Appendix A
DEMAND FORECASTING METHODOLOGY

2000–2020 Demand Forecasting Methodology

At the beginning of the Outlook process, a methodology was developed to forecast demands by individual utility that could be summarized on a regional basis. This methodology is based on utilities' current water use patterns, regional (Puget Sound Regional Council [PSRC]) demographic projections, and estimates of reductions in water consumption due to plumbing code requirements. Generally, the following steps were used to develop the demand forecast:

- Calculate individual utilities' current water use factors (water use factors are the average amount of water used per single-family or multifamily household per day, or per employee per day.) Current water use factors include reductions achieved to date from various efforts, including conservation.
- Estimate the future reduction in water use factors based on plumbing code requirements (plumbing code savings.)
- Forecast single-family households, multifamily households, and employment through 2020 within each utility's retail service area.
- Forecast baseline demands, based on water use factors (including plumbing code savings) and demographic forecasts for each utility.

A detailed description of the demand forecasting methodology is presented below.

Calculating Current Water Use Factors

Using survey data provided by utilities,[1] current water use factors were developed for each individual utility for single-family and multifamily households and non-residential use, based on average 1996–1998 water use.

Non-residential water use factors were calculated as non-residential demand per employee within each utility's service area. An exception to this is large industrial use. This component of non-residential demand does not typically vary based on the number of employees in an area. For the purposes of calculating water use factors, consumption by some individual customers using more than 100,000 gallons of water per day for industrial

[1] Information about individual utilities' current water use was requested in a survey that was sent to the 158 largest utilities in the three-county area. (A complete list of these utilities is provided in Table 1-2 of the Outlook report and their service area boundaries are shown in Figure 4-1.)

applications were not included in the calculations of demand per employee. This large industrial water use was assumed to remain constant through 2020, and was added into demand projections after projecting future non-residential demand based on employees.

Non-revenue water use was calculated as a percentage of overall water use for each utility, based on their reported 1996–1998 water use. Non-revenue water use is the difference between water produced and metered consumption. Non-revenue water can include leakage, hydrant testing, main flushing, fire fighting, reservoir overflows, and other unmetered uses. For the demand projections, the average 1996–1998 percentage of non-revenue water for each utility was assumed to remain constant through 2020.

Similar to water use factors, maximum day and peak month peaking factors were calculated from utilities' 1996–1998 reported water use (maximum day and peak month peaking factors are the ratio of the maximum day demand to the average day demand, and the ratio of the average day during the peak month to the average day demand.)

For utilities that did not return a survey, current water use factors and peak day peaking factors from similar, nearby utilities were used. For smaller utilities and private wells, average water use factors for each county were used. These average water use factors were calculated based on the average of all individual utilities' factors, excluding Seattle, Tacoma, and Everett.

Estimating Future Reductions in Water Use Factors

Water use factors may decline over time for several reasons. Reductions in water use factors will generally come from:

- Increasing number of low water using plumbing fixtures required by the plumbing code for new and remodel construction (plumbing code savings),
- New conservation measures, including utility programs and conservation rate structures, and
- Improvements in water utility operations.

For the baseline demand forecast, the estimated future reduction in water use factors includes only the first of these components, plumbing code savings. Potential effects of the other factors on demands (such as utility sponsored conservation efforts and rate structures) will be estimated separately, as they require additional actions on the part of individual utilities to implement, whereas plumbing codes savings are independent of utility actions. A conservation workgroup with a variety of stakeholders will be formed to explore this potential.

Forecasting Population, Households, and Employment

The demographic and economic projections used to develop the 2000–2020 Outlook forecasts were prepared by the PSRC and published in June 1999. These projections are consistent with the Washington State Office of Financial Management's (OFM's) statewide population and employment forecast by County. The PSRC refines OFM's forecast with information on recent development and local conditions for King, Pierce, and Snohomish Counties. For planning purposes, the three-county area is divided into forecasting areas, called Transportation Analysis Zones (TAZs). The PSRC forecasts population, single-family and

multifamily households, and numbers of employees within each TAZ for 2000, 2010, and 2020.

In order to estimate the current and future population, households, and employment in each utility's service area, it was necessary to apportion the PSRC's TAZ forecasts to utility service areas. This was done with the use of a geographic information system (GIS) analysis, then refined with survey data reported by the individual utilities.

Some utilities do not serve all of the single-family households within their service area boundaries, especially in more rural areas. The households that are not served by a utility are served by private wells. The number of single-family homes served by private wells within each utility service area was estimated by comparing the total number of single-family homes in the service area (based on the apportioned PSRC data) to the utility's reported number of single-family connections. This number of single-family homes served by private wells was assumed to remain constant through 2020, as some new homes will be built with private wells, while some existing homes with private wells will eventually connect to the local utility.

Within each utility's service area, all of the multifamily and non-residential development was assumed to be served by the utility.

Preparing the Baseline Demand Forecast

The baseline demand forecast was prepared by first applying the estimated future reduction in water use factors to the current utility water use factors. Current water use factors include reductions achieved to date from various efforts, including conservation. Then, the reduced water use factors were multiplied by projections of single-family and multifamily households and employment to develop residential and non-residential demand projections for each utility. The 1996–1998 average large industrial water use was then added to those projections. Non-revenue water use was calculated as a percentage of the above combined demands to develop a total future demand projection for each utility. The individual utilities' demand forecasts were then summarized on a subregional and regional basis. The July 2000, Population and Demand Forecasting Technical Memorandum contains individual utility forecasts (see Appendix D)

Step 1: Identify Utilities and Collect Utility Demand Data

Based on input from the Water Supply Planning Committee, the 158 largest utilities in King, Pierce, and Snohomish Counties were selected as the basis for the demand forecast. All of these utilities were asked to complete the Survey of Water Demand and Sources of Supply, Parts 1 and 2. Returned surveys were used in the demand forecasting process to provide basic demand data for 1990 and 1996–1998. For demand forecasting, the key information from the surveys included the following items:

- Demand data, by category, for 1990 and 1996–1998 (single-family, multifamily, non-residential);
- Peak day and peak month data for 1996–1998;
- Non-revenue water in 1996–1998;
- Number of single-family accounts in 1990 and 1996–1998; and
- Determination of accounts using greater than 100,000 gpd during 1996–1998.

For those utilities that indicated they have industrial customers using more than 100,000 gallons per day (gpd), follow-up was performed to gain additional data. The data requested was demand data for 1996, 1997, and 1998, for any customers averaging at least 100,000 gpd during any one of those three years. The 1996–1998 values were averaged, to account for the high variability in water use by individual industrial accounts. The 1996–1998 average water use for these customers was held constant in future demand projections.

Step 2: Calculate Current Water Use Factors

For each utility that returned a complete survey, the following water use factors were calculated using the average of 1996–1998 demand data, and the corresponding households and employment:

- Gallons per household per day, single-family,
- Gallons per household per day, multifamily, and
- Gallons per employee per day (excluding large industrial accounts)

Large industrial water use was not included in calculating non-residential water use per employee.

In addition, peaking factors were calculated for peak day and peak month demand. Where utilities returned a partial survey, water use and peaking factors were calculated if sufficient data was available.

Some utilities either did not return surveys or did not report sufficient information to calculate water use factors, non-revenue water, and/or peaking factors. For these utilities, current water use factors and peak day peaking factors from similar, nearby utilities were used. For smaller utilities and private wells, average water use factors for each county were used. These average water use factors were calculated based on the average of all individual utilities' factors, excluding Seattle, Tacoma, and Everett.

Step 3: Forecast Population, Single-Family and Multifamily Households, and Employment through 2020 by Utility Retail Service Area

Three data sources were combined to develop demographic characteristics for the entire service area of each utility. These sources were:

1. A GIS map of utility retail service areas, compiled by the Water Supply Planning Committee. Service areas represent the ultimate buildout of each utility's water delivery system, and are typically derived from the Coordinated Water System Plan (CWSP) processes that have previously been undertaken in each county.
2. A GIS map of transportation analysis zones (TAZs) throughout the three counties.
3. Puget Sound Regional Council's (PSRC) June 1999 Projections of Population and Employment, for each transportation analysis zone (TAZ). This includes actual values from the 1990 Census, and projected values for all other years generated by the PSRC's forecasting model.

Seattle Public Utilities staff performed an analysis of the Service Area and TAZ mapping data, and provided a table listing:

- Each utility surveyed;

- The percentage of each TAZ falling within each utility service area (for example, a single utility could have 100 percent of one TAZ, but only 50 percent of another TAZ, within its service area boundary). These percentages were based on 1990 census data available at census block scale.

For each utility, the percentage of each TAZ was then combined with the PSRC's demographic projections for each TAZ to produce a demographic profile of the utility's entire service area (this includes areas served by the utility, as well as areas not served). The demographic profile includes the following elements:

- Total population within each utility's service area,
- Total employment within each utility's service area,
- Number of single-family households within each utility's service area, and
- Number of multifamily households within each utility's service area.

The initial demographic profiles were produced for each year forecasted by the PSRC model, which includes, 1990, 1998, 2000, 2010, and 2020. For intermediate years forecasted, values were generated using straight-line interpolation between the initial set of values. For example, a value for 2005 was produced by interpolating between the values for 2000 and 2010.

Step 4: Calculate the Population, Employment, and Households Actually Served By Utilities

Within each utility's service area, all of the multifamily and non-residential development was assumed to be served by the utility. However, there are a significant number of single-family homes that are within utility service areas, but are currently served by private wells.

Single-Family Homes

The number of single-family homes served by private wells within each utility service area was estimated by comparing the total number of single-family homes in the service area (based on the apportioned PSRC data) to the utility's reported number of single-family connections. Many utilities that returned surveys provided a count of the number of single-family accounts they served. For those utilities that did not return a survey or did not report this information, Department of Health data on single-family connections for each utility was used.

The number of single-family homes served by private wells was assumed to remain constant through 2020, as some new homes will be built with private wells, while some existing homes with private wells will eventually connect to the local utility. However, the percentage of households served by private wells within a utility's service area generally declines in the forecast because the total number of households increases, while the number of households served by private wells is held constant.

Total Population

Total population within a given service area is a mixture of people living in single-family housing and people living in multifamily housing. To estimate the actual population served, a weighted average was taken of the percentage of single-family households served, and percentage of multifamily households served (100 percent).

Step 5: Forecast Demands

Average day demands were projected to future years based on the 1996–1998 water use factors, reduced to account for future plumbing code savings, and the growth projected in each demographic category. For each of the demand categories, the water-use factor was multiplied by the projected number of employees, households, or population. For example, in the non-residential category, the projected number of employees in each year was multiplied by the 1996–1998 water use factor.

Large industrial demand was projected to remain constant over time.

In the case of non-revenue water, the average 1996–1998 percentage was applied to future years, using the combined total of residential, non-residential, and large industrial demand. In other words, the percentage of non-revenue water experienced in 1996–1998 was held constant, so the quantity of non-revenue water grows at the same rate as total retail water sold.

For each year forecasted, peak month and peak day demands were calculated. Peaking factors were obtained from the 1996–1998 data reported by utilities, and were held constant for all subsequent years. Peaking factors were applied to the average day demand calculated for each year, to yield peak day and peak month demand.

Step 7: Aggregate Results on a County and Regional Basis

Once the demand projections had been generated for each of the utilities surveyed, the results were aggregated into county and regional totals. In addition, average water use factors were calculated for the combined water use in each county.

Methodology for Extending Demand Forecast to 2050

Demographic Forecast

In order to extend the demand forecast to 2050, the demographic forecast to 2020 was used as the starting point. The growth rates shown in Tables A-1 and A-2 were applied to the 2020 regional demographic projections from Phase 1 of the Outlook, based on the following steps:

Step 1: For the period 2020–2030 PSRC's annual growth rates were applied to each of the following categories for the three-county region as a whole:

- Single-family households
- Multifamily households
- Employment
- Population

Step 2: For the period 2030 to 2050, BEA's annual growth rate (2025–2045) was applied. Since BEA does not provide forecasts of households, the population growth rate was applied equally to single-family and multifamily households. The BEA employment growth rate was applied to employment.

It is important to recognize that the demographic growth rates were applied to the entire three-county region as a whole. This was necessary because the sources of the growth rates described above do not provide geographic resolution at a finer scale. As a result, the results cannot be used at a finer scale such as specific counties, or individual utility service areas. However, the results are useful at a regional level, for broad planning purposes.

Demand Forecast

Phase 1 of the Outlook developed the water demand forecast using five categories of demand. These are:

- Single-family residential demand
- Multifamily residential demand
- Non-residential demand
- Large industrial demand
- Non-revenue water

These five categories continue to be the basis of the forecasts extended to 2050.

In order to calculate demands associated with the first three categories listed, water use factors were multiplied by the demographic forecasts to 2050. Water use factors are defined as water use in gallons per day per household, or per employee (for further details, see February 24, 2000 Technical Memorandum). The 2020 "baseline" water use factors were calculated for the three-county region as a whole, based on the results from Phase 1. These water use factors were then held constant for the period from 2020–2050. This approach is based on the assumption that water consumption per household and per employee will not vary after 2020. In essence, this means that demands in the single-family, multifamily, and non-residential categories are projected to grow at the same rate as the demographic variables shown in Tables A-1 and A-2.

This is slightly different from the approach used in Phase 1. Phase 1 assumed a gradual decline in water consumption per household and per employee due to "baseline conservation" between 2000 and 2020. Baseline conservation was defined as reductions in demand due solely to plumbing code requirements for the installation of low water using fixtures in new and remodeled construction (plumbing code savings). The savings attributable to the 1993 plumbing code changes are expected to be fully achieved by 2020 (note that conservation programs implemented by utilities are a separate issue, to be covered separately in Phase 2 of the Outlook). Due to the uncertainty associated with possible changes in "baseline" conditions after 2020, water use factors were held constant from 2020 to 2050. This results in a conservative forecast, since water use factors may decline after 2020 due to further conservation actions, technological advances, and other factors.

The regional, baseline, projected water use factors for 2020 are:

Single-family residential:	205 gallons per household per day
Multifamily residential:	25 gallons per household per day
Non-residential:	42 gallons per employee per day

Large industrial demand was defined in Phase 1 as demand associated with retail customers whose usage is largely industrial in character, and who use 100,000 gallons per day or more. These large industrial demands were originally developed using utility customer data from 1996–98. In order to calculate demands associated with the large industrial category, the

same assumption used in Phase 1 was applied: large industrial demands were held constant throughout the planning period. Based on the information collected in Phase 1, the regional total for large industrial demand is 68 mgd in terms of average day demand (ADD).

Non-revenue water is the difference between water produced and metered consumption. This can include leakage, hydrant testing, main flushing, fire fighting, reservoir overflows, and other unmetered uses. Non-revenue water was calculated as a percentage of the total demands included in the other four categories. In extending the forecast to 2050, the regional percentage of non-revenue water calculated for 2020 was applied. This percentage is based on data provided by water utilities for 1996–98, calculated for the three-county region as a whole. This value (9.5 percent of metered demand) was held constant throughout the planning period.

The regional average day demand was calculated as the sum of the five categories described above. As in Phase 1, maximum day demand (MDD) was calculated by applying a peaking factor. During Phase 1, peaking factors were calculated separately for each utility, based on utility data from 1996–98. For the 2050 regional forecast, a single peaking factor was calculated for the entire region, based on the regional 1996–98 data. This value (1.96 ratio of MDD to ADD) was held constant throughout the planning period. It is recognized that a variety of factors, such as conservation targeted at peak day and peak season water usage, could in fact cause peaking factors to change during the planning period.

Tables A-1 and A-2 present the demographic information and associated annual growth rates from the PSRC (draft) forecast and the BEA statewide forecast, respectively. The growth rates embodied in the two sources are quite consistent with each other. For example, the PSRC population growth rate from 2020 to 2030 is identical to the BEA population growth rate from 2015 to 2025. The employment growth rates during these time periods are also nearly identical. Both sources show continued growth, but at a gradually declining rate in successive decades.

Table A-1: Puget Sound Regional Council Four-County Growth Forecast

	1990	2000	2010	2020	2030
Population	2,768,300	3,360,400	3,815,100	4,275,500	4,710,600
Annual Growth Rate	---	1.96%	1.28%	1.15%	0.97%
Single-family Households	745,100	899,900	1,022,000	1,143,800	1,251,100
Annual Growth Rate	---	1.91%	1.28%	1.13%	0.90%
Multifamily Households	326,400	426,400	532,800	644,000	749,700
Annual Growth Rate	---	2.71%	2.25%	1.91%	1.53%
Employment	1,434,500	1,798,700	2,057,200	2,236,900	2,356,500
Annual Growth Rate	---	2.29%	1.35%	0.84%	0.52%

SOURCE: From PSRC Draft Working Forecast Database, provided to EES as a digital file.
NOTE: The four counties are King, Kitsap, Pierce, and Snohomish.

Table A-2: Washington State Growth Forecast
U.S. Bureau of Economic Analysis

	2000	2010	2015	2025	2045
Population	5,833,000	6,625,000	7,008,000	7,719,000	8,898,000
Annual Growth Rate	---	1.28%	1.13%	0.97%	0.71%
Employment	3,415,100	3,963,000	4,156,600	4,385,500	4,961,100
Annual Growth Rate	---	1.50%	0.96%	0.54%	0.62%

SOURCE: U.S. Bureau of Economic Analysis (BEA), 1995, BEA Regional Projections to 2045, Volume 1, States.

Methodology for Urban Growth Area Demand Forecast

A regional water demand forecast was developed for water utilities within the region through 2020 using the following five categories:

- Single-family residential
- Multifamily residential
- Non-residential
- Large industrial
- Non-revenue water

The results of the forecasts for these five categories are the basis of the Urban Growth Area (UGA) forecasts.

Apportionment of Demographic Projections to UGAs

Seattle Public Utilities Geographic Information System (GIS) staff prepared the initial apportionment analysis, determining the number of single- and multifamily households (SFHH and MFHH) that are located within specific utility service areas and UGA boundaries. This analysis, which was based on Puget Sound Regional Council (PSRC) 1996 UGA boundary data and census block statistics from 1990[2] was then extended by identifying the particular UGAs to which households were apportioned. In the rare case where water service areas cross into more than one UGA, households were apportioned between the multiple UGAs, based upon inspection of service area and UGA boundaries. The results of this analysis performed for each water utility were percentages of single- and multifamily households located within specific UGAs. These apportionment percentages were used in calculating the percentage of a utility's demand located within each UGA.

No apportionment of employment projections was available by UGA. To estimate the portion of each utility's non-residential development (by employment) within each UGA, the percentage of multifamily units within each UGA was used as an indicator and the same percentage was applied to the forecast number of employees served by the utility.

[2] Although the UGA apportionment is based upon 1990 demographic data and results in constant apportionment percentages applied to demands associated with future years, dynamic changes in the demographic characteristics of the utility service areas and UGAs are captured, due to the use of PSRC demographic projections in the initial calculations of demand in Phase 1 of the Outlook.

The apportionment percentages were then applied to PSRC forecasts for population, single- and multifamily households, and employment through 2020. Employment numbers for a given utility were apportioned between UGAs and non-UGA areas based upon the population apportionment percentage, as no apportionment was originally made based upon employment. The same apportionment percentages utilized in this demographic analysis were used in the UGA demand calculations, discussed in the following section.

UGA Demand Forecast Calculation

Forecasted demands were grouped by UGA for 2000, 2010, and 2020. Utility service area demands were first calculated for each of the five demand categories listed earlier, and then summed to arrive at an Average Daily Demand (ADD). Maximum Daily Demand (MDD) for each utility was then calculated by multiplying the calculated ADD by a utility-specific peaking factor (as defined in Phase 1). The ADD and MDD demands were then grouped by UGA to arrive at total UGA demands. The following steps were taken to develop these results:

Step 1 (Single-family residential demand): To determine the single-family residential ADD demand for the UGA(s) served by a given utility, the total single-family residential baseline demand for the utility (as calculated in Phase 1) was multiplied by the SFHH apportionment percentage for the served UGA(s) (described above).

Step 2 (Multifamily residential demand): This step is similar to the calculation in Step 2. To determine the multifamily residential ADD demand for the UGA(s) served by a given utility, the total multifamily residential baseline demand for the utility (as calculated in Phase 1) was multiplied by the MFHH apportionment percentage for the served UGA(s) (described above).

Step 3 (Non-residential demand): This step is also similar to the calculation in Step 1. To determine the non-residential ADD demand for the UGA(s) served by a given utility, the total non-residential baseline demand for the utility (as calculated in Phase 1) was multiplied by the MFHH apportionment percentage for the served UGA(s) (described above). In the absence of an apportionment percentage based upon employment demographic data, the MFHH apportionment percentage was used as an estimate.

Step 4 (Large industrial demand): The large industrial customers identified in Phase 1 purchase water from utilities that are fully contained in the UGAs. Therefore, 100 percent of the demand associated with these customers was apportioned to the UGA(s) served by the utilities from which the users purchase water.

Step 5 (Non-revenue water): To determine the non-revenue water associated with the UGA(s) served by a given utility, the single-family, multifamily, non-residential, and large industrial demands for each UGA served by that utility were summed; then, this sum was multiplied by the non-revenue percentage associated with the utility.

Step 6 (ADD and MDD): For each UGA served by a given utility, the ADD was calculated by summing the single-family, multifamily, non-residential, large industrial, and non-revenue demands associated with those UGAs. The MDD for each UGA served by a given utility was then calculated by multiplying the respective ADD by the peaking factor associated with that utility.

Step 7 (Grouping by UGA): Once the demands within all categories were appropriately apportioned to the UGAs served by all utilities, and associated ADD and MDD demands were calculated, the demands were grouped by UGA and summed.

Approximately 5 percent of the total regional baseline demand is associated with smaller utilities and private wells, and is not included in analyses performed on the larger utilities. The apportionment data revealed that approximately 40 percent of the total demand for smaller utilities and private wells located within UGAs; however, the breakdown amongst the various UGAs was difficult to determine, based upon the nature of the data. For this reason, and due to the fact that the demand associated with this category is very small compared to the overall total, the demand in this category for each county was apportioned to the county's major metropolitan UGA. Though not completely accurate, this method was determined to be the most appropriate manner in which to address demands not associated with specific utilities.

WRIA Demand Forecast Methodology

A regional water demand forecast was developed for water utilities within the region through 2020 using the following five categories:

- Single-family residential
- Multifamily residential
- Non-residential
- Large industrial
- Non-revenue water

The results of the forecasts for these five categories are also the basis of the WRIA forecasts presented in this technical memorandum.

Source of WRIA Demographic Apportionment Data

Seattle Public Utilities GIS staff prepared the analysis apportioning single- and multifamily households and employment to each of the nine WRIAs located within the planning area. This data included the number of single-family households (SFHH), multifamily households (MFHH), and employees (EMP) located in the WRIAs served by each utility for 2000, 2010, and 2020. To illustrate the concept of apportionment, assume a utility serves customers geographically located within two WRIAs. For this utility, the numbers of SFHH, MFHH, and EMP were apportioned to the two WRIAs served.

Based upon these figures, percentages of apportionment by WRIA were developed for each utility for the categories of SFHH, MFHH, and EMP. For example, the SFHH apportionment figures for a given utility may reveal that 75 percent of the SFHH served by that utility are located within a certain WRIA, while 25 percent are located in another WRIA. The apportionment percentages may be different for the other demand categories of MFHH and EMP, all dependent upon the geographical characteristics of the utility's service area.

These apportionment percentages were used in the following WRIA demand calculations.

WRIA Demand Forecast Calculation

Forecasted demands were grouped by WRIA for 2000, 2010, and 2020. Demands beyond 2020 were not calculated, as the apportionment data is not projected past that year. Demands were first calculated for each of the five demand categories listed earlier, and then ultimately summed to arrive at an Average Daily Demand (ADD) for the WRIAs served by each utility.

Maximum Daily Demand (MDD) was then calculated by multiplying the calculated ADD by a peaking factor (as defined in Phase 1). The ADD and MDD demands were then grouped by WRIA to arrive at total WRIA demands. The following steps were taken to develop these results:

Step 1 (Single-family residential demand): To determine the single-family residential ADD demand for the WRIAs served by a given utility, the total single-family residential baseline demand for the utility (as calculated in Phase 1) was multiplied by the SFHH apportionment percentages for the served WRIAs (described above).

Step 2 (Multifamily residential demand): This step is similar to the calculation in Step 2. To determine the multifamily residential ADD demand for the WRIAs served by a given utility, the total multifamily residential baseline demand for the utility (as calculated in Phase 1) was multiplied by the MFHH apportionment percentages for the served WRIAs (described above).

Step 3 (Non-residential demand): This step is also similar to the calculation in Step 1. To determine the non-residential ADD demand for the WRIAs served by a given utility, the total non-residential baseline demand for the utility (as calculated in Phase 1) was multiplied by the EMP apportionment percentages for the served WRIAs (described above).

Step 4 (Large industrial demand): To determine the large industrial ADD demand for the WRIAs where such customers are located, the total demand of each large industrial customer was assigned to a single WRIA. There was no splitting of demand for a given customer in this demand category. Table A-3 lists all of the large industrial customers in the planning area, along with the utility that serves them and the WRIA in which they are located. The WRIA assignments shown in Table A-3 were based on inspection of the geographical location of the customers.

Step 5 (Non-revenue water): To determine the non-revenue water associated with the WRIAs served by a given utility, the single-family, multifamily, non-residential, and large industrial demands for each WRIA served by that utility were summed; then, this sum was multiplied by the non-revenue percentage associated with the utility (as determined in Phase 1).

Step 6 (ADD and MDD): For each WRIA served by a given utility, the Average Daily Demand (ADD) was calculated by summing the single-family, multifamily, non-residential, large industrial, and non-revenue demands associated with those WRIAs. The Maximum Daily Demand (MDD) for each WRIA served by a given utility was then calculated by multiplying the respective ADD by the peaking factor associated with that utility (as determined in Phase 1).

Step 7 (Grouping by WRIA): Once the demands within all categories were appropriately apportioned to the WRIAs served by all utilities, and associated ADD and MDD demands were calculated, the demands were grouped by WRIA and summed.

Table A-3: Large Industrial Customers

Utility	Customer	WRIA
Bellevue	Coca Cola Bottling Company	8
Bellevue	Safeway Distribution Center	8
Everett	Associated Sand/Gravel	7
Everett	Boeing (75th & Seaway)	7
Everett	Boeing (Airport & Kasch Park)	7
Everett	Boeing (Casino Rd.)	7
Everett	Kimberly-Clark (Federal)	7
Everett	Kimberly-Clark (Scott N Fire Line)	7
Everett	Kimberly-Clark (Scott S Fire Line)	7
Everett	Kimberly-Clark Corp. (Marine View Dr.)	7
Everett	Overall Laundry	7
Everett KC Untreated	Kimberly-Clark Untreated	7
Puyallup	—	10
Seattle	Alpac Corp.	9
Seattle	Birmingham Steel Corp.	9
Seattle	Darigold Inc.	9
Seattle	James Hardie Gypsum WA	9
Seattle	LaFarge Corp.	9
Seattle	Municipal Golf of Seattle	9
Seattle	Northlake Shipyard Inc.	9
Seattle	Port of Seattle (Serv. # 01753550)	9
Seattle	Port of Seattle (Serv. # 01753560)	9
Seattle	Rainer Brewing Co.	9
Seattle	Seafreeze Ltd.	9
Seattle	Seattle Steam Co. (Serv. # 01674030)	9
Seattle	Seattle Steam Co. (Serv. # 01674040)	9
Seattle	Rainier Brewing Co. (Serv. # 01709670)	9
Seattle	Rainier Brewing Co. (Serv. # 01709710)	9
Seattle	Todd Shipyards (Serv. # 01701440)	9
Seattle	Todd Shipyards (Serv. # 01701650)	9
Seattle	Vitamilk Dairy Iinc.	9
Tacoma	Atlas Foundary	10
Tacoma	Atochem N. America	10
Tacoma	Continental Lime	10
Tacoma	Domtar Gypsum	10
Tacoma	Nalleys Fine Foods	10
Tacoma	Pedersons Fryer Farm	10
Tacoma	Pioneer Chlor Alkali	10
Tacoma	Port of Tacoma	10
Tacoma	Simpson	10
Tacoma	Tacoma Power, Steam Plant	10
Tacoma	US Oil Refining	10

NOTE: Data covers large industrial customers of public water systems. Data is from 1999.