City of Thorne Bay

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Business Plan

Completed: November 1, 2017

Applicable Project: 17-VSW-KTB-009-01

Engineer: Chase Nelson, P.E., DOWL

Water and Sewer Utilities

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ACRONYMS

DBPR	Disinfectants and Disinfection Byproducts Rule
DCCED	Alaska Department of Commerce, Community and Economic Development
DEC	Alaska Department of Environmental Conservation
DOC	dissolved organic carbon
FC	fecal coliform
gpd	gallons per day
gpm	gallons per minute
HAA5s	Haleoacetic Acids
LTIESWTR	Long Term Interim Enhanced Surface Water Treatment Rule
MCLs	maximum contaminant levels
mL	milliliter
NF	nanofiltration
O&M	Operations and Maintenance
PO	purchase order
R&R	Repairs and replacement
RCA	Regulatory Commission of Alaska
RUBA	Alaska Department of Commerce, Community and Economic Development Rural Utility Business Advisor
RUS	United States Department of Agriculture Rural Utilities Service
SCADA	Supervisory control and data acquisition
SNC	Significant Non-Compliers
TOC	Total Organic Compounds
TTHMs	Total Trihalomethanes
UV	ultraviolet
VSW	Alaska Department of Environmental Conservation, Village Safe Water
WTP	water treatment plant
WWTF	wastewater treatment facility

Section 1 Executive Summary

The City of Thorne Bay (City) was incorporated in 1982 as a second-class city within the Prince of Wales-Hyder Census Area. The city is responsible for administration of the local government, including water and sewer utilities (Alaska Department of Commerce, Community and Economic Development [DCCED], 2017).

The City, in conjunction with the State of Alaska Village Safe Water (VSW), is developing solutions to:

- Reduce disinfection byproducts (DBPs) in the City's potable water.
- Improve wastewater effluent quality by constructing a disinfection system.

The City has been working with the Alaska Department of Environmental Conservation (DEC) on both of these issues.

On July 21, 2015, the City entered into a Compliance Order by Consent to address exceedances of DBPs in Thorne Bay's potable water (Appendix A). The City commissioned a Design Study Report that recommended air stripping, pH management, and improvement of coagulation. The study also recommended investigating ground water sources for the community. These recommendations recognized limited funding available to reduce DBPs.

In December of 2012, the DEC issued a sewer facility discharge permit with a compliance schedule. Due to limited funds available, the City has been unable to keep pace with the schedule. The City completed an Effluent Disinfection Preliminary Engineering Report (CTB PER, 2015, Appendix B), which identified the best alternative as retrofitting the existing chlorine contact basin with an ultraviolet (UV) disinfection system. However, the City had been unable to fund this improvement.

In 2016 the City successfully competed for VSW grant funding to construct both projects. VSW expanded the scope to take a second look at the systems proposed for installation. VSW commissioned a Design Analysis Report (VSW DAR, 2017, Appendix C) to further examine UV disinfection for wastewater and refine the approach. A Preliminary Engineering Report (VSW PER, 2017, Appendix D), which examined water improvement options, reconsidered air stripping for reducing DBPs, but determined that upgrades to the facility to include a nanofiltration membrane polishing filter would perform better with more long-term economic efficiency.

This business plan will outline the community economic parameters around these developments, and outline a feasible regime of funding maintenance and eventual replacement.

Section 2 Community Overview

Location

Thorne Bay is on the east coast of Prince of Wales Island, 47 air miles northwest of Ketchikan. It is on the island road system, 60 miles from Hollis and 36 miles east of the Klawock Junction (DCCED, 2017).

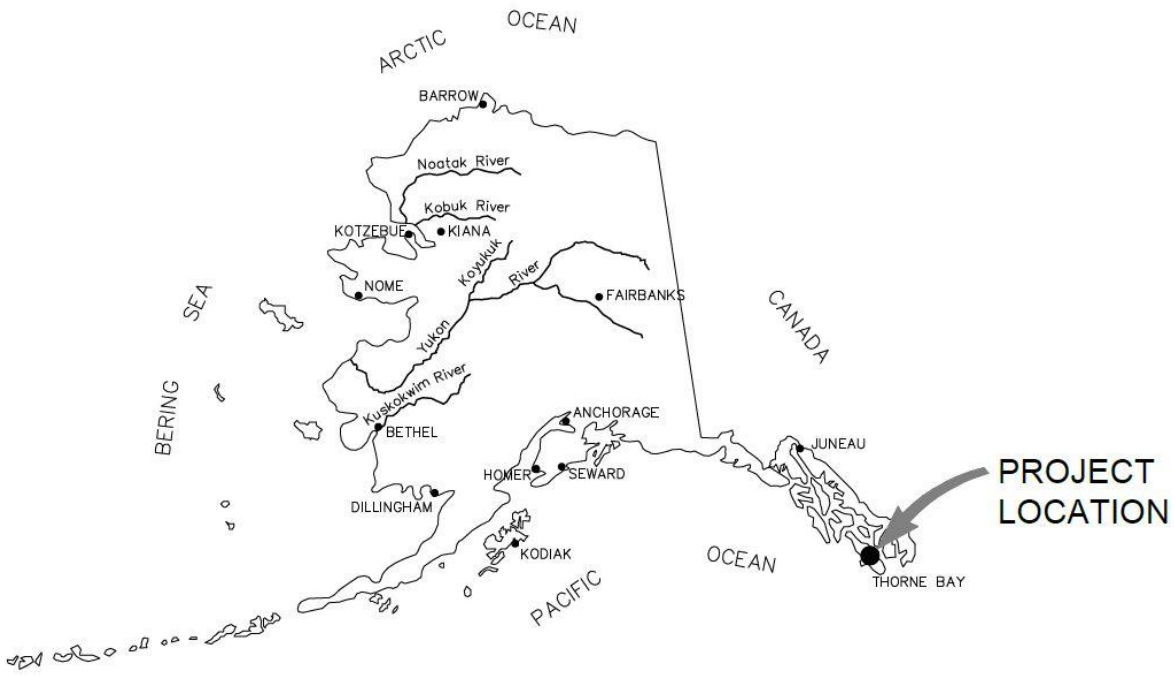

Figure 1: Location of Thorne Bay, Alaska

Thorne Bay is located in a temperate rain forest. Nearby Ketchikan broke a 50-year local record for summer rainfall in 2017, with 40 inches of rain, bringing the yearly total to 104 inches by the end of August. Average annual rainfall is 150 inches (Kheiry, 2017).

Population & Housing Characteristics

Census data from 2010 shows Thorne Bay's population of 471 people consists of 274 males and 197 females. Median age is 44, and 96 percent of the population is white. Notably, of Thorne Bay's 354 housing units, 25% are for seasonal, recreational or occasional use (DOLWD 2017). Median household income is $49,323, and 20% of residents live in poverty. Approximately 50% of residents are employed. Utilities and services available to residents include piped water and sewer, electric,

refuse collection and landfilling, public safety and animal control, harbor and dock services, and road development and maintenance (DCCED, 2017).

Thorne Bay's water distribution system and sewer system each have 203 connections. The water system has one pressure zone, and the sewer has four lift stations (DEC, 2017).

Davidson Landing and "South Thorne Bay" is a rural part of the City of Thorne Bay, across the bay from the core of the city. Davidson Landing residents use rain catchment and wells for water, and septic systems for sewerage disposal. Davidson Landing and South Thorne Bay are not currently connected to the City's water and sewer utilities.

Transportation Available

Thorne Bay is a major transportation hub for Prince of Wales Island. Privately-owned transshipment facilities stage in Thorne Bay to serve communities on the island road system. The City operates provides landfill services, solid waste services, and recycling collection.

Figure 2: Transshipment and Landfill Facilities for Prince of Wales Island. Thorne Bay is host to privately-owned transshipment facilities (left) and City-provided landfill services, solid waste services, and recycling collection (right).

There are float plane services at two docks – one at the harbor, and the other at "The Port," a commercial shop and post office facility. Thorne Bay's harbor's 100 slips accommodate boats up to 50 feet, and a guest slip for vessels up to 100 feet (DCCED, 2017; Thorne Bay Harbor, 2017). Thorne Bay residents can access the Klawock Airport via 36 miles of paved highway. The Klawock airport has a paved, 5,000 foot runway with non-precision instrument approaches (AirNAV, 2017, DCCED, 2017).

Figure 3: Harbor Facilities. *Thorne Bay's harbor accommodates float plane operations as well as boats. The orange wind sock is on the float plane dock.*

The Interisland Ferry's 198 foot *Motor Vessel Stikine* departs daily from Hollis for Ketchikan at 8:00 am and makes a return trip at 3:30 pm (IFA, 2017). Hollis is 60 miles from Thorne Bay on the island road system.

Key Assumptions

Community-related information assumes that sources have presented reliable data. See the "Citations" sections for sources cited. Note that census data used by state agencies is from 2010, seven years before this report. We assume population growth will be neutral, and at the time of writing this plan, the City does not anticipate the development of any new water-intensive industries such as fish processing.

Section 3 Management Structure

Organizational Chart

Current management consists of the City Administrator, who has direct supervision of two Water/Wastewater staff. Per ordinance, the Administrator acts as the Planning Director and Public Works Director when those positions are not filled. Law Enforcement is listed twice to illustrate two different roles. One is an EMS Responder and works directly with the EMS Director. The other is a Fire Responder and works directly with the Fire Chief.

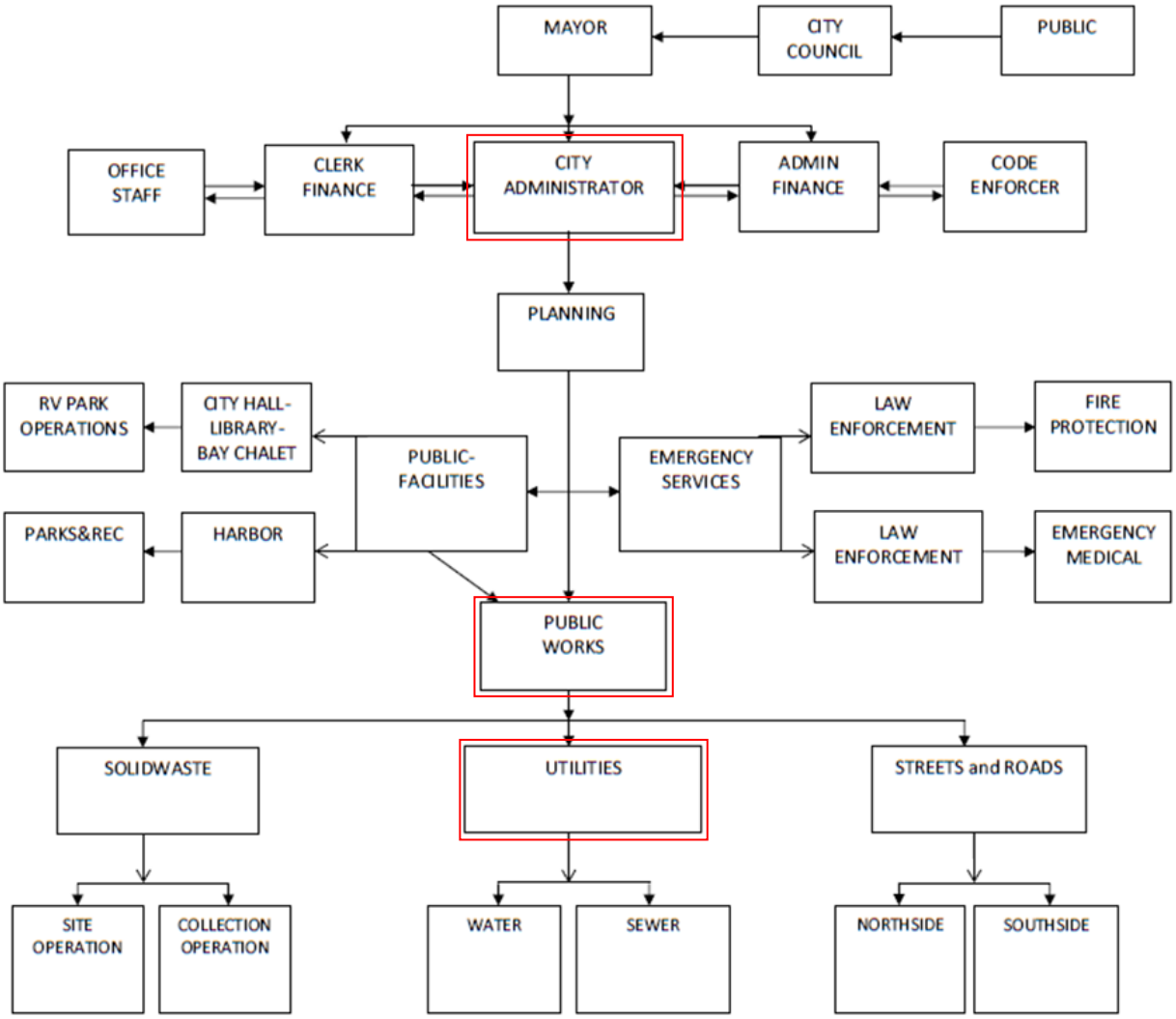

Figure 4: City of Thorne Bay Organizational Chart (CTB, 2016)

The City Administrator serves as the chief administrative and executive officer for the City, and is appointed by the City Council. Per Chapter 2.14 of City Code, the powers and duties explicitly outlined include managing staff, custody of municipal property, supervision of public works, budgeting, and establishing fees for services and programs.

The City Clerk is hired by the City Council, and chiefly serves as administrative support for Council functions. The City Clerk can be combined with the City Treasurer, who is the primary custodian of funds and keeps an itemized account of money received and dispersed. Both positions are outlined in Chapter 2.16 of City Code.

The City does not currently have a Public Works Director, so utilities staff work directly with the City Administrator.

Water and wastewater operators are responsible for daily operation of both systems.

Staffing and Training

As noted above, the City Administrator has operational control of Thorne Bay's utilities as delegated by the Mayor. As outlined in Section 2.14.050 of City Code, the City Administrator will:

- Hire, supervise, discipline, and evaluate all City employees and volunteers, or further delegate this authority in a given case;
- Direct the care and custody of municipal property;
- Direct and supervise the construction, maintenance, and operation of municipal public works;
- Direct and supervise the operations of municipal departments and programs;
- Prepare and submit the annual budget and capital improvements program to the council;
- Keep the mayor and council fully advised concerning the financial condition and needs of the city;
- Apply for state, federal or other grants and, upon the mayor's approval of the project or the council's appropriation therefore, execute and carry out the terms and condition of such grant agreements;
- Establish rates, fees, or charges for services, leases, and programs provided or administered by the city except where such rates, fees, or charges have been established by the mayor or the council or the authority to establish such rates, fees or charges has been delegated to a board or other body; and
- All other duties assigned by the mayor or council.

The City Administrator has received training pertinent to utility management through the DCCED Rural Utility Business Advisor (RUBA) Program.

Day to day operation of water and wastewater utilities is performed by a Water/Wastewater Operator, who serves as the Water and Sewer Supervisor. The Supervisor(s) and staff hired by the Mayor, with the recommendation of the City Administrator, are responsible for the operation and maintenance of the City's four core sanitation services: water treatment, water distribution, sewer collection and sewer treatment. Duties include:

- Maintenance,
- Minor and major schedule and unscheduled repairs throughout all four systems,
- Monthly reporting to the DEC as required,

- Direct sampling as scheduled for water quality and wastewater effluent quality compliance,
- Implementation of a preventative maintenance schedule,
- Construction of new water distribution mains and residential /commercial service connections and wastewater collection mains and residential/commercial service connections.

Other duties as assigned may include preparing and operating within the respective budgets (CTB, 2016).

The Primary Water/Wastewater Operator holds the following certificates:

- Water Treatment Class 2, and
- Wastewater Treatment Class 1

This is compliant with the Alaska Administrative Code 18 AAC 74, Water and Wastewater Certification and Training. The City currently has one other primary operator who has passed the exams, and is anticipated to have his Water Treatment Class 1 and Water Distribution Class 1 certificates by his two-year work anniversary on October 15, 2017. The other primary operator is new in his career, and provides important redundancy and longevity.

The Water/Wastewater technician currently holds the following certifications:

- Water Treatment Class 2, and
- Expired Wastewater Treatment Class 1.

Key Assumptions

As with any small town with limited staffing, the change of one staff member can have consequences. The Water/Wastewater Operator has been in the position since 2009, indicating stability, and the other primary operator has been with the City since 2015.

Section 4 Existing Infrastructure and Proposed Facility Improvements

Current Infrastructure

Water

Raw water is piped from Water Lake to the City's water treatment plant (WTP). The WTP was constructed in 1987 and uses direct filtration to treat water. This process is enhanced by the addition of a polymer-based coagulant salt and a 2,500 gallon pressurized flocculation tank, which provides reaction time for flocculation and allows some settling. Three 60-inch pressure filters remove suspended solids from process water. Each filter consists of a sand layer, anthracite layer, and gravel layer.

The raw water is soft, acidic, and has a high total organic compound (TOC) load. The TOC consists of inorganic carbon and Dissolved Organic Carbon (DOC). Significant DOC quantity remains after the existing treatment processes, which react with the chlorine disinfection and create DBPs.

The filtered water is dosed with liquid sodium hypochlorite prior to being stored in a 286,000-gallon bolted steel tank. A sidestream circulates water into and out of the tank. Additional hypochlorite is added, as needed, to maintain residual in the tank.

The pressurized flocculation tank would provide approximately 60 to 70 minutes of reaction time at a design WTP flow rate of 35 to 45 gallons per minute (gpm). However, given the actual flows are significantly less, settling occurs in the flocculation tank and not at the filters. A streaming current detector regulates doses of coagulant. A proprietary compound believed to consist of a blend of a polyamide with polyquaternary ammonium chloride provides both coagulation and flocculation functions. The flocculation tank effectively forms and accumulates floc, which the operators drain every several days.

The three existing water filters are loaded at a surface rate of less than one gpm per square-foot, resulting in decent filtration of floc and suspended solids and relatively long filter runs of 48 hours or longer, varying with seasonal raw water quality. Continuous turbidity monitoring on each individual filter complies with the Long Term Interim Enhanced Surface Water Treatment Rule (LTIESWTR). Turbidity is also monitored on the combined filter effluent prior to the storage tank. Chlorine is continuously dosed into the treated water (12 percent hypochlorite); the level of dosing appears to be manually monitored and adjusted. There is no on-line chlorine monitor or automatic adjustment. Water corrosivity and pH monitored and adjusted manually with soda ash (sodium carbonate).

The WTP can produce up to 60,000 gallons of potable drinking water per day, but actual production rates are far less.

Thorne Bay is a Class A community water system under 18 AAC 80.1990, and permitted as public water system AK2120216. The City is currently on the DEC Significant Non-Compliers (SNC) List for violations of the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR, 63 FR 69390-69476). Thorne Bay has Haleoacetic Acids (HAA5s) and Total Trihalomethanes (TTHMs)

exceeding maximum contaminant levels (MCLs). There is also a history of turbidity monitoring violations when the power has gone out.

More information on the water system is available in:

- VSW PER, 2017 (Appendix D)

Sewer

The existing wastewater treatment facility (WWTF) was constructed in 1994 as an extended aeration treatment facility. The facility is an approved DEC Class 1 WWTF. The untreated wastewater from the collection system is pumped to the treatment facility's headworks. In the headworks room, influent flows through a bypass channel with an automated bar screen and a manual bar screen to remove large suspended solids. Downstream of the headworks is a circular extended aeration basin with a surface aerator/agitator. A small clarifier is located in the center of the basin. Effluent from the clarifier flows by gravity into a chlorine contact basin and discharges into a deep water diffuser located in Thorne Bay. The treatment facility is also equipped with a square open aerated solids detention basin and a solids dewatering press. The wastewater treatment facility has an average daily design capacity of 140,000 gpd and a design peak hour (largest volume of water within a one-hour period) of 420,000 gpd. The treatment facility currently treats an average of 40,000 gpd. This design population was 900 people, which is far more than what it serves.

The existing WWTF has an unused concrete chlorine contact basin which measures 12 feet wide by 20 feet long and has a water depth of 6.88 feet. The contact basin has three channels, which are 3 feet to 4 feet wide and discharge over a concrete weir to the effluent piping. At the facility's design peak hour flow rate of 420,000 gpd (292 gpm), the chlorine contact time in the basin was 34 minutes.

The existing gas chlorination disinfection system is abandoned since it was not needed to meet the facility's previous discharge requirements (average day 100,000 fecal coliform (FC)/100 milliliter [mL], maximum day 150,000 FC/100mL). A bypass pipe carries the influent flow directly from the basin to the effluent vault. Recent improvements to the collection system to reduce inflow and infiltration issues have been successful but have resulted in an increased concentration of wastewater flow. More stringent fecal coliform permit limits have led to the need to re-instate disinfection.

The City's WWTF is an authorized secondary treatment facility with a surface water discharge. Discharge authorization is by the State of Alaska's General Permit (AKG572000) and facility permit (AKG572045). The discharge permits were reissued on October 1, 2017, and will expire on September 30, 2022. The DEC set forth a compliance schedule for the treatment facility to meet required fecal coliform bacteria limits per the facility discharge permit, which the City has been unable to meet.

More information on the wastewater system is available in:

- CTB PER, 2015 (Appendix B)
- VSW DAR, 2017 (Appendix C)

Proposed Facility Improvements

Both of these projects are associated with the VSW project number on the title page.

WATER

The recommended alternative is a nanofiltration (NF) polishing filter skid for full flow and optimized pretreatment.

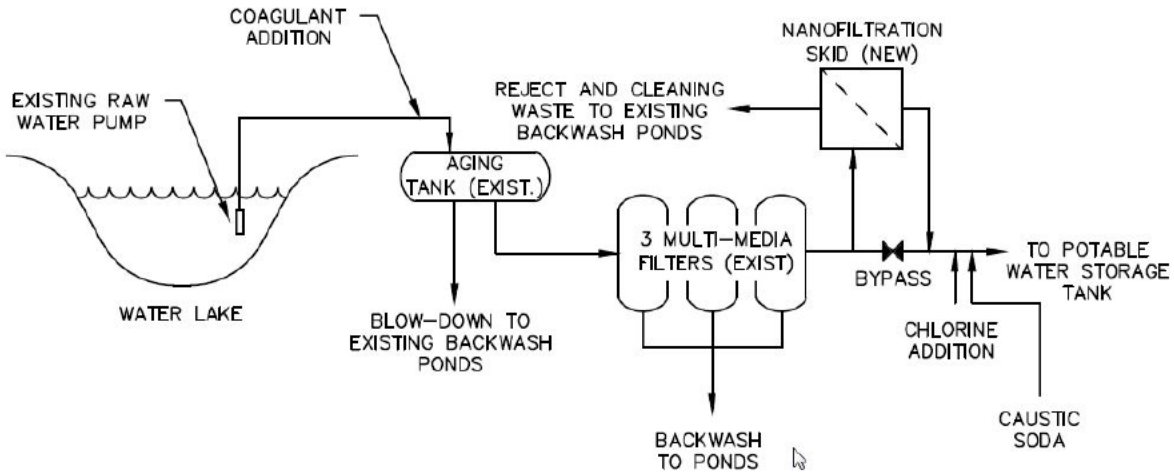

Figure 5: Potable Water Treatment Improvement Schematic. Schematic of nanofiltration process at Thorne Bay. VSW PER 2017.

This alternative requires mechanical and automation upgrades to the existing plant and additional equipment:

- A new personal computer-based supervisory control and data acquisition (SCADA) system for data collection and reporting, with cellular modem for alarm messaging to operators.
- One new instrument/control panel with programmable logic controller and associated input/output modules to automate the backwash procedure and control start/stop of NF skid.
- Three new air release valves (one per filter).
- New instrumentation, including four pressure transmitters, two temperature transmitters, one level transmitter, one pH transmitter, four new flow meters, and one chlorine analyzer.
- Connection of existing instruments to the new control panel, namely the four existing turbidity meters, streaming current monitor, and three metering pump speed and/or stroke signals.
- Upgrade of 7 motor operated valves per filter for a total of 21 new actuated valves.
- Upgrade of backwash flow control valves (2 exist. ClaVal) to automate backwash flow rates for filling at 75 gpm and backwashing at 240-300 gpm.
- Three new differential pressure transmitters (one per filter) and two new pressure transmitters (raw water inlet header and filtered water outlet header).
- One new air blower or air compressor with receiver tank and air flow control equipment for air enhanced backwashing of the existing filters.
- Complete piping modifications around the aging tank to return flow to its design direction, and add an automatic purge valve to the bottom of the tank.

- Add a small tank mixer in the storage tank to improve mixing, minimize icing, and reduce water age in the tank.
- Modify the pretreatment chemical dosing system to accommodate Nalco 8186 coagulant to replace the current 8105 and increase dosing rate to 60 milligrams per liter.
- Add a 12-foot x 50-foot concrete pad behind the existing water treatment building (used to set the new containerized system).
- Install a packaged NF membrane skid rated for 60 gpm feed flow, and all associated piping and controls required for integration into the existing system, including Clean in Place equipment and containerized neutralization capability.
- Demolition of existing valves and equipment (circulation pump) no longer used or intended for upgrade.

Existing filters will feed the NF skid from upstream of the chlorination point. The water sent to the NF skid would be filtered through the membranes, and 99 to 99.7 percent of all remaining organics would be removed and sent to the backwash ponds. A typical NF skid is approximately 85 percent efficient including the existing multimedia filters as pretreatment. Approximately 51 gpm would leave the skid as permeate if the treatment plant inlet flow was 60gpm.

The 2050 design flow rate required (46 gpm) is based on a plant operation time of 20 hours per day. Significant degradation of the raw water could occur with no impact to treated water quality because:

- The membrane skid could be operated at a lower recovery rate to ensure treated water quality remains the same.
- Operating at a lower recovery rate would not reduce system capacity as all calculations are based on 20 hours per day operation and the system is capable of 24 hours per day operating times. This is not a long term solution as it comes with its own costs, such as additional power use or reduced membrane life.
- Any purchased NF skid could have the option of an additional membrane pressure vessel for increased capacity if required in the future. Increased capacity is not likely to be required, but it is not uncommon to allow for additional membranes to be added to a skid system. An additional membrane vessel would cost about $10,000.

The treatment plant improvements for this alternative would be made inside the existing building and the new NF equipment would be containerized and likely placed behind the existing building in an existing vestibule.

Figure 6: NF Skid Location. Site map showing the location of the proposed nanofiltration skid on the current plant.

Timeline:

The following are the recommended improvements in order of priority in the event they are phased:

1. Change coagulants. There are at least three studies (including the one that is the basis of this report) suggesting NALCO 8186 should be used with this raw water. This is an easy fix and should be implemented immediately with follow-up testing and optimization.
2. Add a small mixer to the current treated water storage tank. This would improve mixing in the tank, reducing stratification, icing issues, and overall water age.
3. Upgrade the controls and automate the existing treatment plant. This involves the addition of new valve actuators, an on-line chlorine analyzer, and a new control panel that integrates existing instruments. The upgraded controls should include a personal computer-based data collection system and modem with the ability to transmit alarms.
4. Add air enhanced backwash capabilities.
5. Begin a testing plan to optimize plant chemical use and minimize power use.
6. Install the NF polishing filter skid between the existing filters and the chlorination point.

SEWER

The recommended improvement for the sewer treatment system is to retrofit the existing chlorine contact basin with a UV disinfection system that would allow installation of both UV banks in a single channel.

The UV disinfection system will have a duty and stand-by bank of UV disinfection equipment. Only one bank would operate at a time, but both modules will be capable of individually treating the facility peak hourly flow rate. UV modules with horizontal or vertical lamp orientations are available. The selection of a vertical or horizontal lamp orientation impacts the design of the contact basin modifications. Therefore, procurement of the UV disinfection system has been completed prior to the 65 percent project design.

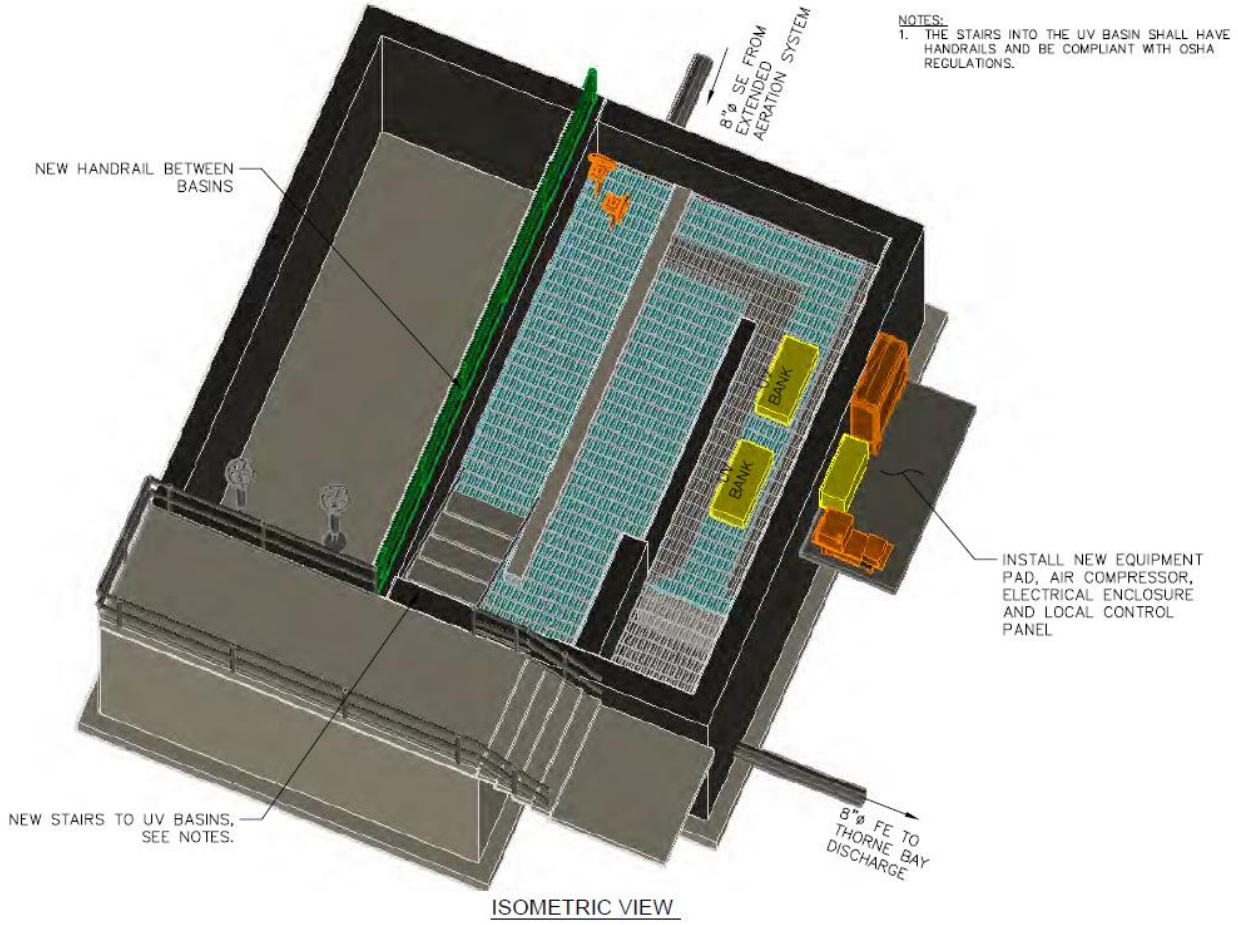

Figure 7: Sewer Disinfection Improvements. Schematic of the current plant with vertical UV disinfection (yellow blocks) installed in the existing concrete basin.

In addition to UV modules, the disinfection system design will include ancillary equipment such as an air compressor, electrical enclosure, control panel, and conduits. The ancillary equipment will be installed adjacent to the contact basin on the existing ground surface.

Design criteria for the UV system include the following:

- Redundancy of the disinfection system to facilitate maintenance of each UV bank.
- Each UV bank must be designed to treat 100 percent of the peak hourly flow (420,000) gpd.
- Suitability for outdoor equipment installation and freezing conditions.
- Adequate channel length for contact time of UV lights to wastewater (typically 20 to 30 seconds).
- Access to equipment and means for removal from channel.
- Installation of electrical equipment and routing of conduit through existing walls.
- The UV system will provide for future connections to a telemetry system to remotely relay the operational status and alarms to the operators.

Timeline:

At the time of writing this plan the City and VSW were actively soliciting quotes for procurement of the recommended UV equipment, as outlined in the VSW DAR (2017), Section 6.0. Subsequent raceway design will accommodate the equipment chosen.

35% design ..... Complete
Procurement..... Complete
Selection..... Complete
Delivery of UV Equipment to Thorne Bay ..... December, 2017
65% Design..... October, 2017
95% Design..... November, 2017
Construction Documents..... December, 2017

Key Assumptions

Operational costs and replacement reserves are within the capability of the City, and the City is willing to accept these costs.

Estimated costs in the referenced documents are for 2017/18, and need to be inflated accordingly if construction is delayed.

No other large expenditures will be required to address urgent condition problems.

Section 5 Financial Data

The information below is limited to that which is suggested by United States Department of Agriculture Rural Utilities Service (RUS) Bulletin 1720-2: current rate schedules, annual operations and maintenance (O&M) costs, other capital improvement programs, a tabulation of users by monthly usage categories, and the status of existing debts and required reserve accounts.

Table 1: Current Water Rate Schedule and Customer Count, as of October 1, 2017

Customer Type	Monthly Charge	Base Gallons	Overage Charge per unit/thousand	Number of Customers
Residential	$63.97	3,000	$12.00+tax	112
Commercial	$95.97	5,000	$12.00+ tax	32
Senior	$31.99	3,000	$12.00 no tax	20

Table 2: Current Wastewater Rate Schedule and Customer Count, as of October 1, 2017

Customer Type	Monthly Charge	Base Gallons	Overage Charge per unit/thousand	Number of Customers
Residential	$71.70	N/A	N/A	112
Commercial	$71.70	N/A	N/A	32
Senior	$35.95	N/A	N/A	20

The City has operated the water utility with a deficit for the last two years, and the sewer with a deficit for the last three years.

Table 3: Water Systems Income and Expenses (Source: City Budget Ordinances)

Fiscal Year	Annual O&M Costs	Annual Income	Net
2014	$97,038	$121,891	$24,853
2015	$131,378	$114,404	($16,974)
2016	$165,579	$128,602	($36,977)

Table 4: Wastewater Systems Income and Expenses (Source: City Budget Ordinances)

Fiscal Year	Annual O&M Costs	Annual Income	Net
2014	$135,898	$93,241	($42,657)
2015	$151,538	$94,924	($56,614)
2016	$148,649	$108,344	($40,305)

The City does not currently have any outstanding debts related to the water or wastewater system, nor does it have a capital improvement plan in place at this time. In 2015 the City passed an ordinance to raise water and sewer rates to counteract the growing disparity between O&M costs and income. The proposed rate hikes are $5.29 and $7.47 per month for water and sewer, respectively,

for the years 2015-2018. In addition, the "senior" rate category has been eliminated. The rate increases are reflected in the above table for the years 2015 and 2016. With 164 total users and a $5.29 additional monthly fee, income for 2017 will increase by $10,410 over 2016 (excluding overages and bulk water sales). Projected annual income was expected to increase in 2017 to $139,000 and again in 2018 to $149,000 not accounting for the possibility of additional customer water conservation that may occur. Income should increase very slightly due to additional users from 2019 through the design year of 2050.

The City uses Quick Books accounting software. The City's purchasing and approval practices are outlined in City Code, Chapter 3.12: Purchasing. To summarize: the City will get an estimate from vendors, then fill out a purchase order (PO), making sure there are adequate funds in the department budget. The City will order parts using the PO number, and the PO and invoice are entered into Quick Books under the appropriate budget line item. If the purchase requires more than in the budget line item, the administrator or clerk sign the PO. If the purchase is more than two thousand dollars, City Council approval is required unless it is expenditure for a project already approved through grants, ordering of chemicals, monitoring, or utility bills.

Estimated Annual Income

Like most communities, the City of Thorne Bay does a monthly review of profit and loss, and adjusts "on the fly" if needed. These adjustments recognize seasonal fluctuations – for instance, the Harbors Department may be operating in the red early in the year, but the busy summer season will put them well back into the black. As noted above, both the water and wastewater utilities have operated in the red for the last few years, but the City has been able to use other funds to cover the expenses. Also noted above, the City has passed an ordinance to increase utility fees to cover costs, and those fees are in the implementation process.

In the tables below, "miscellaneous income" is from services not regularly provided, such as receiving septage, water delivery, pipe thawing or other services.

WATER

Improvements to the water system will result in annual operating costs estimated at $155,861 in 2018 dollars (VSW PER 2017, page 36). Below is the income planned for the utility.

Table 5: Planned Water Utility Income, for October 1, 2019 *(Benner, 2017)*

Income Type	Rate	# of Customers	Collection Rate	Annual Income
Miscellaneous Income				$450
Sales Tax	6%			$10,202
Water Fees				
Residential	$74.57	140	100%	$125,277
Commercial	$106.57	35	100%	$44,759
TOTAL 2019				**$180,688**

SEWER

The UV disinfection system will require additional operation and maintenance compared to the current facility operations. The system will include an automatic cleaning system, but the following maintenance items will still be required on a regular basis:

- Weekly inspection of the lamp bulbs.
- Removal of bulbs from the UV module and manual cleaning with a cleaning agent to remove grime and debris as required.
- Replacement of bulbs that are burnt out.

Additional operational expenses are anticipated to increase $10,897 annually. The 2017 approved budget expenses of $150,674 (Appendix E) annual operating costs combined with the additional operational expenses is anticipated to be $161,571 in 2018 dollars annually.

Below is the income currently planned for the utility

Table 6: Planned Sewer Utility Income, for October 1, 2019 *(Benner, 2017)*

Income Type	Rate	# of Customers	Collection Rate	Annual Income
Equipment Rentals				$200
Miscellaneous Income				$200
Sales Tax	6%			$10,924
Sewer Fees				
Residential	$86.64	140	100%	$145,555
Commercial	$86.64	35	100%	$36,515
TOTAL 2019				**$193,394**

Estimated Annual Expenses

The City does not currently carry loan or bond debt, the Fiscal Year (FY)17 budget is included in Appendix E.

While bonding is an option, the State's current credit rating (downgraded due to fiscal uncertainty) could make debt unpalatable. The downgrade from AAA to AA could mean half a percentage point added to the prevailing interest rate, and further downgrades could make that penalty higher (Brooks, 2017). Also note that the City receives approximately $38,000 in revenue sharing that supports the City Council activities, the Village Public Safety Officer, fire services, and the library. If the State's fiscal crisis impacts State revenue sharing, the City will be forced to raise money or find further efficiencies.

Operations and Maintenance

The projected O&M costs and Repairs and Replacement costs have been developed under the supervision of a licensed Professional Engineer. They were developed through planning and design reports for VSW, and are considered to be reasonable.

WATER

The water system annual budget for FY2017 is $150,014. Water system improvements are estimated to increase operational and maintenance costs to $155,861.

Table 7: Water Improvements: Annual Operations and Maintenance Costs

ANNUAL OPERATIONS AND MAINTENANCE COSTS	
Description	*Annual Costs*
NF Booster Pump	$4,165
Extra power for air for enhanced backwash and feed pump	$5,527
Employee expenses/operators	$95,511
Maintenance with additional chemicals	$50,658
Total Annual O&M Costs	**$155,861**

See section 6.9.4 of the VSW PER (2017) for Cost Estimates.

SEWER

The sewer system improvements annual budget for FY2017 is $150,674. Sewer system improvements are estimated to increase operational and maintenance costs to $161,571. Currently the City is bypassing their chlorine wastewater disinfection system, so the addition of UV disinfection may increase O&M costs $4,250 through monitoring and maintenance if staff are currently fully utilized. The City Administrator feels that the proposed water and sewer improvements will improve overall efficiency and that the extra two hours a week required for sewer improvements operations will be easily accommodated in staff's current work week.

Table 8: Sewer Improvements: Annual Operations and Maintenance Costs

ANNUAL OPERATIONS AND MAINTENANCE COSTS	
Description	*Annual Costs*
UV disinfection power costs, 14,892 kW hr @ 0.240/kW/hr	$3,574
Demand charge, power	$173
Lamp replacement	$900
Labor, estimate 2 hours a week	$4,250
Chemical (cleaner, lab supplies)	$500
Major equipment repair and replacement	$1,500
Current operational costs, 2018	$150,674
Total Annual O&M Costs	**$161,571**

Repairs and Replacement

The organization will incur expenses relating to the repairs and replacement of the system. Repairs and replacement (R&R) costs are those expenses defined as items costing more than $1,000 and

have a lifespan of greater than seven years. R&R costs are capital cost that will be depreciated over the useful life of the item.

WATER

For the proposed water improvements, the City should be setting aside $24,170 annually to be able to replace system elements at the end of their useful life.

Table 9: Annual Set-Aside for Major Repairs and Replacement of Water Treatment Elements

Description of Equipment	(Number	X Cost)/	Useful Life=	Depreciation
Containerized 60 GPM NF Skid	1	$225,000	20	$11,250
New Compressor/Blower	1	$11,320	15	$ 755
New Instruments/Valves	1	$42,875	10	$4,288
Piping changes & connections	1	$10,191	40	$255
Water Tank mixer	1	$23,073	20	$1,154
Upgraded SCADA	1	$85,000	15	$5,667
Concrete pad for NF container	33.3	$800	40	$666
Unlisted items	10%	$20,471	15	$136
ANNUAL SET-ASIDE FOR MAJOR REPAIRS AND REPLACEMENT				**$24,170**

SEWER

For the proposed sewer improvements, the City should be setting aside $10,735 annually to be able to replace system elements at the end of their useful life.

Table 10: Annual Set-Aside for Major Repairs and Replacement of Sewer Treatment Elements

Description of Equipment	(Number	X Cost)/	Useful Life=	Depreciation
Bypass piping - 8" tee	1	$1,000	50	$20.00
Bypass piping - 8" valves	2	$4,000	50	$160.00
Bypass piping - 8" piping, linear feet	15	$80	50	$24.00
Concrete channel for UV system, cubic yard	17.41	$1,200	50	$417.84
Concrete electrical equipment pad	0.79	$1,200	50	$18.96
Walkway and grating over basin, square foot	250	$75	50	$375.00
Stairs into basin	5	$800	50	$80.00
Handrail, linear foot	20	$100	50	$40.00
Effluent weir improvements	1	$5,000	50	$100.00
UV disinfection equipment - Glasco	1	$87,586	20	$4,379.30
Electrical improvements, generator and UPS	1	$102,400	20	$5,120.00
ANNUAL SET-ASIDE FOR MAJOR REPAIRS AND REPLACEMENT				**$10,735.10**

Time Line / Design Life of Major Components

As illustrated in the tables above, different elements of the systems have differing useful lives. Maintenance will have a positive effect on the design life of all building, plant and equipment.

Annual Profit

An analysis of revenue and expenses appears above. To summarize:

Table 11: Estimated Annual Profit and Loss

Revenue/Expense	Water Treatment	Sewer Treatment
Annual Operational Expenses (entire utility w/ improvement)	$155,861	$161,571
Annual Capital Set-Aside	$ 24,170	$10,735
Subtotal expenses	$180,031	$172,306
Estimated Annual Income*	$180,688	$193,394
	$ 657	$21,088

*FY2019 (Benner, 2017)

Planned increases in water and sewer rates would cover increased costs associated with both water and sewer improvements.

Key Assumptions

- There is no outside source of funding for water or sewer operations.
- Construction grants will be less plentiful and more competitive than in the past due to State fiscal uncertainty.
- The City may lose Municipal Revenue Sharing from the State.
- Revenue projections do not include uncollectable fees. Per the City Administrator, the year-end collection rate is 100%, though it may vary throughout the year (Benner, 2017).

Section 6 Legal Authority & Issues

Ownership

The City of Thorne Bay will own water and sewer improvements in their entirety.

Ordinances Related to New Project

The City of Thorne Bay derives extraterritorial jurisdiction of powers as outlined in Chapter 1.14 of Municipal Code, to "...provide for and maintain....utility services...outside its boundaries and may regulate their use and operation to the extent that the jurisdiction in which they are located does not regulate them." This jurisdiction is authorized in Alaska Statute 29.35.020.

Title 13 of Municipal Code addresses utilities, including Chapters:

- 13.04: Sewer – General Provisions (such as description of service, ownership, and liability),
- 13.08: The Collection System
- 13.12: Application for Sewer Service
- 13.14: Sewage Service Rates
- 13.20: Prohibited Acts
- 13.24: Miscellaneous Provisions
- 13.28: Water – General Provisions
- 13.32: Application for Water Service
- 13.36: Water Main Extensions
- 13.40: Service Regulations
- 13.44: Water Meters
- 13.48: Water Rates
- 13.52: Discontinuance of Water Service
- 13.56: Responsibility for Water Equipment
- 13.60: Fire Hydrants
- 13.64: Miscellaneous Provisions
- 13.68: Service Penalties

Code does not appear to need updates due to proposed improvements.

The City budget is approved by ordinance, the latest of which is Ordinance 17-05-02-02-FY17 Budget Amendment, found in Appendix E.

City utility rates are adopted by resolution. The latest is Resolution 15-07-21-03, amending Resolution 13-03-05-02 and establishing new water and sewer rates for the City of Thorne Bay (Appendix F). Note that the City Council meeting where this was discussed was the same meeting where the Compliance Order by Consent was discussed (See below for details, and Appendix F for minutes).

Special Permits, Licenses and Regulations

The City has entered into a Compliance Order by Consent with DEC (Appendix A) to address DBPs in the potable water. The City has been working since 2010 on a solution. The City will be able to come into compliance with the COBC with financial support from VSW - but not on the schedule set forth in it.

DEC issues wastewater discharge permits for sewage treatment plants. DEC reissued authorization to discharge permit for the City via the State's general permit (AKG572000) and an individual facility permit (AKG572045) in October of 2017. These permits expire on September 30, 2022, and included a compliance schedule for the City to comply with fecal coliform bacteria limits in the effluent.

When improvements are designed, DEC's Water and Wastewater sections will need to review the plans for compliance, and provide Approvals to Construct. After construction, record drawings will need to be submitted and DEC will provide an Approval to Operate.

Improvements to the water and sewer treatment systems will take place wholly on City property, and do not require additional easements.

DCCED provides a RUBA for small communities. While the City manages their own utilities, they comply with RUBA goals and requirements.

Key Assumptions

DEC will continue to work with the City on compliance issues, as the City has provided a good faith effort to address DEC's concerns.

City leadership will have continued interest in a working relationship with DEC.

Section 7 Interagency Relationships

Involvement of Other Agencies

Involvement in Construction Phase

The City has signed an agreement that VSW is acting on behalf of the City in development of these projects (Appendix G).

Involvement in Ongoing Operations

The City will manage ongoing operations.

Funding of Major Components

VSW will provide the funding for construction of the proposed water and sewer improvements. No match is required.

Regulatory Agencies

The primary regulatory agency for the water and sewer project is the DEC Divisions of Water and Environmental Health. Of concern to these water and sewer projects is the agency's regulatory authority over water quality, testing standards, sewer disposal, operator training standards and engineering plan approval. See the "Special Permits, Licenses and Regulations" section above for more information.

The Regulatory Commission of Alaska (RCA) is another regulatory agency that may be involved in the project. The agency is the utility regulator for the state. They issue a "certificate of public convenience and necessity" to utilities after finding them "fit willing and able" to provide the public service. The City already possesses a certificate from RCA to operate its current system.

Key Assumptions

DEC will continue to work with the City on compliance issues, as the City has provided a good faith effort to address DEC's concerns.

Section 8 Summary

Wrap-up

VSW and the City will address water and sewer regulatory compliance issues through this project.

The City's current water treatment system produces high levels of DBPs. VSW and the City propose to retrofit the existing treatment plant with a nanofiltration system and optimize some of the pre-treatment processes.

The City's sewage system effluent does not meet discharge authorization standards for fecal coliform bacteria. VSW and the City propose to retrofit the current treatment plant with UV disinfection.

Timelines

Water improvements will be designed during the spring of 2018, and bid that summer for construction in the late summer, fall or winter.

UV equipment for sewage treatment has been bid. Sewer plant improvements will be designed around the selected vendor's equipment in the spring of 2018. Construction of improvements is anticipated in the late summer or winter. Fall construction (October/November) should be avoided due to the "rainy season," and accommodating construction could be difficult.

Ability to Pay

The median household income for the City is $49,323 (DCCED, 2017). Using the table from "Annual Profit" above, we see that, for water, the City's planned rate increases will cover costs associated with water and sewer improvements.

A resident paying for water and sewer service will spend $170.88 a month, or $2050.56 a year in 2019. This cost is 4% of the City's median income, which is higher than the national average. According to the United States Department of Labor's Bureau of Labor Statistics, a 2016 Consumer Expenditure survey showed the mean national income of $74,664, and an annual expenditure on utilities of $569, or less than 1% of income (BLS, 2017).

Key Assumptions

Key assumptions related to community impact are:

- Household income from State of Alaska statistics is correct.
- Household expenses from the community are reasonable and correct.

- There will be no significant increase in the cost of air and freight transportation.
- This document has not considered the effect of natural disasters such as fire, flood, and earthquake.
- VSW chooses to go forward with improvements as outlined in this document.

Citations

AirNAV. PAKW Klawock Airport, Klawock, AK. https://www.airnav.com/airport/PAKW Accessed 8/24/2017

Benner, Wayne. E mail correspondence with I. Gallion of DOWL. September 20, 2017.

BLS. U.S. Bureau of Labor Statistics. Table 1300. "Age of reference person: Annual expenditure means, shares, standard errors, and coefficients of variation, Consumer Expenditure Survey, 2016." https://www.bls.gov/cex/2016/combined/age.pdf Accessed 9.5.2017.

Brooks, James "State's Credit Trouble Trickles Down to Street Level." *Juneau Empire*. August 25, 2017, Section A.

CTB, City of Thorne Bay. *Employee Handbook*. 2016.

DCCED: Department of Commerce, Community and Economic Development, Community and Regional Affairs. State of Alaska. https://www.commerce.alaska.gov/dcra/DCRAExternal/community/Details/4e6cc7c9-137e-4b57-b549-c367df971985 Accessed 8/22/2017.

DEC. Department of Environmental Conservation, Division of Water. State of Alaska. https://dec.alaska.gov/Applications/Water/OpCert/Home.aspx?p=SystemSearchRecord&d=198&search=thorne%20bay Accessed 8/22/2017.

DOLWD. Department of Labor and Workforce Development, Research and Analysis. State of Alaska. http://live.laborstats.alaska.gov/cen/dp.cfm Accessed 8/22/2017.

IFA. Alaska's Inter-island Ferry Authority. http://dscreationgslentz.homestead.com/ Accessed 8/24/2017.

Khiery, Leila. "Ketchikan shatters summer rainfall record." *KRBD (Radio).* August 30, 2017. https://www.krbd.org/2017/08/30/ketchikan-shatters-summer-rainfall-record/ Accessed 9.5.2017

Thorne Bay Harbor. City of Thorne Bay. http://thornebay-ak.gov/harbors/ Accessed 8/24/2017

Appendices

Appendix A

Compliance Order by Consent

Appendix B

City of Thorne Bay

Wastewater Treatment Facility Effluent Disinfection

Preliminary Engineering Report, August 2015

Appendix C

City of Thorne Bay and State of Alaska Village Safe Water

Thorne Bay Wastewater Treatment Plant Improvements

Final Design Analysis Report, June 2017

Appendix D

City of Thorne Bay and State of Alaska Village Safe Water

Water Treatment Plant Improvements

Preliminary Engineering Report, June 2017

Appendix E

ORDINANCE 17-05-02-02: An Ordinance of the City Council for the City of Thorne Bay, Alaska; Amending Ordinance 16-06-21-02 and Ordinance 16-11-15-01, Which Established the FY17 Budget of Anticipated Revenues and Expenditures for the City of Thorne Bay July 1, 2016 through June 30, 2017.

Appendix F

Resolution 15-07-21-03, A Resolution of the City Council for the City of Thorne Bay, Alaska, Amending Resolution 13-03-05-02, Establishing New Water and Sewer Fees

(includes meeting minutes)

Appendix G

Standard Contract for VSW Professional Services