STORM WATER DRAINAGE MASTER PLAN

CITY OF TILLAMOOK, OREGON
OCTOBER, 2004

PREPARED BY

LDC

DESIGN GROUP, INC.

RENEWAL 12-31-05

PROJECT 3115

ORDINANCE NO. ____

AN ORDINANCE OF THE CITY OF TILLAMOOK ADOPTING A STORM WATER DRAINAGE MASTER PLAN

WHEREAS, the City of Tillamook, Oregon lies at or near the confluence of several surface water bodies, which comprise a substantial portion of the Tillamook Bay basin. The City sits at a relatively low elevation adjacent to these surface waters, and there is a close interrelationship between manmade facilities and the naturally occurring waterways, and

WHEREAS, the city has evolved over many decades, there have been many relatively small, localized storm water systems developed to convey storm runoff to one or more of these bodies. In many cases, there may not have been much strategic planning to develop those systems within the context of providing the best functional values to the City as a whole. There also does not appear to have been much consideration given to the possible effects of municipal development on the quality of the storm water that is being regularly discharged into those water bodies, and

WHEREAS, in the modern era, however, it has become necessary for Tillamook to address the effects of its municipal storm water discharges on stream water quality. The impetus for this change in priorities is the federal Clean Water Act, as implemented through the authority of the Oregon Department of Environmental Quality (DEQ), and

WHEREAS, in addition to addressing water quality concerns, the City also desires to evaluate its existing storm water conveyance infrastructure and to develop a Master Plan for the ultimate build out of the City's storm water facilities. This Master Plan, therefore, addresses the conveyance capacities and efficiencies of its existing and future facilities, and it also addresses the diverse water quality issues that have been raised by DEQ and other entities, and

WHEREAS, the Master Plan provides a comprehensive, integrated "roadmap" for the City to follow in implementing improved storm water controls and conveyance systems. This roadmap contains both steps the city can take in the near future, such as operational changes affecting existing systems, and longer term solutions such as Capital Improvements that will result in improving storm water quality as time progresses.

NOW, THEREFORE, based on the foregoing, the City of Tillamook ordains as follows:

Section 1: The Storm Water Drainage Master Plan document prepared for the City of Tillamook by the LDC Design Group, Inc. dated October 2004 along with any subsequent amendments is hereby adopted and incorporated hereto by reference.

PASSED FIRST READING by the Council this _____ day of _____, 2005.

PASSED SECOND READING by the Council this _____day of _____, 2005.

APPROVED by the Mayor this _____ day of _____, 2005.

Mayor

ATTEST:

City Recorder

PROCLAMATIONS: **None.**

PRESENTATION: **Stormwater Drainage Master Plan**

Rich Gitchlag and Clint Davis, LDC Engineering gave an overview of the project. The master plan was conceived by Oregon DEQ (Department of Environmental Quality) due to concerns over water quality in Tillamook Bay. First thing they did was inventory and map the City's storm sewer system with help from Arley Sullivan, Public Works Director and Jon Williams, Street Supervisor. They did a Water Quality Analysis which involved collecting samples from the City's storm sewer system and receiving streams (i.e. Trask River, Hoquarton Slough and Holden Creek) to determine the City's relative contribution of water run-off characteristics to the overall watershed that goes to Tillamook Bay. They found that 30-40% of the overall bacteria content of the Trask River comes from City sources and, in comparison to some of the higher basins, that works out to 10-15% of the total bacteria going into Tillamook Bay. Other typical characteristics of urban runoff were tested and found to be of values typical of most urban areas.

Sullivan commented that the Master Plan is available for Council review. It is a tremendous benefit to the City. It is a very useful tool for doing locates. He said the Master Plan would put the City in a good position to deal with CMOM (Capacity Management Operations and Maintenance) regulations. It is unclear when the regulations would become active. The next step is to start implementing some of the guidelines formulated by LDC as funds would allow. This plan should not have much affect on the Wastewater Facility Plan. Capacity should not be affected when the sanitary cross-connections are found and dealt with. When the upgrades are completed at the plant it should be able to take care of anything for a long time.

PERMITS & LICENSES: **None.**

PROJECT UPDATE: **Wastewater Facilities Plan**

John Harrison, Kennedy-Jenks gave the Council an overview of the Open House. He also said that he, Gervasi and Sullivan went to Salem to talk with the "money" people about funding for upgrades to the aged plant.

DEQ has changed the City's permit for waste-load to twice as many allowable pounds in winter months due to no adverse environmental impact. DEQ and the City looked at outfall and what could be done to disperse the effluent in a better way. Kennedy-Jenks will be submitting the Facility Plan to DEQ on December 20, 2004.

At the One-Stop Funding meeting of November 10, 2004 he distributed background information of the treatment plant/collection system and the proposed project components. Gervasi stated that the Council and public realize a new treatment plant and improvements to the collection system are required and costs involved achieving the improvements. Sullivan spoke of the need for the City to purchase property for sludge disposal and indicated the availability of a 70-acre parcel near Tillamook that would potentially allow for year-round application of bio-solids. Richard Santner of DEQ said that DEQ can approve a separate Land Purchase Loan as soon as the Facility Plan is approved and a Bio Solids Management Plan is approved.

The Community Development Block Grant (CDBG) has been increased to $1M. It may be available if at least 51% of Tillamook's residents qualify as low to moderate income. The latest census indicates that Tillamook is currently 48% low to moderate income. It was suggested that the City have a consultant undertake an independent survey to verify the actual percentage of low to moderate income. Santner indicated that State Revolving Funds (SRF) could be used to pay for the survey. Mention of the impending annexation added to the idea of having an independent survey done. Harrison stated that the City has $1.5M definite and a possible $2.5M. **Harrison** explained the rate study and said that sewer rates are going up around the state. The average rate is $30/month. Harrison gave the following rates of impact to homeowners:

Without any grants	$48/mo. up to $69/mo. in five-year increments
With grants	$43/mo. up to $64/mo. in five-year increments

EXECUTIVE SUMMARY

The City of Tillamook and its environs possess several unique factors that affect the characteristics of stormwater runoff from the City and the near vicinity.

The City is located at or near the confluence of several rivers and sloughs, and most of the City is low-lying in relation to those water bodies. It also possesses a storm drainage infrastructure that is rather antiquated and undersized in some areas, and is adequate for current and future needs in other areas of the City.

Within both the City and the general vicinity, there are concerns about the quality of the stormwater runoff and streamflows that ultimately flows into Tillamook Bay. There are many factors that contribute to these concerns, and the City's urban stormwater runoff is one of those factors.

This Storm Water Drainage Master Plan addresses the diverse needs for improvements to the City's many existing stormwater conveyance systems. Due to the limited scope of this Plan and the complex nature of the above factors, this plan does not include specific or final designs of any recommended improvements. Rather, this Plan is a comprehensive, planning level document by which the City and other entities can prioritize and implement improvements to both the conveyance and the quality of the City's urban stormwater runoff.

The results of this Plan are numerous, and are depicted both in the written sections of this report and on the detailed maps that are included within this report. All of the recommended Capital Improvements will benefit the hydraulic capacity of the City's storm drainage infrastructure. Also, some of these Capital Improvement recommendations, plus the Operations/Maintenance and Design Guideline recommendations, will have a significant beneficial effect on the quality of the City's runoff that is discharged to the receiving water bodies.

I
INTRODUCTION

A. Background

The City of Tillamook, Oregon lies at or near the confluence of several surface water bodies, which comprise a substantial portion of the Tillamook Bay basin. The City sits at a relatively low elevation adjacent to these surface waters, and there is a close interrelationship between manmade facilities and the naturally occurring waterways.

As the City has evolved over many decades, there have been many relatively small, localized stormwater systems developed to convey storm runoff to one or more of these surface water bodies. In many cases, there may not have been much strategic planning to develop those systems within the context of providing the best functional values to the City as a whole. There also does not appear to have been much consideration given to the possible effects of municipal development on the quality of the stormwater that is being regularly discharged into those water bodies.

In the more modern era, however, it has now become necessary for Tillamook to address the effects of its municipal stormwater discharges on stream water quality. The impetus for this change in priorities is the federal Clean Water Act, as implemented through the authority of the Oregon Department of Environmental Quality (DEQ).

B. Objectives and Approach

In addition to addressing water quality concerns, the City also desires to evaluate its existing stormwater conveyance infrastructure and to develop a Master Plan for the ultimate buildout of the City's stormwater facilities. This Master Plan, therefore, addresses the conveyance capacities and efficiencies of its existing and future facilities, and it also addresses the diverse water quality issues that have been raised by DEQ and other entities.

In summary, the Master Plan provides a comprehensive, integrated "roadmap" for the City to follow in implementing improved stormwater controls and conveyance systems. This "roadmap" contains both steps the city can take in the near future, such as operational changes affecting existing systems, and longer term solutions such as Capital Improvements that will result in improving stormwater quality as time progresses.

C. Acknowledgments

LDC Design Group, Inc. would like to express sincere appreciation to the City Manager, the Planning Department, and the Public Works Department of the City of Tillamook, whose generous time and cooperation provided valuable assistance and information throughout the study.

II

STUDY AREA CHARACTERISTICS

A. Topography, Setting and Study Area Limits

The City of Tillamook is located in the lowlands near the Tillamook Bay estuary, adjacent to the northwestern coastline of Oregon. The entire watershed that drains into the Bay is comprised of some 580 square miles of land area. Much of this area is steep, forested uplands. Urban areas and agriculture dominate the lowland areas closest to the Bay.

Of the five rivers that drain into Tillamook Bay, the Trask and Wilson Rivers flow directly adjacent to the Tillamook City southerly and northerly boundaries, respectively, very near their respective downstream points of confluence with the Bay. Holden Creek drains local areas along the southerly side of the City. Hoquarten Slough similarly drains local areas along the northerly side of the City's downtown business district.

Sheet 1 of the Insert Maps, located at the back of this report, provides an overall view of the City and all of the open watercourses in the vicinity. As shown on Sheet 1, most of the developed portion of the City is bounded by the Trask River, Holden Creek, and Hoquarten Slough.

The study area is primarily concerned with the area bounded by the City Limits. To evaluate the flow patterns and runoff volumes, it was also necessary to evaluate the entire watershed areas that are tributary to each open water course shown on Sheet 1. Some of those watersheds are shown in tabular form in this report, but are not shown on any of the Insert Maps.

B. Existing Stormwater Conveyance Systems

The City's existing network of stormwater drainage, or conveyance, systems is shown on Sheets 2, 3 and 4 of the Insert Maps. These maps were developed as a result of a substantial field investigation performed jointly by the City and by LDC Design Group, Inc. These maps depict the primary components of the City's existing public storm drainage systems, as well as some private facilities that are closely interconnected with the City systems. It should be noted that many of these systems are very old, and little if any documentation was available on these systems. Therefore, the information shown on the Insert Maps represents the best available information that was obtainable within the scope of this study.

In general, the existing stormwater systems provide a beneficial means of conveying rainfall runoff away from surface areas, and discharging that runoff into one of the adjacent open watercourses as shown on the Index Maps. These systems will be discussed in more detail, in Chapter IV of this report.

C. Land Use and Zoning

Many of the City's existing land use characteristics have evolved slowly, over a period of many decades. There is a downtown commercial business core area. Then there are more dispersed residential areas, consisting primarily of single - family uses and some limited multi – family areas as well.

Within the existing City Limits, the majority of the land has been developed, with some areas still available for expansion.

D. Regulatory Setting and Project Goals

This Storm Water Drainage Master Plan ("Plan") was initiated through a prioritization procedure, as implemented by the Oregon Department of Environmental Quality (DEQ). This project was partially funded by the US Environmental Protection Agency through DEQ's "319 Program", with the balance being funded by the City.

The DEQ has prioritized this project on the basis of its potential benefits to water quality within the adjacent streams and within Tillamook Bay. In compliance with this objective, this Plan evaluates the water quality characteristics of the City's urban stormwater runoff. This evaluation includes the following elements:

1. A comparison of the City's runoff characteristics with urban runoff parameters that are typical of most urban areas.
2. A more in-depth delineation of critical water quality parameters that may have a deleterious effect on receiving waters.
3. A comprehensive evaluation of the general magnitude of impacts that these critical water quality parameters may have on the adjacent watercourses, as well as on Tillamook Bay itself.

In addition to water quality concerns, the other primary goal of this Plan is to identify and map out the City's existing stormwater drainage infrastructure, and then to develop recommendations for needed improvements to that infrastructure. Those improvements will benefit both the hydraulic capacity and the water quality characteristics associated with this infrastructure.

It should be noted that this Plan does not specifically address the periodic flooding events that are caused by overflowing adjacent watercourses, either by overtopping their embankments or by their causing excessive impoundment of City runoff during major storm events. The Plan's recommendations do include feasible measures, e.g. tide gates where appropriate, to help mitigate or reduce the effects of such catastrophic flooding events. The issues associated with City-wide flooding problems are being dealt with through other mechanisms, such as the City's "Flood Mitigation Action Plan" and the Federal Emergency Management Agency's (FEMA) assistance programs provided to local communities.

III

EXISTING CONDITIONS AND EVALUATION CRITERIA

A. Hydraulic System Capacities

A1. Existing City Drainage Systems

The City's existing stormwater infrastructure is shown, in detail, on the Insert Maps. Sheet 1 shows the entire City in a schematic manner. Sheets 2, 3 and 4 show the complete layout of all systems identified by this Plan. A substantial portion of the City is served by these systems. Existing pipe sizes (diameters) are shown, wherever they are known. In a few locations, due to the lack of manholes or other structures on main lines, pipe sizes are not known. Typical structures including catch basins and manholes are also shown, wherever they have been identified.

During the field mapping work as discussed in Chapter II, a reconnaissance survey was also performed to develop approximate slopes of the existing pipes within the various stormwater conveyance systems. This was accomplished by the use of a hand-held level, known spot elevations on nearby ground surfaces, and by measuring down to pipe inverts or flowlines at manholes on the main lines. While it was only possible to obtain approximate pipe slopes, the information obtained is of sufficient accuracy to develop pipe carrying capacities within reasonable accuracy limits. The implications of this type of planning-level data are discussed further in section A2 below.

Once the City's existing storm drainage systems had been mapped as completely as possible, computer modeling was then used to evaluate the capacities of these systems. **Appendix A** presents the individual basin maps and the calculated results for each system. Individual sub-basin areas tributary to each system were located using existing topographic mapping of the City, provided by Tillamook County. Each system, including individual or groups of main line pipe segments, was then analyzed using the computerized Santa Barbara Urban Hydrograph method (SBUH). This method was chosen because of its widespread use in the Pacific Northwest region. It is also an appropriate method for smaller drainage basins of less than 200 acres in size, and all of the City of Tillamook's storm drainage systems serve relatively small, local drainage basin areas that are much smaller than 200 acres in land area.

The next consideration was the selection of the appropriate design storm for evaluation of the existing systems. Design storms are established on the basis of recurrence interval, or probability of occurrence within a given year. Appendix A shows the SBUH results for both the 10-year and 25-year storm events. Typically, the 25-year storm is most commonly used for design of new

stormwater conveyance systems. However, there is also an overriding duty of the design engineer to ensure public safety and avoidance of flooding of improved structures, such as houses, during storm events that are larger than the theoretical design storm. Therefore, the decision was made to use the 10-year storm as the basis to evaluate existing systems, given that system overflows due to undersized pipes are relatively rare. When overflows do occur, the majority of flooding problems in Tillamook are related more to the adjacent flooding watercourses, than they are to undersized pipe systems. Consideration was also given to the relative age of existing systems in comparison with new systems.

A2. Proposed System Upgrades or Expansions

Sheets 5, 6 and 7 of the Insert Maps show the Plan's recommendations for upgrading or expanding the City's existing systems. These maps are color coded to show where existing system components are deemed adequate, and where high or low priority improvements are recommended. The majority of recommended improvements consist of replacement of existing pipe network segments, usually because the existing pipes are undersized. A few of the recommendations are for expansions of existing systems into local areas of the City that are not now adequately served by piping systems. As is the case for the maps of the existing systems, Sheets 5, 6 and 7 do not show recommended pipe slopes – these would be determined as part of the final engineering design of any particular improvement project.

It needs to be emphasized that this Plan is intended to be used as a comprehensive planning tool, to enable the City and other entities to implement specific Plan recommendations. Those implementation programs would include certain essential elements such as funding, land surveys, detailed engineering designs, construction and permitting elements. Since this Plan does not provide the level of detail or precision inherent in those implementation elements, its primary benefit is that it provides guidelines for those subsequent implementation programs. The implication of this discussion is that the recommendations shown on Sheet 5, 6 and 7 are to be used for planning purposes, and not for direct conversion into final design assumptions or construction activities. There are many details to be addressed in any implementation project, that are beyond the scope and level of detail presented by this Master Plan.

The sizes of the recommended piping improvements are based on the 25-year storm using the SBUH method, as discussed in Section A1 above. Since all City storm drainage systems discharge into adjacent open watercourses, the effects of high river or slough levels, and of tidal influences, were considered in the system hydraulic analyses. The Mean High Water (MHW) elevation in Tillamook Bay was obtained from the National Oceanic and Atmospheric Administration (NOAA). River watershed data were obtained from the US Geological Survey

(USGS), and local slough basin areas were determined using available topographic mapping sources. Data thus obtained were then interpreted to estimate the free water surface ("tailwater") elevations at the City systems' stormwater outfalls (labeled "OF" on the Insert Maps).

The next step was to take the hydraulic data for each system, shown in Appendix A, and determine an approximate "hydraulic grade line" throughout each main piping run. This procedure allows determination of whether or not a pipe run would be surcharged during the design storm event. Engineering judgment was then applied to ensure that any surcharging would not cause storm runoff to "pop out" onto the ground surface at any catch basin or manhole locations. The end result of this work, again as shown on Sheets 5, 6 and 7 of the Insert Maps, is the delineation of storm pipe sizes needed to adequately convey the design storm event.

B. Water Quality Concerns and Criteria

As discussed in Chapter II, water quality concerns are a primary motivation for the creation of this Master Plan. This report section provides a general description of existing water quality problems in Tillamook Bay, and the methodology used to establish the water quality characteristics of Tillamook City's stormwater discharges to adjacent open watercourses.

B1. Background

DEQ's "319 Program" grant approval document (December 2002) for this Plan describes urban runoff as a source of degradation of "the water quality of local rivers, sloughs, and the Tillamook Bay". This document identifies two major plans, which address the water quality issues associated with the Bay and a broad list of other related topics concerning the entire Tillamook Bay watershed. These two plans are as follows:

1. The DEQ's establishment of Total Maximum Daily Loads (TMDLs) for temperature and bacteria within the Tillamook Bay basin's surface waters.

2. The Tillamook Bay National Estuary Program's (TBNEP) "Comprehensive Conservation and Management Plan (CCMP) (1999).

It is important to note that the City of Tillamook occupies a very small land area, in relation to the entire Tillamook Bay watershed area (1.5 square miles vs. 582 square miles = 0.25% of total watershed area). This suggests that the potential effects of the City's urban runoff should be viewed in the context of relative effects on water quality, as well as the measured local runoff characteristics presented in this Plan.

As part of the development of this Storm Water Master Plan for the City of Tillamook, considerable research was performed in reviewing the most pertinent documentation available on water quality issues in the Tillamook Bay watershed, with special emphasis on the open watercourses that receive urban runoff directly from City drainage systems. During the performance of this research, it was noted that a substantial amount of applicable water quality data have been developed by a few key agencies, most notably the Oregon DEQ and, to a lesser extent, the U.S. Environmental Protection Agency.

Collectively, these documents have put together a large amount of useful data concerning the water quality and related (e.g. riparian/fisheries habitat) issues facing the Tillamook Bay watershed. It was also noted that these documents give considerable attention to the effects and implications of storm runoff at selected locations within the entire, 582 square-mile watershed. However, due to the sheer magnitude of the watershed and its myriad water quality issues, it is understandable that these documents do not address the City of Tillamook's water quality characteristics to any great extent. Therefore, it is quite appropriate that the DEQ has charged this Stormwater Master Plan with the task of providing more definitive data and evaluation of the City's urban runoff.

The primary documents and research tools used in the background research for development of this Plan are the following:

- DEQ's online laboratory analytical database, for water quality monitoring results at selected stream locations around the City.
- DEQ's Report entitled "Determination of Major Source Areas of Fecal Coliform Bacteria along the Lower Reaches of the Wilson and Trask Rivers" (April, 2003).
- DEQ's report entitled "Tillamook Bay Watershed Total Maximum Daily Load (TMDL)" (June, 2001).
- U.S. EPA's report entitled "Results of the Nationwide Urban Runoff Program, Volume I" (December, 1983) ("NURP").

B2. Methodology for Water Quality Evaluation

In order to evaluate the quality Tillamook's urban runoff, it was first necessary to inventory all of the City's existing stormwater conveyance systems as discussed in Chapter II of this Plan. Part of that inventory also included location of the outfalls, or discharge locations, of those systems to the adjacent open watercourses that run through the City. All known outfall locations are shown on the Insert Maps.

Next, a strategy was developed to characterize the relative effects of City runoff on stream water quality, as discussed earlier. Due to time and budgetary limitations, it was necessary to conduct a limited sampling and laboratory analysis program at selected locations. Two sets of water quality data were thus obtained, on February 24 and on March 25, 2004. Since the work to develop this Master Plan was first started in November of 2003, it was not feasible to perform this work earlier during the rainy season. There were two other criteria that dictated the selection of these dates for the sampling work: there was a fairly typical amount of rainfall occurring on and before these dates, typical for the time of year; and, it was necessary for the sampling to coincide with a very low tide event during daylight hours, since some City storm outfalls are submerged by the receiving streams most of the time.

By extrapolation of data thus obtained during relatively typical rainy period conditions, it was possible to make some projections of the City's overall runoff water quality characteristics. Also, when City outfall samples were taken along a given stream reach, samples were also taken from the receiving stream itself, both upstream and downstream of all City outfalls along that stream reach. Using this approach, it was then feasible to develop an approximate mass balance of runoff constituent loadings between the stream reach outfalls and the stream itself.

The "streams" thus analyzed include the Trask River and the Hoquarten Slough, since these two streams receive over 95% of the City's runoff, and they are "linear" features that facilitate this type of analysis. The Trask River analysis also includes Holden Creek and its City outfalls, since Holden Creek is a significant tributary with significant influence on Trask River water quality. The northerly strip of the City, along U.S. Highway 101, crosses several streams (sloughs), with a very small percentage of the City's total runoff draining to these sloughs. Also, there are no known City storm drainage systems that discharge into the Wilson River. Therefore, the Trask and Hoquarten systems are considered highly representative of all City runoff, and the data evaluated can be extrapolated to include all City runoff at all locations.

B3. Findings

Section B1, above, identified the two major plans that address Tillamook Bay's water quality issues. This Plan has identified key elements of the City's stormwater runoff, as it relates to those documents. These elements are as follows:

a) Pertaining to the goals of the CCMP:

- Most of the City's runoff is generated at point sources, i.e. piped stormwater conveyance systems, rather than non-point sources as

- previously assumed. Runoff from non-point sources is relatively minor and is typically not characteristic of urban runoff, e.g. from woodlands, agricultural and grazing fields, and open meadows.
- Stream temperature enhancements will primarily involve better cooperation from private property owners along streambanks, through better enhancement and maintenance of riparian vegetation features that can provide stream shading.
- Suspended sediments in most City runoff are at very minor concentrations, and have little impact compared with stream sediments generated during flooding events. It is estimated that the City contributes approximately 1-2% of the total amount of suspended sediments to the Trask River and Hoquarten Slough, which together receive over 95% of the storm runoff generated within the City limits.

b) Pertaining to the DEQ's TMDLs for bacteria:

E. coli bacteria in runoff from some of the City's outfalls appear to exceed DEQ's TMDL criteria for the Trask River. This determination was made in relation to the estimated flow rate of the Trask River (1800 CFS), when the two sets of water quality samples were obtained. The E. coli concentration (counts/100 ml) TMDL limit varies with the Trask River flow rate. By interpolating the data points in the DEQ (2001) document, the limit at 1800 CFS would be approximately 450 counts/100 ml.

The tables on the following two pages present the results of the laboratory analytical results for E. coli bacteria. The analyses were performed by the Tillamook Estuaries Partnership's laboratory in Garibaldi, Oregon. The "Upper" and "Lower" "Trask" and "HQ" samples indicate the in-stream locations on the Trask and Hoquarten watercourses, respectively, that are immediately upstream and downstream of the series of City outfalls to each watercourse. The numbered "T" and "HQ" series represent the City outfalls to the Trask and Hoquarten, and "T6" is the Holden Creek outfall to the Trask River. "HC" samples are in-stream Holden Creek samples, with "HC-1" at the Miller Avenue crossing and "HC-5" being the furthest upstream sample, located at the Trask River Road crossing. "HLD" samples are at City outfalls to Holden Creek.

It is interesting to note that the background bacteria count, at the most upstream location on Holden Creek, is higher than that on all of the City's outfalls to Holden Creek. This would indicate that the upstream land uses, notably agriculture and farming, have a larger impact on Holden Creek bacterial water quality than does the urban runoff from the City. It is again important to remember that the upstream uses are

COLILERT SAMPLE SHEET.XLS

Date Sampl 2/24/04
Collected by LDC

Date Processed ____ 2/24/04
Processed by _____ DFR

Date Read 2/25/05
Read By __ DFR

Site	Time Processed	Time Read	Total Coliform			E. coli			Notes
			Large	Small	MPN	Large	Small	MPN	
Lower HQ	4:10	11:20	49	35	816	49	31	649	
Upper HQ			47	43	571	43	9	115	
HQ1			49	48	>2419	49	40	1120	
HQ3			49	48	>2419	49	29	580	
HQ5			49	48	>2419	49	48	>2419	
HQ8			49	48	>2419	49	19	326	
Lower Trask			49		1553	49	33	727	
Upper Trask			48		249	30	8	57	
T3			49		2419	49	68	980	
T4			X	X	X	X	X	X	Sample Failure
T5			49	48	>2419	49	48	>2419	
T6			49	48	>2419	49	48	>2419	
N3			49	48	>2419	49	48	>2419	

COLILERT SAMPLE SHEET.XLS
LDC DESIGN GROUP SAMPLES

Date Sampl 3/25/04
Collected by LDC

Date Processed ____ 3/25/04
Processed by _____ DFR

Date Read 3/26/05
Read By __ DFR

Site	Time Processed	Time Read	Total Coliform			E. coli			Notes
			Large	Small	MPN	Large	Small	MPN	
Lower HQ	5:05	12:30	46	35	343	44	15	146	
Upper HQ			49	46	1986	49	42	1300	
HQ1			49	48	>2419	49	42	1300	
HQ5			49	48	>2419	49	34	770	
Lower Trask			49	37	921	44	10	126	
Upper Trask			49	27	517	42	12	117	
T5			49	48	>2419	49	48	>2419	
T6			49	48	>2419	49	48	>2419	
101N			49	48	>2419	49	42	1300	
HC-1			49	48	>2419	49	48	>2419	
HC-2			49	48	>2419	49	39	1046	
HC-3			49	48	>2419	49	48	>2419	
HC-4			49	48	>2419	49	48	>2419	
HC-5			49	48	>2419	49	48	>2419	
HLD-1			49	48	>2419	49	32	687	
HLD-2			49	48	>2419	49	45	1733	
HLD-3			49	48	>2419	45	11	140	
HLD-3A			49	48	>2419	49	37	921	
HLD-4			49	48	>2419	47	18	214	
HLD-5			49	48	>2419	44	15	146	
HLD-6			47	21	240	34	8	69	

mostly non-point sources, and the City's runoff is primarily from point sources.

A related comment can be made, concerning the background bacteria levels in the Trask River and in Hoquarten Slough. Some results were within the TMDL limits, and some were not. Again, the elevated background limits are likely the result of various rural land use practices, largely outside the jurisdiction and control of the City of Tillamook.

Finally, this Plan has identified several locations in the City, where there appear to be some cross-connections between storm drainage and sanitary sewer systems. The general locations of these conditions and descriptions of field observations are shown on fold-out exhibit maps, immediately following this page. This Plan envisions solutions to these conditions, as part of the Capital Improvement Recommendations in Chapter IV.

c) Pertaining to the extent of other City runoff constituent concentrations:

- General. **Appendix B** contains all of the laboratory analyses that were performed, on runoff constituents other than bacteria. These analyses were all performed by Environmental Services Laboratory, Inc. of Portland, Oregon.

  Table 1, on the next page, gives a summary of the ranges and median data values for all runoff constituents tested, and compares these values with typical urban runoff as presented in the U.S. EPA's "NURP" report cited in section B1, above. A review of the data in Table 1 indicates that Tillamook's water quality, in general, compares quite favorably with typical urban runoff parameters.

- Total Suspended Solids. The median TSS value tested is near the lower (cleaner) end of the typical range of urban values. This condition exists, even in the absence of any water quality treatment facilities on most City outfalls. As also discussed under section B3.a) above, these TSS levels are so low that they do not contribute to the degradation of the receiving streams, nor to the quality of Tillamook Bay itself.

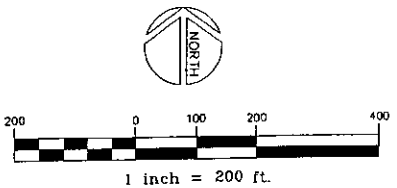
- Nitrates. Nitrate levels were generally below typical urban values. It is interesting to note that both Holden Creek and Hoquarten Slough contained the highest levels of nitrates analyzed. Further, these levels were reduced as these streams flowed past the City's storm drain outfalls. Measured values in the outfalls themselves were also significantly less than those in the streams.

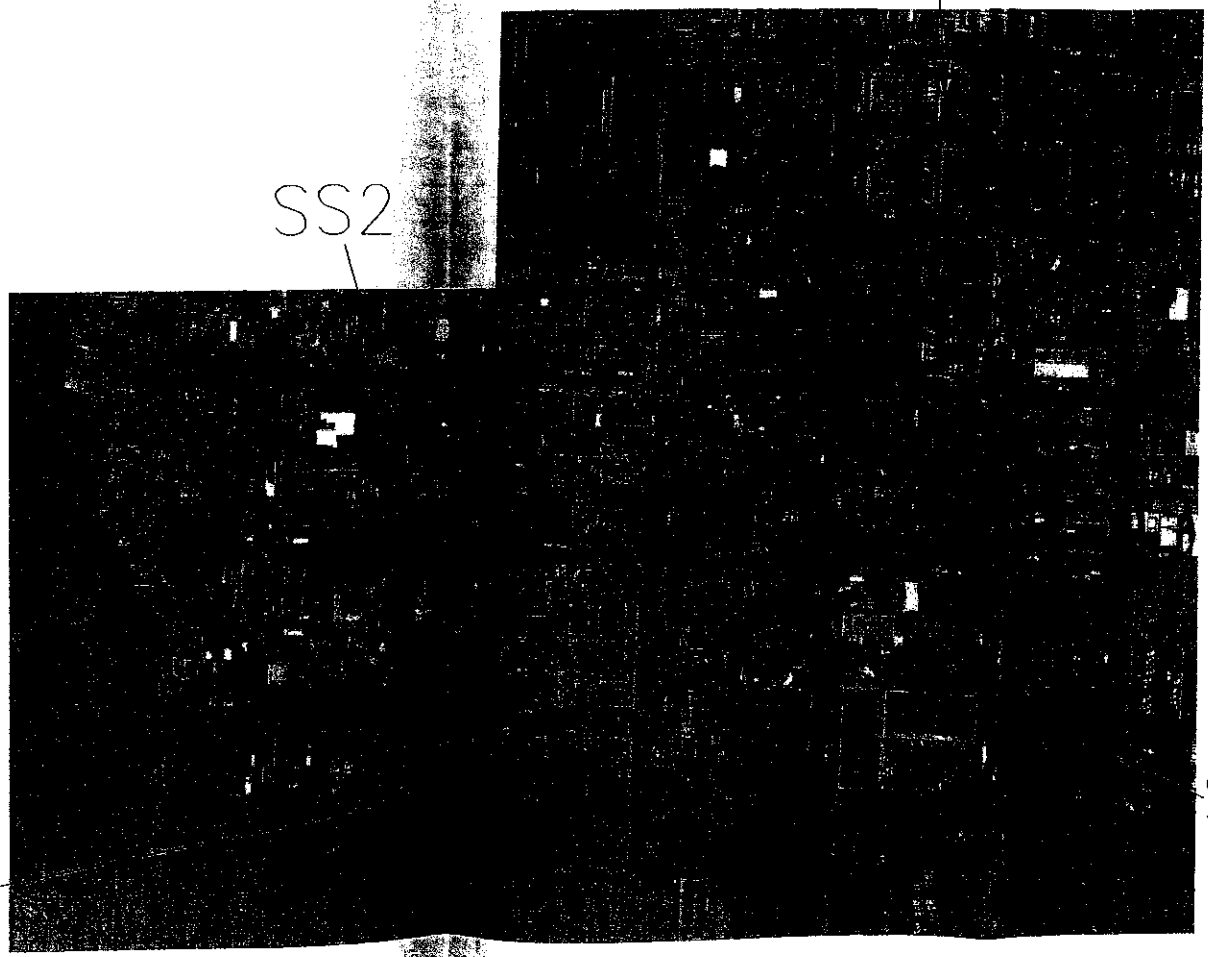
Table 1
City Outfall Samples
Laboratory Analytical Results

Runoff Constituent	Concentration		Typical Urban Values (mg/l) 1/
	Range (mg/l)	Median (mg/l)	
Total Suspended Solids 2/	ND3/-89	32	35-100
Nitrates 4/	0.092-2.12	0.250	0.30-1.75
Phosphorus 5/	N.D.	N.D.	0.18-1.50
BOD	2.0-10.9	4.06	4.0-15.0
Lead	N.D.	N.D.	0.04-0.35
Zinc	0.020-0.086	0.057	0.06-0.50

1/ from U.S. EPA "NURP" Report
2/ A.K.A. "Sediments"
3/ None Detected
4/ Used partially as an indicator of septic system effluent influence
5/ Only one outfall analyzed

EXISTING SANITARY SEWER TO STORM SEWER CROSS TIE LOCATIONS





NOTES:

SS1 – 12TH ST BETWEEN STILLWELL AVE AND ELM AVE KNOWN CROSS TIE PROBLEM AREA. TOILET PAPER DOWNSTREAM OF OUTFALL. MANY SS LATERAL LEAKS. SIGNIFICANT AMOUNT OF WATER RUNNING IN STORM SEWER DURING DRY WEATHER. WATER IN SD MH AT 12TH AND FIR, 12TH AND GROVE, AND 12TH AND ELM HAD SOAPY SANITARY SMELL. SOUND OF CASCADING WATER UPSTREAM OF SD MH AT 12TH AND ELM COULD BE HEARD ON A DRY DAY.

SS2 – GROVE AVE BETWEEN 10TH ST AND 12TH ST CONTRIBUTES TO PROBLEM DESCRIBED IN SS1 ABOVE. EVIDENCE OF SMOKE FROM SD MH AND CATCHBASINS AT 10TH, 11TH, AND 12TH AND GROVE WAS PRESENT WITH SMOKE BLOWER ON SS MH AT 11TH AND GROVE.

SS3 – 8TH ST BETWEEN IVY AVENUE AND MAIN STREET SMOKE IN SS MH FROM WITH BLOWER ON SD MH AT 8TH AND MAIN STREET. SMOKE FROM CATCH BASINS ON 8TH EAST OF MAIN STREET WITH BLOWER ON SS MH AT 8TH AND IVY AVENUE.

SS9 – 12TH ST AND PACIFIC AVE
CATCHBASIN IN PARKING LOT ON NW CORNER DRAINS TO ABANONED SS MH AND THEN DRAINS TO CATCHBASIN ON THE STREET AND INTO STORM SYSTEM.

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CITY OF TILLAMOOK
210 LAUREL AVENUE
TILLAMOOK, OREGON 97141

PROJECT
CITY OF TILLAMOOK
STORMWATER
MASTER PLAN
TILLAMOOK, OREGON

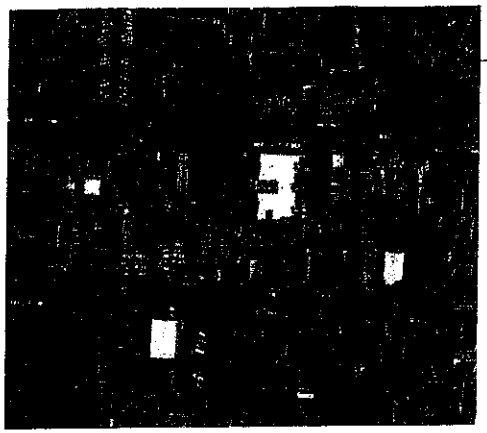
DRAWING TITLE
SANITARY SEWER
TO STORM SEWER
CROSS TIE LOCATIONS

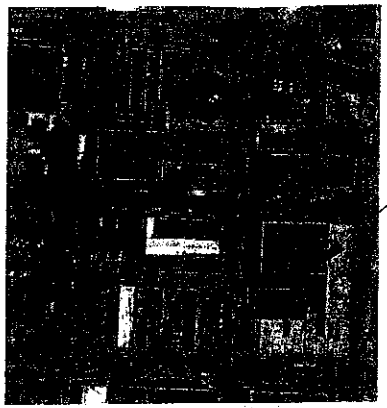
NO.	DATE	REVISIONS	DESIGN BY: TSG	DRAWN BY: CJD	CHECKED BY: CJD

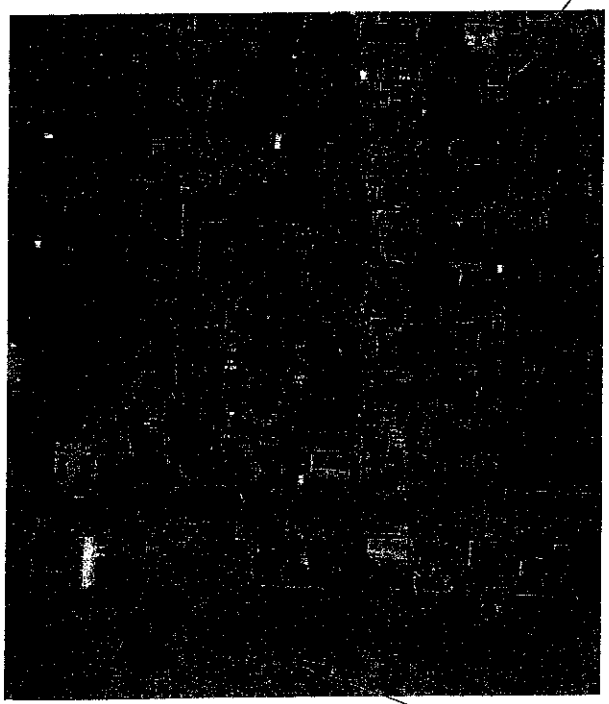
LDC
Planners
Engineers
Surveyors
DESIGN GROUP

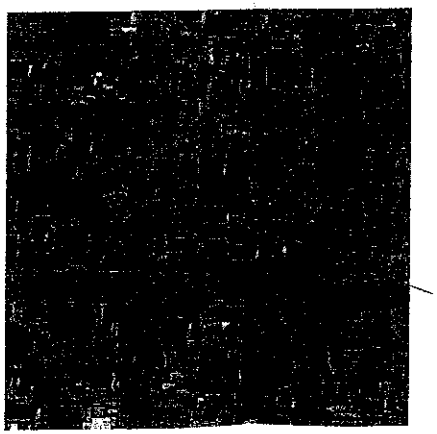
JOB NO.: 3115
SHEET NO.: 1 OF 3
EXH1

EXISTING SANITARY SEWER TO STORM SEWER CROSS TIE LOCATIONS









NOTES:

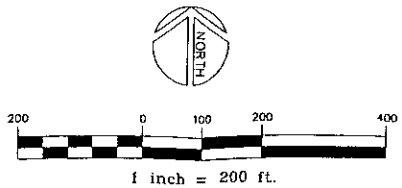
SS4 – MAIN AVE BETWEEN 6TH ST AND 7TH ST
SMOKE TEST ON SS CLEANOUT NEAR 7TH AND MAIN RESULTED IN SMOKE FROM SD MH AT 6TH AND MAIN (SD MH COULD NOT BE OPENED EVEN WITH A BACKHOE) AND FROM CB IN FORD DEALERSHIP PARKING LOT (ON EAST SIDE OF MAIN).

SS5 – 2ND ST AND MAIN AVE
SMELL OF SANITARY SEWER WAS PRESENT IN SD MH. SMOKE WAS PRESENT IN SS MH WITH BLOWER ON SD MH.

SS6 – 10TH BETWEEN MADRONA AVE AND NESTUCCA AVE
SANITARY VISIBLE IN SD MH AT 10TH AND NESTUCCA. SANITARY ROOF VENTS SMOKED ON HOMES ON BOTH SIDES OF 10TH BETWEEN MADRONA AND NESTUCCA WITH BLOWER ON SD MH.

SS7 – OVERFLOW IN MH IN PASTURE SOUTH OF 9TH ST AND CHESTNUT AVE
APPEARS THAT OVERFLOW PIPE ALLOWS FOR DISCHARGE OF SS TO TRASK RIVER AT MODERATE WATER LEVELS. (ALSO SEE SD4 ON SHT 3.)

SS8 – 6TH ST AND CEDAR AVE
2 CATCHBASINS ON 6TH ST EAST OF CEDAR AVE SMOKED WITH BLOWER ON SS MH AT 9TH AND CHESTNUT AND WITH BLOWER ON SD MH AT 6TH AND CEDAR.



PREPARED FOR: CITY OF TILLAMOOK, 210 LAURE AVENUE, TILLAMOOK, OREGON 97141

PROJECT: CITY OF TILLAMOOK STORMWATER MASTER PLAN, TILLAMOOK, OREGON

DRAWING TITLE: SANITARY SEWER TO STORM SEWER CROSS TIE LOCATIONS

NO.	DATE	REVISIONS	CHECKED BY: CLD
			DESCRIPTION

CADD BY: DBD

LDC DESIGN GROUP
Planners
Engineers
Surveyors

JOB NO.: 3115
SHEET NO.: 2 OF 3
EXH2

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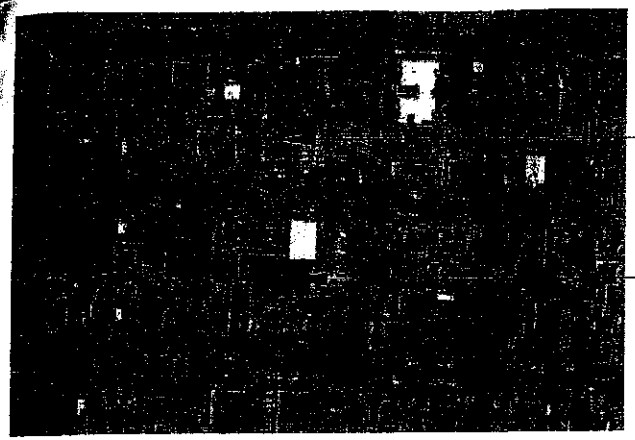

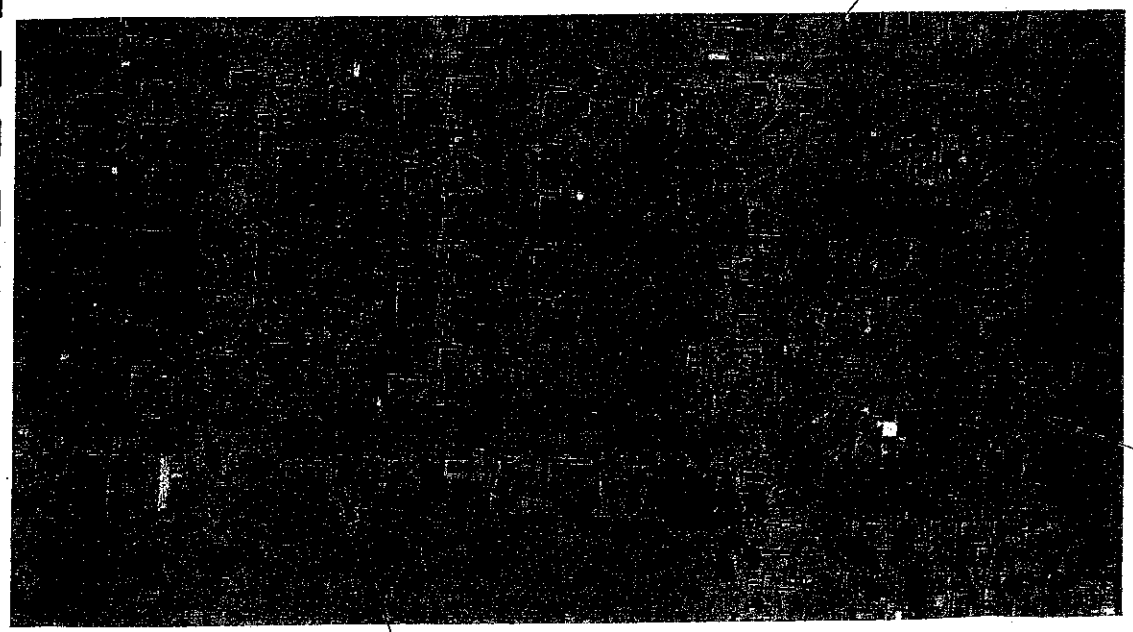

EXISTING STORM SEWER TO SANITARY SEWER CROSS TIE LOCATIONS

HUDSON

200 0 100 200 400

1 inch = 200 ft.

NOTES:

SD1 – MANOR AVE AND ELM AVE
2 CATCHBASINS CONNECT TO SANITARY SEWER.

SD2 – 9TH ST AND MANOR AVE
CATCHBASIN EAST SIDE OF MANOR CONNECTS TO SANITARY SEWER.

SD3 – 7TH ST AND MAIN AVE
CATCHBASIN ON NW CORNER CONNECTS TO SANITARY SEWER.

SD4 – 9TH ST AND CHESTNUT AVE
STORM MAIN HEADING SW OUT OF STORM MANHOLE AT 9TH ST AND CHESTNUT AVE APPEARS TO CONNECT TO SANITARY MANHOLE IN PASTURE SOUTH OF 9TH. (ALSO SEE SS7)

SD5 – MAIN AVE BETWEEN 7TH ST AND 8TH ST
2 CATCHBASINS IN FORD DEALERSHIP ON WEST SIDE OF MAIN AVE BETWEEN 7TH ST AND 8TH ST APPEAR TO CONNECT TO SANITARY SEWER. (WATER OFTEN BACKS UP AT CB TO SOUTH.)

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210 LAUREL AVENUE
TILLAMOOK, OREGON 97141

PROJECT:
CITY OF TILLAMOOK
STORMWATER
MASTER PLAN
TILLAMOOK, OREGON

DRAWING TITLE:
STORM SEWER TO SANITARY SEWER CROSS TIE LOCATIONS

NO.	DATE	REVISIONS	CHECKED BY: CLD
			DRAWN BY: TMD

Planners
Engineers
Surveyors
LDC
DESIGN GROUP

JOB NO. 3115
SHEET NO. 3
EXH3

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From this evaluation, it is evident that these streams are being contaminated primarily from sources upstream of the City limits. It should be noted that both septic disposal systems and livestock farming will generate significant nitrates in either subsurface disposal or in surface runoff. It has been noted by the City of Tillamook that there are failing septic systems, especially near Holden Creek, both within and outside (upstream) of the City limits. While these system failures can contribute to elevated stream nitrate levels, the data collected for this Plan indicate that background levels further upstream are even more significant in their impact on stream water quality.

- Other Constituents. The other water quality parameters noted on Table 1 are well within typical urban levels.

B4. Summary.

The quality of stormwater runoff in the City of Tillamook is, in general, typical of many urban areas. Overall, the City's runoff is of relatively good quality, with two notable exceptions. The more significant exception is that of the bacteria (measured as E. coli counts) levels in many of the City's stormwater outfalls. The other exception is the significant increase in total suspended solids (TSS) in the lower reach of Holden Creek, above its confluence with the Trask River. Some of the causes of these exceptions are identified in this Plan, and other causes will require additional detailed study.

Although the water quality sampling and analysis component of this plan was limited in both scope and duration, an effort was made to set forth an approximation of the relative amount of bacteria in the City's runoff in comparison with the total bacteria amounts in the adjacent watercourses. Based on a very preliminary mass balance analysis, then, it is estimated that the City's stormwater runoff contains approximately 30% to 40% of the total bacteria loadings within the Trask River. This estimate was then extrapolated to the entire Tillamook Bay watershed, based on relative watershed areas only. Since the Trask River watershed area is approximately 30% of the Bay's total watershed area, it is roughly estimated that about 10% to 15% of the total bacteria loading in Tillamook Bay arises from the City's runoff.

The next chapter, "Recommended Capital Improvements", contains recommended improvements that would benefit both the hydraulic capacity and water quality elements of the City's existing stormwater infrastructure.

IV
CAPITAL IMPROVEMENT RECOMMENDATIONS

A. Basis for Recommendations

As discussed throughout this report, this Master Plan is intended to address the larger scale, most important elements of the City's stormwater drainage facilities and characteristics. These elements include both the hydraulic capacities and the water quality characteristics of the City's stormwater infrastructure and its urban runoff to adjacent streams.

It is intended that this Plan's primary benefit is its use as a strategic planning tool. The recommended improvements and their associated budgets are, therefore, approximate and indicative of the general magnitude and relative importance of the various recommendations. For actual implementation of any specific improvement project, the total scope and budget for the project will need to be refined and updated. It should also be noted that the recommended budgets are for improvements to the storm drainage network alone, and that related improvements to sanitary sewer or other nearby systems would be in addition to the recommended budgets shown herein.

The recommended improvements are arranged in order of relative priority. The Highest Priority Improvements are intended to result in significant benefits to both runoff water enhancements, and to hydraulic conveyance carrying capacities. The High Priority Hydraulic Improvements are based on significant shortfalls in the capacities of the existing systems, where those shortfalls are on the order of 50% or more of the needed capacities. Lower Priority Hydraulic Improvements are generally on localized branches of storm drainage systems, and in some cases are extensions into areas not currently served, where the hydraulic shortfall or other factors are not as critical as the higher priority projects. Also, some of these improvements are upsizing existing pipes to the minimum recommended main line size of 12 inches in diameter.

B. Planning Level Capital Improvements and Budgets 1/

A. Highest Priority Improvements 2/ 3/ – These are the known, substantial projects that will result in significant water quality and hydraulic capacity enhancements:

1. Improvements to large, multi-branched system with its piping network converging at Elm Avenue and 12th Street. This includes multiple disconnection of existing cross-connections with the sanitary sewer system: $700,000

2. Improvements to linear system with its outfall manhole at Chestnut Avenue and 9th Street. This includes elimination of apparent direct connections into the sanitary sewer system: $235,000

3. Improvements to a local, branched system with its outfall manhole located south of Laurel Avenue and 11th Street. This includes elimination of sanitary lateral connections to the storm drainage system: $195,000

4. Improvements to an ODOT main line in Main Avenue, from 6th Street to the outfall to Hoquarten Slough. This includes elimination of all sanitary system connections to the storm drainage system: $290,000

1/ Planning level budgets include estimated costs of engineering, surveying, construction and contingencies. Budgets do not include administration, legal fees or permitting costs. Budgets should be refined through a more detailed evaluation process, prior to implementation.

2/ Ranked in order of potential benefits to both water quality and capacity enhancements within the existing storm drainage systems.

3/ It was not possible to identify all cross-connections between storm drainage and sanitary sewer systems. Therefore, more detailed studies are needed to address this problem, and more CIP's for water quality enhancement are likely to result therefrom.

B. <u>High Priority Hydraulic Improvements</u> 1/ - These are the projects that will correct significant hydraulic deficiencies in the existing systems:

1. Piping improvements and relocation of the system outfall, at the local system that currently outfalls near Beachwood Avenue and 7th Street. Includes a low flow bypass to the existing adjacent marsh area for water quality benefits: $215,000

2. Piping improvements along Birch Avenue, from 5th Street to 1st Street, including the outfall: $180,000

3. Piping improvements at two adjacent, separate systems that outfall from Front Street along Elm and Fir Avenues, respectively: $97,000

4. Piping improvements at two adjacent, separate systems that both outfall from Front Street and Stillwell Avenue: $320,000

5. Improvements to large, partially ODOT linear system with the main line in Pacific Avenue, outfalling to Holden Creek: $500,000

6. Reconstruction of the crushed outlet pipe across the lumber mill property, from 8th Street near Park Avenue to Holden Creek. $150,000

7. Replacement of the Holden Creek culvert at Miller Avenue with 2 – 36-inch diameter pipes. $50,000

8. Improvement to the hydraulic capacity of Holden Creek, from Evergreen Drive to Miller Avenue. 2/

9. Replacement of existing branch pipes near Alder and Maple Street, which are part of the Evergreen Avenue system that outfalls to Holden Creek. $70,000

10. Replacement of the lower Williams Avenue system that outfalls to Holden Creek. $160,000

11. Replacement of the lower Meadow Avenue system that outfalls to Holden Creek. $82,000

1/ Not ranked in any particular order. It is unknown whether or not these improvements may result in water quality enhancements; further studies are needed to identify these potential benefits.

2/ Costs are unknown. This project would involve significant environmental permitting and associated costs.

C. Lower Priority Hydraulic Improvements 1/ - These are the projects that will correct relatively localized deficiencies in the existing systems:

1. Replacement of the upper branch lines in the system that outfalls westerly of Beachwood Avenue, within 9th Street and Cottonwood and Ash Avenues. $110,000

2. Replacement of the upper branch pipe in 5th Street, that connects to the main line in Birch Avenue which outfalls near 1st Street. $34,000

3. Replacement of the upper branch lines in 4th Street and Elm Avenue, that connect to the main line in Elma Avenue which outfalls to Hoquarten Slough. $88,000

4. Replacement of pipes in Ivy Avenue, that are part of the system which outfalls to Hoquarten Slough. $32,000

5. Replacement of branch lines in 2nd, 3rd and 4th Streets, between Laurel and Ivy Avenues, which are tributary to the main ODOT line in Main Avenue that outfalls to Hoquarten Creek. $84,000

6. Addition of branch line in 8th Street, to the main line in Laurel Avenue that outfalls to Holden Creek. $65,000

7. Replacement of branch lines in 3rd and 4th Streets, between Nestucca and Park Avenues which are tributary to the same ODOT line as in Item 5. above. $115,000

8. Replacement of the upper system in DelMonte Avenue, which connects to the High Priority lumber mill property outlet pipe. $190,000

9. Replacement of local branches, in Linden Drive and Hawthorne Lane, which connect to the main line in Evergreen Drive that outfalls to Holden Creek. $95,000

10. Replacement of local branch lines at and near Alder Lane, which are tributary to the main line in Williams Avenue that outfalls to Holden Creek. $72,000

1/ Not ranked in any particular order. It is unknown whether or not these improvements may result in water quality enhancements; further studies are needed to identify these potential benefits.

V

FUNDING ALTERNATIVES

A. General

The City of Tillamook currently has no funding mechanism that addresses the public storm sewer system either for capital improvements or maintaining the existing system. Repair and maintenance revenues come directly from the City's operations and maintenance budget for street repair as is typical for many cities, which do not have a separate Surface Water Utility.

It is becoming increasingly more burdensome as Oregon cities comply with state and federal mandated requirements to implement best storm water management practices or even to keep up with the demands of development. It is prudent for the City of Tillamook to address these needs by developing sound funding and financing options. It is also necessary that these funds be dedicated for the strict purpose of maintaining and building the storm drainage system and not be diverted for other purposes. This chapter addresses some of revenue and financing options that are available for construction, operations and maintenance of the storm drainage system.

B. Operations and Maintenance Funds

Surface Water Utility / Storm Drainage Service Fee

The Storm Drainage Service Fee is a monthly service charge that is based upon the annual cost to provide Operations and Maintenance to the existing storm drainage system. It is similar to monthly water and sanitary sewer utility fee. It is generally based on the amount of the impervious area of a property. For instance, the fee may be related to the impervious area of a typical residential lot. Through the formation of a surface water utility as an enterprise fund capital improvements can be funded as well as recovering reasonable costs for administration of the program. Billing is generally accomplished along with water and sewer utility bills.

Another element of this fee may be Water Quality Program Costs. Some jurisdictions have established water quality data for various land uses. Using a weighting factor, fees may be established that are related to the property use. Properties that provide their own water quality facility or pollution reduction measures would be exempt or receive a discount.

Storm drainage service fee factors, as mentioned above, may be considered separately or collectively in determining a fee schedule. Typically storm drainage

service fees generally range from $1.50 per month to $6.00 per month and have been successfully used in numerous cities within Oregon and Washington.

C. Capital Improvement Program Funding

The funding options available for storm sewer improvements are similar to those funding options available to other existing enterprise activities. Most of the methods identified below are in effect in one or more communities in Oregon and all are applicable in Oregon.

General Fund Revenues (property tax, franchise fees, local income tax)
Sanitary Sewer Utility Revenue
Surface Water Utility Revenues
Special Assessments
Serial Levy
Bonds/ Local Improvement Districts
Developer Funding
System Development Charges

C1. General Fund

The general fund is an established source of revenue for any purpose the city wishes, including construction, maintenance and repair of drainage related projects. It is generally heavily drawn upon for the normal operations of a city and historically general fund revenues are having a difficult time keeping up with inflation and a city's growth. It may be argued that the use of general fund taxes to provide revenue for drainage related items is an inequitable practice. These taxes are based on assessed property value and do not relate to the property's generated runoff.

C2. Sewer Utility Revenues

It is the practice in some cities to utilize a portion of the revenues collected with the sanitary sewer service fees for financing storm drainage projects. This is not a recommended practice unless a combined utility is formed with a rate structure which supports both types of service, surface water and sanitary.

C3. Special Assessments / Serial Levy

Theoretically, a special assessment may be levied against properties in a city or against special portions of a city for a specific benefit. This may be a one-year only assessment for capital improvements and operations and maintenance of

the drainage system. It has the disadvantage of not being a reliable source of revenue and must be periodically approved by the voters. A serial levy for operations and maintenance can be imposed for up to five years before it would need to be reauthorized by the voters.

C4. Bonds/Local Improvement Districts

Under Oregon law, a city has the power to issue general obligation and revenue bonds. Bonds are available to fund capital improvements, but are not for the purpose of funding the operations and maintenance of the storm drainage system.

The Local Improvement Districts (LID) generally provides funding for localized drainage improvements. Funds come from the assessment of the properties within the district. The city will issue bonds (Bancroft Bonds) that allow the property owners within the district to repay over time. The formation of a LID is either by petition by a property owner seeking improvement to a property or through council approval. Both require public involvement and hearings. It is often difficult for the LID to request for additional funds to account for inflation. These bonding mechanisms are appropriate to fund capital improvements in conjunction with other sources of funding. These mechanisms are not available or are not appropriate to fund operations and maintenance.

C5. System Development Charges (SDC)

The Storm Drainage Master Plan is the only rational nexus for basing the calculations of an SDC. The SDC is a common source of funding in the State of Oregon. It is paid by new connections to the storm drainage system. The SDC is based on the demand placed on the system by the new user and the capital cost associated in meeting that demand. Methodologies for developing system development charges may be based on cost of existing and new facilities, outstanding debt, etc. Once the cost basis is developed, the system capacity may be used to estimate the unit costs that are assigned to the new connection. SDC revenue is often used in conjunction with bond revenues or other sources of capital (developer donated capital) to fund capital projects.

C6. Developer Funded

Often developers are required to extend a storm drain line from its connection to the existing system or proposed outfall location to the most upstream end of the project site. The requirement for the extension is to be sized to accommodate the proposed project and future contributing developments. Some cities will pay or credit the developer the difference between associated project storm drain costs and the upsized pipeline. This "credit" may be allowed in the context of an

SDC charge methodology. For this reimbursement, the city must have another funding mechanisms in place.

C7. Urban Renewal District

Funding for capital projects may be obtained through revenue from urban renewal districts. The source of this funding is tax increment financing. The assessed value of each property within the district (for taxation by entities other than the urban renewal district) is frozen at its value at the time the district is formed. As the market value of the property rises above its value at the time the urban renewal district was formed, that increased value is taxed at the same rate, but all taxes collected on that increased value go to the urban renewal district.

C8. Real Estate Transfer Tax

The real estate transfer tax is a tax placed on all sales of property within the City. It is a variation of the system development charge.

C9. Loans

Loans administered by the Oregon Department of Environmental Quality through the Revolving Loan Fund, may be available for capital projects, which improve water quality. These are low interest obligations for which projects must meet certain criteria to qualify.

C10. Grants

While grants are not a usual method of funding stormwater activities they should not be ruled out as a possible source of capital. An innovative project may qualify for a grant as a "demonstration project". Grants may also be available from industry or private foundations to fund projects, which protect unique or valuable resources or have other special benefits.

VI

OPERATIONS AND MAINTENANCE

A. General

Presently the City has no scheduled maintenance program to systematically evaluate and clean the storm drainage lines, catch basins, manholes, and outfalls. Maintenance is based on an "As Needed" basis by which problems (i.e. flooding, debris, or broken pipes) are addressed when observed or when complaints are received at City Hall.

B. Operation and Maintenance Objectives

The operations and maintenance program should include the following objectives:

- Provide for public safety.
- Provide for and promote water quality protection.
- Maintain capacity and integrity of storm drainage system.
- Reduce potential of property damage by obstructed system facilities.
- Reduce nuisance water on public streets.
- Reduce impact to City's resources.
- Evaluate and upgrade maintenance priorities.
- Identify future maintenance needs.
- Provide public awareness of drainage system maintenance needs.
- Improve public awareness regarding activities which cause water quality .problems (erosion, soap, and chemical discharges).

C. Maintenance Requirements

To develop a viable maintenance program, it is necessary to identify and define the various elements

- It is vital to identify and define the various elements that help to make the program successful. The following are a few of such operations and maintenance elements:
- Storm drainage facilities need to be separated into major and minor systems. Individual structures and elements should be identified within each type of system. Major system elements are given a higher ranking than minor system elements.
- Damaged elements should be identified as to the severity of damage. Major structural elements are given immediate attention and resources while minor repairs may receive lesser attention.
- Street flooding that is a result of plugged culverts and pipes are identified as to their location and their effect on major and minor drainage systems.

D. Program Recommendations

The following recommendations are provided to assist the City in developing an operations and maintenance program:

- A Capital Maintenance Budget should be established for repairs of storm drainage facilities. Various funding programs previously referenced should collect revenue for this budget.
- A schedule of routine inspection of system elements should be implemented. Catch basins, culverts, outfalls, etc. should be observed for debris accumulation, structural condition, and any irregularities. Observed conditions should be rated for system type (major or minor), urgency, required materials, personnel and cost.
- A storm drain database should be developed to inventory system elements, record maintenance and action, and monitor public concerns (complaints of local problem areas).
- Regularly evaluate the database to determine operations and maintenance patterns and develop manpower and budgetary requirements.
- Provide an emergency fund to deal with catastrophic events effecting storm drainage facilities.
- Obtain easements from private owners to access public facilities (where necessary).
- Establish maintenance standards to define the level of service to be provided as shown in Table 8-1 for pipes and culverts and Table 8.2 for catch basins.
- Outfalls with tide gates should be inspected after every major storm event. Other outfalls should be inspected twice annually in the fall and spring.

Table 8-1 Maintenance Standards for Pipes and Culverts

DEFECT	CONDITIONS WHEN MAINTENANCE NEEDED	MAINTENANCE RESULTS
Sediment and debris	Accumulated sediment that exceeds 20 percent of the pipe diameter	Pipe cleaned of all sediment and debris
Vegetation	Vegetation that reduces free movement of water through pipes	All vegetation removed so water flows freely through pipes
Damage	Protective coating is damaged; rust is causing more than 50 percent of deterioration to any part of pipe Any dent that decreased the end area of pipe by more than 20 percent	Pipe repaired or replaced
Debris barriers	Trash or debris plugging more than 20 percent of the barrier opening	Barrier clear to receive capacity flow
Damaged/missing bars	Bars are bent out of shape more than 3 in (7.62 cm)	Bars in place with no bends > ¾ in
	Bars are missing or entire barrier missing	Bars in place according to design
	Bars are loose and rust is causing 50 percent deterioration to any part of barrier	Repair or replace barrier to design standards

Table 8-2 Maintenance Standards for Catch Basins

DEFECT	CONDITIONS WHEN MAINTENANCE NEEDED	MAINTENANCE RESULTS
Trash and debris (including sediment)	Trash or debris of more than ½ ft^3 located in front of the catch basin opening or blocking capacity of basin by > 10 percent	No trash or debris located immediately in front of catch basin opening
	Trash or debris in the basin that exceeds 1/3 to ½ the depth from the bottom of basin to invert of the lowest pipe into or out of the basin	No trash or debris in catch basin
	Trash or debris in any inlet or outlet pipe blocking more than 1/3 of the height	Inlet and outlet pipes free of trash or debris
	Dead animals or debris that could generate odors that would cause complaints or dangerous gases	No dead animals or vegetation present
	Deposits of garbage exceeding 1 ft^3	No trash or debris in catch basin
Structural damage to frame and/or top slab	Corner of frame extends more than ¾ in past curb face into the street (if applicable)	Frame is even with curb
	Top slab has holes larger than 2 in^2 or cracks wider than ¼ in (to ensure that all materials run into basin)	Top slab is free of holes and cracks
	Frame not sitting flush on top slab-i.e., separation of > ¾ in of the frame from top of slab	Frame is sitting flush on top of slab
Cracks in basin walls or bottom	Crack wider than ½ in and longer than 3 ft (0.91 m), any evidence of soil particles entering catch basin through cracks, or structure is unsound	Basin replaced or repaired to design standards
	Crack wider than ½ in and longer than 1 ft at any joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through crack	No cracks more than ¼ in wide at joint of inlet/outlet pipe
Settlement/misalignment	Basin has settled more than 1 in or has rotated more than 2 in out of alignment	Basin replaced or repaired to design standard
Fire hazard	Presence of chemicals such as natural gas, oil, and gasoline	No flammable chemicals present
Vegetation	Vegetation growing across and blocking more than 10 percent of basin	No vegetation blocking opening to basin
	Vegetation (or roots) growing in inlet/outlet pipe joints > 6 in tall and < 6 in apart	No vegetation or root growth present
Pollution	Nonflammable chemicals of > 12 ft^3 per 3 ft of basin length	No pollution present other than surface film

VII
RECOMMENDED DESIGN GUIDELINES

The City of Tillamook currently has adopted official documents that pertain to the design, development and operation of municipal storm drainage systems. The City's Comprehensive Plan sets forth policies that address storm drainage issues. The City's General Development Standards set forth numerous criteria and guidelines for control of urban runoff, including erosion control aspects. Also, the City's Public Works Department has adopted "Design Standards and Standard Details", which include specific design criteria, requirements and Standard Construction Details for many aspects of stormwater management. Finally, there are state and national codes and ordinances, such as the Uniform Plumbing Code (UPC) and APWA Standards which, if properly enforced, would more substantially benefit the City's stormwater infrastructure.

There are amendments and additions that can be made to these documents, especially with respect to water quality safeguards within the Development Standards and the Public Works criteria. Due to the limitations in the Scope of this Storm Water Drainage Master Plan, however, this Plan does not contain any detailed or in-depth proposed revisions to the above documents.

Further, it is important to put "Design Guidelines" per se within the context of the Plan's findings and its recommended priority projects. As discussed in Chapter III.B. of this plan, concerning urban runoff water quality, there is one single contaminant (bacteria) that far exceeds all other water quality parameters in its importance. This contaminant exists in relatively high concentrations in many City stormwater outfalls. This situation largely exists, due to violations of standard UPC and other criteria for proper separation of storm drainage and sanitary sewerage facilities. The other notable contaminant, suspended solids, is of primary concern within a limited section of Holden Creek, and can be addressed in a very site-specific manner.

All other water quality parameters tested were well within acceptable levels for the City's urban runoff. Therefore, from a water quality standpoint, there is only a small improvement in water quality, which might be achieved through the adoption of structural controls that would address water quality parameters. The adoption of the Plan's Operations and Maintenance recommendations (Chapter VI) would provide greater overall water quality benefits, than would the adoption of structural controls.

For all of the above reasons, then, it is recommended that the findings and recommendations set forth in early chapters of this Plan be adopted and implemented, as the most effective means of addressing Tillamook's stormwater issues.