1	374.5	374.3	373.8	373.7	374.3	374.2
RSWO045B2	72083	72084	72" CMP Culvert	68	10	371.8	371.6	25	9	28	20	26	374.2	374.1	373.2	373.1	374.5	374.3	373.8	373.7	374.3	374.2
RSWO045BRD	72083	72084	Roadway	68		380.5	380.5	0	0	0	0	0	374.1	374.1	373.1	373.1	374.3	374.3	373.7	373.7	374.2	374.2
RSWO045C	72082	72083	Natural	850	10	372.2	371.5	53	21	58	41	54	374.8	374.2	373.8	373.2	375.0	374.5	374.5	373.8	374.9	374.3
RSWO050A1	72081	72082	72" CSP Culvert	46	10	372.2	372.4	26	10	28	20	26	374.9	374.8	373.9	373.8	375.1	375.0	374.6	374.5	375.0	374.9
RSWO050A2	72081	72082	72" CSP Culvert	46	10	372.4	372.2	28	11	30	22	28	374.9	374.8	373.9	373.8	375.1	375.0	374.6	374.5	375.0	374.9
RSWO050ARD	72081	72082	Roadway	46		384.7	384.7	0	0	0	0	0	374.8	374.8	373.8	373.8	375.0	375.0	374.5	374.5	374.9	374.9
RSWO050B	70615	72081	Natural	1353	10	375.2	372.2	48	11	51	36	48	376.9	374.9	376.1	373.9	376.9	375.1	376.7	374.6	376.9	375.0
RSWO050C	72080	70615	Natural	141	10	375.5	375.2	48	11	51	36	48	377.7	376.9	376.8	376.1	377.7	376.9	377.5	376.7	377.7	376.9
RSWO060A	74014	72080	Natural	693	10	370.5	375.5	47	12	50	35	48	377.7	377.7	376.8	376.8	377.7	377.7	377.5	377.5	377.7	377.7
RSWO060B	74013	74014	Natural	420	10	369.2	370.5	49	30	51	41	54	377.7	377.7	376.8	376.8	377.7	377.7	377.5	377.5	377.7	377.7
RSWO070A	74009	74013	Natural	288	10	377.0	371.4	43	29	45	41	52	378.1	377.7	377.9	376.8	378.1	377.7	378.1	377.5	378.2	377.7
RSWO070B1	74008	74009	48" CSP Culvert	501	10	378.3	376.8	15	10	16	15	18	379.6	378.1	379.3	377.9	379.6	378.1	379.5	378.1	379.7	378.2
RSWO070B2	74008	74009	48" CSP Culvert	501	10	378.2	377.0	14	9	14	13	16	379.6	378.1	379.3	377.9	379.6	378.1	379.5	378.1	379.7	378.2
RSWO070B3	74008	74009	48" CSP Culvert	501	10	378.1	377.0	14	10	15	14	17	379.6	378.1	379.3	377.9	379.6	378.1	379.5	378.1	379.7	378.2
RSWO070BRD	74008	74009	Roadway	501		384.1	384.1	0	0	0	0	0	378.1	378.1	377.9	377.9	378.1	378.1	378.1	378.1	378.2	378.2
RSWO070C	74007	74008	Natural	826	10	378.9	378.1	43	29	45	42	53	380.6	379.6	380.3	379.3	380.6	379.6	380.6	379.5	380.7	379.7
RSWO070D.1	74006	74007	66" CSP Culvert	253	10	378.5	378.9	43	30	45	43	54	381.7	380.6	381.2	380.3	381.7	380.6	381.7	380.6	382.0	380.7

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
RSWO070DRD	74006	74007	Roadway	250		386.0	386.0	0	0	0	0	0	380.6	380.6	380.3	380.3	380.6	380.6	380.6	380.6	380.7	380.7
RSWO070E	74005	74006	Natural	296	10	378.3	378.5	44	30	45	43	54	381.7	381.7	381.2	381.2	381.8	381.7	381.7	381.7	382.1	382.0
RSWO080A.1	74004	74005	66" CSP Culvert	43	10	378.5	378.3	44	30	46	45	56	381.9	381.7	381.3	381.2	381.9	381.8	381.8	381.7	382.2	382.1
RSWO080ARD	74004	74005	Roadway	43		388.2	388.2	0	0	0	0	0	381.7	381.7	381.2	381.2	381.8	381.8	381.7	381.7	382.1	382.1
RSWO090A	78833	74004	Natural	197	10	377.2	378.5	33	14	35	24	33	381.9	381.9	381.3	381.3	381.9	381.9	381.8	381.8	382.2	382.2
RSWO090Aa	74003	78833	Natural	208	10	377.3	377.2	32	11	34	24	32	381.9	381.9	381.3	381.3	382.0	381.9	381.9	381.8	382.2	382.2
RSWO090B	75433	74003	Natural	153	10	377.4	377.3	32	11	34	24	32	381.9	381.9	381.3	381.3	382.0	382.0	381.9	381.9	382.2	382.2
RSWO090C	74001	75433	Natural	112	10	377.5	377.4	31	12	33	25	32	381.9	381.9	381.3	381.3	382.0	382.0	381.9	381.9	382.2	382.2
RSWO090D	74405	74001	Natural	251	10	379.3	377.5	31	14	34	33	42	381.9	381.9	381.3	381.3	382.0	382.0	381.9	381.9	382.2	382.2
RSWO090E.1	74406	74405	84" x 120" CMP Culvert	71	10	379.8	379.3	29	4	30	22	30	381.9	381.9	381.3	381.3	382.0	382.0	381.9	381.9	382.2	382.2
RSWO090ERD	74406	74405	Roadway	71		389.4	389.4	0	0	0	0	0	381.9	381.9	381.3	381.3	382.0	382.0	381.9	381.9	382.2	382.2
RSWO090F	76415	74406	Natural	146	10	380.0	379.8	29	4	30	22	30	382.1	381.9	381.3	381.3	382.2	382.0	381.9	381.9	382.3	382.2
RSWO090G.1	76414	76415	84" x 120" CMP Culvert	57	10	379.9	380.0	29	5	30	22	30	382.1	382.1	381.3	381.3	382.2	382.2	381.9	381.9	382.3	382.3
RSWO090GRD	76414	76415	Roadway	57		390.1	390.0	0	0	0	0	0	382.1	382.1	381.3	381.3	382.2	382.2	381.9	381.9	382.3	382.3
RSWO090H	58287	76414	Natural	116	10	380.5	379.9	29	5	30	22	30	382.2	382.1	381.3	381.3	382.3	382.2	381.9	381.9	382.3	382.3
RSWO110A.1	58310	58287	60" CSP Culvert	47	10	381.0	380.5	29	5	30	22	30	382.6	382.2	381.5	381.3	382.7	382.3	382.4	381.9	382.7	382.3
RSWO110ARD	58310	58287	Roadway	26		392.0	389.0	0	0	0	0	0	382.2	382.2	381.3	381.3	382.3	382.3	381.9	381.9	382.3	382.3
RSWO110B.1	58311	58310	54" CSP Culvert	387	10	376.5	374.8	29	5	30	22	30	382.8	382.6	381.5	381.5	382.8	382.7	382.5	382.4	382.8	382.7
RSWO110BRD	58311	58310	Roadway	388		389.8	389.8	0	0	0	0	0	382.6	382.6	381.5	381.5	382.7	382.7	382.4	382.4	382.7	382.7
RSWO110C.1	58315	58311	27" CSP Culvert	1155	10	379.9	376.5	6	5	5	10	13	383.0	382.8	381.8	381.5	383.0	382.8	384.1	382.5	385.4	382.8
RSWO110CRD	58315	58311	Roadway	1154		389.8	389.1	0	0	0	0	0	382.8	382.8	381.5	381.5	382.8	382.8	382.5	382.5	382.8	382.8
RSWO140	77703	58311	54" CSP Culvert	544	10	379.7	376.5	23	-30	25	-37	-42	382.8	382.8	381.3	381.5	382.9	382.8	382.5	382.5	382.8	382.8
Pipe Segments associated with some UIC CP Pipe and Pretreat Projects																						
Wilkes	Poplar	72084	30" CSP Culvert	1100	10	376.0	371.5	1	2	1	2	3	376.3	374.1	376.5	373.1	376.3	374.3	376.5	373.7	376.5	374.2

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
Flat Creek																						
RSFC010A	99329	70197	Natural	850	10	364.6	364.3	66	58	68	76	90	368.1	367.8	368.0	367.8	368.1	367.8	368.2	367.8	368.3	367.8
RSFC010B1	99330	99329	41' x 60" CMP Culvert	92	10	365.0	364.7	32	28	34	38	45	368.4	368.1	368.3	368.0	368.4	368.1	368.6	368.2	368.8	368.3
RSFC010B2	99330	99329	41' x 60" CMP Culvert	92	10	365.4	364.6	34	30	35	38	45	368.4	368.1	368.3	368.0	368.4	368.1	368.6	368.2	368.8	368.3
RSFC010BRD	99330	99329	Roadway	92		371.5	371.5	0	0	0	0	0	368.1	368.1	368.0	368.0	368.1	368.1	368.2	368.2	368.3	368.3
RSFC020A	72768	99330	Natural	750	10	365.3	364.7	66	59	68	77	90	368.5	368.4	368.4	368.3	368.6	368.4	368.7	368.6	369.0	368.8
RSFC020B1	72767	72768	36" CSP Culvert	72	10	366.1	365.3	33	30	34	38	45	369.0	368.5	368.8	368.4	369.1	368.6	369.4	368.7	369.9	369.0
RSFC020B2	72767	72768	36" CSP Culvert	72	10	366.3	365.3	33	30	35	38	45	369.0	368.5	368.8	368.4	369.1	368.6	369.4	368.7	369.9	369.0
RSFC020BRD	72767	72768	Roadway	72		372.0	372.0	0	0	0	0	0	368.5	368.5	368.4	368.4	368.6	368.6	368.7	368.7	369.0	369.0
RSFC020C	72766	72767	Natural	200	10	366.5	366.1	50	47	51	59	69	369.2	369.0	369.0	368.8	369.3	369.1	369.5	369.4	370.1	369.9
RSFC020D1	72765	72766	36" CSP Culvert	68	10	367.2	367.0	23	21	24	29	34	369.6	369.2	369.3	369.0	369.6	369.3	370.0	369.5	370.6	370.1
RSFC020D2	72765	72766	36" CSP Culvert	68	10	366.7	366.5	27	26	27	30	35	369.6	369.2	369.3	369.0	369.6	369.3	370.0	369.5	370.6	370.1
RSFC020DRD	72765	72766	Roadway	68		372.2	372.2	0	0	0	0	0	369.2	369.2	369.0	369.0	369.3	369.3	369.5	369.5	370.1	370.1
RSFC020Da	76952	72765	Natural	233	10	366.7	366.7	50	47	51	59	69	369.6	369.6	369.4	369.3	369.7	369.6	370.0	370.0	370.6	370.6
RSFC020Db.	76953	76952	50" x 76" CMP Culvert	63	10	366.8	366.7	50	46	51	59	69	369.8	369.6	369.6	369.4	369.9	369.7	370.2	370.0	370.9	370.6
RSFC020DbR	76953	76952	Roadway	63		373.9	374.0	0	0	0	0	0	369.8	369.8	369.6	369.6	369.9	369.9	370.2	370.2	370.9	370.9
RSFC020E	72764	76953	Natural	809	10	367.7	366.8	50	47	51	59	69	370.0	369.8	369.9	369.6	370.1	369.9	370.4	370.2	371.0	370.9
RSFC020F1	72763	72764	36" x 48" CMP Culvert	65	10	367.2	367.7	17	17	17	20	23	370.3	370.0	370.1	369.9	370.3	370.1	370.7	370.4	371.4	371.0
RSFC020F2	72763	72764	36" x 48" CMP Culvert	65	10	367.2	368.2	16	15	17	20	23	370.3	370.0	370.1	369.9	370.3	370.1	370.7	370.4	371.4	371.0
RSFC020F3	72763	72764	36" x 48" CMP Culvert	65	10	367.2	367.9	17	16	18	20	23	370.3	370.0	370.1	369.9	370.3	370.1	370.7	370.4	371.4	371.0
RSFC020FRD	72763	72764	Roadway	65		373.1	373.1	0	0	0	0	0	370.0	370.0	369.9	369.9	370.1	370.1	370.4	370.4	371.0	371.0
RSFC020G	72762	72763	Natural	800	10	368.2	367.2	52	50	53	61	71	370.4	370.3	370.3	370.1	370.5	370.3	370.8	370.7	371.5	371.4
RSFC030A1	72761	72762	82" x 84" CSP Culvert	55	10	368.5	368.2	26	26	27	34	41	370.5	370.4	370.3	370.3	370.5	370.5	370.9	370.8	371.5	371.5
RSFC030A2	72761	72762	82" x 84" CSP Culvert	55	10	368.5	368.2	26	26	27	34	41	370.5	370.4	370.3	370.3	370.5	370.5	370.9	370.8	371.5	371.5
RSFC030ARD	72761	72762	Roadway	55		374.7	374.7	0	0	0	0	0	370.4	370.4	370.3	370.3	370.5	370.5	370.8	370.8	371.5	371.5

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
RSFC030B	72244	72761	Natural	1456	10	370.4	368.5	30	32	30	37	43	371.3	370.5	371.5	370.3	371.5	370.5	371.6	370.9	371.8	371.5
RSFC050A	75660	72244	Natural	1294	10	372.2	370.4	31	35	31	39	46	373.5	371.3	373.5	371.5	373.4	371.5	373.5	371.6	373.6	371.8
RSFC050B1	75659	75660	24" CSP Culvert	61	10	372.5	372.2	10	11	10	13	15	374.0	373.5	374.1	373.5	374.0	373.4	374.2	373.5	374.5	373.6
RSFC050B2	75659	75660	24" CSP Culvert	61	10	372.5	372.2	10	11	11	13	15	374.0	373.5	374.1	373.5	374.0	373.4	374.2	373.5	374.5	373.6
RSFC050B3	75659	75660	24" CSP Culvert	61	10	372.5	372.3	10	11	10	12	15	374.0	373.5	374.1	373.5	374.0	373.4	374.2	373.5	374.5	373.6
RSFC050BRD	75659	75660	Roadway	61		376.9	377.0	0	0	0	0	0	374.0	374.0	374.1	374.1	374.0	374.0	374.2	374.2	374.5	374.5
RSFC050C	78673	75659	Natural	1056	10	375.9	372.5	23	26	23	30	34	376.9	374.0	376.9	374.1	376.9	374.0	377.0	374.2	377.1	374.5
RSFC050D1	75654	78673	1.5x5' Box Culvert	25	10	376.1	375.9	23	26	23	30	34	377.2	376.9	377.3	376.9	377.2	376.9	377.5	377.0	377.6	377.1
RSFC050DRD	75654	78673	Roadway	25		379.2	379.2	0	0	0	0	0	376.9	376.9	376.9	376.9	376.9	376.9	377.0	377.0	377.1	377.1
RSFC050E	72799	75654	Natural	1016	10	374.9	376.1	24	27	24	32	37	377.6	377.2	377.6	377.3	377.5	377.2	377.8	377.5	377.9	377.6
RSFC060A.1	72800	72799	30" CSP Culvert	56	10	375.6	374.9	16	18	14	21	23	377.8	377.6	377.9	377.6	377.7	377.5	378.1	377.8	378.4	377.9
RSFC060ARD	72800	72799	Roadway	56		379.8	379.8	0	0	0	0	0	377.6	377.6	377.6	377.6	377.5	377.5	377.8	377.8	377.9	377.9
RSFC060B	72795	72800	Natural	850	10	376.7	375.6	7	7	6	11	13	377.8	377.8	377.9	377.9	377.7	377.7	378.2	378.1	378.4	378.4
RSFC070A.1	72794	72795	30" CSP Culvert	45	5	377.2	376.7	9	8	6	16	20	378.2	377.8	378.2	377.9	378.0	377.7	378.7	378.2	379.0	378.4
RSFC070ARD	72794	72795	Roadway	45		381.0	381.0	0	0	0	0	0	377.8	377.8	377.9	377.9	377.7	377.7	378.2	378.2	378.4	378.4

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
A-1 Channel																						
RSA1010A	72757	72745	Bridge	42	25	352.1	352.3	396	305	407	440	548	356.4	355.5	356.1	355.2	356.4	355.5	356.5	355.6	356.9	355.9
RSA1010B	72744	72757	Natural	2400	25	356.2	352.1	378	302	392	421	521	359.8	356.4	359.4	356.1	359.9	356.4	360.0	356.5	360.4	356.9
RSA1030A	72743	72744	Natural	4200	25	362.8	356.2	323	286	335	368	447	367.4	359.8	367.3	359.4	367.5	359.9	367.7	360.0	368.1	360.4
RSA1030B.1	72742	72743	Bridge	32	25	362.9	362.8	321	284	335	364	441	367.6	367.4	367.4	367.3	367.6	367.5	367.8	367.7	368.2	368.1
RSA1030BRD	72742	72743	Roadway	32		372.3	372.3	0	0	0	0	0	367.4	367.4	367.3	367.3	367.5	367.5	367.7	367.7	368.1	368.1
RSA1030C	73394	72744	Natural	1633	10	362.3	356.2	14	14	15	17	20	362.8	359.8	362.8	359.4	362.8	359.9	362.8	360.0	362.9	360.4
RSA1030D	75021	73394	Natural	1016	10	366.1	362.3	14	17	15	18	20	366.7	362.8	366.8	362.8	366.7	362.8	366.7	362.8	366.7	362.9
RSA1030Da.	75020	75021	24" x 141" CMP Culvert	96	10	366.3	366.1	14	16	15	17	20	367.7	366.7	367.7	366.8	367.7	366.7	367.8	366.7	368.0	366.7
RSA1030DaR	75020	75021	Roadway	96		370.7	370.7	0	0	0	0	0	366.7	366.7	366.8	366.8	366.7	366.7	366.7	366.7	366.7	366.7
RSA1030Db	73395	75020	Natural	522	10	366.8	366.3	15	20	16	20	22	367.7	367.7	367.7	367.7	367.8	367.7	367.8	367.8	368.0	368.0
RSA1030E	72747	73395	Natural	1633	10	368.2	366.8	24	31	21	36	43	369.0	367.7	369.2	367.7	369.0	367.8	369.2	367.8	369.2	368.0
RSA1030F1	72746	72747	14" CSP Culvert	55	10	368.8	368.2	7	9	7	9	9	371.2	369.0	371.9	369.2	371.0	369.0	372.3	369.2	372.3	369.2
RSA1030F2	72746	72747	24" CSP Culvert	55	10	369.1	368.8	16	22	15	25	25	371.2	370.3	371.9	370.5	371.0	370.2	372.3	370.6	372.3	370.6
RSA1030FRD	72746	72747	Roadway	55		372.1	372.1	0	0	0	12	21	369.0	369.0	369.2	369.2	369.0	369.0	372.3	372.2	372.3	372.2
RSA1060A	71215	72742	Natural	1140	25	365.0	362.9	303	266	316	341	411	368.8	367.6	368.5	367.4	368.9	367.6	369.1	367.8	369.5	368.2
RSA1060B	72741	71215	Natural	560	25	366.6	365.0	293	254	306	332	401	369.9	368.8	369.6	368.5	370.0	368.9	370.1	369.1	370.5	369.5
RSA1060C	72740	72741	Bridge	39	25	366.7	366.6	293	254	306	332	402	370.2	369.9	370.0	369.6	370.2	370.0	370.4	370.1	370.8	370.5
RSA1060D	72739	72740	Natural	1000	25	367.6	366.7	215	176	232	230	284	371.5	370.2	371.2	370.0	371.6	370.2	371.7	370.4	372.1	370.8
RSA1060E	72738	72739	Natural	500	25	367.8	367.6	192	153	213	208	261	371.8	371.5	371.5	371.2	372.0	371.6	372.0	371.7	372.4	372.1
RSA1130A1	72737	72738	72" CSP Culvert	600	25	370.2	367.9	63	50	70	69	86	372.5	371.8	372.1	371.5	372.7	372.0	372.6	372.0	373.1	372.4
RSA1130A2	72737	72738	72" CSP Culvert	600	25	370.1	367.8	66	52	73	71	89	372.5	371.8	372.1	371.5	372.7	372.0	372.6	372.0	373.1	372.4
RSA1130A3	72737	72738	72" CSP Culvert	600	25	370.2	367.9	63	50	70	69	86	372.5	371.8	372.1	371.5	372.7	372.0	372.6	372.0	373.1	372.4
RSA1130ARD	72737	72738	Roadway	600		381.7	381.7	0	0	0	0	0	371.8	371.8	371.5	371.5	372.0	372.0	372.0	372.0	372.4	372.4
RSA1130B	70756	72737	Natural	2145	25	372.1	370.1	164	124	191	166	208	377.0	372.5	376.5	372.1	377.2	372.7	377.0	372.6	377.4	373.1
RSA1140A	72796	70756	Natural	1155	25	372.8	372.1	154	116	182	153	196	377.6	377.0	377.1	376.5	377.9	377.2	377.6	377.0	378.1	377.4
RSA1140B.1	69264	70756	36" CSP Culvert	839	10	374.1	373.3	21	16	17	31	30	379.6	377.0	377.6	376.5	379.0	377.2	382.1	377.0	382.2	377.4
RSA1140BRD	69264	70756	Roadway	839		382.0	380.0	0	0	0	1	8	377.0	377.0	376.5	376.5	377.2	377.2	382.1	380.0	382.2	380.1
RSA1270A.1	74046	72796	60" CSP Culvert	160	10	372.9	372.8	35	41	34	55	67	377.6	377.6	377.1	377.1	378.0	377.9	377.6	377.6	378.1	378.1
RSA1270ARD	74046	72796	Roadway	160		384.3	386.4	0	0	0	0	0	377.6	377.6	377.1	377.1	378.0	378.0	377.6	377.6	378.1	378.1
RSA1270B.1	74044	74046	60" CSP Culvert	463	10	373.1	372.9	35	41	34	55	67	377.7	377.6	377.2	377.1	378.0	378.0	377.8	377.6	378.4	378.1
RSA1270BRD	74044	74046	Roadway	463		383.0	384.3	0	0	0	0	0	377.7	377.7	377.2	377.2	378.0	378.0	377.8	377.8	378.4	378.4
RSA1270C.1	74042	74044	60" CSP Culvert	412	10	373.3	373.1	35	42	34	56	68	377.7	377.7	377.4	377.2	378.1	378.0	378.0	377.8	378.7	378.4
RSA1270CRD	74042	74044	Roadway	412		382.2	383.0	0	0	0	0	0	377.7	377.7	377.4	377.4	378.1	378.1	378.0	378.0	378.7	378.7

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1270D.1	74040	74042	60" CSP Culvert	409	10	373.5	373.3	36	42	34	56	68	377.8	377.7	377.5	377.4	378.1	378.1	378.1	378.0	379.0	378.7
RSA1270DRD	74040	74042	Roadway	409		383.4	382.2	0	0	0	0	0	377.7	377.7	377.4	377.4	378.1	378.1	378.0	378.0	378.7	378.7
RSA1280A.1	74034	74040	60" CSP Culvert	216	10	373.6	373.5	31	34	29	48	58	377.8	377.8	377.5	377.5	378.1	378.1	378.2	378.1	379.1	379.0
RSA1280ARD	74034	74040	Roadway	216		383.3	383.4	0	0	0	0	0	377.8	377.8	377.5	377.5	378.1	378.1	378.2	378.2	379.1	379.1
RSA1280B.1	74032	74034	60" CSP Culvert	269	10	373.8	373.6	31	34	29	48	58	377.9	377.8	377.6	377.5	378.2	378.1	378.3	378.2	379.2	379.1
RSA1280BRD	74032	74034	Roadway	269		382.4	383.3	0	0	0	0	0	377.9	377.9	377.6	377.6	378.2	378.2	378.3	378.3	379.2	379.2
RSA1280C.1	76483	74032	60" CSP Culvert	1331	10	374.3	373.8	32	35	29	49	59	378.1	377.9	377.9	377.6	378.3	378.2	378.7	378.3	379.9	379.2
RSA1280CRD	76483	74032	Roadway	1331		382.9	382.4	0	0	0	0	0	377.9	377.9	377.6	377.6	378.2	378.2	378.3	378.3	379.2	379.2
RSA1280Ca.	74031	76483				374.4	374.3	29	32	27	47	54	378.1	378.1	377.9	377.9	378.3	378.3	378.8	378.7	380.0	379.9
RSA1280CaR	74031	76483				383.0	382.9	0	0	0	0	0	378.1	378.1	377.9	377.9	378.3	378.3	378.7	378.7	379.9	379.9
RSA1280D.1	74030	74031	60" CSP Culvert	1012	10	374.9	374.4	30	33	27	49	60	378.4	378.1	378.2	377.9	378.5	378.3	379.1	378.8	380.5	380.0
RSA1280DRD	74030	74031	Roadway	1022		384.9	383.0	0	0	0	0	0	378.1	378.1	377.9	377.9	378.3	378.3	378.8	378.8	380.0	380.0
RSA1290A.1	74026	74030	54" CSP Culvert	496	10	375.7	375.4	14	15	12	23	25	378.4	378.4	378.3	378.2	378.5	378.5	379.2	379.1	380.6	380.5
RSA1290ARD	74026	74030	Roadway	496		384.0	384.9	0	0	0	0	0	378.4	378.4	378.3	378.3	378.5	378.5	379.2	379.2	380.6	380.6
RSA1290B.1	74024	74026	48" CSP Culvert	182	10	376.3	376.2	14	16	12	25	26	378.5	378.4	378.4	378.3	378.5	378.5	379.2	379.2	380.6	380.6
RSA1290BRD	74024	74026	Roadway	182		384.8	384.0	0	0	0	0	0	378.4	378.4	378.3	378.3	378.5	378.5	379.2	379.2	380.6	380.6
RSA1290C.1	74022	74024	48" CSP Culvert	410	10	376.6	376.3	14	16	12	26	30	378.6	378.5	378.6	378.4	378.7	378.5	379.4	379.2	380.8	380.6
RSA1290CRD	74022	74024	Roadway	410		383.4	384.8	0	0	0	0	0	378.6	378.6	378.6	378.6	378.7	378.7	379.4	379.4	380.8	380.8
RSA1290D.1	74020	74022	42" CSP Culvert	880	10	377.4	376.6	15	16	13	29	34	379.3	378.6	379.4	378.6	379.2	378.7	380.3	379.4	381.3	380.8
RSA1290DRD	74020	74022	Roadway	880		385.7	383.4	0	0	0	0	0	378.6	378.6	378.6	378.6	378.7	378.7	379.4	379.4	380.8	380.8
RSA1150A1	72797	72796	72" CSP Culvert	167	25	374.8	375.0	65	40	77	67	85	378.1	377.6	377.5	377.1	378.5	377.9	378.1	377.6	378.6	378.1
RSA1150A2	72797	72796	72" CSP Culvert	155	25	374.8	375.0	66	41	78	68	86	378.1	377.6	377.5	377.1	378.5	377.9	378.1	377.6	378.6	378.1
RSA1150ARD	72797	72796	Roadway	160		384.4	384.7	0	0	0	0	0	378.1	378.1	377.5	377.5	378.5	378.5	378.1	378.1	378.6	378.6
RSA1150B	72734	72797	Natural	3273	25	377.1	375.1	126	65	147	129	165	381.9	378.1	380.8	377.5	382.2	378.5	382.0	378.1	382.4	378.6
RSA1160A.1	72733	72734	Bridge	92	25	378.7	378.6	97	28	112	102	128	382.0	381.9	380.8	380.8	382.2	382.2	382.0	382.0	382.5	382.4
RSA1160ARD	72733	72734	Roadway	92		387.8	387.8	0	0	0	0	0	381.9	381.9	380.8	380.8	382.2	382.2	382.0	382.0	382.4	382.4
RSA1160B	72732	72733	Natural	165	25	377.1	378.7	94	-36	107	94	121	382.0	382.0	380.8	380.8	382.3	382.2	382.1	382.0	382.5	382.5
RSA1160C1	72731	72732	60" CSP Culvert	61	25	377.0	377.1	47	-17	53	47	60	382.1	382.0	380.8	380.8	382.4	382.3	382.2	382.1	382.7	382.5
RSA1160C2	72731	72732	60" CSP Culvert	61	25	377.0	377.1	47	-17	53	47	60	382.1	382.0	380.8	380.8	382.4	382.3	382.2	382.1	382.7	382.5
RSA1160CRD	72731	72732	Roadway	61		383.9	383.8	0	0	0	0	0	382.0	382.0	380.8	380.8	382.3	382.3	382.1	382.1	382.5	382.5
RSA1160D	72730	72731	Natural	769	25	377.9	377.0	93	-30	106	94	120	382.2	382.1	380.8	380.8	382.5	382.4	382.3	382.2	382.9	382.7

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1160E1	72729	72730	72" CMP Culvert	89	25	378.4	377.9	46	14	52	47	60	382.4	382.2	380.8	380.8	382.7	382.5	382.5	382.3	383.1	382.9
RSA1160E2	72729	72730	72" CMP Culvert	89	25	378.4	377.9	46	14	53	47	60	382.4	382.2	380.8	380.8	382.7	382.5	382.5	382.3	383.1	382.9
RSA1160ERD	72729	72730	Roadway	89		386.5	386.5	0	0	0	0	0	382.2	382.2	380.8	380.8	382.5	382.5	382.3	382.3	382.9	382.9
RSA1160F	71940	72729	Natural	1207	25	379.1	378.4	91	28	104	94	120	382.5	382.4	380.8	380.8	382.7	382.7	382.5	382.5	383.2	383.1
RSA1160G.1	71941	71940	60" x 144" CMP Culvert	61	25	379.2	379.1	91	29	103	95	120	382.7	382.5	380.8	380.8	383.0	382.7	382.8	382.5	383.5	383.2
RSA1160GRD	71941	71940	Roadway	61		388.2	388.2	0	0	0	0	0	382.5	382.5	380.8	380.8	382.7	382.7	382.5	382.5	383.2	383.2
RSA1160H	72726	71941	Natural	650	25	379.5	379.2	91	29	103	96	121	382.8	382.7	381.4	380.8	383.1	383.0	382.9	382.8	383.5	383.5
RSA1170A	72736	72734	Natural	610	10	379.9	377.1	64	76	54	111	134	382.0	381.9	382.0	380.8	382.2	382.2	382.4	382.0	382.6	382.4
RSA1170B.1	72101	72736	60" CSP Culvert	140	25	380.1	380.0	20	25	18	44	52	382.1	382.0	382.3	382.0	382.3	382.2	382.9	382.4	383.1	382.6
RSA1170BRD	72101	72736	Roadway	140		393.0	393.0	0	0	0	0	0	382.0	382.0	382.0	382.0	382.2	382.2	382.4	382.4	382.6	382.6
RSA1170C	72735	72736	Natural	2200	10	382.7	379.9	12	15	11	19	23	383.8	382.0	383.9	382.0	383.7	382.2	384.0	382.4	384.2	382.6
RSA1170D.1	72100	72735	36" CSP Culvert	150	25	383.5	382.7	13	16	11	27	32	384.7	383.8	384.9	383.9	384.6	383.7	385.5	384.0	385.7	384.2
RSA1170DRD	72100	72735	Roadway	150		393.0	393.0	0	0	0	0	0	383.8	383.8	383.9	383.9	383.7	383.7	384.0	384.0	384.2	384.2
RSA1200A1	72725	72726	60" CMP Culvert	200	25	379.8	379.7	54	17	61	57	72	383.5	382.8	381.8	381.4	383.8	383.1	383.6	382.9	384.3	383.5
RSA1200A2	72725	72726	60" CMP Culvert	200	25	380.0	379.8	51	15	59	54	70	383.5	382.8	381.8	381.4	383.8	383.1	383.6	382.9	384.3	383.5
RSA1200ARD	72725	72726	Roadway	200		393.0	393.0	0	0	0	0	0	382.8	382.8	381.4	381.4	383.1	383.1	382.9	382.9	383.5	383.5
RSA1200B	72724	72725	Natural	950	25	380.6	379.8	138	155	145	171	225	383.6	383.5	383.2	381.8	383.9	383.8	383.7	383.6	384.4	384.3
RSA1230A.1	72723	72724	60" CMP Culvert	136	25	381.9	380.6	142	159	150	171	187	387.2	383.6	388.2	383.2	387.4	383.9	388.8	383.7	389.5	384.4
RSA1230ARD	72723	72724	Roadway	136		389.0	389.0	0	0	0	0	40	383.6	383.6	383.2	383.2	383.9	383.9	383.7	383.7	389.5	389.3
RSA1230B	72722	72723	Natural	900	25	381.6	381.9	135	150	140	164	209	387.3	387.2	388.3	388.2	387.5	387.4	388.9	388.8	389.6	389.5
RSA1230C	72721	72722	Natural	1400	25	382.6	381.6	148	184	146	224	245	387.4	387.3	388.3	388.3	387.6	387.5	388.9	388.9	389.6	389.6
RSA1230D1	72720	72721	36" CSP Culvert	68	25	382.7	382.7	53	68	50	86	95	388.5	387.4	390.0	388.3	388.7	387.6	391.3	388.9	392.6	389.6
RSA1230D2	72720	72721	36" CSP Culvert	68	25	382.6	382.6	53	68	50	86	95	388.5	387.4	390.0	388.3	388.7	387.6	391.3	388.9	392.6	389.6
RSA1230D3	72720	72721	36" CSP Culvert	68	25	382.6	382.6	53	68	50	86	95	388.5	387.4	390.0	388.3	388.7	387.6	391.3	388.9	392.6	389.6
RSA1230DRD	72720	72721	Roadway	68		393.7	393.7	0	0	0	0	0	387.4	387.4	388.3	388.3	387.6	387.6	388.9	388.9	389.6	389.6
RSA1230E	72719	72720	Natural	900	25	384.2	382.6	165	217	153	316	361	388.7	388.5	390.1	390.0	388.8	388.7	391.3	391.3	392.7	392.6
RSA1060F.1	85030	71215	48" CMP Culvert	30	10	366.2	365.7	13	14	11	15	19	368.8	368.8	368.5	368.5	368.9	368.9	369.1	369.1	369.5	369.5
RSA1060Fa	71214	85030	Natural	415	10	368.7	366.2	12	12	11	15	18	369.4	368.8	369.4	368.5	369.4	368.9	369.5	369.1	369.6	369.5
RSA1060FRD	85030	71215	Roadway	30		371.2	371.2	0	0	0	0	0	368.8	368.8	368.5	368.5	368.9	368.9	369.1	369.1	369.5	369.5
RSA1060G1	71213	71214	2x4.5' Box Culvert	31	10	369.1	368.7	12	12	11	15	18	369.8	369.4	369.8	369.4	369.8	369.4	369.9	369.5	370.1	369.6
RSA1060GRD	71213	71214	Roadway	31		373.7	373.7	0	0	0	0	0	369.4	369.4	369.4	369.4	369.4	369.4	369.5	369.5	369.6	369.6

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1060H	71212	71213	Natural	1034	10	370.3	369.1	12	12	11	15	18	371.7	369.8	371.7	369.8	371.7	369.8	371.8	369.9	371.9	370.1
RSA1060I1	71211	71212	18" CMP Culvert	42	10	370.7	370.5	6	6	5	7	9	372.0	371.7	371.9	371.7	371.9	371.7	372.1	371.8	372.2	371.9
RSA1060I2	71211	71212	18" CMP Culvert	42	10	370.7	370.3	7	7	6	8	10	372.0	371.7	371.9	371.7	371.9	371.7	372.1	371.8	372.2	371.9
RSA1060IRD	71211	71212	Roadway	42		375.7	375.7	0	0	0	0	0	371.7	371.7	371.7	371.7	371.7	371.7	371.8	371.8	371.9	371.9
RSA1060J	71210	71211	Natural	712	10	372.0	370.7	13	13	11	15	18	373.1	372.0	373.1	371.9	373.1	371.9	373.2	372.1	373.3	372.2
RSA1060S.1	85031	71210	36" x 72" CMP Culvert	18	10	371.8	372.1	37	37	34	43	50	374.0	373.5	374.0	373.5	373.9	373.4	374.2	373.6	374.4	373.8
RSA1060Sa	71209	85031	Natural	586	10	371.5	371.8	37	37	34	43	50	374.2	374.0	374.2	374.0	374.1	373.9	374.4	374.2	374.5	374.4
RSA1060SRD	85031	71210	Roadway	18		375.9	375.9	0	0	0	0	0	373.1	373.1	373.1	373.1	373.1	373.1	373.2	373.2	373.3	373.3
RSA1060U	72749	71209	Natural	308	10	371.3	371.5	63	64	58	74	83	374.4	374.2	374.4	374.2	374.3	374.1	374.6	374.4	374.8	374.5
RSA1080A.1	72748	72749	48" CMP Culvert	40	10	371.7	371.3	63	64	58	74	84	375.2	374.4	375.2	374.4	375.0	374.3	375.6	374.6	375.9	374.8
RSA1080ARD	72748	72749	Roadway	40		376.5	376.5	0	0	0	0	0	374.4	374.4	374.4	374.4	374.3	374.3	374.6	374.6	374.8	374.8
RSA1080B	72791	72748	Natural	1857	10	372.4	371.7	37	37	33	38	41	376.6	375.2	376.6	375.2	376.1	375.0	377.0	375.6	377.5	375.9
RSA1090A.1	72790	72791	42" CSP Culvert	438	10	374.3	372.4	41	42	34	48	53	377.5	376.6	377.5	376.6	376.8	376.1	378.0	377.0	378.7	377.5
RSA1090ARD	72790	72791	Roadway	438		379.8	379.7	0	0	0	0	0	376.6	376.6	376.6	376.6	376.1	376.1	377.0	377.0	377.5	377.5
RSA1090B	72789	72790	Natural	18	10	374.3	374.3	41	43	34	49	56	377.5	377.5	377.5	377.5	376.9	376.8	378.0	378.0	378.7	378.7
RSA1090C1	72788	72789	27" x 40" CMP Culvert	30	10	374.4	374.3	21	21	17	25	25	377.8	377.5	377.8	377.5	377.1	376.9	378.3	378.0	378.7	378.7
RSA1090C2	72788	72789	27" x 40" CMP Culvert	30	10	374.5	374.3	21	21	17	25	25	377.8	377.5	377.8	377.5	377.1	376.9	378.3	378.0	378.7	378.7
RSA1090CRD	72788	72789	Roadway	30		378.1	378.1	0	0	0	9	42	377.5	377.5	377.5	377.5	376.9	376.9	378.3	378.2	378.7	378.7
RSA1090D	72787	72788	Natural	386	10	374.7	374.4	23	23	20	22	24	377.9	377.8	377.9	377.8	377.3	377.1	378.3	378.3	378.7	378.7
RSA1090E1	72786	72787	2x8' box Culvert	40	10	375.0	374.7	24	24	19	24	22	377.9	377.9	377.9	377.9	377.3	377.3	378.3	378.3	378.7	378.7
RSA1090ERD	72786	72787	Roadway	40		377.9	377.9	0	1	0	18	25	377.9	377.9	377.9	377.9	377.3	377.3	378.3	378.3	378.7	378.7
RSA1090F	72785	72786	Natural	772	10	375.1	375.0	25	26	20	38	42	378.0	377.9	378.0	377.9	377.4	377.3	378.3	378.3	378.7	378.7
RSA1090G1	72784	72785	36" CMP Culvert	91	10	375.0	375.1	13	14	10	22	24	378.0	378.0	378.1	378.0	377.5	377.4	378.4	378.3	378.8	378.7
RSA1090G2	72784	72785	36" CMP Culvert	91	10	375.1	375.1	13	14	10	22	25	378.0	378.0	378.1	378.0	377.5	377.4	378.4	378.3	378.8	378.7
RSA1090GRD	72784	72785	Roadway	91		381.0	380.9	0	0	0	0	0	378.0	378.0	378.0	378.0	377.4	377.4	378.3	378.3	378.7	378.7
RSA1100A	72783	72784	Natural	19	10	376.0	375.0	11	-7	10	-12	-15	378.0	378.0	378.1	378.1	377.5	377.5	378.4	378.4	378.8	378.8
RSA1100B.1	72782	72783	24" x 42" CMP Culvert	858	10	376.5	376.0	11	-7	10	12	14	378.5	378.0	377.7	378.1	378.4	377.5	378.6	378.4	378.8	378.8
RSA1100BRD	72782	72783	Roadway	800		380.0	380.0	0	0	0	0	0	378.0	378.0	378.1	378.1	377.5	377.5	378.4	378.4	378.8	378.8
RSA1100C	72781	72782	Natural	9	10	376.5	376.5	16	16	17	18	21	378.5	378.5	378.2	377.7	378.4	378.4	378.6	378.6	378.8	378.8

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS		(ft)		US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1100D.1	72780	72781	30" CSP Culvert	24	10	376.5	376.5	16	16	17	18	21	378.7	378.5	378.5	378.2	378.6	378.4	378.7	378.6	378.9	378.8
RSA1100DRD	72780	72781	Roadway	24		380.2	380.2	0	0	0	0	0	378.5	378.5	378.2	378.2	378.4	378.4	378.6	378.6	378.8	378.8
RSA1100E	72793	72780	Natural	133	10	376.6	376.5	16	16	17	18	21	378.7	378.7	378.6	378.5	378.7	378.6	378.8	378.7	379.0	378.9
RSA1100F.1	72792	72793	30" CSP Culvert	30	10	376.7	376.6	16	16	17	18	21	378.9	378.7	378.8	378.6	379.0	378.7	379.1	378.8	379.3	379.0
RSA1100FRD	72792	72793	Roadway	30		380.0	380.0	0	0	0	0	0	378.7	378.7	378.6	378.6	378.7	378.7	378.8	378.8	379.0	379.0
RSA1100G	72779	72792	Natural	135	10	376.8	376.7	16	16	17	18	21	379.0	378.9	378.9	378.8	379.1	379.0	379.1	379.1	379.3	379.3
RSA1100K	72798	72779	Natural	740	10	376.9	376.8	10	-10	11	10	12	379.0	379.0	378.9	378.9	379.1	379.1	379.1	379.1	379.3	379.3
RSA1100L.1	72102	72798	36" CMP Culvert	292	10	378.2	376.9	9	6	9	10	11	379.5	379.0	379.2	378.9	379.6	379.1	379.6	379.1	379.8	379.3
RSA1100LRD	72102	72798	Roadway	292		413.5	413.5	0	0	0	0	0	379.0	379.0	378.9	378.9	379.1	379.1	379.1	379.1	379.3	379.3
RSA1100H	72778	72779	Natural	50	10	376.7	376.8	15	26	16	39	46	379.0	379.0	378.9	378.9	379.1	379.1	379.1	379.1	379.3	379.3
RSA1100I.1	72777	72778	36" CSP Culvert	70	25	376.9	376.7	16	26	16	41	48	379.1	379.0	379.3	378.9	379.1	379.1	379.9	379.1	380.2	379.3
RSA1100IRD	72777	72778	Roadway	70		382.3	382.3	0	0	0	0	0	379.0	379.0	378.9	378.9	379.1	379.1	379.1	379.1	379.3	379.3
RSA1100J	72776	72777	Natural	180	10	377.2	376.9	16	26	16	43	50	379.2	379.1	379.3	379.3	379.1	379.1	380.0	379.9	380.3	380.2
RSA1110A1	72103	72776	30" CSP Culvert	280	25	377.6	377.2	8	13	8	23	26	379.3	379.2	379.8	379.3	379.3	379.1	381.2	380.0	381.9	380.3
RSA1110A2	72103	72776	30" CSP Culvert	280	25	377.6	377.2	8	13	8	23	26	379.3	379.2	379.8	379.3	379.3	379.1	381.2	380.0	381.9	380.3
RSA1110ARD	72103	72776	Roadway	280		382.0	382.0	0	0	0	0	0	379.2	379.2	379.3	379.3	379.1	379.1	380.0	380.0	380.3	380.3
RSA1060K	71208	72740	Natural	800	10	371.6	366.7	34	38	36	34	31	372.5	370.2	372.5	370.0	372.6	370.2	372.5	370.4	372.5	370.8
RSA1060L	71207	71208	2x4' Box Culvert	40	10	371.6	371.6	24	24	22	27	29	373.0	372.5	373.0	372.5	373.0	372.6	373.1	372.5	373.3	372.5
RSA1060M	71210	71207	Natural	550	10	370.8	371.6	24	24	22	27	30	373.1	373.0	373.1	373.0	373.1	373.0	373.2	373.1	373.3	373.3
RSA1060N.1	72754	72739	36" CMP Culvert	25	10	368.9	368.4	24	26	23	28	30	371.8	371.5	371.5	371.2	371.9	371.6	372.0	371.7	372.5	372.1
RSA1060NRD	72754	72739	Roadway	25		373.1	373.0	0	0	0	0	0	371.5	371.5	371.2	371.2	371.6	371.6	371.7	371.7	372.1	372.1
RSA1060O	72753	72754	Natural	320	10	371.4	368.9	24	24	23	27	29	372.8	371.8	372.8	371.5	372.7	371.9	372.8	372.0	372.9	372.5
RSA1060P.1	72752	72753	26" x 42" CMP Culvert	40	10	371.6	371.4	24	24	23	27	29	373.5	372.8	373.5	372.8	373.4	372.7	373.6	372.8	373.7	372.9
RSA1060PRD	72752	72753	Roadway	40		374.9	374.9	0	0	0	0	0	372.8	372.8	372.8	372.8	372.7	372.7	372.8	372.8	372.9	372.9
RSA1060Q	72751	72752	Natural	330	10	371.2	371.6	25	24	23	27	30	373.6	373.5	373.6	373.5	373.5	373.4	373.7	373.6	373.8	373.7
RSA1060R.1	72750	72751	36" CMP Culvert	40	10	371.5	371.2	25	25	23	29	32	374.1	373.6	374.1	373.6	374.0	373.5	374.3	373.7	374.5	373.8
RSA1060RRD	72750	72751	Roadway	40		375.4	375.4	0	0	0	0	0	373.6	373.6	373.6	373.6	373.5	373.5	373.7	373.7	373.8	373.8
RSA1060T	71209	72750	Natural	270	10	371.5	371.5	25	26	23	29	32	374.2	374.1	374.2	374.1	374.1	374.0	374.4	374.3	374.5	374.5
RSA1160I.1	59020	72726	60" CMP Culvert	1081	10	380.8	379.5	-13	-2	-17	-14	-22	381.8	382.8	381.2	381.4	381.9	383.1	381.9	382.9	382.1	383.5
RSA1160IRD	59020	72726	Roadway	1081		388.8	393.0	0	0	0	0	0	381.2	381.2	377.2	377.2	381.3	381.3	380.7	380.7	382.1	382.1
RSA1210A.1	59021	59020	54" CSP Culvert	560	10	381.2	380.8	42	57	38	79	92	383.9	382.7	384.4	383.0	383.8	382.6	385.2	383.4	385.8	383.6
RSA1210ARD	59021	59020	Roadway	560		390.6	388.8	0	0	0	0	0	381.2	381.2	377.2	377.2	381.3	381.3	380.7	380.7	382.1	382.1

APPENDIX B
TABLE B-4
HYDRAULIC PERFORMANCE OF THE RIVER ROAD SANTA CLARA STORM DRAINAGE SYSTEM UNDER FUTURE LAND USE CONDITIONS WITH CIPs

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Invert Elevation (ft)		Peak Flow (cfs) Future Land Use Conditions					Water Surface Elevation under Future Land Use Conditions (ft)									
													10-Year		25-Year Summer		25-Year Winter		50-Year		100-Year	
	US	DS				US	DS	10-Year	25-Year-S	25-Year-W	50-Year	100-Year	US	DS	US	DS	US	DS	US	DS	US	DS
RSA1210B.1	59112	59021	48" CSP Culvert	1506	10	382.3	381.2	16	22	14	32	35	384.4	383.9	385.0	384.4	384.3	383.8	386.0	385.2	386.8	385.8
RSA1210BRD	59112	59021	Roadway	1506		390.0	390.6	0	0	0	0	0	384.4	384.4	385.0	385.0	384.3	384.3	386.0	386.0	386.8	386.8
RSA1210C.1	85032	59112	36" CSP Culvert	33	10	382.8	382.8	16	22	14	30	34	384.5	384.4	385.1	385.0	384.4	384.3	386.1	386.0	386.9	386.8
RSA1210CRD	85032	59112	Roadway	33		390.0	390.0	0	0	0	0	0	384.4	384.4	385.0	385.0	384.3	384.3	386.0	386.0	386.8	386.8
RSA1210D	76744	59059				384.3	382.8	16	22	14	31	34	385.7	384.5	386.0	385.1	385.6	384.4	386.9	386.1	388.0	386.9
Pipe Segments associated with some UIC CP Pipe and Pretreat Projects																						
Shirley-1	Shirley	74030	30" CSP Culvert	1090	10	377.1	374.9	3	3	3	5	7	378.4	378.4	378.3	378.2	378.5	378.5	379.2	379.1	380.7	380.5
Shirley-2	Shirley	74030	30" CSP Culvert	1090	10	377.1	374.9	3	3	3	5	7	378.4	378.4	378.3	378.2	378.5	378.5	379.2	379.1	380.7	380.5
Stark	Crocker	76483	36" CSP Culvert	1060	10	376.5	374.4	3	5	3	6	7	378.1	378.1	377.9	377.9	378.3	378.3	378.8	378.7	379.9	379.9
BushnelST	Bushnell	72730	18" CSP Culvert	1015	10	379.9	377.9	1	1	0	1	1	382.2	382.2	380.8	380.8	382.5	382.5	382.3	382.3	382.9	382.9
Dalton	Hamilton	76744	36" CSP Culvert	1100	10	386.5	384.3	4	5	3	8	9	387.2	385.7	387.3	386.0	387.2	385.6	387.6	386.9	388.2	388.0

APPENDIX C

METHODOLOGY FOR ESTIMATING THE EFFECTIVE IMPERVIOUS AREA OF URBAN WATERSHEDS

Technical Note 58

Methodology for Estimating the Effective Impervious Area of Urban Watersheds

By: Roger C. Sutherland, P.E.

One of the most difficult and important param eters that must be estimated for accurate hydrologic analyses is the effective impervious area (EIA) of a watershed or basin of interest. Effective impervious area (EIA) is the portion of the mapped impervious area (MIA) within a basin that is directly connected to the drainage collection system. EIA includes street surfaces, paved driveways connecting to the street, sidewalks adjacent to curbed streets, rooftops which are hydraulically connected to the curb or storm sewer system, and parking lots.

EIA is usually reported as a percentage of total basin or subbasin area. In traditional urban runoff modeling or hydrologic analysis, the EIA for a given basin is usually less than the MIA. However, in highly urbanized basins, EIA values can approach and equal MIA values.

Effective impervious area is the portion of total impervious cover that is directly connected to the storm drain network.

The EIA of a basin is an important parameter in the rainfall to runoff process because it directly affects the volume of runoff. Many hydrological models assume all the precipitation that falls on impervious areas becomes direct runoff. In actuality, the precipitation falling on impervious areas which are not hydraulically connected to the drainage collection system will not always result in direct runoff. Impervious area that does not contribute directly to runoff should be subtracted from the mapped impervious area to obtain the *effective* impervious area, in order to get a more accurate estimate of runoff volumes.

Determination of Effective Impervious Area

The methodology for determining EIA has been refined through three levels:

1. Direct measurement in the field

The direct measurement of EIA is a tedious exercise which is rarely undertaken since most consultants cannot afford its excessive labor cost. To actually measure the EIA of a basin, it is necessary to catalog and evaluate the effectiveness of the hydraulic connection between *each* of the impervious areas and the major collector systems. This extremely time consuming exercise is impractical for most drainage planning and design related activities.

2. Derivation from models run on gauging data

If a basin is gaged, the effective impervious area can be estimated by employing a rainfall-to-runoff model like HEC-1 or SWMM to calibrate the EIA parameter. This calibration is performed by fixing reasonable estimates of the precipitation loss components for the pervious portions of the basin and impervious areas, then adjusting the value of EIA to correlate computed and observed runoff volumes. The calibration process should be undertaken for several observed rainfall events, with the final estimate of EIA representing the weighted average of those values calibrated for each individual storm.

3. Empirical equations derived from whole-basin or subbasin parameters

Empirical equations can be developed to compute realistic values of EIA based on physical basin parameters that are easy to estimate. For example, the U.S.G.S. developed estimates of EIA for over forty watersheds throughout the metropolitan areas of Portland and Salem, Oregon (Laenen, 1980 and 1983). Working with this database, the U.S.G.S. also developed an empirical equation to estimate EIA as a function of MIA.

It should be noted that the modeling technique used by the U.S.G.S. lumped all of the precipitation excess into a single optimized percentage of the basin area that was assumed to be contributing runoff. This optimized value was defined as the effective impervious area. Working with these optimized values (in %) of EIA and their corresponding MIA values, the U.S.G.S. (Laenen, 1983) developed the following equation:

$$EIA = 3.6 + 0.43\,(MIA) \qquad (1)$$

Equation (1) has been found to work well for MIA values greater than 10% and less than 50% but provides unrealistic EIA values for MIA values outside of this range, i.e., the more urbanized areas. In surface water management master planning, one commonly deals with *small subbasins* (i.e. 20 to 70 acres) in which the ultimate mapped impervious area can routinely exceed 50%, and may be as high as 90%.

Therefore, there is a need to develop a better relationship between MIA and EIA and several alternative equations have been recently developed, based upon the U.S.G.S. data, to satisfy this need, known as the Sutherland Equations.

The general form of the equation to describe the relationship between MIA and EIA is as follows:

$$EIA = A\ (MIA)^B \quad (2)$$

In Equation (2), A and B are a unique combination of numbers such that the following criteria are satisfied:

1. If MIA = 1 then EIA = 0%
2. If MIA = 100 then EIA = 100%

Based on the U.S.G.S. calibrated values of EIA for all basins with MIA ≥ 4%, several empirical equations were developed to apply to various generalized conditions of subbasins which may be encountered in the drainage master planning process. The first equation presented below (i.e. Equation 3) provided the best fit for all of the MIA versus EIA data used in the analysis. The remaining equations were based primarily on engineering judgement and experience as it relates to the various subbasin conditions which affect EIA.

The **Sutherland EIA Equations** are as follows:

1. *Average basins* where the local drainage collector systems for the urban areas within the basin are predominantly storm sewered with curb and gutters, no dry wells or other drainage infiltration areas are known to exist, and the rooftops in the single family residential areas are not connected to the storm sewer or piped directly to the street curb.

$$EIA = 0.1\ (MIA)^{1.5},\ MIA \geq 1 \quad (3)$$

2. *Highly connected basins* where everything in Condition 1 applies except the residential rooftops are predominantly connected to the streets or storm sewer system.

$$EIA = 0.4\ (MIA)^{1.2},\ MIA \geq 1 \quad (4)$$

3. Totally connected basins where 100% of the urban area within the basin is storm-sewered, with all impervious surfaces appearing to be directly connected to the system.

$$EIA = MIA \quad (5)$$

4. Somewhat disconnected basins where at least 50% of the urban areas within the basin are not storm sewered, but are served by grassy swales or roadside ditches, and the residential rooftops are not directly connected. Alternatively, Condition 1 may apply, but the basin is known to have a few dry wells or other infiltration areas.

$$EIA = 0.04\ (MIA)^{1.7},\ MIA \geq 1 \quad (6)$$

5. Extremely disconnected basins where only a small percentage of the urban area within the basin is storm sewered, or a large portion of the basin area (i.e. 70 percent or more) drains to dry wells or other infiltration areas.

$$EIA = 0.01\ (MIA)^{2.0},\ MIA \geq 1 \quad (7)$$

Figure 1 compares the Sutherland EIA Equations along with the original U.S.G.S. Equation for the range of impervious data collected in Oregon. The variation in the 42 actual subbasin data presented in Figure 58.1 demonstrates the difficulty in accurately estimating the EIA of a drainage basin. It is imperative that the drainage planner or engineer performs some degree of on-site investigation of the basin to determine which EIA equation may apply to the given circumstance. The greatest strength of the Sutherland EIA Equations is their consistency in providing reasonable estimates of EIA over the entire range of MIA. Therefore, they can be used in the surface water management planning process to estimate the change in EIA which will occur as a basin becomes urbanized.

References

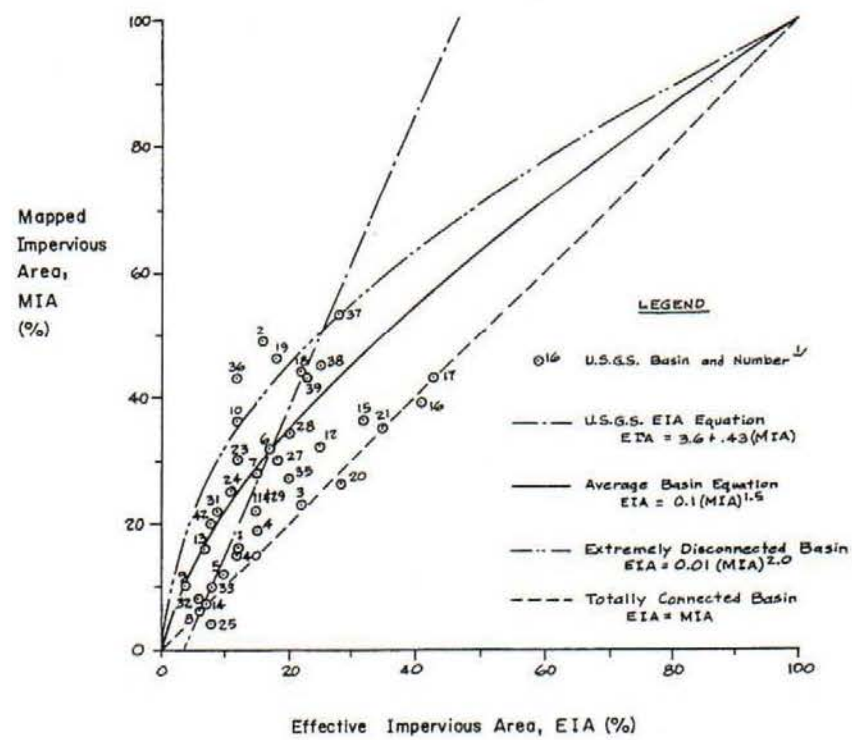
Laenen, A. 1980. Storm Runoff as Related to Urbanization in the Portland, Oregon - Vancouver, Washington Area, U.S.G.S. Water Resource Investigations Open File Report 80-689.

Laenen, A. 1983. Storm Runoff as Related to Urbanization Based on Data Collected in Salem and Portland and Generalized for the Willamette Valley, Oregon, U.S.G.S. Water Resources Investigations Open File Report 83-4143.

Contact

Roger C. Sutherland, P.E.
Kurahashi & Associates, Inc.
12600 SW 72nd Avenue, Suite 100
Tigard, Oregon 97223
(503) 968-1605
FAX (503) 968-1105

Figure 58.1: Plot of Sutherland equations and USGS equation



1/ EIA valves were based on a U.S.G.S. rainfall to runoff model study. Only points with MIA ≥ 4 were plotted (Laenen, 1980 and 1983).

APPENDIX D

CAPITAL PROJECT UNIT COST TABLES

APPENDIX D
Eugene Basin Planning
Unit Cost Tables for Estimating Capital Project (CP) Costs
August 2009

INTRODUCTION

The following tables provide the unit costs and back-up documentation associated with material and construction costs for various drainage system components.

The purpose of these tables is to provide general guidance with respect to CP costs and to allow for cost comparisons between CPs. These unit costs are based on original and refined unit costs used for the Eugene Master Plan in 1999 with a 15% increase to all original unit costs to reflect current conditions (2007). These increased costs are only applicable to the scale of projects in the City's preliminary storm system CP list. They are not applicable to projects that are of a much smaller or larger scale than those preliminary CPs.

Tables 1 through 4 – Tables 1 through 4 provide estimated capital/construction costs for each CP type (e.g., pipe installation, open channel improvements, and detention and water quality facilities). Table 1 provides cost estimates for all of the CP types except for pipes and structural water quality treatment systems (i.e., CONTECH Storm Filter). Table 2 provides cost estimates for drainage pipe, based on pipe size and depth of cover. Table 3 provides detailed back-up information regarding estimated construction costs for drainage pipe installation. Table 4 provides cost estimates for five different sized structural water quality facilities (i.e., CONTECH Storm Filter). For many of the CPs in Table 1 and the pipe costs in Table 2, the unit cost must be multiplied by a quantity such as acre-feet, square yards, or lineal feet to estimate the total capital cost for that CP.

Tables 5 through 7 – Tables 5 through 7 provide the back-up information that was used to estimate the unit costs for CP types listed in Table 1. Table 5 provides unit costs for the various elements that comprise each CP (e.g., labor, excavation, etc.). Table 6 provides the quantities of each element that comprise the CPs (e.g., 1 hour of labor, 6 cubic yards of excavation, etc.). Table 7 provides the detailed back-up capital/construction cost information for each CP type based on Tables 5 and 6.

(Note: a revision was made to the Natural Resource Enhancement and Open Waterway Improvement Construction unit costs November 2001. See the addendum following this summary, prior to the tables.)

Table 8 – Table 8 provides the estimated maintenance costs for each CP type. For many of the CPs, the maintenance cost must be multiplied by a unit such as acre-feet or square yards in order to come up with the total estimated maintenance cost.

Estimated maintenance costs have been calculated and reported for flood control CPs. A maintenance cost is not provided for capital projects to increase the pipe sizes based on the assumption that maintenance of piped systems typically includes catch basin/manhole cleaning and that this cleaning is already being conducted for the existing piped system. A general maintenance cost is provided for water quality CPs (CONTECH StormFilter and raingardens), based on personal communication (emails and phone calls).

Table 9 – Table 9 provides the detailed back-up information for estimating the maintenance costs for each CP type except for increased pipe sizes and raingardens.

Tables 1, 2, 4, and 8 were used to estimate capital and maintenance costs that are provided in the draft CP fact sheets. Tables 3, 5, 6, 7 and 9 are only provided to show back-up for information presented in Tables 1, 2, 4, and 8.

November 1, 2001

Addendum to Natural Resource Enhancement and Open Waterway Improvement Construction Unit Costs

As requested by the City, URS has reviewed and recommended revisions to the construction activity/material unit costs developed for the Storm Drainage Master Planning project for open channel improvements (Types 1 and 2), natural resource enhancement, and natural resource revegetation. The distinction between these project types for basin planning was as follows:

- Open channel improvements (Type 1) – Modify existing channels. Construction activities and materials included traffic control, excavation (0 to 10 foot bottom width, 4 to 6 foot depth, 3:1 side slopes), hydroseed, and erosion protection at inlets and outlets.
- Open channel improvements (Type 2) – Modify existing channels. Construction activities and materials included the same elements as for Type 1 except channel excavation was increased to a 10 to 20 foot bottom width and 6 to 10 foot depth.
- Natural resource enhancement – Plant additional vegetation.
- Natural resource revegetation – Remove invasive vegetation, grade and revegetate.

For each of these project types, overall unit costs were developed based on unit costs for construction activities and materials including: traffic control, general excavation, hydroseeding, trees and shrubs, riprap, and erosion control. In this letter, we revised our unit costs for the project construction activities and materials based on a review of bid tabulations from two recently completed enhancement projects in Eugene (i.e., the 1135 and ACE projects), the Longfellow Creek Habitat Improvement Project in Seattle, Washington, the Oregon Department of Transportation Historical Bid Price Listings, and the RS Means 2000 Heavy Construction Cost Data book. This letter report includes a description of how the specific construction activities/materials unit costs were revised, a discussion of how recommended unit costs were identified, a recommended new unit cost for natural resource enhancement, and a recommendation for computing construction costs for open waterway improvements.

<u>Unit Costs Compiled from Other Projects/Sources</u>
Table 1 presents the unit costs from the above mentioned projects and sources for each of the appropriate construction activities/materials. Clearing and grubbing, and grading were added to the list of construction activities and materials because it is likely that with most natural resource enhancement projects some clearing and grubbing of invasive vegetation or dead trees will be necessary and that regrading of the top soil will also be necessary. The range of unit costs, which can be compared with the existing basin planning unit costs, is provided in Table 1. From this range, we developed new recommended unit costs to be used for the construction activities/materials elements of the project types. For those elements that had unit costs from more than two projects/sources (i.e., general excavation, hydroseeding, trees, shrubs, and riprap) the average of the unit costs was recommended. For elements that had only two sources (i.e., clearing and grubbing, grading, and erosion control), the numbers were compared with the existing basin planning costs and an average was taken of all three. The recommended unit costs (rounded up to the nearest dollar) are presented in Table 1.

Natural Resource Enhancement

The natural resource enhancement and natural resource revegetation project types were combined into one type of improvement “natural resource enhancement”. For earlier basin planning, natural resource enhancement included planting of trees/shrubs only, while natural resource revegetation included general excavation, hydroseeding, planting trees/shrubs, and erosion control. During this review it was determined that it would be unlikely that a capital project would include only tree/shrub planting, and that if the natural resources of an area were designated to be enhanced, that enhancement would likely include some clearing and grubbing, grading, hydroseeding, planting trees/shrubs and erosion control. Clearing and grubbing, and grading were added because it is likely that with most natural resource enhancement projects some clearing and grubbing of invasive vegetation or dead trees would be necessary and that regrading of the top soil would also be necessary. For a strictly natural resource enhancement project (i.e., no channel modifications) it is unlikely that much excavation would be necessary, therefore excavation was removed from the cost estimate. The construction activities/materials that comprise natural resource enhancement now include clearing and grubbing, grading, hydroseeding, planting trees/shrubs, and erosion control.

The original basin planning costs for natural resource enhancement and natural resource revegetation were $10/square yard (SY) and $49/SY respectively. After combining the two types of projects into one type, natural resource enhancement, the new recommended unit cost is $13/SY, as presented in the table below.

Natural Resource Enhancement Unit Cost

Construction Activity/Material	Units	Unit Costs	Units	Unit Costs	Comments
Clearing and Grubbing	AC	$4,300	SY	$0.90	
Grading	CY	$5	SY	$5	Assume a maximum depth of 1 foot to be regraded.
Hydroseed	AC	$3,200	SY	$0.66	
Trees/Shrubs	EA	$120/$36	SY	$6	Assume trees planted at 20-foot spacing on-center (O.C.) and shrubs planted at 10 feet O.C.
Erosion Control	AC	$3,800	SY	$0.62	
Total for Natural Resource Enhancement			**SY**	**$13**	

Although the construction activity and material unit costs for clearing and grubbing, hydroseed and erosion control increased, they are being applied on a square yard basis. Therefore, these increases did not have much impact on the unit cost for natural resource enhancement. The greatest factor that led to the decrease in the unit cost for natural resource enhancement is the modification to the quantity of trees/shrubs per square yard. In the calculations for the basin planning costs, the quantity of trees/shrubs was 0.5 each per SY, which corresponds to a tree/shrub planted approximately every 4 feet O.C. During this review, it was determined that a more appropriate spacing for shrubs would be every 8 feet O.C. and every 20 feet O.C. for trees. For example, on a 100 foot long, 25 foot wide buffer the revised spacing would allow for planting of either 12 trees at a unit cost of $120/tree or 52 shrubs at a unit cost of $36/shrub, while the original basin planning allowed approximately 139 trees/shrubs to be planted. On a square yard basis, the basin planning costs for trees/shrubs as part of natural resource enhancement were approximately $25/SY, while the recommended unit costs would be approximately $6/SY for either trees or shrubs. Another significant factor in the decrease of the natural resource enhancement unit cost was the quantity of erosion control per SY in the basin planning quantity tables. The basin planning quantity tables indicated that 0.008 acres (38.7 SY) of erosion control would be applied every SY. It appears that this quantity was an error and that the correct quantity for erosion control per SY would be 0.0002 AC (1 SY) per SY.

Open Waterway Improvements

Before this review, open channel improvements were divided into two different types (i.e., Type 1 and Type 2). Both the Type 1 and Type 2 improvements included traffic control, excavation, hydroseeding, trees and shrubs, riprap, and erosion control. The estimated construction costs per unit were based on lineal feet. During this review, it was determined that there was a need to determine quantities for each open waterway improvement project specifically, rather than rely on general quantities for the various construction activities/materials. The quantities that are input into the cost tables have a significant impact on the overall cost of open waterway improvements. The quantity of excavation, the area to be hydroseeded and the area disturbed for which erosion control would be needed vary greatly between projects. Therefore, we are not recommending a general construction unit cost for open waterway improvements. We are recommending that each project be evaluated individually and that costs are developed based on the recommended unit costs for construction activities and materials provided in Table 1. In addition, if each open waterway improvement project is evaluated individually there is no longer a need for two different types of improvements. Therefore, we recommend that these improvements be combined into one category.

TABLE 1
STORMWATER FACILITIES
ESTIMATED CONSTRUCTION COSTS PER UNIT

Stormwater Facility Type	Unit	$/Unit[Notes 1+2]	Description of Stormwater Facility Construction Activities
Trash Rack Inlet (Type 1)	EA	$5,940	Cone shaped rebar cage bolted to an inlet structure (manhole or vault), inlet protection (riprap, geotextile fabric), clearing of invasive vegetation, grading and revegetation .
Trash Rack Inlet (Type 2)	EA	$9,970	Steel trash rack approximately 15 ft wide and 4 ft high placed in the channel with concrete foundation walls on both banks. Also includes inlet protection, clearing of invasive vegetation, grading and revegetation.
Garbage and Debris Removal	CY	$120	Hand collected debris not requiring mechanical means to lift, hauled in 10 CY truck to disposal.
Sediment Removal	CY	$250	Removal of sediment from channels and culverts with heavy equipment. Includes hydroseeding for revegetation.
Streambank Stabilization	SY	$90	Grading, geotextile, toe reinforcement, revegetation and erosion control.
Open Channel Improvements (Type 1)	LF	$350	Traffic control, excavation (0 to10 ft bottom width, 4 to 6 ft depth, 3:1 side slopes), hydroseed, erosion protection at inlet and outlet. Modification of existing channel.
Open Channel Improvements (Type 2)[Note 4]	LF	$730	Same as above except 10 to 20 ft bottom width, 6 to 10 ft depth.
Dry Extended Pond	Ac-Ft	$59,700	Gravel access road (25 ft long x 12 ft width), clearing & grubbing, excavation (3 ft depth), grading, erosion protection at inlet & outlet, hydroseed, trees & shrubs, safety fence, erosion control.
Wet Extended Pond	Ac-Ft	$59,700	Gravel access road (25 ft long x 12 ft width), clearing & grubbing, excavation (3-6 ft depth), grading, erosion protection at inlet & outlet, hydroseed, trees & shrubs, safety fence, erosion control. No lining has been included.
Stormwater Marsh/Wetland	AC	$88,300	Gravel access road (25 ft long x 12 ft width), grading (1-2 ft depth, no removal from site), erosion protection at inlet & outlet, hydroseed, vegetation and erosion control.
Flood Control Facility	Ac-Ft	$59,700	Gravel access road (25 ft long x 12 ft width), clearing & grubbing, excavation (3 ft depth), grading, erosion protection at inlet & outlet, hydroseed, trees & shrubs, safety fence, erosion control.
Outfall Protection	EA	$7,670	Precast concrete outlet structure, erosion protection, geotextile fabric, clearing of vegetation around structure, grading and revegetation.
Vegetated Swale	LF	$17	Traffic control, clearing & grubbing, excavation (4ft bottom width, 2 ft depth, 4:1 side slopes), hydroseed, erosion protection at inlet and outlet.
Infiltration Trench	LF	$50	Clearing & grubbing, excavation (2ft bottom width, 4 ft depth), geotextile fabric, 4"-8" perforated pipe, drain rock, and hydroseed.
Natural Resource Enhancement[Note 3]	SY	$10	Add additional vegetation
Natural Resource Revegetation[Note 3]	SY	$56	Remove invasive vegetation, grade and revegetate.
Recreational Trail	SF	$5	Clearing & grubbing, grading (up to 1 ft depth), erosion control, cedar shavings. Does not include storm drainage, signage, benches or other recreational amenities.
Raingarden - Native Soils [Note 5]	SF	$8	Includes installation of plants. Does not include grading, curb work, and sod installation outside of garden area.
Raingarden - Engineered Soils [Note 6]	SF	$29	Includes installation of plants, bed amendment (with engineered soils), and underdrain piping. Does not include grading, curb work, and sod installation outside of garden area.

Note 1: The costs in this table reflect an update of the original Table 1 prepared in 1999. It is based on a 2007 update that included an accross the board increase of 15% to all unit costs in Table 7. It also includes the inclusion of geotextile fabric for both types of open channel improvements (see update to Table 7).

Note 2: Construction costs presented in this table are planning level estimates. They are reflective of average facilities constructed under typical conditions. Each facility will vary depending on site conditions, the size and number of facilities constructed, and depending on the local construction market at the time of bidding. Contingencies should be reflected for budgeting purposes based on the variety of possible conditions.

Note 3: For purposes of calculating costs, these 2 categories have been combined and called Natural Resource Enhancement (use $13/sy) see attached addendum dated 11/01. This $13/sy should be updated to $15/sq based on the 15% increase being applied for a 2007 update.

Note 4: The cost presented here for TYPE II channel improvements of $730 reflects a 2007 accross the board update of +15% to the costs in the 1999 tables. However, due to several years experience with this type of project and an expectation of economies of scale (e.g., wider bottom width, deeper excavation, but same start up/mobilization/erosion control costs, etc.), an amount of **$600/LF** is now used as the unit cost here.

Note 5: Native soil raingarden cost estimates are assumed for 2007 and were provided by David Dods at URS (Overland Park, Kansas) , email dated 9-21-2007 and approved by Eugene and Lane County staff. See attached email.

Note 6: Engineered soil raingarden cost estimates are estimated for 2007, based on information provided by David Dods at URS (Overland Park, Kansas) , email dated 9-21-2007, and information provided by the City of Portland (phone call with City 8-10-09). The two costs provided ($24/sf from Kansas City and $34/sf from Portland) were averaged to take into account the fact that the Kansas City estimate was assumed to be on the low side when compared to typical costs in Eugene, and the City of Portland's estimate was on the high side given that it reflected 2009 costs as opposed to 2007. To be consistent with the other unit costs in these tables, unit costs should reflect 2007 estimates.

Reference:
Table 1 summarizes data in Table 7.
Table 5 (Unit Cost) x Table 6 (Quantities) = Table 7 (Unit Cost per CIP Type)

TABLE 2
STORMWATER FACILITIES
ESTIMATED CONSTRUCTION COSTS
FOR STORM DRAIN INSTALLATION IN IMPROVED AREAS

Storm Drain Pipe Construction Cost per Linear Foot												
	Diameter (inches)											
Cover Depth (feet)	**18**	24	30	36	42	48	54	60	66	72	84	96
2-5	$90	$120	$170	$220	$250	$300	$350	$400	$480	$520	$680	$830
5-10	$110	$150	$200	$250	$290	$340	$400	$450	$540	$580	$760	$920
10-15	$120	$170	$230	$280	$330	$380	$440	$500	$600	$650	$830	$1000
15-20	$140	$190	$250	$310	$360	$420	$490	$560	$660	$710	$910	$1090

Note 1: The costs in this table reflect an update of the original table prepared in 1999. The 2007 update includes a 15% increase to all unit costs.

Note 2: Construction costs presented in this table are planning level estimates. These estimated costs include shoring, excavation, backfill/air tamped compaction, piping, pavement restoration, minor stream management, and traffic control costs associated with typical projects, and average utility relocation in improved areas. Trench excavation is assumed to be by excavator or backhoe (mechanical means or blasting not included). Utility easement or other land acquisition costs are excluded. Information presented in this table is a summary of Table 3.

Reference: Cost = volume * ($excavation + $backfill) + $shoring + $piping + 5 + $pavement + $traffic control + $stream management

TABLE 3
STORMWATER FACILITIES
ESTIMATED CONSTRUCTION COSTS
FOR STORM DRAIN INSTALLATION IN IMPROVED AREAS
BACK UP INFORMATION

	Storm Drain Pipe Construction Cost per Linear Foot											
	Diameter (inch)											
Depth of Cover (ft)	18	24	30	36	42	48	54	60	66	72	84	96
Sub Task												
Pipe + Bed (ft)	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7.5	8.5
Width (ft)	3	4	5	6	7	8	9	10	11	12	14	16
Bedding (ft)	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.6
Shoring (lf)	$ 10.34	$12.42	$14.90	$17.88	$21.46	$25.75	$30.90	$30.90	$37.09	$44.51	$53.41	$64.09
Excavation (CY)	$ 11.50	$11.50	$11.50	$11.50	$11.50	$11.50	$11.50	$11.50	$11.50	$11.50	$11.50	$11.50
Backfill and Air Tamped Compaction (CY)	$ 17.25	$17.25	$17.25	$17.25	$17.25	$17.25	$17.25	$17.25	$17.25	$17.25	$17.25	$17.25
Piping (lf)	$ 15.00	$29.33	$59.80	$79.35	$90.85	$108.10	$131.10	$154.10	$204.70	$203.55	$304.75	$379.50
Pavement Restoration	$ 6.40	$8.54	$10.67	$12.81	$14.94	$17.08	$19.21	$21.35	$23.48	$25.62	$29.89	$34.16
Traffic Control	$ 20.91	$23.00	$25.30	$27.83	$30.61	$33.67	$37.04	$40.75	$44.82	$49.30	$54.23	$59.66
Stream Management	$ 12.54	$14.38	$16.53	$19.01	$21.86	$25.14	$28.91	$33.25	$38.24	$43.97	$50.57	$58.15
Cover (CY)												
2-5	0.7	1.1	1.5	1.9	2.3	2.8	3.3	3.9	4.5	5.1	6.5	8.0
5-10	1.4	1.9	2.4	3.0	3.6	4.3	5.0	5.7	6.5	7.3	9.1	11.0
10-15	1.9	2.6	3.3	4.1	4.9	5.8	6.7	7.6	8.6	9.6	11.7	13.9
15-20	2.3	3.3	4.3	5.2	6.2	7.3	8.3	9.4	10.6	11.8	14.3	16.9
2-5	$90.32	$124.60	$174.80	$216.19	$251.81	$295.67	$348.00	$397.15	$482.17	$518.89	$684.19	$830.56
5-10	$110.44	$145.90	$201.42	$248.13	$289.08	$338.26	$395.92	$450.39	$540.73	$582.78	$758.72	$915.74
10-15	$124.82	$167.20	$228.04	$280.08	$326.35	$380.85	$443.83	$503.63	$599.30	$646.67	$833.26	$1,000.93
15-20	$136.32	$188.49	$254.66	$312.02	$363.62	$423.45	$491.75	$556.87	$657.86	$710.56	$907.80	$1,086.11

Note 1: The costs in this table reflect an update of the original table prepared in 1999. The 2007 update includes a 15% increase to all unit costs.

Note 2: Construction costs presented in this table are planning level estimates. These estimated costs include minor stream management, traffic control costs associated with typical in-stream culvert projects, average utility relocation and pavement restoration costs in improved areas. Utility easement or other land acquisition costs are excluded. Information presented in this table is summarized in Table 2 (costs in Table 2 are rounded to the nearest $10).

TABLE 4
STORMWATER FACILITIES
ESTIMATED CONSTRUCTION COSTS
FOR WATER QUALITY STRUCTURES

Device/Model	Total Installed Cost	Number of Cartridges
Compost Storm Filter (CSF) Function: Primarily metals uptake and oil & grease removal. Commonly used with sediment manhole.		
CSF 8x6	$58,500	6
CSF 8x6	$70,000	11
CSF 12x6	$73,280	11
CSF 16x8	$138,560	33
CSF 16x8	$157,000	39

Note 1: StormFilter costs were provided by Contech Stormwater Solutions (email to URS dated 10-24-2007, email attached). If other proprietary treatment systems are proposed, costs for other facilities will be updated.

Note 2: Construction costs presented in this table are planning level estimates. Costs represent installation of average facilities under typical conditions. Estimates reflect vaults installed in public right of way, in an existing residential paved street, with average utility conflicts and restoration costs.

TABLE 5
STORMWATER FACILITIES
CONSTRUCTION COST ESTIMATE
BACK-UP INFORMATION

Construction Activity/Materials	Units	$/Unit
Manual Labor	Labor-Hr	$35
Traffic Control	Labor-Hr	$32
Gravel Access Road	SF	$4.37
Clearing & Grubbing	AC	$2,300
General Excavation	CY	$17
Grading	CY	$6
Inlet Cone & Structure	EA	$4,025
Trash Rack Structure	EA	$8,050
Pond Outlet	EA	$5,750
Curb & Gutter	LF	$14
Hydroseed	AC	$2,300
Trees & Shrubs	EA	$58
Geotextile Fabric	SY	$2.01
Rip Rap	TN	$69
Chain Link Fence	LF	$20
Erosion Control	AC	$2,300
Drain Rock	CY	$30
Crushed Rock	CY	$25
Truck Haul (Disposal)	CY	$21
Perforated Drain Pipe	LF	$30
Cedar Savings	CY	$25

Note 1: The above costs (originally prepared in 1999) were updated in 2007 with an across the board increase of 15%.

Note 2: The above are representative unit costs based on information collected from bid tabulation sheets from two years (1997-1999) in the Eugene, Lebanon and Portland areas. These costs are representative of average conditions and assume that the CP projects are competitively bid. Unit costs include materials and installation. Actual construction cost will vary with site conditions and local factors at time of bidding.

Unit cost for trees assumes bare root stock with temporary water for 2-3 years.

Note 3: With respect to Natural Resource Enhancement and Open Waterway Improvement Construction Costs (not included in this table), unit costs were revised (Nov. 2001) for clearing & grubbing, hydroseeding, trees & shrubs, and erosion control. See attached addendum.

Reference:
Table 5 (Unit Cost) x Table 6 (Quantities) = Table 7 (Unit Cost per CIP Type)

TABLE 6
STORMWATER FACILITIES
CONSTRUCTION EFFORT/QUANTITIES ESTIMATE
BACK-UP INFORMATION

Construction Activity/ Materials	Unit	Trash Rack Inlet (Type 1)	Trash Rack Inlet (Type 2)	Garbage and Debris Removal	Sediment Removal	Streambank Stabilization	Open Channel Improvements (Type 1)	Open Channel Improvements (Type 2)	Dry Extended Pond	Wet Extended Pond	Stormwater Marsh/Wetland	Flood Control Facility	Outfall Protection	Vegetated Swale	Infiltration Trench	Natural Resource Revegetation*	Natural Resource Enhancement*	Recreational Trail
		EA	EA	CY	CY	SY	LF	LF	Ac-Ft	Ac-Ft	AC	Ac-Ft	EA	LF	LF	SY	SY	SF
Manual Labor	**Lb-Hr**			3														
Traffic Control	**Lb-Hr**						0.6	1.2						0.16				
Gravel Access Road	**SF**								350	350	350	350						
Clearing & Grubbing	**AC**	0.1	0.1		0.0002				0.33	0.33		0.33	0.1	0.0002	0.0002			0.00002
General Excavation	**CY**				8		2	6	1600	1600	500	1600		0.3	0.3	0.5		
Grading	**CY**	8	8			0.6			100	100	1000	100	8					0.4
Inlet Cone & Structure	**EA**	1							1	1	1	1						
Trash Rack Structure	**EA**		1															
Pond Outlet Structure	**EA**								1	1	1	1	1					
Curb & Gutter	**LF**								20	20	20	20						
Hydroseed	**AC**	0.1	0.1		0.0002	0.0002	0.008	0.02	0.33	0.33	1	0.33	0.1	0.0002	0.0002	0.0002		
Trees & Shrubs	**EA**	5	5		2	1	4	8	100	100	1000	100	5	0.1		0.5	0.21	
Geotextile Fabric	**SY**	45	45			1	3	3					45		1.1			
Rip Rap	**CY**	15	15			0.33	0.28	0.5	3	3	3	3	15					
Chain Link Fence	**LF**								600	600		600						
Erosion Control	**AC**				0.0002	0.0002	0.008	0.016	0.33	0.33	1	0.33		0.0002		0.008		0.00002
Drain Rock	**CY**														0.3			
Crushed Rock	**CY**																	
Truck Haul	**CY**			1														
Perforated Drain Pipe	**LF**														1			
Cedar Shavings	**CY**																	0.11

Note 1: An update to this table was made in 2007 to add 3SY of geotextile fabric for each lineal foot of open channel improvement for both TYPE I and TYPE II improvements.

Note 2: The above are representative quantities based on average construction conditions. Actual construction quantities will vary with site conditions. The quantities above represent the volume and effort to construct/perform each unit of water quality facility (i.e. 1 CY of Sediment Removal). Volumes of excavation are assumed to include hauling offsite (approximately 10 mile round trip) and disposal.

*To calculate costs, the Natural Resource Revegetation and Natural Resource Enhancement activities (and associated costs) were combined into one activity, called Natural Resources Enhancements, and cost estimate. See attached memo dated 11/2001.

Reference:
Table 5 (Unit Cost) x Table 6 (Quantities) = Table 7 (Cost per CIP)

TABLE 7
STORMWATER FACILITIES
CONSTRUCTION COST ESTIMATE
BACK-UP INFORMATION

Construction Activity/ Materials	Unit	Trash Rack Inlet (Type 1)	Trash Rack Inlet (Type 2)	Garbage and Debris Removal	Sediment Removal	Streambank Stabilization	Open Channel Improvements (Type 1)	Open Channel Improvements (Type 2)	Dry Extended Pond	Wet Extended Pond	Stormwater Marsh/Wetland	Flood Control Facility	Outfall Protection	Vegetated Swale	Infiltration Trench	Natural Resource Revegetation*	Natural Resource Enhancement*	Recreational Trail
		EA	EA	CY	CY	SY	LF	LF	Ac-Ft	Ac-Ft	AC	Ac-Ft	EA	LF	LF	SY	SY	SF
Manual Labor	Lb-Hr	$ -	$ -	$ 103.50	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Traffic Control	Lb-Hr	$ -	$ -	$ -	$ -	$ -	$ 19.32	$ 38.64	$ -	$ -	$ -	$ -	$ -	$ 5.15	$ -	$ -	$ -	$ -
Gravel Access Road	SF	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,529.50	$ 1,529.50	$ 1,529.50	$ 1,529.50	$ -	$ -	$ -	$ -	$ -	$ -
Clearing & Grubbing	AC	$ 230.00	$ 230.00	$ -	$ 0.46	$ -	$ -	$ -	$ 759.00	$ 759.00	$ -	$ 759.00	$ 230.00	$ 0.46	$ 0.46	$ -	$ -	$ 0.05
General Excavation	CY	$ -	$ -	$ -	$ 138.00	$ -	$ 34.50	$ 103.50	$ 27,600.00	$ 27,600.00	$ 8,625.00	$ 27,600.00	$ -	$ 5.18	$ 5.18	$ 8.63	$ -	$ -
Grading	CY	$ 46.00	$ 46.00	$ -	$ -	$ 3.45	$ -	$ -	$ 575.00	$ 575.00	$ 5,750.00	$ 575.00	$ 46.00	$ -	$ -	$ -	$ -	$ 2.30
Inlet Cone & Structure	EA	$ 4,025.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,025.00	$ 4,025.00	$ 4,025.00	$ 4,025.00	$ -	$ -	$ -	$ -	$ -	$ -
Trash Rack Structure	EA	$ -	$ 8,050.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Pond Outlet Structure	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,750.00	$ 5,750.00	$ 5,750.00	$ 5,750.00	$ 5,750.00	$ -	$ -	$ -	$ -	$ -
Curb & Gutter	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 276.00	$ 276.00	$ 276.00	$ 276.00	$ -	$ -	$ -	$ -	$ -	$ -
Hydroseed	AC	$ 230.00	$ 230.00	$ -	$ 0.46	$ 0.46	$ 18.40	$ 46.00	$ 759.00	$ 759.00	$ 2,300.00	$ 759.00	$ 230.00	$ 0.46	$ 0.46	$ 0.46	$ -	$ -
Trees & Shrubs	EA	$ 287.50	$ 287.50	$ -	$ 115.00	$ 57.50	$ 230.00	$ 460.00	$ 5,750.00	$ 5,750.00	$ 57,500.00	$ 5,750.00	$ 287.50	$ 5.75	$ -	$ 28.75	$ 12.08	$ -
Geotextile Fabric	SY	$ 90.56	$ 90.56	$ -	$ -	$ 2.01	$ 6.04	$ 6.04	$ -	$ -	$ -	$ -	$ 90.56	$ -	$ 2.21	$ -	$ -	$ -
Rip Rap	CY	$ 1,035.00	$ 1,035.00	$ -	$ -	$ 22.77	$ 19.32	$ 34.50	$ 207.00	$ 207.00	$ 207.00	$ 207.00	$ 1,035.00	$ -	$ -	$ -	$ -	$ -
Chain Link Fence	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,730.00	$ 11,730.00	$ -	$ 11,730.00	$ -	$ -	$ -	$ -	$ -	$ -
Erosion Control	AC	$ -	$ -	$ -	$ 0.46	$ 0.46	$ 18.40	$ 36.80	$ 759.00	$ 759.00	$ 2,300.00	$ 759.00	$ -	$ 0.46	$ -	$ 18.40	$ -	$ 0.05
Drain Rock	CY	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.97	$ -	$ -	$ -
Crushed Rock	CY	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Truck Haul	CY	$ -	$ -	$ 20.70	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Perforated Drain Pipe	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 29.90	$ -	$ -	$ -
Cedar Shavings	CY	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.78
Total $/Unit CIP		$ 5,944.06	$ 9,969.06	$ 124.20	$ 254.38	$ 86.65	$ 345.98	$ 725.48	$ 59,719.50	$ 59,719.50	$ 88,262.50	$ 59,719.50	$ 7,669.06	$ 17.46	$ 47.18	$ 56.24	$ 12.08	$ 5.18

Note 1: These costs that were originally estimated in 1999 now reflect 2007 updates. The updates in this table are based on a 15% increase to costs provided in Table 5.

*To calculate costs, the Natural Resource Revegetation and Natural Resource Enhancement activities (and associated costs) were combined into one activity, called Natural Resources Enhancements, and cost estimate. See attached memo dated 11/2001.

Reference:

Table 5 (Unit Cost) x Table 6 (Quantities) = Table 7 (Unit Cost per CIP Type)

Table 7 Total Cost per Unit of CIP is Summarized in Table 1

TABLE 8
STORMWATER FACILITIES
ESTIMATED ANNUAL MAINTENANCE COSTS

Stormwater Facility Type	Unit	Annual $/Unit	Description of Stormwater Facility Maintenance Activities
Trash Rack Inlet (Type 1 & 2)	1 EA	$3,080	Inspect and clean inlet, inspect vegetation and slope protection, remove debris.
Open Channel (Type 1 & 2)	500 LF	$3,800	Inspect sediment loading and vegetation, remove sediment and debris.
Dry Extended Pond	5 AC-FT	$6,490	Inspect and clean inlet and outlet, maintain vegetation, inspect sediment loading, remove sediment, remove debris, inspect separation berm.
Wet Extended Pond	5 AC-FT	$6,030	Inspect and clean inlet and outlet, maintain vegetation, inspect sediment loading, remove sediment, remove debris, inspect and repair separation berm.
Flood Control Facility	5 AC-FT	$4,810	Inspect and clean inlet and outlet, maintain vegetation, inspect sediment loading, remove sediment, remove debris, inspect and repair separation berm.
Stormwater Marsh/Wetland	5 AC	$3,310	Inspect and clean inlet and outlet, inspect & maintain vegetation, remove debris.
Vegetated Swale	500 LF	$4,090	Inspect and clean inlet and outlet, remove debris, remove sediment, maintain vegetation.
Infiltration Trench	500 LF	$2,700	Inspect and clean inlet, remove debris, remove sediment.
Water Quality Structures	1 EA	$1,170	Inspect and remove debris and sediment from structures.
Natural Resource Enhancement	5 AC	$644	Inspect vegetation, remove debris.
Natural Resource Revegetation	5 AC	$1,012	Inspect vegetation, remove debris.
Recreational Trail	1,000 LF	$2,300	Inspect trail, remove debris and maintain vegetation.

Note: Maintenance costs presented in this table are planning level estimates and are based on information provided by the Unified Sewerage Agency (now clean Water Services) of Washington County. They ar representative of average facilities maintained under typical conditions. Each facility will vary depending on site conditions and the size of the facility.

StormFilter maintenance costs are not presented but estimated to be **$195** per cartridge annually (representative of 2009 cost, per phone call with vendor dated 6-18-2009). This cost assumes that maintenance would be provided by the vendor. If the City/County were to perform maintenance, the unit cost per cartridge would be approximately $90 (2009 estimate).

Raingarden maintenance costs are not presented but estimated to be $1.30/ square foot of raingarden (representative of 2009 cost, per email communication with Steve Fancher at the City of Gresham - email attached). This average cost is calculated assuming $1.00/ square foot of raingarden for typical annual maintenance and $3.00/ square foot of raingarden every 10-years for larger-scale maintenance.

Reference:
Table 8 is a summary of data presented in Table 9.

TABLE 9
STORMWATER FACILITIES
ESTIMATED ANNUAL MAINTENANCE COSTS

	Frequency Times/Year	Effort/Time Lb-Hr	$ @ $46/hr	Hours	Equip./Time $/hr Rate	$ Total	Comments
Trash Rack Inlet (Type 1 & 2)							
Emergency Response	10	1	$ 460.00	0	$ -	$ -	
Inspect & Clean Inlet/Outlet	4	4	$ 736.00	2	$ 172.50	$ 1,380.00	Vactor Truck & Operator
Routine Repair			$ -		$ -	$ -	
Maintain Vegetation	4	2	$ 368.00	2	$ 11.50	$ 92.00	Mower, Weedeater, Etc.
Disposal Costs	4		$ 46.00		$ -	$ -	
Subtotals			*$ 1,610.00*			*$ 1,472.00*	
Total Estimate Annual Maintenance				***$ 3,082.00***			
Open Channel (Type 1 & 2)							
Inspect Vegetation & Sediment Loading	2	1	$ 92.00	0	$ -	$ -	
Maintain Vegetation			$ -		$ -	$ -	
Remove Debris/Garbage	4	2	$ 368.00	0	$ -	$ -	
Remove Sediment	1	8	$ 368.00	4	$ 345.00	$ 1,380.00	Tractor Shovel, 10 CY Dump & Operators
Disposal Costs	1		$ 920.00		$ -	$ -	Assumes 10 CY/Year
Inspect Slopes	2	1	$ 92.00	0	$ -	$ -	
Repair Slopes (On Going Activity)			$ 575.00	0	$ -	$ -	Annual Misc. Cost
Subtotals			*$ 2,415.00*			*$ 1,380.00*	
Total Estimate Annual Maintenance				***$ 3,795.00***			
Dry Extended Pond							
Inspect & Clean Inlet/Outlet	4	4	$ 736.00	2	$ 172.50	$ 1,380.00	Vactor Truck & Operator
Inspect Vegetation	2	1	$ 92.00	0	$ -	$ -	
Remove Debris/Garbage	4	2	$ 368.00	0	$ -	$ -	
Maintain Vegetation	4	4	$ 736.00	4	$ 11.50	$ 184.00	Mower, Weedeater, Etc.
Inspect Sediment Loading	2	1	$ 92.00	0	$ -	$ -	
Remove Sediment	0.5	12	$ 276.00	6	$ 345.00	$ 1,035.00	Tractor Shovel, 10 CY Dump & Operators
Disposal Costs	0.5		$ 920.00		$ -	$ -	Assumes 10 CY Every Two Years
Inspect slopes	2	1	$ 92.00	0	$ -	$ -	
Repair Slopes (On Going Activity)			$ 575.00		$ -	$ -	Annual Misc. Cost
Subtotals			*$ 3,887.00*			*$ 2,599.00*	
Total Estimate Annual Maintenance				***$ 6,486.00***			
Wet Extended Pond							
Inspect & Clean Inlet/Outlet	4	4	$ 736.00	2	$ 172.50	$ 1,380.00	Vactor Truck & Operator
Inspect Vegetation	2	1	$ 92.00	0	$ -	$ -	
Remove Debris/Garbage	4	2	$ 368.00	0	$ -	$ -	
Maintain Vegetation	4	4	$ 736.00	4	$ 11.50	$ 184.00	Mower, Weedeater, Etc.
Inspect Sediment Loading	2	1	$ 92.00	0	$ -	$ -	
Remove Sediment	0.5	12	$ 276.00	6	$ 345.00	$ 1,035.00	Tractor Shovel, 10 CY Dump & Operators
Disposal Costs	0.5		$ 460.00		$ -	$ -	Assumes 10 CY Every TwoYears
Inspect slopes	2	1	$ 92.00	0	$ -	$ -	
Repair Slopes			$ 575.00		$ -	$ -	Annual Misc. Cost
Subtotals			*$ 3,427.00*			*$ 2,599.00*	
Total Estimate Annual Maintenance				***$ 6,026.00***			
Flood Control Facility							
Inspect & Clean Inlet/Outlet	4	2	$ 368.00	2	$ 172.50	$ 1,380.00	Vactor Truck & Operator
Inspect Vegetation	2	1	$ 92.00	0	$ -	$ -	
Remove Debris/Garbage	4	1	$ 184.00	0	$ -	$ -	
Maintain Vegetation	4	4	$ 736.00	4	$ 11.50	$ 184.00	Mower, Weedeater, Etc.
Inspect Sediment Loading	2	1	$ 92.00	0	$ -	$ -	
Remove Sediment	0.5	8	$ 184.00	4	$ 345.00	$ 690.00	Tractor Shovel, 10 CY Dump & Operators
Disposal Costs	0.5		$ 230.00			$ -	Assumes 5 CY Every two Years
Inspect slopes	2	1	$ 92.00	0	$ -	$ -	
Slope Repair (On Going Activity)			$ 575.00		$ -	$ -	Annual Misc. Cost
Subtotals			*$ 2,553.00*			*$ 2,254.00*	
Total Estimate Annual Maintenance				***$ 4,807.00***			
Stormwater Marsh/Wetland							
Inspect & Clean Inlet/Outlet	4	4	$ 736.00	2	$ 172.50	$ 1,380.00	Vactor Truck & Operator
Inspect Vegetation	2	1	$ 92.00	0	$ -	$ -	
Remove Debris/Garbage	2	2	$ 184.00	0	$ -	$ -	
Maintain Vegetation	4	4	$ 736.00	4	$ 11.50	$ 184.00	Mower, Weedeater, Etc.
Subtotals			*$ 1,748.00*			*$ 1,564.00*	
Total Estimate Annual Maintenance				***$ 3,312.00***			
Vegetated Swale							
Inspect & Clean Inlet/Outlet	4	2	$ 368.00	1	$ 172.50	$ 690.00	Vactor Truck & Operator
Remove Debris/Garbage	2	2	$ 184.00	0	$ -	$ -	
Maintain Vegetation	4	4	$ 736.00	4	$ 11.50	$ 184.00	Mower, Weedeater, Etc.
Inspect Sediment Loading	2	1	$ 92.00	0	$ -	$ -	
Remove Sediment/Regrade	1	8	$ 368.00	4	$ 345.00	$ 1,380.00	Tractor Shovel, 10 CY Dump & Operators
Disposal Costs	1		$ 92.00		$ -	$ -	Assumes 2 CY Per Year
Subtotals			*$ 1,840.00*			*$ 2,254.00*	
Total Estimate Annual Maintenance				***$ 4,094.00***			
	Frequency Times/Year	**Effort/Time Lb-Hr**	**$ @ $40/hr**	**Hours**	**Equip./Time $/hr Rate**	**$ Total**	**Comments**
Infiltration Trench							
Inspect & Clean Inlet/Outlet	4	4	$ 736.00	2	$ 172.50	$ 1,380.00	Vactor Truck & Operator
Remove Debris/Garbage	2	2	$ 184.00	0	$ -	$ -	
Inspect Sediment Loading	2	2	$ 184.00	0	$ -	$ -	
Remove Sediment	0.3	8	$ 110.40	4	$ 86.25	$ 103.50	Water Truck (Flush lines) & Operator
Disposal Costs	0.3		$ 28.75		$ -	$ -	Assumes 2 CY Every Three Years
Subtotals			*$ 1,214.40*			*$ 1,483.50*	
Total Estimate Annual Maintenance				***$ 2,697.90***			
Water Quality Structures							
Remove Debris/Garbage	2	2	$ 184.00	0	$ -	$ -	
Inspect Sediment Loading	2	2	$ 184.00	0	$ -	$ -	
Remove Sediment	0.3	8	$ 110.40	4	$ 172.50	$ 690.00	Vactor Truck & Operator
Disposal Costs	4		$ 276.00		$ -	$ -	Assumes 3 CY a Year
Subtotals			*$ 478.40*			*$ 690.00*	
Total Estimate Annual Maintenance				***$ 1,168.40***			

Natural Resource Enhancement							
Inspect Vegetation	1	1	$ 46.00	0	$ -	$ -	
Routine Repair			$ 230.00		$ -	$ -	Annual Misc. Cost
Remove Debris/Garbage	2	4	$ 368.00	0	$ -	$ -	
Subtotals			*$ 644.00*			*$ -*	
Total Estimate Annual Maintenance				***$ 644.00***			
Natural Resource Revegetation							
Inspect Vegetation	2	2	$ 184.00	0	$ -	$ -	
Routine Repair			$ 460.00		$ -	$ -	Annual Misc. Cost
Remove Debris/Garbage	2	4	$ 368.00	0	$ -	$ -	
Subtotals			*$ 1,012.00*			*$ -*	
Total Estimate Annual Maintenance				***$ 1,012.00***			
Recreational Trail							
Inspect Vegetation	2	2	$ 184.00	0	$ -	$ -	
Remove Debris/Garbage	4	4	$ 736.00	0	$ -	$ -	
Maintain Vegetation	2	12	$ 1,104.00	12	$ 11.50	$ 276.00	Mower, Weedeater, Etc.
Subtotals			*$ 2,024.00*			*$ 276.00*	
Total Estimate Annual Maintenance				***$ 2,300.00***			

Note: Labor rate of $40/hr from the original table produced in 1999 was updated with an increase of 15% to $46/hr in 2007. The original information was based on information provided by the Unified Sewerage Agency of Washington County (now Clean Water Services). Labor for maintenance activities was assumed to be City maintenance staff averaged for maintenance and supervisor effort. Effort shown includes travel time and office documentation time. This table also reflects a 2007 update of of +15% to the unit costs for equipment, disposal, and slope repair.

Reference:
Table 9 information is summarized in Table 8.

"Simescu, Andreea" <SimescuA@contech-cpi.com>
10/24/2007 01:59 PM

To <Angela_Brown@URSCorp.com>
cc
bcc
Subject RE: Cost estimates for various size Stormfilter units

History: This message has been replied to and forwarded.

Angela,

Here are the designs available soon:

- 8X6 w/ 11 cartridges $35,000
- 8X16 w/ 39 cartridges $78,500

Let me know if you need anything else.

Andreea Simescu, E.I.
Stormwater Designer
CONTECH Stormwater Solutions Inc.
11835 NE Glenn Widing Dr., Portland, OR 97220
Tel: 503.258.3138 Toll free: 800.548.4667 x138 Fax: 800.561.1271
simescua@contech-cpi.com
contechstormwater.com

From: Angela_Brown@URSCorp.com [mailto:Angela_Brown@URSCorp.com]
Sent: Tuesday, October 23, 2007 4:15 PM
To: Simescu, Andreea
Cc: Krista_Reininga@URSCorp.com
Subject: RE: Cost estimates for various size Stormfilter units

Hi Andrea - Thanks for the cost information. If you guys are proposing additional designs of the vaults to hold more cartridges, please send me those costs and sizes as well. We are in the process of writing up the costs now and the entire update to the plan should be done in Dec/ Jan so the more information we can pull together now, the better.

Thanks!
Angela

Angela Brown, PE
URS Corporation
111 SW Columbia Suite 1500
Portland, OR 97201

Phone: (503) 478-2762
Email: angela_brown@urscorp.com

"Simescu, Andreea"
<SimescuA@contech-cpi.com>
10/23/2007 04:07 PM

To <Angela_Brown@URSCorp.com>
cc
bcc
Subject RE: Cost estimates for various size Stormfilter units

History: This message has been replied to.

Hi Angela,

Sorry I am just getting back to you on this. Here is the updated pricing:

- 6X8 w/6 cartridges $29,250
- 6X12 w/11 cartridges $36,640
- 8X16 w/33 cartridges $69,280

The 8X18 design can hold 33 cartridges (same as the 8X16). We are coming up with some new designs in November that will have integrated inlet and outlet sumps and you will be able to fit more cartridges in each size. I can give you that information as well but the vaults are not available yet. Please let me know if you need to have that now or later.
Thank you.

Andreea Simescu, E.I.
Stormwater Designer
CONTECH Stormwater Solutions Inc.
11835 NE Glenn Widing Dr., Portland, OR 97220
Tel: 503.258.3138 Toll free: 800.548.4667 x138 Fax: 800.561.1271
simescua@contech-cpi.com
contechstormwater.com

From: Angela_Brown@URSCorp.com [mailto:Angela_Brown@URSCorp.com]
Sent: Monday, October 22, 2007 4:16 PM
To: Simescu, Andreea
Cc: Krista_Reininga@URSCorp.com
Subject: Cost estimates for various size Stormfilter units

Hi Andrea - Im working on updating the unit cost tables for a Master Plan that we (URS) previously completed in 1999 for the City of Eugene. The compost StormFilters were referenced and I am hoping you would be able to help me with some updated costs for some various standard sizes (I realize that you have the manhole and cast in place units, but I think we will stick with just the vault systems for right now). In the original cost estimate, we assumed full number of cartridges (operating at 15 gpm) per size facility. The depth is assumed to be 8'.

The standard sizes previously referenced are:
6x8, 6x12, 8x12, 8x14, 8x16, 8x18

I know that some of these sizes no longer exist, so we will only reference those sizes that are currently used. Hopefully you will be able to help. Thanks in advance and let me know if you need any more information

Thanks
Angela

Angela Brown, PE

URS

David Dods/OverlandPark/URSCorp	To	Krista Reininga/Portland/URSCorp@URSCORP
09/21/2007 12:34 PM	cc	Angela Brown/Portland/URSCorp@URSCORP
	bcc	
	Subject	Re: rain garden costs

History: This message has been forwarded.

Rusty in Minnesota says he builds streetside raingardens with replaced soils and an underdrain for $7 - $8/square foot. The qualifiers:

- Most of the plants that go in them are plugs
- the edging is the black plastic stuff
- No walls around the gardens
- The underdrain is a pipe wrapped in a filter fabric sock. He does not use a gravel layer

For KC, I estimated that same price ($7/SF) for gardens that use native soils and no underdrains. A garden with replaced soils and underdrains might run $15 - 25/square foot. I don't have a high degree of confidence in the latter number because we just have not built that many here yet.

My calculations are attached. If you need to put together a pretty good cost estimate for your project, I could help you come up with the line items to be included. But the unit costs would have to come from your area.

Raingarden construction cost est, 09-21-07.xls

Best wishes,

David

Krista Reininga/Portland/URSCorp

Krista Reininga/Portland/URSCorp	To	David Dods/OverlandPark/URSCorp@URSCORP
09/20/2007 03:36 PM	cc	Angela Brown/Portland/URSCorp@URSCorp
	Subject	rain garden costs

Hi David,
For our Eugene project, we are developing capital improvement program costs. Do you have any kind of table or anything already prepared that would show the range in rain garden costs in terms of construction and then also maintenance?
Thanks,
Krista

"Fancher, Steve"
<Steve.Fancher@greshamoregon.gov>
08/03/2009 01:58 PM

To "'Angela_Brown@URSCorp.com'" <Angela_Brown@URSCorp.com>
cc
bcc
Subject RE: Raingarden Maintenance Costs

History: This message has been replied to and forwarded.

Hi Angela,

My slide from the ACWA conference is a little (or a lot) confusing. The anticipated $500/year maintenance cost for NE Holladay Street is wholly contributed to the rain gardens, as we're not planning on sweeping the porous pavement portion any more than the 10-times/year we already sweep standard streets in Gresham. The 3 rain gardens total about 500 square-feet in size, so you can say we anticipate the annual maintenance cost to be around $1/square-foot. On top of the annual maintenance cost, we anticipate needing to spend $1,500 or $3/sf every 10 years for a larger-scale rehab.

As a disclaimer, the costs I've presented are still very rough guesses, as we don't have very many public rain gardens or porous pavements and the ones we do have are relatively new. So far, we have not spent any time or money maintaining the public street rain gardens at NE Holladay (2.5 years old). They continue to look very nice and are performing well, and it's unclear about how much maintenance the adjacent property owners are taking on if any. We also are not spending any more maintaining our porous pavement streets than we do on standard ones. The City of Gresham already sweeps streets 10 times per year on average, which has been sufficient to prevent clogging of the porous systems. At some point in time maybe 5-10 years out, I do anticipate having to do some type of maintenance to the streetside rain gardens, such as removal of some accumulated sediment, replanting and remulching.

A better source of rain garden maintenance data is Henry Stevens with the City of Portland BES. The policy in place while I was there relied on the adjacent property owner for routine maintenance, but I believe they have since changed to perform more functions as a city. Hope this helps.

Steve Fancher
Watershed Division Manager
City of Gresham, DES
503-618-2583
steve.fancher@greshamoregon.gov

From: Angela_Brown@URSCorp.com [mailto:Angela_Brown@URSCorp.com]
Sent: Monday, August 03, 2009 10:37 AM
To: Fancher, Steve
Subject: Raingarden Maintenance Costs

Hi Steve -

Im working with Krista Reininga on a Stormwater Basin Plan for Eugene where we are proposing raingardens to manage runoff generated after UICs are decommissioned. I was wondering if you have any maintenance cost

APPENDIX E

EVALUATION OF UICS WITH RESPECT TO HIGH GROUNDWATER

EVALUATION OF DEQ RULE AUTHORIZATION CRITERION G FOR SANTA CLARA STORMWATER BASIN DRY WELLS

INTRODUCTION

In 1974, the U.S. Environmental Protection Agency (EPA) enacted the Underground Injection Control (UIC) program under the Safe Drinking Water Act. The Oregon Department of Environmental Quality (DEQ) was delegated primacy in Oregon by the EPA in 1984, and re-authorized in 1991. DEQ regulates the program under Oregon Administrative Rules (OAR) Chapter 340, Division 44. The intent of the UIC program is to protect groundwater quality by regulating the injection of fluids into the ground. Dry wells are a type of injection system installed and used by the City of Eugene and Lane County to manage stormwater runoff from roads, parking lots, roofs, and other impervious surfaces by injecting the stormwater into the ground. Dry wells are regulated by the DEQ UIC program.

DEQ developed a set of criteria, known as "rule authorization criteria" to assess whether use of an injection system is authorizable by DEQ. The criteria define certain conditions that must be met in order for the injection system to be authorizable. Criterion G specifies the condition that a dry well shall not discharge directly into groundwater or below the highest seasonal groundwater level. This technical memorandum presents the methods, results, and conclusions for assessing whether dry wells within the Santa Clara Stormwater Basin (SCSB) have a reasonable likelihood of discharging to groundwater.

PROJECT LOCATION AND DRY WELL DESCRIPTION

The SCSB is located in the northern portion of the City of Eugene, primarily with Sections 1 through 16, 23, and 24 in Township 17 South, Range 4 West, in Lane County, Oregon. Dry wells are typically constructed as approximately 4-foot-diameter perforated concrete pipes installed vertically within the ground. Installation steps typically include excavation of a pit, placement of the dry well pipe into the pit, and backfilling of the pit with drain rock. The depths of the dry wells are typically in the range of 10 to 15 feet. Stormwater catch basins collect stormwater runoff from curbs and gutters, and convey the stormwater to the dry wells via drainpipes. Less commonly the dry well may contain a perforated lid through which stormwater may directly discharge to the dry well.

METHODS

The Oregon Water Resources Department (OWRD) maintains a database of water wells installed within the state of Oregon. The database consists of copies of "well logs", which are forms completed by well installers (drillers) to record pertinent data regarding well location, method of well construction, and hydrogeologic observations such as the water level. To assess the depth to groundwater in the SCSB, the well log database was searched to identify well logs within the township, range, and sections described above that contained useful water level information.

RESULTS

A search of the OWRD well log database resulted in 1,447 well log records, of which 1,187 records contained water level information. The water levels for these 1,187 records ranged from 0.7 to 230 feet below ground surface (bgs), and spanned the time from 1914 to 2006. Of these, only seven records contained water levels that were below 50 feet bgs. The mean water level for all 1,187 records was 11.6 feet bgs. Figure 1 is a time-sorted plot of the 1,187 water level records.

To further assess the water levels, the water level for each record was plotted as a function of well completion depth. Of the 1,187 records with useful water level information, only 1,027 records also contained completion depth information. Figure 2 presents a plot of the water level as a function of well completion depth. Well completion depths ranged from seven to 390 feet bgs. The plot shows a slight downward trend, indicating that deeper water levels are more commonly associated with deeper wells.

The comparison of water level to well depth is important because the dry wells within the SCSB are typically installed at shallow depths (about 10 to 15 feet). To accurately estimate the water level at these shallow depths, it is best to use water level information for water wells that are installed at similar depths. Wells that are installed at greater depths may have corresponding water levels that are not representative of shallow conditions (i.e., depths at which dry wells are installed). Therefore, a subset of the 1,187 records was created by selecting records for wells with completion depths of 20 feet or less. This resulted in 286 records. The mean water level for the 286 records was 9.4 feet bgs. Figure 3 is a time-sorted plot of the 286 water level records.

Finally, water levels are also a function of climate and are known to fluctuate throughout the year as a function of seasonal rainfall. In the Eugene area, the highest water levels typically occur during the February through May time period. To estimate the highest seasonal groundwater level within the SCSB, a subset of the 286 shallow well records was created by selecting records for the months of February through May. This resulted in 105 records. The mean water level for the 105 records is 8.1 feet. Of these 105 records, 19 of them (or approximately 18%) had water levels that were 5 feet or shallower.

CONCLUSIONS

The OWRD well log database was searched to obtain historic water level information for water wells within the SCSB. The information was used to assess whether dry wells within the SCSB have a reasonable likelihood of discharging directly into groundwater or below the highest seasonal groundwater level. The following conclusions are based on the evaluation of the well log database:

1. The mean water level for 1,187 wells with completion depths of seven to 390 feet bgs is 11.6 feet bgs.
2. The mean water level for 286 wells with completion depths of 20 feet or less is 9.4 feet bgs.
3. The mean water level during the wettest part of the year for wells with completion depths of 20 feet or less is 8.1 feet and 18% of these water depths were five feet or less.
4. Dry wells within the SCSB have a reasonable likelihood of discharging directly to groundwater or below the highest seasonal groundwater level.

FIGURE 1
Depth to Groundwater for 1,187 Records
1914 to Present

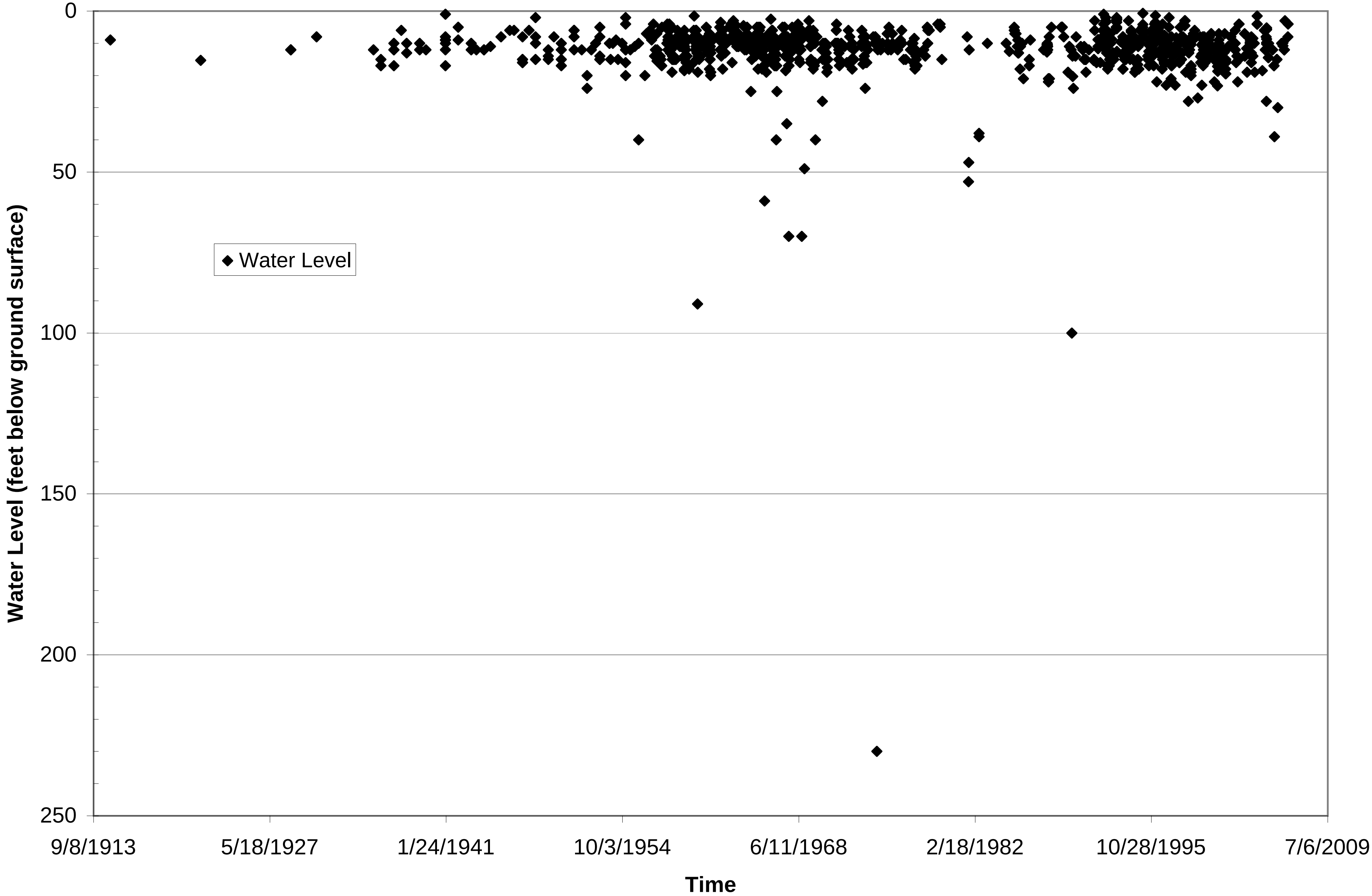


FIGURE 2
Water Level Plotted as a Function of Well Completion Depth

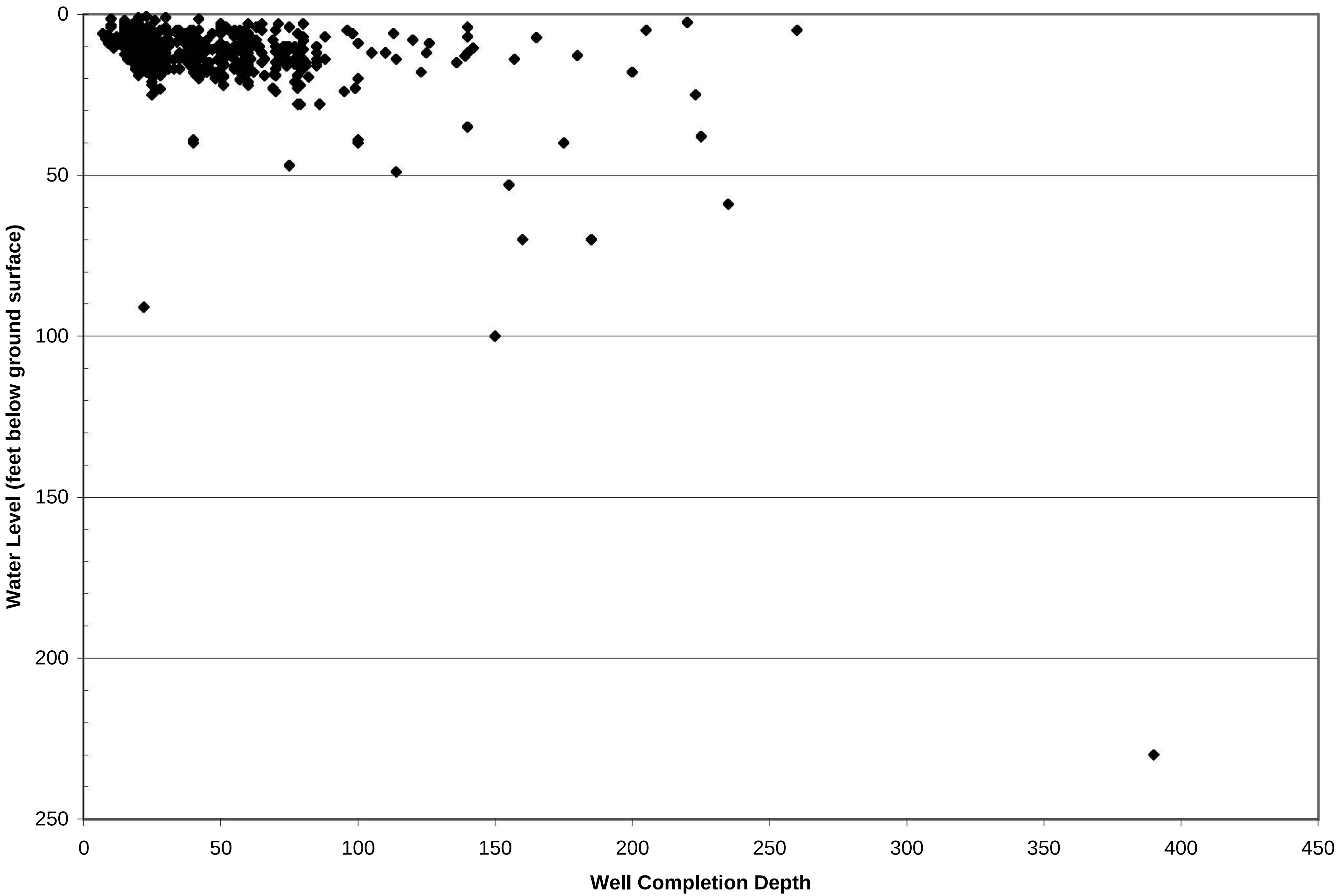
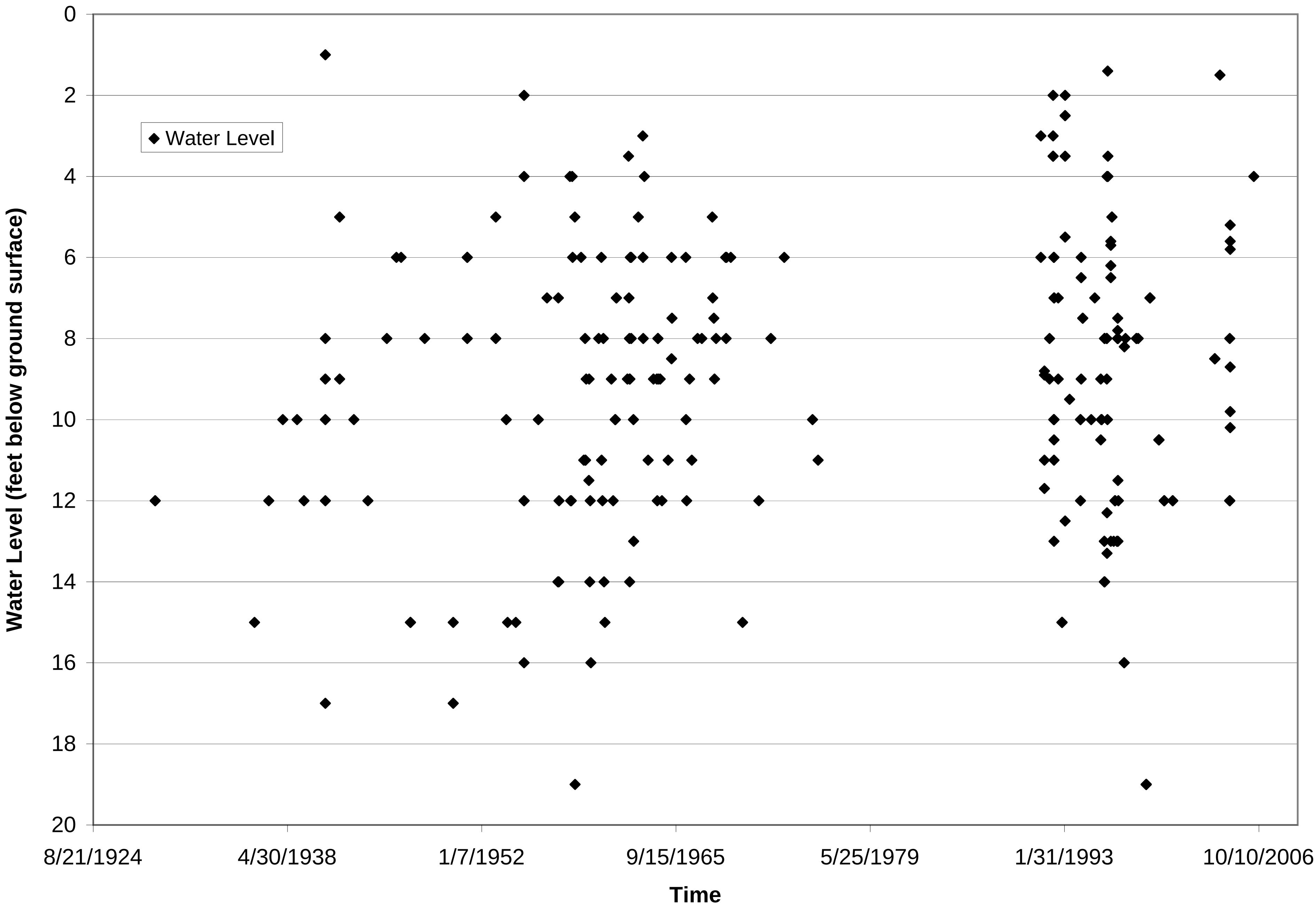


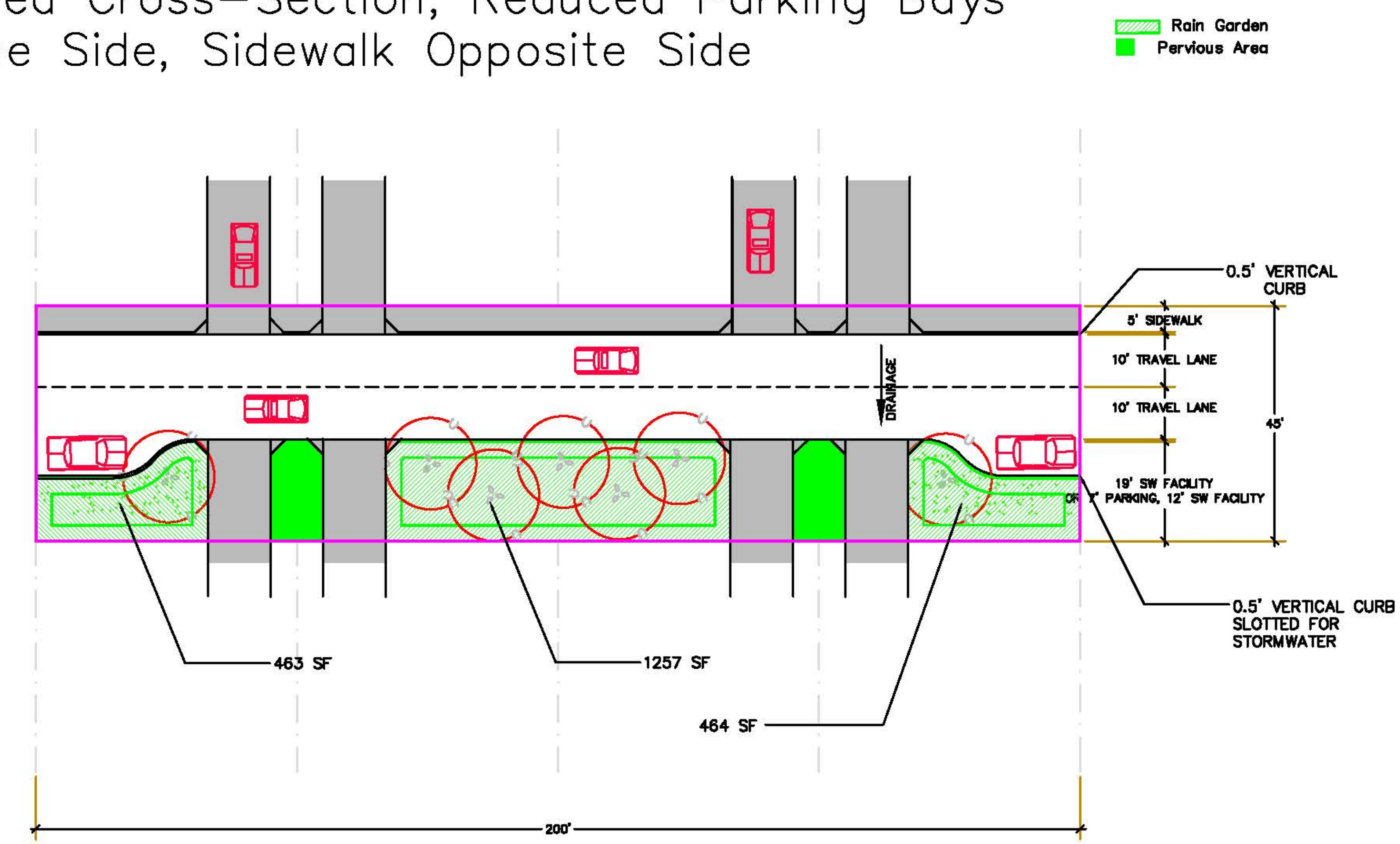
FIGURE 3
Depth to Groundwater for Shallow Wells (20 feet deep or less)



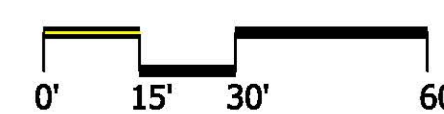
APPENDIX F

RAIN GARDEN SIZING CALCULATIONS AND PLAN VIEWS FOR SIX ROW OPTIONS

Shed Cross-Section, Reduced Parking Bays One Side, Sidewalk Opposite Side



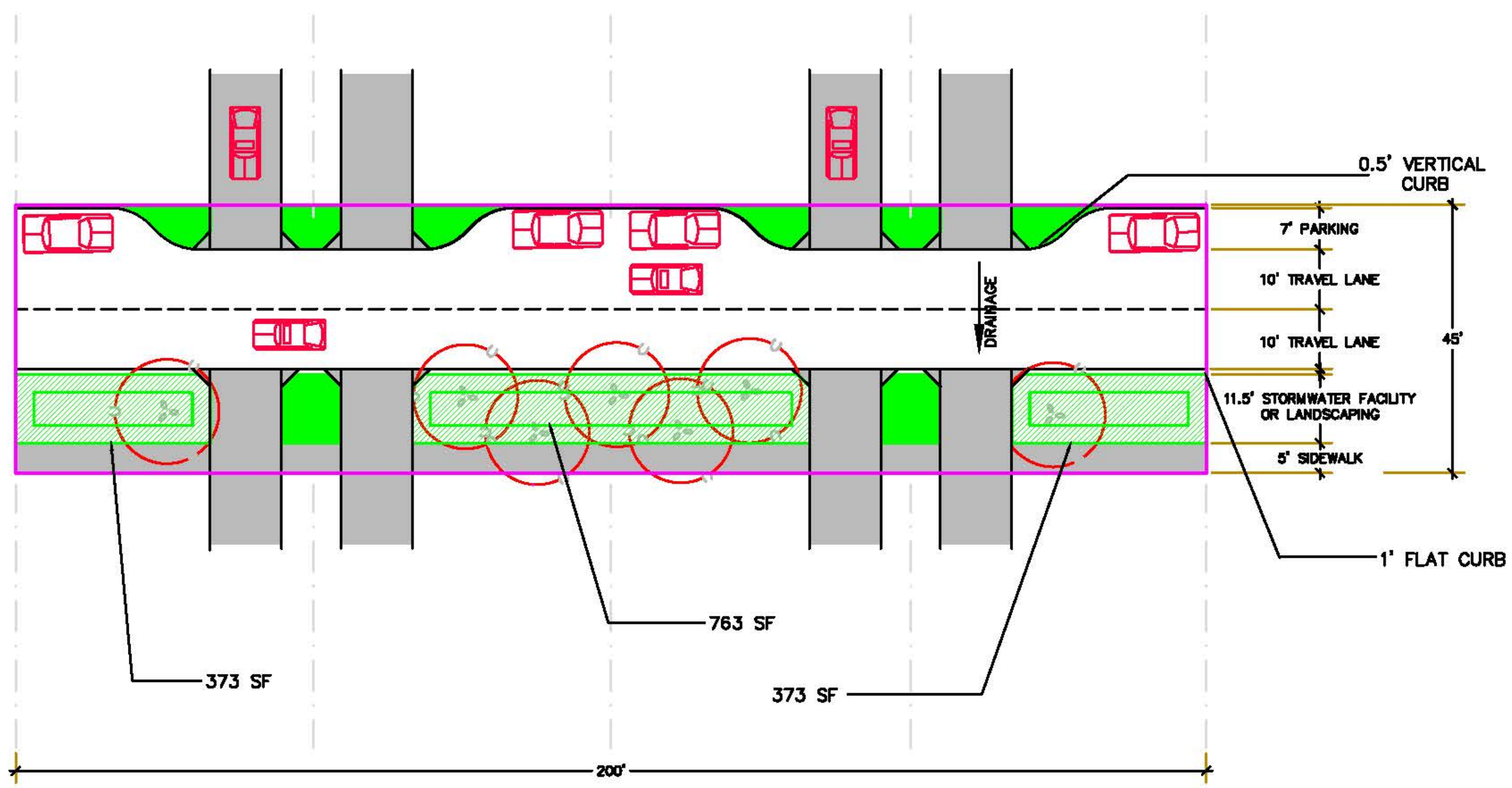
Scale: 1"= 30'-0"



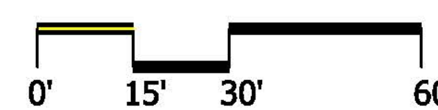
GREEN STREET CONCEPT #1 - SHED CROSS-SECTION

Shed Cross–Section, Parking Bays One Side, Sidewalk Opposite Side

Rain Garden
Pervious Areas

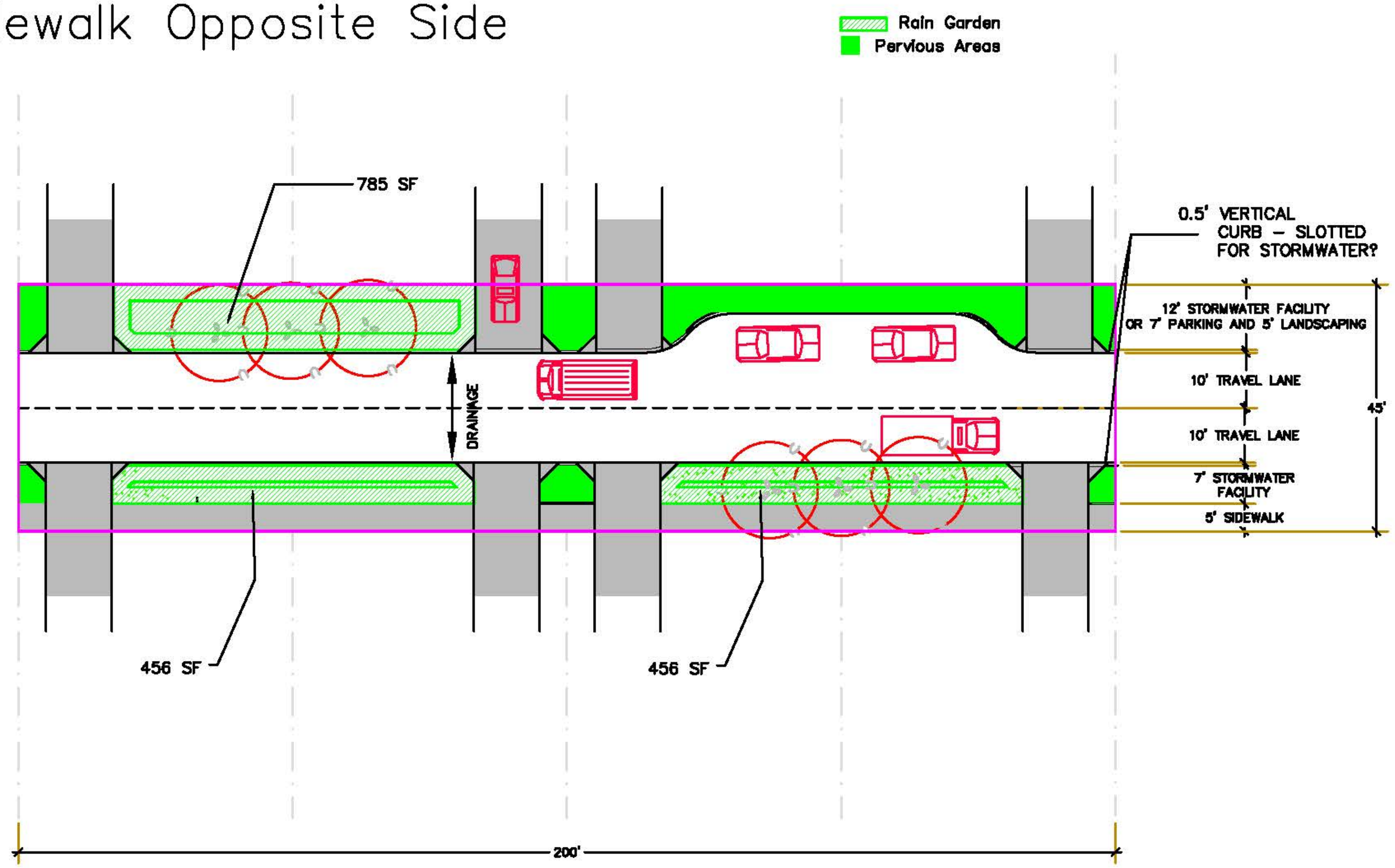


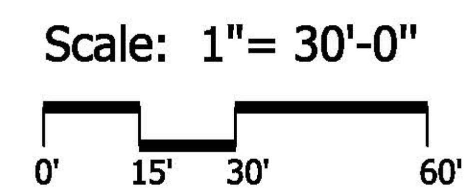
Scale: 1"= 30'-0"



GREEN STREET CONCEPT #2 - SHED CROSS-SECTION

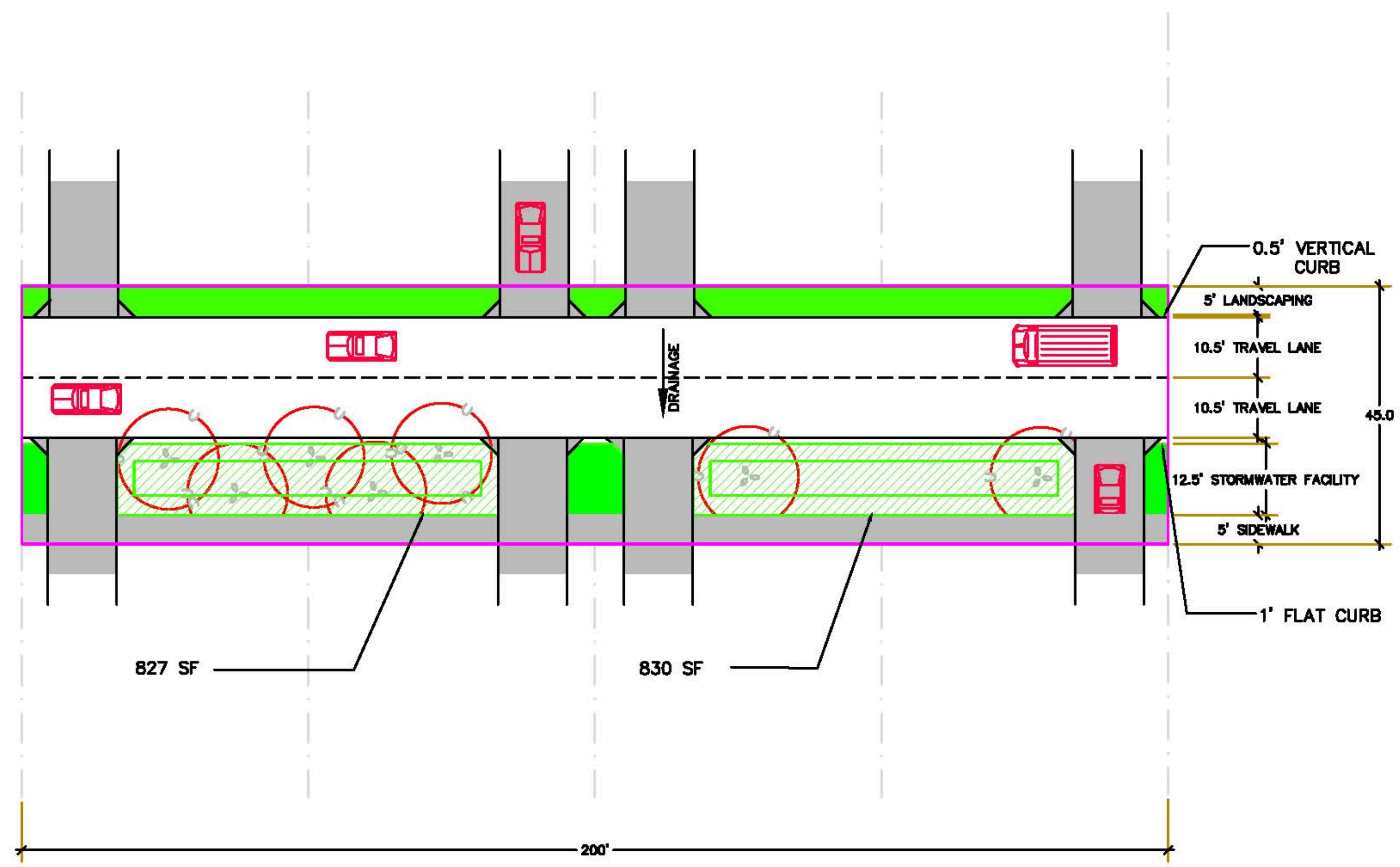
Crown Cross–Section, Reduced Parking Bays One Side, Sidewalk Opposite Side





GREEN STREET CONCEPT #3 - CROWNED CROSS-SECTION

Shed Cross–Section, On–Street Parking, Sidewalk One Side

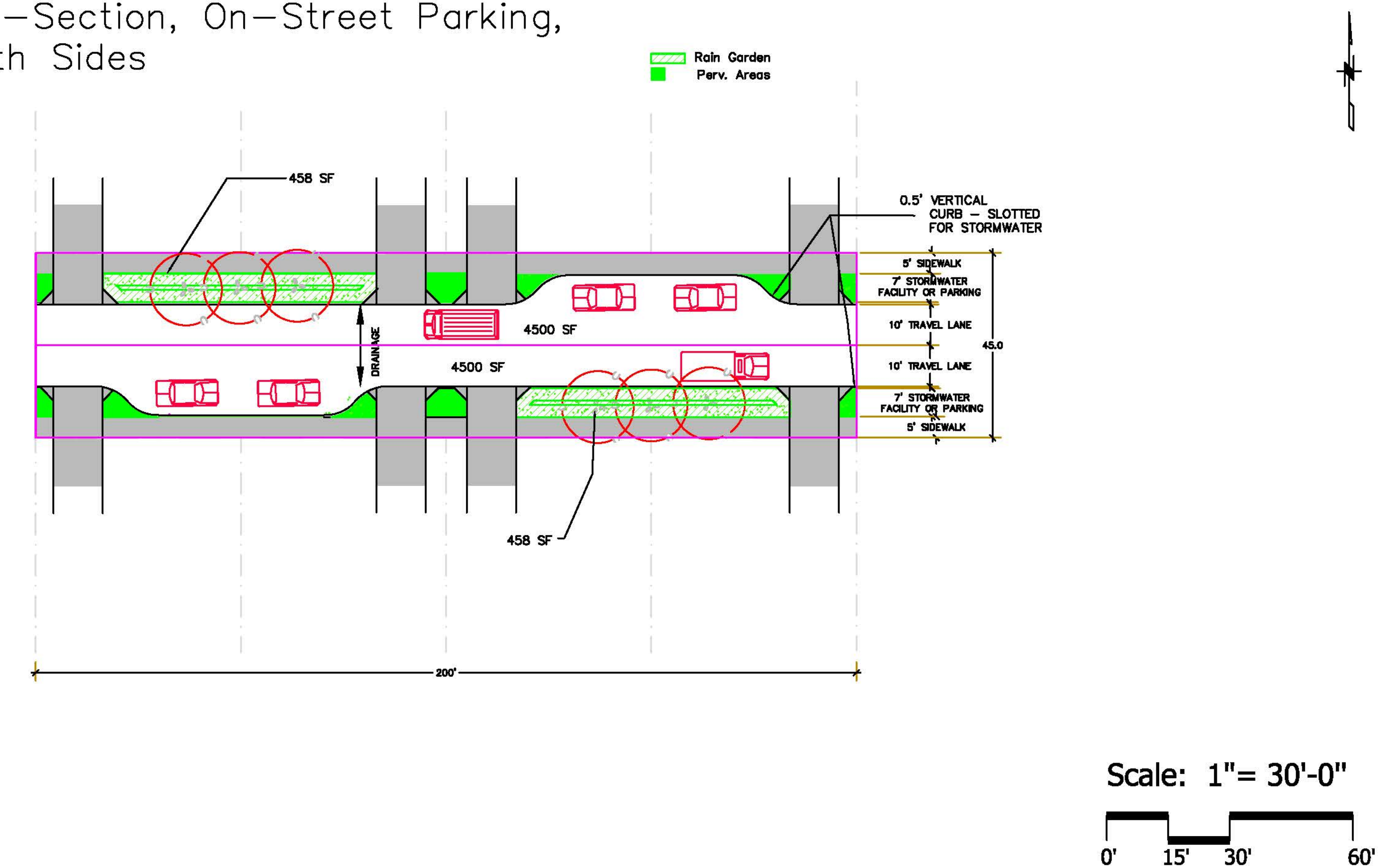


Scale: 1"= 30'-0"

0' 15' 30' 60'

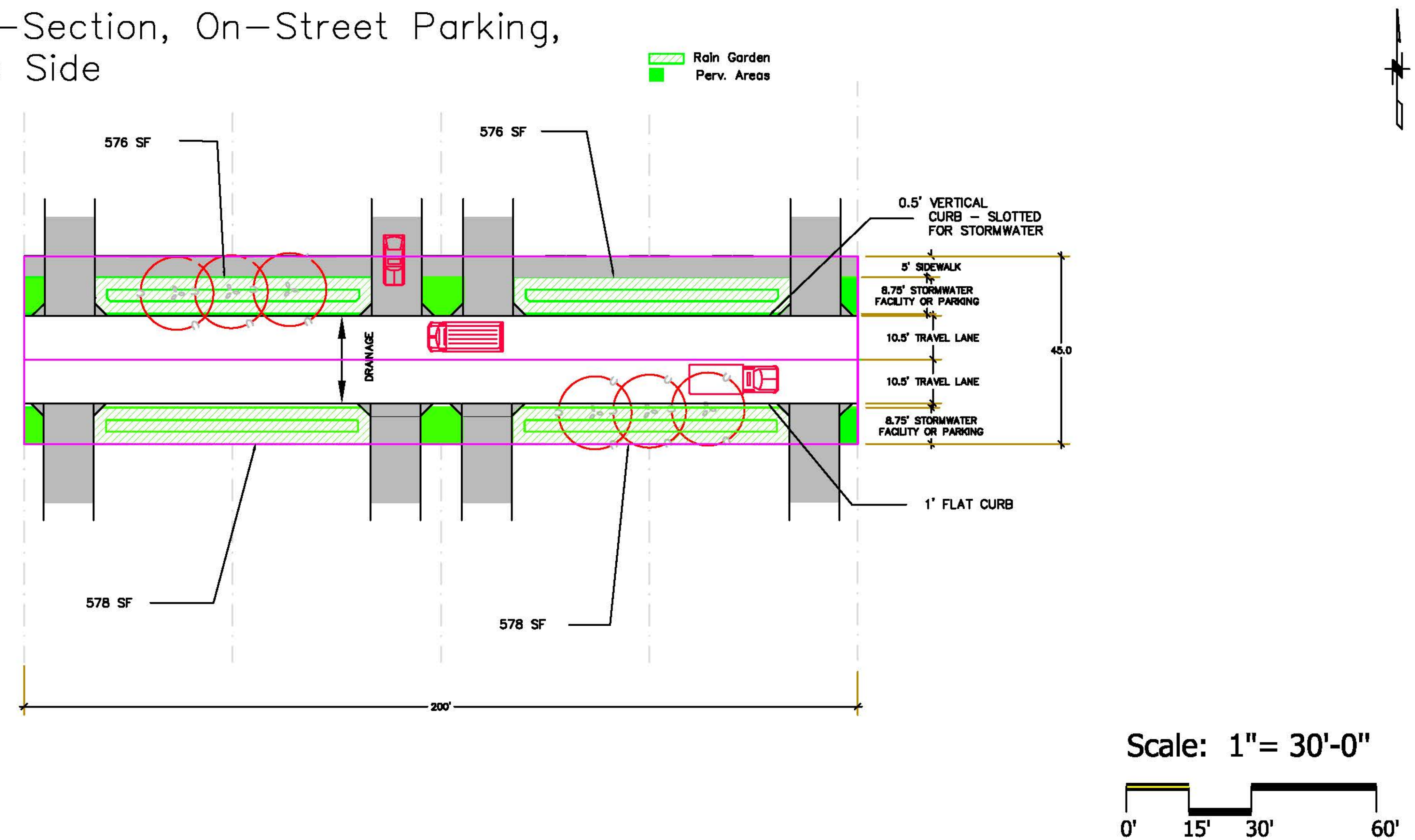
GREEN STREET CONCEPT #4 - SHED CROSS-SECTION

Crown Cross–Section, On–Street Parking, Sidewalk Both Sides



GREEN STREET CONCEPT #5 - CROWNED CROSS-SECTION

Crown Cross–Section, On–Street Parking, Sidewalk One Side



GREEN STREET CONCEPT #6 - CROWN CROSS-SECTION

APPENDIX G

SUMMARY OF MODEL REFINEMENTS SINCE THE INITIAL 2002 STUDY

To: Therese Walch

From: Hernan Rodriguez, PE and Krista Reininga, PE.

Date: April 10, 2007

Subject: River Road Santa Clara Model Changes

As requested by the City, URS has updated the XP-SWMM models developed for the River Road Santa Clara Stormwater Master Plan project (August 2002). Models were updated using survey data collected by Lane County between October and December 2005. Areas surveyed for updating the models were identified in Section 3.0 of the current draft basin plan (August 2002) and during a June 21, 2005 meeting and in a memo to the City from URS dated August 25, 2005. Once the survey was completed, the original subbasin delineations were refined to account for new information. In addition, drainage basins for UIC areas were delineated. The model was then run to simulate conditions both with and without UICs in place. This was done to get an initial idea of whether decommissioning of all UICs would result in additional flooding issues. The purpose of this memo is to summarize the following:

- changes to the original model based on new survey information;
- changes to the model based on updated subbasin delineations;
- methods for modeling UICs; and
- results from modeling conditions both with and without UICs.

HYDRAULIC CHANGES

The following changes were made, based on the new survey data collected between October and December 2005, when updating each subbasin model:

Flat Creek Subbasin

- Model segment RSFC020E from node 72765 to 72764 was divided into 3 segments to incorporate the culvert under Hilo Dr. (node 75697 to 75698) that was not included in the original model. The new segment names are RSFC020Da, RSFC020Db, and RSFC020E.

- Model segment RSFC050A from node 72244 to 72799 was divided into 5 segments to incorporate 2 culverts that were not included in the original model. The new segment names are RSFC050A, RSFC050B, RSFC050C, RSFC050D, and RSFC050E.

Spring Creek Subbasin

- Model segment RSSC010D from node 85033a to 72012 was divided into 3 segments to incorporate a culvert not included in the original model. The new segment names are RSSC010D, RSSC010Da, and RSSC010Db.

- Segment RSSC040B from node 72006 to 72007 was updated with a new length, invert, and rim elevations obtained from the new survey data.

- Model segment RSSC100B from node 72002 to 72770 was divided into 3 segments to incorporate a culvert not included in the original model. The new segment names are RSSC100B, RSSC100C, and RSSC100D.

Willamette Overflow Subbasin

- A new segment RSWO140 from node 77703 to 58311 was added to the model to extend the model farther upstream to incorporate a 54-inch pipe segment upstream of node 58311 that was not included in the original model.

- Node 58289 was renamed to 58310 to match the node number from the survey data and the GIS layer.

- Data for segments RSWO110A, RSWO110B, RSWO110C, RSWO040C, RSWO090B, RSWO090C, RSWO090D, RSWO090E, RSWO090F, RSWO090G, RSWO090H, RSWO080A, were updated according to survey information related to lengths and elevations.

- Segment RSWO090A was divided into 2 segments, segment RSWO090A and RSWO090Aa, since new survey data was collected for these segments individually.

- Segments RSWO070E, RSWO070F, RSWO070G, and RSWO070H were renamed to RSWO070B, RSWO070C, RSWO070D, and RSWO070E respectively because old segment names RSWO070A, RSWO070B, RSWO070C, and RSWO070D were combined into one segment (RSWO070A) in the new survey data. These segments were updated with new invert elevation and cross-section information obtained from new survey data.

- Segments RSWO060B, RSWO060A, RSWO050C, RSWO050B, RSWO050A, and RSWO040C were updated based on new survey information for lengths and elevations.

A-1 Channel Subbasin

- Segments RSA1100L, RSA1100K, RSA1100G, RSA1100F, RSA1100E, RSA1100D, RSA1100C, RSA1100B, RSA1100A, RSA1090G, RSA1090F, RSA1090E, RSA1090D, RSA1090C, RSA1090B, RSA1090A, RSA1080B, RSA1080A, RSA1060U, RSA1060J, RSA1060I, RSA1060H, RSA1060G, RSA1060C, RSA1010A, RSA1030B, RSA1230A, RSA1160F, RSA1160E, RSA1160D, RSA1160C, RSA1160B, RSA1160A, RSA1150B were updated based on survey information for lengths and elevations.

- Segment RSA1060S from node 71209 to 71210 was divided into 2 segments to incorporate a 36x72-inch CMP culvert that was included in the new survey but not included in the original model. The new segment names are RSA1060S and RSA1060Sa.

- Segment RSA1060F from node 71214 to 71215 was divided into 2 segments to incorporate a 48-inch CMP culvert that was included in the survey but not included in the original model. The new segment names are RSA1060F and RSA1060Fa.

- Segment RSA1030D from node 73395 to 73394 was divided into 3 segments to incorporate the culvert under Auction Ct. that was not included in the original model. The new segment names are RSA1030D, RSA1030Da and RSA1030Db.

- Node numbers for segment RSA1160H were changed from 72727-72728 to 71941-71940 to match node numbers from the GIS layer.

HYDROLOGY CHANGES

The following changes were made with respect to updating subbasin delineations, as a result of the new survey data:

Flat Creek Subbasin

- A runoff node was moved from node 72244 to 75659 according to the new basin delineation.

A-1 Channel Subbasin

- Subbasin RSA1-020 was added at node 72757 according to the new basin delineation.
- Subbasin RSA1-070 was moved from node 72740 to 72742 according to the new basin delineation.

MODELING METHODOLOGY TO ACCOUNT FOR UICs

A separate XP-SWMM model was developed for each of the four subbasins in the River Road Santa Clara major basin. The following four models were developed for each of the four subbasins:

- Existing conditions model without UICs;
- Existing conditions model with UICs;
- Future conditions model without UICs; and
- Future conditions model with UICs

Existing Conditions Model without UICs

This model was developed to represent existing conditions of the stormwater system without modeling the effects of UICs. All runoff from subbasins with UICs was assumed to drain into the piped and surface stormwater drainage system without infiltrating into the existing UICs.

Existing Conditions with UICs

This model was developed to represent existing conditions of the stormwater system while modeling the effects of the UICs. UICs were assumed to infiltrate runoff from up to the 5-year storm event (3.6 inches). UICs were modeled as storage nodes that store runoff up to the 5-year storm event. When the capacity of the storage node is reached (5-year event) the subbasins with UICs begin contributing all additional runoff flows to the piped and surface stormwater drainage system. The storage nodes were sized using an iterative trial and error process until the 5-year event filled the storage volume but did not contribute runoff flows to the piped and surface stormwater drainage system.

Future Conditions Model without UICs

This model was developed to represent future development conditions of the stormwater system without modeling the effects of the UICs. All runoff from subbasins with UICs was assumed to drain into the piped and surface stormwater drainage system without infiltrating into the existing UICs.

Future Conditions with UICs

This model was developed to represent future development conditions of the stormwater system while modeling the effects of the UICs. UICs were assumed to infiltrate runoff from up to the 5-year storm event (3.6 inches). UICs were modeled as storage nodes that store runoff up to the 5-year storm event. When the capacity of the storage node is reached (5-year event) the subbasins with UICs begin contributing all additional runoff flows to the piped and surface stormwater drainage system. The storage nodes were sized using an iterative trial and error process until the 5-year event filled the storage volume but did not contribute additional runoff flows to the piped and surface stormwater drainage system.

Results of Modeling Conditions Both With and Without UICs

While it was anticipated that existing UICs might relieve some flooding issues, the comparison of model results between the models with and without UICs for the design storms required by the City (10-year and 25-year storm event) did not show significant differences with respect to flooding problems. It is assumed that this was the case for the following reasons:

1. The UICs were only assumed to infiltrate runoff up to the 5-year storm event and the design events modeled were the 10 and 25-year events. Hence, the accommodation of the 5-year storm was overwhelmed by the larger storms; and

2. Only 20% of the total drainage area was assumed to be area draining to UICs. Hence the majority of the drainage area is accommodated via the pipe and surface drainage system only.

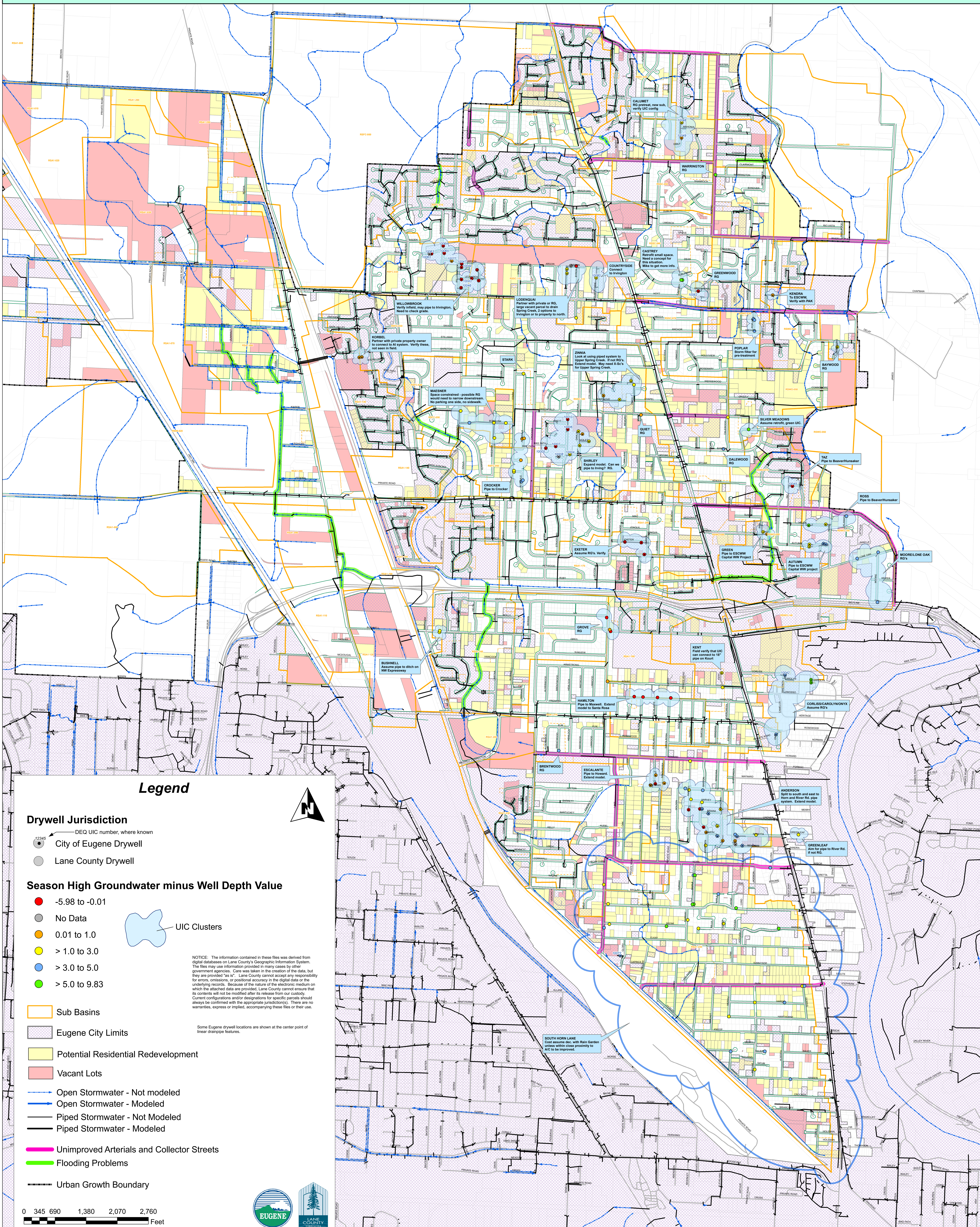
Following the development of the XP-SWMM models for each subbasin (with and without UICs) it was discovered that the GIS maps only included the 86 Lane County dry wells and not the 72 Eugene dry wells. A decision was made not to update the basin delineations to include the Eugene UICs, as resources were limited to conduct an additional analysis. In addition, it was decided that the model without the UICs would be used to design conceptual flood control CIPs, in order to be conservative and to account for the fact that UICs may need to be decommissioned in the future to address UIC regulatory requirements under the Safe Drinking Water Act. Therefore, results of an updated analysis to include the Eugene dry wells in addition to the Lane County dry wells already included in the model would not provide significant additional value.

APPENDIX H

RIVER ROAD SANTA CLARA
STORMWATER MANAGEMENT STRATEGY
DEVELOPMENT MAP

River Road - Santa Clara Stormwater Management Strategy Development

Preliminary Concepts



APPENDIX I

PUBLIC COMMENTS AND RESPONSES

Comments on the River Road / Santa Clara Stormwater Basin Master Plan from the Santa Clara Community Organization.

Therese Walch
Eugene Public Works
99 E. Broadway, Suite 400
Eugene, OR 97401

October 23, 2009

This basin master plan for River Rd/Santa Clara is an opportunity to use all the "tools" in the toolbox to best protect the open waterways, maximize storm water conveyance through these channels, and accommodate future densification without sacrificing what makes the RR/SC neighborhoods unique. While this plan touts some new ideas in the use of rain-gardens both along streets and in neighborhoods, it misses the mark in recognizing the existing natural infrastructure and prioritizing its protection and enhancement. The cost of manufactured infrastructure that degrades over time versus the protection of existing natural infrastructure that improves over time is not something we can afford, and is not the wisest use of what we have. This plan falls short of its aspirations to "provide a management strategy for storm water that reflects the uniqueness of the RR/SC basin". Our hydrology is not what makes us unique. The forms and patterns created by heritage trees, waterways, prime soils, agricultural operations, significant populations of both urban and rural and county and city residents and all they bring to their neighborhood is what makes us unique. Without taking into account these factors, this plan has no chance to meet its goal of planning reflecting that uniqueness.

The major difference between this basin and others throughout the city is our lack of storm water infrastructure and our extensive network of open waterways. These waterways, both large and small, are the infrastructure that makes development possible. They are also our primary defense from flooding. To date, many of the "lesser" waterways in our area have not been mapped and merit no level of protection from filling by development. These swales and watercourses, not wet much of the time, are what protect the existing older development from high water events. As larger lots on these swales are divided and infill development happens, the swales are not identified as part of a complete stormwater system and are instead deemed "depressions" in otherwise developable land and filled. There is no recourse for the existing residents along what was a continuous watercourse that now ends at their property line. The neighbor's fill has increased their risk of inundation. There is a need for these watercourses to be mapped and protected from filling. Developers in our area view them as impediments to the "clean slate" they like to use when mapping their subdivision. We see them as an opportunity for the developer to design around their own use of them to accommodate the increase in stormwater their development will ultimately bring while maintaining the natural infrastructure that protects all of Santa Clara and River Rd. In this way, there is a direct benefit for the developer to use them and save on manufactured infrastructure costs.

To date our basin has a total impervious surface area of approximately 37.5%, and is projected in this plan to reach 51% at buildout. This will be the highest projected percentage of impervious surface of any of the city's basin areas. This plan highlights how impervious surface area affects both water quality and flood control profoundly.

> Water quality: Research shows that "water quality degradation occurs at relatively low levels of imperviousness (10-20%), so the implications of development on water quality are significant" (p.2-23).
>
> Flood control: The computer model used to predict water levels did not match actual observed levels. Model parameters were adjusted to try and make the model more closely resemble actual conditions. Then several "additional model runs were conducted to evaluate the model's sensitivity to changes in input parameters. The results of these sensitivity analyses indicated that the impervious percentage area was the most sensitive model input parameter."(p. 3-6)

So, with impervious surface percentage being the most influential variable, this basin projected to have the greatest impervious area, and our necessary reliance on infiltration and open waterways for stormwater conveyance, alternative development standards to require on-site storage and infiltration of stormwater makes sense. The unique set of circumstances in the RR/SC basin (lack of piped infrastructure, reliance on infiltration and open waterways, highly permeable soils) requires a solution that protects and enhances our natural drainage.

Section 2: study area characteristics
Both the city and the county have differing development standards for floodplain development and floodway development, however, "more detailed floodplain studies necessary to map floodway boundaries have not been conducted for this basin" (p.2-17). Without these delineations, development is allowed to encroach on waterways in detrimental ways. We need development standards that will allow our natural infrastructure to meet our needs.

Section 3: flood control evaluation
Data collected for the computer modeling in this section was collected over an eight day period and validated for only three of those days in only one location. The effects of the resulting modeling did not match observed conditions and the data was subsequently "adjusted" to try and match real events. This is not a comprehensive data set upon which to draw conclusions for an entire basin, design major capital projects and form a course of action.

In looking at table 3-2, which details the hydraulic performance of RR/SC under present conditions and notes capacity issues for 10, 25, 50 and 100 year storms, there is no data listed for WO-005 from node 72088 continuing downstream to the end of the basin boundary. This section of the WO experienced significant flooding in the Feb. 1996 event. Stormwater rose from the storm drains to inundate the street over the curbs. In relating this to public works multiple times over the last few years in relation to ongoing development on this section of the WO, we were told that in high water events the sheer quantity of water in the Willamette River causes the WO to back up and not be able to drain into the Willamette. This anomaly is not reflected in the planning along the WO, or in the computer model which projects waterway capacity in high water events. The 1996 high water was deemed a "25 year" storm event, yet this section of the WO rose to the 374-375 foot level, close to the"100 year flood" level. I am concerned that this computer modeling will not reflect actual conditions.

Drywells in our area were designed to accommodate a five year event. Current code requires stormwater systems to accommodate a ten year event. When rainfall exceeds the five year event, drywells become ineffective and the water is instead infiltrated where it falls, in roadside swales, in "remnant" waterways and identified open waterways. The data presented here shows that there are very few flooding problems associated with existing development in both the 10 and 25 year storms, yet the plan, in section 3.5.1 proposes 16 major capital projects associated with existing and future modeled capacity problems. Section 3.5.2 proposes an additional thirty-some projects associated with drywell decommissioning and rain gardens along all streets south of Horn Lane in River Rd. The modeling for future problems was done with the assumption that the drywells would be decommissioned. If that is so, how are these two lists not redundant and creating capacity for the same stormwater twice? The data presented (few capacity issues, disparity between modeled and observed conditions, ineffectiveness of drywells in carrying capacity) is not complete or compelling in light of the proposed capital projects.

Plans for the other basins, completed in 2002, did not incorporate development standard alternatives. "The reason for this decision was that most of the identified flooding problems were anticipated to occur as a result of existing developed conditions. While future development would exacerbate some of the problems, a capital project to address flows from future development was more cost effective than requiring developers to address the issue through on-site storage requirements. For this basin, the conclusions from this previous analysis were assumed to apply" (p. 3-15). The RR/SC basin plan was delayed for the last seven years in part because this basin is <u>significantly</u> different than the other basins. The challenges we face and the opportunities we have require us to problem solve differently than we did in the other basins. The last quote, however, clearly states that there was no analysis of the value of development standard alternatives in light of our circumstances and whether or not they are an appropriate tool for RR/SC. The data provided shows that there are few capacity issues related to existing development but that capacity will need to be expanded to accommodate expected buildout scenarios. This possibility cries out for the use of development standards to avoid costly capital projects and to meet the goals of the neighborhoods for livable communities. The required use of low impact development standards (LIDS), pervious pavement in all roads, parking lots and driveways, and on-site storage and infiltration of all storm water would go a long way toward meeting the goals for water quality and flood control for new development without staggeringly expensive capital projects.

Section 4: water quality evaluation

The water quality evaluation for the RR/SC basin is based on incomplete data. All water quality collection sites were located in other basins and pollution estimates were extrapolated from measured levels of total suspended solids (TSS) even though "TSS has not been shown to directly relate to all other pollutants".

The estimated percentage increase in TSS loads (as a measure of pollution) for our basin, according to fig. 4-2, is approximately 20% due to decommissioning of drywells, but 55% due to future development. These figures suggest that future development will be far more deleterious to our water quality than the effects of decommissioning drywells. However, this plan proposes no development standards for future development to address this situation. Conventional wisdom is that storm water directly injected to the water table via drywells pollutes the groundwater and that runoff directly piped to open waterways pollutes the surface water. We agree with those premises, but do not come to the same action plan for the basin based on the collected information. Instead of trying to collect and treat storm water on a municipal scale without adequate mechanical infrastructure and piping, a dispersed system of infiltration based on development standards that prioritize non-mechanical infiltration of storm water, on site infiltration, and post development flows not exceeding pre-development conditions would accomplish both capacity and quality issues. Greater dividends will be reaped through addressing future development impacts before they are manifest than creating oversized capital projects for decommissioning drywells that will also hopefully meet the needs for future capacity.

Pollutant load estimates in this plan are built on an assumption that "new development would occur without the inclusion of water quality BMPs". However, new stormwater standards require the pretreatment of storm water using BMPs in PUDs and subdivisions and the stormwater code updates should require the same of all new development.

The idea that "decommissioning of all drywells would result in those discharges being transferred, untreated, to surface waters" presupposes that the water otherwise captured by drywells will be sent to open waterways. The water presently collected in drywells could surface infiltrate, as happens informally everywhere throughout our basin presently. If this were the case, it would not be transported to surface waters untreated, but treat itself in our native soils through infiltration.

The proposed rain garden street designs and the accompanying assumption that streets in our area will be widened at the time of "improvement" have not been publicly discussed. Adopting a menu of options that change a 25 foot road bed to a 50 foot roadway without public process or input will create undue amounts of tension and dissent within our neighborhoods. Experiences with context sensitive street designs and the ongoing discussions around costs to the adjacent property owners for these "improvements" need to be rolled out to our community with adequate opportunity for participation, questioning, and processing by the residents. Ironically, all of the proposed street options create more impervious surface than presently exists. Are we not then creating the problem so that we can engineer a solution instead of valuing our narrower roadbeds which do an admirable job of transporting us and reducing runoff? Many communities around the world are adopting the use of narrower streets, shared streets and other more innovative solutions that encourage the use of alternative modes of transport while reducing the paving footprint, preserving urban canopy and vegetation, and improving neighborhood livability.

Section 5: stormwater related natural resources

As mentioned in the beginning, the top-tier priority for stormwater related natural resources in our basin would be the mapping, protection, and enhancement of all our "lesser" waterways that are not accounted for through Goal 5, WR, WP and WQ overlays. The progress of changes to and implementation of LID standards in the code is unclear to us, but the required use of them within our basin makes functional, fiscal, and environmental sense. Doing all we can to minimize the need for large scale centralized infrastructure will allow us to grow and develop at a rate that the neighborhood can support.

In closing, this plan outlines a wide array of costly capital projects designed to meet capacity and quality issues that have been identified based on incomplete data. Instead of forging ahead with a hope that this will be good enough, we would like to see us really look at all the possible tools to meet our needs. New development can and should retain and infiltrate all its stormwater on site. This is done in other communities with both new development and redevelopment and with retrofits for existing development. Responsibility for the effects of our own impacts should rest with each of us. In this way we can begin to build neighborhoods that meet the needs of their residents and minimize the need for costly capital projects that invariably need maintenance and replacement over time.

Thank you for your consideration,
Jerry Finigan, Chair SCCO
Kate Perle, executive board SCCO
Kelly Burke, executive board SCCO
Rod Graves, executive board SCCO
Timothy Foelker, executive board SCCO
Cathy Lesiak, member SCCO
Karen Lawrence, member SCCO

Comments on the River Road / Santa Clara Stormwater Basin Master Plan
from the River Road Community Organization.

October 23, 2009

Dear Therese,

These comments are submitted on behalf three members of the RRCO Executive Board. There has not been time to share the information in the Basin Plan with RRCO's full board or membership or the broader neighborhood during this comment period, nor have we been able to solicit feedback or take any kind of vote on its content.

Overall, we are very disappointed that the proposed Basin Plan does not assess or recommend low impact development (LID) standards for our neighborhood--standards to reduce the percentage of impervious surface and development footprints, protect well-draining native soils and "country-style" drainage systems, and protect large trees. It also does not discuss downspout disconnects or rainwater catchment systems, topics raised by RRCO members at past meetings about the Basin Plan. LID standards are desirable not only for stormwater management, but also to protect neighborhood character and broader environmental values. RRCO and residents of our area have been asking for such standards for many years--during the Transition Project meetings and other processes and venues. As noted in the Executive Summary, each drainage basin offers unique conditions and opportunities for implementing development standards. Yet this plan ignores previous public input, and does not use this opportunity to propose unique or specific low impact development standards for this basin.

We are also disappointed that neither this Plan nor existing City-wide stormwater standards (whether for private development or public capital projects) require on-site infiltration to the maximum extent feasible, as is required in Portland, nor require non-structural best management practices first, before use of engineered facilities.

We are also very concerned that the proposed local street designs--with sidewalks, wider lanes or parking bays, and on-street rain gardens--are much wider and pave much more land than our existing local streets. Such streets would dramatically alter the character of our neighborhood, lead to loss of large trees and landscaping, and likely involve costly assessments to adjacent property owners. We believe that they would also encourage faster driving and greatly reduce the effective pedestrian zone relative to our existing "shared space" streets. There must be less expensive and intrusive ways to manage stormwater runoff from our streets. More options need to be evaluated (shared space and skinny streets, pervious/porous surfacing), and the public needs much more opportunity for involvement in designs for our local streets.

Section 3: Flood Control Evaluation

3.2-3.4 Model validation, results, and flooding problems

This plan compares model results with actual conditions at just one point during one 3-day rainy period. This does not seem like enough data to validate a model over the entire basin. Also, the model results at this one point do not correlate well with actual observed conditions, even after "adjustments"--actual drainage is considerably better than predicted by the model. It seems that more work is needed to truly validate the model, or it may lead to over-predicting flooding problems and over-sizing of stormwater facilities.

Also, simulations were done that showed that drywells do not provide significant drainage benefits in larger storms, even if they are carrying the full flow they are sized to handle (from a five-year storm). And even without the drywells being included, the overall model shows very few flooding problems even during the larger (10- and 25-year) storms. This aspect of the modelling does seem to match some of our observations about what happens to roadway runoff during a rainstorm. Water infiltrates quickly into roadside drainage swales, and some of it also pools at low points in the street or areas where the drainage areas along the right of way have been compacted or paved. Eventually this water just evaporates. Certainly areas right near the drywells do drain into those for a short time during and after rainstorms, but it seems that even without the drywells, water flows have many places to drain away naturally into roadside swales, and soils are permeable enough to drain quickly. More could be done to educate property owners and residents about the function of the roadside swales, and to intervene to correct minor drainage problems in areas where water pooling does occur.

3.5.1 Capital projects

Capacity deficiencies (e.g, areas of potential flooding) in the system are identified through modelling, and 16 specific capital projects are recommended to add more capacity to provide varying levels of flood protection for various sizes of rainstorms. However, as above, it seems that these projects might be over-sized, given that the model seems to overestimate flooding problems. It seems important to refine the model until its results more closely match observed reality before designing capital projects, some of which are extremely expensive.

3.5.2 Drywell decommissioning projects

Supposedly the capital projects above will handle all modelled and observed flooding problems throughout the system. Also, the modelling results and on-street observations suggest that existing drywells may not be contributing much to the overall drainage of our area. Given this, is it really necessary to add additional capacity to replace the lost capacity of drywells? Isn't this just redundant capacity that will be largely superfluous to controlling flooding, just as the drywells are now? Certainly the capacity in existing roadside swales needs to be preserved, but it seems that capacity arguably is sufficient as long as pavement width of roadways is not widened (since there is very little flooding now).

The assumption that local streets will be widened at the time of "improvement," with added paving width for driving, parking and sidewalks, is something that has not had a proper public airing. These assumptions also do not seem to be the best choices in terms of stormwater management.

In our opinion, the local street designs summarized in Table 4-1 are unnecessarily wide, with too much new paving and too much deference to facilitating cars. Many neighbors have expressed interest in narrower, pedestrian-oriented "shared street" or "woonerf" street models (and currently our local streets function in much this way), yet none of the proposed designs reflects such a model. The models that are proposed all include a separate new sidewalk, which arguably is not necessary or desirable for local streets in most of our neighborhood. The models also propose either widening existing travel lanes for cars, or adding separate parking bays. Adding all this pavement is detrimental to stormwater goals, as well as to neighborhood livability and other environmental goals. And it seems to be contributing to the need for extra-wide engineered rain gardens to infiltrate the induced new runoff. In any case, the wide "footprints" of the new roadways (2.5 - 3 times wider than current paving widths) would have a huge impact on neighborhood character (front yards, landscaping and existing large trees). The design of residential streets, together with the amount and speed of traffic they carry, contributes significantly to a sense of community, neighborhood feeling, and perceptions of safety and comfort. At the least, affected residents need much more say before any street designs are adopted as guidelines. Residents also need to be fully informed at the outset about their responsibility for costs of road improvements, and the relative costs of various design options. The potential costs and impacts on neighborhood character are significant.

Residents should have the opportunity to evaluate and compare some "shared street" options without sidewalks, and some narrower driving lane and on-street parking options. Some communities and guidelines are now suggesting and installing roadways as narrow as 14 feet wide for two-way traffic (18 feet of "drive-able" surface counting edge treatments). Also, permeable pavement options need to be considered. The use of permeable paving could reduce roadway runoff and help filter out pollutants, reducing or eliminating the need for additional stormwater facilities. Residents are also interested in "context sensitive" designs that preserve existing large trees, something that also has value for stormwater management.

3.5.3 Development standards

This section states that flood control development standards were not selected for implementation in other Basin plans completed in 2002, for various reasons. The text also notes that detailed cost comparisons were done in conjunction with the other Basin Plans, showing that it was more cost effective to use public capital improvements, not a combination of public improvements and requirements on developers to address on-site storage.

It is not explained why the same conclusions from other Basin Plans, or the rather dated cost analyses, are assumed to apply to our RR-SC Basin today. It is also not clear how total costs of public capital projects can (or should) be compared with costs to private developers. At the least, more explanation is needed to justify why these earlier data and conclusions are relevant to the RR-SC Basin and this Basin Plan.

The text notes that many flooding problems in other basins are caused by "existing developed conditions", and concludes that these problems need to be addressed by new (public) capital projects (instead of new development standards). It seems that other conclusions are equally reasonable. If existing (private) development causes flooding, then doesn't this suggest that development standards DO need to change to prevent similar flooding problems in the future? Also, shouldn't private property owners be required to address existing problems on their property, rather than new public projects having to be sized to handle their runoff? Portland's Stormwater code encourages, and in some cases, requires stormwater retrofit projects for private property. Eugene's could do the same.

In any case, at least parts of the RR-SC Basin are significantly different than other Basins. Many areas in our neighborhood rely more on on-site stormwater infiltration and (non-structural) natural infiltration. We also have a relatively high groundwater table, and many people have and use irrigation wells. Current City-wide stormwater standards allow, but do not encourage or prioritize dispersed, on-site stormwater management. City stormwater codes also do not require protection of natural hydrology, nor offer enough non-structural choices for accomplishing on-site infiltration. We do not believe that existing City-wide stormwater standards or programs to encourage LID practices are sufficient to protect natural drainage, groundwater recharge, or surface water flows needed to maintain stream ecology in our area. Surface water flows (Flat Creek, Spring Creek) have already been altered by existing development.

Also, if projected total impervious surface in the Basin could be reduced via new development standards, it seems that would reduce the few modelled and observed flooding problems throughout the system and allow some of the proposed public (flood control) capital projects to be smaller in size.

Here are some of the low impact development standards or methods that we think need to be required or promoted in our Basin, and that need to be evaluated in this Basin Plan:
* prioritization of on-site infiltration (as in Portland)
* prioritization of non-structural Best Management Practices, including

* Cluster development,
* Minimize soil compaction,
* Minimize total disturbed area,
* Protect natural flow pathways,
* Protect riparian buffers,
* Protect and enhance sensitive areas and native vegetation,
* Reduce impervious surfaces,
* Disconnect impervious surfaces/downspouts,
* Rainwater catchment/harvesting.

* Split flow infiltration methods that preserve predevelopment stormwater flows in terms of rate, quality, frequency, duration, and volume, and thus more closely mimic natural systems. This is important for groundwater recharge, and preservation of surface water flow and natural channels and landscapes.

Section 4: Water Quality Evaluation

4.2 Evaluation of existing and expected future water quality conditions

The pollutant load estimates seem based on very shaky assumptions. First, no actual data was collected from our Basin about pollution levels, but data from other areas of Eugene was used to estimate it. Second, pollutant loads for Total Suspended Solids (TSS) were used as a general indicator of other pollutants, though "TSS has not been shown to directly relate to all other pollutants". Third, when computing pollutant loads, decommissioning of drywells is assumed to result in 100% of those discharges being transferred, untreated, to surface waters. This seems like a very high estimate given the discontinuous nature of our drainage system, and the relatively high permeability of soils.

In any case, it is unclear how these questionable pollution estimates are even used--they don't seem to be driving particular actions or sizing of treatment facilities.

On pg. 4-5, the Plan does conclude that "pollutant loads in the RR-SC basin could potentially increase by up to 85% as a result of future development and drywell decommissioning, if treatment and/or other forms of infiltration are not provided for flows associated with drywell decommissioning." But in fact, Figures 4-1 through 4-3 show that the treatment of flows associated with drywell decommissioning would handle only a small part of the additional pollution that is projected--and this is the case even with the seemingly very exaggerated assumption about pollution that will be re-directed from drywells. In fact, the data presented show that most of the projected future pollution will be from new development.

Thus, "treatment and infiltration of the flows associated with drywell decommissioning" appears to be NOT very helpful at reducing the potential 85% increase in pollution that is mainly from other sources. Instead, it seems that development standards to address pollution from private development would be more effective, and the logical top priority for this Plan. The sentence would be less misleading if it said "pollutant loads in the RR-SC basin could potentially increase by up to 85% as a result of future development, if treatment and/or other forms of infiltration are not provided for flows associated with future development."

4.3.1 Capital projects alternatives

We understand that the existing drywells in our area are considered potential sources of pollution to groundwater, and that they need to be decommissioned to meet federal and state laws. However, not much else is very clear or convincing in this section about how (surface water) pollution will be addressed in our Basin, or what pollutants are of concern, or how the Basin Plan contributes to solving identified problems. In particular, it is not clear why rain gardens in conjunction with drywell decommissioning ought to be such a major focus. As above, the data is not convincing that decommissioning drywells will lead to significant additional surface water pollution that needs to be addressed near the sites of those drywells.

As in our comments on Section 3, we have many concerns about the proposed local street designs with sidewalks and rain gardens. In terms of water quality, narrower "shared space" designs that do not include a separate sidewalk, and that use pervious pavement to reduce effective impervious area of the roadway, would be better choices for protecting water quality.

4.3.2. Development standards to address water quality

Water quality development standards in the City stormwater manual may be sufficient to address water quality issues for new development in our Basin, unless significant types or amounts of new development (smaller and single-family units?) are exempted from the standards. Also, we are not aware of what particular changes are being proposed for the update underway, nor what particular ways to encourage LID might be proposed under separate LID initiatives. However, there are many other low impact development standards that protect water quality that the City could consider, including those we listed above in our comments on section 3.5.3. Some of these may be lower in cost, more effective, and serve other beneficial functions besides just protecting water quality. We think additional low impact development standards should be encouraged or required for the RR-SC basin, to protect water quality and other values.

As for preventing stream bank erosion, the Eugene Water Quality Protected Waterways ordinance and WQ overlay zone requirements are a good first step for protecting waterway segments that run through certain identified properties that are within City jurisdiction. However, Lane County needs to adopt similar protections that apply to waterway segments running through unannexed properties within the UGB. These waterways--including segments of Upper Flat Creek and tributaries of the A1 channel--need protection whether or not the properties annex to the City.

Section 5: Stormwater Related Natural Resources

5.2.2 Development Standards Alternatives

As above, Lane County needs to adopt protections similar to those in the City's Water Quality Waterways ordinance, to protect waterway segments that pass through properties that are in Lane County jurisdiction now, and whether or not they are ever annexed to the City. Also, more protections are needed to prevent fill of waterways, even small ones, and whether or not such fill is done in the context of "development".
And low impact development standards, as listed in our comments on section 3.5.3, are needed to help ensure groundwater recharge and
to help retain more natural stream flow in waterways such as Flat Creek and Spring Creek.

Perhaps it is not feasible to consider more stream corridor acquisition for segments of Flat Creek or other waterways in our neighborhood, but it does seem that more could be done to educate property owners and the community about the natural values of even small waterways, and to encourage their protection and restoration.

Section 6: Summary

Overall, it seems that the data in this document show that the rain garden projects proposed as part of the drywell decommissioning are not needed for flood control. Also, the data is not convincing that they are needed for pollution control. If they were constructed, of course, they'd perform some of these functions. But they will replace swales that already perform these same functions, seemingly well. Does decommissioning the drywells really need to be linked to proposals for new sidewalks and wider streets and replacing our existing drainage swales? If necessary, the swales probably could be "spot renovated" with much less cost and disruption to our neighborhood character and landscape.

Section 6.3 says that the proposed capital projects will be funded primarily through stormwater user fees and systems development charges. But does this include the costs of all the local street "improvements" that are proposed in conjunction with the drywell decommissioning?   If not, and if the full street improvements are going to occur at the same time as the decommissionings (and assessments charged to local property owners), then this needs to be explained.

Sincerely,

Becky Riley
Jolene Siemsen (co-chair)
Marilyn Mohr
(RRCO board members)

City of Eugene & Lane County response to SSCO & RRCO October 2009 comments.

Date: February 23, 2010

To: Jerry Finigan (Chair), Santa Clara Community Organization
Becky Riley & Jolene Siemsen (Co-Chair), River Road Community Organization

From: Therese Walch, City of Eugene Public Works
Dan Hurley, Lane County Public Works

Thank you for the offering your comments and input on the draft River Road-Santa Clara (RR-SC) Stormwater Basin Plan. We sincerely appreciate the time and attention you have given to reviewing this document and the proposed stormwater management strategies. We have considered your comments carefully, consulted with other staff and managers in our respective organizations, and offer the following responses. We reiterate first the purpose of the stormwater basin planning, and what we understand to be the main themes of your comments. Following that, responses are provided by topic area, and include references to the community organization's comments (Attachments A[1] and B[2]). We are looking forward to meeting with you to discuss these responses in more detail. Please see the last page of this letter for contact information if you need to reach us in the meantime.

PURPOSE OF STORMWATER BASIN PLANNING

The purpose of the basin planning is to develop a stormwater management strategy that takes into consideration the unique stormwater-related characteristics of each basin, carries out established local policies, complies with federal and state regulations, and reflects input from stakeholders including residents of the basin. As with the City's six other basin plans, the RR-SC Plan describes a "multiple-objective" approach (i.e. incorporating water quality, stormwater-related natural resources and flood control) to stormwater management that reflects the problems and opportunities within the RR-SC basin. It is to be used by City and County staff for background/contextual information, for development of the City's (and County's, in this case) capital improvement programming, for contextual support for development standards, and for evaluating technical information about the stormwater system. It is intended to be complementary with the other activities conducted within the City and County's stormwater programs. The Basin Plans are not used by the City or County in a manner that regulates the conduct or activities of the public.

---

[1] Attachment A: Santa Clara Community Organization comments (Letter to Therese Walch from Kate Perle, on behalf of Jerry Finnigan (Chair), Kate Perle, Kelly Burke, Rod Graves, Timothy Foelker, Cathy Lesiak, and Karen Lawrence, October 23, 2009), annotated to include comment numbers: "SC-XX."

[2] Attachment B: River Road Community Organization comments (E-mail to Therese Walch from Becky Riley, on behalf of Becky Riley, Jolene Siemsen (Co-Chair), Marilyn Mohr, and Carleen Reilly (Co-Chair), October 26, 2009), annotated to including comment numbers: "RR-XX."

OVERARCHING THEME OF PUBLIC COMMENT

An overarching theme of the comments from the River Road Community Organization (RRCO) and Santa Clara Community Organization (SCCO) is that the basin plan strategies do not address the uniqueness of the basin, reflected in its "heritage trees, waterways, prime soils, agricultural operations, significant populations of both urban and rural and county and city residents" and that the plan misses the mark in prioritizing the protection and enhancement of the basin's existing natural infrastructure [SC-1][3].

While the RR-SC Plan does not go as far, prescriptively, as the community organizations desire, the unique stormwater-related characteristics of the basin were significant factors in the development of strategies for River Road – Santa Clara. The strategies reflected in the basin plan, complimented by city-wide efforts including new initiatives implemented since the 2002 adoption of the other six stormwater basin plans, go a long way towards achieving the desired outcomes we heard expressed by the community groups, and reflect significant accomplishments in moving away from single-focused flood control stormwater management to multiple-objective stormwater management as conveyed in the City's stormwater policies. The mechanisms for achieving the outcomes with respect to development standards are not as prescriptive as the community organization's comments indicate they would like to see, but reflect the City's policy decisions aimed at balancing prescriptive-ness, incentives, and choice. Some factors such as the preservation of heritage trees and the protection of agricultural uses for example simply reside outside of the purview of the basin planning process. We offer the following as examples of stormwater management strategies that address the RR-SC basin's unique characteristics:

- New <u>local green street design concepts</u> were developed that utilize rain gardens, surface infiltration, and on-site stormwater management for adjoining properties as opposed to a traditional curb/gutter/piped street improvement. These green street design concepts were developed specifically to address the problems and opportunities related to stormwater management in RR-SC including the lack of a consistent stormwater system, very flat topography, well-draining soils, mixed jurisdictional areas, significant extent of vacant and "underdeveloped" properties, large number of unimproved streets, and federal regulatory limitations on the use of drywells for stormwater destination. Once incorporated into the City's Local Street Plan, these green street design concepts may be used city-wide as appropriate.

- <u>Public underground injection controls (UICs), or drywells</u> in RR-SC that do not meet Safe Drinking Water Act regulations, primarily due to the shallow groundwater conditions in the basin, will be replaced, many with vegetated surface infiltration facilities (i.e. rain gardens).

---

[3] SC = Santa Clara Community Organization comment, on annotated Attachment A.

- Water quality retrofit projects were identified for specific locations in RR-SC to address high pollutant land uses in built-out areas developed prior to the enactment of Stormwater Development Standards.

- Capital projects were identified to address flooding problems on the major stormwater system that were identified by the RR-SC system model under existing and future development conditions. Capital projects will be incorporated into the City's larger list of capital projects, and prioritized in accordance with capital improvement program (CIP) project prioritization criteria.

- Support for implementation of Stormwater Development Standards to address the quality of runoff from new development and re-development (Note: Stormwater Development Standards were instituted in 2006 for development inside city limits). The standards include incentives for impervious surface area reduction techniques, and a range of green infrastructure options for meeting the stormwater requirements including rain gardens, filter strips, vegetated swales, and green roofs.

- Support for increased implementation of green infrastructure and low impact development (LID) practices through potential administrative adjustments, integration of LID practices with other initiatives, land use code amendments and other program enhancements. (Note: City Council direction on implementing LID was provided at a January 17, 2007 worksession on "Green Infrastructure and Low Impact Development" and a September 17, 2008 follow up work session).

- Support for protecting certain waterways with a strong relationship to those considered water quality impaired by the State of Oregon, and not otherwise protected, including segments of waterways in RR-SC: Flat Creek, Spring Creek, and the East Santa Clara Waterway (Note: The City's /WQ Water Quality Overlay Zone was enacted in 2009 and applies to certain properties within the Eugene city limits including in RR-SC. It also applies to certain properties outside city limits and inside the urban growth boundary, (UGB) but only upon annexation). The /WQ Overlay Zone compliments other waterway protections previously adopted by the City and County (namely, Goal 5) to protect wetlands and wildlife habitat.

The City of Eugene and Lane County have worked closely together on the basin planning and will continue to collaborate to implement the RR-SC Plan, within the respective agency's funding constraints.

COMMENTS AND RESPONSES BY TOPIC AREA

Topic: Protection of Natural Functions of Waterways

- ***Map all waterways, and protect them from filling. County should adopt /WQ inside UGB, outside city limits. [SC-2], [SC-14], [RR-14] [RR-15][4]***

Waterways are very important components of the RR-SC stormwater system, as is the case in each of Eugene's six other stormwater basins. Evidence of the importance of waterways to the City's stormwater system is Policy 1.1 of the Comprehensive Stormwater Management Plan (CSWMP, adopted by City Council in 1993) which states: *Incorporate the beneficial functions (flood control, stormwater conveyance, water quality treatment) of natural resources into the City's storm drainage system.*

In total, the City and County have applied land use/zoning regulations to a system of local waterways inside the urban growth boundary (approximately 100 miles in length) which meet federal and state requirements and local policies related to water quality and natural resources. The City recently applied waterway protections to 13.5 miles of waterways in the form of the /WQ Water Quality Overlay Zone, adopted by City Council in March 2009. Prior to that, in 2005 and 2006, the City Council and the Board of County Commissioners each adopted a /WR Water Resources Overlay Zone that protects waterways within the Eugene UGB for their significant habitat value. Prior to that, in 1995, the City Council adopted waterside setback ordinances (/WB Wetland Buffer Overlay Zone, /WP Waterside Protection Overlay Zone) in the west Eugene wetlands area to protect wetlands and waterways in west Eugene. A fact sheet describing local waterway protections through land use and zoning overlays is included in this response to comments. Additional waterway protections through land use and zoning regulations are not under consideration by the City at this time or in the foreseeable future. Lane County is constrained by resources to enforce greater protections of minor waterways. However it is presently establishing a working group in conjunction with watershed councils and other interested parties to analyze and make recommended changes to the County's riparian protection ordinance applicable outside of the urban growth boundary.

While significant waterway protection has been achieved over the last decade through local land use regulation, the protections do not apply to all waterways. Smaller waterways may be categorized as wetlands and may therefore be protected to some degree by federal and state wetland fill regulations.

[4] RR = River Road Community Organization comment, on annotated Attachment B.

- ***Educate property owners and residents about the function of roadside swales and small waterways. [RR-5]***

Lane County and the City of Eugene currently partner on stormwater education activities inside the Urban Growth Boundary (UGB) as part of the City/County Stormwater Intergovernmental Agreement related to the City of Eugene's National Pollutant Discharge Elimination System (NPDES) Phase I permit and Lane County's NPDES Phase II Permit. Under the agreement, a *Stormwater Connections* newsletter is mailed directly to all city and county residents inside the urban growth boundary. Articles have been included in the *Stormwater Connections* newsletter (Spring 2005, Spring 2007 issues) related to the importance of ditches and swales and the adverse impacts to them of dumping debris and filling. An article is being drafted for inclusion in the Spring 2010 issue related to this topic, and additional articles will be considered for future additions. The City and County are always open to input about newsletter topics and public outreach strategies in general, and encourage residents to contact Kathy Eva, Eugene's Stormwater Information Specialist at: 541-682-2739.

Citizens in both jurisdictions are encouraged to contact the City of Eugene Maintenance Division (#541-682-4800) or County Road Maintenance Department (#541-682-6901) to identify areas where water pooling occurs and to assist in identifying possibilities for correcting minor drainage problems.

- ***City and County have different floodplain development standards. More detailed delineations are needed to prevent encroachment on waterways. [SC-5]***

The City and County participate in the National Flood Insurance Program (NFIP) program. The Federal Emergency Management Agency (FEMA) is tasked with creating floodplain maps for the entire country; the City has adopted the most recent flood maps provided by FEMA. For financial and practical reasons FEMA has devoted more attention to urban areas that are at risk of flooding, and to larger streams and rivers. Detailed studies have been conducted for two waterways in the Eugene area: the Willamette River and Amazon Creek. As with rural areas and smaller tributaries across the country, the smaller waterways in Eugene have had floodplain boundaries determined using approximate methods; these areas are known as 'approximate A Zones.' Santa Clara has many small approximate A Zones. It is not anticipated that FEMA will perform a detailed hydrological analysis for Eugene's approximate A Zones in the foreseeable future.

The City and Lane County have adopted floodplain development regulations that apply in their respective jurisdictional areas. The Lane County and City of Eugene floodplain regulations are similar as both are intended to meet Code of Federal Regulation standards for participation with the NFIP, and state mandates. Under a 1987 Intergovernmental Agreement, authority for land use and building permit review within the urban growth boundary including areas outside Eugene city limits is conveyed to the City (with some exceptions, e.g. for the Airport and the

Lane County Fairgrounds). Development in approximate A Zones is required to meet the same City and County development standards as those in areas where detailed studies have been conducted, with just a few differences. Where detailed studies have been conducted, the hundred year water surface elevation is determined by FEMA (the expected water surface elevation corresponding to a statistical flooding event that has a one percent chance of occurring in any given year), and a floodway is designated. For approximate A Zones, the best available data from an authoritative source is used where possible to determine the 100-year water surface elevation, and when good data is not available the applicant is responsible for determining the 100-year elevation using a FEMA approved method, which is then evaluated by City staff. Larger developments, such as subdivisions over five acres or fifty lots are required to provide detailed hydrological analyses. Floodplain development regulations are the same in either case (detailed study areas vs. approximate A Zone areas) except that approximate A Zone areas do not have designated floodways. Floodways are intended to remain unobstructed to convey floodwaters out of our community, are typically associated with high velocity flows, and have significant encroachment provisions.

The City and County floodplain development standards would not significantly change as a result of a detailed floodplain analysis in areas now designated as approximate A Zones, with the exception of floodway development prohibitions. However, for the City of Eugene, regulations regarding watercourse alterations at Eugene Code Section 9.6707 protect the flood carrying capacity of some rivers and streams that have no designated floodway. Other regulations often apply to development within the floodplain such as federal and state wetland regulations, and local natural resource and water quality waterway protections.

Topic: Development Standards / Low Impact Development

- ***No development standards proposed in the Basin Plan for future development. Instead of collecting and treating stormwater on a municipal scale, maximize on-site infiltration, and require that post-development flows equal pre-development flows for new development. Require prioritization of non-structural BMPs over engineered facilities. Basin plan does not assess or recommend LID standards. Require low impact development standards [RR-1], [RR-2], [SC-10], [SC-14]***

The RR-SC Plan supports the implementation of city-wide Stormwater Development Standards, for much the same reasons they were proposed by the other 2002 basin plans: mainly, that on-site stormwater controls are the most cost-effective way to deal with the water quality impacts of new development. Municipal-scale collection and treatment of stormwater is not being proposed. Retrofitting the existing municipal system through capital projects is another element of the city-wide water quality strategy, but it is more targeted to collection/treatment in high pollutant source areas and opportunistic restoration/rehabilitation of the open and piped system to incorporate water quality features, and is not wholesale collection and treatment.

City-wide Stormwater Development Standards[5], enacted in 2006, include requirements for: destination, pollution reduction, oil controls, source controls, and flow controls for the headwaters area (for water quality). These requirements apply to properties inside city limits as well as any properties annexed to the city from the urban growth boundary.

Stormwater **destination requirements** were already in place in 2006 and apply to all development, for the purposes of providing adequate stormwater conveyance and appropriate levels of flood control. The **water quality requirements** added in 2006 (pollution reduction, oil controls, source controls, and headwater flow controls) apply to new development and re-development that add or replace 1,000 square feet of impervious surface area or more.

The City's code prescribes the basic design standards (flood control design storm and water quality design storm) that must be met and references the *Stormwater Management Manual* for acceptable facility options and detailed siting criteria and design requirements for each facility. The City does not dictate the type of facilities or stormwater management method that must be used to meet the flood control and water quality requirements, but rather provides the "tools" or best management practices to facilitate green infrastructure/low impact development (LID) practices. Facility options in the *Stormwater Management Manual* include those that allow onsite management of stormwater including ecoroofs and roof gardens, pervious pavement, stormwater planters, tree credits, swales, filter strips, soakage trenches, infiltration sumps, drywells and rain gardens. Financial incentives in the form of lower systems development charges and stormwater user fees are provided for certain techniques (pervious pavement, eco-roofs, contained planters, and tree credits) that reduce impervious surface areas. These techniques also results in smaller water quality facilities for treating runoff from the remaining impervious area. Beyond the stormwater development standards code and manual, the City has produced and distributed brochures (e.g. "Planters with a Purpose"), conducted outreach and trainings for the design community, and is setting an example for the community through its public capital improvement projects.

In addition to supporting the Stormwater Development Standards, the RR-SC Plan supports following through on direction provided by the Eugene City Council related to LID. At a January 17, 2007 worksession ("Green Infrastructure and Low Impact Development"), Council directed staff to conduct a review of the Eugene Code and administrative policies and procedures to identify barriers and regulatory or incentive-based approaches to increase the use of LID practices. At a follow-up September 17, 2008 worksession ("Low Impact Development - Results of Review"), Council directed staff to further increase implementation of LID practices. This work is underway, beginning with identifying specific administrative adjustments, incentives, and other LID-related actions or implementation.

[5] Eugene Code Section 9.6790-9.6797

An assessment of the types of facilities constructed in the past year in Eugene shows that a proportionally higher number of green infrastructure/LID[6] facilities over mechanical treatment facilities are being implemented by private development. More specifically, for the period of time from July 1, 2008 through June 30, 2009:

- Of the 124 land use applications reviewed for stormwater development standards purposes, three times as many proposals incorporated green infrastructure/LID facilities, as compared to those that incorporated mechanical water quality treatment facilities (90 vs. 34, respectively).
- With respect to residential building permits issued, 54 of the 55 incorporated green infrastructure/LID facilities, and one incorporated mechanical treatment.
- With respect to commercial building permits issued, 35 of the 69 incorporated green infrastructure/LID facilities (including: 2 filtration planters; 6 vegetated swales; 9 grassy swale; 7 vegetated filter strips; 5 rain gardens; 2 soakage trenches; and 4 pervious pavers), and 34 incorporated mechanical treatment facilities.

In summary, the City's approach to regulating stormwater management is a combination prescriptive- choice- incentive-based approach. The Stormwater Development Standards and *Stormwater Management Manual* prescribe the basic requirements, offer a range of choices including many green infrastructure/LID choices to suit a wide range of site-specific conditions, and incentivize the preferred choices through financial and other means. The owner/developer must meet the stormwater development standards, and is allowed to make choices in terms of stormwater facility type utilized, suitable for each individual property. The City provides outreach and training, and sets an example through its capital projects. In addition, the City is actively working to identify additional incentives and reduce or eliminate barriers to implementing LID, in accordance with City Council direction. The outcome of this approach is that the vast majority of residential developments and a slight majority of commercial/industrial developments are choosing green infrastructure/LID facilities. The City will continue to seek ways to further increase the use of these facilities.

[6] Green infrastructure facilities for purposes of the City's categorization include vegetated swales, filter strips, and rain gardens, which are all pervious in nature. Soakage trenches are infiltration facilities, therefore pervious by design, but are not vegetated. Therefore, soakage trenches are considered LID facilities, but not green infrastructure as the term is commonly used. Mechanical facilities are not pervious in nature.

- ***Development standards to address pollution from private development would be more effective than treatment and infiltration of flows associated with drywell decommissioning and therefore should be a higher priority. [RR-12]***

Both are important and necessary aspects of the stormwater management strategy for RR-SC and are not mutually exclusive actions. Stormwater Development Standards are necessary for meeting the Clean Water Act and associated municipal stormwater permits issued to the City of Eugene (National Pollution Discharge Elimination System, or "NPDES" Phase I permit) and Lane County (NPDES Phase II permit). As described above, the City's stormwater development standards apply to properties inside city limits as well as any properties annexed to the city from the urban growth boundary. These standards address the water quality impacts from new development and re-development sites within city limits. Addressing existing UICs that must be decommissioned for lack of separation to high groundwater levels is also necessary to meet Safe Drinking Water Act regulations (see Department of Environmental Quality, or DEQ, web site for more information about UIC regulations and pending permits for municipalities utilizing UICs: http://www.deq.state.or.us/wq/uic/permits.htm). Providing treatment and conveyance for stormwater currently directed to certain UICs is necessary to address the potential water quality impacts to surface water (of surfacing water currently directed to sub-surface – for UICs decommissioned utilizing a piped system) and groundwater (to provide treatment of water directed to sub-surface, prior to reaching groundwater – for UICs decommissioned utilizing rain gardens).

- ***Reduce projected impervious surface area via development standards, and as a result CPs would be smaller in size. Requiring low impact development standards, pervious pavement for all roads, parking lots and driveways, and on-site storage and infiltration of all stormwater would reduce the size of capital projects. [SC-9] [RR-10]***

As described in responses above, the City provides incentives for certain best management practices (e.g. pervious pavement, eco-roofs, contained planters, and tree credits) through lower systems development charges and user fees, and through impervious surface area reduction in sizing stormwater facilities. The City encourages, but does not require, green infrastructure/LID facilities over structural engineered facilities. The majority of residential developments, and slightly more than half of the commercial developments over the past year have chosen to use green infrastructure/LID facilities. Follow through on Eugene City Council direction to further increase implementation of LID is underway. It is anticipated that all of these efforts will reduce the total impervious surface area in the RR-SC basin and throughout the City, as compared to traditional development. However, development standards and incentives affect only the areas undergoing development and re-development, and must be considered in the context of the large amount of existing impervious area not affected by the development standards.

Most proposed flood control capital projects were identified to address problems predicted to occur by the model developed for the major system, for larger storm events, based upon assumed impervious surface area percentages. The City acknowledges that the assumed impervious surface area percentages used in the model are inherently slightly conservative, as they do not reflect assumptions about the degree to which impervious surface area will be reduces through incentives, however it is the City's, County's and consulting engineer's best professional judgment that slight conservatism is appropriate in the assessment of the major flood control elements of the system for purposes of identifying potential flooding problems and capital project needs. It is very important to realize, however, that during capital project design, in advance of any capital project construction, a more detailed storm drainage study is conducted which delineates the drainage areas, impervious areas, and runoff volumes to a greater level of detail than is done in the master planning process and would refine the size of flood control facilities.

- ***Justify why flood control standards do not pencil out compared to flood control capital projects for this basin. [SC-9], [RR-9]***

As with the other stormwater basins, most of the identified flooding problems in RR-SC were anticipated to occur as a result of existing developed conditions. While future development would exacerbate some of the problems, a capital project would already be required to address existing condition flooding. Implementing on-site storage requirements for new development would not address the majority of capacity-related problems as identified by the model.

- ***Require on-site storage and infiltration for all new development. [SC-4], [SC-9], [RR-2]***

As described above, the method for managing stormwater is not prescribed, but acceptable choices are provided in the *Stormwater Management Manual*. The appropriate destination method is site-specific and depends on a number of factors including soil type, slopes, and availability of public and private infrastructure. While on-site storage and infiltration is not explicitly required, certain circumstances prevalent in the RR-SC basin would in effect necessitate on-site retention/infiltration, for example:

  - *Development sites in any area of the City where a public stormwater system does not exist and extension from the public system is not planned.* Figure 4-11 (Project Planning Phase) in the draft basin plan illustrates this situation, which reflects inherent constraints in some areas of the RR-SC basin (as well as other areas within the City, but less so) for piping stormwater off-site. The decision making process reflected in the figure conveys the City's strategy to allow for use of capacity where there is capacity in an existing piped system, and for connection to an existing piped system if it is feasible and there is capacity in the downstream receiving system. Given the RR-SC basin's inherent constraints (including discontinuous stormwater system, flat topography, mixed jurisdictional areas, funding constraints), however, extending the piped system wholesale throughout RR-SC is not feasible nor is it the City's plan to do so. As shown on the figure, new development or infill development, if not located on an improved street that drains to a piped system, will need to assess the feasibility of constructing a piped system (including downstream connection and capacity constraints), and if not feasible or desirable, then the developer would need to select an approved alternative for managing stormwater on-site. Modifications to Figure 4-11 will be made to reflect more clearly that on-site stormwater management (including volume controls) would be necessary under these circumstances.

- *Future situation, assuming new local "green street" design concepts are incorporated into the City's Local Street Plan (through a separate process).* The local green street design concepts, which are envisioned to be alternatives to current local street standards, as proposed, assume that the linear rain gardens are sized for right of way runoff only, therefore development sites adjacent to a green streets would by necessity need to manage stormwater on-site (including volume controls). The green streets concepts could be employed on new local streets, or in a re-development situation.

- ***Permeable pavement options need to be considered. [RR-8]***

Most street improvements will occur in response to development and most likely only in areas annexed by the City of Eugene. Permeable pavement has been used by the City on a pilot project basis, and is an accepted stormwater impervious surface reduction technique as long as it meets design criteria, but is not acceptable yet for use in the right of way. It should be acknowledged that such pavements accompany a higher construction cost and may be limited in their functionality without significant maintenance to prevent pore clogging. Permeable pavements are not recommended for sites with a likelihood of high oil and grease concentrations, which would include streets with a high number of average daily trips (> 1,000).

Topic: Impervious Surface Area (ISA)

- ***RR-SC highest ISA percentages compared to other basins. [SC-3]***

The amount of impervious surface area (ISA) will increase as vacant or "underdeveloped" (meaning, not yet developed to Metro Plan designation and related densities) properties are developed. The basin plans estimate the future, or "buildout" ISA by assuming properties will be developed in accordance with the Metro Plan designations, and utilizes average ISA percentages by generalized land use categories, and the area of each land use category. The buildout ISA for the RR-SC basin is projected to be 50% (plan page 2-12), an increase from the 2006 ISA of 37.5%. The increase in ISA can be partly attributed to the relatively significant amount of vacant industrial area (326 acres as of 2006) within the basin. The estimated average

ISA for industrial land use is 60%, as compared to 35% for low density residential land use (see Volume I, Appendix B for ISA factors by land use category), which significantly increases the overall basin buildout ISA.

Overall, however, the buildout ISA for RR-SC is similar to that projected for the other basins: Bethel-Danebo (increases from 35% in 2006 to 50% at buildout), Willakenzie (37% in 2006 to 47% at buildout), Amazon (33% to 44%), Willamette River (40% to 44%), Laurel Hill (20% to 43%), and Willow Creek (14% to 42%).

As with the other basins, now that stormwater development standards are in place (since mid-2006), it is expected that the actual buildout ISA will be lower than the 50% calculated since the ISA factors used in the calculations assume buildout using traditional development practices. As described previously, this is appropriately conservative for use in modeling the major stormwater system for purposes of ensuring adequate conveyance and flood control.

Topic: Underground Injection Controls or UICs (Drywells)

- ***It seems that rain garden projects proposed for drywell decommissioning are not needed for flood control, and may not be needed for pollution control either. Is it necessary to replace the lost capacity of drywells since they do not appear to have much of an effect on the overall drainage of the area? Instead of conveying UIC runoff to surface waterways (as part of decommissioning), infiltrate. [RR-7], [RR-16], [SC-12]***

Existing UICs must be decommissioned to meet Safe Drinking Water Act regulations. These facilities manage stormwater runoff primarily generated by impervious surfaces in the existing rights of way with an average contributing area of approximately 2.7 acres per drywell. There are approximately 150 total in RR-SC, with roughly equal numbers owned and managed by Eugene and Lane County. The County and the City must provide alternative means to convey the runoff currently managed by the existing drywells to meet the City and County's goals and policies related to flood control and water quality protection, and to remain in compliance with Oregon Drainage Law. Surface infiltration via rain gardens will be employed in decommissioning isolated drywells where there is no piped system with capacity nearby to connect to. In addition to managing the runoff for flood control, rain gardens provide the added benefit of surface water treatment and groundwater recharge. For the instances where there is capacity in the municipal system and the system is in close enough proximity for connection, the RR-SC plan assumes the runoff originally going to the drywell will be directed to the municipal system. In that case, pre-treatment of runoff utilizing a structural water quality facility prior to discharging to the municipal system will be incorporated.

- ***Why are rain gardens in conjunction with drywell decommissioning such a major focus? [RR-12]***

Due to the discontinuous nature of the stormwater conveyance in this Basin, it was considered impractical to extend new piping to each of the drywells to be decommissioned. Rain gardens are proposed as an alternative solution for isolated drywells or clusters of drywells that are of considerable distance from an existing stormwater pipe and for which no piped extension is planned.

- ***Does drywell decommissioning need to be linked to proposals for new sidewalks, wider streets, replacing existing drainage swales? Could existing swales be "spot renovated" instead? [RR-17]***

Decommissioning of drywells is not necessarily linked to proposals for street improvements. Staff acknowledges that the RR-SC Plan conveys that impression, and will clarify the strategy in that regard. It is most likely that the regulatory timeline for decommissioning drywells will require action by the City and County on all drywells within the next 10-12 years, necessitating the construction of isolated rain gardens and piped connections to the existing system – depending on the specific circumstances for each drywell. In the case of an isolated UIC decommissioned via a rain garden, the rain garden could be configured longitudinally, oriented parallel to the street and coincident with the existing swale(s) if the swale could be engineered to function adequately to infiltrate the City's flood control design storm. Adequate surface area and infiltration rates in a rain garden must be achieved in order to handle the flows currently being managed by a drywell.

Where local street improvements occur in the next 10-12 years, and if the street improvement is in an area with several public drywells to be commissioned, it makes sense to consider incorporating the management of the roadway runoff via rain gardens into the plan to decommission the UICs.

Topic: Local Green Street Design Concepts

- ***Would add too much new impervious area, alter character of the neighborhood, and result in loss of street trees and other vegetation. Would involve costly assessments; who pays? Need more discussion and public review before implemented. [SC-13], [RR-3], [RR-18]***

Staff's objective in developing the local green street concept drawings was to provide alternatives to traditional "improved" local street sections (which include curbs, gutters, pipes). The green street concepts address problems and opportunities inherent in a discontinuous stormwater system, rapidly draining soils, flat topography, and shallow groundwater. They also incorporate feedback received from the RR-SC community groups on maintaining narrower streets and utilizing green infrastructure. The concepts are intended to be used as a starting point for future discussions and a separate public process which will take into account other non-stormwater related concerns before they are implemented. The green street concepts, once finalized, would most likely be utilized in areas annexed to the City of Eugene. Generally speaking, with respect to financing, if a local street improvement is developer driven, it would be paid for by the developer. If it is initiated by the property owners through the formation of a local improvement district, it would be paid for by assessments to the abutting property owners. The UIC decommissioning elements (e.g. rain gardens and appurtenances) would most likely be funded by the City's stormwater utility fund capital improvement budget.

Improvements to arterials and collectors streets may follow the City's "context sensitive" collaborative design process which incorporates significant opportunities for public input on road design, stormwater management, preservation of trees, funding options, and safety.

Topic: Modeling and Capital Projects

- ***Modeled and observed conditions do not match up. Model does not extend far enough. Limited data upon which the model was based and the adjustment of the model to fit observed conditions [model calibration] is inadequate as the basis for major capital projects, and may result in oversized capital projects. [RR-4], [RR-6], [SC-4], [SC-6], [SC-7]***

The stormwater model used to evaluate the capacity of the public drainage system is a generalized representation of the system. Calibrating the model to match measured or observed conditions is an iterative process involving adjusting certain variables (within realistic ranges) and comparing results, adjusting again, and comparing results, until a best fit is obtained. The computer model for the RR-SC basin planning evaluated the capacity of approximately 160 open waterway and pipe segments under existing and future land use conditions. The models were updated using survey data collected by Lane County between October and December 2005. The model was validated and adjusted in response to historic photos and observed freeboard elevations provided by the City and through comparison of actual conditions at the Willamette Overflow using real rainfall data for the period from December 27, 2005 to January 3, 2006.

Through the RR-SC model calibration process, the impervious surface area percentages were modified to reflect "effective impervious area" as opposed to mapped impervious area. This adjustment is realistic because of the relatively disconnected nature of the stormwater system in RR-SC, but it is still somewhat conservative (as evidenced by the fact that the surface water elevations predicted by the model are somewhat higher than observed values). See page 3-7 of the basin plan for a more detailed discussion of the adjustment to ISA factors, and rationale.

The current model is the best fit based upon best available information and professional engineering judgment of the engineering consultants, and the City's engineering staff. It is acknowledged that further refinement to the model based upon measured flow data would be beneficial to confirm capacity issues on the major system. Therefore, installation of a flow meter in the Basin has been added to the capital project list.

The capacity-related capital projects resulting from the modeling will be added to the City's long-term stormwater capital improvement needs. The City's project list (including all stormwater project needs, city-wide) is significantly larger than the budget available, and by necessity a prioritization process is used to identify the highest priority projects for implementation. Prioritization criteria include whether a flooding problem is observed vs. predicted by modeling, which is where the large stormwater projects referred to in the comment would not rise to the top in the foreseeable future. Flow data and model refinement will realistically precede implementation of these capital projects. In effect, these projects are placeholders for potential capital investment in the future to maintain system capacity, and are based upon the best available information and professional engineering judgment. Individual stormwater facility capital projects will be assessed using additional data prior to final design and construction to ensure proper sizing. The County does not currently have funding for stormwater related capital projects. As the County develops funding for such projects, prioritization will be assigned in a manner similar.

With respect to the extent of the model, basin planning stormwater models were generally limited due to budget and resource constraints to the larger system (pipes 36-inches and larger, and larger waterways), generally inside city limits. The RR-SC basin plan model goes beyond the modeling in other basins in that it extends, for the most part, through the mix of jurisdictional areas to the urban growth boundary. The Willamette Overflow downstream from node 72088 was not included in the model because most of it is on the edge of the UGB, with some located outside the UGB, and is located downstream from subbasin WO-000 which lies entirely outside of the UGB.

- ***It appears redundant to create capacity with facilities to replace drywells and construct large flood control capital projects. [SC-8]***

The City's Stormwater Development Standards require stormwater systems (pipes or drywells) serving less than 40 acres to be designed for a 5-year storm. Open channel systems serving less than 40 acres and all systems serving 40 acres up to 640 acres must be designed for a 10-year storm, except for culverts and bridges for arterial streets which must be designed for a 25-year storm.

The modeling for future (build-out) conditions reflects that the existing drywells do not manage a volume of runoff significant enough to affect capacity needs of the major system. In other words, whether under existing conditions or future buildout conditions, the existing public drywells do not have a significant effect on the major system conveyance needs. The decommissioning of drywells is not driving the capacity-related capital projects. What is driving the capacity related projects is a set of constraints on the major system (for example, on the upper A1 system) that are predicted by the model for the larger contributing area under existing (2006) conditions, and exacerbated by future development.

Topic: Pollutant Estimates

- ***Pollutant load estimates are not based upon basin-specific water quality data. Question use of TSS as an indicator. Question assumption regarding contribution of runoff from decommissioned UICs. [SC-10], [RR-11]***

Although there is limited data on water quality in the Basin, the pollutant load estimates point to the need to address expected increases in pollutants from added impervious surfaces, and provide a means by which pollutant estimates can be compared between basins and contrasted between existing and future build-out conditions. Estimating pollutant loads helps in identifying locations for water quality capital projects. For example, RRSC-2, Water Quality Facilities for High Source Areas, includes specific high pollutant source locations for water quality retrofit facilities. The pollutant load estimates also support the implementation of Stormwater Development Standards and support continuation of the other complimentary best management practices conducted in the City and County's stormwater programs. Estimating pollutant loads from runoff being surfaced by decommissioning drywells supports the strategy for decommissioning drywells via rain gardens or pipe connections with pre-treatment, so as not to adversely affect downstream surface water quality.

With regards to the use of total suspended solids (TSS) as an indicator of pollutant, TSS was used in the basin plans as a surrogate for the suite of pollutants typically associated with stormwater (specifically, sediment, nutrients, heavy metals). This is a common approach, utilized by other large municipalities in the state of Oregon. The TSS amounts are approximations based upon pollutant loading data used by the Phase I municipalities in Oregon.

- ***Estimates assume no water quality BMPs for future development. Estimates assume all runoff from decommissioned drywells will be transferred untreated to surface waters. [RR-10], [SC-11]***

Agree. The pollutant load estimates are based upon pollutant loading concentrations used by Phase I municipalities in Oregon, and the comment is correct in that the loadings assume no water quality BMPs. The pollutant load estimates were generated for illustrative and comparative purposes (e.g. identifying high pollutant source areas within a basin, comparing basin loads), and staff thought it important to use the same approach as for the other stormwater basins completed in 2002.

The City is collaborating with other Phase I municipalities and professionals across the country to compile and utilize effectiveness data for stormwater management facilities so as to better estimate pollutant loadings from urban areas utilizing these facilities.

STAFF CONTACT INFORMATION

Therese Walch, P.E., Water Resources Manager
City of Eugene Public Works Department
99 E. Broadway, Suite 400
Eugene, OR 97401
Tel: 541-682-5549
E-mail: therese.walch@ci.eugene.or.us

Dan Hurley, P.E. Senior Engineering Associate
Lane County Public Works Department
3100 E. 17th Avenue
Eugene, Oregon 97403
Tel: 541-682-3811 / Cell: 541-954-1935
E-mail: daniel.hurley@co.lane.or.us

ATTACHMENTS

Attachment A: Santa Clara Community Organization comments
Attachment B: River Road Community Organization comments
Fact Sheet: Protecting Water Quality and Wildlife Habitat in Eugene

Additional comments received from the Santa Clara Community Organization.

Therese Walch and Dan Hurley March 10, 2010
City of Eugene and Lane County
Re: Comments to accompany RR/SC basin plan

Therese and Dan,
We thank you for meeting with us to review your comments to our criticisms regarding the RR/SC storm water basin master plan. Your offer to include a last set of comments generated by that meeting to accompany the proposal to the various elected officials is appreciated.

We reiterate that the uniqueness of our basin is not adequately reflected in the proposed plan strategies and refer you to the SCCO comments of Oct 23, 2009 that highlight some of our challenges and our need for development standards to help address these problems. No other basin is categorized by our blend of high water table, lack of storm water infrastructure, fertile well-draining soils, and reliance on open waterways for the vast majority of storm water conveyance.

Our proximity to the Willamette River makes us particularly flood-prone and heightens our focus on the importance of all open waterways within our neighborhood. As stressed in our comments, the protection and enhancement of these watercourses is pivotal in averting widespread flooding. Staff comments point to the myriad of overlays and protective measures applied to date. We appreciate these measures, but reiterate that they leave out vital watercourses that are part of our naturally occurring system. Our storm water system is akin to the human circulatory system, and the existing protections apply only to the arteries leaving the veins and capillaries unprotected. The system can not function effectively for the entire body of Santa Clara without adequate mapping and protection of our "lesser" waterways. The protection and enhancement of these create an existing storm water infrastructure that can accommodate development without capital projects. (See Santa Clara Community Organization comments dated Oct. 23, 2009)

Staff uses the terms green infrastructure and low impact development throughout the basin plan, but doesn't differentiate between man-made engineered infrastructure (even "green" infrastructure) and naturally occurring infrastructure. Our neighborhood is riddled with swales, sloughs, channels and waterways that are naturally occurring infrastructure. These serve the long time residents as flood control measures. When they are obliterated by infill development, they are replaced on the development site by something that only serves the storm water needs of the infill, not the rest of the residents along what used to be a continuous storm water system. This places the existing residents at much greater risk of inundation. We would like the basin plan to prioritize the protection and enhancement of naturally occurring infrastructure which can continue to serve the existing residents as well as accommodate infill development.

Finally, we urge the adoption of low impact development standards coupled with post development runoff not exceeding pre-development levels for this basin as a primary means to achieve both storm water quantity and quality goals. These measures make long-term economic and ecological sense. Let these neighborhoods be the trial ground for these principles and create a model which can inform development throughout the watershed.

Sincerely,
Jerry Finigan and
executive board of the Santa Clara Community Organization

Comments from the River Road & Santa Clara Community Organizations to the Lane County Board of Commissioners.

Date: March 31, 2010

To: Lane County Board of Commissioners
From: River Road Community Organization Board
Santa Clara Community Organization Board

Dear Commissioners,

Your board is being asked to adopt the River Road-Santa Clara Stormwater Basin Plan at your work session later today. We urge you to make a simple amendment to this Plan prior to giving your support. The amendment we request is that an Appendix be added that includes the attached summary of points relating to stormwater that have been raised by our organizations in previous comments and discussions over many years, but that have not been incorporated into the Basin Plan or City or County stormwater codes to date. We believe they are important points that need to be addressed in plans and policies for our area, and that they need to be recorded in the Stormwater Basin Plan, a major planning and guidance document.

Of course, we would prefer that these points had been fully incorporated into the Basin Plan document. However, the Appendix we propose would at least capture our input for future planning processes.

Much of River Road and Santa Clara developed in a typical suburban pattern. There are many problems caused by this form of development, but also some benefits and opportunities relating to stormwater management and protection of natural resources. As it stands, we do not believe the River Road-Santa Clara Stormwater Basin Plan provides specific enough guidance to protect our area--the groundwater resource and our domestic wells, small waterways, good soils, natural drainage, big trees, and country-like atmosphere. We hope that additional planning and refinements can be undertaken to address our concerns as outlined in the attachment.

River Road and Santa Clara need neighborhood refinement plans or special overlay zones that identify: a) sites and zones appropriate for compact development, redevelopment and stormwater retrofit; b) sites and zones appropriate for low-density development or that need special protections to maintain natural and existing drainage; and c) development and public works standards that protect natural hydrology and ecology and the beneficial elements of neighborhood character.

Thank you for your support for inclusion of our points in the River Road-Santa Clara Stormwater Basin Plan.

Sincerely,

Carleen Reilly, Co-Chair (for River Road Community Organization board)
395 Marion Lane, Eugene, OR 97404

Jerry Finigan, Chair (for Santa Clara Community Organization board)
1250 Irvington Drive, Eugene, OR 97404

ATTACHMENT to River Road-Santa Clara Stormwater Basin Plan
Summary of Recommendations from River Road Community Organization and Santa Clara Community Organization (March 2010)

The following points are of priority concern to residents of our neighborhoods. We ask that these elements, all related to stormwater management, be considered and incorporated into future City of Eugene and Lane County plans, policies, regulations, agreements, standards, actions and public works projects applicable to or conducted in the River Road and Santa Clara neighborhoods. Some of these points might be incorporated into neighborhood refinement plans or special area zones that identify: a) sites and zones appropriate for compact development, redevelopment and stormwater retrofit; b) sites and zones appropriate for low-density development or that need special protections to maintain natural and existing drainage; and c) development and public works standards that protect natural hydrology and ecology and the beneficial aspects of neighborhood character.

Natural Hydrology and Ecology:
Groundwater, Streams, Soils, Trees, Native Plants and Plant Communities

• **Groundwater recharge:** Ensure that this is a policy goal for River Road and Santa Clara.

• **On-site infiltration (as stormwater destination):** Require on-site infiltration (to the ground and groundwater) to the maximum extent feasible for development, streets, and public works in River Road and Santa Clara.

• **Streams:** Protect and restore naturalized flow volumes and rates in Spring Creek, Flat Creek, E. Santa Clara Waterway, and minor waterways. Also protect these waterways from fill and disturbance, including that done outside the context of "development" and on properties not yet annexed to the City of Eugene.

• **Floodways:** Protect smaller natural flow pathways and floodways not otherwise delineated.

• **Soils, Trees, Plant Communities:** For new development and for public works projects, prioritize non-structural Best Management Practices (preserving soils, trees, native plants and plant communities; minimizing site disturbance; reduced development footprint and amount of impervious surface, etc.) over engineered, structural stormwater "facilities" such as those in the City's Stormwater Management Manual.

Development and Infrastructure:
Streets, Ditches, Parking Lots, Rainwater Catchment

• **Local Streets:** Develop more options for (and public involvement in design of) local streets and street standards that are context-sensitive and recognize the value and stormwater management function of existing large street trees, landscaping, roadside ditches, truly minimal pavement widths, and "shared space" or "home zone" designs that do not require separate sidewalks. Overall, strive for a reduced amount of pavement, especially that dedicated to auto traffic and parking.

• **Roadside Ditches:** Protect (and renovate where needed) existing roadside drainage ditches to preserve their stormwater management function.

• **Parking Lots:** Require stormwater retrofit of existing parking lots that do not meet current City of Eugene stormwater code standards. Reduce parking requirements for future development.

• **Rainwater Catchment:** Allow and encourage rainwater catchment and use, to reduce erosion and runoff during rainstorms, and reduce the capacity required for alternate stormwater management.

HERSHNER HUNTER LLP

STEVE CORNACCHIA
scornacchia@hershnerhunter.com

April 27, 2010

Lane County Board of Commissioners
Attn: Daniel Hurley
Land Management Division
125 E. 8th Avenue
Eugene, OR 08401

Re: Eugene Stormwater Basin Master Plan – River Road/Santa Clara
Junction City Water Control District
Our File No. 10461.20102

Commissioners:

We represent Junction City Water Control District ("District"). The District has requested that we respond on its behalf to the City of Eugene's proposed Stormwater Basin Master Plan (Volume VIII) for River Road/Santa Clara ("Master Plan"). On behalf of our client we wish to thank the Board of Commissioners for delaying Lane County acceptance and approval of the Master Plan until the District has had an opportunity to comment on it.

In general, it must be recognized that the majority of the storm water runoff from the northern developed lands of the City of Eugene will eventually enter the District's system of flood control ditches. The District believes that the Master Plan does not adequately address either that fact or the fact that the District's system was not built to completely handle the discharges of storm water from developed urban lands and uses.

The District has three major concerns regarding the city's plan for discharging storm water from urban development into the District's ditch system:

1. How will the District's system of ditches be maintained following urban development of the land that contains that system?

2. How will flow rates (and the District's policies regarding flow rates) from developed urban lands that exceed historical levels of flow rates from agricultural land be addressed before development is approved?

3. How will potential urban pollution be addressed and be prevented from entering the District's ditches?

Our late arrival on the scene of the Master Plan results from the continuation of a communication problem that exists between the City of Eugene, Lane County and the District. The District has not been directly included in the drafting of the storm water basin planning document and first learned of its existence last month. The District did not directly participate in the drafting of the document even though, on at least two occasions, the District has requested, in writing, that the city and the county communicate with it on matters regarding development of land in the northern River Road/Santa Clara area that is within the boundary of the District. In 2002 and again in 2005 we sent written requests to the city and the county asking that both governmental entities improve communication with the District prior to further development within the northern River Road/Santa Clara area. Copies of the letters containing the District's requests are attached to this correspondence for inclusion in the record of this proceeding.

On December 17, 2002 we requested:

> "... that you assign the appropriate persons within the affected divisions of Lane County Public Works (Surveyor, Building and Planning) to contact and work with us to establish a process that provides a determination of future maintenance responsibility prior to the approval of any planning or building action for property within the subject area. Specifically we suggest that, at a minimum, the process provide the District an opportunity to respond to any application for subdivision or partition of land within the subject area and following that response, for Lane County to place the necessary conditions or restrictions (e.g., C,C&Rs) on the subdivision or partition to ensure that maintenance of the ditches continues after residential development has occurred. We note that the same type of process should be in place regarding any subdivision or partitioning of property in the area north of Beacon Drive and the Urban Growth Boundary that includes either of the subject channels."

On that same date we made the same request to the City of Eugene. The District has not received a response to its 2002 correspondence. In response to a City of Eugene ordinance withdrawing property from the District in 2005, the District again requested that the city communicate with it prior to development of the subject area. The District has received no response to that request.

The District maintains a system of agricultural drainage ditches that extend from the Amazon Channel in west Eugene to the City of Monroe. The District's boundary and its ditch system overlap the City of Eugene's Urban Growth Boundary between Beltline Road and Beacon Drive. Essentially, the District eventually receives all of the city's storm water from that area. The District's A-1 Channel and its F Channel are located in that area.

The District's system was developed over 40 years ago to partially drain agricultural lands in the area between Eugene and the City of Monroe. The District operates and maintains its system pursuant to numerous easements across private property. The District's system was developed to serve flooded agricultural lands—it was not developed to receive water discharges from the impervious surfaces of urban lands and urban uses. The District's system was developed to drain flood waters from agricultural lands and was engineered to limit inundation of those lands to several days in duration—it was not engineered to immediately remove all storm water from those agricultural lands. The District's system has no additional capacity to handle storm water from impervious surfaces of urban land that exceed historical pre-development flow rates.

The impact of discharging storm water from urban lands into the District's system is exacerbated by the development of residential subdivisions over lands that contain the ditches. In the case of the southern end of the two channels between Beltline Road and Beacon Drive, the District is prevented from performing any function on them in areas of residential development. The construction of fences and other residential development serves as a barrier to District efforts to maintain the channels for the free flow of flood and irrigation waters. The Lynnbrook II subdivision is a perfect example of such a situation. Even though C,C&Rs were recorded with the subdivision, many property owners have not provided any maintenance effort and, in some cases, have actually placed structures and vegetation, including trees, within the ditches. Back yard fences prevent the District from any access to the ditches for maintenance purposes.

Out of concern about encroaching urban development from both the cities of Eugene and Junction City, the District retained the services of EGR & Associates, Inc. ("EGR"), to conduct a capacity study of that portion of the Flat Creek basin that contains the F, F-2 and F-2-a Channels (the area closest to Eugene on the south, Junction City on the north and including the site of the planned State of Oregon hospital and corrections facilities). EGR concluded that the District's system of flood control ditches is at capacity during significant rainfall events. It also concluded that high water tables throughout the area limited the amount of storm water absorbed by soil. Concluding that the District's ditch system has no additional capacity for post-development storm water discharges from newly-developed urban land, EGR recommended to the District that it promulgate policies to apply to requests from urban development for the discharge of post-development flow rates of storm water into the District's system. Those policies were adopted by the District's Board of Directors and are as follows:

1. For properties within the Flat Creek basin, post-developed storm water flow rates shall be regulated for the 2-year through 50-

year, 24-hour, rainfall events. Rainfall events in excess of the 50-year, 24-hour, storm will not be regulated.

2. The allowable post-developed flow rate, for each regulated recurrence interval, shall be limited to the greater of:

a. A flow rate equal to 0.116 cfs per acre, or

b. Historic pre-development flow rates considering any constraints up to the point of connection with the District's system.

The Master Plan does not adequately address the three issues presented earlier in this response. The Master Plan does not adequately recognize and implement the District's policies regarding the discharge of storm water from developed urban lands.

The District requests that before adoption of the Master Plan the participating jurisdictions work with the District to modify the Master Plan to address the District's issues and to recognize and implement its policies regarding those issues.

At a minimum, and for example, the following sections of the Master Plan should be modified:

- Section 2.5.1 Waterways needs to be modified to accurately describe the District's system of ditches and the capacity of those ditches to move water from the area (particularly the A-1 Channel and Flat Creek);
- Section 2.5.5 needs to be modified to accurately describe the District's system, its capacity and existing flow rates (and the implementation of District policies regarding the same);
- Section 3.1 needs to be modified to incorporate the District's hydrologic and hydraulic information regarding its capacity and both pre-development and post-development flow rates.

In conclusion, the District requests a simple acknowledgement by Lane County and the City of Eugene that it is an agricultural flood control district whose system of ditches does not have the capacity to absorb additional water from newly-developed urban lands and uses. In concert with that acknowledgement, the District requests that the Master Plan reflect those facts and that the Master Plan include the District's policies regarding storm water discharge from newly-developed urban land and uses.

Please contact me if you have questions regarding this response.

Best regards,

STEVE CORNACCHIA

PSC:nps
Enclosures
cc: District Manager

City of Eugene response to the
Junction City Water Control District

Public Works
Engineering

City of Eugene
99 East Broadway, Suite 400
Eugene, Oregon 97401
(541) 682-5291
(541) 682-8410 FAX

September 22, 2010

Steve Cornacchia
Junction City Water Control District
95282 Hwy 99 E
Junction City, OR 97448

Re: Eugene Stormwater Basin Master Plan – River Road/Santa Clara
Junction City Water Control District

Dear Mr. Cornacchia,

Thank you for your interest and that of the Junction City Water Control District in the River Road – Santa Clara Stormwater Basin Master Plan. We appreciate the District's input reflected in your letter to the Lane County Board of Commissioners provided at their March 31, 2010 work session on the topic. We would like to take this opportunity to respond to the issues that you raised. In particular, you expressed thoughts and concerns about the referral of development proposals to the District, waterway maintenance and the free flow of water, receiving stream capacity, and the water quality of urban discharges to District streams.

As a courtesy, we would be happy to include you in the referral process for development proposals for properties that drain to District waterways. To assist us in ensuring that we have the area delineated as you desire, please provide me with a map showing the boundaries of the area(s) for which you would like referrals. The District's comments will then be reviewed in the context of the City of Eugene's requirements and policies.

Regarding responsibility for maintenance of waterways on properties annexed to the City that may have a District easement, these waterways would fall under City of Eugene maintenance policies and practices upon annexation. The City would determine, on a case by case basis, whether we would have an interest in acquiring any existing easements. You expressed concern about the construction of fences and other obstructions in waterways upstream from District waterways, and a desire to keep these waterways free flowing. Significant progress has been made by the City (and County) in regards to development regulations in and adjacent to waterways. With adoption of the /WR Water Resources Conservation Overlay Zone in 2005, and the /WQ Water Quality Overlay Zone in 2009, the City prohibits the construction of fences and structures in and immediately adjacent to certain waterways including Flat Creek and the A1 Channel – which are of the most concern by the District.

The capacity of receiving streams is of interest to the City. We reviewed the EGR report ("South Highway 99 Stormwater Feasibility Analysis," November 9, 2009) referenced in your letter, but were unable to see how the report's conclusions correlated with specific capacity constraints at the urban growth boundary since the geographic area of primary interest and assessment in the report is quite a bit further north, nearer to Junction City. We would be glad to review any additional information pertinent to the area that you could provide, within the context of City code and policies.

The quality of water going into receiving streams is also of interest to us. The City implements a stormwater program under its National Pollution Discharge Elimination System (NPDES) Phase I municipal stormwater permit to protect and improve water quality. The City's stormwater program includes public education and outreach, erosion prevention, illicit discharge detection and removal, spill response, street sweeping, catching basin cleaning, leaf pick-up, volunteer programs to restore streams and plant trees, regulatory waterway protections, and water quality capital improvement projects. Since the adoption of stormwater development standards in 2006, developments adding or replacing 1,000 square feet of impervious area or more are required to meet pollution reduction requirements. As with other municipalities across the state and country, our stormwater program continues to evolve. On the horizon for the City of Eugene are efforts to further prioritize low impact development, infiltration, and on-site retention of stormwater runoff. If the District has any pertinent information regarding the quality of water going into District streams, we would be happy to review that information within the context of our NPDES permit and City policies.

Thank you again for your interest in the River Road – Santa Clara Basin Plan.

Sincerely,

Therese Walch

Therese Walch, P.E.
Water Resources Manager
City of Eugene Public Works Department

Letter of support from the Santa Clara Community Organization following edits made in September 2012.

SANTA CLARA COMMUNITY ORGANIZATION

established 1977

October 4, 2012

To Lane County Commissioners;

As Board Members of the Santa Clara Community Organization, we would like to give you an update on our continued involvement in the crafting of the River Road/Santa Clara Stormwater Basin Master Plan.

When the plan was last brought to the County Board in March of 2010, your Board received letters from members of the Santa Clara And River Road organizations identifying shortcomings in the plan. Since that time, we have continued to work with both the City and County as they modified and finalized the Plan. Attempts to address the identified shortcomings were made including edits to Section 1 and through other City processes.

We appreciate that our concerns were heard and issues were clarified. We understand this plan is a blueprint that can guide future work. We look forward to our continued involvement as our community plans for the future.

The Santa Clara Community Organization is now supportive of the plan as edited. The SCCO Board members would like you to know that we now endorse the plan.

Sincerely,

Santa Clara Community Organization Board

Jerry Finigan, Chair

a local voice in government

Letter of support from the River Road Community Organization following edits made in September 2012.

HURLEY Daniel M

From: Jon Belcher [jbelcher@efn.org]
Sent: Tuesday, October 09, 2012 2:17 PM
To: HANDY Rob M; BOZIEVICH Jay K; LEIKEN Sid W; SORENSON Pete; STEWART Faye H
Cc: HURLEY Daniel M; WALCH Therese; Bev Barr; REILLY CARLEEN (LCOG List); BELCHER JON (LCOG List); Kate Kelly; Kira Lehman; Michael Lambros; NEFF Ray (SMTP); Tuula Rebhahn ; Will Dixon
Subject: River Road Community Organization Letter of Support for River Raod/Santa Clara Stormwater Basin Master Plan

We wish to thank both Daniel Hurley and Therese Walsh for their assistance and cooperation during our involvement in developing the River Road/Santa Clara Stormwater Basin Master Plan. The following letter was unanimously passed at last night's River Road Community Organization meeting with 22 neighbors participating:

October 8, 2012

To Lane County Commissioners;

We would like to give you an update on our continued involvement in the crafting of the River Road/Santa Clara Stormwater Basin Master Plan.

When the plan was last brought to the County Board in March of 2010, your Board received letters from members of the Santa Clara And River Road organizations identifying shortcomings in the plan. Since that time, we have continued to work with both the City and County as they modified and finalized the Plan. Attempts to address the identified shortcomings were made including edits to Section 1 and through other City processes.
We appreciate that our concerns were heard and issues were clarified. We understand this plan is a blueprint that can guide future work. We look forward to our continued involvement as our community plans for the future.

The River Road Community Organization is now supportive of the plan as edited and we now endorse the plan.

Sincerely,

River Road Community Organization

/signed /signed
Carleen Reilly Jon Belcher
River Road Community Organization Co-chairs

Jon Belcher (jbelcher@efn.org)