Section 6

Storm Drain Model

6.1 Projecting Developed Conditions

To establish future demands on the storm water system, zoning and land use maps from the 2000 Comprehensive Plan (See Appendix A) were used. The maps provided the basis for storm runoff forecasts. A summary of the curve numbers (CN) for City zoning requirements is provided in Table 6.1.1.

TABLE 6.1.1
HYDROLOGIC CURVE NUMBERS FOR
FUTURE GROWTH BASED ON LAND USE

USE	EXAMPLE	HYDROLOGIC CN*
Residential	Single Family and Multi-Family Units	75 85
Commercial	Retail Commercial W/ Parking	92
Industrial	Light Industrial	88
Open Areas	Timber, Cultivated Areas	70 77
Planned Development	Planned Development RV Parks	94 98

* CN reflects fair draining soil characteristics rated as Class B.

6.2 Discharge Estimates

Present and future discharge estimates for each drainage basin were developed according to the methodology in Section 5. The HydroCad™ and XP-SWMM2000 computer models were used to forecast peak storm flows for both existing and urbanized conditions. A summary of the flow projections for existing and fully urbanized land-use in each major basin is provided below in Table 6.2.1.

TABLE 6.2.1
CITY OF COOS BAY
PREDEVELOPMENT AND POSTDEVELOPMENT PROJECTED PEAK FLOWS

BASIN NUMBER	BASIN AREA (Ac)	EXISTING Q, FLOWS (cfs)		POST-DEVELOPMENT Q, FLOWS (cfs)	
		25-YEAR	50-YEAR	25-YEAR	50-YEAR
1	40.0	23.0	26.7	23.0	26.7
2	35.6	20.6	23.6	20.6	23.6
3	5.4	3.3	3.8	3.3	3.8
4	81.0	50.4	58.1	50.4	58.1
5	65.7	34.9	40.4	34.9	40.4
6	4.5	4.4	5.0	4.4	5.0
7	22.2	19.8	22.4	19.8	22.4
8	12.3	14.1	15.7	14.1	15.7
9	14.4	15.1	16.9	15.1	16.9
10	33.7	24.3	27.9	24.3	27.9
10A	14.40	16.1	17.9	16.1	17.9
11	7.7	7.4	8.3	7.4	8.3
12A	300.0	66.9	78.6	66.9	78.6
12B	660.0	121.9	156.7	158.8	198.5
12C	44.6	53.3	59.0	53.3	59.0
13	15.8	17.3	19.2	17.3	19.2
14	123.8	50.1	58.7	59.3	68.6
15	74.0	68.3	75.7	68.3	75.7
16	29.0	24.1	26.9	24.1	26.9
17	132.3	77.9	90.2	122.4	136.9
18	73.4	32.3	39.0	75.0	84.1
19	102.6	36.4	44.0	58.7	68.2
20	35.0	35.8	40.1	35.8	40.1
21	2.5	1.8	2.1	1.8	2.1
22	105.0	36.5	44.6	36.5	44.6
23	16.0	7.0	8.5	7.0	8.5
24	29.0	13.0	15.6	13.0	15.6
25	128.0	48.4	58.0	48.4	58.0
26	69.0	38.3	44.9	51.4	58.8
27	25.0	6.2	7.0	6.2	7.0

6.3 Basin Descriptions

The following subsection describes each basin individually. The description is contained in one page, which contains a summary of the flow conditions, the existing system with present day problems, and the future system with recommended projects. The basin descriptions are intended as a narrative for the mapping in Appendix A.

Basin No. 1

Basin 1 is a 40-acre parcel bound to the west by Koosbay Blvd, by Yew Ave. to the north, the Bay on the east, and Pine Avenue on the south. Most of the drainage area flows down to Teakwood Ave., where it is then transported across Highway 101 by an 18-inch concrete culvert into the Bay.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)

Slope
0-30%

Current Land-use
9.20 Acres Commercial
8.00 Acres Industrial
14.0 Acres Small Residential
8.60 Acres Forest/Brush

Peak Runoff
25-Year Storm: 23.0 CFS
50-Year Storm: 26.7 CFS
Future 25-Year Storm: 23.0 CFS
Future 50-Year Storm: 26.7 CFS

Existing System
The general route of runoff appears to be overland surface flow with localized channels, such as driveway culverts in the uplands. In the lower areas, near Highway 101, the water is transported to the Bay through culverts and outfall lines. Approximately 80% of the surface area of the catchment is west and above the highway. Approximately half of the basin's runoff flows under the highway through an 18" diameter concrete pipe on its way to the Bay. The outfall has no tidegate. ODOT is responsible for the highway culverts, ditches, and catch basins.

Present Day Problems
The existing outfall at Teakwood does not have a tide gate installed. The hydraulic analysis indicated that the existing 18" diameter outfall along Teakwood should be upgraded to an 18" diameter PVC or equivalent pipe.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 2

Basin 2 is approximately 36 acres located to the south of Basin 1. The basin drains to the east, into the Bay. The upper portion of the basin is bound to the west near 14th Street, and to the south by Myrtle and Nutwood Avenues, from which it then extends to the Bay.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-30%

Current Land-use
11.30 Acres Commercial
2.10 Acres Industrial
21.86 Acres Small Residential
0.35 Acres Forest/Brush

Peak Runoff
25-Year Storm: 20.6 CFS
50-Year Storm: 23.6 CFS
Future 25-Year Storm: 20.6 CFS
Future 50-Year Storm: 23.6 CFS

Existing System
Most of the runoff in Basin 2 follows the natural contours of the basin in its route to the Bay. Along the way, some of the water is collected in roadway piping and transported to the Bay. The lower portion of the basin is affected by tides, which at times creates surcharging within the storm water system. Storm drainage from approximately 12.5 acres of the basin along Koosbay Blvd. is transported to Basin 4 through 10” diameter piping. The remaining water enters the Bay through a 24” diameter CMP outfall along Pine St.

Present Day Problems
The existing 24” diameter CMP outfall along Pine St. needs to be lined with PVC or equivalent piping to increase flows during high tide events. The 18”diameter piping located upstream of the existing 24” diameter CMP outfall along Pine Avenue is of an unknown material, and should be PVC or equivalent pipe to handle storm flows.

Future System
No significant development is predicted for this basin throughout the planning period.

Basin No. 3

Basin 3 is approximately nine acres located to the south of Basin 2. The basin drains to the east, into the Bay. The upper portion of the basin is bound to the west by 8th Street, and to the south by Koosbay Blvd.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)

Slope
0-30%

Current Land-use
5.30 Acres Commercial
3.70 Acres Small Residential

Peak Runoff
25-Year Storm: 3.3 CFS
50-Year Storm: 3.8 CFS
Future 25-Year Storm: 3.3 CFS
Future 50-Year Storm: 3.8 CFS

Existing System
The runoff water in the basin is collected in catch basins along Myrtle Ave. and discharged to the Bay through a 15" diameter pipe. The existing outfall pipe is CMP with a flapper style tidegate.

Present Day Problems
The pipe is adequately sized for flow, but the outfall pipe has holes large enough to allow all flow to bypass the tidegate.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 4

Basin 4 is approximately 81 acres located to the south of Basin 3. The basin drains to the east, into the Bay. The upper portion of the basin is bound to the west by 14th Street, and to the south by Hemlock and Ivy Avenues, from which the southern boundary extends to the Bay.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-30%

Current Land-use
20.61 Acres Commercial
2.30 Acres Industrial
52.13 Acres Small Residential
6.00 Acres Forest/Brush

Peak Runoff
25-Year Storm: 50.4 CFS
50-Year Storm: 58.1 CFS
Future 25-Year Storm: 50.4 CFS
Future 50-Year Storm: 58.1 CFS

Existing System
Most of the runoff in Basin 4 follows the natural contours of the basin in its route to the Bay. Along the drainage path, the water is collected in roadway piping on Juniper Avenue, and then transported to 6th Street and Koosbay Blvd through 24-inch concrete piping. At this intersection the storm water piping ties into the 42-inch wastewater plant effluent outfall, which discharges in the Bay under the Orcas mooring. The lower portion of the basin is affected by tides, which at times creates surcharging within the storm water system. The material of pipe used in the outfall is unknown. Two additional outfalls serve the lower portion of the basin, a 12-inch line draining the highway and around the Motel 6, and a 24-inch CMP with an 18-inch PVC liner serving west of Koosbay Blvd between 6th and 8th Streets. The 12-inch line has a flapper tidegate; the 18-inch line has no gate.

Present Day Problems
Surcharging was reported in the 42-inch outfall which overflows storm water and effluent through catch basins on Koosbay Blvd at 6th and 7th Streets. The modeled flows would require a 36” PVC or equivalent outfall line for storm water.

Future System
No significant development is predicted for this basin throughout the planning period.

Basin No. 5

Basin 5 is approximately 66 acres located to the south of Basin 4. The basin drains to the east, into the Bay. The upper portion of the basin is bound to the west by 10th Street, and to the south by Date Avenue, from which the southern boundary extends to the Bay.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-50%

Current Land-use
10.30 Acres Commercial
55.40 Acres Small Residential

Peak Runoff
25-Year Storm: 34.9 CFS
50-Year Storm: 40.4 CFS
Future 25-Year Storm: 34.9 CFS
Future 50-Year Storm: 40.4 CFS

Existing System
Most of the runoff in Basin 5 follows the natural contours of the basin in its route to the Bay. Along the drainage path, the water is collected in roadway piping on Ivy Avenue and other arterial roadways, and then is transported to the Bay through a 24" diameter CMP piping. The 24-inch line has a tidegate in a vault just west of Highway 101. The lower portion of the basin is affected by tides, which at times creates surcharging within the storm water system.

Present Day Problems
No problems were reported although modeling of the basin indicate that the pipe on Ivy Ave. needs upsizing to 30" PVC or equivalent pipe to adequately meet the 50-year design flows.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 6

Basin 6 is approximately 4.5 acres located to the south of Basin 5. The basin drains to the east, into the Bay. The upper portion of the basin is bound to the west by 4th Street and Basin 5 and to the south the boundary runs just south of the Lumberman's store, from which the southern boundary extends to the Bay.

Soil Type
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-30%

Current Land-use
0.61 Acres Commercial
3.92 Acres Industrial

Peak Runoff
25-Year Storm: 4.4 CFS
50-Year Storm: 5.0 CFS
Future 25-Year Storm: 4.4 CFS
Future 50-Year Storm: 5.0 CFS

Existing System
Most of the runoff in Basin 6 follows the natural contours of the basin in its route to the Bay. Along the drainage path, the water is collected in 12" diameter piping on Hemlock Ave. and Highway 101. The water is then is transported to the Bay through 18" diameter CMP outfall pipe, although ODOT drawings show the section under the highway to be 18-inch concrete. The lower portion of the basin is affected by tides, which at times creates surcharging within the storm water system.

Present Day Problems
Portions of Highway 101 in this basin have historical flooded during high tide events, coinciding during times of rain. Field investigation indicates that the outfall does not have a tide gate installed. Modeling of the basin indicates that a 18" PVC outfall or equivalent is needed to meet the 50-year rainfall event.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 7

Basin 7 is approximately 22 acres located to the south of Basin 6. The basin drains to the east, into the Bay. The upper portion of the basin is bound to the west by N. 2nd Ct. and Basin 5. The southern boundary roughly follows Elm Avenue.

Soil Type
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-50%

Current Land-use
5.96 Acres Commercial
8.05 Acres Industrial
8.20 Acres Small Residential

Peak Runoff
25-Year Storm: 19.8 CFS
50-Year Storm: 22.4 CFS
Future 25-Year Storm: 19.8 CFS
Future 50-Year Storm: 22.4 CFS

Existing System
Most of the runoff in Basin 7 follows the natural contours of the basin in its route to the Bay. Along the drainage path, the water is collected in roadway piping and transported towards Highway 101 and the Bay. The water is then is transported to the Bay through 18" diameter pipe of unknown material which is approximately 520 feet south of Hemlock Ave. on Highway 101 South. The lower portion of the basin is affected by tides, which at times creates surcharging within the storm water system.

Present Day Problems
Portions of Highway 101 in this basin have historical flooded during high tide events, coinciding during times of rain. Records do not indicate if a tide gate is installed on the outfall pipe. Modeling of the basin indicates that the existing 18" diameter outfall pipe 520 feet south of Hemlock Ave. on Highway 101 does not meet the 50-year rainfall event. A 24" diameter PVC or equivalent pipe should be installed to meet 50-year rainfall runoff.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 8

Basin 8 is approximately 12.3 acres bound to the north by Basin 7, Broadway to the west, and the Bay to the east. The southern boundary runs just south of Birch Avenue.

Soil Type
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-10%

Current Land-use
7.29 Acres Commercial
5.02 Acres Industrial

Peak Runoff
25-Year Storm: 14.1 CFS
50-Year Storm: 15.7 CFS
Future 25-Year Storm: 14.1 CFS
Future 50-Year Storm: 15.7 CFS

Existing System
Runoff in the basin is collected along roadways in the basin, and then transported to the Bay through two outfalls. One of the outfalls is a 24” diameter pipe of unknown material that runs along Birch Ave. A tidegate shown in record drawings as located in a vault at Front Street and Birch has been removed. The other outfall is a 12” diameter pipe of unknown material that is located on Date Ave.

Present Day Problems
Records do not indicate if a tide gate is installed on either of the outfall pipes. Modeling of the basin indicate that the existing 24” diameter pipe needs to be PVC or equivalent material to meet a 50-year rainfall event. Modeling results indicate that the 12” diameter outfall on Date Ave. needs to be sized to 14” diameter PVC or equivalent to meet the 50-Year Rainfall event. The 12” diameter outfall on Date Ave. does meet the 25-year rainfall event.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 9

Basin 9 is an "L" shaped parcel of approximately 14 acres wrapping around the west and south sides of Basin 8. The boundary starts at Date Avenue and North 2nd Street and continues south following North 2nd Street to Park Avenue. At Park Avenue, the boundary jogs east to Broadway and then south again to Highland Avenue, following Highland to the Bay. Basin 9 is bound on the other borders by Basins 7 and 8 and the Bay.

Soil Type
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-20%

Current Land-use
2.40 Acres Commercial
11.0 Acres Industrial
1.00 Acres Small Residential

Peak Runoff
25-Year Storm: 15.1 CFS
50-Year Storm: 16.9 CFS
Future 25-Year Storm: 15.1 CFS
Future 50-Year Storm: 16.9 CFS

Existing System
Runoff in the basin is collected along roadways in the basin, and then transported to the Bay through an 8" diameter pipe of unknown material on Alder Ave. Three outfalls were identified at Alder Avenue; although two of these may serve local and highway catch basins only.

Present Day Problems
Records do not indicate if a tide gate is installed on the outfall pipe. Modeling of the basin indicate that the existing 8" diameter pipe on Alder Ave. needs to be 12" diameter PVC pipe or equivalent to meet a 50-year rainfall event.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 10

Basin 10 is approximately 33.7 acres. The basin boundary starts at Date Avenue and North 2nd Street and runs diagonally southwest to the intersection of Telegraph Drive and Signal Way, continuing south along Telegraph Drive to the intersection with Park Avenue. From this intersection the boundary goes southeast to the intersection of 2nd and Highland, following 2nd Street to just south of Market Avenue and then continuing west to the Bay. The remaining borders are formed by Basin 9 and the Bay.

Soil Type
Wintley Silt Loam
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-50%

Current Land-use
9.60 Acres Commercial
0.70 Acres Industrial
23.40 Acres Small Residential

Peak Runoff
25-Year Storm: 24.3 CFS
50-Year Storm: 27.9 CFS
Future 25-Year Storm: 24.3 CFS
Future 50-Year Storm: 27.9 CFS

Existing System
Runoff in the basin is collected along roadways in the basin, and then transported to the Bay through a 30” diameter concrete pipe to the Bay.

Present Day Problems
No problems were reported, although some of the area within the basin is located in the flood plain. Modeling of the basin indicate that the existing 30” diameter concrete pipe needs to be 30” diameter PVC pipe or equivalent to meet a 50-year rainfall event.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 10A

Basin 10A is approximately 14.4 acres bound to the north by Basin 10 and to the west by the Bay. From the Bay, the south boundary roughly follows Central Avenue to 4th Street then jogs north on 4th to north of Commercial Avenue, continuing west to 6th Street and then north to Basin 10.

Soil Type
Wintley Silt Loam
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-50%

Current Land-use
14.40 Acres Commercial

Peak Runoff
25-Year Storm: 16.09 CFS
50-Year Storm: 17.89 CFS
Future 25-Year Storm: 16.09 CFS
Future 50-Year Storm: 17.89 CFS

Existing System
Pump Station 11 is located in this basin. Runoff from the western portion of this basin and from areas adjacent to 3rd Street between Curtis and Market gravity feed to this station. At low tide the system gravity feeds to the Bay through a 36-inch outfall at Tidegate 16. At high tide, the station floats activate the two pumps and pressurize the downstream portion of the gravity system. Tidegates in the discharge vault next to the station prevent the station from pressurizing the upper portions of the gravity system. The pumps are rated at 2,700 gpm each.

Present Day Problems
No problems were reported, although part the basin is located in the flood plain and flooding occurs downstream of the pump station at the intersection of Bayshore Drive and Commercial Avenue during heavy rains at high tides. Installation of backflow valves at the catch basins downstream of the pump station is recommended to prevent flooding in this area.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 11

Basin 11 is approximately 7.7 acres bound to the north by Basin 10A, the east by the Bay, and the south by Curtis.

Soil Type
Udorthents, (Artificial Fill)

Slope
0-1%

Current Land-use
6.19 Acres Commercial
1.51 Acres Industrial

Peak Runoff
25-Year Storm: 7.4 CFS
50-Year Storm: 8.3 CFS
Future 25-Year Storm: 7.4 CFS
Future 50-Year Storm: 8.3 CFS

Existing System
One 18-inch CMP outfall line, on Central Avenue, drains Broadway from Commercial to Bennett Avenues and Central from 4th Street to the Bay. There are two other outfalls within 10-feet of this outfall (Tidegate 14) that do not show on City maps. A 24-inch concrete outfall located a few feet to the north was noted as having considerably higher flows than the 18-inch line on the plans.

Present Day Problems
No problems were reported, although some of the area within the basin is located in the flood plain and Broadway floods in front of the Egyptian Theater during unusually high tides. Modeling of the basin indicates that the existing CMP pipe on Central Avenue has inadequate capacity and needs to be 18” diameter concrete pipe or equivalent to meet a 50-year rainfall event. Without pumping, this area is subject to flooding during high tide high rain events.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 12A

Basin 12A is approximately 300 acres comprising the Mingus Park Lake drainage basin. This basin does not have direct access to discharge in the Bay except through culverts. The boundaries run from 14th and Juniper to Ocean Blvd and Butler, continuing south on Ocean Blvd to Central Avenue and thence east on Central to 7th Street and directly north to Basin 9. The other boundaries are formed by Basins 4, 5, and 9. Flows from this basin are conveyed via a 42-inch diameter concrete pipe to Basin 12C, where they join the Mill Slough Box. Basin 12A has the highest potential for creating retention storage areas of all of the areas in the City Limits.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-50%

Current Land-use
36.00 Acres Commercial
180.00 Acres Small Residential
84.00 Acres Forest/Brush

Peak Runoff
25-Year Storm: 66.9 CFS
50-Year Storm: 78.6 CFS
Future 25-Year Storm: 66.9 CFS
Future 50-Year Storm: 78.6 CFS

Existing System
Most of the storm water runoff within the basin is collected at Mingus Lake. From Mingus Lake, the water spills over the lake weir and is transported through 36” diameter piping of unknown material to the north branch of the Mill Slough Box, a 42” diameter concrete pipe at the intersection of Commercial and North 8th Street.

Present Day Problems
The lake has a history of flooding the south end of Mingus Park and a resident reported that during high tide events, the water can back up into Blossom Creek as was observed during a February 2004 high tide. The storm water modeling indicates that the existing 36” diameter pipe of unknown material exiting Mingus Lake is undersized for the 50-year storm runoff. Modeling indicates that the 36” diameter pipe of unknown material would be adequate if it was 36” diameter PVC or equivalent pipe. The 42” diameter concrete pipe should be lined with PVC to meet the 50-year storm runoff.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 12B

Basin 12B is approximately 660 acres comprising includes the upper area of Blossom Gulch. The Basin follows the ridgeline dividing the Pony Creek Watershed from the Blossom Gulch Basin on the northwest and the City Limits south of Elrod on the east. Basins 5 and 12C bind the basin to the south and east. Basin 12A forms the western boundary. Most of this basin is outside of the city limits.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)
Geisel Silt Loam
Nestucca Silt Loam

Slope
0-50%

Current Land-use
28.00 Acres Small Residential
632.00 Acres Forest/Brush

Peak Runoff
25-Year Storm: 121.9 CFS
50-Year Storm: 156.7 CFS
Future 25-Year Storm: 158.8 CFS
Future 50-Year Storm: 198.5 CFS

Existing System
As storm water travels down Blossom Gulch, it enters into a 4x5 foot box culvert, the Mill Slough Box, which transports the water towards the Bay. This culvert enlarges to 8x5 foot at 7th Street, where the drainage from Mingus Lake joins the stream.

Present Day Problems
During the coincidence of high tide and rainfall, water backs up Blossom Gulch behind Blossom Gulch Elementary School. The floodplain of Blossom Gulch Creek is below the higher high tide level and subject to flooding at tides over nine feet. Damage to structures has occurred and Anderson Avenue is periodically submerged, preventing access for residents west of the city limits. While the County has dredged Blossom Gulch Creek to provide storage, the amount gained is marginal, and the stream is fish bearing, limiting the work that may be done. Field investigation indicates that water from Mingus Lake will at times flow back into Blossom Gulch during high tide events. The results of modeling the basin demonstrate that the Mill Slough Box is undersized to handle existing flows, with higher flows projected due to development.

Future System
It is estimate that approximately 141 acres of existing forest will be developed into residential housing over the next 20 years.

Basin No. 12C

Basin 12C is the basin that conveys flows from Blossom Gulch Creek and Mingus Lake to the Bay, consisting of approximately 60 acres adjacent to the path of the Mill Slough Box. The east boundary is 10th Street from Elrod to Central Avenues and 7th Street north to Telegraph Drive. Basins 9, 10, and 11 form the northwest boundary. The south border runs from 10th and Elrod east to the Bay just south of Curtis Avenue in an erratic line.

Soil Type
Wintley Silt Loam
Udorthents, (Artificial Fill)
Geisel Silt Loam

Slope
0-30%

Current Land-use
60 Acres Commercial

Peak Runoff
25-Year Storm: 53.3 CFS
50-Year Storm: 59.0 CFS
Future 25-Year Storm: 53.3 CFS
Future 50-Year Storm: 59.0 CFS

Existing System
Stream flows from Blossom Gulch Creek and storm waters from Basins 12A and 12B are transported through Basin 12C in an 8x5 foot concrete box culvert, the Mill Slough Box, built on pilings between 1915 and 1920. Storm water in Basin 12C is transported through catch basins and piping to the box culvert. The culvert discharges into the Bay through a wood tide gate at Curtis Avenue. Gravity sewers penetrate the box culvert in several places. Grouting was done in the past to seal cracks and gaps discovered when sinkholes appeared on top of the culvert.

Present Day Problems
Water visibly bypasses the tidegate and has eroded soil from under the culvert at the gate. The bypasses may be due to cracks in the concrete. While the concrete appears to be in good condition, it is within 20 years of its rated life. Field investigations at 7th Street disclosed 8 to 12 inches of gravel and sand sediment in the culvert. The storm water modeling indicates that the existing 4x5 foot and 8x5 foot Mill Slough box sections are undersized for the 50-year rainfall event with 20-year build out. The gravity sewer pipes in the culvert further restrict the capacity so that the culvert is undersized for current 50-year flows. The system has very little storage and backs flows up into the creek at high tides. Gravity sewers crossing through the culvert show signs of damage and past repairs.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 13

Basin 13 is approximately 16 acres bound to the west by 4th Street. The basin is bound to the south by the Ferguson Avenue right-of-way, the west by the Bay, the east by Highway 101, and to the north by Basin 12C. The eastern section Elrod Ave. is located in this basin.

Soil Type
Udorthents, (Artificial Fill)

Slope
0-1%

Current Land-use
13.60 Acres Commercial
2.00 Acres Industrial
0.20 Acres Brushy/Fields

Peak Runoff
25-Year Storm: 17.3 CFS
50-Year Storm: 19.2 CFS
Future 25-Year Storm: 17.3 CFS
Future 50-Year Storm: 19.2 CFS

Existing System
Catch basins within the basin collect runoff water and transport it to the outfall line that flows to the Bay. The existing outfall pipe (Outfall 11) is a 12” diameter pipe of unknown material. A wood 12-inch outfall with flow was discovered during field investigations at the location shown on City plans, but may not be the outfall on the plans. This basin had a history of flooding, but installation of a 15-inch overflow to Pump Station 15 several years ago appears to have alleviated the problem. Due to the low elevation in the basin, it is not feasible to have a gravity flow system during a rainfall event coinciding with a high tide.

Present Day Problems
Sections of Highway 101 within the basin have been noted as flooding. Modeling indicate that the existing 12” diameter outfall is undersized for the 50 year rainfall event, and should be upsized to an 18” diameter PVC or equivalent pipe. The wood outfall is in extremely poor shape, is packed with gravel, and is missing a tidegate.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 14

Basin 14 is approximately 124 acres bound to the north and west by Basins 12B, 12C and 13. The south boundary starts at Basin 12B and roughly follows Ingersoll Avenue to 5th Street, turning south to follow 5th to Kruse, continuing east to 4th and following 4th north to Hall Avenue. The boundary continues east on Hall to Highway 101 and then angles southeast to the intersection of Coalbank and Isthmus Sloughs. The west boundary is the Bay. The high school, historic 5th Street neighborhood, and the area between Golden and Hall Avenues are in this basin.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)
Wintley Silt Loam

Slope
0-30%

Current Land-use
36.00 Acres Commercial
7.00 Acres Industrial
33.00 Acres Small Residential
27.00 Acres Forest
20.80 Acres Grassy Fields

Peak Runoff
25-Year Storm: 50.1 CFS
50-Year Storm: 58.7 CFS
Future 25-Year Storm: 59.3 CFS
Future 50-Year Storm: 68.6 CFS

Existing System
Catch basins within the basin collect runoff water and transport it to the outfall line that flows to the Bay. The existing outfall on Golden Ave is a 36” diameter concrete pipe. Due to the low elevation in the basin, it is not feasible to have a gravity flow system during a rainfall event coinciding with a high tide. A tidegate is located at the intersection of Golden and Bayshore Drive.

Present Day Problems
Sections of Highway 101 within the basin and 2nd Street south of Golden Avenue flooded during the time of this study at high tides. Elevation maps indicate that this basin has little to no storage for storm water. Fill placed in the 1980’s at Golden Field buried the storm water lines and manholes to an inaccessible depth for maintenance, new connections, or inspection.

Future System
It is estimated that approximately 27 acres of existing forest will be developed into residential housing over the next 20 years.

Basin No. 15

Basin 15 is approximately 74 acres that is bound to the north and west by Basin 14. The basin is bound to the south by Kruse Avenue and Highway 101. Coalbank Slough serves as the eastern boundary of the basin. The Fred Meyers and Safeway stores are located in this basin.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)

Slope
0-7%

Current Land-use
68.10 Acres Commercial
2.40 Acres Industrial
3.52 Acres Small Residential

Peak Runoff
25-Year Storm: 68.3 CFS
50-Year Storm: 75.7 CFS
Future 25-Year Storm: 68.3 CFS
Future 50-Year Storm: 75.7 CFS

Existing System
Catch basins within the basin collect runoff water from the roadways and commercial lots and transport it to the outfall line that flows to the Bay. The existing outfall pipe on Johnson Ave. is a 42" diameter pipe of unknown material. Pump Station Number 15 is located approximately 150 feet east of the Johnson Avenue and Front Street intersection. The pump station is equipped with 3 pumps. The two smaller pumps have a design capacity of 4,350 gpm each and the larger pump has an estimated capacity of 11,000 gpm. Catch basins on Highway 101 northbound (Bayshore Drive and 1st Street) between Curtis and Johnson are piped to this station from Basins 13 and 14.

Present Day Problems
Sections of Highway 101 within the basin and the west Fred Meyer parking lot have been noted as flooding. Elevation maps indicate that this basin has little to no storage for storm water. The discharge vault of the pump station leaks where the frame meets the pavement.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 16

Basin 16 is approximately 29 acres that is bound to the north by Basin 15, and the west by the west side of 2nd Street. The basin is bound to the south and east by Coalbank Slough.

Soil Type
Udorthents, (Artificial Fill)

Slope
0-1%

Current Land-use
11.75 Acres Commercial
17.25 Acres Industrial

Peak Runoff
25-Year Storm: 24.1 CFS
50-Year Storm: 26.9 CFS
Future 25-Year Storm: 24.1 CFS
Future 50-Year Storm: 26.9 CFS

Existing System
Catch basins within the basin collect runoff water from the roadways and commercial lots and transport it to the outfall lines that flow to the Bay. Currently there are four outfall lines within the basin. A 12" diameter PVC line is located at S. 2nd St., and a 24" diameter HDPE pipe along Broadway, a 24" diameter HDPE pipe at S. 1st St., and a 12" diameter CMP line is located at Front Street. Due to the low elevation in the southeast sections of the basin, it is not feasible to have a gravity flow system during a rainfall event coinciding with a high tide. All outfalls have tidegates. The basins at Front Street and at 1st Street have sediment basins.

Present Day Problems
No problems were reported, although some of the area has elevations in the 9-foot range. Personnel at Les's Sanitary report flooding problems due to tidegates becoming fouled with debris, stating that they regularly clean debris from the gates. The sediment basins are plugged with accumulated sediment and debris.

Future System
Some of the existing commercial buildings may be removed and replaced with new commercial development and paving. No changes to the basic land-use are expected.

Basin No. 17

Basin 17 is approximately 132 acres that is bound to the north by Basin 14 at Ingersoll Avenue, and the east by Basins 14 and 16. Coalbank Slough forms part of the south boundary. The west boundary starts at Coalbank Slough and 9th Street and goes north to Lockhart Avenue. From 9th and Lockhart the boundary angles west-northwest to Basin 12B.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)

Slope
0-30%

Current Land-use
31.00 Acres Commercial
6.25 Acres Industrial
44.00 Acres Small Residential
51.00 Acres Forest

Peak Runoff
25-Year Storm: 77.9 CFS
50-Year Storm: 90.2 CFS
Future 25-Year Storm: 122.4 CFS
Future 50-Year Storm: 136.9 CFS

Existing System
Storm water runoff in Basin 17 is transported to the Bay through two main outfall pipes. One of the pipes, a 24" diameter CMP pipe serves the northeast section of the basin, and a 36" diameter CMP pipe serves the rest of the basin. Both of the outfalls follow S. 5th St. on their route to the Bay. The 36" diameter pipe picks up a small creek that flows through the drainage. The 24" diameter pipe currently only collects water from the residential area in the northeast section of the basin, along Johnson from 9th to 5th Street. An additional 12-inch outfall serves catch basins at 7th and Lockhart Avenue. All of the lines have tidegates.

Present Day Problems
The tidegate located at 7th and Kruse is undersized and of a poor configuration for maintenance. Salt water has flooding yards north of the gate.

Future System
It is estimated that approximately 51 acres of existing forest will be developed into residential housing over the next 20 years.

Basin No. 18

Basin 18 is approximately 73 acres that is bound to the north and east by Basin 17, and the west by Basin 12B. The south boundary starts at Dakota Avenue and Coalbank Slough, following Dakota west to 13th Street, then 13th north to Minnesota Avenue and from there roughly northwest to Basin 12B.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)
Langlois Silty Clay Loam

Slope
0-50%

Current Land-use
3.50 Acres Commercial
21.00 Small Residential
51.00 Forest/Brushy

Peak Runoff
25-Year Storm: 32.3 CFS
50-Year Storm: 39 CFS
Future 25-Year Storm: 75 CFS
Future 50-Year Storm: 84.1 CFS

Existing System
As runoff storm water travels from the upper-forested areas of the basin, the storm water is collected by catch basins along Minnesota Ave. and Southwest Blvd. The storm water is transported along Southwest Blvd. through a 15” diameter pipe of unknown material to the outfall at Tidegate 1.

Present Day Problems
Flooding was reported on the south side of Minnesota, east of S. 12th Street and on the north side of Minnesota, west of S. 13th Street.

Future System
It is estimate that approximately 51 acres of existing forest will be developed into residential housing over the next 20 years.

Basin No. 19

Basin 19 is approximately 103 acres that is bound to the north by Basins 18 and 12B. The ridgeline at the top of the hill forms the western boundary for the basin, and Basins 20 and 22 form the southern boundaries. The basin is bound to the east by Coalbank Slough. The south boundary runs from the slough, parallel to and north of Washington Avenue, to 20th Street and California Avenue and then follows California to Basin 12B.

Soil Type
Templeton Silt Loam
Udorthents, (Artificial Fill)
Langlois Silty Clay Loam

Slope
0-50%

Current Land-use
6.5 Acres Commercial
44 Acres Small Residential
52.5 Acres Forest

Peak Runoff
25-Year Storm: 36.4 CFS
50-Year Storm: 44.6 CFS
Future 25-Year Storm: 58.7 CFS
Future 50-Year Storm: 68.2 CFS

Existing System
As runoff storm water travels from the upper-forested areas of the basin, the storm water collects in the marshy areas along Southwest Blvd. If the tide is high, the water is stored until low tide, and during low tide, the water drains to the Bay. Water from Basin 18 is also stored in the marshy lowland areas during high tide because Basin 18's inlet pipe is behind the tide gate. The storm water is transported to the Bay through a 42" CPM pipe. The pipe does have a tide gate.

Present Day Problems
Dakota Avenue has been reported as a flooding area. The 42" diameter outfall pipe on Dakota Avenue has failed, and tidewater flows freely into the basin. Much of the basin is too low to promote a gravity system capable of meeting the 50-year storm runoff without flooding. A 48" diameter PVC outfall pipe is needed to meet the 50-year storm water runoff event.

Future System
It is estimate that approximately 28 acres of existing forest will be developed into residential housing over the next 20 years.

Basin No. 20

Basin 20 is approximately 35 acres that is bound to the north by Basin 19. From the southeast corner of Basin 19, the boundary follows Coalbank Slough south to Oregon Avenue and then continues south along Southwest Boulevard to Idaho Avenue. The boundary then turns west along Idaho, jumping to the north at 15th Street and continuing west midway between California and Idaho Avenues to 16th Street. The boundary then runs roughly north to 17th Street and the boundary with Basin 19.

Soil Type
Templeton Silt Loam

Slope
0-30%

Current Land-use
35.00 Acres Small Residential

Peak Runoff
25-Year Storm: 35.8 CFS
50-Year Storm: 40.1 CFS
Future 25-Year Storm: 35.8 CFS
Future 50-Year Storm: 40.1 CFS

Existing System
Runoff from the basin travels along natural drainage courses and roadways within the basin area. As water travels along California, Oregon, and Washington Avenues, it is collected in catch basins, and distributed downstream to an outfall pipe that is located approximately 125 feet north of the Southwest Blvd. and Oregon St. intersection. The outfall pipe is 24” diameter pipe of unknown material. No tide gate is needed due to the elevation of the outfall invert.

Present Day Problems
A broken pipe at the outfall, a sinkhole, and property damage was reported for this basin. Modeling of the basin indicates that the outfall piping should be increased to meet 50-year storm water runoff events. The pipe would need an equivalent diameter of 30” PVC pipe or equivalent.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 21

Basin 21 is approximately 2.5 acres that is bound to the north by Basin 20, and the south and west by Basin 22. This basin also drains to the Coalbank Slough.

Soil Type
Templeton Silt Loam

Slope
0-30%

Current Land-use
2.53 Acres Small Residential

Peak Runoff
25-Year Storm: 1.8 CFS
50-Year Storm: 2.1 CFS
Future 25-Year Storm: 1.8 CFS
Future 50-Year Storm: 2.1 CFS

Existing System
The runoff from this basin flows along Southwest Blvd., where it then crosses the roadway, and is diverted through natural drainage courses towards the Bay. The existing outfall pipe is 8" diameter pipe of unknown material.

Present Day Problems
No problems were reported for this basin.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 22

Basin 22 is approximately 105 acres that is bound to the north by Basins 19, 20, and 21. Southwest Boulevard forms the east boundary and the mountain ridgeline forms the western boundary of Basin 22. The south boundary runs from Southwest Boulevard, just south of Illinois Avenue, wraps around the north side of Englewood School, and ends at the ridgeline north of Pennsylvania Avenue.

Soil Type
Templeton Silt Loam
Langlois Silty Clay Loam

Slope
0-30%

Current Land-use
50.00 Acres Residential
55.00 Acres Forest

Peak Runoff
25-Year Storm: 36.5 CFS
50-Year Storm: 44.6 CFS
Future 25-Year Storm: 36.5 CFS
Future 50-Year Storm: 44.6 CFS

Existing System
This basin is the drainage basin for Middle Creek, draining to the east through a 48-inch culvert under Southwest Boulevard into a drainage ditch system in the reclaimed tidal lands currently used as pasturage. Two outfalls with tidegates at the dike on Coalbank Slough control drainage from the ditch system. These tidegates are located outside the City limits and are maintained by the Englewood Diking District.

Present Day Problems
Flooding problems for properties bordering Middle Creek, between Montana and Illinois Avenues were reported. These properties are below the high tide line and flood when water tops the dike along Coalbank Slough. The City has installed tidegates at the creek for three individual properties.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 23

Basin 23 is approximately 16 acres that is bound to the north by Basin 22 and includes the area surrounding the paved portion of Pennsylvania Avenue. The south boundary starts at Pennsylvania and Southwest Boulevard and angles southwest to 17th Street and Iowa Avenue, then heading northwest back to Pennsylvania at 19th Street.

Soil Type
Templeton Silt Loam
Langlois Silty Clay Loam

Slope
0-30%

Current Land-use
8.00 Acres Residential
8.00 Acres Forest

Peak Runoff
25-Year Storm: 7.0 CFS
50-Year Storm: 8.5 CFS
Future 25-Year Storm: 7.0 CFS
Future 50-Year Storm: 8.5 CFS

Existing System
The runoff from this basin flows along Southwest Blvd., where it then crosses the roadway, and is diverted through natural drainage courses towards Coalbank Slough. The existing outfall pipe is 8” diameter pipe of unknown material.

Present Day Problems
There is flooding on Southwest Boulevard frequently due to plugging of this catch basin and the undersized culvert.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 24

Basin 24 is approximately 29 acres and is the southernmost basin in the study area. Basins 22 and 23 bind the basin to the north and east. The west boundary runs about 300 feet to the west of 21st Street. The south boundary runs from 21st Street to Libby Lane.

Soil Type
Templeton Silt Loam

Slope
0-50%

Current Land-use
11.78 Acres Large Lot Residential
11.22 Acres Small Lot Residential
6.00 Acres Forest

Peak Runoff
25-Year Storm: 13.0 CFS
50-Year Storm: 15.6 CFS
Future 25-Year Storm: 13.0 CFS
Future 50-Year Storm: 15.6 CFS

Existing System
The storm water runoff follows natural contours and drainage ways within the basin.

Present Day Problems
No problems were reported for this basin.

Future System
No development is predicted for this basin throughout the planning period.

Basin No. 25

Basin 25 is approximately 128 acres. The boundary runs west from the Water Board on Ocean Boulevard to Cottonwood Avenue, following Cottonwood east to Juniper, and Juniper east to 14th Street. The boundary continues north on 14th Street to Pine Avenue and then angles northwest to 15th Street south of Teakwood, from which point it follows the south border of Bay Area Hospital then turns north to Kinney Road. The remaining boundaries are comprised of the boundary of the study area. The Hospital branch of Pony Creek flows north through this basin.

Soil Type
Geisel Silt Loam
Templeton Silt Loam
Bullards Sandy Loam

Slope
0-50%

Current Land-use
26.00 Acres Commercial
30.00 Acres Small Lot Residential
72.00 Acres Forest

Peak Runoff
25-Year Storm: 48.4 CFS
50-Year Storm: 58.0 CFS
Future 25-Year Storm: 48.4 CFS
Future 50-Year Storm: 58.0 CFS

Existing System
The storm water runoff follows natural contours and drainage ways within the basin and eventually collects in a gulley that crosses Kinney Rd. There is a 36” diameter CMP culvert which transitions into a 42” diameter CMP culvert under Kinney Rd.

Present Day Problems
No problems were reported for this basin. Modeling of the basin indicate that the existing culvert under Kinney road needs to be upgraded to a 36” diameter PVC or equivalent pipe to meet the 50-year rainfall event. Field investigation revealed that the culvert is partially filled with sediment, and is deformed at its northern end.

Future System
It is estimated that approximately 56 acres of existing forest will be developed into medical/commercial area over the next 20 years.

Basin No. 26

Basin 26 is approximately 69 acres bound to the south and west by Basin 25. The east boundary starts at Pine Street, approximately 130 feet east of 14th Street and runs north paralleling 14th to the north study area boundary north of Yew Avenue.

Soil Type
Bandon Sandy Loam
Geisel Silt Loam
Bullards Sandy Loam

Slope
0-12%

Current Land-use
11.50 Acres Commercial
43.00 Acres Small Lot Residential
14.50 Acres Forest/Brushy

Peak Runoff
25-Year Storm: 38.3 CFS
50-Year Storm: 44.9 CFS
Future 25-Year Storm: 51.4 CFS
Future 50-Year Storm: 58.8 CFS

Existing System
The storm water runoff follows natural contours and drainage ways within the basin until it reaches Thompson Rd. There is an n 18” diameter pipe of unknown material that transitions into a 21” diameter pipe of unknown material that transports the water down Thompson Rd. to the Kinney Rd culvert crossing in Basin 25.

Present Day Problems
No problems were reported for this basin. Modeling of the basin indicate that the 21” diameter pipe that enters into the Kinney Rd. crossing should be upgraded to a 21” diameter PVC pipe or equivalent.

Future System
It is estimated that approximately 15 acres of existing forest will be developed into medical/commercial area over the next 20 years.

Basin No. 27

Basin 27 is approximately 25 acres bound to the south by Basin 2. The basin is bound to the east by Basin 1, and to the North by the study boundary. Basin 26 forms the western edge of the boundary.

Soil Type
Geisel Silt Loam
Bullards Sandy Loam

Slope
0-12%

Current Land-use
25.00 Acres Small Lot Residential

Peak Runoff
25-Year Storm: 10.45 CFS
50-Year Storm: 12.81 CFS
Future 25-Year Storm: 10.45 CFS
Future 50-Year Storm: 12.81 CFS

Existing System
Approximately 6.4 acres of Basin 27 flows onto Thompson Rd. where it is collected in catch basins and transported to a natural gulley on the north side of Thompson Rd. The pipe is a 12" diameter pipe of unknown material. The remaining acreage within the basin follows natural drainage courses and contours of the basin.

Present Day Problems
No problems were reported for this basin. Modeling of the basin indicate that the 12" diameter pipe along Thompson Rd. should be increased to a 18" diameter PVC pipe or equivalent sized pipe to meet the 50-year rainfall event.

Future System
No development is predicted for this basin throughout the planning period.