2. Demographic & Growth Projections

The configuration of the City's sewer system is influenced by several factors including development trends, political considerations, and topography. The City desires to maximize the use of gravity pipelines in the hopes of minimizing the number of pump stations required. This Wastewater Comprehensive Plan Update established logical wastewater service areas based on topography, the drainage characteristics of the area, and corresponds with the City's growth objectives. Modifications may then be made in consideration of the influence of existing facilities, political boundaries, and growth patterns as this plan is implemented. This Plan permits sufficient flexibility to provide for existing areas of need and the future development within the City's Urban Growth Area (UGA) boundary.

2.1. Growth Management

The Growth Management Act (GMA) was enacted in 1990 to address the population growth that occurred in areas of Washington State during the 1980s. To ensure a continuation of Washington's high quality of life, officials across the state have addressed growth management within various levels of government. The basic objective of the GMA is to encourage local, county, and city governments to develop and implement a 20-year comprehensive plan that incorporates their vision of the future within the framework of the broader needs of the state.

Under the GMA, municipalities must complete city planning and coordinate these planning efforts with those of the county. The planning effort of a municipality includes the establishment of an Urban Growth Area (UGA). Municipalities are to plan for the provision of providing wastewater services to areas within their established UGAs.

Under the provisions of the Growth Management Act, the City of Gig Harbor has adopted its Comprehensive Land Use Plan. Gig Harbor is currently in compliance with the Growth Management Act.

2.2. Location

The City of Gig Harbor is located on the Gig Harbor Peninsula at the southern end of Puget Sound in Pierce County approximately five miles northwest of Tacoma, across the Narrows. Gig Harbor is bordered by Henderson Bay to the northwest, unincorporated Pierce County to the west, south and north, and Puget Sound to the east.

Gig Harbor is primarily a residential community with waterfront commercial activities. Waterfront activities include marinas for pleasure and fishing boats, commercial vessel moorage facilities, and boat repairs. In recent years, commercial activities have developed along the State Route 16 (SR16) corridor. The City has annexed several areas to the north and south, including existing subdivisions and developed commercial properties along SR16.

2.3. Study Area

The study area for this Plan consists of the City of Gig Harbor urban growth area (UGA) shown in the map included in Appendix B.

2.4. Demographic Assessment

The Demographic Forecast Allocation Model for Wastewater (DFAM-WW) was developed for the City to improve the ability to use forecasted growth in the City's UGA to support detailed planning of City wastewater utility infrastructure. The DFAM-WW serves this purpose by allocating growth to wastewater basins within the UGA, as well as providing a flexible tool for incorporating actual growth observed over time and localized changes in growth rates related to new infrastructure or other conditions. The primary input to the DFAM-WW results from the City's Buildable Lands Analysis.

The DFAM-WW was designed as a computer spreadsheet-based tool to provide a flexible and user-friendly environment for working with demographic projections within the City's UGA. Model calculations are performed through a combination of Excel based equations and Visual Basic programming (macros). A digital copy of the model has been provided to the City for use by City staff.

The DFAM-WW provides the City with a tool that can be used to update Gig Harbor's Wastewater Comprehensive Plan and adapted for other utility and/or transportation planning projects. The model permits ready modification of key inputs and assumptions that define spatial and temporal growth patterns. It can be updated with new growth projections when they become available and can address any planning period through 2050.

2.4.1. Process to Develop DFAM-WW Model

The City's Planning and Engineering staffs and consultants developed the DFAM-WW. Initially identified were the desired features of the model and discussions of available data and inputs. In order to provide basic inputs to the model, the City's pre-existing Buildable Lands Inventory (BLI) and Buildable Lands Analysis (BLA) were utilized. However, City staff noted that this pre-existing work did not extend outside City Limits. Thus, the same inventory and analysis methodology was applied to the area outside City Limits and the results from this expanded BLA were then used as inputs to the DFAM-WW.

2.4.2. DFAM-WW Overview

The DFAM-WW uses existing forecasted demographic data to generate an annual estimate of wastewater generating populations in the City's UGA. This model is designed to generate annual population estimates by allocating existing forecasted demographic data spatially into delineated wastewater basins. It also permits adjustment of growth rates within the planning period to recognize that growth may occur more rapidly during some periods than others. "Trigger Events" (an activity or project that could influence

the rate of growth) can be identified that prompt accelerated growth and development. These trigger events allow for manual adjustments to the demographic forecasts to individual wastewater basins or all wastewater basins for short-term or long-term periods.

The model allows analysis of six distinct demographic categories: population; single-family households; multifamily households; employment; school enrollment; and the prison population at the Washington Corrections Center for Women (WCCW). Each of these demographic categories represent definable components of wastewater generation.

Temporal Distribution

Figure 2-1 displays the modeling approach, using households as an example. The process begins with entry of aggregate demographic data for the entire UGA broken down by wastewater basin. The wastewater breakdown is carried through the entire model and can be re-aggregated for key outputs. The spatially distributed data is then used to develop an unadjusted annual forecast of the projected demographic data based on a straight-line allocation. Resulting unadjusted annual growth rates are determined.

In the next step, the model allows the user to adjust annual growth rates, for any wastewater basin to reflect changes in growth resulting from growth patterns and trigger events. Based on the adjusted growth rates, the model then generates an adjusted forecast of the projected demographic data for all years of interest.

The model is designed to allow single-family households, multifamily households, and employment to be broken down into sewered and unsewered categories. This feature is intended to support development of the City's wastewater plan. It accounts for both conversions of existing sites with septic systems to service by the City's sewer system and new development connected to the sewer system in the future. This element was not included for the prison or school enrollment since the prison and all schools are fully sewered.

Figure 2-1. Flow Chart Depicting Approach for Residential Analysis

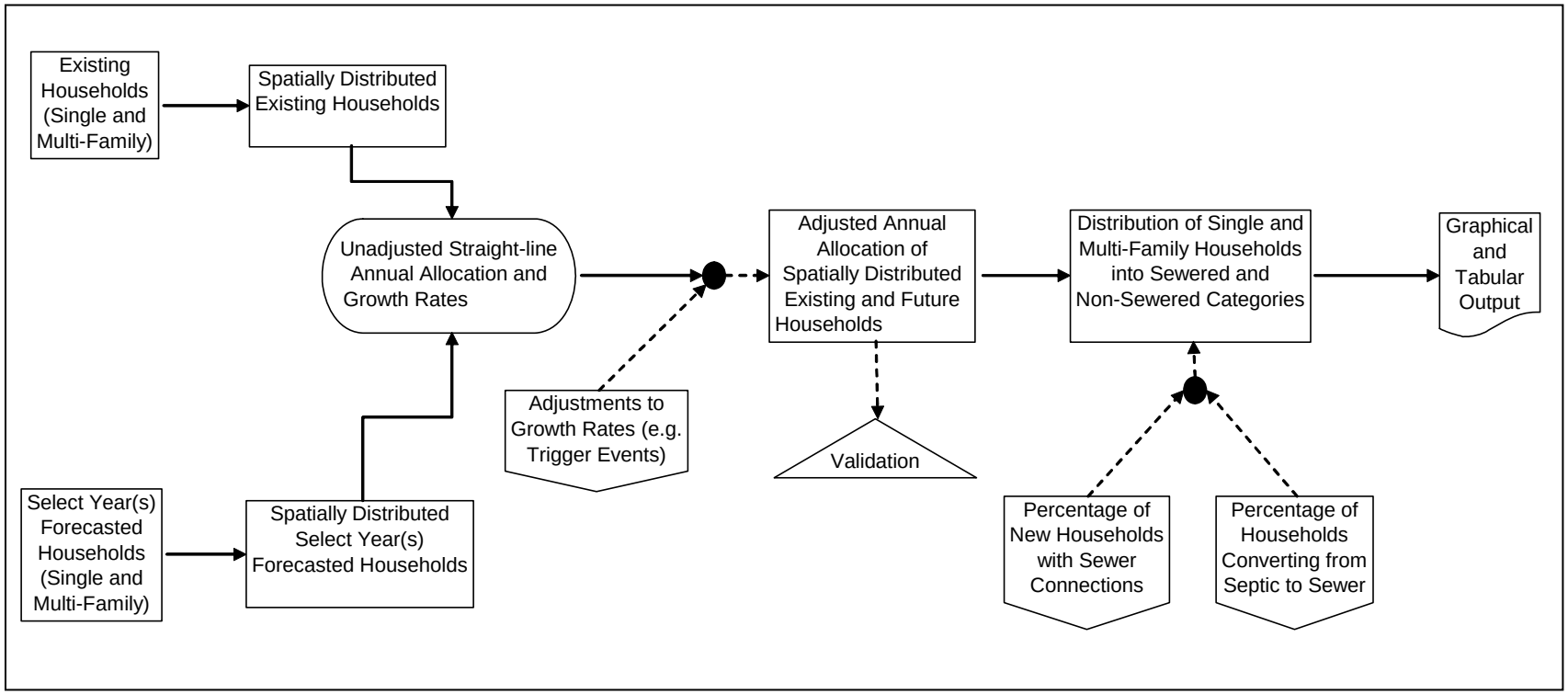
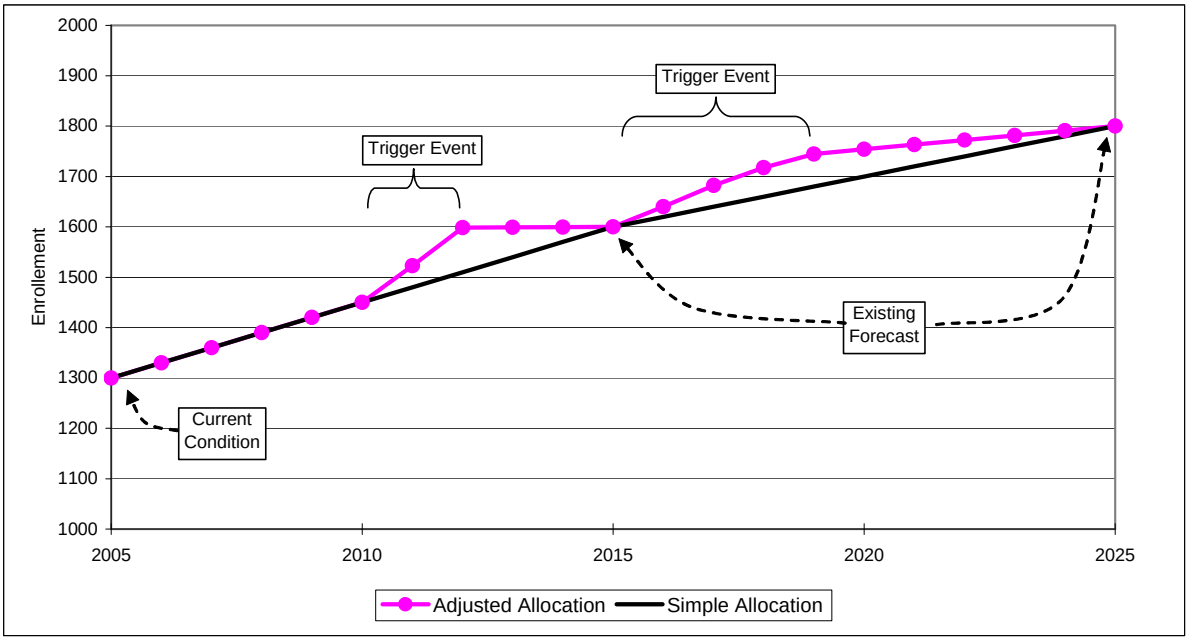


Figure 2-2 illustrates how a pre-existing forecast is input and then adjusted. An initial curve is plotted to show initial data (2005) and forecasts for two later years (2015 and 2025). This is labeled "simple allocation." Growth rates based on this line are then modified for two trigger events (one in 2011-2012 and the second in 2016-2019). Note that the growth rates following the trigger events are reduced to ensure that the existing forecasts are not exceeded. While not shown in this example, the model is also capable of reflecting a long-term effect that lifts the growth curve for all subsequent years.

Figure 2-2. Example of Model Application



Spatial Distribution- Wastewater Basin Delineation

The City's UGA was broken down into wastewater basins (see map in Appendix B). These wastewater basins represent the fundamental building blocks for this analysis and provide the ability to differentiate growth rates for each basin within the UGA. This in turn will support identification of needs for utility improvements based on growth and related wastewater flow projections.

The boundaries of the wastewater basins that directly feed into each of the individual pump stations were established by identifying the gravity lines that drain into each pump station, by using the City-wide collection system map, and using previously developed drawings with basin boundaries shown. Furthermore, the topography of the area also helped in identifying areas with higher elevations and the borders of the collection basins. These basins were delineated to reflect anticipated differences in growth potential resulting from population and household growth, annexations, and corresponding need for utility services. Appendix B shows the wastewater basin boundaries.

Existing Wastewater Basin Descriptions

WW Basin 1. Basin 1 is served by Lift Station 1 and is generally located northeast of the City's downtown area near the north end of the harbor along Vernhardson Street. Flows from Lift Station 1 are discharged to Basin 2. Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and it does not appear that the basin boundaries can be expanded to provide additional areas by gravity.

WW Basin 2. Basin 2 is served by Lift Station 2A and is generally located north of the harbor in the vicinity of Peacock Hill Avenue. Flows from Lift Station 2A are discharged to Basin 3. Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and there is the potential to extend gravity service north along Peacock Hill Avenue. Figure 2-3 shows the City's desired approach to extending gravity sewer piping on Peacock Hill Avenue to serve Basin 2 (and Basin 15).

WW Basin 3. Basin 3 is served by Lift Station 3A. All wastewater flows generated in the City's service area flow through Lift Station 3A, which discharges directly to the City's wastewater treatment plant. Basin 3 has the largest service area of all basins, encompassing about 25 percent of the City's UGA area. The Basin 3 area generally extends to the southeast along Stinson Avenue, to the southwest south of Rosedale Street in the vicinity of Gig Harbor High School, to the northwest to the Washington Corrections Center for Women (WCCW), and to the northeast near Borgen Boulevard. The boundaries of this existing basin include both the existing collection system and additional non-sewered areas that appear to be serviceable in the future by extending gravity pipelines connected to the existing gravity piping in this basin. Further sub-basin analysis would be needed in the northeast near Peakcock Hill Road and the northwest near Burnham Drive.

WW Basin 4. Basin 4 is served by Lift Station 4, and is generally bounded on the north by Rosedale Street, to the east by Soundview Drive, and to the south and west by State Route (SR) 16, and includes Pioneer Way along the center area of the basin. Flows from Lift Station 4 are discharged to Basin 3. Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and it does not appear that the basin boundaries can be expanded to provide additional areas by gravity.

WW Basin 5. Basin 5 is served by Lift Station 5. It is a relatively small basin adjacent to the waterfront off Harborview Drive, and is east and down gradient of Basin 4. Flows from Lift Station 5 are discharged to Basin 4. Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and it does not appear that the basin boundaries can be expanded to provide additional areas by gravity.

WW Basin 6. Basin 6 is served by Lift Station 6, and is generally located adjacent to the waterfront east of Soundview Drive and is east and down gradient of Basin 4. Flows from Lift Station 6 are discharged to Basin 4. Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and it does not appear that the basin boundaries can be expanded to provide additional areas by gravity.

WW Basin 7. Basin 7 is served by Lift Station 7, and is generally located east of SR 16 in the vicinity of Olympic Drive. Flows from Lift Station 7 are discharged to Basin 4. Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and it does not appear that the basin boundaries can be expanded to provide additional areas by gravity.

WW Basin 8. Basin 8 is served by Lift Station 8, and is generally located west of SR 16 in the vicinity of Point Fosdick Drive and 56th Street. Basin 8 also receives wastewater flows from Goodman Middle School and Harbor Heights Elementary School (located outside the City's UGA boundary), which are metered and billed by the City. It was assumed during this analysis that flows from the school would continue to discharge to the City's system in the future. Flows from Lift Station 8 are discharged to Basin 4. Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and it does not appear that the basin boundaries can be expanded to provide additional areas by gravity.

WW Basin 9. Basin 9 is served by Lift Station 9, and is generally located east of Olympic Drive and west of Reid Drive. Flows from Lift Station 9 are discharged to Basin 7. The boundaries of this existing basin include both the existing collection system and additional non-sewered areas that appear to be serviceable in the future by extending gravity pipelines connected to the existing gravity piping in this basin. Further sub-basin analysis would be needed in the northern portion of the basin.

WW Basin 10. Basin 10 is served by Lift Station 10, which serves the Forest Grove Apartments in the vicinity of Olympic Drive and 56th Street. Flows from Lift Station 10 are discharged to Basin 8. Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and it does not appear that the basin boundaries can be expanded to provide additional areas by gravity.

WW Basin 11. Basin 11 is served by Lift Station 11, which serves the Woodland Creek subdivision off of 38th Avenue. Flows from Lift Station 11 are discharged to Basin 8. Due to topography sloping west toward the UGA boundary, Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and it does not appear that the basin boundaries can be expanded to provide additional areas by gravity.

WW Basin 12. Basin 12 is served by Lift Station 12. Basin 12 has the second largest service area, encompassing about 10 percent of the City's UGA area. The Basin 12 area generally extends east and west of SR 16 and includes portions of Burnham Drive, Borgen Boulevard and Woodhill Drive. Basin 12 also receives wastewater flows from Canterwood. Flows from Basin 12 are discharged to Basin 3. The boundaries of this existing basin include both the existing collection system and additional non-sewered areas that appear to be serviceable in the future by extending gravity pipelines connected to the existing gravity piping in this basin. Further sub-basin analysis would be needed in the northeast portion of the basin near Peakcock Hill Road, and in the northwest portion of the basin near Burnham Drive.

WW Basin 13. Basin 13 is served by Lift Station 13. Basin 13 is in the northwest corner of the UGA, bounded by the waterfront to the west and SR 16 to the east, and includes Peninsula High School. Flows from Basin 13 are discharged to Basin 12. The boundaries of this existing basin include both the existing collection system and additional non-sewered areas that appear to be serviceable in the future by extending gravity pipelines connected to the existing gravity piping in this basin. Further sub-basin analysis would be needed in the southeast portion of the basin in the vicinity of Goodnough Drive.

WW Basin 14. Basin 14 is served by Lift Station 14. Basin 14 is west of SR 16 adjacent to Wollochet Drive and Wagner Way. Basin 14 also receives wastewater flows from the Wollochet Harbor Sewer District (located outside the City's UGA boundary), which is metered and billed by the City. It was assumed during this analysis that flows from the Wollochet Harbor Sewer District would continue to discharge to the City's system in the future. Flows from Basin 14 are discharged to Basin 3. The boundaries of this existing basin include both the existing collection system and additional non-sewered areas that appear to be serviceable in the future by extending gravity pipelines connected to the existing gravity piping in this basin. Further sub-basin analysis would be needed in the northern portion of the basin in the vicinity of Wagner Way.

WW Basin 16. Basin 16 is served by Lift Station 16, which serves the McCormick Ridge Condominiums between Canterwood Boulevard and SR 16. Flows from Lift Station 16 are discharged to Basin 12. Due to topography sloping west toward SR 16, Existing sewer piping generally covers the existing basin area to provide gravity collection to the existing lift station, and it does not appear that the basin boundaries can be expanded to provide additional areas by gravity.

WW Basin Canterwood and Rush. The Canterwood basin is served by Septic Tank Effluent Pump (STEP) systems owned and operated by the Canterwood STEP Association and the Rush Division 12 STEP Association. This basin serves the Canterwood housing development surrounding the Canterwood Golf and Country Club located within the City's UGA boundary. Total flow from the Canterwood STEP Association is metered and billed by the City. Similarly, total flow from the Rush Division 12 STEP Association is metered and billed by the City. It was assumed during this analysis that flows from both STEP Associations would continue to discharge to the City's system in the future. Canterwood and Rush basin flows are discharged to Basin 12.

As expected, the City's current sewer system map indicates there are no City wastewater facilities in the Canterwood basin. However, the City's wastewater billing database indicates that several parcels in the Canterwood basin are billed individually for sewer service.

LEGEND

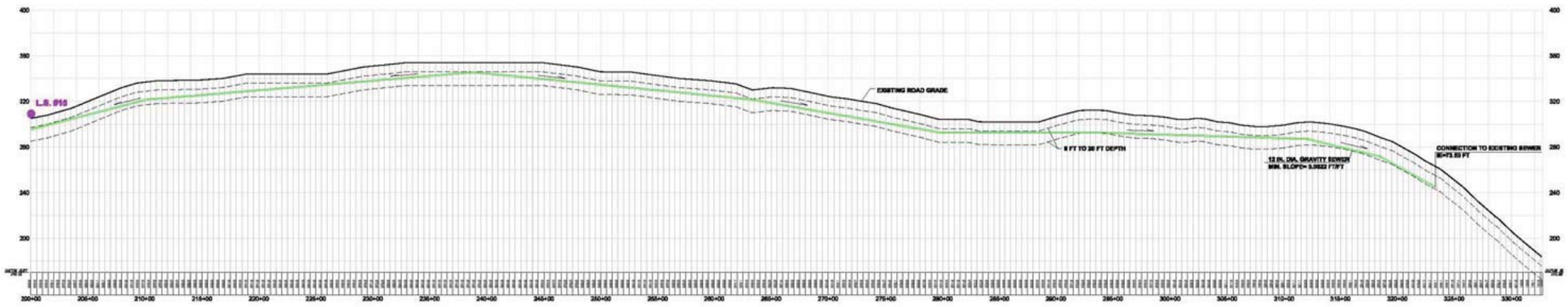
- 2008 WASTEWATER BASIN BOUNDARY
- CURRENT MODEL PIPE NETWORK
- PROPOSED SEWER ALIGNMENT
- UGA BOUNDARY
- CONTOURS
- PARCEL
- EXISTING LIFT STATION
- FUTURE LIFT STATION LOCATION

CITY OF GIG HARBOR

WASTEWATER BASINS 1, 2, & 15

PRINTED JULY 1, 2008

Figure 2-3. Basins 2 and 15 Plan and Profile



Future Wastewater Basin Descriptions

The "future" wastewater basin boundaries were delineated following a similar approach to delineating the existing basin boundaries. The future boundaries were first delineated based on topography and then refined by correlating the basin boundaries to parcel boundaries. The future basins encompass the areas between the existing basin boundaries and the City's UGA boundary. Future basins are defined as areas having the following characteristics:

- Currently non-sewered areas where sewer collection/conveyance piping and lift stations do not currently exist
- Areas where topography indicates that gravity pipelines could provide sewer collection service to one or more low elevation locations within the basin, resulting in the need for one or more lift stations within the basin with corresponding forcemain piping to convey flows from the future basin to connect to the existing collection system.

The future basins are numbered 15 and 17 through 21. The City requested that future basins be identified with a sequential numerical value which would extend the existing basin numbering format. The boundaries of the future basins include non-sewered areas where topography indicates that gravity pipelines could provide sewer collection service to one low elevation location within the basin, resulting in the need for one lift station within the basin with corresponding forcemain piping to convey flows from the future basin to connect to the existing collection system. The general location, issues, constraints, and challenges associated with each of the future wastewater basins are described in this section.

Future WW Basin 15. Future Basin 15 will be served by Lift Station 15A. Future basin 15 is in the northeast corner o the UGA, bounded by Basin Canterwood to the west and Basin 2 to the south. Flows from Basin 15 will be discharged to Basin 2. Due to the natural topography within the basin, the City has determined that further development within the basin may require grinder pumps to discharge wastewater into the collection system. Figure 2-3 shows the City's desired approach to extending gravity sewer piping on Peacock Hill Avenue to serve Basin 15 (and Basin 2).

Future WW Basin 17. Future Basin 17 is served by Lift Station 17A. Basin 17 is located south of the Washington Corrections Center for Women (WCCW) on Bujacich Dr, bounded by Basin 18 to the south and Basin 3 to the east. Lift Station 17A will discharge into Basin 3.

Future WW Basin 18. Future Basin 18 will be served by Lift Station 18A and is generally located at the south end of 56th Ave Ct and will discharge into Basin 3.

Future WW Basin 19. Lift Station 19A will serve Future Basin 19. Basin 19 will be located near Crescent Valley Dr along Goodman Dr. Lift Station 19A will discharge into Basin 1 and is boarded by Future Basin 20 to the south. Due to the natural topography of

the basin, the City has determined that future sewer extensions along properties bordering Gig Harbor may require grinder pumps to discharge wastewater into the system. Figure 2-4 shows the City's desired approach for gravity sewer piping to serve Basin 19 (and Basin 20).

Future WW Basin 20. Future Basin 20 will be served by Lift Station 20A, which will flow into Future Basin 19. Lift Station 20A is located along the south end of Goodman Dr. Due to the natural topography of the basin, the City has determined that future sewer extensions along properties boarding Gig Harbor may require grinder pumps to discharge wastewater into the system. Figure 2-4 shows the City's desired approach for gravity sewer piping to serve Basin 20 (and Basin 19).

Future WW Basin 21. Lift Station 21A will serve Future Basin 21. Basin 21 will be located along Skansie Avenue near Hunt Street. Basin 21 will discharge into Basin 3 and is boarded by Basin 14 to the east and Basin 3 to the north.

Components of Demographic Forecast Allocation Model for Wastewater

As noted above, six demographic categories are built into the DFAM-WW. These are:

- Population
- Single-family households;
- Multifamily households;
- Employment;
- School enrollment; and
- Offender population at the Washington Corrections Center for Women (WCCW).

This section describes these categories more fully. Tables 2-1, 2-2, and 2-3 summarize demographic inputs from the BLA and other sources, used in DFAM-WW. Tables 2-4 and 2-5 present additional information relating to sewered and unsewered areas.

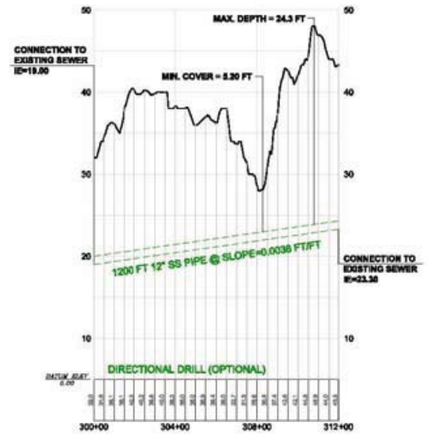
Population

Population was calculated based on the number of single-family and multifamily households, using a figure of 2.19 persons per household. The population data was used as an indicator of forecasted growth; however, the other demographic category data was utilized to develop flow projections.

Single-family and Multifamily Households

Future wastewater generation from the domestic population will be impacted by two factors: growth in single and multi-family households; and conversion of households from septic systems to the sewer system.

The DFAM-WW is designed to (1) allocate existing households and projected growth annually and by wastewater basin, and (2) categorize allocated households by their connection to the sewer system.



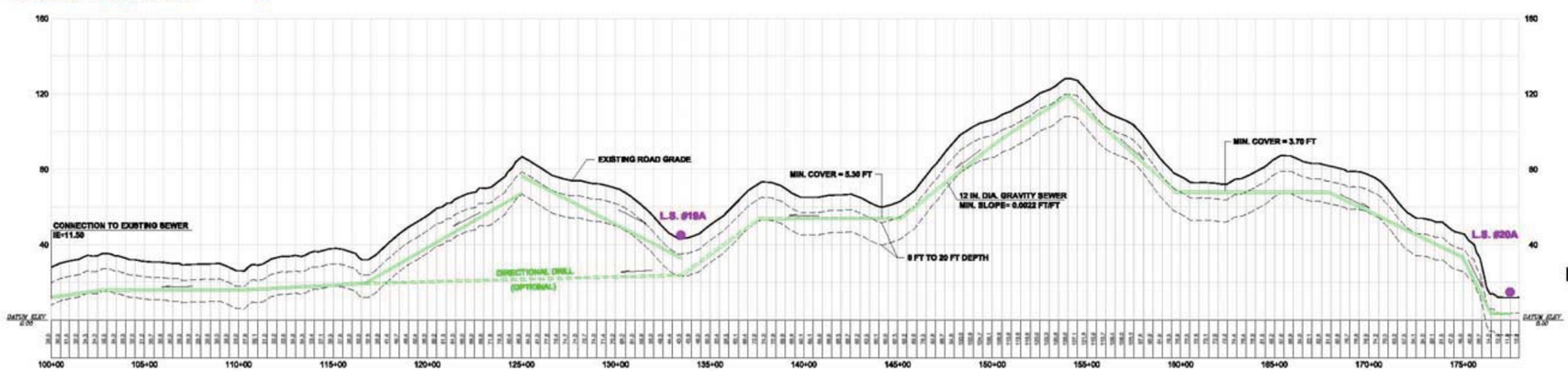


Figure 2-4.
Basins 19 and 20 Plan and Profile
CITY OF GIG HARBOR
WASTEWATER BASINS 1, 19, & 20
PRINTED JUNE 30, 2008

Employment

Future wastewater generation from the commercial sector will be impacted by the amount, type and location of growth. Therefore the DFAM-WW is designed to allocate existing and projected commercial growth, expressed as employment, annually by wastewater basin. The employment demographic is represented by the number of employees anticipated to be located within the service area.

School Population

Eight schools generate wastewater that enters the City's wastewater conveyance and treatment system. The schools, located in the Peninsula School District #401, are identified in Table 2-2. The DFAM-WW allocates the projected school population over a 20-year period and allows for temporal adjustments to this growth (i.e. trigger events and wastewater basin specific growth rates). The DFAM-WW shows that all schools are growing at the same rate and no new schools are built within the UGA. This information should be revisited with the school district and if necessary updated to reflect district expectations.

Prison Population

The City of Gig Harbor provides wastewater services to the State of Washington Correction Center for Women (WCCW). The WCCW is located within the City's UGA, but outside City Limits. As shown in Table 2-3, the current offender population at the WCCW is 896, and is forecasted to increase to 996 by 2015 (DOC 2005). The DFAM-WW is designed to allocate the projected WCCW inmate population over a 20-year period. Like other data in the DFAM-WW, prison data can be updated periodically, as the Washington State Department of corrections prepares new forecasts of the offender population.

Sewered and Unsewered Areas

The model provides a breakdown of sewered and unsewered parcels. In developing the model, identified discrepancies between the County's parcel database and the City's billing database were rectified.

Adjustments to Demographic Forecasts

The DFAM-WW is initially run using existing demographic forecasts for the City of Gig Harbor and its UGA. For example, data on current and forecasted single-family households is entered for years 2005, 2008, 2025 and 2050 (buildout) respectively. For all years between these dates, the model initially estimates population using straight-line interpolation between the data entered. This information is then converted to an annual growth rate for every year. This represents the annual change each year from 2006 to 2050, expressed as a percentage. (Note: for planning purposes, the City selected the year 2050 to correlate with buildout conditions). The annual growth rate is produced for each wastewater basin and for all six demographic categories discussed above.

Following the initial straight-line growth allocation between forecasted data points, the model permits planners to manually adjust growth rates. This can be done in any one wastewater basin, or in all of the wastewater basins, for short-term or longer-term periods. This can be used to account for "trigger events" that have a pronounced effect on growth conditions or simply to allow planners to use actual growth trends to modify long-term forecasts. Both of these conditions are discussed below.

Trigger Events

Trigger events are discrete events that have a significant impact on size and timing of growth rates and/or the location of growth. Within the DFAM-WW trigger events are classified, based on the potential size of the area impacted, as either "Area Specific" or "Region Wide." Impacts from Area Specific trigger events are identified with one or more specific wastewater basins. Impacts from Region Wide trigger events impact the entire UGA. The trigger events included within the DFAM-WW are identified and described in Table 2-6

It is important to note that trigger events may cause increases or decreases in growth and vary in the size and timing of the change. Therefore each trigger event should be evaluated individually. In addition, the DFAM-WW allows for modification to trigger events, in response to observations of actual growth patterns that emerge in the coming years.

Wastewater Basin Growth Rates

In addition to specific events that trigger short-term changes in growth rates, actual growth rates may simply differ from forecasted growth rates. This may occur throughout the UGA or locally within one or more wastewater basins. The DFAM-WW allows the user to modify growth rates to individual wastewater basins.

For example, if actual growth rates over a five year period are substantially higher than forecast, the DFAM-WW can be modified accordingly. This may require either an adjustment to growth rates within that time period; modification of the base forecast at specified planning horizons (e.g. 2025); or both.

Table 2-1. Dataset for Use in DFAM-WW

Area Code (1)	Households						Employment		
	Current Estimate (2)		Total Future Capacity (3)				Current	Total Future Capacity (3)	
			2025		Buildout				
	SF	MF	SF	MF	SF	MF	Estimate (2)	2025	Buildout
WWB-1	103	45	197	88	233	103	219	96	107
WWB-2	433	206	641	278	718	315	210	323	364
WWB-3	550	366	1,572	926	1,688	1,003	5,831	12,913	14,299
WWB-4	366	420	438	527	461	553	3,067	3,522	3,935
WWB-5	14	9	17	11	17	11	57	46	57
WWB-6	98	31	133	32	147	36	--	16	20
WWB-7	189	121	270	189	304	211	703	819	877
WWB-8	209	313	181	370	189	383	3,749	3,954	4,958
WWB-9	184	83	223	103	245	113	--	30	38
WWB-10	154	145	175	156	183	163	207	309	339
WWB-11	143	12	227	17	258	19	138	312	358
WWB-12	67	2	771	28	824	30	2,427	7,256	7,724
WWB-13	124	34	217	56	252	66	2,509	3,920	4,520
WWB-14	52	33	114	55	126	63	976	1,664	1,985
WWB-15	43	92	73	168	91	205	--	48	60
WWB-16	--	94	--	65	--	65	--	--	--
WWB-17	--	--	--	--	--	--	327	4,179	4,846
WWB-18	137	13	309	22	356	26	--	52	64
WWB-19	45	9	88	15	101	18	--	13	16
WWB-20	59	1	97	2	107	2	--	9	11
WWB-21	115	42	260	75	298	89	308	731	836
WWB-Canterwood	548	--	784	--	941	--	--	138	173
WWB-Rush	--	--	71	--	71	--	--	--	--

SF = Single Family; MF = Multifamily

Minor PSA ID: i=inside city limits; o=outside city limits

1. PSA refers to the geographic areas that the Gig Harbor UGA was divided into for the purposes of this analysis. The "o" in the minor ID refers to outside the city limits, while "i" refers to inside city limits.
2. Current refers to the current estimated number of households or employees, irrespective of the BLI classification parcels are assigned to.
3. Total Future Capacity refers to the total estimated number of households or employees that is potentially available by 2025 or buildout. This is the sum of developed and future additional capacity.

Table 2-2. Gig Harbor UGA School Population

Area Code Wastewater Basin	Schools	Student Enrollment (1)(2)										Type	Notes
		2005	2006	2007	2008	2009	2010	2015	2020	2025	2030		
WWB-13	Peninsula High School	1,311	1,343	1,362	1,389	1,423	1,466	1,683	1,933	2,134	2,288	High	Inside UGA
WWB-3	Gig Harbor High School	1,508	1,531	1,553	1,584	1,623	1,672	1,920	2,204	2,434	2,609	High	Inside City Limits
WWB-8	Harbor Heights Elementary (3)	571	567	575	587	602	620	717	828	912	974	Elementary	Outside UGA
WWB-8	Goodman Middle School (3)	581	587	596	608	623	642	736	845	934	1,001	Middle	Outside UGA
WWB-3	Henderson Bay (3)	144	152	154	158	161	166	191	219	242	259	High	Inside City Limits
WWB-3	Harbor Ridge Middle School	573	548	556	567	581	598	687	789	871	933	Middle	Inside City Limits
WWB-13	Purdy Elementary	471	492	499	509	523	539	623	718	792	846	Elementary	Inside UGA
WWB-3	Discovery Elementary	466	428	434	443	454	468	541	624	688	735	Elementary	Inside City Limits
TOTAL		5,625	5,648	5,728	5,844	5,991	6,172	7,098	8,160	9,007	9,644		

1. 2005 and 2006 extracted from Peninsula School District No. 401 actual enrollment posted on http://www.psd401.net/district/enrollment.asp. 2005 was posted June 2005. 2006 was posted March 2006.
2. Projected enrollment for 2007 through 2030 calculated by applying the annual percent growth for the Gig Harbor Peninsula area to each schools enrollment. Annual percent growth for the Gig Harbor Peninsula is based on the Moderate Forecast presented in the "Peninsula School District No. 401 Demographic and Economic Analysis in Support of Long-Range Planning," Draft Report, March 23, 2006.
3. Data obtained from City of Gig Harbor, personal communication with Maureen Isaman on June 24, 2005.

Table 2-3. Current and Projected Prison Population

Area Code	Description	Inmates	
		2005	2015
WWB-3	Wastewater Basin 3	896	996

Source: Washington State Department of Corrections, April 2005. Statewide Water System Plan (Draft).

Table 2-4. Sewered Employment Based on Current and Developed Parcels by Basin for the Gig Harbor UGA

Area Code (1)	Current Employment (2)				Developed Parcel Employment (3)			
	Active Sewer Connection	No Sewer Connection	Total Current Employment	Percent Sewered	Active Sewer Connection	No Sewer Connection	Total Developed Employment	Percent Sewered
WWB-1	219	--	219	100.0%	51	--	51	100.0%
WWB-2	71	139	210	33.7%	45	118	163	27.7%
WWB-3	4,828	1,003	5,831	82.8%	3,831	454	4,285	89.4%
WWB-4	2,716	351	3,067	88.5%	2,163	133	2,296	94.2%
WWB-5	56	1	57	98.9%	3	1	4	83.7%
WWB-6	--	--	--	0.0%	--	--	--	0.0%
WWB-7	587	117	703	83.4%	552	85	637	86.7%
WWB-8	2,781	968	3,749	74.2%	1,735	224	1,959	88.6%
WWB-9	--	--	--	0.0%	--	--	--	0.0%
WWB-10	79	127	207	38.4%	79	108	187	42.4%
WWB-11	16	122	138	11.7%	--	122	122	0.0%
WWB-12	1,379	1,048	2,427	56.8%	620	1,035	1,655	37.5%
WWB-13	1,527	982	2,509	60.9%	1,493	587	2,080	71.8%
WWB-14	271	705	976	27.7%	217	497	714	30.4%
WWB-15	--	--	--	0.0%	--	--	--	0.0%
WWB-16	--	--	--	0.0%	--	--	--	0.0%
WWB-17	--	327	327	0.0%	--	--	--	0.0%
WWB-18	--	--	--	0.0%	--	--	--	0.0%
WWB-19	--	--	--	0.0%	--	--	--	0.0%
WWB-20	--	--	--	0.0%	--	--	--	0.0%
WWB-21	--	308	308	0.0%	--	308	308	0.0%
WWB-Canterwood	--	--	--	0.0%	--	--	--	0.0%
WWB-Rush	--	--	--	0.0%	--	--	--	0.0%

Minor PSA ID: i=inside city limits; o=outside city limits

1. PSA refers to the geographic areas that the Gig Harbor UGA was divided into for the purposes of this analysis. The "o" in the minor ID refers to outside the city limits, while "i" refers to inside city limits.
2. Current refers to the current estimated number of employees, irrespective of the BLI classification parcels are assigned to.
3. Developed employees are those employees that are currently in place, classified as developed, and are anticipated to remain unchanged.

Table 2-5. Current and Developed Parcels with Sewer Connection by Household Type and Wastewater Basin

Area Code (1)	Current Estimate of Households (2)						Percent Sewered			Estimated Households on Developed Parcels (3)						Percent Sewered		
	Active Sewer Connection			No Sewer Connection						Active Sewer Connection			No Sewer Connection					
	SF	MF	Subtotal	SF	MF	Subtotal	SF	MF	Total	SF	MF	Subtotal	SF	MF	Subtotal	SF	MF	Total
WWB-1	27	8	35	76	37	113	26.2%	17.7%	23.6%	17	8	25	26	12	38	39.5%	39.7%	39.6%
WWB-2	178	21	199	255	185	440	41.1%	10.2%	31.2%	138	21	159	131	80	211	51.3%	20.8%	43.0%
WWB-3	371	155	526	179	211	390	67.5%	42.4%	57.4%	296	64	360	100	79	179	74.7%	45.0%	66.8%
WWB-4	343	271	614	23	149	172	93.7%	64.5%	78.1%	269	241	510	14	108	122	95.1%	69.1%	80.7%
WWB-5	14	3	17	--	6	6	100.0%	33.3%	73.9%	13	3	16	--	6	6	100.0%	33.3%	72.7%
WWB-6	76	13	89	22	18	40	77.6%	41.1%	68.9%	48	7	55	17	4	21	73.9%	61.7%	72.2%
WWB-7	6	22	28	183	100	283	3.2%	17.9%	8.9%	3	16	19	93	62	155	3.1%	20.2%	10.7%
WWB-8	--	189	189	209	124	333	0.0%	60.4%	36.2%	--	189	189	141	122	263	0.0%	60.8%	41.8%
WWB-9	57	--	57	127	83	210	31.0%	0.0%	21.3%	56	--	56	62	55	117	47.5%	0.0%	32.3%
WWB-10	--	122	122	154	23	177	0.0%	84.4%	41.0%	--	122	122	142	2	144	0.0%	98.2%	45.9%
WWB-11	28	--	28	115	12	127	19.6%	0.0%	18.1%	28	--	28	46	4	50	37.8%	0.0%	35.9%
WWB-12	17	--	17	50	2	52	25.6%	0.0%	24.6%	10	--	10	1	--	1	90.8%	0.0%	90.8%
WWB-13	1	--	1	123	34	157	0.8%	0.0%	0.6%	--	--	--	29	4	33	0.0%	0.0%	0.0%
WWB-14	1	--	1	51	33	84	1.9%	0.0%	1.2%	--	--	--	28	--	28	0.0%	0.0%	0.0%
WWB-15	--	--	--	43	92	135	0.0%	0.0%	0.0%	--	--	--	1	12	13	0.0%	0.0%	0.0%
WWB-16	--	44	44	--	50	50	0.0%	46.8%	46.8%	--	24	24	--	4	4	0.0%	85.7%	85.7%
WWB-17	--	--	--	--	--	--	0.0%	0.0%	0.0%	--	--	--	--	--	--	0.0%	0.0%	0.0%
WWB-18	--	--	--	137	13	150	0.0%	0.0%	0.0%	--	--	--	77	--	77	0.0%	0.0%	0.0%
WWB-19	--	--	--	45	9	54	0.0%	0.0%	0.0%	--	--	--	17	2	19	0.0%	0.0%	0.0%
WWB-20	--	--	--	59	1	60	0.0%	0.0%	0.0%	--	--	--	37	1	38	0.0%	0.0%	0.0%
WWB-21	--	--	--	115	42	157	0.0%	0.0%	0.0%	--	--	--	64	4	68	0.0%	0.0%	0.0%
WWB-Rush	--	--	--	--	--	--	0.0%	0.0%	0.0%	--	--	--	--	--	--	0.0%	0.0%	0.0%
WWB-Canterwood	205	--	205	343	--	343	37.4%	0.0%	37.4%	42	--	42	37	--	37	53.2%	0.0%	53.2%

SF = Single Family; MF = Multifamily

Minor PSA ID: i=inside city limits; o=outside city limits

1. PSA refers to the geographic areas that the Gig Harbor UGA was divided into for the purposes of this analysis. The "o" in the minor ID refers to outside the city limits, while "i" refers to inside city limits.
2. Current refers to the current estimated number of households, irrespective of the BLI classification parcels are assigned to.
3. Developed households are those households that are currently in place, classified as developed, and are anticipated to remain unchanged.

Table 2-6. Trigger Events Potentially Impacting Growth Rates in Gig Harbor's UGA

Event	Completion Date	Location	Description	Area of Impact
Region Wide Impacts				
New Tacoma Narrows Bridge and Upgrade to Existing Narrows Bridge	Completed	South of Gig Harbor next to existing Narrows Bridge	Daily 85,000 to 90,000 vehicles use the corridor today and use is estimated to increase to 120,000 vehicles/day in 2020(WSDOT 2005).	Impacts Large Portion of Kitsap Peninsula, including the entire Gig Harbor UGA
Area Specific				
Franciscan Health Systems St. Anthony Hospital.	Early 2006 construction. Open Early 2008	Near Canterwood Boulevard and Burnham Drive in North Gig Harbor	New Hospital.	To Be Determined by City Planning Staff
Costco	Completed	Gig Harbor North Area (Site Plan Review - 10910 Harbor Hill Dr.)	Will construct necessary infrastructure required for additional residential development. The residential development will follow by a couple of years.	To Be Determined by City Planning Staff
YMCA	Completed	Gig Harbor North Area	Will construct necessary infrastructure required for additional residential development. The residential development will follow by a couple of years.	To Be Determined by City Planning Staff
WSDOT Projects – Interchange Reconstruction	In Progress of identifying	Wollochet interchange on SR-16	May dramatically influence the residential development on the west side of SR-16	To Be Determined by City Planning Staff
WSDOT Projects – Crossing	In Progress of identifying	New over crossing of SR-16 at Hunt Street	May dramatically influence the residential development on the west side of SR-16.	To Be Determined by City Planning Staff
Washington Correction Center for Women - Health Care Facility Expansion	2009	Washington Correction Center for Women	The Existing 9,900 square foot clinic/infirmary will be replaced with a new two-story 16,415 square foot facility.	To Be Determined by City Planning Staff
Uptown multi-care property	Complete	To Be Determined by City Planning Staff	To Be Determined by City Planning Staff	To Be Determined by City Planning Staff
12-Plex Theater	Complete	To Be Determined by City Planning Staff	To Be Determined by City Planning Staff	To Be Determined by City Planning Staff
Proposed Park and Ride	To Be Determined by City Planning Staff	To Be Determined by City Planning Staff	To Be Determined by City Planning Staff	To Be Determined by City Planning Staff

2.4.3. Structure and Operation of Model

The instructions for running the DFAM-WW are included in the Excel file containing the model.

Step 1. User inputs geographic area data.

Step 2. User inputs the current and projected demographic data from existing sources for the entire Gig Harbor UGA by geographic area (unadjusted forecast). Data is only entered for select years for which data is available. Data may be directly typed into Step 1 worksheet or the Step 1 worksheet can be linked to one of the input worksheets.

Step 3. Model interpolates/extrapolates unadjusted annual allocation of the projected demographic data from Step 2, based on a straight-line trend.

Step 4. Model calculates unadjusted growth rates (percent growth) in each year based on Step 3 results. Note that in instances where a growth rate can not be estimated because the prior year is a zero, the term "Initial" is inserted by the model.

Step 5. User inputs Trigger Event data to be incorporated into the modified forecast.

Step 6. Model calculates modified forecast using Step 2 and Step 5 inputs. This worksheet only contains select years forecast and trigger event modified forecast.

Step 7. Model calculates the modified annual straight-line allocation using Step 6 results.

Step 8. Model calculates the growth rates for the modified annual allocation from Step 7. This is a key output of the model.

Step 9. User inputs the select years current and projected percent sewered for each demographic (e.g., user enters in the percent of single family households that are sewered within a specific geographic area).

Step 10. Model calculates annual percent sewered using Step 9 inputs.

Step 11. Model calculates sewered demographics using results from Step 7 and Step 10.

Step 12. Model calculates non-sewered demographics using results from Step 7 and Step 10.

Step 13. User input and model calculation of annual unit wastewater generated per demographic (e.g., wastewater per single family household in gallons per day).

Step 14. Model calculates Annual Dry Weather Flow using Step 11 and Step 13 results.

Step 15. User inputs peaking factor. Model calculates Sanitary Peak Flow using Step 14 results and peaking factor.

Step 16. User input and model calculation of annual Inflow and Infiltration for the entire UGA.

Step 17. Model calculates each geographic areas share of the UGA inflow and infiltration (i.e., the spatial distribution of inflow and infiltration within the UGA). The model uses the sum of population, employment, school enrollment, and inmates to calculate the share.

Step 18. Model calculates Maximum Day Inflow and Infiltration using Step 16 and Step 17 results.

Step 19. Model calculates Peak Hour Inflow and Infiltration using Step 16 and Step 17 results.

Step 20. User input and model calculation of wastewater contributed by areas outside of the UGA (Other Contributors to Wastewater Flow).

Step 21. Model calculates Maximum Day Flow by summing Average Dry Weather flow for each demographic (Step 14), Maximum Day I&I (Step 18), and Other Contributors (Step 20). User can select between using ADWF based on population or based on households.

Step 22. Model calculates Peak Day Flow by summing Sanitary Peak Flow for each demographic (Step 15), Peak Hour I&I (Step 19), and Other Contributors (Step 20). User can select between using SPF based on population or based on households.

Table 2-7 depicts the main menu contained in the DFAM-WW. The steps listed above are shown in the far right column of this table.

Table 2-7. DFAM-WW Main Menu

Gig Harbor Demographic Forecast Allocation Model - Wastewater (DFAM-WW) Main Menu				
Components		**User Input**	**Macros (Click Button to Run)**	**Worksheets (Click Link to go to sheet)**
--	Instructions	n/a	Run ALL Steps	Instructions
	Note: Linked Cells on each worksheet generate pop-up graphs displaying the data series.			
External Inputs				
--	External Data: Inputs on demographic forecasts and number of sewer connections from BLA.	**Data & Conversion Factors**	n/a	Inputs 1
--	External Data: Inputs on percent of households sewered.	**Data & Percent Sewered Assumptions**	n/a	Inputs 2
Demographic Forecast				
(1)	Geographic Areas	**Codes, Descriptions, & Map**	Display / Hide Selected Rows	STEP 1
(2)	Forecasted Demographics	**Forecasted Demographics**	n/a	STEP 2
(3)	Straight-line Allocations	*Computed by Model*	Allocate Demographics	STEP 3
(4)	Growth Rates of Straight-line Allocation	*Computed by Model*	n/a	STEP 4
(5)	Trigger Events	**User Identified Increases**	Check: Overlapping Events	STEP 5
(6)	Modified Demographic Forecast: Manual and Trigger Event	**Trigger Events/Modified Growth Rates**	Setup Modifications	STEP 6
(7)	Modified Straight-line Allocations	*Computed by Model*	Modified Allocation	STEP 7
(8)	Growth Rates for Modified Straight-line Allocations	*Computed by Model*	n/a	STEP 8
Wastewater Flow Estimation				
(9)	Forecast of Percent Sewered (%)	**Forecast of Future Percent Sewered**	n/a	STEP 9
(10)	Straight-line Forecast of Percent Sewered (%)	*Computed by Model*	Allocate Percent Sewered	STEP 10
(11)	Straight-line Forecast of Sewered Demographics	*Computed by Model*	n/a	STEP 11 (Sewered)
(12)	Straight-line Forecast of Non-Sewered Demographics	*Computed by Model*	n/a	STEP 12 (Non-Sewered)
(13)	Unit Wastewater Flow Generated Per Demographic	**Forecast of Unit Wastewater Flow**	Calculate Unit Wastewater	STEP 13
(14)	Wastewater Annual Dry Weather Flow	*Computed by Model*	n/a	STEP 14 (ADWF)

Gig Harbor Demographic Forecast Allocation Model - Wastewater (DFAM-WW) Main Menu				
Components		**User Input**	**Macros (Click Button to Run)**	**Worksheets (Click Link to go to sheet)**
(15)	Sanitary Peak Flow	**Peaking Factor**	n/a	STEP 15 (SPF)
(16)	Temporal Inflow and Infiltration Distribution	**Inflow and Infiltration for the Entire UGA by Year**	Calculate Updated Interpolatation	STEP 16 (I&I Dist)
(17)	Spatial Inflow and Infiltration Distribution	*Computed by Model*	n/a	STEP 17 (%SewPop)
(18)	Maximum Day Inflow and Infiltration	*Computed by Model*	n/a	STEP 18 (Max I&I)
(19)	Peak Hour Inflow and Infiltration	*Computed by Model*	n/a	STEP 19 (Peak I&I)
(20)	Other Contributors to Wastewater Flow	**Flow**	Calculate Updated Interpolatation	STEP 20
(21)	Maximum Day Flow	**Select Demographic Option**	n/a	STEP 21 (MDF)
(22)	Peak Hour Flow	**Select Demographic Option**	n/a	STEP 22 (PHF)