City and Borough of Wrangell
Assembly Work Session
AGENDA

Tuesday, October 20, 2020
6:00 PM

Location: ZOOM Teleconference

WORK SESSION

1. CALL TO ORDER

2. ITEM(S) OF BUSINESS

a. Water Treatment Plant Improvement Project - Conceptual Design for DAF Equipment

3. ADJOURNMENT

MEMORANDUM

TO: Lisa Von Bargen, Borough Manager

FROM: Amber Al-Haddad, Capital Facilities Director

SUBJECT: Water Treatment Plant Improvements Project - Conceptual Design for DAF Equipment

DATE: September 14, 2020

Lisa:

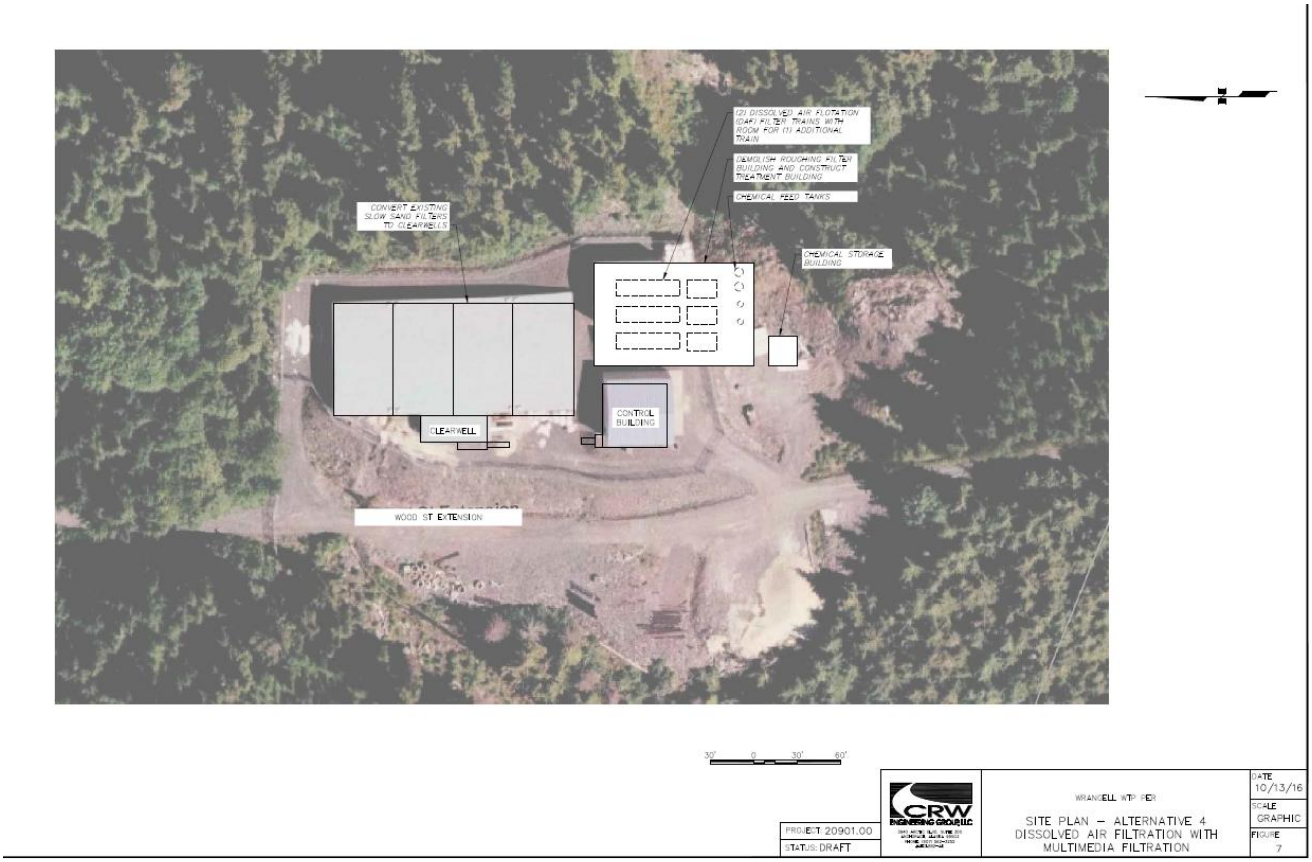
In response to the Water Treatment Plant Improvements project questions posed at the September 8, 2020 Assembly meeting, below is a synopsis from the Preliminary Engineering Report (PER), developed by CRW Engineering Group (CRW), that describes the conceptual design, the design water flow to meet future growth, and redundancy for uninterrupted operations. This report also offers a review of the current project funding and project cost estimates.

The initial conceptual design and construction cost in the PER, including a Dissolved Air Flotation (DAF) water treatment system, to replace our existing Slow Sand Filtration treatment system, and the associated backwash waste and disposal system. The initial cost of the project was estimated at $12,925,000.

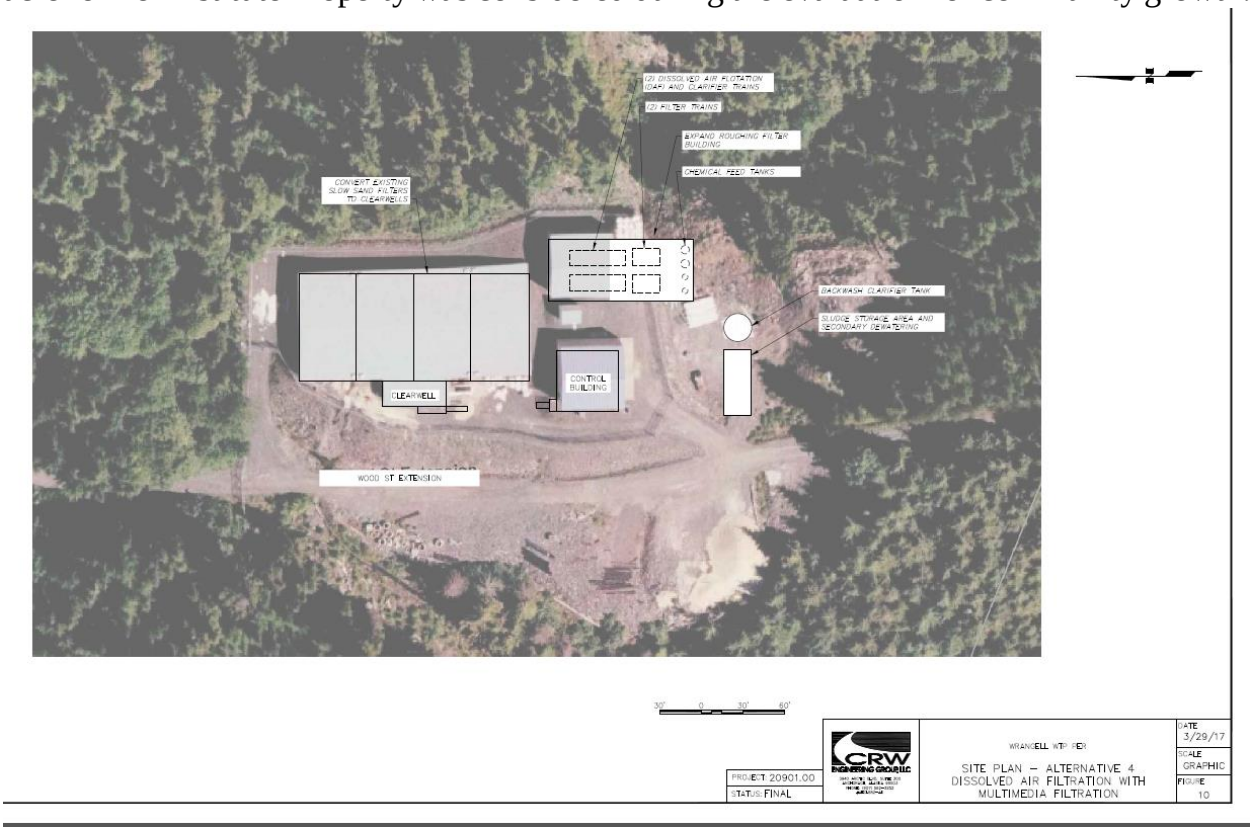
With the understanding that this project cost would prove to be greater than Wrangell's ability to acquire funding, we sought ways to reduce the project cost. The nearly $13 million project cost was revised to a $9,051,000 project cost. The nearly $4 million in project cost reduction was achieved by reducing the footprint of the roughing filter building's reconstruction, to house the new DAF and filtration systems. With the reduced footprint, there were also associated site work cost reductions, and certain other proposed components were revised.

The original idea was to construct the building large enough to accommodate a future, third DAF train and filter, to be added as Wrangell exceeded the 20-year projected water demand. The current project includes only a modest renovation of the existing roughing filter building, to accommodate the anticipated two, parallel DAF units which have a combined design flow rate of 1.8 million gallons per day production. The reduced project cost was also achieved by changing the backwash waste disposal from the *Alternative No. A1 - Extend Sewer Service to Wastewater Treatment Plant* to the *Alternative D - Recycle of Backwash Water to Process.*

Below is the originally proposed site plan for the project with associated cost of $12,925,000. This site plan reflects the larger footprint of the DAF building and has a notation that the larger building is proposed for the installation of two DAF trains, but with the capacity to accommodate a third DAF train:



Below is the final proposed site plan for the project with associated cost of $9,051,000. This site plan reflects the smaller footprint for the proposed, two DAF trains, sized to meet the expected water demands of Wrangell for twenty years. The development of the 134-acre former Institute Property was considered during the evaluation for community growth.



The two-train conceptual DAF design developed by CRW under the PER, which received federal funding from USDA's Rural Development and from the Economic Development Administration (EDA), was based on the following criteria:

- The average daily demand (ADD) is based on Wrangell's water usage measured in 2014. The 2014 ADD was determined by summing the total volume of water consumed and dividing this value by 365 days. For the purpose of this evaluation, the engineers assumed the per-capita daily rate to decrease by about 5% in 2037 due to replacement of leaking CBW water lines during the 20-year span and a continuing national trend of lower water consumption from conservation efforts.

- The maximum daily water demand (MDD), is the projected volume of water consumed in one day. MDD is estimated by multiplying the ADD by a peaking factor, which is commonly 150% for municipalities; however, a peaking factor of 175% was used for CBW, based on the review of the daily plant flow variation recorded between 2012 and 2015. The PER suggested that the final design should

ensure that the water storage system should be sized such that Wrangell can accommodate the occasional peaks in demand which exceed the 175% factor.

The MDD determined for Wrangell in 2014 was estimated to be 1.5 million gallons per day. And based on Wrangell's projected growth to the year 2037, the MDD was estimated to be 1.8 million gallons per day. The below excerpts, taken from the PER, reflect the flow rate calculation used to identify the design flow for this project.

WRANGELL WATER USE

2014

2014 DCCED Population	2406	
Per Capita Water Use	251	gallons per capita per day
Residential Water Use	**603,906**	gpd

Transient Population	300	(ADEC Water Watch)
Per Capita Water Use	251	gallons per capita per day
Residential Water Use	**75,300**	gpd

ACTUAL DATA

Commercial Customers	monthly			daily (interpolated)			*% of total ADD*
	max flow	min flow	average flow	max flow	min flow	average flow	
IFA	-	-	-	-	-	-	
Trident Seafoods	12,544,588	-	1,785,194	418,153	-	59,506	7.0%
Sea-level SFDS	10,465,198	-	2,299,823	348,840	-	76,661	9.0%
Fish & Game Dock	-	-	-	-	-	-	-
Heritage HBR	1,565,000	-	525,440	52,167	-	17,515	2.0%
Shoemaker HBR	836,600	11,600	153,704	27,887	387	5,123	0.6%
City Dock	301,282	-	55,587	10,043	-	1,853	0.2%
Reliance	1,822,584	49,329	390,017	60,753	1,644	13,001	1.5%
Standard Oil	275,720	656	49,575	9,191	22	1,653	0.2%
Wrangell Oil/Petro Marine	131,001	1,743	26,480	4,367	58	883	0.1%
Travel Lift	52,723	-	11,563	1,757	-	385	0.0%
Projected Summation	**27,994,696**	**63,328**	**5,297,383**	**933,157**	**2,111**	**176,579**	20.6%
Actual Total Flows	**20,295,338**	**928,739**	**5,788,301**	**676,511**	**30,958**	**192,943**	22.5%
% of Project Summation	72%	1467%	109%				

Average Daily Demand (all users)	**855,785**	gal/day	594	gpm
Estimated MDD (all users)	**1,497,625**	gal/day	1,040	gpm
175% ADD residential + MDD commercial	2,121,767.03	gal/day	1,473	gpm

WRANGELL WATER USE

Projected 2037

2037 Predicted Population	2911	
Per Capita Water Use	240	gallons per capita per day
Residential Water Use	698,640	gpd

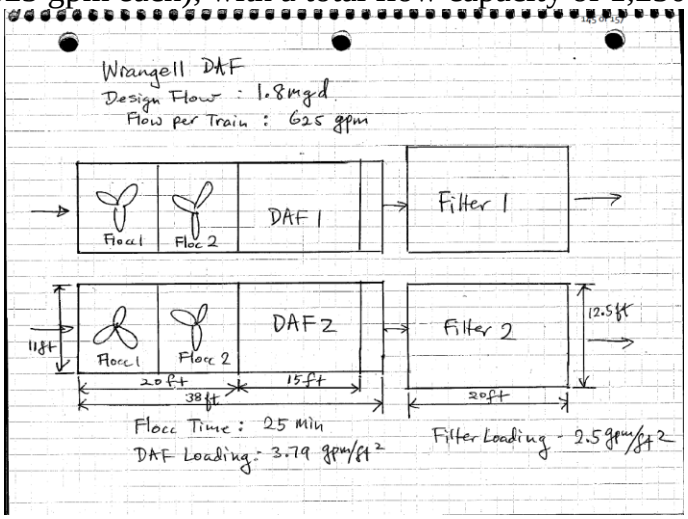
Transient Population	363	(ADEC Water Watch)
Per Capita Water Use	240	gallons per capita per day
Residential Water Use	87,120	gpd

EXTRAPOLATED DATA ASSUMING YEARLY 0.8% GROWTH IN INDUSTRY

Commercial Customers	monthly			daily (interpolated)			*% of total ADD*
	max flow	min flow	average flow	max	min	average	
IFA	-	-	-	-	-	-	
Trident Seafoods	15,066,050	-	2,144,018	502,202	-	71,467	7.2%
Sea-level SFDS	12,568,703	-	2,762,088	418,957	-	92,070	9.2%
Fish & Game Dock	-	-	-	-	-	-	-
Heritage HBR	1,879,565	-	631,053	62,652	-	21,035	2.1%
Shoemaker HBR	1,004,757	13,932	184,599	33,492	464	6,153	0.6%
City Dock	361,840	-	66,760	12,061	-	2,225	0.2%
Reliance	2,188,923	59,244	468,411	72,964	1,975	15,614	1.6%
Standard Oil	331,140	788	59,540	11,038	26	1,985	0.2%
Wrangell Oil/Petro Marine	157,332	2,093	31,802	5,244	70	1,060	0.1%
Travel Lift	63,320	-	13,887	2,111	-	463	0.0%
Projected Summation	**33,621,630**	**76,057**	**6,362,157**	**1,120,721**	**2,535**	**212,072**	21.3%
Extrapolated Actual Flows	**21,310,105**	**975,176**	**6,077,716**	**710,337**	**32,506**	**202,591**	20.3%
% of Project Summation	63%	1282%	96%	41%			

Average Daily Demand (all users)	**997,832**	gal/day	693	gpm
Estimated MDD (all users)	**1,746,206**	gal/day	1,213	gpm
175% ADD residential + MDD commercial	2,495,801.00	gal/day	1,733	gpm

- Our existing plant's design flow was 900 gpm; however, certain modifications were made throughout the course of its operation since 1999 that allowed the flow capacity to be increased to 1,000 gpm. The conceptual flow design and associated number of trains proposed to meet the MDD of 1.8 million gallons per day were two DAF trains (625 gpm each), with a total flow capacity of 1,250 gallons per minute.



- In determining the proposed number of DAF trains and their design flow rate, the engineers considered the increase to the treated water storage capacity, by converting our existing sand filters to additional water storage. The total volume of additional water storage, from the combined four sand filters, will be 896,000 gallons (this is equal to the two, combined water storage tanks we currently have). By providing a water treatment rate of at least the volume consumed in one day will allow the water storage to be replenished in a reasonable amount of time. It was determined that if the treatment rate could keep pace with maximum demand, the stored volume could be maintained during periods of high-water use and be refilled faster. By providing the additional water storage, the increased stored volume would not only meet the maximum daily water demand (MMD), but it would also provide nearly 2 days' worth of the average daily water demand (ADD).

The scope of work included in the RFQ for the engineering design project indicates that the work of the engineer will include the following Pre-Engineering Design efforts, before entering the Engineering Design phase:

a. Review the Preliminary Engineering Report; Recommend final design and scope for the Dissolved Air Flotation treatment system, with special attention to the following design parameters:

    1. Assess and reaffirm treatment plant flow capacity to meet the maximum daily water demand for Wrangell's 20-year projected future growth, estimated in the Preliminary Engineering Report to be 1.8 GPD.
    2. Evaluate options for redundancy to ensure uninterrupted operation, including but not limited to infrastructure (i.e. floc and filter tanks), equipment (i.e. pumps, motors), instrumentation (i.e. flow meters), and automation and control (i.e. computers, PLCs, etc.). The resulting system shall provide a high level of operational flexibility and reliability to accommodate critical water production needs.
    3. Assess and reaffirm the associated backwash and waste disposal method which will best serve the needs of the overall treatment system.

b. Prepare a Technical Memo, as an addendum to the Preliminary Engineering Report, to recommend and justify DAF treatment system design parameters, including process improvement alternatives and backwash and waste disposal alternatives, supporting any changes between the conceptual design and the final recommended design.

c. Conduct a workshop with the Owner and funding agencies to review the design Technical Memo and analysis.

d. Propose project timeline and preliminary budget, including pre-purchasing of long delivery items, if appropriate.

As to the concern for redundancy, the industry indicates that DAF systems use redundant design to ensure that the most critical components of their systems are dependable. A redundant design generally includes backup components in the system or is comprised of interchangeable components so that the system can be repaired quickly and without interruption. This includes equipment (pumps, motors), instrumentation (flowmeters, analyzers), and automation and control (computers, power source, PLCs, etc.). Redundancy also includes installed units (not spare parts) used for monitoring and control of processes. This too reduces a larger capital cost and real estate use/acquisition.

CBW's design flow rates were estimated in the PER for the purpose of scaling the economic comparison between options. These design flow rates were based on existing water usage that is increased according to anticipated growth rates of population and water consumption by significant users. The PER indicates that the design flow rates are considered conceptual at the PER development stage of the project, and they should be confirmed or adjusted, as needed, during the design phase. This has been made part of the scope of work required of the selected engineer of record, providing the final design.

Assembly member Powell raised a very important point at the last meeting. If the scope of work changes based on final engineering, that could significantly increase the cost of the project. What follows is the relevant information we have about this issue.

- The current cost estimate of the project is $9,051,000, based on a project scope including two DAF Trains (625 gpm each) and onsite treatment of the wastewater.
- Fortunately, the budgetary cost estimate includes 15% estimating contingency and 3.5% inflation for a total premium of $18.5%.
- Current funding for this project is:

EDA Grant	$2,996,953
USDA Loan	$3,821,000
USDA Grant	$2,114,047
CBW Match	$ 119,000
Total	$9,051,000

The original grant from USDA was $3,161,000. It was reduced by $1,046,953 when the Borough was awarded more grant money from EDA. It is our understanding this additional grant money has not yet been deobligated from our project and could be made available for the project based on scope and budget changes in the final design and engineering.

The current design and project cost estimate include the onsite wastewater treatment alternative. We know that this additional onsite process puts us in a position where a Level

4 Water Treatment Operator is required. Unfortunately, it was recommended in the PER because it is half the cost of the off-site treatment at the wastewater plant. We believe offsite treatment will be recommended in the final design; therefore, we can already expect a project cost increase. From the PER, these alternative cost estimates are:

Offsite Treatment:	$1,659,000
Onsite Treatment:	($ 860,000)
Difference:	$ 799,000

The current design and estimate also includes two DAF Trains (625 gpm each) at a cost of $1,360,000. This budget number does not include the 18.5% for contingency and inflation. Discussions with a DAF manufacturer suggest the most reasonable increase in size are 1,000 gpm trains, if more treatment capacity is recommended to meet Wrangell's needs, based on the final engineering. This could result in an approximate 30% cost increase, or about $400,000.

Based purely on estimates we currently have on hand, if there are changes to the wastewater treatment, and/or train size, the project could see a cost increase of about $1.2 Million. If the USDA grant authorization is still available, that means a cost increase to the Borough of only $200,000.

One significant unknown is… if the DAF train size is increased, does the building size need to increase as well. Larger trains could require either a larger footprint or a higher building.