SECTION 3
FLOW PROJECTIONS

3.1 INTRODUCTION

In order to evaluate the City's existing sewer system and plan for future improvements, it is necessary to estimate the loading, or flows, which the system will be required to carry. Two separate types of flow projections are included in this Section: sewer collection system flows and treatment plant flows, each of which are discussed further in this Section. Generally, collection system flows are simple calculations of flows from each of the City's two primary sewer collection basins, based on per capita domestic flows and an assumed infiltration and inflow (I & I) flow rate. They are presented for the purpose of identifying average and peak flow rates in a basin and provide the basis for preliminary design and local facility sizing. Treatment plant flows are based on diurnal curves throughout the system and are intended to represent the worse case scenario of flows which may reach the treatment plant at a given point in time. These flows are intended to provide the basis for treatment plant sizing.

All of the flows presented include consideration of both domestic, or base flows, as well as estimated flows resulting from I & I into the system. The flows have been calculated using estimated flow per capita and the projected changes in population and employment outlined in Section 2. Per capita flow data was determined using industry standards for various customer classes and land uses and calibrated to actual water use and flows within the City using historical water use data obtained from the Skagit County PUD No. 1 and the City's treatment plant flow records. As discussed later in this Section, consideration was made for the volume of flow expected from various types of users, and higher per capita discharge rates were assigned to the appropriate system connections. The estimated I & I has been considered separately and estimated in gallons per acre per day. I & I estimates for collection system flows and treatment plant flows have been calculated differently, as discussed later in this Section. Section 6 provides a discussion on how these projections were used in the system modeling and analysis.

3.2 COLLECTION SYSTEM FLOWS

Using the population and employment forecasts presented Section 2, flow projections comprised of domestic, commercial, and specific high users were developed. Table 3-1 presents the flows per capita by population type used in the modeling and flow projections for the system. These estimated average flows were derived from a combination of sources, including actual City flow data, historical water use data, Department of Ecology Sewage Design Standards, the Uniform Plumbing Code and engineering experience.

Table 3-1
City of Sedro-Woolley
Estimated Sewer Base Flows by Population Type

Population Type	Average Daily Flow
Residential	75
Office/Retail	35
Commercial High User	Determined on a per connection basis from water use data

Note: Average flow rates do not include infiltration and inflow.
Source: State Department of Ecology and City Records.

The averages listed in Table 3-1 were confirmed with actual City data. Infiltration and inflow is not included in the average base flow rates shown in Table 3-1 because it can vary significantly throughout a system and therefore is addressed as a separate flow component, as discussed later in this Section. Potential reductions in water use due to conservation efforts have not been included in these sanitary sewer flow estimates, making these estimates conservative in nature.

Table 3-2 presents estimated existing and projected flows for the City's sewer service area by major drainage basin. These estimates are based on projected population and employment figures presented in Section 2 and average flow rates identified in Table 3-1

Four separate flow projections are presented in Table 3-1 and are further explained below:

- **Base Flows** are a simple calculation of average flow rates without consideration of infiltration or inflow. Base flows have been determined by applying average flows per capita (as indicated in Table 3-1) to the population and employment data presented in Section 2.
- **Peak Flows** are used to estimate domestic flows at peak periods (typically early morning and evenings) and do not take infiltration and inflow into account. A peaking factor of 3.0 has been applied to base flows to estimate the peak flows indicated in Table 3-2 (Base Flow x 3.0 = Peak Base Flow). This peak rate is based upon actual treatment plant flows, past planning, and the Department of Ecology Manual for Sewage Works Design.
- **Infiltration and Inflow** (I & I) is calculated at a City-wide rate of 1,200 gallons per acre per day (gpad) with consideration of how I & I might be distributed amongst specific problem areas including high groundwater, older systems, or a number of illicit connections. Please note that additional information regarding high infiltration and inflow inflow areas is provided in Section 6. The I & I rate was determined by comparing average historical wet weather and average dry weather flows from the measured Northern State Multi Service Center area and multiplying by a factor of safety of 2.0 with allowance of open space not contributing to I & I inflow. Additional I & I tests in the urban areas with older

systems will provide better estimates of I & I throughout the City. More detailed I & I information is provided in plan section 6.3.

- **Total Flows or peak flows plus Infiltration and Inflow** have been determined by adding the aforementioned I & I rate to the peak base flows. No peaking of I & I has been assumed.

The buildout projections included in Table 3-2 also assume an expansion of the sewer system to include currently unsewered areas within the City limits and UGA.

Table 3-2
City of Sedro-Woolley
Collection System Flows

	Third-Metcalf Street Basin			Township Street Basin			Total		
	2004	**2010**	**Buildout**	**2004**	**2010**	**Buildout**	**2004**	**2010**	**Buildout**
Estimated Base Flow (mgd)	0.17	0.20	0.23	0.19	0.33	0.37	0.36	0.53	0.60
Estimated Peak Base Flow (mgd)	0.51	0.60	0.69	0.57	0.99	1.11	1.08	1.59	1.80
Infiltration & Inflow (mgd)	0.35	0.44	0.69	0.75	0.80	1.36	1.10	1.24	2.05
Peak Base Flow Plus I & I (mgd)	0.86	1.04	1.38	1.32	1.79	2.47	2.15	2.83	3.85

Note: Assumes a peaking factor of 3.0 per actual treatment plant historical data.

3.3 TREATMENT PLANT FLOWS

The City monitors flows at the treatment plant and keeps daily records. Detailed information on the treatment plant flows in located in Section 8 of this document.