

CHAPTER 1

DESCRIPTION OF WATER SYSTEM

The Town of Friday Harbor (Town), recognizing the importance of establishing a uniform process to identify present and future needs and a means to meet those needs in an efficient and cost-effective manner, has prepared this Water System Plan. The objective of this chapter is to provide basic information about the Town's water system.

OWNERSHIP AND MANAGEMENT

The Town of Friday Harbor owns and operates a municipal water system that serves the Town of Friday Harbor and portions of unincorporated San Juan County. The Washington State Department of Health (DOH) water system identification number is 265950. A copy of the Water Facilities Inventory (WFI) form for the system is included in Appendix A.

The Town of Friday Harbor is governed by a Mayor/Council non-partisan form of government. Voters elect the mayor and five council members to four-year terms. All represent the community at large rather than individual districts or areas within the Town.

The Town's current mailing address is:

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Figure 1-1 is a location and vicinity map for the Town of Friday Harbor. Figure 1-2 shows the areas served by the Town and Friday Harbor urban growth area (FHUGA), as established by the Town's Comprehensive Plan for Growth Management.

SYSTEM HISTORY AND BACKGROUND

Friday Harbor has been the commercial, social, and cultural hub of San Juan Island since the 1890s. When the islands became a separate county in 1873, Friday Harbor was named the county seat. By 1909, Friday Harbor was a busy seaport with a commercial center, and a population of three or four hundred. Friday Harbor's economy was driven by San Juan County's agriculture, which shipped products (e.g., apples, pears, cherries, peas, cream, eggs, poultry, grain, salmon, timber, and lime) to domestic and foreign markets from Friday Harbor's waterfront. By 1912, it was believed that economic development and growth would outpace available water supplies.

The Town constructed a dam at Trout Lake and a wood pipeline to transport water by a gravity flow system into town through Beaverton Valley. The concrete dam and spillway, with a screened outlet pipe at its southeastern abutment, were originally built in 1928. In the early 1950s a new asbestos cement main transmission line, along San Juan Valley Road, replaced the wood pipeline. In 1958, the system was again upgraded and the dam raised 11 feet to its present height. Since then, the Town's water system has been steadily updated to meet the demands of a growing population.

In 1979, the Town acquired additional surface water rights through the Lake 310 Augmentation Project #1 (AUG 1). The AUG 1 project entailed building a dam near the southeast end of Lake 310 to collect overflow water from a 190-acre watershed, which is then pumped over a hill and into Trout Lake Creek, which drains into Trout Lake. In 1988, the Town again acquired additional surface water rights and constructed a second augmentation project (AUG 2), consisting of a stream diversion, a pumping station, and a force main. The pump station and diversion structure are located approximately a quarter mile northeast of the water treatment plant. Runoff water was originally diverted from the stream and pumped to the treatment plant. Direct pumping from AUG 2 to the treatment plant presented difficulties in producing an acceptable treated water quality level and severely limited the use of AUG 2. In 1994 the pump station was improved and a main was added to pump water from AUG 2 directly back to Trout Lake.

Geography

The coastline of Friday Harbor is steep and rocky, rising from sea level to about 100 feet. The geology consists of the Roche Rock formation overlain with various types of gravelly silty loams and gravelly sandy loams. Ground surface elevations in the Town range from 100 to 200 feet above sea level. The shoreline is characterized by narrow beaches, with steep slopes between the beach and upland terrain. Progressing inland from town, the land rises gently to Trout Lake, about 5 miles from the Town center and the Town's primary water storage. The upland terrain can be described as gently rolling with valleys.

Adjacent Purveyors

Surrounding areas not served by the Town of Friday Harbor are served primarily by individual wells. Both surface and groundwater are in short supply in San Juan County. Groundwater sources are not easily incorporated into public water supplies due in part to intermittent water quality problems, including iron, sulfur, and color. More importantly, groundwater sources are limited in production capacity, ranging from 3 to 15 gallons per minute (gpm) for typical wells on the island.

Insert Figure 1-1. Vicinity Map

INSERT Figure 1-2. Areas Served and the Friday Harbor Urban Growth Area

INVENTORY OF EXISTING FACILITIES

A description of the water system facilities currently owned and operated by the Town of Friday Harbor is provided in the following sections. Figure 1-3 provides an overview of the existing system facilities.

Supply Sources

Friday Harbor's water is supplied from three surface water sources: Trout Lake, overflow from Lake 310 pumped into the Trout Lake watershed (AUG 1), and a seasonal diversion of water from a stream in Section 17 east of Trout Lake (AUG 2). Water rights for these sources are presented in Appendix B.

Trout Lake. Until 1979, Friday Harbor's water supply came from one surface water source, Trout Lake. Trout Lake is located west of town in an isolated, undeveloped pocket and surrounded by a steep drainage basin of approximately 840 acres, of which the Town owns about 570 acres. The lake is formed by a concrete dam and spillway with a screened outlet pipe at its southeastern abutment. The dam, originally built in 1928, was raised 11 feet to its present height of 37 feet during the 1950's.

The Town contracted for the "Town of Friday Harbor Trout Lake Capacity Analysis," in 1994 (KCM 1994). The 1993 drought conditions, which continued into 1994, caused the water level in Trout Lake to drop to its lowest recorded level. The problem was severe enough to raise concerns that the Town would not have sufficient water storage for anticipated consumption in 1994. In an effort to make rational planning decisions and verify the actual storage volume in Trout Lake, the Town contracted with Island Carto-Technical Services, Inc. to survey the impoundment. A 5-foot contour map of the impoundment was developed to more accurately estimate the relationship between impoundment water levels and storage volume. It is this study that will be used for future planning.

The total volume of Trout Lake was determined to be 468 million gallons (MG). The outlet pipe elevation is 288.2 inches below the spillway. It was assumed that this outlet could be used until the water level reached 287 inches below the spillway. The volume below the outlet is called "dead storage" because it is not readily available. The estimated usable volume is 370 MG. The estimated dead storage volume is 98 MG.

Given the estimated volume of the reservoir, the KCM 1994 report used annual precipitation, consumption, and resulting reservoir elevation records to estimate the average annual recharge to the lake from rainfall. The purpose was to determine a relationship to predict water supply capacity during periods of drought. A linear regression analysis method was used to conclude that no effective recharge from runoff to the lake occurred until 18.5 inches of rain had fallen annually. For each additional inch of rain over the 18.5-inch annual rate, the report estimated an average of 35 MG of reservoir recharge. This relationship deals with average annual conditions and was presented as a planning tool to make multiple year projections.

Insert Figure 1-3. Water Facilities Map

The KCM 1994 report combines the estimated reservoir volume with the average recharge projection to estimate a sustainable reservoir yield. It concluded that the reservoir provides the Town of Friday Harbor with a sustainable annual yield of 168 MG when combined with the yields from the AUG 1 and AUG 2 systems.

In 1995 the Town constructed facilities to allow withdrawal from the dead storage volume by installing a pipe for siphoning water from the deeper part of the impoundment. The installation of the proposed siphoning facilities could increase the Town's supply by up to 30 MG. By adding the reservoir dead storage capacity, the sustainable annual yield is increased to an estimated 193 MG. However, use of dead storage would only be condoned during drought conditions, therefore the effective total sustainable storage is 168 MG.

Without additional water supplies or storage capacity, the Town of Friday Harbor is constrained by these sustainable yield limits. Therefore, for consumption demands greater than these limits, the Town will not be able to provide an adequate water supply as required by the Washington Growth Management Act (GMA).

Augmentation 1 (AUG 1). In 1979, the Lake 310 augmentation project (AUG 1) was constructed to supplement Trout Lake with more surface water runoff. The project entailed building a dam near the southeast end of Lake 310 to collect overflow water from a 190-acre watershed via Lake 310. The Lake 310 overflow water is captured in a small storage impoundment and pumped over a hill and into Trout Lake Creek, which drains into Trout Lake.

The Lake 310 watershed is not owned by the Town. As with Trout Lake, it is in the remote mountainous interior of the island and is protected from significant development. The water rights for AUG 1 limit water withdrawals to the period from October 1 to April 15, and allow a 225-gpm instantaneous withdrawal and an annual withdrawal of about 78 million gallons (MG), with certain limitations.

Augmentation 2 (AUG 2). In 1988, the Town constructed a second augmentation project (AUG 2), consisting of a stream diversion, a pumping station, and a force main. The pump station and diversion structure are located approximately a quarter mile northeast of the water treatment plant and are designed to collect water from a 3,850 acre watershed. Runoff water was originally diverted from a stream in Section 17 and pumped to the treatment plant. Direct pumping from AUG 2 to the treatment plant presented difficulties in producing an acceptable treated water quality level and severely limited the use of AUG 2. In 1994, the pump station was improved and a main was added to pump water from AUG 2 to Trout Lake prior to treatment. AUG 2 was pumped extensively in the winter of 1994-95, and the treatment plant has experienced difficulties treating the mixture of Trout Lake and AUG 2 water. The water rights for AUG 2 limit water withdrawals to the period from November 1 to April 15 and allow for a 1,350 gpm instantaneous withdrawal with an annual withdrawal of approximately 240 MG with certain limitations.

Table 1-1. Existing Sources and Sustainable Yield

Source	Sustainable Yield, MG
Trout Lake Reservoir	106
Trout Lake Reservoir and AUG 1	146
Trout Lake Reservoir, AUG 1 and AUG 2	168
Trout Lake Reservoir, AUG 1, AUG 2, and Dead Storage ¹	193

¹Dead storage would only be used during drought conditions; therefore, the effective total sustainable yield is 168 MG.

Water Treatment Plant

The Town of Friday Harbor applies conventional filtration and disinfection treatment to its raw water sources. In 1993, construction began on a treatment plant to replace the old pressure filtration system with a gravity filtration system. A pump station, clearwell, and backwash pump added to the water treatment plant in 1994 allowed the plant to meet disinfection requirements of the Surface Water Treatment Rule. New gravity filters and a new treatment building were constructed in 1995.

Three gravity filters are located at the Water Treatment Plant, two of which can be operated simultaneously, leaving one as back-up in case of failure. Usually operated at a conservative 4 gpm/sf, the filters have been pilot tested at higher rates within the hydraulic capacity of the system pumps and piping. At a surface loading rate of 5 gpm/sf, each of the three filters would have a capacity of 845 gpm. During peak season, two filters operating jointly increase potential production to 1,690 gpm. However, contact time constraints limit production to about 700 gpm, depending upon temperature and pH.

Water Distribution System

Friday Harbor's water distribution system is supplied by water storage reservoirs and pump stations, creating the following four separate pressure zones: elevations 207, 232, 327, and 460 feet. Water is distributed in approximately 12 miles of pipeline. The pipes range from 2 to 12 inches in diameter. Most of the older 4 to 10-inch diameter pipe are asbestos cement or cast iron, while most of the more recently installed pipe is PVC. Gravity flow from the 1.0 MG reservoir and flow from the approximately 5.5 mile 10-inch source transmission pipeline feed the 232 and 207 pressure zones distribution network through 2- to 10- and 12-inch diameter mains, augmented by additional pumping from sources on an as-needed basis. The 327-foot pressure zone is fed from the pump station located at the 0.5 MG storage tank. The existing distribution system is shown on Figure 1-3.

Table 1-2 provides an inventory of the pipes in the system, including pipe diameter and approximate length. The water storage reservoirs and pump stations are summarized in Table 1-3 and Table 1-4.

Table 1-2. Pipe Length and Size within Friday Harbor’s Primary Distribution System

Pipe Diameter (inches)	Approximate Length of System Pipe (lineal ft.)
4-inch	12,040
6-inch	42,058
8-inch	39,142
10-inch ¹	1,850
12-inch	3,200

¹10-inch transmission main adds an additional 28,800 ft

207-Foot Pressure Zone. Raw water from Trout Lake, filtered through the 700 gpm treatment plant, is pumped via 10- and 12-inch-diameter transmission mains to the Town’s 0.5 MG standpipe located at Spring Street and Marguerite Place. During high system demands, three 350 gpm pumps are available at the treatment plant to maintain the standpipe at a hydraulic grade line elevation of 207 feet. During lower system demands, a single 200 gpm pump maintains hydraulic grade in the 207-foot pressure zone. There are 41 connections directly off the 207-foot pressure zone transmission main, upstream of the standpipe. Any disruption of electrical service from the treatment plant pumps results in low service pressures for connections in this zone. Emergency power for these pumps is available at the water treatment plant.

232-Foot Pressure Zone. Because elevation 207 was insufficient to meet the Town’s demands at acceptable pressures, two 360 gpm pumps and one 340 gpm pump located at the 0.5 MG standpipe have been installed to supply water to the 1.0 MG tank. The 1.0 MG tank maintains a hydraulic grade line at elevation 232, which is the pressure zone serving nearly all of the service area, with some residences along the waterfront equipped with pressure-reducing valves to protect their internal piping from excess pressure. Emergency power for these pumps is available.

327-Foot Pressure Zone. The 0.5 MG standpipe also provides water to booster pumps for a 327-foot pressure zone on the hillside west of Marguerite Place. The high pressure zone is developed by a pressure tank and two 150 gpm pumps. The system has a tank with a capacity of 3,000 gallons. The 327-foot pressure zone currently serves 91 connections. The zone may eventually serve up to 158 connections when all lots within the zone are fully developed, which may occur over the next 25 years.

460-Foot Pressure Zone. A 6-inch supply line from the 232-foot zone feeds the 460-foot pressure zone through two 120 gpm pumps to a 50,000 gallon standpipe in Hillview Terrace. The 141-lot single-family subdivision served by this zone is outside the FHUGA. As mentioned above, this area has a 50,000-gallon concrete storage tank.

Table 1-3. Water Storage

Tank	Pressure Zone	Volume
Storage Tank #1	232' Zone & overflow, 327' zone	1,000,000 gallons
Storage Tank #2	207' Zone & overflow	500,000 gallons
Storage Tank #3	460' Zone (outside FHUGA)	50,000 gallons

Table 1-4. Pumping Stations

Pump Station Location	Use	No.	Capacity (gpm)	Head (Pressure)	Horsepower	Standby Power Available
AUG 1	Raw Water	2	800/each	180	50	No
AUG 2	Raw Water	2	1340/each	235	60	No
Water Treatment Plant	Supply	3	350	230 ft (100 psi)	25	Yes
Reservoir Pump Station	Distribution	2	360	55	7.5	Yes
		1	340	45	5.0	
327 Zone Pump Station	Distribution	2	150	180	20	Yes
460 Zone Pump Station	Distribution	2	120/each	365	25	No

RELATED PLANS AND DOCUMENTS

The following previous engineering studies and planning documents were consulted in the preparation of the 2002 Water System Plan:

Water Conservation Plan, August 2001

The Water Conservation Plan in Appendix C describes background information on the water system, including demographic factors that influence the Town's water supply, and ongoing and proposed water conservation and demand management programs. This plan provides the basis for current and future water use patterns presented in this report.

Trout Lake Dam Improvement Feasibility Study, October 1997 (Draft)

Recognizing the need for additional storage capacity, the Town contracted to conduct this Trout Lake Dam Improvement Feasibility Study. The purpose of the study was to evaluate alternatives and estimated costs for raising the existing dam or constructing a new dam downstream to impound additional water. The study was never adopted by the Town.

Town Of Friday Harbor, Comprehensive Water System Plan Update, February 1997

This update to the Town's Water System Plan was prepared by KCM Inc. to guide the Town through the year 2015 for water resources, water treatment improvements, distribution system improvement and expansion, and capital improvement financing.

Developers Water Extension Requirements, March 1992

Within its capacity, it is the Town's intent to serve new development or redevelopment within the Town. To ensure that these extensions are acceptable, Friday Harbor has adopted Water Extension Requirements, included in Appendix D, which provide information on procedures, contracts, bonds, easements, design standards, and payback agreements.

Town of Friday Harbor Utility Rate Study Update, Final Report, October 1996

This water and sewer rate study by Financial Consulting Solutions Group, Inc. was accepted December 5, 1996 by the Town of Friday Harbor. The study recommends significant increases in the Town's water and sewer rates to meet the utilities' financial requirements and the cost of service. It addresses "right to connect" charges, "system development" charges, and an inverted block rate water user fees.

Trout Lake Capacity Analysis, Final Report, June 1994

This report by KCM, Inc. responds to a reservoir drawdown due to drought conditions. It summarizes previous reservoir capacity estimates, presents an updated reservoir capacity analysis by Island Carto-Technical Services, Inc., estimates the storage available to meet 1994 demands, and makes short-term recommendations to meet the 1994 consumption demands.

Town of Friday Harbor Comprehensive Plan & EIS, Draft Community Profile, April 14, 1994

The Community Profile by Butler & Associates is intended as an information resource for the Town and general public to develop a new Town of Friday Harbor Comprehensive Plan. It presents a compilation of existing conditions and current trends affecting the community. This includes sections on land use, population, and capital facilities that are applicable to this Water System Plan.

Friday Harbor Comprehensive Plan, Draft Alternatives, March 16, 1994

This report by Butler & Associates presents the goals, objectives, and alternatives evaluated for inclusion in the draft Comprehensive Plan & EIS. It presents the issues related to eight initial alternatives, summarizes the public meeting discussions related to them, and concludes with four alternatives for further study.

Town of Friday Harbor Utility Rate Study, Final Report, December 1993

This rate study by Financial Consulting Solutions Group, Inc. was accepted December 16, 1993 by the Town of Friday Harbor. The study recommends water and sewer rates to meet the utilities' financial requirements and the cost of service. It addresses "right-to-connect" charges, projected revenue requirements, allocated cost of services, and a recommended rate design.

Town of Friday Harbor, Amended Comprehensive Plan, October 1993

This memo revised the capital improvement schedule in the 1990 Comprehensive Water Plan Update. The schedule was revised to include the AUG 2 pipeline completed in February 1994, which allows the Town to pump water from the AUG 2 source up to Trout Lake.

Emergency Water Shortage Response Plan, September 1988

The shortage of water supply in the area forced the Town to issue a moratorium on new out-of-town water connections in 1979 and adopt a water shortage response plan in 1988, included in Appendix E. In June 1994 the Town passed multiple resolutions that doubled the cost of water used above a base level of consumption, issued a moratorium on any new in-town non-single-family water system connections, issued a three-stage water emergency conservation plan, and declared the most severe conservation restrictions to be in effect. The moratorium restricting in-town connections was lifted in spring 1995 when drought conditions no longer existed.

AREAS SERVED

This section describes the existing service area and other areas connected to the Town's water system. The future service area is not expected to extend beyond the present boundaries of the FHUGA.

Existing Areas Served

The Town of Friday Harbor currently serves water to all users within the Town limits and some residential, commercial, and light industrial areas outside the Town. Currently there are 370 out-of-town connections that include the Turn Point/Southern Cross/Pear Point area, Brown Island, Hillview Terrace, Hillside Subdivision, and the University of Washington Laboratory. Figure 1-3 shows the extent of the Town's water system.

Only one large water user is located outside the Town limits: the University of Washington (UW) Laboratory, which is a teaching research facility, located north of town. The closure of the sand and gravel pit east of the Town has significantly reduced industrial water consumption. The Port of Friday Harbor, a convalescent center, and the schools are among the large water users within the Town limits. Residential areas to the north, west, and east of town are also served by the Friday Harbor system, as is Brown Island via a submarine pipeline from Friday Harbor.

Zoning and Land Use

Friday Harbor's current land use designations, shown on Figure 1-2, consist of nine zoning categories. The nine zoning categories include Single Family Residential (SF), Multifamily Residential (MF), Professional Service (PS), Commercial (CO), Utility (UT), Public Service (PU), Shoreline Public Accommodation (SA), Light Manufacturing (LM), and Light Industrial (IN).

There are no significant industrial users on the system. The public authority users include the UW Laboratory and the Port of Friday Harbor. Commercial development consists of office buildings, stores, medical offices, a convalescent center, a retirement center, and restaurants. Commercial development is oriented to support the local residents as well as seasonal visitors and recreational activities. Surrounding the Town is unincorporated San Juan County, consisting largely of single-family residential development. The Town does not allow extension of water service to areas outside the Town limits.

Service Area Agreements

The Town of Friday Harbor currently has no service area agreements.

WATER SERVICE POLICIES

The Town of Friday Harbor has several water system management policies that affect its growth and development. Policies and ordinances have been established to ensure system users an adequate water supply. These ordinances and resolutions provide the Town with the means to influence water system growth, demands, and development when local droughts occur or until additional water resources are acquired. Copies of the Town ordinances and resolutions are included in Appendix F.

Table 1-5. Town of Friday Harbor Water Service Policies

Policy Name	Issues Covered	Policy Number
Direct Connection Policy	Policy establishing conditions applicable to all service connections, including meters, valves and installation requirements.	Ordinance No. 1080, Friday Harbor Municipal Code (FHMC) 13.04
Minimum Standards Policy	Policy to establish Town minimum design and performance standards for proposed developments within the Town's existing areas served.	Ordinance No. 1081, FHMC 13.08
Direct Extension Policy	Policy to establish conditions for main extensions including the application process, preparation of plans and specifications, plan review and inspection, construction, and temporary mains.	Ordinance No. 1081, FHMC 13.08
Connection Responsibility Policy	Metered water service shall be installed at the expense of the consumer in accordance with a fee schedule established by town ordinance.	Ordinance No. 1080, FHMC 13.04
Connection Fee Policy	Policy establishing water service connection fees that shall be charged and collected by the Town. Connection fees are outlined in Chapter 9 of this document.	Ordinance No. 1050, FHMC 13.05
Water Rate Policy	Policy concerning the monthly water rate charges for customers of the water system	Ordinance No. 1050, FHMC 13.05
Meters Policy	Each property serviced by the Town water supply shall be connected by separate metered connection to the Town main.	Ordinance No. 1080, FHMC 13.04
Materials Policy	Policy stating minimum requirements for materials in providing water service.	Ordinance No. 1081, FHMC 13.08
Emergency Drought Policy	Policy to establish water use restriction during times of drought	Ordinance No. 1083, FHMC 13.16
Drought Water Policy	Policy creating new classification of water rates during times of severe drought	Ordinance No. 1083, FHMC 13.16
Cross Connections Control	Established regulations eliminating water system cross connections.	Ordinance No. 1081, FHMC 13.08
Limitations on New Services	Policy that limits connections for out-of-town services	Ordinance No. 1141, FHMC 13.12