



**KING COUNTY**

1200 King County Courthouse  
516 Third Avenue  
Seattle, WA 98104

**Signature Report**

**February 6, 2001**

**Ordinance 14040**

**Proposed No.** 2001-0024.1

**Sponsors** Pelz and Nickels

1 AN ORDINANCE approving the Val Vue Sewer District  
2 2000 Comprehensive Sewer Plan.

3  
4 PREAMBLE:

5 K.C.C. chapter 13.24 requires approval of comprehensive plans for sewer utilities  
6 as a prerequisite for granting right-of-way franchises and approval of right-of-way  
7 construction permits.

8 The Val Vue Sewer District 2000 Comprehensive Sewer Plan (plan) discusses  
9 sewer service to existing and future populations within the district's nine-square-mile  
10 service area. The service area includes the cities of Burien, SeaTac and Tukwila and  
11 parts of urban unincorporated King County. The service area is predominantly  
12 comprised of single-family residences, although multi-family residences, commercial  
13 areas and industries are also served. Approximately thirty thousand residents and twenty  
14 thousand employees are currently served by the district. By 2020, the population  
15 projected to be served by the district is nearly forty-five thousand.

16 The district's waste water flows are currently treated by three different agencies:  
17 King County, Southwest Suburban Sewer District and Midway Sewer District. The

18 district has recently completed a study of infiltration and inflow and is continuing to work  
19 with King County to monitor and reduce it.

20 The King County utilities technical review committee (UTRC) reviewed and  
21 conditionally approved the plan on February 10, 1999. The conditions of approval,  
22 technical changes to the plan, are reflected in the plan version attached to this ordinance.  
23 The UTRC recommends that the council approve the plan.

24 The district prepared a determination of non-significance for the plan on August  
25 20, 1998, in accordance with the state Environmental Policy Act.

26 The district adopted the plan on October 17, 2000.

27 BE IT ORDAINED BY THE COUNCIL OF KING COUNTY:

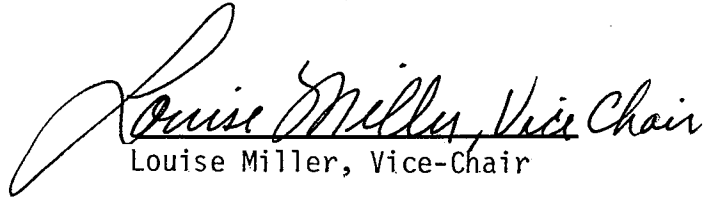
28 SECTION 1. The Val Vue Sewer District 2000 Comprehensive Sewer Plan,

29 Attachment A to this ordinance, is hereby approved without conditions.

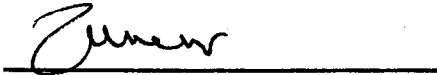
Ordinance 14040 was introduced on 1/16/01 and passed by the Metropolitan King County Council on 2/5/01, by the following vote:

Yes: 10 - Mr. von Reichbauer, Ms. Miller, Ms. Fimia, Mr. Phillips, Mr. Pelz,  
Mr. McKenna, Ms. Sullivan, Mr. Gossett, Mr. Vance and Mr. Irons  
No: 0  
Excused: 3 - Mr. Nickels, Mr. Pullen and Ms. Hague

KING COUNTY COUNCIL  
KING COUNTY, WASHINGTON

  
Louise Miller, Vice-Chair

ATTEST:



Anne Noris, Clerk of the Council

APPROVED this 15 day of February, 2001.

  
Ron Sims, County Executive

Attachments      A. Val Vue Sewer District 2000 Comprehensive Sewer Plan

Attachment  
14010

2001 024

"WORKING TOWARD A BETTER ENVIRONMENT"



**VAL VUE SEWER DISTRICT**

**2000 COMPREHENSIVE SEWER PLAN**



Penhallegon Associates Consulting Engineers, Inc.  
750 Sixth Street South  
Kirkland, Washington 98033  
(425) 827-2014

# VAL VUE SEWER DISTRICT

## 2000 COMPREHENSIVE SEWER PLAN

Val Vue Sewer District  
14816 Military Road South  
P.O. 69550  
Seattle, Washington 98188  
Phone (206) 242-3236

### Commissioners

Joe T. Colello  
Francis L. Sheen  
Michael J. West

### District Manager

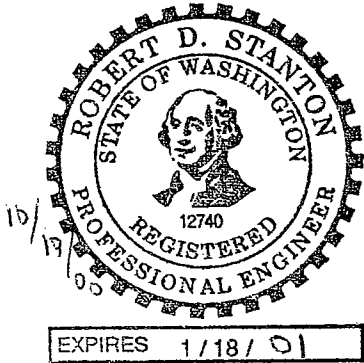
T.J. Matleich

### Assistant District Manager

Dana Dick

**VAL VUE SEWER DISTRICT  
COMPREHENSIVE SEWER SYSTEM PLAN  
ENGINEER'S CERTIFICATION**

The technical material and data contained in this report was prepared by Penhallegon Associates Consulting Engineers, Inc. under the supervision of the below listed individuals. Those responsible staff members who are registered professional engineers are licensed in the State of Washington.



Handwritten signature of Robert D. Stanton in black ink.

Robert D. Stanton, P.E.  
Vice President

Handwritten signature of Susan E. Boyd in black ink.

Susan E. Boyd  
Associate

**VAL VUE SEWER DISTRICT  
COMPREHENSIVE SEWER SYSTEM PLAN  
EXECUTIVE SUMMARY**

This Comprehensive Sewer System Plan is a summary of the conclusions and findings of recent planning and engineering studies completed by Penhallegon Associates Consulting Engineers, Inc. for Val Vue Sewer District.

The District's current service area reflects the 1995 merger of Rainier Vista Sewer District into Val Vue Sewer District. This document provides the District with one consolidated Comprehensive Sewer System Plan which covers the entire District service area. Following the merger of Rainier Vista Sewer District into Val Vue, the consolidated District operated under the two comprehensive plans which were in place at the time of the merger. This document updates and supercedes the previous plans and provides the District with one document to guide future development of the sanitary sewer system. It has been prepared in accordance with the requirements of the State of Washington Department of Ecology, King County and the cities within which the District operates.

The primary objectives in developing this document were as follows:

1. To determine the adequacy of the existing sanitary sewer system to meet the current and projected needs of the customers of the District in accordance with all applicable state, federal and local regulations governing the provision of sanitary sewer service;
2. To analyze the sanitary sewer system and identify potential deficiencies and recommended improvements, including potential ways of improving service by interconnecting the sanitary sewer systems of the previous Districts; and,
3. To develop a ten year capital improvements program to serve as a guideline for future development of the sewer system.

Val Vue Sewer District's service area consists of approximately 6,000 acres of land located north and east of the Sea-Tac International Airport, in southern King County. The service area generally extends from the Seattle City limits on the north, to South 176<sup>th</sup> and 182<sup>nd</sup> Streets on the south, and from Interstate Highway 5 and State Route 599 on the east to First Avenue South and State Route 509 on the west. The District serves within the limits of the cities of Burien, SeaTac and Tukwila and within unincorporated King County. No service area changes are contemplated in this plan, although there is some uncertainty of whether or not the District will extend service to the currently unsewered area in the eastern portion of the District. This area is outside of the District's corporate limit and within the City of Tukwila, but could logically be served by the District. The District does not, however, propose extension of service to this area unless requested to do so by the City of Tukwila. The only boundary changes recommended by this Plan are the annexation of small pockets of land which are completely surrounded by the District.

Land use within the service area is predominantly single family residential with multi family residential and commercial uses concentrated along major thoroughfares. The northeastern



portion of the District, along East Marginal Way South and adjacent to the Duwamish River, is classified as industrial. The District currently serves approximately 7,000 connections or 14,000 equivalent residential units or ERU's. Population within the service area is estimated at 30,000 people and approximately 20,000 people are employed within the service area.

Projected development within the service area is limited to that associated with infill development in the short term, and redevelopment in the future. A reduction in single family residential uses and increase in multi-family and commercial uses is anticipated to occur in the future. Development of the proposed third runway at Sea-Tac International Airport could significantly impact future development in the general area and further increase the projected shift away from single family land uses to those more conducive to supporting increased activity at the airport. Based on interpolation of population and employment projections provided by the Puget Sound Regional Council, it is estimated that population will increase from approximately 30,000 in 1997 to nearly 45,000 by the year 2020 and that the number of ERU's served by the District will increase from approximately 14,000 to approximately 23,000 over the same period of time.

The District's sanitary sewer system has been divided into eleven primary drainage basins and twenty five drainage sub-basins for the purpose of analysis of the system and projection of future needs. Pipe sizes within the District range from 6- to 24-inches and the District currently maintains 19 pump stations to compensate for the hilly terrain within the service area. The District does not maintain wastewater treatment or disposal facilities and instead relies on the service of King County-Metro, Southwest Suburban Sewer District and Midway Sewer District for these services. Delivery of flow to these entities for treatment and disposal of wastewater is accomplished through system connections and in accordance with existing interlocal agreements.

Analysis of the sewer system identified several areas where deficiencies exist, either due to pipe size or condition, and specific projects which are not necessitated by existing deficiencies, but would improve the overall operation of the system. An example of this later type of project is the elimination of Pump Station No. 17 and rerouting of flows to the east. Similar projects include redirection of flows in the southern portion of the District to Midway Sewer District for treatment and disposal, which will increase capacities elsewhere in the Val Vue System and provide a logical extension of Midways Wastewater Treatment Plant service area. The majority of the recommended improvements outlined in this Plan, however, are for extension of service to areas which are currently unsewered. These areas occur throughout the District, but as indicated on the Sewer System Plan Map included at the back of this document, there is a large unsewered area on the west side of the District. It is proposed that the sewers installed in the western portion of the District will flow into the Southwest Suburban Sewer District for treatment and disposal. The unsewered areas in the eastern portion of the District could logically be served by Val Vue but extension of service to these areas would only be accomplished at the request of the City of Tukwila.

In addition to the system analyses completed for the planning process, a specific infiltration and inflow study has recently been accomplished to compile the results of ongoing flow monitoring in the system. This study is included in the appendices of the Plan and outlines the District's program for future infiltration and inflow reduction.





Of the nearly \$17.5 million dollars in improvements recommended for the sanitary sewer system, approximately \$7.5 million are anticipated before the year 2006. Of that amount, only \$1 million are proposed for financing out of rates and charges. The District has accomplished a rate study and adjusted its monthly rates, general facility charges and local facility charges in response to the Capital Facilities Plan outlined in Chapter 7. Projects not funded by rates and charges are anticipated to be financed by developers extensions and/or ULID's. It is recommended that the District continue to support ULID's and extension of sewers into unsewered areas in accordance with the Growth Management Planning mandate that urban level of service be provided to all areas within the urban growth area.



**VAL VUE SEWER DISTRICT  
 COMPREHENSIVE SEWER SYSTEM PLAN  
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**VAL VUE SEWER DISTRICT  
COMPREHENSIVE SEWER SYSTEM PLAN  
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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 INTRODUCTION**

This report compiles and summarizes the results and conclusions of planning and engineering studies undertaken by Penhallegon Associates Consulting Engineers, Inc. in developing this Comprehensive Sanitary Sewer System Plan for Val Vue Sewer District.

Prior to the development of this Plan, the District operated under two separate plans for the Val Vue and Rainier Vista portions of the District. These two Plans were in place at the time of the Rainier Vista Sewer District merger into Val Vue Sewer District in 1995 and have remained in effect except as amended by a subsequently consolidated Capital Facilities Plan which was prepared in March of 1997.

This Plan replaces the previous planning documents and provides the District with a consolidated Comprehensive Plan for the entire sewer district service area. It has been prepared in accordance with the requirements of the State Department of Ecology and the applicable requirements of the jurisdictions within which it operates. Included herein are: Identification and description of the characteristics of the District's service area; Description of the existing sanitary sewer system; Minimum design criteria adopted by the District; Identification of system deficiencies; Recommendations for system improvements; and, A schedule and financial plan for upgrading the sanitary sewer system to accommodate the existing and projected population and land use for the service area.

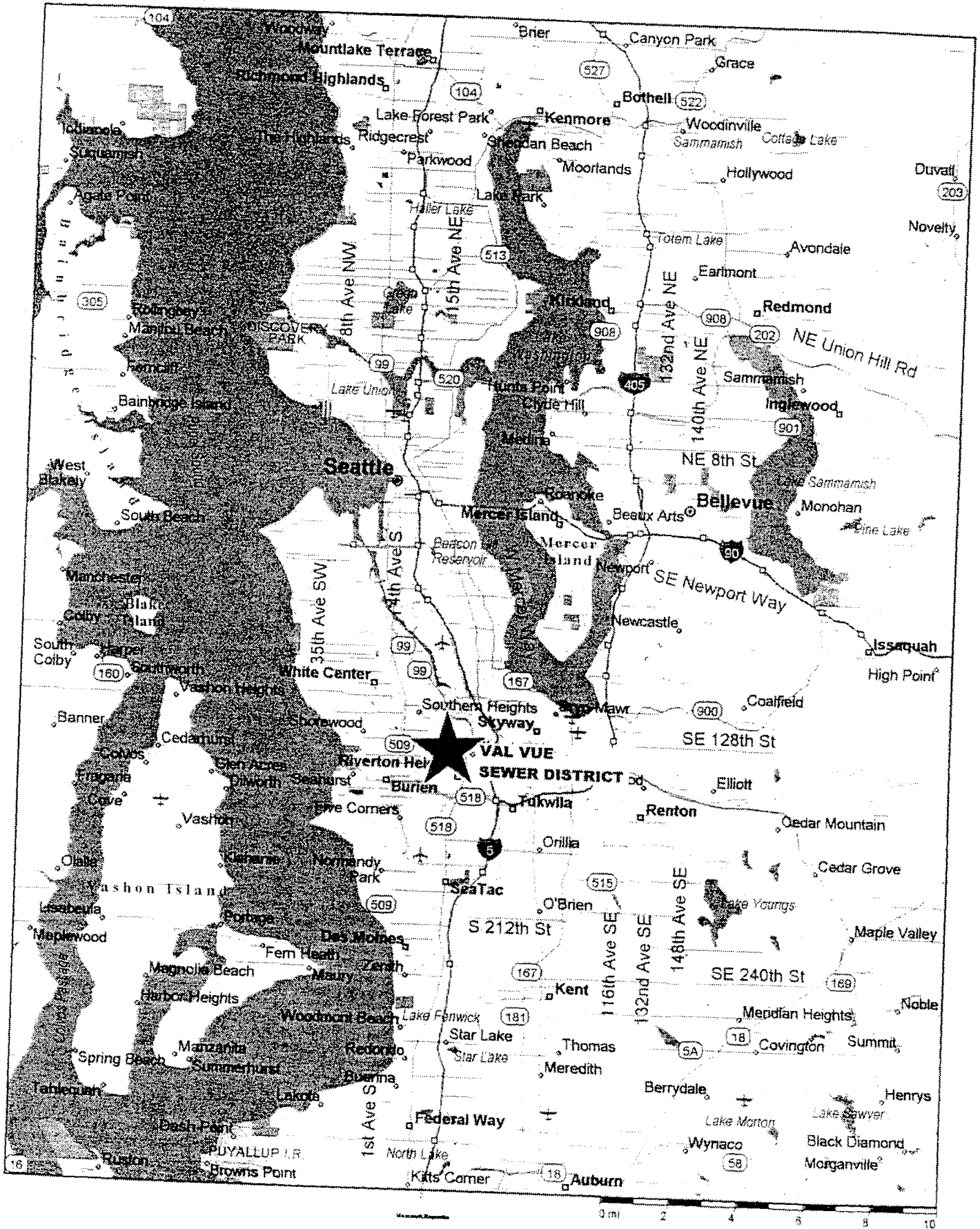
### **1.2 AUTHORIZATION**

Recognizing the need to update its comprehensive planning documents and provide a consolidated document establishing future service to the District, Val Vue Sewer District's Board of Commissioners authorized Penhallegon Associates Consulting Engineers, Inc. to prepare this document in accordance with all applicable rules and regulations governing planning for sanitary sewer utility systems.

### **1.3 LOCATION**

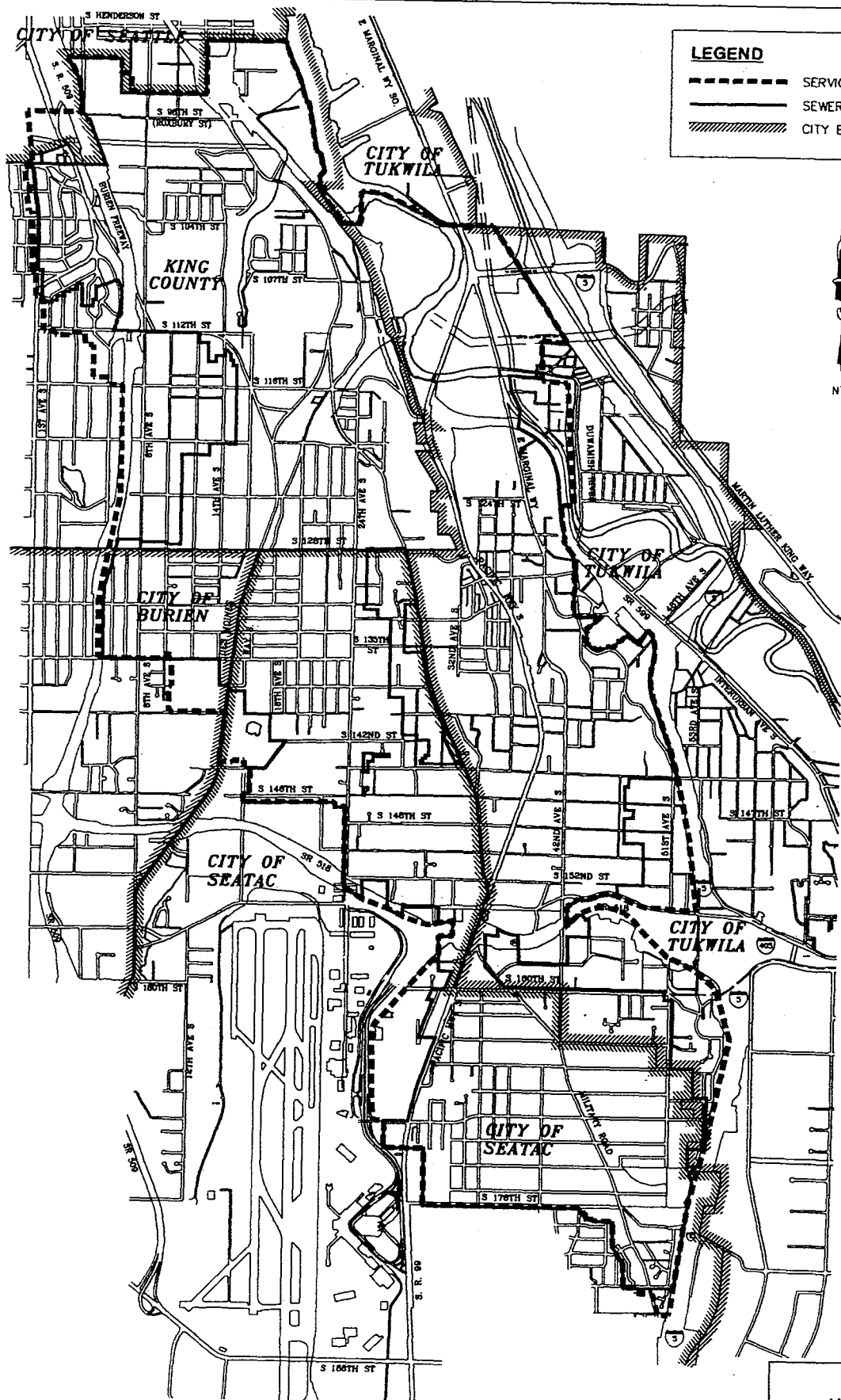
As shown on Figures 1-1, 1-2, and 1-3, Val Vue Sewer District is located south of the City of Seattle, in King County, Washington. The District generally extends from the City of Seattle limits at South Director Street and South Cambridge Street on the north to South 176<sup>th</sup> and 182<sup>nd</sup> Streets on the south, and from Interstate Highway 5 and State Route 599 on the east to 1<sup>st</sup> Avenue South and State Route 509 on the east. The District serves within the limits of the cities of Burien, SeaTac and Tukwila, and within unincorporated King County. Additional information regarding boundaries and service area is contained in Chapter 2.





**FIGURE 1 - 1  
LOCATION MAP**





**LEGEND**

- SERVICE AREA BOUNDARY
- SEWER DISTRICT BOUNDARY
- ////// CITY BOUNDARIES



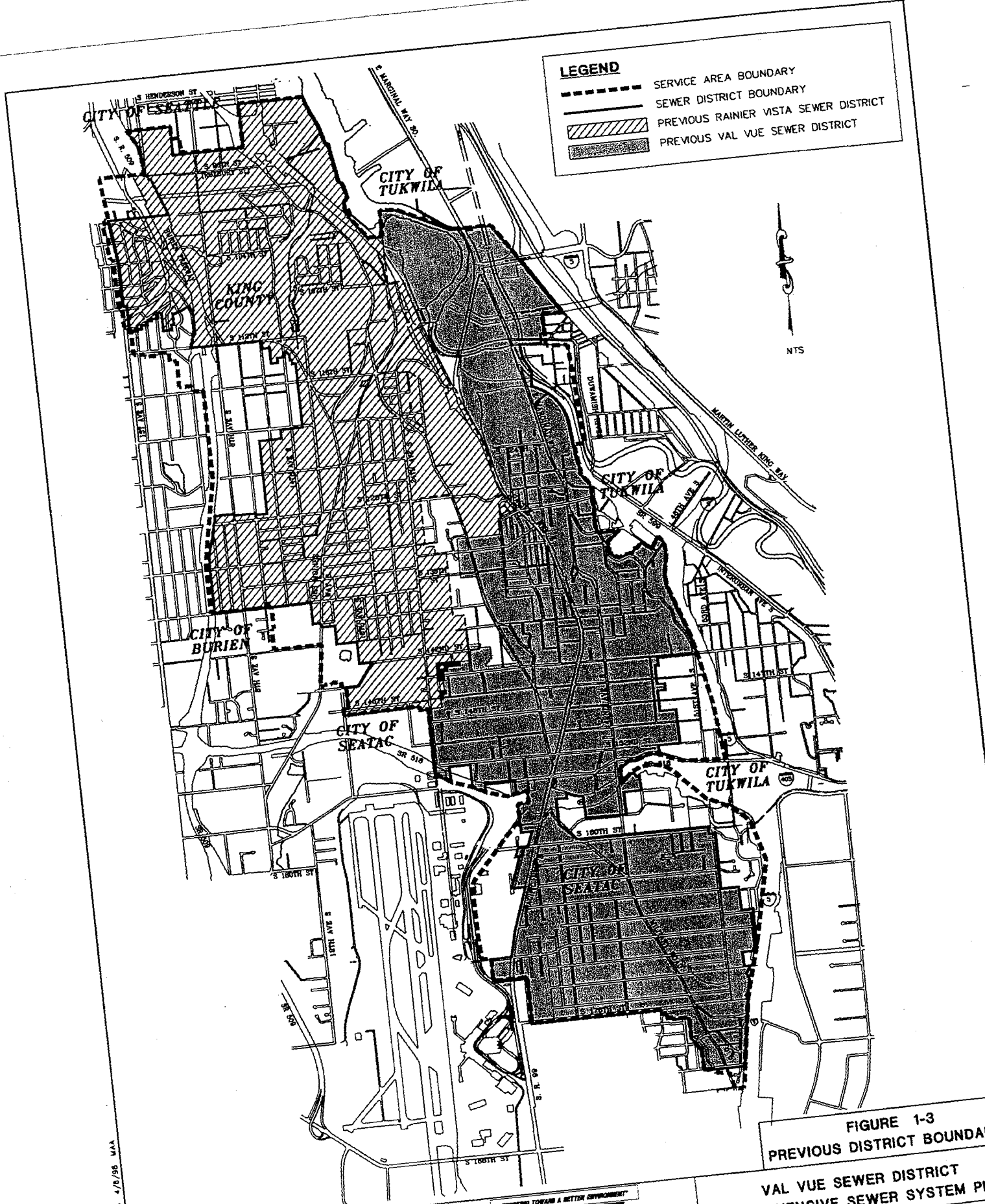
**FIGURE 1-2  
VICINITY MAP**

PAGE: 7105F1-2 8/18/88 PLS

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**ValVue**  
 SEWER DISTRICT

**VAL VUE SEWER DISTRICT  
 COMPREHENSIVE SEWER SYSTEM PLAN**



**LEGEND**

- SERVICE AREA BOUNDARY
- \_\_\_\_\_ SEWER DISTRICT BOUNDARY
- ▨▨▨▨ PREVIOUS RAINIER VISTA SEWER DISTRICT
- ▩▩▩▩ PREVIOUS VAL VUE SEWER DISTRICT

NTS

FIGURE 1-3  
PREVIOUS DISTRICT BOUNDARIES

VAL VUE SEWER DISTRICT  
COMPREHENSIVE SEWER SYSTEM PLAN

PACE: 7/05/1-3 4/18/98 WAA

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WORKING TOWARD A BETTER ENVIRONMENT  
**Val Vue**  
SEWER DISTRICT

## 1.4 HISTORY OF THE DISTRICT

The Val Vue Sewer District, one of the first sewer Districts in King County, was established in 1946 for the purpose of providing sanitary sewer service to the Cascade Homes Addition and businesses along Pacific Highway South (International Blvd.) The original District was quite small, covering an area of only 0.37 square miles. Effluent was treated, chlorinated and discharged into the Duwamish River at a primary type treatment plant located just east of Pacific Highway South near South 135<sup>th</sup> Street. This plant remained in service until 1958, when flows from the area increased to a point that necessitated construction of a new primary treatment plant. The second plant was located near 42<sup>nd</sup> Avenue South and South 129<sup>th</sup> Street and also discharged to the Duwamish. It remained in service until 1966, when construction of freeways in the area necessitated abandoning the facility and contracting with the Municipality of Metropolitan Seattle (now King County-Metro) for wastewater treatment and disposal. In 1972, Val Vue entered into a contract with Des Moines Sewer District (now referred to as Midway Sewer District) for the treatment and disposal of wastewater flows from the major motels in the southern portion of the District.

In 1995, Rainier Vista Sewer District merged into Val Vue Sewer District to form one consolidated sanitary sewer district. The Rainier Vista portion of the current Val Vue service area generally includes the northwest and western areas of the District. Figure 1-3 shows the boundaries of Val Vue and Rainier Vista prior to the merger.

Rainier Vista Sewer District was formed in 1945 to provide sanitary sewer service to the Beverly, Beverly Heights, Lerina, and McKinley areas of unincorporated King County. Subsequent to formation of the District a large area was annexed in 1946 and a comprehensive plan was adopted by the District in 1947.

No action was taken on construction of a sewer system until 1956, when another comprehensive plan was adopted. Financing for the proposed system was accomplished by a combination of revenue bonds and through the formation of Utility Local Improvement District (ULID) No. 1. The original collections system and treatment plant were constructed in 1958 and 1959. Subsequently, ULID Nos 2 through 14 were formed to construct the core of the original Rainier Vista sewer system.

Rainier Vista continued to expand by ULID's and developer extensions. In 1976, Rainier Vista's original treatment plant was closed and the District contracted with King County-Metro for treatment and disposal of wastewater flows from the majority of the District. Subsequently, an agreement was reached with Southwest Suburban Sewer District for treatment and disposal of wastewater flows from the western portion of the District.

## 1.5 AUTHORITY AND MANAGEMENT OF THE DISTRICT

Authority and procedures for sewer district functions is provided by the State of Washington in RCW Title 57. The District's Board of Commissioners consists of five elected officials and



holds public meetings on the first and third Tuesday of every month. District meetings are held at the District office, the address and phone number of which is:

Val Vue Sewer District  
14816 Military Road South  
P.O. Box 69550  
Seattle, Washington 98188  
Phone: (206) 242-3236

Day to day operation of the District is the responsibility of the District Manager, who oversees all office and field operations. To augment the expertise of the Board of Commissioners and staff, the District employs the services of consulting engineers as well as legal counsel and certified public accountants.

## **1.6 OBJECTIVES**

The primary objective of Val Vue Sewer District is to provide high quality, efficient, and low cost sanitary sewer service to it existing and future customers. Implicit to achieving this objective are the following considerations:

- ▶ Development and adoption of a Comprehensive Sanitary Sewer System Plan to be used as a guideline for future planning and construction of facilities to address the specific system requirements of the service area.
- ▶ Development of environmental polices which will provide guidelines for preservation of water quality and other features of the environment, as set forth in state and federal regulations.
- ▶ Compliance with the objectives and criteria set forth in the comprehensive plans and other requirements of the State Department of Ecology, King County-Metro, and the cities of Burien, SeaTac and Tukwila.
- ▶ Operation of the sanitary sewer system in a manner which is consistent with accepted procedures and practices and which maximizes the useful life of any and all components of the system.
- ▶ Maintaining a financial level sufficient to retire all bonded indebtedness as it comes due, maintain adequate cash reserves, and provide service at the lowest reasonable cost.

## **1.7 RELATED PLANNING STUDIES**

The recent planning and engineering studies by the District which have been considered in



developing this document are listed below. Related plans and policies of other jurisdictions which have been considered in this planning process are identified later in this section.

- ▶ Val Vue Sewer District Interim Capital Facilities Plan, 1997, Penhallegon Associates Consulting Engineers, Inc.
- ▶ Val Vue Sewer District General Facility Charge/System Facility Charge Study, 1997, Penhallegon Associates Consulting Engineers, Inc.
- ▶ Val Vue Sewer District, Comprehensive Sewer Plan, 1993, Horton Dennis and Associates, Inc.
- ▶ Rainier Vista Sewer District Comprehensive Sewer System Plan, 1990, Hammond, Collier, Wade-Livingstone Associates, Inc.

## **1.8 RULES AND REGULATIONS**

Val Vue Sewer District operates under a variety of rules and regulations, which are summarized in the following paragraphs. Detailed discussions regarding specific regulations affecting this document are contained in specific sections of this document, as appropriate.

### **1.8.1 Federal Requirements**

Val Vue Sewer District is required to acct operate within the regulations and requirements of the federal government, including the Endangered Species Act(ESA). The recent listing of the Puget Sound Chinook Salmon and Bull Trout as "threatened species" will impact the District's sanitary sewer system operations. Although the exact nature and scope of the of the impacts is subject to finalization of the "4d Rule" issued by the National Marine Fishery Service, the District expects indirect and direct implications. In that Val Vue does not maintain its own treatment facility, many of the implications of the ESA may be implemented by those agencies which the District relies on for treatment (King County-Metro, Southwest Suburban Sewer District and Midway Sewer District). Participation in the programs of these agencies may include compliance with specific programs and/or through financial participation through rates.

In addition, Val Vue expects the "4d Rule" will impose new requirements associated with operation and maintenance activities. The District expects to adopt "Best Management Practices" (BMP) to supplement and/or document its existing operations and maintenance procedures. Val Vue Sewer District is prepared, as part of its ESA compliance program, to retain staff members who are trained in BMP compliance and monitor projects for ESA compliance. The costs associated with the implementation of the ESA compliance program will be considered in the District's future rate setting.



### **1.8.2 State of Washington Requirements**

Val Vue Sewer District operates under the general rules and regulations put forth by Title 57 of the Revised Code of Washington. Additional requirements for various aspects of sewer district operation consistent with protection of the health and safety of the general public and the environment, are found throughout the laws of the State of Washington and are adhered to by the District.

Approval of this Comprehensive Sanitary Sewer System Plan is under the jurisdiction of the State Department of Ecology (DOE). This Plan has therefore been prepared, and the District operates in accordance with the requirements set forth in DOE's "Criteria for Sewage Works Design", which incorporates the policies, guidelines and practices of the State Department of Ecology and identifies the minimum engineering criteria for design, construction and operation of a public sanitary sewer system.

The Growth Management Act (GMA) has a direct impact on utility system planning as it requires that a complete inventory of existing facilities and a comprehensive effort toward determining the capability of existing systems to accommodate future growth. Although the majority of growth management planning activities are the responsibility of counties and cities, the District is cooperating with these jurisdictions in their efforts to comply with the GMA. This Plan gives consideration to the myriad of data and information required by the GMA.

### **1.8.3 King County Requirements**

A portion of Val Vue Sewer District is within unincorporated King County and the District operates within the regulations and requirements established by the King County Code. Specifically, Chapter 13.24 of the King County Code has been utilized in the development of this document.

The District also operates in accordance with the requirements of King County - Metro, which is responsible for the treatment and disposal of the majority of wastewater flows from the District. The District operates under the terms and conditions of its contract with King County-Metro. Similarly, the District maintains contracts with Midway Sewer District and Southwest Suburban Sewer District for wastewater treatment and disposal and adheres to the terms and conditions of those contracts.

### **1.8.4 City Requirements**

Val Vue Sewer is within the corporate limits of the Cities of Tukwila, SeaTac and Burien and therefore adheres to the policies, requirements and regulations of those entities as appropriate to specific areas of the District. The Comprehensive Plans of these jurisdictions have been utilized in the development of this document.



## **CHAPTER 2**

### **DESCRIPTION OF THE SERVICE AREA**

#### **2.1 EXISTING BOUNDARIES**

The existing corporate boundary of Val Vue Sewer District is shown on Figure 2-1. As indicated, the District generally extends from the Seattle city limits at South Cambridge and South Director Streets on the north, to South 176<sup>th</sup> and South 182<sup>nd</sup> Streets on the south; and from 1<sup>st</sup> Avenue South and State Route 509 on the west, to State Route 599 and Interstate Highway 5 on the east. The District serves within the cities of SeaTac, Tukwila and Burien, and within unincorporated King County, as indicated on Figure 2-1.

#### **2.2 FUTURE SERVICE AREA**

Figure 2-2 shows the anticipated future service area of Val Vue Sewer District, as well as the service areas of adjacent sanitary sewer service providers. As indicated, the District's future service area is different than the District's corporate boundary. The future service area boundary has been determined to be the logical area which could be served by the District based on topography and the distance to existing system facilities.

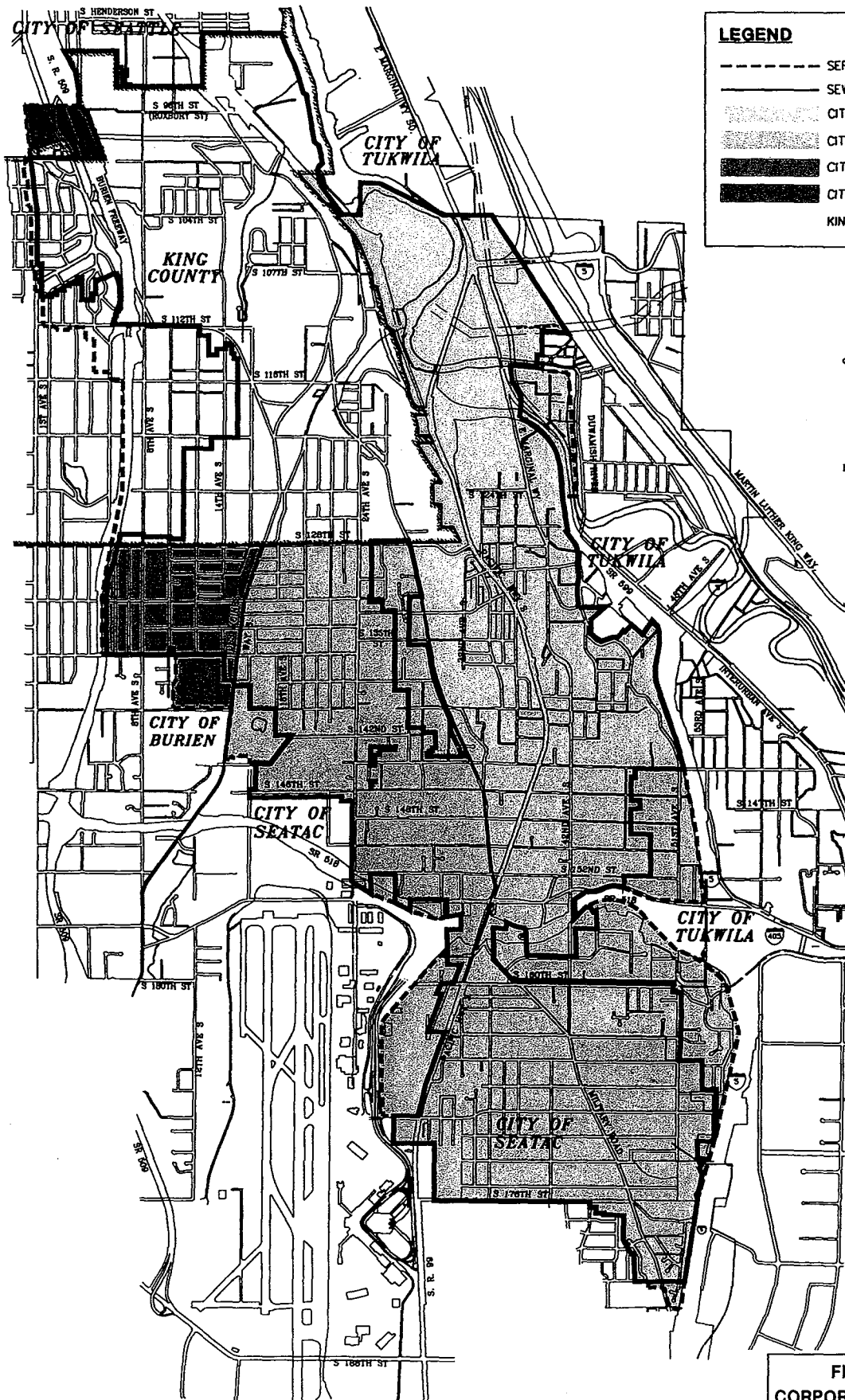
#### **2.3 INTERLOCAL AGREEMENTS**

Val Vue Sewer District maintains interlocal agreements with several adjacent agencies, as well as with King County/Metro, as summarized in Table 2-1. Copies of interlocal agreements are available at the District's office for review by any interested parties.

#### **2.4 SERVICE AREA CONFLICTS**

There are no known service area conflicts between the District and neighboring purveyors. As mentioned previously, the District operates within the limits of the cities of Tukwila, SeaTac and Burien. Service within these jurisdictions is expected to continue in the future. There are areas along the District's eastern boundary, just west of Interstate 5, which could be served by either Val Vue or the City of Tukwila. Because these areas are within the City of Tukwila and are currently unserved, the City would have first right of refusal for extending facilities to serve the areas. It may be more practical, however, for Val Vue to serve these potential connections. The City of Tukwila and Val Vue Sewer District have entered into discussions to determine the most logical service provider for these areas.





**LEGEND**

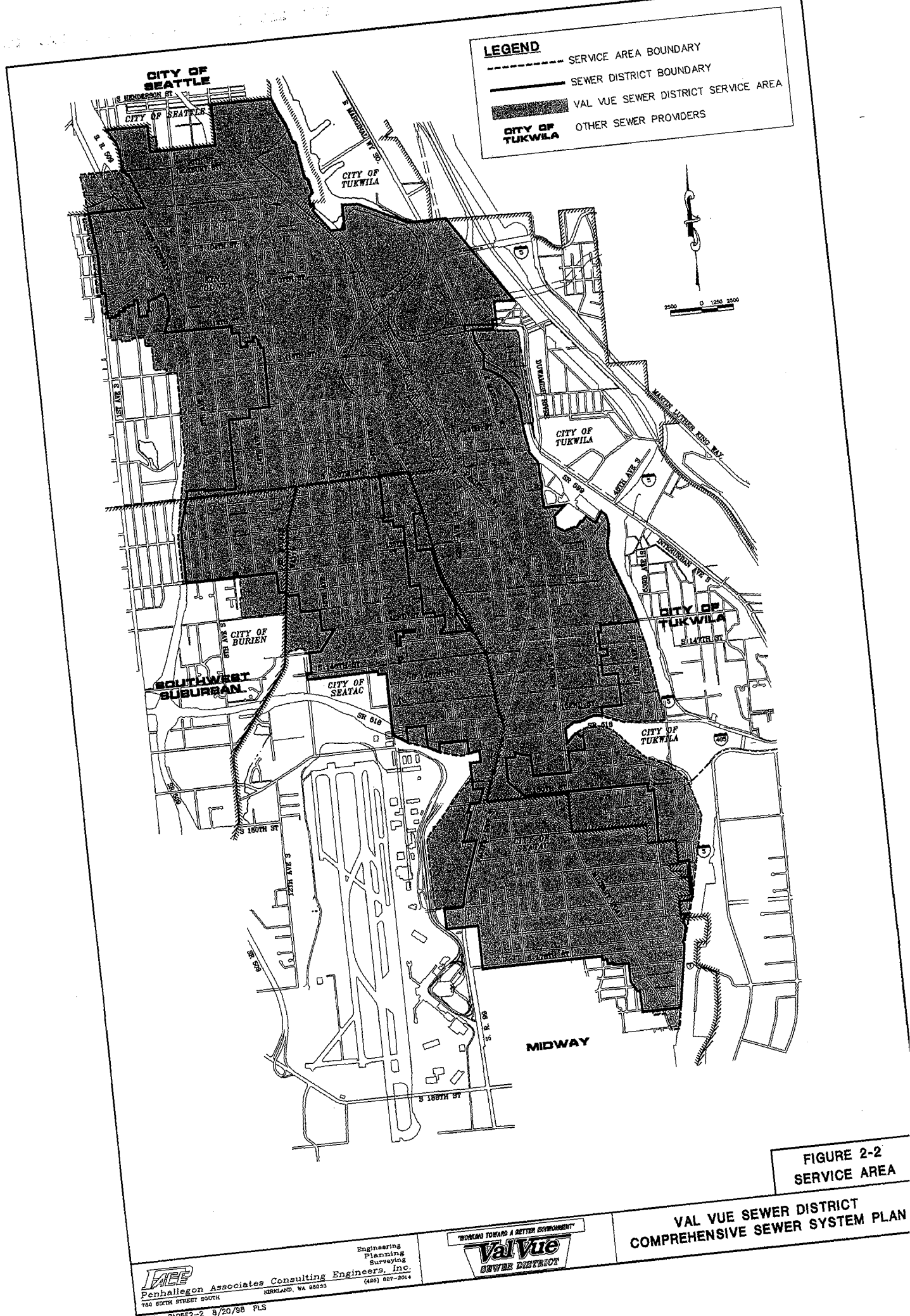
- SERVICE AREA BOUNDARY
- SEWER DISTRICT BOUNDARY
- [Stippled Pattern] CITY OF TUKWILA
- [Cross-hatched Pattern] CITY OF SEATAC
- [Solid Black] CITY OF BURIEN
- [Dark Grey] CITY OF SEATTLE
- [White] KING COUNTY



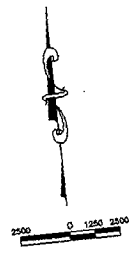
**FIGURE 2-1  
CORPORATE BOUNDARIES**

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**LEGEND**  
 - - - - - SERVICE AREA BOUNDARY  
 \_\_\_\_\_ SEWER DISTRICT BOUNDARY  
 [Shaded Area] VAL VUE SEWER DISTRICT SERVICE AREA  
 [Hatched Area] OTHER SEWER PROVIDERS



**FIGURE 2-2  
 SERVICE AREA**

**VAL VUE SEWER DISTRICT  
 COMPREHENSIVE SEWER SYSTEM PLAN**



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Engineering  
 Planning  
 Surveying

8/20/96 PLS

**TABLE 2-1  
SUMMARY OF INTERLOCAL AGREEMENTS**

Agreement With	Date	Nature of Agreement
King County-Metro	3/1/73	Rainier Vista - Sewage Disposal Agreement
King County-Metro	3/19/87	Rainier Vista - Extension of Sewage Disposal Agreement
SW Suburban Sewer District	3/14/83	Service Boundary Agreement
King County-Metro	8/1/66	Sewage Disposal Agreement
Port of Seattle	7/15/68	Sewage Disposal Agreement
Des Moines Sewer District (now known as Midway Sewer District) & King County-Metro	9/7/72	Sewer Service Area Agreement
City of Tukwila	5/22/75	Sewage Disposal Agreement
City of SeaTac	2/11/97	Agreement for Video Inspection Work



# CHAPTER 3

## PHYSICAL CHARACTERISTICS

### 3.1 TOPOGRAPHY

Topography of the Val Vue Sewer District service area is typical of that found in the Puget lowland and elevations range from over 500 feet in the southern portion of the District, to near sea level in the vicinity of the Duwamish River. The most predominant natural physical feature in the study area is the Duwamish River. The Duwamish River has been diked but not straightened and still exhibits the serpentine characteristics of a mature stream. The river valley typifies the last stage of development of an old valley: wide, flat bottom, broad meander belt and generally gentle slopes.

The Riverton Heights area, which is in the south central portion of the service area, slopes gently to the east. The general topography of the area tends to be lineated, with localized areas of varying steepness, all typical of Puget lowland glaciated terrain.

### 3.2 DRAINAGE BASINS

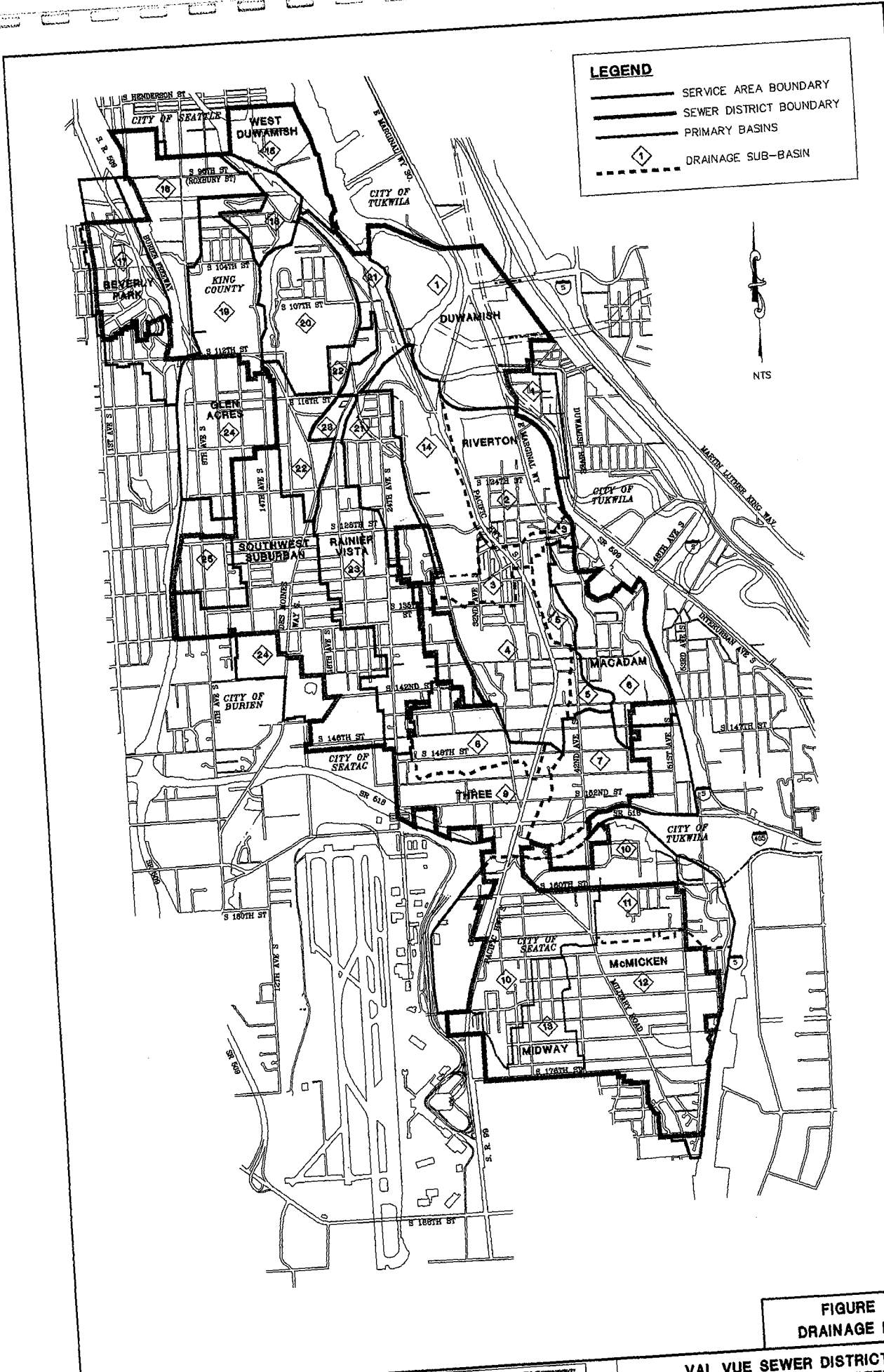
The District has been divided into 11 primary drainage basins and 25 drainage sub-basins for the purpose of defining service to each area of Val Vue Sewer District. Drainage basins have been identified using topographic information as well as system specific characteristics, and are shown on Figure 3-1. Geographic descriptions, existing system information and recommended improvements for each drainage basin are presented in subsequent chapters of this Plan.

### 3.3 GEOLOGY AND SOILS

Soil conditions of the Val Vue Sewer District are dominated by Quaternary deposits primarily composed of Vashon Drift in the uplands, and post glacial alluvial deposits in the Duwamish River bottom. Ten different soils series are found within the area, and these soils have either been formed directly from glacial deposits or from alluvial or lacustrine action. The following list indicates the parent material from which soils in the area are derived.

<u>Parent Material</u>	<u>Soil</u>
Glacial Till	Alderwood
Glacial Outwash	Ragnar
Glacial Drift	Cathcart
Drift or Lacustrine	Bellingham
Lacustrine	Kitsap
Organic Decomposition	Woodinville, Seattle, Mukilteo & Carbondale





**LEGEND**

- SERVICE AREA BOUNDARY
- SEWER DISTRICT BOUNDARY
- - - - PRIMARY BASINS
- ◇ DRAINAGE SUB-BASIN



**FIGURE 3-1  
DRAINAGE BASINS**

**VAL VUE SEWER DISTRICT  
COMPREHENSIVE SEWER SYSTEM PLAN**

Soil types occurring within the Val Vue area are indicated in Table 3-1. In general, the soils in the study area are suited for urban development in the uplands and for agricultural uses in the lowlands. As indicated in Table 3-1, none of the soils in the area are considered suitable for septic drainfields.

TABLE 3-1 VAL VUE SEWER DISTRICT SOIL TYPES		
Symbol	Soil Series	Potential for failure of Septic Drainfields.
AgB, AgD, AgC	Alderwood	Severe: Slow Substream permeability.
Be	Beausite	Severe: Bedrock at a depth of 20 to 40".
InC	Indianola	Slight and Moderate: Moderate if slope is more than 8% ; Possible pollution hazard.
KpD	Kitsap	Severe: Very slow permeability.
Pu	Puget	Severe: Slow permeability; Seasonal high water table.
Py	Puyallup	Severe: Flood hazard.
Rh	Riverwash	Severe: Flood hazard.
Sk	Seattle	Severe: Seasonal high water table.
Su	Sultan	Severe: Seasonal high water table; Flood hazard.
Wo	Woodinville	Severe: Seasonal high water table; flood hazard.

### 3.4 CLIMATE

The climate of the area is characteristic of the Seattle metropolitan area, which is strongly influenced by maritime masses originating over the Pacific Ocean and can generally be described as having mild, wet winters and warm, dry summers. Temperatures typically range from 34 to 49 degrees Fahrenheit in the winter months and 51 to 75 degrees Fahrenheit during the summer months. Rainfall in the area averages 35-40 inches annually.



### **3.5 HYDROLOGY**

The primary hydrologic feature in the study area is the Duwamish River, which flows through the northeastern portion of the District. WAC 173-201 designates the Duwamish as water quality Class B (good), which generally means that water quality shall meet or exceed requirements for most uses. Because of the close proximity to development and on-site sewage disposal systems, water quality is of concern. Other small tributaries within the District include Hamms Creek and other unnamed streams which flow to the Duwamish.

### **3.6 SENSITIVE AREAS**

Sensitive area such as streams, wetlands, steep slopes, floodplains and areas of erosion hazard do occur within the service area. Specific information pertaining to sensitive areas can be obtained from King County or the appropriate city within which the District operates.



## **CHAPTER 4**

### **DEMOGRAPHICS AND SYSTEM FLOWS**

#### **4.1 GENERAL**

This Chapter of the Plan details the land use, zoning and population characteristics of the District's service area. Population, employment and land use data from the municipalities within which the District operates, as well as from the Puget Sound Regional Council, have been used to develop realistic growth projections for the District and to estimate future wastewater flows from the service area. These projections provide the basis for evaluating the exiting system's capabilities to meet the current and projected development within the service area.

#### **4.2 ZONING AND LAND USE**

Figure 4-1 provides a generalized summary of zoning and projected land use within the service area. Because the District operates within the limits of the cities of SeaTac, Tukwila, Burien, and King County, zoning classifications have been generalized in order to achieve consistency and to provide a basis for further analysis. Figure 4-1 is not intended to be used as a site specific zoning map and such information should be obtained from the agency having jurisdiction in the specific area of interest.

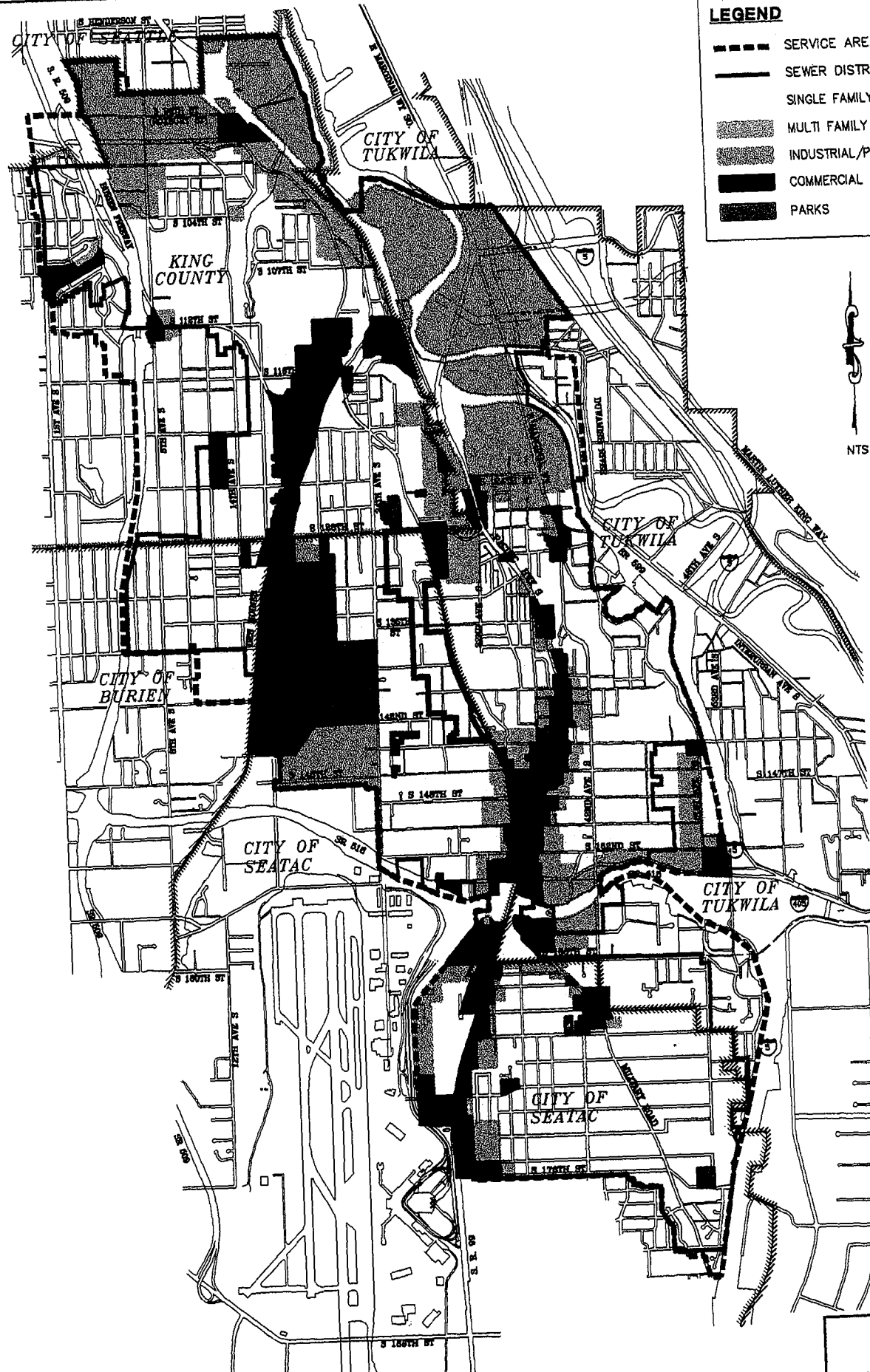
As indicated on Figure 4-1, land use in the area is predominantly single family residential with multi family and commercial uses concentrated along major thoroughfares. The northeastern portion of the District, along East Marginal Way and adjacent to the Duwamish River, is classified as industrial. Percentages of total land area under various zoning classifications are estimated as follows: Single family - 65%; Multi family - 7%; Industrial - 15%; Commercial - 8%; and, Parks/Open Space - 5%.

#### **4.3 PROJECTED DEVELOPMENT**

Projected development within the service area is limited to that associated with infill development over the short term, and redevelopment in the future. A reduction in single family residential uses and increase in multi family and commercial uses is anticipated to occur in the future. This projected shift in land use is further discussed in paragraph 4.6 of this Section, which details population and employment projections for the service area.

Development of the proposed third runway at Sea Tac International Airport could significantly impact future development in the general area and increase the projected shift from single family to multi family and commercial land uses required to support additional airport activity.





**LEGEND**

- SERVICE AREA BOUNDARY
- SEWER DISTRICT BOUNDARY
- [Stippled] SINGLE FAMILY
- [Cross-hatched] MULTI FAMILY
- [Diagonal lines] INDUSTRIAL/PORT USE
- [Solid black] COMMERCIAL
- [Dotted] PARKS



FIGURE 4-1  
ZONING MAP

VAL VUE SEWER DISTRICT  
COMPREHENSIVE SEWER SYSTEM PLAN

FACE: 7/05/11 5/20/08 PLS

**VACE**  
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## 4.4 POPULATION AND EMPLOYMENT

Table 4-1 provides projected population and employment within the District through the year 2020. Population and employment projections are presented by Census Tracts and combined into Forecast Analysis Zones (FAZ's). FAZ's are established by the Puget Sound Regional Council (PSRC) for the purpose of population and employment forecasting. FAZ's typically consist of several Census Tracts which have been combined into larger areas because they exhibit similar existing and projected demographic characteristics.

The projections contained in Table 4-1 are based on information from the PSRC and has been modified to fit the service area boundaries of the District. As indicated, it is expected that population and employment within the District will increase over the immediate and long range planning periods. The most significant increases are expected in the multi family and commercial (including industrial) customer classification. This shift in development is expected as a result of infill development and single family property redevelopment. The biggest influence on future development and growth within the District is expected to be increased activity and development related to Sea-Tac International Airport, which abuts the District's southwestern boundary.

## 4.5 FLOW PROJECTIONS

Using the population and employment forecasts presented in Paragraph 4.4 and Table 4-1, flow projections have been developed for the District's future service area by primary drainage basins. Projected flows are indicated in Table 4-2. Several assumptions were utilized in developing the projected flows contained in Table 4-2:

- The future service area, as defined in Chapter 2 of this document, includes areas which could be served by the District, including those areas in the eastern portion of the District which could also be served by the City of Tukwila. Although the projected flows are not substantial, it is important to note that service by the District is dependent on the timing of development and Tukwila's desire to extend service to these currently unserved properties.
- Average daily flows have been determined using the following criteria:
  - Residential flows: 75 gallons/capita/day
  - Industrial flows: 75 gallons/employee/day
  - Commercial flows: 35 gallons/employee/day
- Peak flows have been determined by applying a peaking factor of 2.5 to average daily flows and do not include infiltration and inflow.
- Future infiltration and inflow (I/I) has been calculated at 1,100 gallons/acre/day. The District has recently conducted an I/I study which is included in the Appendices to this Plan and indicates that currently I/I ranges from approximately 1,100 gpad in some basins to nearly 2,500 gpad in others. Future facility planning is based on achieving



an overall I/I rate of 1,100 gpad and Val Vue has adopted an aggressive program for I/I reduction and prevention. As indicated in the Capital Facilities Plan included in Section 7 of this Plan, several recommended projects are intended to address current I/I issues.



**TABLE 4-1  
POPULATION AND EMPLOYMENT FORECASTS**

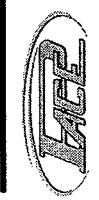
FAZ/ CTract	% in Dist.	1990					2000					2010					2020					
		SF HH	MF HH	Pop- ulation	Employ- ment		SF HH	MF HH	Pop- ulation	Employ- ment		SF HH	MF HH	Pop- ulation	Employ- ment		SF HH	MF HH	Pop- ulation	Employ- ment		
3600	5%																					
283.00	33%	364	3	934	2,072	401	3	1,020	2,516	417	4	1,057	2,706	505	5	1,208	3,026	568	6	1,347	3,223	
		364	3	934	2,072	401	3	1,020	2,516	417	4	1,057	2,706	505	5	1,208	3,026	568	6	1,347	3,223	
3705	27%																					
273.00	100%	1,246	631	4,764	1,278	1,359	789	5,347	1,340	1,408	856	5,597	1,366	1,713	1,277	6,977	1,892	1,995	1,979	9,124	2,185	
281.00	44%	189	174	812	522	189	206	870	562	189	220	895	579	225	314	1,116	1,099	262	450	1,459	1,229	
284.01	2%	1	2	7	314	1	3	8	340	1	3	8	352	1	5	13	401	1	7	16	453	
284.02	100%	980	372	3,205	1,120	1,028	442	3,415	1,199	1,049	472	3,505	1,233	1,366	697	4,455	1,949	1,723	1,034	5,825	2,247	
284.03	10%	112	99	425	119	110	114	443	137	109	121	450	145	137	182	590	144	158	265	771	181	
		2,529	1,278	9,214	3,353	2,688	1,553	10,083	3,578	2,756	1,672	10,455	3,675	3,442	2,475	13,150	5,485	4,140	3,735	17,196	6,295	
3816	10%																					
269.00	100%	450	82	1,421	110	482	91	1,498	116	495	95	1,531	118	540	107	1,555	129	563	142	1,663	129	
		450	82	1,421	110	482	91	1,498	116	495	95	1,531	118	540	107	1,555	129	563	142	1,663	129	
3825	80%																					
264.00	100%	967	1,256	5,143	4,374	971	1,397	5,364	4,004	973	1,457	5,459	3,845	990	1,598	5,471	3,969	778	1,906	5,598	3,931	
270.00	66%	648	76	2,000	89	679	84	2,064	116	692	87	2,092	127	734	95	2,098	146	747	112	2,148	163	
271.00	100%	677	421	2,609	369	712	474	2,774	454	727	497	2,844	490	745	538	2,851	550	701	626	2,917	597	
274.00	48%	800	27	2,128	390	834	30	2,184	493	849	31	2,207	537	894	33	2,214	610	918	39	2,267	660	
		3,092	1,780	11,881	5,222	3,196	1,984	12,386	5,066	3,241	2,072	12,602	4,999	3,363	2,264	12,633	5,274	3,144	2,684	12,930	5,352	
3905	52%																					
263.00	16%	73	13	183	2,944	84	18	209	2,789	88	20	220	2,723	129	35	314	2,897	173	55	430	3,098	
272.00	82%	491	217	1,705	4,006	517	284	1,897	4,691	528	313	1,980	4,985	689	575	2,823	6,566	809	945	3,859	8,028	
282.00	84%	571	905	3,046	710	483	1,191	3,390	1,267	445	1,314	3,537	1,506	233	2,410	3,046	5,045	0	3,664	6,897	3,899	
		1,136	1,134	4,934	7,660	1,084	1,493	5,497	8,748	1,061	1,647	5,738	9,214	1,051	3,020	6,184	14,508	982	4,664	11,186	15,025	
Total District		7,571	4,277	28,384	18,417	7,850	5,125	30,483	20,023	7,970	5,489	31,383	20,712	8,902	7,871	34,730	28,421	9,397	11,231	44,321	30,024	
% Change						3.69%	19.83%	7.39%	8.72%	1.52%	7.09%	2.95%	3.44%	3.24%	9.99%	2.98%	8.86%	5.56%	42.68%	27.62%	5.64%	
		Single-Family	Multi-Family	Pop-ulation	Com-mercial	Single-Family	Multi-Family	Pop-ulation	Com-mercial	Single-Family	Multi-Family	Pop-ulation	Com-mercial	Single-Family	Multi-Family	Pop-ulation	Com-mercial	Single-Family	Multi-Family	Pop-ulation	Com-mercial	
Number of Connections (Commercial in ERU's, all others in units)		6,251	4,592	30,483	4,048	6,496	4,918	31,383	4,187	7,767	7,053	34,730	5,746	8,900	10,063	44,321	6,070	8,900	10,063	44,321	6,070	
		PROJECTED ERUS	3,674		4,048	6,496	3,934		4,187	7,767	5,642		5,746	8,900	8,050		5,746	8,900	8,050		6,070	

Notes: Projections are based on Puget Sound Regional Council Data and adjusted to fit the District's service area.



**TABLE 4-2  
POPULATION AND FLOW PROJECTIONS BY DRAINAGE BASINS**

Drainage Basin	Acres	1990				1997				2000				2010				2020			
		Total Res-idential	Total Comm/Ind	TOTAL	Total Res-idential	Total Comm/Ind	TOTAL	Total Res-idential	Total Comm/Ind	TOTAL	Total Res-idential	Total Comm/Ind	TOTAL	Total Res-idential	Total Comm/Ind	TOTAL	Total Res-idential	Total Comm/Ind	TOTAL		
Beverly Park	476	2,467	903	3,370	2,588	844	4,275	2,640	818	3,458	2,666	852	3,518	2,800	847	3,647					
Glen Acres	484	2,514	1,036	3,550	2,606	976	4,557	2,645	950	3,595	2,652	993	3,645	2,715	998	3,713					
Rainier Vista	953	4,931	2,244	7,175	5,274	2,168	9,609	5,421	2,135	7,556	5,841	2,390	8,231	6,567	2,491	9,058					
Duwamish	425	599	3,363	3,962	643	3,176	6,995	662	3,096	3,758	760	3,283	4,043	888	3,486	4,374					
West Duwamish	124	869	1,270	2,139	931	1,376	3,684	958	1,422	2,380	1,134	1,763	2,897	1,363	2,063	3,426					
Macadam	219	641	1,121	1,762	713	1,339	3,391	744	1,432	2,176	1,061	1,940	3,001	1,451	2,394	3,845					
Midway	141	902	517	1,419	962	556	2,073	987	572	1,559	1,255	804	2,059	1,642	922	2,564					
McMicken	611	6,031	3,258	9,289	6,448	3,854	14,157	6,627	4,110	10,737	7,723	4,939	12,662	9,285	5,448	14,733					
SW Suburban	647	2,567	2,556	5,123	2,865	2,940	8,746	2,993	3,105	6,098	3,902	4,134	8,036	5,173	5,007	10,180					
Riverton	913	2,777	965	3,742	2,979	1,055	5,090	3,066	1,094	4,160	3,423	1,695	5,118	3,996	1,895	5,891					
Three Tree	1,033	3,894	1,369	5,263	4,273	1,914	8,101	4,435	2,148	6,583	6,095	3,656	9,751	8,210	4,670	12,880					
<b>TOTAL</b>	<b>6,026</b>	<b>28,192</b>	<b>18,602</b>	<b>52,820</b>	<b>30,282</b>	<b>20,198</b>	<b>70,678</b>	<b>31,178</b>	<b>20,882</b>	<b>52,060</b>	<b>36,512</b>	<b>26,449</b>	<b>62,961</b>	<b>44,090</b>	<b>30,221</b>	<b>74,311</b>					
<b>AVERAGE DAILY FLOWS (gpm)</b>																					
Beverly Park	476	128	36	164	135	31	197	138	29	166	139	30	168	146	29	174					
Glen Acres	484	131	40	171	136	34	205	138	32	170	138	33	171	141	32	173					
Rainier Vista	953	257	81	338	275	72	418	282	68	350	304	74	378	342	74	416					
Duwamish	425	31	164	196	33	149	332	34	143	177	40	143	183	46	146	193					
West Duwamish	124	45	50	96	49	50	148	50	49	99	59	57	116	71	63	134					
Macadam	219	33	44	77	37	47	131	39	48	87	55	60	115	76	71	146					
Midway	141	47	13	60	50	14	78	51	14	66	65	20	85	86	23	108					
McMicken	611	314	87	401	336	100	537	345	106	451	402	126	528	484	138	622					
SW Suburban	647	134	95	228	149	100	349	156	102	258	203	126	329	269	147	416					
Riverton	913	145	27	172	155	28	212	160	29	188	178	44	222	208	48	256					
Three Tree	1,033	203	35	238	223	48	318	231	53	284	317	90	407	428	115	542					
<b>TOTAL</b>	<b>6,026</b>	<b>1,468</b>	<b>673</b>	<b>2,141</b>	<b>1,577</b>	<b>673</b>	<b>2,924</b>	<b>1,624</b>	<b>674</b>	<b>2,297</b>	<b>1,902</b>	<b>801</b>	<b>2,703</b>	<b>2,296</b>	<b>886</b>	<b>3,182</b>					



**TABLE 4-2 (continued)  
POPULATION AND FLOW PROJECTIONS BY DRAINAGE BASINS**

Drainage Basin	Acres	PEAK FLOWS(gpm)														
		1990			1997			2000			2010			2020		
		Total Residential	Total Comm/Ind	TOTAL	Total Residential	Total Comm/Ind	TOTAL	Total Residential	Total Comm/Ind	TOTAL	Total Residential	Total Comm/Ind	TOTAL	Total Residential	Total Comm/Ind	TOTAL
Beverly Park	476	321	90	411	337	77	492	344	72	416	347	74	421	365	71	436
Glen Acres	484	327	101	428	339	86	512	344	80	424	345	82	428	354	80	434
Rainier Vista	953	642	203	845	687	179	1,045	706	169	875	761	184	945	855	186	1,041
Duwamish	425	78	411	489	84	373	830	86	357	443	99	359	458	116	366	482
West Duwamish	124	113	126	239	121	124	369	125	123	248	148	142	289	177	158	336
Macadam	219	83	109	192	93	118	328	97	121	218	138	150	288	189	177	366
Midway	141	117	33	150	125	35	194	129	35	164	163	50	213	214	57	271
McMicken	611	785	218	1,003	840	251	1,341	863	265	1,128	1,006	314	1,320	1,209	345	1,554
SW Suburban	647	334	237	571	373	250	873	390	256	646	508	315	823	674	366	1,040
Riverton	913	362	68	430	388	71	529	399	72	471	446	109	555	520	121	641
Three Tree	1,033	507	87	594	556	119	795	577	133	711	794	225	1,018	1,069	287	1,356
<b>TOTAL</b>	<b>6,026</b>	<b>3,671</b>	<b>1,682</b>	<b>5,353</b>	<b>3,943</b>	<b>1,683</b>	<b>7,310</b>	<b>4,060</b>	<b>1,684</b>	<b>5,744</b>	<b>4,754</b>	<b>2,004</b>	<b>6,758</b>	<b>5,741</b>	<b>2,215</b>	<b>7,956</b>

PEAK FLOWS Including Infiltration and Inflow (gpm)																
Beverly Park	476			775			778			780			785			800
Glen Acres	484			798			795			424			797			803
Rainier Vista	953			1,573			1,594			875			1,673			1,769
Duwamish	425			814			782			443			782			806
West Duwamish	124			334			340			248			384			430
Macadam	219			360			378			218			455			533
Midway	141			258			267			164			321			378
McMicken	611			1,470			1,557			1,128			1,787			2,021
SW Suburban	647			1,065			1,118			646			1,317			1,534
Riverton	913			1,127			1,156			471			1,252			1,339
Three Tree	1,033			1,383			1,465			711			1,808			2,145
<b>TOTAL</b>	<b>6,026</b>			<b>9,956</b>			<b>10,230</b>			<b>6,107</b>			<b>11,361</b>			<b>12,559</b>

Flow projections are based on 75 gal/capita/day for residential, 75 gal/employee/day for manufacturing uses, and 35 gal/employee/day for other non-residential uses. A peaking factor of 2.5 has been applied to average daily flows to arrive at peak flows. Infiltration and inflow has been estimated at 1,100 gallons per acre per day.



## **CHAPTER 5**

### **EXISTING SYSTEM DATA**

#### **5.1 GENERAL**

Currently, Val Vue Sewer District serves approximately 7,000 connections, or approximately 14,000 Equivalent Residential Units. These connections are served through a network of collector and interceptor lines ranging in size from 6 to 24 inches in diameter. There are approximately 104 miles of sanitary sewer lines in the Val Vue system and pipe materials include PVC (38%), concrete (25%), clay (24%), ductile iron (6%), AC (3%) and other miscellaneous materials (4%). There are eleven primary drainage basins within Val Vue Sewer District. These drainage basins have been determined based on topography as well as the actual facilities that serve each area. An additional 25 drainage sub-basins occur within the primary basins. Val Vue currently maintains 19 pump stations to compensate for topography in the area.

The District does not own or maintain wastewater treatment facilities and instead relies on King County-Metro, Southwest Suburban Sewer District and Midway Sewer District for treatment and disposal of wastewater generated by the District's customers.

Detailed information regarding the primary features of the Val Vue system is put forth in this Chapter and on the Comprehensive Plan Map included at the back of this document. Subsequent portions the Plan identify the minimum design criteria used to evaluate the existing system, details of the system analysis and recommended system improvements.

#### **5.2 DRAINAGE BASINS**

The following provides a description of the primary drainage basins and sub-basins identified for Val Vue Sewer District. Figure 5-1 provides an overview of the drainage basins within the District and they are also included on the Comprehensive Plan Map at the back of the document.

Drainage basins have been identified based on topography, direction of flow within the existing system, and the facilities to which the Val Vue system discharges. Sanitary sewer drainage basins differ somewhat from the surface drainage basins identified by cities and King County for storm drainage purposes. Sanitary sewer systems are provided greater flexibility due to the depth of the piping systems, and can encompass a larger area than surface water drainage basins. No attempt has been made to correlate the sanitary drainage basins of Val Vue Sewer District with the surface water drainage basins of other jurisdictions.

A description of the primary basins and sub-basins within the Val Vue area is presented below. Additional information regarding pumping facilities and connections to other systems for wastewater treatment is presented later in this Chapter.



**LEGEND**

- SERVICE AREA BOUNDARY
- PRIMARY BASINS
- ◇ 20 DRAINAGE SUB-BASINS
- PUMP STATION
- SEWER PIPE



**FIGURE 5-1  
SYSTEM MAP**

**VAL VUE SEWER DISTRICT  
COMPREHENSIVE SEWER SYSTEM PLAN**

### 5.2.1 McMicken Basin

The McMicken basin is located in the southeastern most portion of the District and includes drainage sub-basins 11 and 12. The area is generally bounded on the north by South 16<sup>th</sup> Street, on the west by 40<sup>th</sup> and 42<sup>nd</sup> Avenues South, on the east by the District's eastern boundary at Interstate Highway 5, and on the south by the District's southern boundary at South 176<sup>th</sup> and 182<sup>nd</sup> Streets.

Sub-basin 11, which includes the northern portion of the McMicken basin, is served entirely by gravity flow to the north and east and discharges into the King County-Metro system at two separate connections. Connections to the King County-Metro system are located near the intersections of 51<sup>st</sup> Avenue South and South 160<sup>th</sup> Street, and State Route 518 and Interstate Highway 5.

Sub-basin 12 generally flows by gravity to Pump Station 2 (McMicken) where it pumped through an 8-inch force main to sub-basin 11. The exception to this is the southernmost portion sub-basin 12, which is isolated by a steep ravine from the remainder of the sub-basin. A dosing station, or siphon, is located at approximately South 176<sup>th</sup> Street, adjacent to the Interstate 5 right-of-way, to facilitate flow across the ravine and, eventually, to Pump Station 2.

### 5.2.2 Midway Basin

The Midway drainage basin is located in the southwestern portion of the District and includes drainage sub-basin 13. The Midway basin is designated as such because wastewater flows from it are, or will be directed to Midway Sewer District for treatment and disposal. The Midway basin is larger than the area which currently flows by gravity to Midway Sewer District, and includes areas which were previously part of the Three Tree basin. Currently, there are two connections to Midway Sewer District: one located at 172<sup>nd</sup> Street and Pacific Highway South; and, one located at approximately 2900 South 176<sup>th</sup> Street.

In order to increase the area draining to Midway Sewer District consistent with the basin boundary shown, the District proposes construction of two additional connections to the Midway system. These proposed connections have been tentatively located at South 170<sup>th</sup> Street and 29<sup>th</sup> Avenue South and 32<sup>nd</sup> Avenue South and South 176<sup>th</sup> Street, although final location of the facilities will depend on proposed development within sub-basin 13.

### 5.2.3 Three Tree Basin

Val Vue's Three Tree basin is located in the southern and south central portion of the District, in the vicinity of South 154<sup>th</sup> Street and 52<sup>nd</sup> Avenue South. Sub-basins 7, 8, 9, 10 are included in the Three Tree basin and flow by gravity to two connections to King County-Metro located northwest of the intersection of State Route 518 and Interstate Highway 5. This basin, as represented herein, is slightly smaller due to the realignment of its boundary with the Midway Basin, as discussed previously.





Several areas within the Three Tree basin are currently unsewered, especially in the vicinity of the intersection of State Route 518 and Interstate 5. Much of the unsewered area is outside of the District's legal boundary and within the City of Tukwila. These areas are, however, included in the District's service area because they could logically be served by an extension of the District's system. The District would only serve these particular areas if it is determined to be the best alternative and extension of service is requested by Tukwila. Specific improvements required for extension of service to unsewered areas and other system improvements within the Three Tree basin are discussed in further detail in Chapter 7 of this document.

#### **5.2.4 Macadam Basin**

The Macadam basin serves the eastern portion of the District and includes sub-basin 6. This basin is generally bounded on the north by South 130<sup>th</sup> Street; on the east by the District boundary and I-5; on the south by South 148<sup>th</sup> Street. The westerly boundary is generally along 46<sup>th</sup> Avenue South in the southerly portion and 40<sup>th</sup> and 42<sup>nd</sup> Avenues South in the northerly portion of the basin.

Flows from this basin are directed to the north and east through a series of 6- and 8-inch gravity lines. In 1995 the District abandoned the Macadam Road Pump Station which was previously required for discharge into King County Metro's Interurban Interceptor at 13300 Interurban Avenue South. Abandoning the pump station was possible because King County-Metro upgraded the Interceptor at a greater depth. This allows for gravity flow directly to the King County-Metro system.

Service to unsewered areas in the Macadam basin will require the construction of several small extension projects to accommodate future development in the southeastern portion of the basin. Gravity service could be provided to this area, however, since the area is outside of the District's legal boundary and within the City of Tukwila, the District would provide service to the area only through an agreement with Tukwila.

#### **5.2.5 Riverton Basin**

The Riverton basin is located in the central area of the District and includes sub-basins 2, 3, 4, 5, and 14. This basin is generally bounded on the north by State Route 599; on the west by 40<sup>th</sup> and 42<sup>nd</sup> Avenues South; on the south by South 146<sup>th</sup> Street; and on the west by Military Road South. Service to this area is provided by a combination of gravity flow and pumping stations as further described below by individual drainage sub-basins.

Flows from the entire Riverton basin are directed through sub-basin 3. Facilities within sub-basin 3 all flow by gravity and include a network of 6- and 8-inch collector sewers and a 12- and 15-inch interceptor located on South 130<sup>th</sup> Street. This interceptor discharges to King County-Metro through the District's primary connection to the regional system located at 42<sup>nd</sup> Avenue South and South 128<sup>th</sup> Street. This connection is referred to as the "Val Vue" connection.



Sub-basin 2 covers the northern portion of the Riverton basin. Two pump stations, Pump Station Nos. 6 (Inco) and 7 (Metro) serve the area and direct flows southeasterly to sub-basin 3 and the Val Vue connection. Pump Station No. 7 is located in the northern portion of the basin. It's primary function is to serve Metro's South Base bus facility in the vicinity of South 120<sup>th</sup> Street. Flows from this station are pumped south along East Marginal Way South and discharged to a manhole located across from 12265 East Marginal Way South. A 12-inch diameter gravity line carries these flows to Pump Station No. 6, which provides service to the remainder of the basin. Flows from Pump Station No. 6 are pumped through an 8-inch diameter force main located in East Marginal Way South and discharged to sub-basin 3 at South 130<sup>th</sup> Street.

Sub-basins 4 and 5 are served by a network of 6 through 15-inch gravity lines which flow by gravity to sub-basin 3 and the previously discussed Val Vue connection to King County-Metro.

Sub-basin 14 is located in the western portion of the Riverton basin and serves an area which was part of the Rainier Vista sewer system prior to that District merging into Val Vue. This sub-basin is currently served by Pump Stations 17 (Valley Trucking) and 20 (Hospital) which flow north to the Rainier Vista Basin. Scheduled improvements for sub-basin 14 include abandoning Pump Station No. 17 and routing flows west, through Pump Station No. 7 and to sub-basin 3. The sub-basin boundaries shown on the maps included in this document represent the realigned basins which will result from completion of these improvements.

#### **5.2.6 Duwamish Basin**

The Duwamish basin is located in the northeastern most area of the District and generally includes the industrial areas along East Marginal Way South, West Marginal Way South and Pacific Highway South, as well as the area north of State Route 599 and south of the Duwamish River, which is residential in nature. The Duwamish basin includes only sub-basin 1.

Drainage within the Duwamish basin is influenced by the Duwamish River, which bisects the basin, and the essentially flat topography of the area. Pump stations are required to accommodate service within this basin and flows are pumped to the District's connections to King County-Metro located near the intersections of East Marginal Way South and the Boeing Access Road, and at South 112th Street and the Seattle Transmission Line right-of-way.

Flows from the western portion of the basin, which is west of the Duwamish River and east of West Marginal Way South, are transported across the Duwamish River by Pump Station No. 11 (Boeing) and a 6-inch force main. Pump Stations 8 (East Marginal), 9 (Pacific Highway), and 10 (Towing) serve that portion of the basin which is east of the Duwamish River.

The southern portion of the Duwamish basin is that area which is located south of the Duwamish River and north of SR 599. Service to this area is currently limited to the



area west of East Marginal Way, where Pump Station 12 (Seagate) is utilized to transport flows north across the river to the main portion of the basin. The area east of East Marginal Way is an established residential area which utilizes on-site disposal systems. Provisions for future service to this area have been made by construction of a stub from Pump Station 12 across East Marginal Way South.

Unsewered areas within the Duwamish basin include the previously discussed residential area in the southeastern portion of the basin. Service to this area is anticipated to be provided by the construction of gravity collector sewers to a small lift station which will pump flows to Pump Station No. 12. At the time that sewers are constructed to serve this area, the rotating parts in Pump Station 12 will be replaced to accommodate increased flows.

### **5.2.7 West Duwamish Basin**

The West Duwamish basin is along the westerly banks of the Duwamish River in the northern portion of the District. This small basin contains sub-basin 15 and is served by a combination of gravity lines and pump stations. Wastewater from the basin flow southeasterly and are discharged to the King County - Metro system through the District's Pump Station No. 15 (Delta Marine) which is located near the intersection of South 96<sup>th</sup> Street and West Marginal Way. Pump Station No. 18 (Union Hall) is located in the northwestern corner of the West Duwamish basin and discharges through a forcemain to Pump Station No. 15. Three additional privately owned pump stations (Duwamish Manor, PSF and Yacht Club stations) serve the West Duwamish basin and are indicated on the Plan Map included at the back of this document.

### **5.2.8 Beverly Park Basin**

The Beverly Park drainage basin is located in the northwestern most portion of the District and is bisected by State Route 509, which runs north-south through the basin. The basin generally extends from 8<sup>th</sup> Avenue South and Des Moines Way South on the east to the District's westerly boundary, and from South 116<sup>th</sup> Street on the south to the District's northerly boundary (Seattle City limits).

The Beverly Park basin contains drainage sub-basins numbers 16 and 17 and flows from the area are discharged to King County - Metro through two separate connections. Flows from sub-basin 16 customers are directed to the northeast, through Pump Station No. 14 (96<sup>th</sup> Street) to a connection with King County - Metro adjacent to the pump station. Flows from sub-basin 17, which is in the northwestern portion of the Beverly Park basin, are directed to the northwest and a connection to King County - Metro at 1<sup>st</sup> Avenue South and Meyers Way South. Pump Station No. 13 (Aqua Way) is located within sub-basin 17 and provides service to a small area of the basin which is just west of State Route 509.

The Beverly Park Basin is served by a network of 8-inch collector sewers which flow into trunk lines ranging in size from 10- to 15-inches in diameter. Proposed improvements for this basin include the construction of ULID No. 25 in 1998, which will extend service to an estimated 100 connections located in the vicinity of South



112<sup>th</sup> Street, west of State Route 509. Details regarding this project and other proposed improvements in this basin are contained in Chapter 7.

### **5.2.9 Glen Acres Basin**

The Glen Acres drainage basin is a extends from 8<sup>th</sup> Avenue South on the west to 14<sup>th</sup> and 17<sup>th</sup> Avenues South on the east; and from just north of South 99<sup>th</sup> Street on the north to just south of South 124<sup>th</sup> Street on the south. The Glen Acres basin includes sub-basins 18 and 19 and operates entirely by gravity flow to the north, then east. Discharge to the King County - Metro system is through a manhole connection located near the intersection of 17<sup>th</sup> Place South and Pacific Highway South in the northeastern portion of the basin.

Sub-basin 18 and the northern half of sub-basin 19 are sewered by a network of 8-inch collector sewers flowing to a 12-inch trunk line along 99<sup>th</sup> Avenue South, and ultimately the above mentioned connection to King County - Metro. The southern portion of sub-basin 19 is currently unsewered. Service to the unsewered area, which is generally south of South 112<sup>th</sup> Street, will be accomplished by construction of gravity lines flowing north into the existing Glen Acres basin's system. Further discussion of future improvements in this basin are included in Chapter 7.

### **5.2.10 Southwest Suburban Basin**

The Southwest Suburban basin is located in the southwestern portion of the District and generally extends from 14<sup>th</sup>, 18<sup>th</sup> and 23<sup>rd</sup> Avenues South on the east to the District boundary at State Route 509 on the west; and from South 12<sup>th</sup> Street and South 124<sup>th</sup> Street on the north to the District boundary on the south. This basin is named such because flows from the area are directed to Southwest Suburban Sewer District for treatment and disposal in accordance with an interlocal agreement between the two agencies.

The Southwest Suburban basin includes drainage sub-basins 24 and 25. Most of the area included in this basin is currently unsewered, although as discussed in Chapter 7, conceptual plans for sewerage the entire basin have been made. Sub-basin 25, which includes the northwestern portion of the Southwest Suburban basin, will flow westerly by gravity to a recently constructed boring (South 129<sup>th</sup> Street and State Route 509 crossing) under State Route 509 south of South 128<sup>th</sup> Street and a connection to the Southwest Suburban Sewer District's 4<sup>th</sup> Avenue Interceptor on the west side of State Route 509.

Sub-basin 25 is currently connected to the Southwest Suburban Sewer District through three separate connections located at 7<sup>th</sup> Avenue South and South 136<sup>th</sup> Street, 8<sup>th</sup> Avenue South and South 136<sup>th</sup> Street, and at 16<sup>th</sup> Avenue South and South 144<sup>th</sup> Street. As sewers are provided to the western portion of sub-basin 25, the South 129<sup>th</sup> and State Route 509 crossing will be utilized to transport flows to Southwest Suburban Sewer District.



### 5.2.11 Rainier Vista Drainage Basin

The Rainier Vista drainage basin is a large basin which runs from north to south through the central portion of the District. Sub-basins 20, 21, 22, and 23 are all within the Rainier Vista basin. The basin is served by gravity to the north through a network of 6- and 8-inch collector sewers. Trunk lines along 20<sup>th</sup> Avenue South and Roseburg Avenue South, and 24<sup>th</sup> Avenue South range in size from 10- to 21-inches in diameter and carry flows north to a connection with the King County- Metro system near the intersection of Des Moines Way South and 17<sup>th</sup> Place South. Pump Stations 5 (Hilltop), 18 (Freeway) and 19 (Cul-de-sac) serve isolated areas of low topography within the Rainier Vista basin. Although most of the basin is sewerred, future development east of 24<sup>th</sup> Avenue South, in the vicinity of South 128<sup>th</sup> Street will require extension of existing facilities.

## 5.4 PUMP STATIONS

Val Vue Sewer District currently owns and operates 19 separate pump stations to compensate for the rolling topography of the area. Detailed information on the existing pump station is contained in Table 5-1. Analysis and recommendations concerning future pump station improvements is contained in Chapter 7.

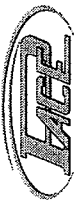
## 5.5 WASTEWATER TREATMENT AND DISPOSAL

Val Vue Sewer District does not own or operate a wastewater treatment facility and relies on the treatment and disposal facilities of other agencies. More than 85% of flows generated in the District are discharged into the King County-Metro system for treatment and disposal. The remainder of flow from the District is discharged into either the Southwest Suburban Sewer District system or the Midway Sewer District system for treatment and disposal. The District maintains interlocal agreements with King County-Metro, Southwest Suburban Sewer District, and Midway Sewer District to accomplish this and copies of these agreements are summarized in Chapter 2 and available at the District office for review. A summary of the District's connections to these other agencies is provided in Table 5-2.



**TABLE 5 - 1  
VAL VUE SEWER DISTRICT  
SEWERAGE PUMP STATION SUMMARY**

Station	Name/Address	Year*	Manufacturer	Capacity	Electrical	Emergency Power	Location Basin/City
2	McMicken 17036 53 <sup>rd</sup> Ave. So.	1995	Triangle Pump ABS Submersible	942 GPM 2 @ 33.5 HP	480V 3 Phase	Full Time Portable Unit	Basin 12 Tukwila
3	24 <sup>th</sup> Avenue 2400 So. 152 <sup>nd</sup> St.	1981	Cornell/Ideal Duplex Wet Well Mounted	100 GPM 2 @ 15 HP	480V 3 Phase	Emergency Plug	Basin 2 SeaTac
4	142 <sup>nd</sup> Street 14055 20 <sup>th</sup> Ave. So.	1990	Peabody Barnes Submersible Duplex	130 GPM 2 @ 2 HP	240V 3 Phase	Emergency Plug	Basin 4 SeaTac
5	Hill Top 10432 17 <sup>th</sup> Ave. So.	1996	Hydromatic Submersible Duplex	180 GPM 2 @ 5 HP	240V 1 Phase	Emergency Plug	King County
6	Inco 3700 So. 124 <sup>th</sup> St.	1993	Meyers 4VHX150M4-43 Submersible Duplex	300 GPM 2 @ 15 HP	480V 3 Phase	Full Time Portable Unit	Basin 2 Tukwila
7	Metro 11911 E. Marginal Way	1986	Dakota Pump Duplex Wet Well Mounted	200 GPM 2 @ 5 HP	480 V 3 Phase	Emergency Plug	Basin 2 Tukwila
8	E. Marginal Way 11200 E. Marginal Way	1990	Cascade/Cornell Ideal Duplex Wet Well Mounted	200 GPM 2 @ 3 HP	240V 3 Phase	Emergency Plug	Basin 1 Tukwila
9	Pac. Highway 11201 Pacific Hwy. So.	1990	Cascade Ideal Duplex ABS Submersible	520 GPM 2 @ 8 HP	240V 3 Phase	Emergency Plug	Basin 1 Tukwila
10	Towing Co. 10712 E. Marginal Way	1980	Ideal - Duplex Cornell Vacuum Lift	400 GPM 2 @ 3 HP	240V 3 Phase	Emergency Plug	Basin 1 Tukwila
11	Boeing 10500 W. Marginal Way	1986	Ideal/Cascade Cornell Duplex Wet Well Mounted	300 GPM 2 @ 5 HP	480V 3 Phase	Emergency Plug	Basin 1 Tukwila
12	Seagate 11601 Interurban Ave. So.	1990	Cascade Ideal - Duplex ABS Submersible	200 GPM 2 @ 10 HP	240V 3 Phase	Emergency Plug	Basin 2 Tukwila



**TABLE 5 - 1 (Continued)  
VAL VUE SEWER DISTRICT  
SEWERAGE PUMP STATION SUMMARY**

Station	Name/Address	Year*	Manufacturer	Capacity	Electrical	Emergency Power	Location Basin/City
13	Aqua Way 10202 4 <sup>th</sup> Ave. So.	1982	Duplex Submersible	200 GPM 2 @ 5 HP	240V 3 Phase	Full Time Fixed Unit	King County
14	96 <sup>th</sup> Street 96 <sup>th</sup> St. & Des Moines Way	1986	Triangle Pump ABS Submersible	250 GPM 2 @ 9 HP	480V 3 Phase	Emergency Plug	King County
15	Delta Marine 1600 So. 96 <sup>th</sup> St.	1977	Duplex Submersible	200 GPM 2 @ 5 HP	240V 3 Phase	Full Time Fixed Unit	King County
16	Union Hall So. 92 <sup>nd</sup> St. & 15 <sup>th</sup> Ave. So	1980	Duplex Submersible	215 GPM 2 @ 5 HP	240V 3 Phase	Full Time Fixed Unit	King County
17	Valley Trucking 12001 Pacific Hwy. So.	1993 Aban- doned 1999	Yeomans Chicago Corp Reliance Electric	370 GPM 2 @ 20 HP 2 @ 40 HP	480V 3 Phase	Full Time Fixed Unit	King County
18	Freeway 11032 26 <sup>th</sup> Ave. So.	1989	Aurora Pump Co.	175 GPM 2 @ 10 HP	480V 3 Phase	Full Time Fixed Unit	King County
19	Cul-De-Sac 12830 24 <sup>th</sup> Ave. So.	1971	Duplex Submersible	100 GPM 2 @ 3 HP	240V 3 Phase	Emergency Plug	SeaTac
20	Hospital 2925 S. 128 <sup>th</sup> St.	1984	Reliance Frame Mounted Duplex Submersible	541 GPM 2 @ 15 HP	480V 3 Phase	Emergency Plug	SeaTac

\* Indicates year of construction or most recent upgrade.

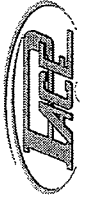


TABLE 5 - 2

## VAL VUE SEWER DISTRICT CONNECTIONS TO OTHER SYSTEMS

Connection With	Approximate Location	Val Vue		Into Pipe Size	Type
		Pipe Size	Drainage Basin		
King County - Metro	1 <sup>st</sup> Ave. S. & Meyers Way	10-inch	Beverly Park	12-inch	Gravity
King County - Metro	S. 96 <sup>th</sup> St. & Des Moines Way So.	8-inch FM	Beverly Park	36-inch	Pump Sta. 14
King County - Metro	S. 96 <sup>th</sup> St. & W. Marginal Way	4-inch FM	W. Duwamish	30-inch	Pump Sta. 15
King County - Metro	17 <sup>th</sup> Pl. So. & W. Marginal Way	12-inch	Glen Acres	24-inch	Gravity
King County - Metro	W. of 17 <sup>th</sup> Pl. So. & Des Moines Way So.	21-inch	Rainier Vista	24-inch	Gravity
King County - Metro	W. of Pacific Hwy. S. & E. Marginal Way	8-inch FM	Duwamish	42-inch	Pump Sta. 10
King County - Metro	So. 128 <sup>th</sup> St. & 42 <sup>nd</sup> Ave. So.	15-inch	Riverton	15-inch	Gravity
King County - Metro	Interurban Ave. So. & Gateway Dr.	12-inch	Macadam	12-inch	Gravity
King County - Metro	52 <sup>nd</sup> Ave. So. & ± Approx. S. 152 <sup>nd</sup> St.	12-inch	Three Tree	24-inch	Gravity
King County - Metro	Renton Three Tree Rd. & 52 <sup>nd</sup> Ave. So.	21-inch	Three Tree	24-inch	Gravity
King County - Metro	S. 160 <sup>th</sup> St. & 51 <sup>st</sup> Ave. So.	8-inch	McMicken	12-inch	Gravity
King County - Metro	N. of So. 160 <sup>th</sup> St. @ Interstate 5	12-inch	McMicken	10-inch	Gravity
Midway Sewer District	So. 176 <sup>th</sup> St. & 38 <sup>th</sup> Ave. So.	8-inch	Midway	8-inch	Gravity
Midway Sewer District	So. 176 <sup>th</sup> St. & 29 <sup>th</sup> Ave. So.	8-inch	Midway	8-inch	Gravity
Midway Sewer District	So. 171 <sup>st</sup> St. & Pacific Hwy So.	8-inch	Midway	8-inch	Gravity
SW Suburban Sewer Dist.	So. 144 <sup>th</sup> St. & 16 <sup>th</sup> Ave. So.	12-inch	SW Suburban	21-inch	Gravity
SW Suburban Sewer Dist.	8 <sup>th</sup> Ave. So. & S. 136 <sup>th</sup> St.	8-inch	SW Suburban	8-inch	Gravity
SW Suburban Sewer Dist.	7 <sup>th</sup> Ave. So. & S. 136 <sup>th</sup> St.	8-inch	SW Suburban	8-inch	Gravity
SW Suburban	So. 129 <sup>th</sup> St. W. of State Route 509	10-inch	SW Suburban	10-inch	Gravity (1998)





# **CHAPTER 6**

## **MINIMUM DESIGN CRITERIA**

### **6.1 INTRODUCTION**

In order to evaluate the District's existing system and plan for adequate future improvements to the system, it is necessary to define minimum design criteria. Minimum design criteria identified includes: typical domestic wastewater quantities generated by various customer classes and land uses; capacity requirements for various components of the system; and projected infiltration and inflow rates and peaking factors to be used in the design of facilities.

### **6.2 MINIMUM DESIGN REQUIREMENTS**

The State Department of Ecology's (DOE) "Criteria for Sewage Works Design" which was published in cooperation with the State Department of Health (DOH) and the U.S. Environmental Protection Service (EPA), sets forth the standards, guidelines and minimum design requirements for sanitary sewer systems operating within the State of Washington. This document, together with the District's minimum requirements and the District's "Rules and Regulations Governing Val Vue Sewer District's Sewage Collection Facilities" as put forth in the Appendices, establish the design criteria and construction standards to be used in evaluation and design. In addition, the District is required to comply with the requirements and regulations of the jurisdictions within which it operates. Val Vue Sewer District is within the corporate limits of the cities of Tukwila, SeaTac, Burien and unincorporated King County, and as such, conducts its operations consistent with the requirements, policies and procedures of those agencies.

### **6.3 DESIGN PERIOD**

In planning sewage facilities, it is necessary to evaluate both present conditions and future service needs, and to design a system compatible with variable demands over a given length of time, or design period. A 20-year minimum design period should be used in evaluating the system and developing a plan for future system improvements.

### **6.4 SYSTEM DESIGN**

All sanitary sewer systems are to be designed in accordance with good engineering practices and by a professional engineer approved by the District and registered in the State of Washington. All pipelines are to be designed and constructed in accordance with the latest "Criteria for Sewage Works Design" as published by the State Department of Ecology, the District's sewer extension policies, and the requirements put forth in this Comprehensive



Sewer System Plan. All main sewer lines are to be constructed under the District's jurisdiction and will be owned and maintained by the District.

Sewer system facilities must be designed with sufficient capacity to carry peak flows from the tributary area at ultimate development, unless other criteria has been established and/or approved by the District. Sewer systems shall be designed and constructed to achieve total containment of sanitary wastes and to minimize infiltration and inflow.

#### **6.4.1 Combined Sewers**

No combined sanitary and storm sewers are allowed within the District.

#### **6.4.2 Overflows**

No overflows or new overflow structures will be permitted.

#### **6.4.3 Collection Sewers**

All new mains are to be a minimum of 8-inches in diameter. Where specifically approved by the District, 6-inch lateral sewers may be installed but must be equipped with Worker Access Devices or clean outs at the end of the main.

Collection sewers and pump stations should be designed for ultimate development of the tributary areas based on the design factors outlined in Tables 6-1 and 6-2, and allowable infiltration and inflow rates.

Gravity sewers are to be used wherever possible. Pump stations will be allowed only after thorough investigation has shown that no other cost effective alternatives exist.

#### **6.4.4 Trunk and Interceptor Sewers**

Trunk and interceptor sewers shall be designed with sufficient capacity to carry peak flows at ultimate development conditions based on the criteria established in Tables 6-1 and 6-2. This flow represents the sum of several loadings calculated separately for each section of sewer or tributary area. The loadings consist of peak wastewater flows, groundwater infiltration, surface water inflow, and any other quantities which are unique to the individual pipeline.

#### **6.4.5 Flow Rates**

Flow in a sanitary sewer system is comprised of domestic, commercial and industrial wastes, groundwater infiltration and surface water inflow. All portions of the sanitary sewer system must be capable of carrying the peak volumes from these sources. Table 6-1 identifies the typical flows associated with various land use types.





#### **6.4.6 Infiltration and Inflow**

Infiltration is groundwater which enters sewer systems through pipe joints, porous pipes or similar openings in the system. Inflow is surface water which enters the sewer system through manhole covers or illegal connections such as footing drains, roof drains or area drains. Limiting infiltration and inflow is a primary goal of sanitary sewer utilities, as both infiltration and inflow contribute an unnecessary quantity of flow in the system, reduce capacity in the system available for wastewater flow and add to treatment and disposal costs.

Infiltration and inflow, or I/I, is expressed in units of gallons per acre per day (gpad). Although new sewers are constructed of materials and methods to eliminate I/I, some allowances must be made for the future deterioration of facilities and potential illegal connections to the system. Typical values to compensate for infiltration/inflow in system evaluation and design are 600 gpad for infiltration and 500 gpad for inflow. These typical values must be adjusted accordingly to suit local conditions. For example, older facilities are determined on a case by case basis and can be as high as 1,200 gpad for infiltration and 2,000 gpad for inflow. Val Vue Sewer District has recently accomplished the preliminary phases of a long range infiltration and inflow program by completing the I/I study provided in the Appendices of this Plan. Through monitoring of flows at various locations throughout the District, it has been determined that basin-wide I/I rates range from approximately 1,100 gpad to nearly 2,500 gpad. Planning for the District, however, is based on an District-wide average I/I rate of 1,100 gpad.

#### **6.4.7 Pipe Materials**

Plastic (PVC) pipe may be used for gravity sewer lines where soil foundation conditions permit and for slopes less than fifteen percent and depths less than 22 feet, unless otherwise approved by the District.

Cement lined ductile iron pipe is required for all other areas and for force mains. Ductile iron pipe placed in peat soils or potentially corrosive areas shall be polyethylene encased.

All rigid pipes must pass standard crushing, flexural and fill tests to insure the installation will be watertight and able to withstand projected earth loads.

Sanitary sewer pipes shall be connected by flexible rubber gasket type joints, or other method specifically approved by the District.

High Density Polyethylene (HDPE) pipe with thermally fused joints is to be used for all pipe bursting and directional drilling sanitary sewer installations.

#### **6.4.8 Sewer Locations**

In general, trunk and interceptor sewers are to be located in existing street rights-of-way or proposed street areas. Where required to utilize natural drainage course and topography, specific pipes may be located within easements.



#### **6.4.9 Depth**

Minimum depth of cover for a sewer line in street right-of-way is six feet. Minimum depth of cover for sewer lines installed in easements is three feet. Shallower depths may be used if pipe crush strength analyses are provided, although in no case shall the depth of cover be less than 30-inches.

#### **6.4.10 Separation**

Wherever possible, a minimum horizontal separation of ten feet, measured edge to edge, is required between gravity sanitary sewers and any existing potable water line. Sewer lines crossing water lines are to be laid below the water lines to provide a separation of at least 18 inches between the invert of the water line and the crown of the sewer pipe. Where the required separation of lines can not be achieved, sewer lines are to be constructed as specified in the DOE Criteria for Sewage Works Design.

#### **6.5.11 Roughness Coefficient**

An "n" value of 0.012 shall be used in Manning's formula for the design of sewer facilities.

#### **6.5.12 Slope**

All sewers shall be designed and constructed to give mean velocities at design flow of not less than 2.0 feet per second (fps). The required minimum slope of pipes are indicated in Table 6-3, although slopes greater than that are sometimes required to allow for higher velocities which will reduce maintenance requirements.

In side sewers, flows at less than super-critical depth are to be avoided because the associated shallow water depths often leave solids in the pipe. Over sizing sewers with respect to capacity in order to allow the use of flatter slopes should be avoided as this may result in operational capacities below sedimentation velocity (2 fps).

Sanitary sewers are to be laid with uniform slope between manholes. Sewers with slopes greater than 15% are to be anchored securely with concrete anchors or retaining gaskets. Sewers with slopes in excess of 40% or with change in velocity greater than 5 fps at any structure shall be equipped with an approved energy dissipater. Any such devices shall be reviewed by the District on a case-by-case basis.



TABLE 6-3 MINIMUM REQUIRED PIPE SLOPES			
Pipe Size	Min. Slope/100 Feet	Pipe Size	Min. Slope/100 Feet
4-inch	2.00% *	16-inch	0.14%
6-inch	1.00% *	18-inch	0.12%
8-inch	0.40%	21-inch	0.10%
10-inch	0.28%	24-inch	0.08%
12-inch	0.22%	27-inch	0.07%
14-inch	0.17%	30-inch	0.06%
15-inch	0.15%	36-inch	0.05%
* 4- and 6-inch pipe allowed for side sewers only			

#### 6.4.13 Alignment

Gravity sewers shall be designed with straight alignment between manholes.

#### 6.4.14 Downsizing

Downsizing of sewer lines, or the installation of a smaller diameter line downstream of a larger diameter line, will not be allowed, except where grade and velocity warrant and downsizing is specifically approved by the District.

### 6.5 MANHOLES

Manholes are to be installed at the end of each line, at all changes in grade, size, or alignment, at all intersections and at distances not greater than 400 feet.

The minimum diameter of manholes is 48 inches. The minimum clear opening in manholes shall be 23 inches. Larger size manholes may be required to accommodate special requirements.

Drop connections are discouraged in the District and shall be kept to an absolute minimum. If allowed by the District, it should be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert should be channeled to prevent deposit of solids.



## **6.6 SEWER PUMP STATIONS**

Design and construction of sewage pump stations and force mains is to be accomplished in accordance with the following minimum design criteria:

### **6.6.1 Location and Flood Protection**

Sewage pump stations are to be located as far as practical from present or proposed built-up residential areas, and all weather road access shall be provided to all pump stations. New pump stations and rehabilitations to existing pump stations are to be submersible type. Noise control, odor control, and station architectural design must be considered in the locating and design of sewage pump stations. Sites for pump stations must be of sufficient size to accommodate expansion of facilities to meet projected build-out conditions.

Operational components must be located at elevations above established 100 year flood/wave action or shall be adequately protected against such action. All pump stations must be designed to remain fully operational during 100 year flood conditions.

### **6.6.2 Pumping Rate and Number of Units**

At least two pumps must be provided at each pump station and each must be capable of handling the anticipated maximum flow. Where three or more pumps are provided, they shall be designed to fit actual flow conditions and must be of such capacity to handle anticipated maximum flow with the largest pump out of service.

### **6.6.3 Pump Cycle Ratios**

A pump cycle ratio represents the percentage of time during which a pump can be expected to run. Recommended pump replacement sizes are based on cycle ratios of 70% for theoretical peak day flows as generated for the design period conditions. Pump station peaking factors of 2.5 are used to arrive at peak flows from average day figures. Conversely, average day flows represent approximately 40% of peak design flows, so that pumps sized according to recommendations operate approximately 30% of the time. These cycle ratios were selected to provide a margin of safety against pump overheating and subsequent wet well flooding which might happen if mechanical problems were to occur at or near peak flow conditions. In addition, lower cycle ratios imply less running time and, therefore, longer pump life.

### **6.6.4 Pumps**

Pumps shall be capable of passing spheres of at least 3 inches in diameter. Pump suction and discharge openings shall be at least 4 inches in diameter.

Pumps shall be placed so that under normal operating conditions they will operate under a positive suction head (unless otherwise approved).



### **6.6.5 Controls**

Air operated pneumatic controls, mercury floats or ultrasonic controls will be used for all sewage pump stations. Provisions should be made to automatically alternate pumps in use. Pump stations with motors and/or controls below-grade should be equipped with a secure external disconnect switch.

### **6.6.6 Site Water**

Water service with an approved backflow prevention device is required at each pump station.

### **6.6.7 Bypass/Storage**

On-site or portable power units should be incorporated into station design. Small stations may require a plug-in device for a portable generator unit, however, large stations will require permanent standby power. Where portable generators are used, storage must be provided to permit time for the generator to be delivered and installed.

### **6.6.8 Alarm System**

The District has a computer controlled, radio monitored alarm system for each District owned and operated pump station. The system checks each station's status hourly, 24-hours a day, for the following conditions: Intrusion; Power failure; Wet dry well; High wet well; Low wet well; Smoke; Operator in trouble; and/or, Line failure.

Test circuits should be provided to enable the alarm system to be tested and verified as in good working order.





# **CHAPTER 7**

## **SYSTEM ANALYSIS AND PROPOSED IMPROVEMENTS**

### **7.1 GENERAL**

This section of the Comprehensive Plan details the results of analysis of the existing sanitary sewer system and provides alternatives and recommendations for improvements to the system.

Analysis of the system has been accomplished by drainage basin, as set forth in Chapter 4, and includes evaluation of all existing facilities (interceptors, collectors and pump stations) in each basin with regard to the current and projected flows. Alternatives for correction of deficiencies in the existing systems ability to serve the existing and projected population of the District have been developed and recommendations for improvements are included in the Capital Facilities Plan at the end of this Chapter.

Through continued upgrades and a stringent preventive maintenance program, Val Vue Sewer District has developed a sound sanitary sewer collection system with relatively few known deficiencies, aside from typical system replacement requirements that are inherent to any utility system. Although it is District policy to provide sanitary sewer service to all new development within its service area, it is difficult to predict the timing of new development. In the Val Vue area, it is almost as difficult to predict the type and magnitude of future developments because of the uncertainties surrounding future expansion of Sea-Tac International Airport. Nevertheless, this plan puts forth a conceptual plan for sewerage all areas of the District, but recognizes that the exact sizing and location of facilities will be determined at the time the service extensions are requested.

Projected wastewater flows through the year 2020 are presented in Chapter 4 of this document. A peaking factor of 2.5 was applied to average flows to determine the maximum flows generated by customers. Estimated infiltration and inflow (I/I) was added to the projected peak flows to arrive at projected peak flows under wet weather conditions. The combined rate of infiltration and inflow is estimated at 1,100 gallons per acres per day and this allowance is used to account for water entering the system through cracks, pipe joints, manhole covers, illegally connected storm drains, etc. For more detailed information regarding I/I in the Val Vue system, please refer to the I/I study provided in the Appendices.

### **7.2 OVERALL SYSTEM IMPROVEMENTS**

The improvements recommended in this Plan are included in the Capital Facilities Plan (CFP) outlined in Table 7-2 at the end of this Chapter and are shown on the Comprehensive Plan Map included at the back of this document. These improvements are required to provide adequate service to all areas of the District. They are intended to be conceptual in nature, especially where extension of sewers to currently unsewered areas is concerned. Only



significant projects are included and this Plan is not intended to provide detailed information regarding service to individual lots as may be required by specific development proposals within the service area.

The majority of improvements required are for the extension of service to areas which currently utilize on-site septic systems for wastewater disposal. Sewer service to these areas is generally anticipated to occur through formation of Utility Local Improvements District's (ULID's). Additional information on this and other types of financing is included in the Implementation Chapter of this Plan.

In addition to the specific projects outlined in the CFP, are annual expenses such as pump station rehabilitation and infiltration and inflow reduction. Pump station rehabilitation is included as an annual expense but priorities for the sequence of this work have not been established. Priorities for pump station improvements should be determined as part of the District's annual budgeting process and based on maintenance records, past problems and other field data. Similarly, the District's ongoing Infiltration and Inflow program has not been prioritized by areas of the District. Again, the District should rely on its maintenance staff for input regarding video inspection, manhole grouting and sealing of specific areas of the system.

## **7.3 DRAINAGE BASIN ANALYSIS**

The ability of the sewer system to accommodate and transport existing flows is analyzed herein. When the analysis shows that the current system is not capable of handling either existing or anticipated future flows, alternatives for system improvements have been considered and recommendations made.

Projected land use plays a key role in determining future system requirements. Future land use is considered in this Plan through inclusion of the land use plans of the various jurisdictions which control zoning within the District and through the use of detailed population and employment projections from the Puget Sound Regional Council. Population projections have been developed for the area by household type. Employment projections are based on the type of business activity.

A summary of the analysis of each primary drainage basin is presented below. Please refer to the maps in Chapter 5 or the full scale District map included at the back of this document for location information.

### **7.3.1 McMicken Basin**

The McMicken basin is located in the southeasternmost portion of the District and includes drainage sub-basins 11 and 12. Flows from this area are discharged to King County-Metro for treatment and disposal. Pump Station No. 2 (McMicken) pumps flow from the southern portion of this basin.

No deficiencies within the McMicken basin have been identified and proposed improvements in this area of the District are limited to the extension of the sewer line



along South 176<sup>th</sup> Street (CFP Project Number 17).

### **7.3.2 Midway Basin**

The Midway drainage basin is located in the southwestern portion of the District and includes drainage sub-basin 13. Flows from this basin are directed to the south and to Midway Sewer District for treatment and disposal. The Midway basin as represented herein, is larger than the area which currently flows by gravity to Midway Sewer District and includes areas which were previously part of the Three Tree basin.

Expansion of the Midway basin is recommended as a means of reducing the amount of flow being discharged to the King County-Metro system. In order to accomplish this, the District proposes construction of two additional connections to the Midway system (CFP Project No. 9).

The Midway basin is served by 8-inch gravity mains which have sufficient capacity to meet projected development in the area. The District is aware, however, of a proposal for large scale development in the southwestern portion of the basin, which may impact the location of proposed new connections to the Midway Sewer District and/or require developer financed improvements in this area.

### **7.3.3 Three Tree Basin**

Val Vue's Three Tree basin is located in the southern and south central portion of the District. Sub-basins 7, 8, 9, 10 are included in the Three Tree basin. This large basin is served by gravity flow through pipes ranging in size from 8- to 21-inches in diameter and discharges to King County-Metro. As mentioned above, the Three Tree basin as represented herein has been realigned to direct additional flows to the Midway basin. This will help increase the capacity in the interceptors within the Three Tree basin and reduce the amount of flow being discharged to King County-Metro.

Proposed Improvements in the Three Tree basin are limited to extension of service to currently unsewered areas (CFP Projects 13, 20, 31, 32, 33, and 34). It is anticipated that these improvements will be completed as required by development within the basin. Two of the identified projects (CFP Projects 33 and 34) could logically be served by Val Vue but are located outside the District's corporate boundaries and within the City of Tukwila. The District and City have entered into discussions to determine the most logical service provider in these areas and the District will not extend service in these areas without an agreement to do so with the City.

### **7.3.4 Macadam Basin**

The Macadam basin serves the eastern portion of the District and includes sub-basin 6. Flows from this basin are directed to the north and east through a series of 6- and 8-inch gravity lines.

No specific deficiencies or proposed improvement projects have been identified for the Macadam basin. However, isolated unsewered areas in the Macadam basin will



require the construction of several small extension projects to accommodate future development in the southeastern portion of the basin. Gravity service could be provided to this area, however, since a portion of the area is outside the District's corporate boundary and within the City of Tukwila, the District would provide service to the area only through an agreement with Tukwila.

### **7.3.5 Riverton Basin**

The Riverton basin is located in the central area of the District and includes sub-basins 2, 3, 4, 5, and 14. Service to this area is provided by a combination of gravity flow and pumping stations as described in Chapter 5. The Riverton Basin, as shown herein represents a realignment of the previous District basins. Specifically, an area which was previously served by Rainier Vista Sewer District has been interconnected to the Val Vue system in order to provide a more reliable and cost effective means of service. This allows for abandoning Pump Station No. 17 (Valley Trucking), construction of a gravity line to Pump Station No. 7 (Metro), upgrade of Pump Station No. 7 to accommodate additional flows, and extension of the force main from Pump Station No. 7 to connect directly into the force main from Pump Station No. 6 (Inco). These improvements are outlined in CFP Project No. 11 and have been completed. A potential future project within the Riverton basin is for abandonment of Pump Station No. 11 (Hospital) and routing of flows to the north through the new gravity line to be installed as part of CFP Project 11. Additional analysis of this possibility is recommended.

Other proposed projects for the Riverton basin include rehabilitation work (CFP Project No. 2) and extension of facilities (CFP Projects 3, 8, 16 and 30). As noted on the CFP, portions of this work have been accomplished during the development of this Plan. Information concerning the extent of these projects, timing and proposed method of financing are contained in Table 7-2.

### **7.3.6 Duwamish Basin**

The Duwamish basin is located in the northeasternmost area of the District and generally includes the industrial areas along East Marginal Way South, West Marginal Way South and Pacific Highway South, as well as the area north of SR 599 and south of the Duwamish River, which is residential in nature.

No existing system deficiencies were identified in the Duwamish basin and proposed improvements are limited to extension of service to the residential area in the southeastern portion of the basin (CFP Project 35). Service to this area will be provided by the construction of gravity collector sewers to a small lift station which will pump flows to Pump Station No. 12. At the time that sewers are constructed to serve this area, the rotating parts in Pump Station 12 will be replaced to accommodate increased flows.

### **7.3.7 West Duwamish Basin**

The West Duwamish Basin is along the westerly banks of the Duwamish River in the northern portion of the District. This small basin contains sub-basin 15 and is served



by a combination of gravity lines and pump stations. No deficiencies have been identified in this basin and therefore, no improvement projects are proposed for this area.

### **7.3.8 Beverly Park Basin**

The Beverly Park drainage basin is located in the northwesternmost portion of the District and contains drainage sub-basins numbers 16 and 17. Flows from the area are discharged to King County - Metro through two separate connections. Flows from sub-basin 16 connections are directed to the northeast, through Pump Station No. 14 (96<sup>th</sup> Street) to a connection with King County - Metro adjacent to the pump station. Flows from sub-basin 17, which is in the northwestern portion of the basin are directed to the northwest, and a connection to King County-Metro at 1<sup>st</sup> Avenue South and Meyers Way South. Pump Station No. 13 (Aqua Way) is located within sub-basin 17 and provides service to a small area of the basin which is just west of State Route 509.

Proposed improvements for this basin include the construction of ULID No. 25 in 1998 (CFP Project 14), which will extend service to an estimated 100 connections located in the vicinity of South 112<sup>th</sup> Street, west of State Route 509. CFP Project 15 is directly related to this project and includes installation of a significant trunk line along 8<sup>th</sup> Avenue South which will carry flows from the southern portion of the basin to existing interceptor lines along the northern portion of 8<sup>th</sup> Avenue South and South 96<sup>th</sup> Street. Portions of these projects have been completed, as indicated on Table 7-2, and additional construction in the next three years, as dictated by development and funding.

Additional projects scheduled for the Beverly Park basin include rehabilitation (upsizing) of the interceptor along South 96<sup>th</sup> Street. This project is expected after 2002.

### **7.3.9 Glen Acres Basin**

The Glen Acres Basin is a large basin which includes sub-basins 18 and 19 and operates entirely by gravity flow to the north and east.

Sub-basin 18 and the northern half of sub-basin 19 are sewered by a network of 8-inch collector sewers flowing to a 12-inch trunk line along 99<sup>th</sup> Avenue South, and ultimately a connection to King County-Metro.

The southern portion of sub-basin 19 is currently unsewered. Service to the unsewered area, which is generally south of South 112<sup>th</sup> Street, will be accomplished by construction of gravity lines flowing north into the existing Glen Acres basin's system. CFP Projects 24 and 25 outline a conceptual approach to providing service to this portion of the basin.

### **7.3.10 Southwest Suburban Basin**

The Southwest Suburban basin is located in the southwestern portion of the District and includes drainage sub-basins 24 and 25. Flows from this area are, or will be



directed to Southwest Suburban Sewer District for treatment and disposal.

Most of this basin is currently unsewered, and CFP projects 1, 7, 26, 27 and 28 provide a conceptual plan for extending service to this area. CFP Project 1 is for the recently constructed boring under State Route 509 at South 129<sup>th</sup> Street and connection to the Southwest Suburban Sewer District system on the west side of State Route 509. This connection will carry flows from the proposed collector sewers in the western portion of the basin.

### **7.3.11 Rainier Vista Drainage Basin**

The Rainier Vista Drainage Basin is a large basin which runs from north to south through the central portion of the District. Sub-basins 20, 21, 22, and 23 are all within the Rainier Vista basin. Pump Stations 5 (Hilltop), 18 (Freeway) and 19 (Cul-de-sac) serve isolated areas of low topography within the Rainier Vista basin. Although most of the basin is sewered, future development east of 24<sup>th</sup> Avenue South, in the vicinity of South 128<sup>th</sup> Street will require extension of existing facilities. Conceptual plans for serving this area are included in CFP Projects 18, 22, 23, and 16. Extension of sewers to this area will allow for the future abandonment of Pump Station 19 (Cul-de-sac). Flows currently being pumped by Pump Station 19 will instead be routed by gravity to the east.

Rehabilitation projects proposed or underway for the Rainier Vista Basin include CFP Projects 4, 5, 6, 10 and 12. Details regarding scheduling and funding for these projects are identified in the CFP.

## **7.4 PROJECT COST ESTIMATES**

Cost estimates have been developed for each project outlined in the Capital Improvements Plan. Cost estimates are based on past experience with similar projects, engineering judgement, anticipated time of year for construction, localized conditions affecting construction, competitive bidding conditions, and other factors. Because of these intangible factors, the exact cost of construction can vary significantly and cannot be accurately predicted until actual bids are received.

Due to the general nature of the projects recommended herein and the lack of detail on any particular project, it is important to realize that the actual design of the project and possible changes to the project could significantly alter the cost of the projects shown. Prior to initiation of the projects, project specifics should be detailed and cost estimates updated to reflect current conditions.

The cost estimates presented in Table 7-1 are based on 1997 prices and reflect total project costs. Total project costs included construction costs, contingency factors, and overhead costs such as engineering, administration, legal fees, taxes, etc. Overhead costs have been estimated at 35% of the construction cost and are broken down in Table 7-1.

Operation and maintenance costs, the costs of land acquisition and easements, and permit



costs, although potentially significant, have not been included in overhead costs or in project cost estimates. These costs should be considered in the initial design phase of any improvements.

<b>TABLE 7-1 ESTIMATED PROJECT OVERHEAD COSTS</b>	
<b>Element of Project</b>	<b>% of Construction Cost</b>
Engineering, Planning, Surveying	12.0%
Inspection	8.0%
Sales Tax	8.6%
District Administration	2.0%
Legal Fees	4.4%
<b>Total Overhead Costs</b>	<b>35.0%</b>

## **7.5 PROJECT SCHEDULES**

The Capital Facilities Plan outlined in Table 7-2 has been developed for a planning period from 1997-2005 but includes projects anticipated over the next ten to twenty years. The anticipated construction date for each facility is outlined in Table 7-2. Val Vue Sewer District develops an annual budget for construction projects. Through this process, the projects outlined in the CFP, along with any additional improvements which have been identified are scheduled for completion. In doing so, the District leaves itself flexibility in implementation of the CFP according to the actual conditions and requirements of the District in a given year.

Unfortunately, it is impossible to predict the timing of development and the need to extend service to currently unsewered areas of the District. The District relies on developers extensions and ULID's for the completion of this type of project. The CFP therefore does not indicate a specific time schedule for many of the required projects. Instead, these projects are annotated with ARBD, or "as required by development". It is the District's policy that all extensions to the system are paid for by the property owners requesting service.

## **7.6 PROJECT FINANCING**

The Capital Facilities Plan outlines possible methods of financing for all projects identified. Additional information on the types of financing available to the District is put forth in the Implementation Chapter of this Document.



APPROVED BY BOARD 5/16/2000

TABLE 7-2 VAL VUE SEWER DISTRICT 2000 CAPITAL IMPROVEMENTS PROGRAM									
Proj. No.	Project From	Along	To	Size	Units	Unit Cost	Cost	Schedule Complete	Funding Rates
1	509 Boring	Boring	E of SR 409	Casing	LS	\$350,000	\$350,000	Complete	
	W-SR-509 @ S-129th St								
	<b>TOTAL</b>								
2	S 125th @ Pacific Highway S Rehab	Easement	560' W	8"	560'	\$140	\$61,600	Complete	PWTF
	W-Side of Pac Hwy S								
	<b>TOTAL</b>								
3	S 141st St & 34th Ave S Replacement	Easement	150' NE	8"	450'	\$140	\$16,500	Complete	PWTF
	S-141st St & 34th Ave S								
	<b>TOTAL</b>								
4	Trestle Line Replacement	Easement	100' W	12" C	400'	\$100	\$10,000	Complete	PWTF
	99th St S & 14th Ave S								
	100' W of 99th & 14th Ave				80'	\$125	\$10,000		
	2 Manholes				2	\$2,500	\$5,000		
	<b>TOTAL</b>								
5	S 104th St Rehab	S 104th St	Des Moines Way	8"	1,100'	\$110	\$121,000	2001	PWTF
	W of 18th Ave S								
	<b>TOTAL</b>						\$121,000		
6	S 120th St & Des Moines Way S Rehab	Easement	250' W	8" (PB)	250'	\$80	\$20,000	Complete	PWTF
	150' S of 120th on DMW S								
	<b>TOTAL</b>								
7	Des Moines Way S & S 132nd St Sewer	Des Moines Way S	S-133rd St	40"	325'	\$125	\$40,625	2001	PWTF
	S-132nd St								
	<b>TOTAL</b>								
8	32nd Ave S & S 138th St Sewers	Easement	350' S of S 137th	8"	100'	\$110	\$11,000	2001	DE
	250' S of S 137th St				480'	\$110	\$52,800		
	350' S of S 137th				660'	\$110	\$72,600		
	480' W & 350' S of S 137th				290'	\$80	\$23,200		
	Side Sewer Stubs for Entire Project						\$159,600		
	<b>TOTAL</b>								
9	Relief Line Connections to Midway Sewer District	29th Ave S	S 176th St	8"	370'	\$110	\$40,700	1999-2000	PWTF
	32nd Ave S & S 175th St		Pacific Hwy S	8"	200'	\$140	(\$22,000)	Complete	
	29th Ave S						\$40,700	Complete	PWTF
	<b>TOTAL</b>								
10	Glendale Way Easement Rehab	Easement	E of Glendale Wy	8"	1,000'	\$140	\$140,000	Complete	PWTF
	S-146th St								
	<b>TOTAL</b>								
11	Eliminate Pump Station No. 17	Abandon Pump Station at S-121st St & SR-99	E Side of SR-99 & S-121st St	LS	4	\$20,000	\$20,000	Complete	PWTF
	W Side of SR-99 & S-121st St		120' W of E Marginal Way	8"	250'	\$250	\$62,500		
	Right of Way/Easement			LS	900'	\$120	\$108,000		
	Upgrade Metre South Base Pump Station			LS	4	\$20,000	\$20,000		
	<b>TOTAL</b>								
12	S 142nd St East of 24th Ave S Rehab	Easement East of 24th Ave S	400' S	8"	400'	\$110	\$44,000	2001	PWTF
	S 142nd St				200'	\$80	\$16,000		
	Side Sewer Stubs for Entire Project						\$60,000		
	<b>TOTAL</b>								

Notes:  
Costs are in 1997 dollars and include Engineering, Construction, Construction Management, Administration and Sales Tax.  
ASRBD = As Required By Development



TABLE 7-2  
VAL VUE SEWER DISTRICT  
2000 CAPITAL IMPROVEMENTS PROGRAM

Proj. No.	Project From	Along	To	Size	Units	Unit Cost	Cost	Schedule	Funding
13	NE McMicken (42nd Ave. S. & S. 160th)	42nd Ave S	300' N of S 164th	8"	1,800'	\$110	\$198,000	1998	ULID
	150' N of S 158th	Side Sewer Stubs for Entire Project		6"	900'	\$80	\$72,000		
		<b>TOTAL</b>					<b>\$270,000</b>		<b>1998-2001</b>
14	S 112th St (W of SR 509)	S 112th St	4th Ave S	8"	1,100'	\$110	\$121,000	1998-2000	ULID
	Occidental	4th Ave S	5th Ave S	8"	650'	\$110	\$71,500	Complete	
	S 112th St	5th Ave S	650' S	8"	650'	\$110	\$71,500	Complete	
	S 110th St	Occidental	S 112th St	8"	650'	\$110	\$71,500	Complete	
	S of S 108th St	2nd Ave S	S 112th St	8"	850'	\$110	\$93,500	Complete	
	S of S 108th St	3rd Ave S	S 112th St	8"	800'	\$110	\$88,000	Complete	
	S 112th St	4th Ave S	850' N	8"	800'	\$110	\$88,000	Complete	
	4th Ave S	5th Ave S	250' N of S 114th St	8"	250'	\$110	\$27,500	Complete	
	5th Ave S	S 111th St	6th Ave S	8"	500'	\$110	\$55,000	Complete	
	N of 111th St	6th Ave S	4th Ave S	8"	1,300'	\$110	\$143,000	Complete	
	Side Sewer Stubs for Entire Project			6"	1,775'	\$80	\$142,000		
	<b>TOTAL</b>						<b>\$532,500</b>		
15	8th Ave S Trunk	8th Ave S	Aqua Way	10"	2,000'	\$125	\$250,000	1998-2000	ULID
	S 105th St	8th Ave S	SR 509	8"	600'	\$110	\$66,000	Complete	
	Aqua Way	Boring	W of SR 509	Casing	400'	\$200	\$80,000	Complete	
	E of SR 509	Aqua Way	S 112th St	10"	500'	\$125	\$62,500		
	8th Ave S						<b>\$378,500</b>		
	<b>TOTAL</b>								
16	Riverton Crest (Military Rd & S 140th St)	S 140th St.	100' W of 29th Ave. S.	8"	1,800'	\$110	\$198,000	1998-2000	ULID
	250' W of 35th Ave. S	29th Ave. S.	S. 138th St.	8"	1,200'	\$110	\$132,000		
	S. 142nd St.	S. 138th St.	Military Rd.	8"	800'	\$110	\$88,000		
	28th Ave S	28th Ave S	End	8"	500'	\$110	\$55,000		
	S. 138th St.	Easement	N 500'	8"	500'	\$110	\$55,000		
	400' W of Military & S 138th	Military Rd.	S. 140th St.	8"	500'	\$110	\$55,000		
	200' S of S 138th	S. 140th St.	W Side of Military	Casing	50'	\$200	\$10,000		
	E side of Military Rd.	31st Ave. S.	Military Rd.	8"	800'	\$110	\$88,000		
	300' N of S. 144th St.	W side of Military Rd	1200' S	8"	1,200'	\$110	\$132,000		
	S 140th St	E side of Military Rd	1000' S	8"	1,000'	\$110	\$110,000		
	S 140th St	33rd Ave S	750' S of S 140th St	8"	750'	\$110	\$82,500		
	New Pump Station N of S 138th St & 29th Ave S				1	\$100,000	\$100,000		
	Side Sewer Stubs for Entire Project			6"	4,550'	\$80	\$364,000		
	<b>TOTAL</b>						<b>\$1,469,500</b>		

Notes:  
Costs are in 1997 dollars and include Engineering, Construction, Construction Management, Administration and Sales Tax.  
ASRB = As Required By Development

**TABLE 7-2  
VAL VUE SEWER DISTRICT  
2000 CAPITAL IMPROVEMENTS PROGRAM**

Proj. No.	Project	From	Along	To	Size	Units	Unit Cost	Cost	Schedule	Funding
17	Military & S. 175th	50' W of I-5	S 175th St.	200' E of Military	8"	1,800'	\$110	\$198,000	1999	ULID
		Side Sewer Stubs for Entire Project			6"	1,000'	\$80	\$80,000		
		<b>TOTAL</b>						<b>\$278,000</b>		
18	Hilltop Park Trunk	24th Ave S @ 124th St S	Esmnt/26th Ave S	S 133rd St	8"	3,350'	\$110	\$368,500	2002-2005	ULID/DE
		<b>TOTAL</b>						<b>\$368,500</b>		
19	96th St from 10th Ave Rehab	10th Ave S	96th St S	Des Moines Way	24"	1,150'	\$200	\$230,000	2002-2005	PWTF
		<b>TOTAL</b>						<b>\$230,000</b>		
20	NW McMicken (Military & 164th, 162nd & 42nd)	32nd Ave S	S 164th St.	250' W of Military	8"	2,400'	\$110	\$264,000	2002-2005	ULID/DE
		S 160th St	34th Ave S	S 162nd St	8"	600'	\$110	\$66,000		
		300' N of S 164th St	34th Ave S	300' S of S 164th	8"	600'	\$110	\$66,000		
		frt of 34th Ave S & S 161st	Easement	750' E of 34th Ave S	8"	750'	\$170	\$82,500	Complete	
		Btwn S 162nd & S 164th	Easement	300' W of Military	8"	1,300'	\$110	\$143,000		
		Btwn S 164th & S 166th	Easement	300' W of Military	8"	1,700'	\$110	\$187,000		
		Side Sewer Stubs for Entire Project			6"	3,675'	\$80	\$294,000		
		<b>TOTAL</b>						<b>\$1,020,000</b>		
21	51st Ave S @ S 182nd St Sewers	S 182nd St	51st Ave S	End	8"	600'	\$110	\$66,000	2005	ULID
		S 182nd & 51st Ave S	Easement W Side of I-5	100' E and 500' S	8"	600'	\$110	\$66,000		
		Side Sewer Stubs for Entire Project			6"	600'	\$80	\$48,000		
		<b>TOTAL</b>						<b>\$180,000</b>		
22	S. 128th St. Trunk	E of 24th Ave S	S 128th St	W of Military Rd	8"	1,000'	\$110	\$110,000	ARB	ULID
		<b>TOTAL</b>						<b>\$110,000</b>		
23	Hilltop Park Area Sewers	Hilltop Pk Trunk @ 125th	Easement	E 400'	8"	400'	\$110	\$44,000	ARB	ULID
		S 128th St	26th Ave S	S 400'	8"	400'	\$110	\$44,000		
		S 128th St	Easement	S to Exist Pump Sta.	8"	400'	\$110	\$44,000		
		W of 26th Ave S	Esmnt/S 130th Pl	W of Military Rd	8"	850'	\$110	\$93,500		
		S 130th Pl	26th Ave S	S 132nd St	8"	500'	\$110	\$55,000		
		26th Ave S	S 132nd St	300' W	8"	300'	\$110	\$33,000		
		26th Ave S	S 131st St	W of Military Rd.	8"	475'	\$110	\$52,250		
		Side Sewer Stubs for Entire Project			6"	1,663'	\$80	\$133,000		
		Eliminate Exist Pump Station			LS	1	\$20,000	\$20,000		
		<b>TOTAL</b>						<b>\$518,750</b>		
24	S 112th St to S 120th St Sewers	10th Ave S	S 112th St	12th Ave S	8"	650'	\$110	\$71,500	ARB	ULID
		Aqua Way	S 112th St	10th Ave S	10"	400'	\$125	\$50,000		
		150' S of S 112th St	8th Ave S	S 120th St	8"	3,850'	\$110	\$423,500		
		8th Ave S	Easement	40th Ave S	8"	650'	\$170	\$77,500	Complete	
		S 112th St	10th Ave S	350' S	10"	350'	\$125	\$43,750	Complete	
		350' S of S 112th St	10th Ave S	600' S of S 124th St	8"	4,600'	\$110	\$506,000		
		10th Ave S	S 115th St	W of 12th Ave S	8"	600'	\$110	\$66,000		

Notes:  
Costs are in 1997 dollars and include Engineering, Construction, Construction Management, Administration and Sales Tax.  
ASRB = As Required By Development

TABLE 7-2 VAL VUE SEWER DISTRICT 2000 CAPITAL IMPROVEMENTS PROGRAM									
Proj No	Project From	Along	To	Size	Units	Unit Cost	Cost	Schedule	Funding
	10th Ave S	S 116th St	W of 12th Ave S	8"	600'	\$110	\$66,000		
	SR 509	S 116th St	W of 10th Ave S	8"	700'	\$110	\$77,000	Complete	
	10th Ave S	S 117th St	W of 12th Ave S	8"	600'	\$110	\$66,000		
	S 112th St	12th Ave S	250' S of S 120th St	8"	2,950'	\$110	\$324,500		
	150' E of 12th Ave S	S 116th St	12th Ave S	8"	150'	\$110	\$16,500		
	150' E of 12th Ave S	S 117th St	12th Ave S	8"	150'	\$110	\$16,500		
	SR 509	S 120th St	250' E of 12th Ave S	8"	1,500'	\$110	\$165,000		
	SR 509	S 124th St	300' E of 10th Ave S	8"	1,350'	\$110	\$148,500		
	Side Sewer Stubs for Entire Project				9,550'	\$80	\$764,000		
	<b>TOTAL</b>						<b>\$2,684,000</b>	ARB	ULID
<b>25</b>	<b>14th Ave S at S 116th St Sewers</b>								
	Glendale Way	14th Ave S	100' N of S 120th	8"	2,400'	\$110	\$264,000		
	14th Ave S	S 115th St	500' W	8"	500'	\$110	\$55,000		
	14th Ave S	S 116th St	400' W	8"	400'	\$110	\$44,000		
	14th Ave S	S 117th St	400' W	8"	400'	\$110	\$44,000		
	Side Sewer Stubs for Entire Project				1,850'	\$80	\$148,000		
	<b>TOTAL</b>						<b>\$555,000</b>	ARB	ULID
<b>26</b>	<b>S 120th St to S 128th St Sewers</b>								
	350' S of S 120th St	12th Ave S	S 128th St	8"	2,200'	\$110	\$242,000		
	S 120th St	14th Ave S	S 128th St	8"	2,400'	\$110	\$264,000		
	14th Ave S	S 120th St	300' W	8"	300'	\$110	\$33,000		
	14th Ave S	S 124th St	300' E	8"	300'	\$110	\$33,000		
	12th Ave S	S 124th St	300' W	8"	300'	\$110	\$33,000		
	14th Ave S	Easement	12th Ave S	8"	1,550'	\$110	\$170,500		
	200' N of S 124th St	Easement	14th Ave S	8"	1,000'	\$110	\$110,000		
	14th Ave S	Easement	S 128th St	8"	1,200'	\$110	\$132,000		
	Side Sewer Stubs for Entire Project				4,625'	\$80	\$370,000		
	<b>TOTAL</b>						<b>\$1,387,500</b>	ARB	ULID
<b>27</b>	<b>S 128th St to S 144th St Sewers</b>								
	S of S 124th St	8th Ave S	S 128th St	8"	1,200'	\$110	\$132,000		
	SR 509	S 128th St	12th Ave S	8"	1,900'	\$110	\$209,000		
	10th Ave S	S 132nd St	400' E of 10th Ave S	8"	400'	\$110	\$44,000	Complete	
	400' W of 10th Ave S	S 134th St	600' E of 10th Ave S	8"	1,000'	\$110	\$110,000		
	6th Ave S	S 136th St	350' E of 8th Ave S	8"	1,000'	\$110	\$110,000		
	S 136th St	6th Ave S	S 128th St	8"	2,450'	\$110	\$269,500		
	S 136th St	7th Ave S	S 128th St	8"	2,450'	\$110	\$269,500		
	S 136th St	8th Ave S	S 128th St	8"	2,400'	\$110	\$264,000		
	S 132nd St	Easement	S 128th St	8"	1,400'	\$110	\$154,000		
	S 136th St	10th Ave S	N of S 130th St	8"	2,200'	\$110	\$242,000		
	S 128th St	10th Ave S	550' N of S 128th St	8"	550'	\$110	\$60,500		
	Side Sewer Stubs for Entire Project				8,475'	\$80	\$678,000		
	<b>TOTAL</b>						<b>\$2,498,500</b>	ARB	ULID
<b>28</b>	<b>12th Ave S &amp; S 138th St Sewers</b>								
	S 128th St	10th Ave S	S 129th St	8"	350'	\$110	\$38,500		
	10th Ave S	S 129th St	400' E of 12th Ave S	8"	1,100'	\$110	\$121,000		
	400' W of 12th Ave S	S 130th St	400' E of 12th Ave S	8"	800'	\$110	\$88,000		

Notes:  
 Costs are in 1997 dollars and include Engineering, Construction, Construction Management, Administration and Sales Tax.  
 ASRBD = As Required By Development

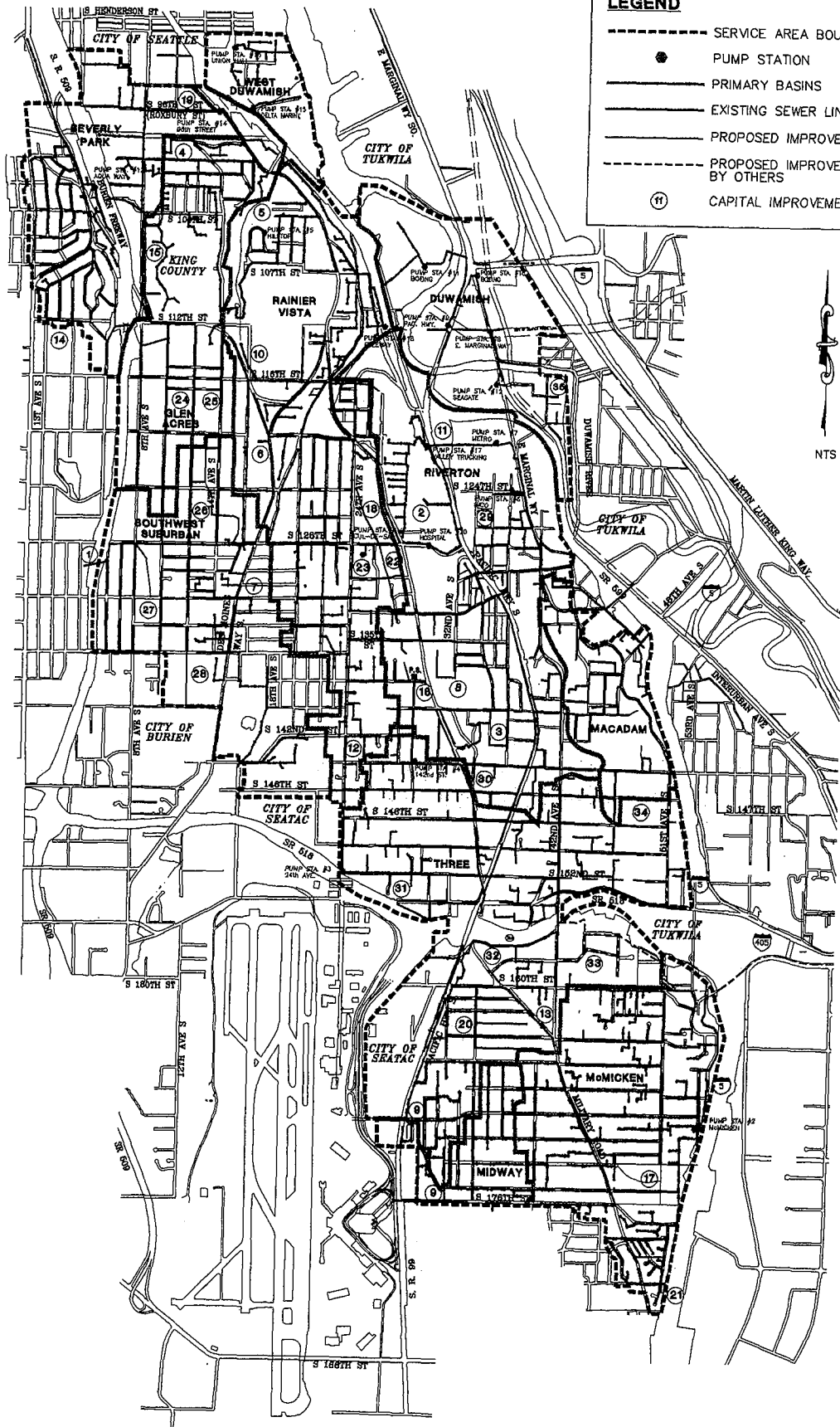
TABLE 7-2  
VAL VUE SEWER DISTRICT  
2000 CAPITAL IMPROVEMENTS PROGRAM

Proj. No.	Project From	Along	To	Size	Units	Unit Cost	Cost	Schedule	Funding
	400' W of 14th Ave S	S 134th St	14th Ave S	8"	400'	\$110	\$44,000		
	400' W of 12th Ave S	S 136th St	12th Ave S	8"	400'	\$110	\$44,000		
	400' W of 14th Ave S	S 136th St	14th Ave S	8"	450'	\$110	\$49,500		
	800' W of Des Moines Wy	S 140th St	Des Moines Way S	8"	800'	\$110	\$88,000		
	S 140th St	12th Ave S/Esmnt	S 128th St	8"	3,800'	\$110	\$418,000		
	550' N of S 140th St	Des Moines Way S	S 144th St	8"	1,850'	\$110	\$203,500		
	Side Sewer Stubs for Entire Project			6"	4,975'	\$80	\$398,000		
	<b>TOTAL</b>						<b>\$1,492,500</b>	ARBDD	ULID/DE
<b>29</b>	<b>S 126th St &amp; 35th Ave S Sewers</b>								
	S 126th St	35th Ave S	S 128th St	8"	400'	\$110	\$44,000		
	34th Ave S	S 126th St	100' W of 36th Ave S	8"	650'	\$110	\$71,500		
	Side Sewer Stubs for Entire Project			6"	525'	\$80	\$42,000		
	<b>TOTAL</b>						<b>\$157,500</b>	ARBDD	PWTF
<b>30</b>	<b>S 144th St @ Military Road</b>								
	Military Rd	S 144th St	33rd Ave S.	8"	1,650'	\$110	\$181,500		
	Side Sewer Stubs for Entire Project			6"	175'	\$80	\$14,000		
	<b>TOTAL</b>						<b>\$195,500</b>	ARBDD	ULID
<b>31</b>	<b>S 154th St &amp; 30th Ave S.</b>								
	150' W of 32nd Ave S	S 154th St.	W to 518 R/W	8"	1,050'	\$110	\$115,500		
	S 154th St.	30th Ave S	N of 518 R/W	8"	450'	\$110	\$49,500		
	30th Ave S	Easement	150' W of 518 & S 154th	8"	800'	\$110	\$88,000		
	518 Ramp Crossing			Casing	50'	\$200	\$10,000		
	Side Sewer Stubs for Entire Project			6"	1,175'	\$80	\$94,000		
	<b>TOTAL</b>						<b>\$357,000</b>	ARBDD	DE
<b>32</b>	<b>Military Rd. &amp; S 158th</b>								
	Int of Military & S 158th	S 158th St	650' E of Military	8"	650'	\$110	\$71,500		
	Side Sewer Stubs for Entire Project			6"	325'	\$80	\$26,000		
	<b>TOTAL</b>						<b>\$97,500</b>	Unknown	Tukwila
<b>33</b>	<b>S 158th St. (E. of 42nd)</b>								
	42nd Ave S	Easement	Proj of 44th Ave 300' N of 156th	8"	750'				
	Proj of 44th 300' N of S 156th	44th Ave S - N Projection	S 158th	8"	760'				
	44th Ave S	S 158th St	47th Ave S	8"	850'				
	44th Ave S	S 156th St	47th Ave S	8"	760'				
	S 156th St	47th Ave S	S 159th St	8"	1,000'				
	44th Ave S	S 158th St	42nd Ave S	8"	750'				
	51st Ave S & S 158th	Easement	47th S & S 156th	8"	1,400'				
	S 159th St	51st Ave S	S 158th St	8"	700'				
	300' N of S 158th &								
	450' E of 47th Ave S	Easement	N to S Edge of 518 R/W	8"	350'				
	S 160th St	43rd Ave S	S 158th St	8"	650'				
	300' N of S 160th & 43rd	Easement	42nd Ave S	8"	350'				
	Side Sewer Stubs for Entire Project			6"	4,160'				
<b>34</b>	<b>51st Ave S (S of S 144th St)</b>								
	550' S of S 144th St	51st Ave S	S 154th St	8"	2,700'				
	51st Ave S	Esmnt 200' N of S 148th	I-5 R/W	8"	260'				
	200' N of S 148th St	Esmnt W of I-5	S 151st St	12"	1,250'				

Notes:  
Costs are in 1997 dollars and include Engineering, Construction, Construction Management, Administration and Sales Tax.  
ASRDD = As Required By Development

TABLE 7-2 VAL VUE SEWER DISTRICT 2000 CAPITAL IMPROVEMENTS PROGRAM										
Proj. No.	Project	From	Along	To	Size	Units	Unit Cost	Cost	Schedule	Funding
		51st Ave S	S 151st St	52nd Ave S	8"	400'				
		51st Ave S	S 146th St	280' E of 46th S	8"	1,030'			Complete	
		51st Ave S	S 148th St	280' E of 46th S	8"	1,030'				
		51st Ave S	S 150th St	400' W of 51st S	8"	400'				
		51st Ave S	S 152nd St	550' W of 51st S	8"	550'				
		Side Sewer Stubs for Entire Project			6"	3,610'				
<b>35</b>	<b>Riverside Interurban</b>							<b>\$805,000</b>	2001	PWTF
		150' E of E Marginal	S 116th St	38th Ave. S.	8"	550'				
		S 116th St.	38th Ave. S.	S 117th St.	8"	260'				
		40th Ave. S.	S 117th St.	38th Ave. S.	8"	310'				
		S 119th & 40th Pl S	40th Ave. S.	260' N of S 117th	8"	920'				
		S 119th & 40th Pl S	S 119th St.	220' E	8"	220'				
		S 119th & 40th Pl S	40th Pl S	250' N	8"	250'				
		S 119th St	Interurban Pl	550' S	8"	550'				
		New Pump Station @ S 117th & 38th Ave S				1				
		Foremain from New Pump Station to Seagate Pump Station				900'				
		Side Sewer Stubs for Entire Project				750'				
<b>36</b>	<b>New District Office</b>							<b>\$1,500,000</b>	2001	Rates
		<b>TOTAL CAPITAL IMPROVEMENTS PROJECTS</b>						<b>\$17,467,050</b>		
		<b>ANNUAL EXPENSES</b>								
	<b>Pump Station Rehabilitation</b>									
	Pump Station Rehabilitation				LS	1	\$20,000	\$20,000		
	<b>Infiltration &amp; Inflow - Annual Expenses</b>									
	Manhole Grouting					100	\$250	\$25,000		
	Short Line Repair/Grouting					15	\$1,200	\$18,000		
	Vehicles (Grout Truck)					1	\$45,000	\$45,000		
	Flow Monitoring					1	\$15,000	\$15,000		
	Miscellaneous.					1	\$5,000	\$5,000		
	<b>TOTAL</b>							<b>\$128,000</b>		
	<b>Other Capital Expenses</b>									

Notes:  
 Costs are in 1997 dollars and include Engineering, Construction, Construction Management, Administration and Sales Tax.  
 ASRBD = As Required By Development



**LEGEND**

- SERVICE AREA BOUNDARY
- PUMP STATION
- PRIMARY BASINS
- EXISTING SEWER LINE
- PROPOSED IMPROVEMENTS
- PROPOSED IMPROVEMENTS BY OTHERS
- Ⓜ CAPITAL IMPROVEMENT PROJECT #



**FIGURE 7-1  
IMPROVEMENTS MAP**

**ValView**  
 Engineering  
 Planning  
 Surveying  
**Penhallegon Associates Consulting Engineers, Inc.**  
 150 SIXTH STREET SOUTH KINGSLAND, WA 90093 (425) 827-9014

"WORKING TOWARD A BETTER ENVIRONMENT"  
**ValView**  
 SEWER DISTRICT

**VAL VUE SEWER DISTRICT  
 COMPREHENSIVE SEWER SYSTEM PLAN**

## **CHAPTER 8 FINANCING**

### **8.1 GENERAL**

This Chapter of the Plan considers the financing option associated with construction of the improvements recommended in Section 7 of this document and outlines specific recommendations for continued operation of the sewer utility in accordance with State regulations and the requirements of the jurisdictions within which Val Vue operates.

### **8.2 FINANCIAL CONSIDERATIONS**

Operation of a sewer utility requires consideration of a variety of expenses, which can be classified as follows:

- Capital Improvement Projects;
- Repair and Replacement Projects;
- Administration, Operation and Maintenance Expenses;
- Debt Service Requirements; and,
- Wastewater Treatment and Disposal Costs.

### **8.3 FUNDING SOURCES**

Revenue sources for financing District operations and capital expenses include rates, Utility Local Improvement Districts (ULID's), Bonds, Grants and Loans. Each of these specific revenue sources are discussed in further detail in the following paragraphs:

#### **8.3.1 Rates**

Revenue from rate and charges is obtained from monthly sewer charges, permit fees, facility charges and connection charges. A summary of the District's current and projected rates and charges is presented in Table 8-1. Monthly sewer use rates were last updated in 1999, when the District implemented a schedule to accommodate the various rates paid to the three separate treatment providers to the District (King County-Metro, Midway and Southwest Suburban Sewer District). Facility and connection charges were reviewed and updated in 1997 and were calculated using the projects outlined in the Capital Facilities Plan (Chapter 7). Copies of the District's rate and facility charge studies are available for review at the District office.



**TABLE 8-1  
VAL VUE SEWER DISTRICT 2000 RATES, FEES AND CHARGES**

Customer Classification	Monthly Rates	
<b>Residential and Condominiums</b>		
Metro-King County Area		\$25.50
Midway Area		\$17.40
SWSSD		\$14.30
<b>Apartments and Trailer Parks</b>		
Metro-King County Area		\$22.60
Midway Area		\$15.70
SWSSD		\$13.00
<b>Commercial/Travel Trailer Parks</b>	<b>First 750 CF</b>	<b>Each Additional 100 CF</b>
Metro-King County Area	\$25.50	\$3.40
Midway Area	\$17.40	\$2.32
SWSSD	\$14.30	\$1.90

Coin operated laundries are granted a 3% evaporation exemption.  
Delinquent Accounts are subject to 10% penalty and 12% annual interest.

Type of Permit	Fee
Single Family Residential	\$80.00
Multi-Family Residence	\$80.00 first dwelling unit \$10.00 each additional unit
Commercial Structures	\$0.05/square foot of ground area \$80.00 minimum
Right-of-Way Permit	\$285.00 (w/ application, filing & 2 hours inspection) \$98.00/each additional hour inspection time
Repair Permit	\$15.00
Capping Permit	\$70.00

Connection Charges	Fee (2000)
<b>General Facilities Charge</b>	
Residential or Res. Equiv.	\$850.00
Multi Family (per living unit)	\$680.00
<b>System Facilities Charge</b>	
Residential or Res. Equiv.	\$37.00/Front Foot (\$1,900.00 minimum)
Multi Family (per living unit)	\$1,520.00/unit

Notes: Connection Charges are one time charges due at the time of connection. Connection charges for non-residential uses are determined by estimating monthly flows/Residential Equivalents.

Treatment Capacity Charge	Fee
Single Family Residence	\$1,090.00
Multiple Dwelling:	
2 - 4 Units	\$872.00/unit
5 or more units	\$698/unit

Note: Treatment charges reflect the costs of other jurisdictions. This one time fee is due at time of connection and paid directly to King County-Metro or the Val Vue Sewer District as appropriate.





### **8.3.2 Utility Local Improvement District Financing (ULID)**

ULID financing is a means by which improvements can be financed by those property owners directly benefitting from those improvements. This method of financing can be initiated either by property owners or by District resolution but in either case must be supported at least 60% of property owners within the benefitting area. ULID financing is generally used for construction of local facilities and initial financing is typically by bond sales. The costs associated with the improvements are usually divided and assessed against properties, although revenue from rates can also be used to repay the bonds.

### **8.3.3 Bond Financing**

Bond financing can be achieved by sale of either general obligation or revenue bonds. General obligation bonds must have the support of the majority of voters in the District. These bonds are paid for by assessments against properties within the District. Revenue Bonds, however, do not require voter approval and may be financed by whatever funds are available to the District for the payment of debt service. This might include revenues from water sales, general fees, latecomer charges or other funds.

### **8.3.4 Grant Financing**

Grant financing for sanitary sewer projects has become increasingly scarce for utility systems in recent years. Grants from the Centennial Clean Water Fund, however, are still available. This program is administered by the State of Washington and is primarily for the planning, design and construction of facilities which will assist in the protection of the State's waters. Although this type of funding has been used for the construction of sanitary sewer facilities in areas adjacent to surface waters, declaration of a public health hazard is typically required for funding. Val Vue may wish to consider coordination with the City of Tukwila for the Riverside Interurban Avenue ULID area along the Duwamish River.

### **8.3.5 Loan Financing**

The primary source of loan financing for public utility systems in Washington is the Public Works Trust Fund program which is administered by the State of Washington Department of Community, Trade, and Economic Development. The Public Works Trust Fund (PWTF) program is a low interest loan program which provides twenty year financing for certain public works projects with interest rates ranging from 0.5% to 1.5% depending on the level of local match funding. Generally, eligible projects are limited to public utility rehabilitation and replacement projects. PWTF funds are distributed annually on a competitive application basis. Up to \$10.0 million may be awarded to a qualifying jurisdiction per biennium.

Val Vue Sewer District has benefitted from PWTF financing for several recent projects and it is recommended that the District evaluate the appropriateness of this type of financing for upcoming projects during its annual budgeting and CFP review process.



## **8.4 FINANCING CAPITAL IMPROVEMENTS**

Capital improvements can be further defined into: (1) General facilities which are facilities such as sewer interceptors, pump stations, force mains, standby power or pumping units and other appurtenances which are required for the overall system to function properly; (2) Local facilities such as distribution mains and appurtenances which benefit a smaller area; and, (3) Individual service lines which benefit only the single property that they serve. Methods for financing each of these types of improvements are described below.

### **8.4.1 General Facilities**

In new and expanding areas, where sewer service is not currently available, General Facilities are typically financed by one of the following methods:

- Passing a general obligation bond which is insured by the voters;
- Forming a ULID and assessing the benefitting properties equally;
- Requiring the initial developer to pay for the improvements with a pay-back arrangement as the area develops (latecomers charges);
- District funding improvements and assessing a charge to each property within the benefitted area as development occurs. This charge must cover all costs incurred, including interest on money and an allowance at a rate that will amortize the investment; and/or,
- District obtaining grants or low interest loans.

In older, established areas such as the Val Vue area, financing general facility improvements or replacement of major system improvements presents a unique challenge. Existing customers of the system have typically paid their fair share of general facility charges through monthly rates and connection charges and the amount of new development, and associated developer financing is typically limited. In these instances, general facilities can be constructed and paid for by the grants, bonds or other funds available to the District and rates established to cover and pay back such financing. Additionally, general facility charges are established so that the required replacements are included in the amount that new customers to the system pay for connection. Val Vue recently completed a General Facility Charge study which takes into account all system improvements which have been completed in the last ten years or are proposed in the next ten years.

### **8.4.2 Local Facilities**

Local facilities such as sewer collection lines and appurtenances benefit a smaller area than general facilities do. The costs for these improvements can be directly attributable to the property owners benefitted and are typically financed by the



following methods:

- Formation of a ULID (Utility Local Improvement District)
- Developer Extension Agreements;
- Payback Latecomer Agreements; and/or,
- Grants and outside assistance to reduce local costs and/or District participation.

Funding local facilities improvement from rates is not recommended because it would result in all customers paying for improvements which benefit only a small area.

#### **8.4.3 Individual Service Lines**

Individual service lines are typically financed by the individual customer receiving direct benefit from such facilities.

### **8.5 FINANCING RECOMMENDED IMPROVEMENTS**

The Capital Facilities Plan put forth in Chapter 7 of this Plan indicates that more than \$6.5 million is required to accomplish all the recommended improvements scheduled through 2005. Since this amount of money is clearly not available from rates and charges, alternative methods of financing must be used. Potential financing options for each project are identified in the CFP. Wherever possible, the District utilizes developer contributions for construction of required extensions and ULID's for extending service to unsewered areas. In addition to continuing this method of financing extension improvements, it is recommended that the District continue to apply for State Public Works Trust funding for appropriate projects as identified in the CFP.

### **8.6 OTHER CONSIDERATIONS**

As discussed in Chapter 2 of this Plan, portions of the District are within the limits of the cities of Tukwila, Sea-Tac, and Burien. In accordance with the laws of the State of Washington, cities which already operate sanitary sewer systems (Tukwila) could assume responsibility for the sewer facilities and service to that portion of the system which is within their limits. For cities which do not currently have sanitary sewer system facilities, establishment of a utility in accordance with state laws would be required prior to takeover. Although no formal discussion regarding takeover of Val Vue has taken place, all parties agree that coordination between jurisdictions is required to protect the interest of the residents of the area. It is recommended that Val Vue continue its coordination efforts with these jurisdictions in order to insure uniform design and permitting procedures. In addition, it is recommended that the District negotiate franchise agreements with the cities having jurisdiction. These franchise agreements should detail the terms and conditions of operating sanitary sewer facilities within city and county right-of-ways.



# **CHAPTER 9**

## **OPERATIONS AND MAINTENANCE**

### **9.1 GENERAL**

This Chapter of the Plan overviews the routine and emergency procedures that Val Vue employs for the operation and maintenance of its system. Specific recommendations for continued operation of the sewer utility are in accordance with State regulations and the requirements of the jurisdictions within which Val Vue operates.

### **9.2 SYSTEM RESPONSIBILITY AND AUTHORITY**

A prerequisite to the delivery of efficient and reliable service to all customers of the District is a competent staff organized such that the responsibility for day-to-day and emergency operations is clearly defined and executed. The following is a summary of Val Vue Sewer District's organization:

#### **9.2.1 Board of Commissioners**

Overall responsibility for the District's operations lies with the elected officials. Val Vue Sewer District currently has a three member Board of Commissioners who are responsible for operation, management, regulatory compliance and financial aspects of the District.

The Board of Commissioners hold regular public meetings which are open to all customers of the District and other interested parties. Meetings are held twice monthly at the District office.

#### **9.2.2 District Manager and Assistant Manager**

The District Manager has the overall responsibility for the management of the sanitary sewer system and all District personnel. In the event that the District Manager is not present, the Assistant Manager has full authority to act on his/her behalf.

#### **9.2.3 Field Superintendent**

The Field Superintendent reports to the District Assistant Manager and is responsible for all field operations and personnel, including routine maintenance of the system and equipment, and field emergency repair. The Field Superintendent is state certified.

#### **9.2.4 Outside Consultants**

Val Vue Sewer District retains the services of outside consultants for its engineering,



planning, surveying and legal requirements. In accordance with state law, engineering consultants are selected based on statements of qualifications periodically requested from specialists in sanitary sewer system engineering.

### **9.2.5 Other Assistance**

Other assistance is required from time to time for specific District projects, maintenance and construction. The District maintains a roster of qualified contractors for small works projects and contracts with other service providers as required by District needs and in accordance with Washington State Law.

## **9.3 RECORD MAINTENANCE**

Operation of a sewer utility requires consideration of long term records management in a format which is useful to the variety of staff members and outside consultants which use them. Val Vue Sewer District maintains the following records on an ongoing basis:

- **Customer Account Information:** Detailed records of each sewer account are maintained through the District's computerized billing system.
- **Interlocal Agreements:** Copies of the District's agreements with King County-Metro, as well as monthly reports required for documentation of wastewater treatment and disposal charges are kept on file at the District Office.
- **Grid Mapping:** The District maintains a comprehensive set of grid maps detailing existing facilities. These maps are at a scale of 1-inch = 100 feet and are updated using as-built information as system improvements and extensions are completed.
- **Comprehensive Plan Map:** The Sewer Comprehensive Map, and other maps included in this document are maintained in a computerized (AutoCAD) format and detail the general location of existing and proposed facilities, as well as physical features, land use, and boundary information for the District
- **Maintenance Reports:** Detailed records of periodic maintenance schedules and system attributes are kept on a computerized maintenance management system. Additionally, flow monitoring is accomplished year round by the District. A signa flow meter is used to collect data which is subsequently downloaded into the maintenance program.



## **9.4 PREVENTIVE MAINTENANCE**

The District utilizes the Five Star Maintenance Management System (DMBS) software for scheduling of preventive maintenance work, and the storage, retrieval and manipulation of information, activities, and records. Generally, preventive maintenance on the District's system includes the following elements:

- All possible hazards are thoroughly and systematically identified.
- Potential failures are detected while still in their developing stages.
- Maintenance activities are prioritized and scheduled.
- Scheduled maintenance of pump stations is completed once weekly and operational checks are performed twice weekly.
- System cleaning and field and video inspection of the system, including lines and manholes, is scheduled and accomplished.
- District staff attend workshops and seminars in order to learn up-to-date techniques and materials.

## **9.5 EMERGENCY PROCEDURES**

### **9.5.1 District Personnel**

Val Vue Sewer District maintains a sanitary sewer emergency response crew on 24-hour call. The District's regular telephone number ((206)-242-3236) is monitored 24 hours a day to allow the public to notify emergency crews at any time. This is accomplished by a voice messaging and pager system to take after hours calls.

The District's on-call crew is available to answer any emergency that may occur within the system and has immediate response responsibility. This includes, but is not limited to response to lift station alarms, sewer back-ups and forcemain blockages, minor repair work and emergency response procedures required to sustain service. In the event of a major emergency, on-call staff are responsible for notifying other staff members as appropriate to conditions. Table 9-1 (at the back of this Chapter) outlines emergency contacts and procedures.

### **9.5.2 Communications**

The District maintains a base radio station to keep in contact with field crews. In addition, certain staff member carry portable phones and pagers for communication



with the District Office or answering service.

### **9.5.3 Supplies and Spare Parts**

The District maintains an inventory of spare parts that are required for routine maintenance and/or emergency repairs. A list of suppliers for after hours and emergency repairs is maintained for response to major emergency conditions.

### **9.5.4 Outside Assistance**

Val Vue maintains relationships with the cities within which it operates for coordination during emergency events. In addition, the District is a participant in the Washington State Association of Water and Sewer District's Mutual Aid Agreement, which provides a mechanism for participants to share resources and staff in the event of an emergency. A copy of that agreement is on file at the District office.

In addition to the relationships that the District has with other jurisdictions for emergency response there are other outside service providers which may be instrumental in emergency response. A summary of emergency contacts, and agencies which the District may be required to notify is provided in Table 9-1.

## **9.6 SYSTEM VULNERABILITY**

The Val Vue Sewer District sewer system consists of individual drainage basins which convey wastewater to one of three agencies responsible for treatment and disposal. These three agencies are King County - Metro which receives the majority of flows from the area, Southwest Suburban Sewer District which is just west of Val Vue, and Midway Sewer District which is south of Val Vue.

The vulnerability of various components of the overall sewer system has been evaluated to identify areas which may be affected in the event of a natural or manmade disaster. System vulnerability includes loss of service, damage to property, and/or health risks which may be associated with failure of the individual components of the sanitary sewer system. A summary of the system vulnerability analysis is presented in the following paragraphs.

### **9.6.1 Treatment and Disposal**

Val Vue maintains agreements with King County-Metro, Southwest Suburban Sewer District and Midway Sewer District for the treatment and disposal of wastewater flows generated within the District. These agencies have full responsibility for adequate treatment and disposal of wastewater in accordance with the rules and regulations governing such operations. Any interruption in the treatment services provided by these agencies would likely result in discharge of untreated wastewater to the Puget Sound.



### **9.6.2 Sewer Mains, Trunks and Regional Interceptors**

Any pipeline is subject to clogging and, under certain circumstances, can break. Clogging of sewer lines can create backups in manholes and in severe cases, can progress back to customer properties. Pipe breaks due to settlement, deterioration of pipe material or other causes can pollute the groundwater and result in excessive infiltration and inflow.

### **9.6.3 Pump Stations**

The District operates pump stations to serve low elevations within the system. Several of the pump stations have overflows which would operate in the event of a mechanical failure or extended power failure. These overflows could create an environmental and health hazard. Failure of a lift station could also cause significant backups in the collection systems surrounding the pump stations.

All of the District's pump stations are equipped with alarm systems which, by telemetering, relay information regarding alarm conditions. Pump station alarms are monitored in the District's maintenance shop during normal working hours. After hours the alarms are relayed by an auto-dialer to the on-call staff member.

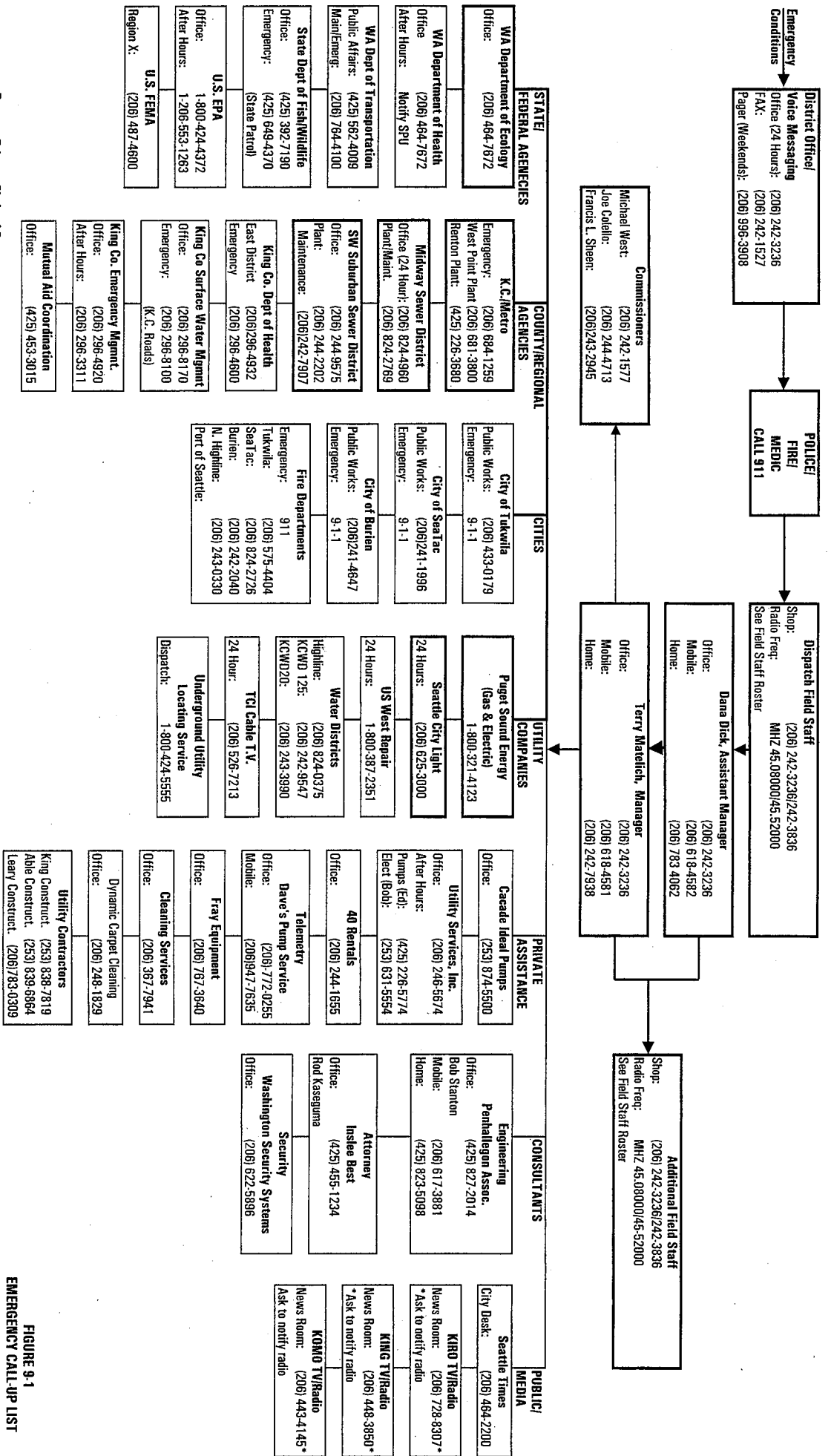
### **9.6.4 Electrical Power**

Power to the northern portion of the District is provided by Seattle City Light and to the southern portion of the District by Puget Sound Energy. Both electrical utilities have an extensive power distribution grid in the Val Vue area and electrical power can be provided by many different directions. Loss of power would shut down pumps and control operations, potentially resulting in pump station overflows and collector line backups. Historically, the District has not experienced regular or extended power outages and maintains backup generators for power failure events. Emergency generators are located on-site at vulnerable pump stations. The District office/shop is equipped with an emergency generator and the District maintains two mobile emergency generators for use throughout the system.





**VAL VUE SEWER DISTRICT EMERGENCY RESPONSE**



Denotes Primary Chain of Contacts

**FIGURE 9-1  
EMERGENCY CALL-UP LIST**

**DETERMINATION OF NON-SIGNIFICANCE**

**Description of the Proposal:** *Adoption of the Val Vue Sewer District  
1998 Comprehensive Sewer System Plan.*

**Proponent:** *Val Vue Sewer District*

**Location:** *Val Vue Sewer District is located east and north of Sea-Tac International Airport and within the cities of SeaTac, Tukwila and Burien, and unincorporated King County. The District generally extends from the Seattle City limits at South Cambridge and South Director Streets on the north, to South 176<sup>th</sup> and South 182<sup>nd</sup> Streets on the south; and from 1<sup>st</sup> Avenue South and State Route 509 on the west, to State Route 599 and Interstate Highway 5 on the east.*

**Lead Agency:** *Val Vue Sewer District*

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

This DNS is issued under 197-11-340(2); the lead agency will not act on this proposal for 15 days from the date below. **Comments must be submitted by September 30, 1998.**

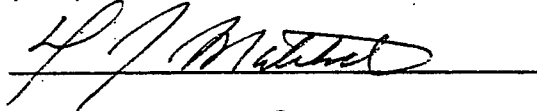
**Responsible Official:** T.J. Matelich

**Position/Title:** District Manager

**Phone:** (206) 730-8195

**Address:** 14816 Military Road South  
P.O. Box 69550  
Tukwila, Washington 98188  
(206) 242-3236

**Signature:**



**Date:**

8-20-98

**VAL VUE SEWER DISTRICT  
COMPREHENSIVE SEWER SYSTEM PLAN  
ENVIRONMENTAL CHECKLIST**

**A. BACKGROUND**

1. Name of proposed project, if applicable: *Val Vue Sewer District -  
Comprehensive Sewer System Plan*

2. Name of applicant: *Val Vue Sewer District*

3. Address and phone number of applicant and contact person:

**Applicant:** *Val Vue Sewer District  
T.J. Matelich, District Manager  
14816 Military Road South  
P.O. Box 69550  
Tukwila, Washington 98188  
(206) 242-3236*

**Contact Person:** *Susan Boyd, Associate  
Penhallegon Associates Consulting Engineers  
750 Sixth Street South  
Kirkland, WA 98033  
(425) 827-2014*

4. Date checklist prepared: *August 12, 1998*

5. Agency requesting checklist: *Val Vue Sewer District*

6. Proposed timing or schedule (including phasing, if applicable):

*A suggested capital improvements schedule is included in Chapter 7 of the Plan and includes tentative project schedules through the year 2005. Specific timing of improvements will depend on the availability of funding, scheduling of developers extensions and specific sewer system requirements.*

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

*Yes. Amendments to the Plan may occur in the future as additional needs are identified to meet the sanitary sewer system requirements within the service area. Complete update of the Comprehensive Sewer System Plan is typically accomplished every six years.*

**8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.**

*Additional environmental documents may be required for implementation of specific projects recommended in the Plan. Completion of environmental documentation will be accomplished in accordance with threshold determination and other requirements of the State Environmental Policy Act.*

**9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain:**

*None which are applicable to this proposal.*

**10. List government approvals or permits that will be needed for your proposal, if known.**

*In accordance with State regulations, the Comprehensive Sewer System Plan must be approved by the State Department of Ecology, King County and the cities within which the District operates.*

**11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)**

*This proposal contemplates adoption of the Val Vue Sewer District Comprehensive Sewer System Plan, which addresses future sanitary sewer service to all areas within the District's service area as described in the Plan. The Plan puts forth a capital improvements schedule in accordance with wastewater flow projections, system analyses, and minimum design criteria developed as part of the Plan.*

**12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.**

*As indicated on Figures 1-1 and 2-1 of the Plan, Val Vue Sewer District is located east and north of Sea-Tac International Airport and within the cities of SeaTac, Tukwila and Burien and unincorporated King County. The District generally extends from the Seattle City limits at South Cambridge and South Director Streets on the north, to South 176<sup>th</sup> and South 182<sup>nd</sup> Streets on the south; and from 1<sup>st</sup> Avenue South and State Route 509 on the west, to State Route 599 and Interstate Highway 5 on the east.*

**B. ENVIRONMENTAL ELEMENTS**

**1. EARTH**

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountains, other

b. What is the steepest slope on the site (approximate percent slope)?

*Not Applicable.*

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

*Not Applicable.*

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

*Unstable soil conditions do occur in isolated areas within the District's service area. Soil testing and mitigation will be employed as appropriate for construction of individual projects identified in the Plan.*

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

*Imported backfill will be required for some pipeline construction projects. No significant changes to existing grades will result.*

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

*Erosion could occur as a result of construction of proposed projects identified in the Comprehensive Sewer System Plan. Appropriate erosion control measures will be addressed in the design phase of each individual project.*

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

*Not Applicable.*

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

*Erosion control measures will be employed wherever necessary for system improvement projects. Disturbed areas will be restored to preconstruction condition as part of each completed project.*

## 2. AIR

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

*Emissions from construction equipment and dust are anticipated during construction of the projects proposed in the Plan.*

b. Are there any off-site sources of emissions or odor that may effect your proposal? If so, generally describe.

*No.*

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

*Construction equipment will be equipped with standard air filtering devices and dust control measures will be utilized during construction to minimize impacts to air quality.*

## 3. WATER

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

*Yes. The Duwamish River and several other streams run through the District. Although the majority of work contemplated by the Plan will occur in dedicated right-of-ways, protection of surface waters may be required in individual projects.*

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

*Not Applicable. Individual projects which are within 200 feet of surface waters will be accomplished in accordance with all appropriate environmental, permitting and design requirements.*

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water to wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

*Not Applicable.*

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

*No.*

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

*Not Applicable.*

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

*Not Applicable.*

**b. Ground**

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

*No.*

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals . . . agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

*Not Applicable.*

**c. Water Runoff (including storm water):**

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

*Not Applicable. The proposed projects identified in the Plan will not increase runoff quantities.*

2) Could waste materials enter ground or surface waters? If so, generally describe.

*Not Applicable.*

**d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:**

*This Comprehensive Plan has been developed to address the provision of sanitary sewer service to all areas of the District. Provision of such service will protect surface and ground water quality by reducing the hazards associated with on-site sewage disposal.*

#### 4. PLANTS

a. Check or circle types of vegetation found on the site:

- deciduous tree: alder, maple, aspen, other  
 evergreen tree: fir, cedar, pine, other:  
 shrubs,  
 grass  
 pasture  
 crop or grain  
 wet soil plants: cattail, buttercup, bulrush, skunk cabbage, other  
 water plants: water lily, eelgrass, milfoil, other  
 other types of vegetation:

b. What kind and amount of vegetation will be removed or altered?

*The majority of work contemplated will occur in dedicated right-of-ways, however, disturbed vegetation will be replaced and sites restored to preconstruction condition where appropriate. Landscaping will be accomplished in accordance with the requirements of the appropriate jurisdiction.*

c. List threatened or endangered species known to be on or near the site.

*Not Applicable.*

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

*As mentioned in 4.b. above, vegetation disturbed during construction will be replaced in accordance with the requirements of the appropriate jurisdiction or property owner.*

#### 5. ANIMALS

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds, other:  
mammals: deer, bear, elk, beaver, other:  
fish: bass, salmon, trout, herring, shellfish, other:

b. List any threatened or endangered species known to be on or near the site.

*None Known.*

c. Is the site part of a migration route? If so, explain.

*Not Applicable.*

d. Proposed measures to preserve or enhance wildlife, if any: *Not Applicable.*



## 6. ENERGY AND NATURAL RESOURCES

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

*Operation of the District's sanitary sewer system requires the use of electricity, water and fuel.*

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

*No.*

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

*Future improvement projects have been identified which will minimize the use of energy for pumping of wastewater.*

## 7. ENVIRONMENTAL HEALTH

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

*There is a minimal environmental and health risk associated with the operation of a sanitary sewer system.*

1) Describe special emergency services that might be required.

*Sanitary sewer system monitoring and emergency response procedures are employed in accordance with safe operational practices and Department of Ecology requirements.*

2) Proposed measures to reduce or control environmental health hazards, if any:

*Although provision of sanitary sewer service is in itself a mitigation measure for the protection of the environment, the District maintains a stringent operation and maintenance program to protect against system problems which may adversely affect the environment.*

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

*Not Applicable.*

2) What types of levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

*A temporary increase in noise levels will be associated with construction of the proposed project.*

3) Proposed measures to reduce or control noise impacts, if any:

*Construction will be limited to normal working hours, generally 8:00 a.m. to 5:00 p.m. Monday through Friday. All standard construction measures will be taken to reduce noise, including use of mufflers and limiting hours of construction where required.*

## 8. LAND AND SHORELINE USE

a. What is the current use of the site and adjacent properties?

*The existing land use of the service area is generally identified and discussed in Chapter 4 of the Plan. As indicated, the area is primarily single family residential in nature, with concentrations of multi-family and commercial types uses along major thoroughfares. The northern portion of the District is industrial in nature and includes a variety of manufacturing and commercial uses.*

b. Has the site been used for agriculture? If so, describe.

*Not Applicable.*

c. Describe any structures on the site.

*Not Applicable.*

d. Will any structures be demolished? If so, what?

*No.*

e. What is the current zoning classification of the site?

*Zoning is consistent with land uses, which are generally described in Chapter 4 of the Plan.*

f. What is the current comprehensive plan designation of the site?

*Urban.*

g. If applicable, what is the current shoreline master program designation of the site?

*Not Applicable.*

**h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.**

*Not Applicable. Construction of specific projects in environmentally sensitive areas will require specific considerations during design in order to mitigate activity in such areas.*

**i. Approximately how many people would reside or work in the completed project?**

*Not Applicable.*

**j. Approximately how many people would the completed project displace?**

*Not Applicable.*

**k. Proposed measures to avoid or reduce displacement impacts, if any:**

*Not Applicable.*

**l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:**

*The Comprehensive Sewer System Plan was developed as a guideline for responding to growth and land uses projected by the various jurisdictions within which the District operates.*

## **9. HOUSING**

**a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.**

*Not Applicable.*

**b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.**

*Not Applicable.*

**c. Proposed measures to reduce or control housing impacts, if any:**

*Not Applicable.*

## **10. AESTHETICS**

**a. What is the tallest height of any proposed structure(s), not including antennas: what is the principal exterior building material(s) proposed?**

*The Plan presents only a listing of proposed sanitary system projects and does not attempt to identify specific project design criteria. Generally speaking, Val Vue Sewer*

*District sanitary sewer system facilities consist of underground pipelines. No above ground facilities are proposed as part of this Plan.*

**b. What views in the immediate vicinity would be altered or obstructed?**

*Not Applicable.*

**c. Proposed measures to reduce or control aesthetic impacts, if any:**

*Not Applicable.*

## **11. LIGHT AND GLARE**

**a. What type of light or glare will the proposal produce? What time of day would it mainly occur?**

*None.*

**b. Could light or glare from the finished project be a safety hazard or interfere with views?**

*None.*

**c. What existing off-site sources of light or glare may affect your proposal:**

*None.*

**d. Proposed measures to reduce or control light and glare impacts, if any:**

*Not Applicable.*

## **12. RECREATION**

**a. What designated and informal recreational opportunities are in the immediate vicinity.**

*Not Applicable.*

**b. Would the proposed project displace any existing recreational uses? If so, describe.**

*No.*

**c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:**

*Not Applicable.*

### 13. HISTORIC AND CULTURAL PRESERVATION

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

*Not Applicable.*

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

*Not Applicable.*

c. Proposed measures to reduce or control impacts, if any:

*Not Applicable.*

### 14. TRANSPORTATION

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

*Not Applicable.*

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

*Not Applicable.*

c. How many parking spaces would the completed project have? How many would the project eliminate?

*None.*

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

*No.*

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

*Not Applicable.*

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

*None.*

g. Proposed measures to reduce or control transportation impacts, if any:

*Not Applicable.*

**15. PUBLIC SERVICES**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, school, other)? If so, generally describe.

*No.*

b. Proposed measures to reduce or control direct impacts on public services, if any.

*Not Applicable.*

**16. UTILITIES**

a. Circle utilities currently available at the site: electricity, Natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

*Not Applicable.*

b. Describe the utilities that are proposed for the project, the utility providing service, and the general construction activities on the site or in the immediate vicinity which might be needed.

*This proposal establishes a plan for the future development of sanitary sewer systems within the identified service area and assures that adequate facilities are provided to meet projected wastewater capacity requirements.*

**C. SIGNATURE**

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: *[Handwritten Signature]*

Date Submitted: *8-20-98*



**D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS**

**1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?**

*No Increases.*

**Proposed measures to avoid or reduce such increases are:**

*Not Applicable.*

**2. How would the proposal be likely to affect plants, animals, fish or marine life?**

*No Impacts.*

**Proposed measures to protect or conserve plants, animals, fish or marine life are:**

*None Necessary.*

**3. How would the proposal be likely to deplete energy or natural resources?**

*Not Applicable.*

**Proposed measures to protect or conserve energy or natural resources are:**

*Efficient planning and design of new facilities and minimizing the use of pump stations will assist in the conservation of energy.*

**4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or primelands?**

*This proposal will not impact any of the above listed areas.*

**Proposed measure to protect such resources of to avoid or reduce impacts are:**

*Construction of the projects identified in the Comprehensive Sewer System Plan will be consistent with the regulations and policies governing the protection of such resources.*

**5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses consistent existing plans?**

*This proposal will not affect, allow or encourage land or shoreline uses.*

**Proposed measures to avoid or reduce shoreline and land use impacts are:**

*Not Applicable.*

**6. How would the proposal be likely to increase demands on transportation or public services**

and utilities?

*This proposal will not impact demands on transportation or public utilities but will serve as a guideline or future sanitary sewer system development.*

**Proposed measures to reduce or respond to such demands are:**

*Not Applicable.*

**7. Identify, if possible, whether the proposal may conflict with local, state or federal laws requirements for the protection of the environment.**

*This proposal is not in conflict with any such laws.*



VAL VUE SEWER DISTRICT  
KING COUNTY, WASHINGTON  
RESOLUTION NO. 2000-16

A RESOLUTION OF THE BOARD OF COMMISSIONERS OF VAL VUE SEWER DISTRICT, KING COUNTY, WASHINGTON, ADOPTING THE 2000 COMPREHENSIVE SEWER PLAN.

WHEREAS, Val Vue Sewer District is a municipal corporation formed under the and with the duties imposed by RCW Title 57; and ,

WHEREAS, the District Board of Commissioners directed Penhallegon Associates Consulting Engineers, Inc. to prepare a Comprehensive Sewer Plan for review and approval by the requirements of the State of Washington, King County, and all other agencies having jurisdiction; and,

WHEREAS, the District has completed all documentation required in accordance with the State Environmental Policy Act, and circulated the Plan for review and comment by agencies having jurisdiction; and,

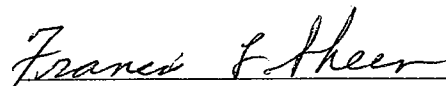
WHEREAS, the Plan has been revised to address all comments received; and,

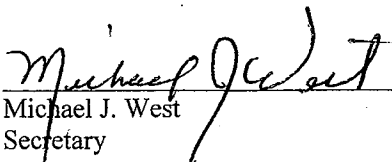
WHEREAS, approval of the Plan by King County requires prior adoption of the document by the District; now, therefore, be it

RESOLVED by the Board of Commissioners of Val Vue Sewer District, as follows:

Section 1: That certain document entitled "2000 Comprehensive Sewer Plan" of Val Vue Sewer District, King County, Washington, as drafted, prepared and proposed by Penhallegon Associates Consulting Engineers, Inc., is herein incorporated by this reference as if set forth in full. And is hereby adopted and approved for use by the District.

ADOPTED by the Board of Commissioners of Val Vue Sewer District, King County, Washington, at a regular open public meeting held the 17<sup>th</sup> day of October, 2000.

  
\_\_\_\_\_  
Francis L. Sheen  
Chairman

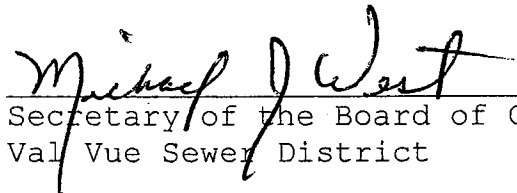
  
\_\_\_\_\_  
Michael J. West  
Secretary

\_\_\_\_\_  
Joe Colello  
Vice-Chairman

**CERTIFICATION**

I, Michael J. West, the undersigned Secretary of Val Vue Sewer District, King County, Washington, (the "District"), DO HEREBY CERTIFY that the attached is a true and correct copy of Resolution No. 2000-16, adopted on the 17<sup>th</sup> day of October 2000 as that resolution appears in the minute book of the District.

DATED this 17<sup>th</sup>, day of October 2000.

  
Secretary of the Board of Commissioners  
Val Vue Sewer District

WORKING TOWARD A BETTER ENVIRONMENT

**Val Vue**  
SEWER DISTRICT

# VAL VUE SEWER DISTRICT

## INFILTRATION AND INFLOW STUDY

OCTOBER 1999

Prepared by:



Penhallegon Associates Consulting Engineers, Inc.

750 Sixth Street South

Kirkland, WA 98033

425-827-2014

# Val Vue Sewer District

## Infiltration and Inflow Study

### Introduction

Val Vue Sewer District requested that Penhallegon Associates Consulting Engineers, Inc. prepare this study as a follow-up to specific issues identified in its recent comprehensive planning effort and as a step in continuing efforts to control infiltration and inflow in its system. The District recognizes the importance of controlling infiltration and inflow (I/I) as a means of reducing wastewater collection, pumping and treatment costs. As a component agency in King County-Metro's regional wastewater treatment and disposal system, Val Vue has been an active participant in regional efforts toward identifying the sources of I/I and potential measures for reducing the flows caused by I/I and is a participant in the King County Regional Infiltration and Inflow Program initiated in June 1999.

### District Information

Val Vue Sewer District was originally established in 1946 and covered 0.37 square miles. Since that time, the District has grown through annexations and a merger with Rainier Vista Sewer District to its current size of approximately 9.4 square miles. Val Vue Sewer District serves approximately 30,500 people through approximately 10,850 residential connections and approximately 4,050 commercial connections. By the year 2010, it is estimated that a population of 34,730 will be served through 14,820 residential connections and 5,750 commercial connections. This increase represents growth of approximately 37% over the next 10± years.

The District's system consists of eleven primary drainage basins served by a network of sewer mains ranging in size from 6-inches to 24-inches and 19 pump stations. Although more than 85% of the District's flow are treated by King County-Metro, the District also relies on the services of Southwest Suburban Sewer District and Midway Sewer District for wastewater treatment and disposal. The delivery of flow to these entities is accomplished through system connections and is in accordance with existing interlocal agreements.

### Study Objectives

Due to projected growth and limited facility size and capacity, the District has a responsibility to operate the sewer system as efficiently as possible. Part of responsible operation, maintenance and system management includes controlling infiltration and inflow into the system. Infiltration is defined as ground water which enters the sewer system through pipe joints, cracked or leaking pipes, porous pipes or similar openings in the system. Inflow is surface water which enters the sewer system through manhole covers, cross connections with storm drainage systems or illegal connections such as yard drains, footing drains, area drains or roof

drains connected to the sewer system.

Excessive infiltration and inflow can lead to capacity issues within the system in sewer mains, pump stations and/or treatment facilities which could cause issues such as sewer overflows, basement backups, or surcharged manholes. If infiltration and inflow are allowed to persist over a period of time, other problems can eventually occur such as increased deterioration of the pipe bedding or backfill which could create or contribute to sewer system failure and/or damage to surrounding utilities. This, in turn, necessitates more system upgrades at a more rapid pace than would otherwise be expected. All of these issues will eventually cost the District and the District's customers as facilities are improved and upgraded to handle the excessive flows caused by infiltration and inflow.

An important step in controlling infiltration and inflow is identifying the most problematic areas in the District and determining the cause of the infiltration and/or inflow. Val Vue took the initial step in this process in late 1995 by purchasing flow monitoring equipment and monitoring sewer mains at various manhole locations. The District has focused its initial monitoring in areas where high infiltration and/or inflow were suspected; therefore, the data may not accurately portray the entire District. The objective of this study was to use the existing flow data to determine approximate infiltration and inflow rate(s) for the District. Estimating I/I will provide base data for further evaluation of facilities. Additional factors for consideration of I/I are pipe and joint materials, age, soil types, ground water levels, facility design (particularly slopes) and land uses in the area.

The results of this study will be used in conjunction with the results of the King County Regional I/I Program to establish an appropriate I/I reduction program for Val Vue Sewer District. In Spring of 2000 a long term meter was placed in the Val Vue system as part of the Regional I/I Program. An additional 19 meters will be placed in the Val Vue system in fall and winter of 2000 for simultaneous monitoring of the District's sub-basins, established as part of the Regional Program. The data from this monitoring effort will also be considered by the District in establishing its specific I/I reduction program.

### **Summary of I/I Program**

An overall Infiltration and Inflow Reduction Program can be divided into five main processes. The first step is to identify the suspect areas in the system. After these areas are identified, they should be monitored to get actual system flow data and inspected, if necessary. The data collected in the monitoring effort is then analyzed and the problem areas assessed. Once the worst areas in the system have been identified, a repair and/or replacement program can be implemented to correct the identified problems. The final step needed for a successful I/I program is continued monitoring and system inspection, together with a continual repair and/or

replacement program. Val Vue Sewer District has been aggressive in controlling infiltration and inflow within its system. Suspected problem areas have been identified by District staff and manhole flow monitoring has been done continuously since 1995. The intent of this study is to analyze the monitoring data, present recommendations regarding areas in need of rehabilitation or replacement and suggest future monitoring locations.

The initial step in preparing this study was to review the existing flow monitoring data. The data was then combined with rainfall data from the Western Regional Climate Center (WRCC) and compiled into spreadsheets, tables and graphs. Rainfall data from the WRCC is collected at Sea-Tac Airport, presumably at the same time each day, and constitutes "official" data for the area.

The data sets for each manhole were separated into wet weather and dry weather categories. For the most part, wet weather monitoring occurred from October through January, while dry weather monitoring includes data from April through September. Base, average and storm flows were then established for each data set. The complete analysis process is described in more detail in the Study Assumptions Section of this report.

The monitored manholes were then plotted on a sewer system map of the District that included contours to determine the contributing areas for each manhole, in acres. This information, combined with the average flow rates, helped establish the average estimated infiltration and inflow for each manhole (expressed as gallons per acre per day or gpad).

Manhole monitoring data was supplemented with pump station data to get a relative I/I rate for areas where manhole flow monitoring has not yet been accomplished or is incomplete.

### **Study Assumptions**

As previously stated, the analysis involved a comparison of wet weather and dry weather flow data. The data sets were reviewed and divided into three groups; base flow, average flow and storm flow. The **base flows** represent the lowest flows within the data sets, which usually correspond to the days with the least rainfall. The **average flows** are primarily the average of all the days in the data sets, excluding days with extremely non-typical characteristics. The **storm flows** represent the flows on days with significant rainfall events, which are days with approximately 0.1 inch of rain or more. The rainfall data presented is the average rainfall amount for the applicable flow period (base, average or storm). Adjustments were made to the flow data set averages to account for a lag time in rainfall events contributing to the flows. The tables containing this information are provided at the end of this study.

The estimated infiltration and inflow for each manhole was calculated as the difference between the storm wet weather flow and the average dry weather flow. This implies that infiltration and

inflow was negligible during the dry season on an average day.

The manhole data was also compared by basin. Manholes in the same basins usually have similar characteristics such as system age, pipe material in the manhole area, etc. This comparison allows some more general statements to be made regarding the system. For example, a general statement can be made indicating that older pipes generally contribute more infiltration and inflow into the system.

It was also assumed that the maximum allowable infiltration and inflow rate is 1,100 gpad. It appears that this goal will be attainable, with continued monitoring and rehabilitation efforts, in many parts of the District. The District should also work to lower this goal as its established infiltration and inflow program progresses.

The rainfall data used in the study came from the Western Regional Climate Center (WRCC). It should be noted that days indicating a trace amount of rainfall were assumed to have no rainfall. The rainfall data was not used in the calculated analysis part of this study. The data is only used to show how the average flows and infiltration and inflow correlate, respectively, to the rainfall. To correlate the rainfall data numerically to the flow data, a detailed analysis would be required and, even then, the assumptions that would be necessary to complete the analysis would override the validity of any findings.

## **Analysis Results and Recommendations**

The section presents a brief description of the basins within the District and the general analysis results and study recommendations for each basin. Additional basin information can be found in the District's Comprehensive Sewer System Plan. The basin analysis sections include tables which summarize a portion of the total manholes monitored. Other manholes which have been monitored are not included in these tables due to either incomplete or inconsistent data. A complete table of manhole data and location map are included at the end of this study. The Macadam, Duwamish, West Duwamish, Beverley Park and Southwest Suburban basins are not addressed in this study because they were not included in the District's initial areas of suspected high levels of I/I.

### ***Glen Acres Basin***

The Glen Acre basin includes nearly 500 acres of land located in the northwestern area of the District. The basin extends from approximately 8<sup>th</sup> Avenue South on the west to 14<sup>th</sup> and 17<sup>th</sup> Avenues South on the east, and from approximately South Roxbury Street on the north to South 124<sup>th</sup> Street to the south. This basin gravity flows to the north and east into a King County-Metro manhole connection located near the intersection of 17<sup>th</sup> Place South and Pacific Highway South. Although some facilities in the basin date back

to the late 1950's, repairs and rehabilitations have been accomplished in particular problem areas. The southern half of the Glen Acres basin is currently unsewered.

As indicated in Table 1, based on available monitoring data, infiltration and inflow rates in the Glen Acres basin are not particularly high and are close to being with the maximum acceptable limit of 1,100 gpad. The northeastern portion of this basin (Manholes C3 and C5) displays higher I/I flows than the rest of the basin. This area, in particular, should be continually monitored. The lower I/I flows are presumed to be, in part, due to past rehabilitation efforts in the area. The District should plan to accomplish periodic monitoring to insure that estimated current levels of I/I are maintained. Such monitoring should be performed near the discharge point to the King County-Metro system to establish whether more detailed monitoring of the basin is required.

Manhole # & Address	Pipe Age & Material	Contrib. Area (acres)	Dry Weather Avg		Wet Weather Storm			Estimated I/I (gpad)
			Average Flow (gpad)	Average Rainfall (inches)	Average Flow (gpad)	Average Rainfall (inches)	% Dry Flow	
C11 S 99 <sup>th</sup> St. & 14 <sup>th</sup> Ave. S	1957 Clay	177	831	0.00	1802	0.60	217 %	972
C3 Des Moines Mem Dr. & 17 <sup>th</sup> Pl. S	1957 Conc	244	771	0.01	1533	0.36	199 %	818
					2023	0.35	262 %	1309
C5 S 96 <sup>th</sup> St. & Des Moines Mem Dr.	1957 Clay	238	715	0.01	1550	0.29	217 %	1553
G9 S 104 <sup>th</sup> St. & 14 <sup>th</sup> Ave. S	1957 Clay	40	119	0.00	510	0.10	429 %	392
<b>Basin Average</b>			<b>729</b>	<b>0.005</b>	<b>1672</b>	<b>0.34</b>	<b>265 %</b>	<b>1141</b>

### **Midway Basin**

The Midway basin is located in the southwestern portion of the District and includes areas which were previously part of the District's Three Tree basin. Although flows from the basin have historically been directed north to the King County-Metro system for treatment and disposal, the District intends to redirect flows from this area to the south and into the Midway Sewer District system for treatment and disposal. Val Vue is currently working with Midway Sewer District on an agreement for the flow transfer and



part of the negotiation process includes confirming that the infiltration and inflow rates are within an acceptable range.

The average infiltration and inflow rate for this basin is higher than the established acceptable level. It is recommended that the District continue monitoring this basin to pinpoint areas for additional video inspection and determine a rehabilitation program of specific pipelines and manholes. Particular locations that should be addressed are in the southwestern part of the basin, where the I/I rates appear to be the highest.

Manhole # & Address	Pipe Age & Material	Contrib. Area (acres)	Dry Weather Avg		Wet Weather Storm			Estimated I/I (gpad)
			Average Flow (gpad)	Average Rainfall (inches)	Average Flow (gpad)	Average Rainfall (inches)	% Dry Flow	
4-57 17303 32 <sup>nd</sup> Ave. S	1963 Conc	100	469	0.01	1767	0.24	426 %	1354
			361	0.00	1446	0.25	348 %	1031
4-59 S 175 <sup>th</sup> St. & 33 <sup>rd</sup> Ave. S	1963 Conc	87	1055	0.03	3241	0.47	307 %	2186
4-68 17321 34 <sup>th</sup> Ave. S	1963 Conc	65	374	0.07	1795	0.35	498 %	1437
			347	0.02	2130	0.25	591 %	1773
4-84 35 <sup>th</sup> Ave. S & S 172 <sup>nd</sup> St.	1963 Conc	40	213	0.00	377	0.03	177 %	158
			225	0.02			168 %	
4-85 37 <sup>th</sup> Ave. S & S 172 <sup>nd</sup> St.	1963 Conc	25	1185	0.00	3858	0.00	325 %	2674
A-19 2900 S 176 <sup>th</sup> St.	1973 AC	33	2285	0.01	3708	0.68	162 %	1424
					5237			3853
<b>Basin Average</b>			<b>621</b>	<b>0.02</b>	<b>1826</b>	<b>0.28</b>	<b>294 %</b>	<b>1616</b>

### ***Rainier Vista Basin***

The Rainier Vista basin covers approximately 950 acres of land running south to north through the central portion of the District. Gravity sewers generally carry flow to a King County-Metro connection near the intersection of Des Moines Way South and 17<sup>th</sup> Place South, although three small pump stations are required to pump flows from

isolated areas where gravity flow is not possible. A small portion of the basin is currently unsewered.

This basin contains some of the oldest pipelines within the District and, based on this analysis, has the highest infiltration and inflow rates in the District. Analysis results indicate that the area in the vicinity of Des Moines Way and South 110<sup>th</sup> Street to South 115<sup>th</sup> Street has particularly high I/I. It is recommended that in addition to continued flow monitoring, immediate manhole and/or video inspection of the lines in this area be accomplished to determine the best method of repair and infiltration and inflow reduction. It should be noted that the District has taken an aggressive stand to reduce I/I in this area. The District has scheduled replacement or rehabilitation of approximately 16,775 linear feet of main for this basin in its Capital Facilities Plan. It is anticipated that the replacement or rehabilitation will be accomplished by pipe bursting and will include manhole sealing and side sewer replacements. This project is scheduled for 2001-2002 although spot repairs may be required before then.

**TABLE 3  
RAINIER VISTA BASIN**

Manhole # & Address	Pipe Age & Material	Contrib. Area (acres)	Dry Weather Avg		Wet Weather Storm			Estimated I/I (gpad)
			Average Flow (gpad)	Average Rainfall (inches)	Average Flow (gpad)	Average Rainfall (inches)	% Dry Flow	
A1 17 Pl. S & Des Moines Way S	1957 Conc	103	1705	0.00	3884	0.36	228 %	2179
					3406	0.32	200 %	1701
A16A 10833 24 <sup>th</sup> Ave. S	1957 Clay, Conc.	137	1542	0.01	6674	0.39	433 %	5133
A16N S 116 <sup>th</sup> St. & Des Moines Way S	1957 Clay	109	2099	0.15	3289	0.60	157 %	1160
A23C 11851 Military Dr. S	1957 Clay	76	1063	0.01	8045	0.39	757 %	6982
A29 20 <sup>th</sup> Ave. S & S 120 <sup>th</sup> St.	1957 Clay	300	803	0.00	1476	0.16	183 %	673
					2243	0.60	279 %	1439
<b>Basin Average</b>			<b>1295</b>	<b>0.03</b>	<b>3654</b>	<b>0.40</b>	<b>320 %</b>	<b>2331</b>

### Three Tree Basin

The Three Tree basin is located in the south central portion of the District and gravity flows to two King County-Metro connections. Several areas within this basin currently do not have sewer service, especially in the area around State Route 518 and Interstate Highway 5.

The estimated infiltration and inflow rates for this basin are higher than the acceptable level. The District should continue its monitoring efforts and complete video inspections for those areas with the highest estimated infiltration and inflow rates. The District Capital Facilities Plan also includes replacement or rehabilitation of approximately 9,150 linear feet of main in this basin.

Manhole # & Address	Pipe Age & Material	Contributing Area (acres)	Dry Weather Avg		Wet Weather Storm			Estimated I/I (gpad)
			Average Flow (gpad)	Average Rainfall (inches)	Average Flow (gpad)	Average Rainfall (inches)	% Dry Flow	
4-10 16850 Pac Hwy S	1963 Conc	165	852	0.00	2871	0.38	322 %	1978
			934	0.00	3550	0.16	398 %	2657
					5647	0.25	632 %	4754
4-24 16654 31 <sup>st</sup> Ave. S	1963 Conc	35	387	0.03	1500	0.28	388 %	1113
A-32 15810 Pac Hwy S	1957 Conc	310	1037	0.00	2575	0.00	248 %	1743
			626	0.02			411 %	
B14-I-9A 15407 42 <sup>nd</sup> Ave. S	1968 Conc	381	1464	0.00	2923	0.14	200 %	1459
D14-I-1A S 154 <sup>th</sup> St. & 52 <sup>nd</sup> Ave. S	1968 Conc	552	1587	0.01	3511	0.25	221 %	1924
<b>Basin Average</b>			<b>1177</b>	<b>0.01</b>	<b>3325</b>	<b>0.21</b>	<b>353 %</b>	<b>2113</b>

### McMicken Basin

The McMicken basin is located in the southeast portion of the District and includes the

area generally bounded by South 16<sup>th</sup> Street to the north, 40<sup>th</sup> Avenue South and 42<sup>nd</sup> Avenue South to the west, Interstate 5 and the District boundary to the east and the District's boundary at South 176<sup>th</sup> Street and South 182<sup>nd</sup> Street to the south. A portion of this basin gravity flows to the King County-Metro connections while the other portion flows to the McMicken Pump Station. Limited manhole data was available for this basin so a combination of pump station data and District staff information has been considered in determining the rate of I/I in the basin.

The McMicken Pump Station was originally constructed in 1974. In 1995 the station was rehabilitated and upgraded. The District has also completed several rounds of extensive manhole grouting and sealing in this basin. After the approximately 250 manholes in the contributing area are grouted or sealed, pump run times decrease significantly. The pump station run times start to increase when the grout or sealant starts deteriorating, due to the fluctuations in the groundwater table and the chemical characteristics of the water. For example, the manholes were grouted in 1992. By 1999 a direct correlation could be seen between rainfall and pump run times, indicating an increase in I/I. The total gallons pumped approximately doubles during wet weather, also indicating grout deterioration and increased I/I.

The limited manhole data for this basin suggests that the higher I/I flow rates are generated in sub-basin 12, the south-central portion of the basin. The District plans on accomplishing additional monitoring in this area to better locate the I/I source(s) in spring of 2000. After this monitoring is accomplished, the District should review the data to determine the next step of action for reducing the I/I.

### ***Riverton Basin***

The Riverton basin is located in the central area of the District and is generally bounded by State Route 599 to the north, 40<sup>th</sup> Avenue South and 42<sup>nd</sup> Avenue South to the west, South 146<sup>th</sup> Street to the south and Military Road to the east. The southern portion of the basin gravity flows to a King County-Metro connection while the northern part of the basin relies on the Inco and Metro Pump Stations to direct flows to the same connection. Again, limited manhole data was available for this basin so the pump station data was analyzed.

The pump station data indicated low infiltration and inflow rates for this basin. This is not considered a critical area but it is recommended that at some point the District accomplish additional manhole monitoring to verify the I/I rate. The District's CFP includes replacement or rehabilitation of approximately 1,050 linear feet of main for this basin. This basin provides an example of the effects of rehabilitation and repair work. In April 1999 a large split in a main contributing to the Inco pump station was repaired. After the repairs were completed the average run times during the wet weather season decreased approximately 22% and the average gallons pumped decreased by approximately 46%.

**Summary**

In general, the estimated infiltration and inflow for each basin is greater than the 1,100 gal/acre/day estimate used in the District's Draft Comprehensive Sewer Plan. This is not surprising since many of the manholes that were monitored are in older parts of the District and, as previously stated, the District chose to monitor manholes in areas where higher infiltration and inflow rates were expected.

The average infiltration and inflow for different drainage basins are given in the table below.

<b>TABLE 5 AVERAGE INFILTRATION AND INFLOW RATES</b>	
<b>Basin</b>	<b>Average Infiltration and Inflow</b>
Glen Acres	1,141 gpad
Midway	1,616 gpad
Rainier Vista	2,321 gpad
Three Tree	2,113 gpad

Some general assumptions can also be made based on the material of the pipes surrounding the monitored manholes. Table 6 presents the average infiltration and inflow rates based on the major pipe material types.

TABLE 7 INFILTRATION AND INFLOW RATES COMPARED TO PIPE MATERIAL	
System Pipe Material	Average Infiltration and Inflow
Asbestos Cement	2,638 gpad
Vitrified Clay	2,123 gpad
Concrete	1,800 gpad

### General Study Recommendations

Preventative maintenance and system rehabilitation can not typically be done for an entire system simultaneously due to time and budget constraints. Therefore, prevention, rehabilitation, or replacement work should be prioritized in order to address the most critical areas first. Critical areas should include areas where failure is imminent, where failure would cause the most damage, and in areas that are contributing the most to infiltration and inflow flow rates.

The District's Capital Facilities Plan (CFP), located in the Comprehensive Sewer Plan, identifies improvements for system issues and prioritizes the related projects. As noted previously, the CFP includes replacement or rehabilitation of several thousand linear feet of sewer main. It is anticipated that most of these projects will also include side sewer replacement. Although this study does not attempt to quantify I/I sources, other reports suggest that side sewers (laterals) can contribute more than 50% of the I/I within a system. The CFP also includes annual expenses for the District's aggressive I/I reduction program which include contributions for manhole grouting, short line repair/grouting, flow monitoring and related miscellaneous expenses. The combination of these projects should significantly reduce I/I throughout the Val Vue system.

In order to accurately prioritize the I/I improvements, additional monitoring, inspections and/or testing of the system should be accomplished. The District owns video inspection equipment and has completed video inspections of many of its sewer mains. It is recommended that manual and video inspections be completed in the areas surrounding the monitored manholes where infiltration and inflow rates are higher than the established acceptable level (1,100 gpad). Television inspections can help identify collection system defects and infiltration and inflow issues such as cracks, sags, offset joints, broken or deformed pipe, defective connections, side sewer issues, or root intrusion.

If additional inspection fails to identify the inflow or infiltration source(s), the District may also consider performing smoke or dye tests. Smoke tests are typically used to identify inflow sources such as water or storm system cross connections, catch basins, or connections from area, roof or footing drains. Inflow can be a large contributing factor to infiltration and inflow flows. Therefore, these relatively inexpensive and quick tests could be very cost effective for the District.

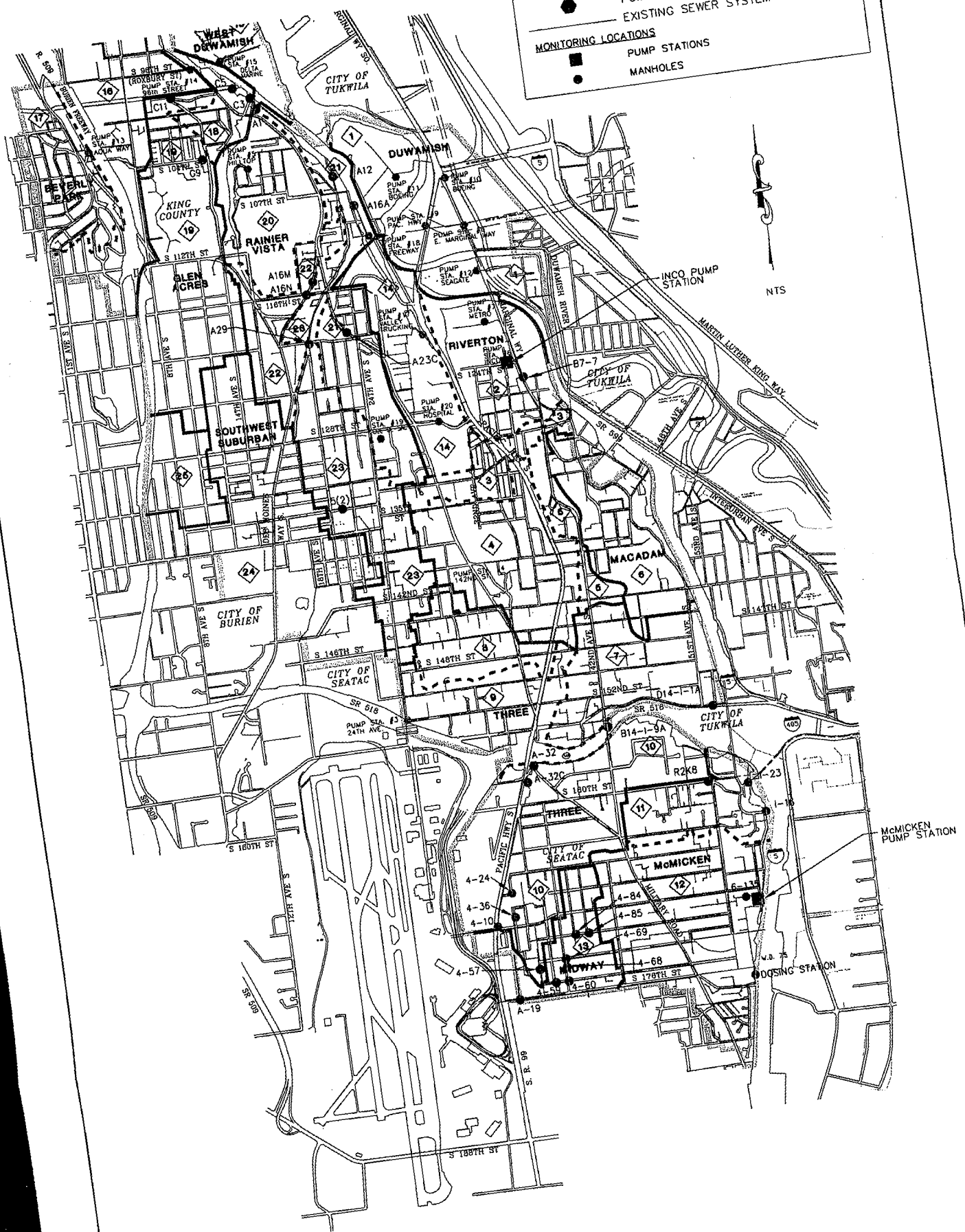
If smoke testing can not be performed, another option to consider is dye testing. Dye testing is primarily used to verifying connections to the sewer system by legal (service connections, plumbing fixtures, etc.) and illegal (roof drains, footing drains, etc.) connections. Rainfall induced infiltration can also be detected by flooding areas over main lines or service laterals and around manholes during the tests.

The Washington State Department of Ecology's *Criteria for Sewage Works Design* also discusses the use of sonar, radar, and thermography testing. These methods are more costly and should only be considered if the other, more conventional, testing methods are not possible.

The District intends to continue to monitor suspect areas within the system and, as stated previously, the District is participating in the King County Regional I/I Program. Part of this study includes placing 17 meters in the Val Vue system to monitor flow in fall/winter of 2000. These meters will simultaneously monitor the flow and rainfall throughout the system. The results from this monitoring effort are expected in early 2001 and the District should consider this invaluable data in its overall I/I analyses.

Continuation of the ongoing manhole inspection program is also critical. Manholes can contribute significantly to the infiltration and inflow flow through pick holes in covers, around the manhole frame, through joints and cracks in the manhole base, or through the annular space around lines connecting to the manhole. Visual inspections can provide important information regarding how any of the above conditions are possibly contributing to inflow or infiltration as well as other maintenance issues such as debris buildup, flow conditions, corrosive atmosphere and grease buildup.

● PUMP STATION  
 — EXISTING SEWER SYSTEM  
 ◆ MONITORING LOCATIONS  
 ■ PUMP STATIONS  
 ● MANHOLES



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**VAL VUE SEWER DISTRICT  
 INFILTRATION AND INFLOW STUDY  
 MONITORING LOCATIONS**



# Val Vue Sewer District

## Infiltration and Inflow Study- Attachment

### Sewer Rehabilitation and Replacement Methods

Before beginning a rehabilitation or replacement program, the necessary monitoring, testing, inspecting, and evaluating must be completed. Estimated infiltration and inflow flows for different areas of the District should be established and an understanding of the causes of the flow must be known. Based on this information, the appropriate rehabilitation or replacement options can be identified. Once the rehabilitation or replacement options are known, a comparative cost analysis should be done.

The number of approaches to the replacement and rehabilitation of buried pipelines has continually increased over the past five years based on the application of new technology. Many of the new approaches, which offer significant reductions in the extent of the excavation required (commonly called "no dig" approaches), have been developed outside of the United States. The level of their development ranges from experimental (little or no field experience) to well-developed (hundreds of miles of work completed under difficult field conditions). The development of the new approaches is continuing and any plan that is developed should retain the flexibility to take advantage of these new technologies. Only those methods which are cost effective, are implementable, and are within the capabilities of the District and/or the local construction community to perform should be considered at any given time.

The following is a brief overview of the technologies that are relatively well-developed. It should be noted that these options usually produce only a minimal reduction in infiltration unless the service laterals are also fully rehabilitated.

#### ***Large Diameter (Pipe Sizes Greater Than 18-Inch Diameter)***

Full pipe rehabilitation (manhole to manhole) is required when the level of deterioration is widespread rather than localized. The full pipe rehabilitation approach includes structural lining and protective lining.

**Structural Linings** provide a system capable of supporting the soil loading either alone or in conjunction with the original pipe material. They include inversion lining (or cured-in-place lining), insertion lining, and conventional slip lining.

**Inversion Lining** consists of inverting a resin-impregnated tube into the original pipe and curing it in place to produce a fiber reinforced pipe. Insituform is the best known inversion lining approach and they clearly have the most extensive experience; however,

competition from Europe (KM Inliner) and Japan (Paltem) can be anticipated in the near future. The advantages of inversion lining include minimal excavation and capacity improvement in very rough sewers. The disadvantages include long cure times (1 day) and the necessity of bypassing the flow during the installation and curing period and no improvement is made to the internal configuration of the existing host pipe.

**Insertion Lining** consists of pushing prefabricated pipe through the existing pipe. The materials can range from high density polyethylene (HDPE) to conventional reinforced concrete. Examples of this approach include Spirolite (HDPE) and Hobas (centrifugally cast, sand impregnated resin). The advantages are installation through the flowing pipe (no need for bypassing the flow), limited excavation and independent load capacity. The main disadvantage is the loss of flow area necessitated by wall thickness and annular clearance requirements.

**Slip Lining** consists of pulling in a continuous liner typically made of HDPE. It requires bypassing the flow and it results in a loss of flow area. Claims of mitigating the loss of capacity through reduced friction may not be appropriate over the life of the pipe.

**Protective Linings** rely on the original pipe for strength. They are selected to protect the original pipe from corrosion/chemical attack and to eliminate infiltration/exfiltration. Examples of this approach include Ribloc/Danby and sprayed linings such as Zebron (polyurethane). Thin-wall Insituform inversion lining can be used as a protective lining. Their advantages are minimal loss of flow area and low cost.

**Joint Repair** is warranted in cases where the joints have failed while the pipe barrel is serviceable. The methods that can be employed are mechanical joint seals (Weco Seal, Link Pipe), spray-on seals (Spin Seal), and chemical grouting. This approach is less costly than full pipe rehabilitation and it can significantly extend the life of a pipe. In some cases remote installation is possible.

**No Dig Construction** is warranted in cases where additional capacity is needed and extensive excavation would be very disruptive to traffic or commerce. Its consideration is also warranted when the cost of surface restoration is high. The well developed methods include jacking and microtunneling.

### ***Small Diameter (Pipe Size Less Than 12-Inch Diameter)***

In the small diameter rehabilitation applications, there are several structural lining approaches in addition to inversion lining. They include spiral lining, reduced diameter slip lining, and

segmented lining.

**Spiral Lining** is a process where a continuous length of liner pipe is fabricated in the manhole using an extruded, interlocking polyvinyl chloride (PVC) strip. Examples of this approach include Ribloc and Danby. Both offer limited loss of flow area and minimal excavation. Neither have fully addressed the reinstatement of service laterals nor the connection to the original pipe/manhole.

**Reduced Diameter Slip Lining** is similar to conventional slip lining using HDPE; however, the diameter of the liner pipe is reduced mechanically prior to installation and restored after installation using internal pressure. The primary advantage of this process is that it minimizes the loss of flow area.

**Segmented Linings** are fabricated in short sections and then assembled in the manhole to minimize excavation. The resultant liner is then either pushed or pulled into the host pipe. This approach has yet to fully address the problems that can be associated with numerous joints that are inherent in its execution, and long-term performance data are not available.

An additional protective lining approach that is available for small diameter pipelines is the use of **folded HDPE or PVC liner**. The liner is "inflated" to nearly the diameter of the host pipe after installation. The examples of this approach are U-Liner and NuPipe. Their primary advantages are the low friction that results when compared to conventional slip lining (allowing longer pulls with lighter equipment) and the minimal loss of flow area after "inflation". The primary disadvantage to this is that there is a minimal reduction in the inflow to the system.

"No Dig" replacement approaches, as in the case of large diameter pipelines, are best employed to minimize surface impacts. Pipe bursting and guided horizontal boring are alternative approaches.

**Pipe Bursting** concurrently fractures the host pipe and compacts the pipe wall fragments and surrounding soil to create a larger bore. A new, larger diameter pipe is pulled or pushed in directly following the bursting tool. The original pipe diameter may be expanded up to a maximum of two sizes (8-inches or 12-inches) or twice the original diameter or 36 inches. The smallest diameter pipe burster can work in 4-inch pipe. Examples of this approach employ either a hydraulic impact or static pull method of installation. The advantages are minimal excavation and increased flow area.

Disadvantages are reproduction of significant sags and potential damage to adjacent buried utilities (in practice, damage to other utilities occurs very rarely).

**Guided Horizontal Boring** is a small diameter variant of directional drilling. A small diameter (1.5 to 2-inch diameter) pilot bore is drilled and then back-reamed to the desired size. A flexible pipe (usually HDPE) is then pulled in place. Vertical and horizontal curves are possible. FlowMole and True Trac are examples of this approach. The major disadvantages of this approach are poor accuracy (grade control) and limited size capability (8-inch diameter maximum).

### ***Laterals***

Rehabilitation/replacement is important for infiltration/inflow reduction when consideration is given to the fact that the total length of service laterals is typically almost the same as the total length of sewer main. Inversion lining, slip lining, folded lining, pipe bursting, conventional cut and cover, impact moling and guided horizontal boring are all candidate approaches to lateral rehabilitation. Consideration should be given to the contribution of the lower lateral to infiltration and the upper lateral to inflow prior to embarking on a program aimed at the entire lateral.

### ***Manhole Rehabilitation Methods***

Approaches to manhole rehabilitation have developed over the years based on new levels of technology. Many options offer better means of rehabilitation without having to reconstruct the manhole. The following is a brief overview of these technologies. It should be noted that the success for each of these methods is only as good as the preparation and workmanship.

**Pre-form Manhole Method** - The problem manhole is pressure washed to remove loose and/or corroded concrete. Reusable lightweight steel panels are manually assembled within the manhole. The steel panels are bolted in place to form a riser and liner that fit the interior shape and size, leaving approximately 3 inches of space between the old wall and the new form. Redi-mixed concrete is then poured into the space filling the voids, sealing leaks and eliminating joints. Special inserts placed in the active lines allow uninterrupted sewage flow. The use of plastic liners within the formwork can also be utilized if corrosion is a problem. This method has only been used once in Val Vue Sewer District, when the manhole was also rehabilitated for structural damage.

**Strong Seal System** - The manhole preparation is similar to the Pre-form Manhole Method. After the cleaning operation is completed, a spray applied Portland cement is introduced against the old wall. The normal structural seal is applied to 3/8 inch

minimum thickness using Type I or III cement. When a more corrosive condition exists, a calcium aluminate cement is applied.

**Other Linings** - Polyurethane and epoxies have been used for manhole liners. The vast majority of these liners have had mixed success, primarily because they are dependent upon the type of installation. The District has successfully used linings for rehabilitation for several projects.

**Physical Liners** - Polyethylene and fiberglass pipe tubes have had excellent success on performance, however, their costs are nearly that of a new reconstructed manhole. These should be evaluated on a case by case basis.

**Manhole Grouting** - Chemical Grouting is commonly used to reduce infiltration in a system. The District owns manhole grouting equipment.