$2.00

CITY OF VENETA
DRAINAGE MASTER PLAN

JUNE 30, 1999

Prepared for:
CITY OF VENETA
88184 Eighth Street
P.O. Box 458
Veneta, Oregon 97487

Prepared by:
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I. EXECUTIVE SUMMARY: VENETA DRAINAGE MASTER PLAN

Contents

This drainage master plan is a technical assessment of the City of Veneta's existing drainage system and a estimate of the performance requirements for this system based upon ultimate (20 year) buildout of the City. As a technical assessment it includes the following elements:

- System Mapping.
- Determination of storm water generated flows.
- Identify existing system deficiencies
- Qualification of system requirements.
- Cost estimates.

The technical analysis identified the following:

- The City's east drainage system is wide and shallow which contributes to enhanced infiltration but also leads to minor flooding over large areas.
- Veneta soils are such that infiltration of storm water is very slow.
- As the drainage system expands to serve flood and water quality needs or urban development the operation and maintenance costs will escalate.
- Use of retention/detention facilities has limited feasibility on elevations above 450.

The challenge will be how does the City maintain and manage flood control, provide drainage, enhance water quality treatment while protecting and enhancing health, diversity and continuity for the citizens, wildlife, native vegetation and important species.

POLICY ISSUES

A. The City's wetland system is the drainage system. How do we maintain both?

B. The City's natural drainage ways are wide and shallow which contribute to infiltration and flooding. Is the City going to maintain these drainage ways or implement policy to maximize the control of flooding?

C. There is insufficient evidence to conclude that rainfall over Veneta is a significant source of recharge to the City's groundwater. Regardless does the City feel it is important to maximize infiltration opportunities to recharge groundwater?

D. Veneta soils are such that infiltration of storm water is very slow. Does the City feel that detention facilities need to be added to optimize ground water recharge?

E. Does the City want its plan to meet the requirements of EPA's storm management plans even though not required at this time.

F. How will these costs be funded?

G. What obligations, if any, does the City feel are appropriate drainage measure to be assumed by developments above elevation 450?

H. Wetlands can be effective pollutant removal systems but does the City want to use their wetlands in this manner and do they have the capability to maintain such systems? (Not allowed by C of E)

1.0 INTRODUCTION

This drainage master plan was prepared to identify the major drainage system deficiencies, propose corrective improvements, estimate the improvement costs, establish upgrade priorities, and recommend means for system improvement financing. This master plan provides the City with information required to establish long-term capital improvement programs and maintenance requirements for drainage. This plan may also serve as a basis for local ordinances to require payment of drainage fees as a condition of final subdivision map approval. In this manner, a portion of the drainage system and improvement cost will be defrayed by land developers.

If a drainage master plan is to be an effective management tool, it should be reviewed annually and updated to reflect changes in drainage areas due to development, changes in land use, and construction cost escalation. The anticipated land use, which is one of the major factors on which any drainage plan is based, may not occur or may be revised due to changing economic and social conditions. For this reason, drainage plans and calculations should remain a requirement for development review. The existing drainage master plan for the City was prepared in June 1982. Since, there has been a substantial amount of development within most of the drainage basins. This development has increased storm run-off and, in some cases, changed drainage patterns.

List of Abbreviations

Q =	Peak discharge in cubic feet per second.
C =	Coefficient of runoff.
I =	Average rainfall corresponding to the time of concentration in inches per hour.
A =	Area in acres.
A =	Cross sectional area.
n =	Manning's roughness coefficient. Roughness coefficient of 0.013 was used for concrete pipe, 0.022 for corrugated metal pipe, and 0.15 - 0.08 for open channels.
R =	Hydraulic radius (a measurement of how much surface contact is experienced by the water flow).
S =	Slope or steepness.
B =	Channel base width
Z =	Channel wall slope in horizontal distance per one foot of vertical height
S =	Channel slope or steepness
n =	Manning's roughness coefficient
Ex. =	Existing
Fut. =	Future
Q =	Storm runoff
Vel. =	Channel flow velocity
D =	Channel depth
FT. =	Feet
C.F.S. =	Cubic feet per second
Sec. =	Second

This study is a planning tool. It identifies areas where storm drain construction will be required, and provides an indication of the size and cost of designated improvements. The drainage improvements proposed should be designed for the modifying influences of catch basin efficiencies, ground slopes, and changes in invert slopes due to underground utility interference. This study assumes reasonable access and field conditions for construction of the master plan facilities required.

The scope of work for this study consisted of the following items:

1. Determine the drainage area boundaries.
2. Locate and identify existing drainage facilities.
3. Develop hydrologic and hydraulic criteria for system development.
4. Analyze the existing drain system for conformance with the study criteria.
5. Propose storm drains to alleviate existing and future drainage system deficiencies.
6. Prioritize the system improvement and drainage facility development.
7. Prepare plates, tables, and details indicating the study procedure and recommendations.
8. Identify financing alternatives.

In addition to the Scope of Work items a brief discussion of stormwater based water pollutants is provided.

1.1 EXISTING SYSTEMS

The City of Veneta storm drain facilities have been constructed by the State of Oregon, the City, individual home owners and private developers. These drains have been constructed at different times using various design criteria. This report analyzes the existing drainage system to verify its adequacy to convey the design run-off. Research of existing City records and field verification of storm drain facilities are reflected in Plates I through IV. The drainage system can be generally categorized by size of facility. The sizes shown in the table below reflect general

ITEM	FEET IN SYSTEM	PERCENT OF SYSTEM
16 inch & Smaller Drain Pipe	18,900	26
18 inch & Larger	10,300	14
Roadside Ditches	10,400	14
Small Ditches (20 C.F.S. or Less)	13,200	18
Large Ditches (greater than 20 C.F.S.)	21,000	28
TOTAL	**73,800**	**100**

In addition to the drainage ditches noted the City also has incidental ditches parallel to the railroad which are not tabulated. Over 60 percent of the City's drainage system consists of open ditches.

1.1 METHODOLOGY

The analysis of drainage networks requires the use of two sciences: Hydrology and Hydraulics. Hydrology is the study of the amount of rainfall which drains from a site. Hydrology has two components: drainage and retention. The amount that flows over the surface is the drainage fraction and the amount that is held on the site is retained or retention. The principal focus of hydrology analysis on small systems such as Veneta's is the determination of the peak flow which leaves the site or drainage system. Facilities must be capable of managing the peak flow without damage to property and unacceptable risks. For this study a storm with a return frequency of ten years was used. That is, for the analysis the peak flow was calculated based upon a storm with a probability of occurring once every ten years. For smaller basins a return interval of 5 years is generally acceptable and with significant facilities subject to storm drainage a longer return interval is often used.

Hydraulics is the study of how systems flow. It is the analysis of the amount of water which can move through a drainage system. The hydrology and hydraulics of Veneta's system are provided in the following overview.

Hydrology

The rational method was used to determine storm runoff. The methodology outlined in the Oregon Department of Transportation (ODOT) Hydraulics Manual was followed. The manual states "drainage areas should be smaller than 300 acres", but the use of the rational method for areas larger than 300 acres is common and somewhat conservative. A drainage master plan normally does not include analysis and recommendations for facilities less than 20 acres. However, this Master Plan does include some areas with less than 20 acres, as these are areas with existing storm drains which serve as primary conduits within a particular area. These smaller areas have been included so that the total drainage system requirements can be more closely estimated. Small lateral storm conduits roadsite ditches isolated storm drains are not within the scope of this Plan and are not included.

The basic formula used in the rational method to predict stormwater runoff is $Q = CIA$

The values for the coefficient of runoff (C) were determined by the use of the coefficient of runoff values in the ODOT Hydraulics Manual. Weighted "C" values for each drainage basin were determined based on a percentage of each land use within a particular drainage basin. A tabulation of those percentages is provided in Appendix C. Separate weighted "C" values were calculated based on existing and future development. The Veneta Comprehensive Plan in conjunction with the Cities Wastewater Facility Plan and Water Master Plan were used to determine zoning information. Future development was projected to 20 years. Below is a list of "C" values for each land use type.

TABLE 1 TYPICAL "C" VALUES FOR VARIOUS LAND USES	
LAND USE	**"C" VALUE**
Open Space (parks, pastures, woodlands, greenways, etc.)	0.25
Low density residential (1-3 units per acre)	0.40
Medium density residential (3-6 units per acre)	0.55
High density residential (6-15 units per acre)	0.75
Commercial/industrial	0.80

The average rainfall intensity (I) was determined using a 10-year frequency storm. Intensity charts from ODOT Manual "Zone 5" were used. This chart is presented in the appendix. ODOT zone 5 includes most of the foothill area above the Willamette Valley floor. The communities of Corvallis, Cottage Grove, Drain, Oakridge and Canyonville are all included in zone 5.

The drainage area (A) was determined from 50-scale and 100-scale topography maps based on a flight date of November 25, 1997 for areas within the City limits. USGS maps were used for areas outside of City limits. The drainage basin boundaries within the City limits are shown on Plates I - IV.

Hydraulics

The Manning's equation was used to determine pipe and channel flow performance. The Manning's equation computes friction head loss, a major factor in determining the required size of conduit or other conveyance device.

The Manning formula is:

$$Q = (1.486/n)\ AR^{2/3}S^{1/2.}$$

Conduits are assumed to flow full with the water surface at the pipe soffit. Free outfall into downstream facilities was also assumed. Pipe slopes were assumed to be equal to ground slopes. The time of concentration was calculated using figures 2.2 and 2.3 from the ODOT Hydraulics Manual. These figures are presented in the appendix. A minimum flow velocity of one foot per second was used to determine travel times. This report assumes clear water flows, and no bulking factors. Bulking factors are used to account for debris within the water flows. Without using a bulking factor, the analysis assumes an average or better level of system maintenance.

TABLE 2

DEFICIENCIES AND ESTIMATED COSTS

No. Location	Immediate Need	Future Need	Today's Cost	Future Cost
1. Baker Lane	Replace Culvert	Same	$ 24,300	0
2. Fern Ridge Library	OK	Add 18 inch pipe	0	$ 8,200
3. Territorial Crossing 500 feet south of Bolton	Add 18 inch pipe	Add 21 inch pipe	$ 19,700	$ 10,100
4. Territorial Crossing 1150 feet south of Bolton	Rebuild Outlet Structure	Same	$ 8,500	
5. Territorial Crossing 1150 feet south of Bolton	OK	Add 24 inch pipe	0	$ 10,800
6. East Bolton Hill Road 800 South of Pine Street	OK	Add 2-24 inch pipes	0	$ 13,026
7A. Perkins Road to Oak Island	12 wide channel - Rebuild	Same	$ 53,760	0
7B. Oak Island to East Bolton Hill Road	12 wide channel - New	Same	$ 115,920	0
8. Oak Island	Add 27 inch pipe	Same	$ 11,376	0
9. Oak Island East	Add 27 inch pipe	Same	$ 19,000	0
10. Sertic North	Establish ROW	Same	$ 6,350	0
11. 8th Street Drain Crossing	Add 18 inch pipe	Same	$ 8,200	0
12. Territorial Highway north to drainway	Add 36 inch pipe	Same	$ 149,100	0
13. Jeans Road Crossing	Add 21 inch pipe		$ 8,600	0
14. Huston Road Crossing North of Highway 126	Replace with 18 inch pipe	Same	$ 8,200	0
15. East Hunter Avenue	18 inch pipe, Acquire ROW	Same	$ 8,200	0
16. Huston Road Crossing	18 inch pipe	Same	$ 8,200	0
		SUM (ROUNDED)	$ 449,400	$ 42,100

1.2 *ANALYSIS*

The preliminary hydraulic design calculations followed ODOT design criteria. The flow rates were used to determine the sizes of the required facilities.

The city was segmented into eleven major drainage basins: A through K. Sub-basins within the major basins were numbered. Node numbers were assigned at key points (e.g., culverts, entrances to storm drain systems, problem areas, etc.) and flows calculated at each node. Basin boundaries and node designations are provided on plates I, II, III, and IV. The results have been tabulated on Basin Calculation Summary Sheets located in the Appendix. Flow widths and depths in natural channels and wetlands will vary widely, depending on the amount of brush and debris. These areas should be analyzed separately to determine the desired flow pattern based upon City goals. The Basin Calculation Summary Sheets show areas of deficiency for existing and future conditions, along with recommendations. Recommendations for future development are in lieu of recommendations for existing development.

Table 3 approximates existing channel flow characteristics for the various locations. Table 4 calculates flow characteristics based on an engineered earth channels for the same locations.

TABLE 3: EXISTING CHANNEL

NODE LOCATION	B (FT.)	Z	S (FT./FT.)	n	EX. Q (C.F.S.)	EX. VEL (FT./SEC.)	D (FT.)	TOP WIDTH	FUT. Q (C.F.S.)	FUT. VEL (FT./SEC.)	D (FT.)	TOP WIDTH
A1.2 - A1.3	8	10	0.004	0.15	21	0.5	2.2	53	23	0.5	2.4	57
A1.3 - A1.4	8	10	0.004	0.15	54	0.6	5.4	116	60	0.6	6.0	128
A1.4 - A1.5	8	10	0.005	0.15	58	0.6	5.2	112	62	0.5	5.5	119
A1.5 - A1.6	8	10	0.005	0.08	178	1.2	8.4	175	195	1.2	9.1	191
A4.2 - A4.3	8	10	0.004	0.15	37	0.5	3.8	84	54	0.6	5.4	116
A4.3 - A4.4	8	10	0.004	0.15	44	0.5	4.4	97	58	0.6	5.8	124
A5.2 - A5.3	6	2	0.004	0.08	47	1.4	4.1	22	49	1.4	4.2	23
A5.3 - A5.4	6	2	0.005	0.08	50	1.6	3.9	22	51	1.5	4.0	22
A5.4 - A5.5	6	2	0.005	0.08	63	1.6	4.8	25	65	1.6	4.9	26

TABLE 4: ENGINEERED CHANNEL

NODE LOCATION	B (FT.)	Z	S (FT./FT.)	n	EX. Q (C.F.S.)	EX. VEL (FT./SEC.)	D (FT.)	TOP WIDTH	FUT. Q (C.F.S.)	FUT. VEL (FT./SEC.)	D (FT.)	TOP WIDTH
A1.2 - A1.3	12	4	0.004	0.08	21	1.1	1.2	22	23	1.1	1.3	22
A1.3 - A1.4	12	4	0.004	0.08	54	1.3	2.5	32	60	1.4	2.7	34
A1.4 - A1.5	12	4	0.005	0.08	58	1.5	2.4	31	62	1.5	2.6	32
A1.5 - A1.6	12	4	0.005	0.08	178	1.8	6.3	62	195	1.8	6.8	66
A4.2 - A4.3	12	4	0.004	0.08	37	1.2	1.9	27	54	1.3	2.5	32
A4.3 - A4.4	12	4	0.004	0.08	47	1.3	2.2	30	58	1.4	2.7	33
A5.2 - A5.3	12	2	0.004	0.08	19	1.1	1.2	17	49	1.5	2.3	21
A5.3 - A5.4	12	2	0.005	0.08	50	1.6	2.2	21	51	1.7	2.2	21
A5.4 - A5.5	12	4	0.005	0.08	178	1.8	6.3	62	65	1.5	2.7	33

STORM POLLUTION

Stormwaters have long been recognized as a potential source of water pollution. Stormwater based pollutants are generally classed as one of five types: Toxins, surface pollutants, sediments, oxygen demanding substances and nutrients. The discussion below provides a brief overview of these types.

Toxins: Toxins generally receive the most public and media scrutiny relative to stormwater drainage pollutants. Toxic are poisonous, carcinogenic or otherwise harmful to organisms. Toxins includes certain metals, many automotive fluids, common household chemicals such as acids and some cleaners and chemicals used as pesticides.

Surface Pollutants: These pollutants are the types of materials which float on the surface. Surface pollutants can include toxins such as fuels but also include substances such as oil and grease. A common source of surface pollutants is waste oil or oil spills from self service oil changes.

Sediments: Sediments include topsoil, sand, clay and things like pieces of tree bark, tires, and just plain dust. Sediments settle on the bottom of waterways where they can prevent oxygen transfer and smother trout and salmon eggs. To much sediment can destroy spawning beds. The worst thing about sediments is that toxins and surface pollutants as well as many nutrients tend to become attached to the sediment particle thus in addition to the sediment problem itself the problem is compounded.

Oxygen-demanding Substances: Aquatic species rely on oxygen to survive. When certain types of pollutants enter the waterway which require oxygen then less oxygen is available for native species. Food wastes and lawn wastes are the most common oxygen demanding substances associated with torm water systems.

Nutrients: Nutrients mean those elements that are nitrous. The most common nutrients are nitrogen and phosphorus but sulfur, potassium and other elements can also be considered nutrients. The most common source of nutrients are fertilizers and detergents. Excessive nutrients can lead to prolific and unsightly aquatic plant growth such as experienced on occasion in Fern Ridge Reservoir.

Large sites (greater than 5 acres) the developer must prepare an erosion control permits for DEQ review to control storm drain source pollutants. The city, State nor EPA have begun to administer rules and regulations relative to control of stormwater source pollutants within small communities with the exception of minor nuisance ordinances. The EPA does currently require that pollution control programs be developed for communities with populations of 100,000 or greater. The city of Eugene is currently developing its stormwater discharge permit program to meet EPA requirements.

Stormwater pollution effects have been reviewed at City planning commission and council meetings in the context of plan preparation and site reviews. At this time the city lacks the resources to pursue the development of stormwater pollution control ordinances. Both the Council and the commission have agreed that the City has a stewardship responsibility for the water and waterways within the city and have stated that it is the City's goal to maintain clean and functional waterways. The City at this has determined that more rigorous enforcement of existing nuisance and litter ordinances along with support of DEQ in the review of erosion control permits is the appropriate strategy for stormwater based pollution control. A detailed analysis of stormwater based pollution in Veneta and development of recommendations for control are not a part of the scope of this project.

1.3 CONCLUSIONS AND RECOMMENDATIONS

This Drainage Master Plan has reviewed the drainage and subarea boundaries, analyzed the existing drainage system, and proposed storm drain improvements to alleviate system deficiencies. The cost of these proposed improvements has been estimated and construction priorities established. Plates have been prepared to illustrate the various components of this Drainage Master Plan.

The City should continue to investigate alternative methods of financing, but it is strongly recommended that a drainage fee program be implemented. This program will provide the most consistent funding source to eliminate drainage deficiencies as development of land occurs within the City. However, for this method to be effective, the fees should be reviewed periodically to adjust for construction cost escalation.

This Drainage Master Plan should serve as a guide for construction of future drainage facilities as funds become available.

The priorities of construction presented in this report should be followed as closely as possible. However, factors such as patterns of development and available revenues may require periodic re-evaluation.

Further study is recommended to determine possible solutions to local ponding problems not resolved by the proposed improvements.

This plan identifies several areas of drainage system deficiency, and develops the criteria for further analysis of drainage systems for design of specific construction projects. Additional detailed analysis of each deficiency area will complete storm drain sizes and catch basin locations to provide the most efficient interception of the anticipated storm flow. This plan is a major step toward the completion of an integrated storm drain network, affording local flood protection to the City of Veneta.